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AUTOMATED LONGWALL GUIDANCE AND CONTROL VERTICAL CONTROL SUBSYSTEM

VOLUME II

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January 1982

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George C. Marshall Space Flight Center
Marshall Space Flight Center, AL

REPORT DOCUMENTATION PAGE

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NASA CR-		

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15. Supplementary Notes

16. Abstract

A design fabrication and implementation of a horizon control of a longwall shearer has been performed. This equipment was tested and demonstrated aboveground at the Department of Energy's surface test facility in Bruceton, PA. This hardware was also installed on a longwall face in the Herrin No. 6 seam in southern Illinois. The feasibility of providing horizon control for a shearer was demonstrated aboveground. The feasibility of retrofitting the necessary sensors in a survivable manner was demonstrated underground. Subsequent tests of a specific component, the natural background sensor, at a western location domonstrated the particular usefulness of this device on a wider application basis.

17. Originator's Key Words	18. Availability Statement
Horizon control Underground mining Longwall shearer control Coal interface detection	

19. U.S. Security Classif. of the Report	20. U.S. Security Classif. of This Page	21. No. of Pages	22. Price
Unclassified	Unclassified	573	

LIST OF APPENDICES

APPENDIX A

SOFTWARE DOCUMENTATION

VERTICAL CONTROL SYSTEM

NAS-7946

SOFTWARE DOCUMENTATION

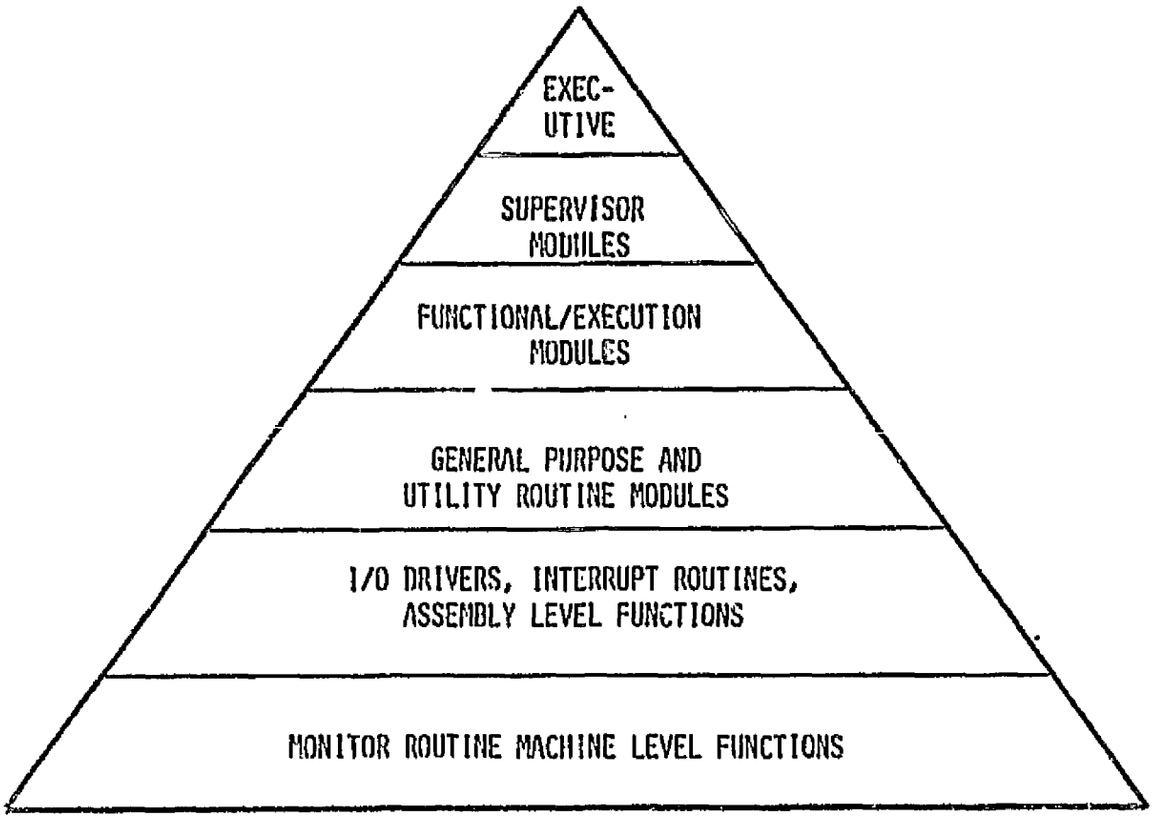
January 1982

Roger Fish

VERTICAL CONTROL SYSTEM

PROGRAM INTRODUCTION

VCS PROGRAM STRUCTURE



PROGRAM CAPABILITY

- SENSOR RANGE ERROR CHECKING
- MULTIPLE RUN MODES (CONTROL LAWS)
- MASK CONTROL OF I/O AND OPERATIONS
- NOT DYNAMICALLY SELF PROGRAMMING
- INTERACTIVE INITIALIZATION
- INTERACTIVE DEBUG OF I/O, MEMORY

OPERATIONAL FEATURES

DUAL MODE:

- RUN MODE (AUTOMATIC)
- DEBUG MODE (INTERACTIVE)

SYSTEM INITIALIZATION:

- PARAMETER SET FROM RAM
- CLEAR RAM BUFFERS
- SET UP POINTERS AND DEFAULT FLAGS
- OPERATOR INTERACTION

  MENU BASED MODIFICATIONS PROMPT FOR CLASS AND ELEMENT CHANGE FLAGS, VARIABLES

OPERATIONAL FEATURES (CONTINUED)

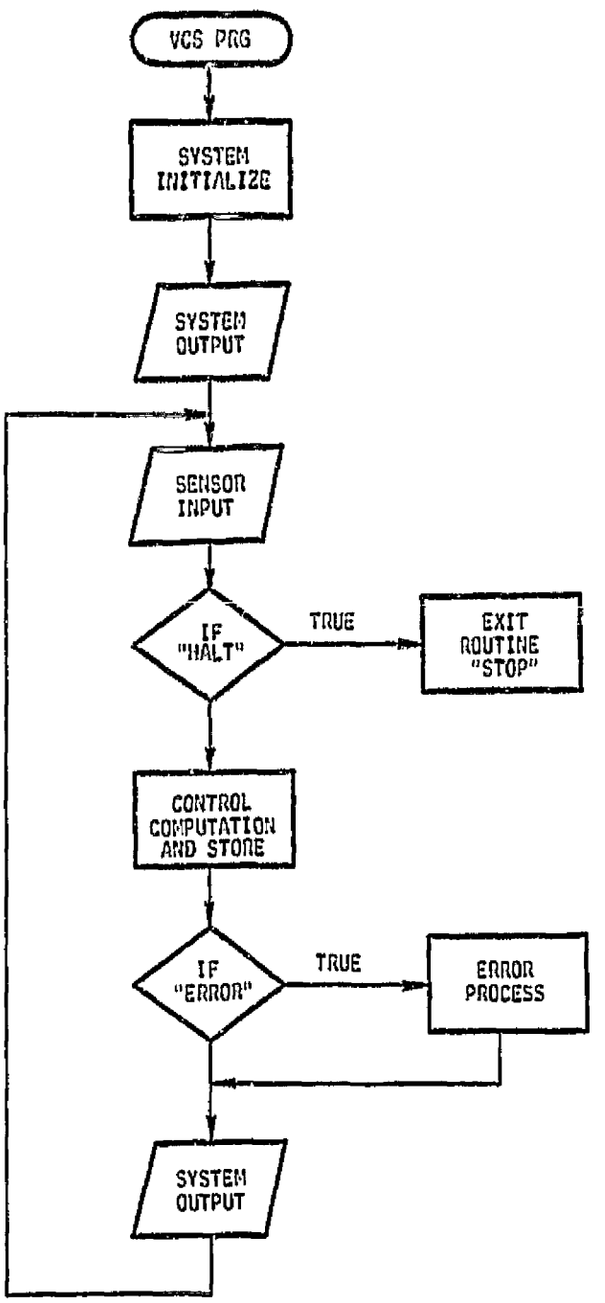
RUN:

INPUT SENSORS (RANGE CHECK)
CONTROL FUNCTION COMPUTATION
OUTPUT CONTROL/DATA
ERROR TEST
SYNCHRONIZE TO CLOCK

DEBUG:

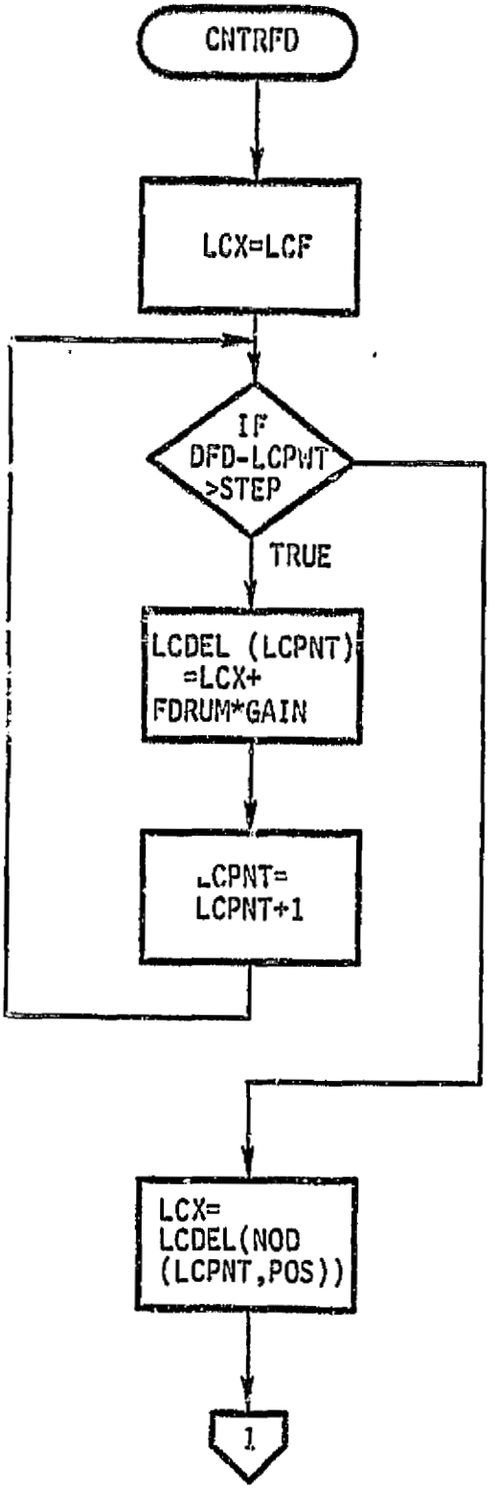
INTERACTIVE SENSOR TEST
OUTPUT TEST
MEMORY CHECK/DUMP
RESTART/INITIALIZE

NORMAL VCS
PROGRAM FLOW

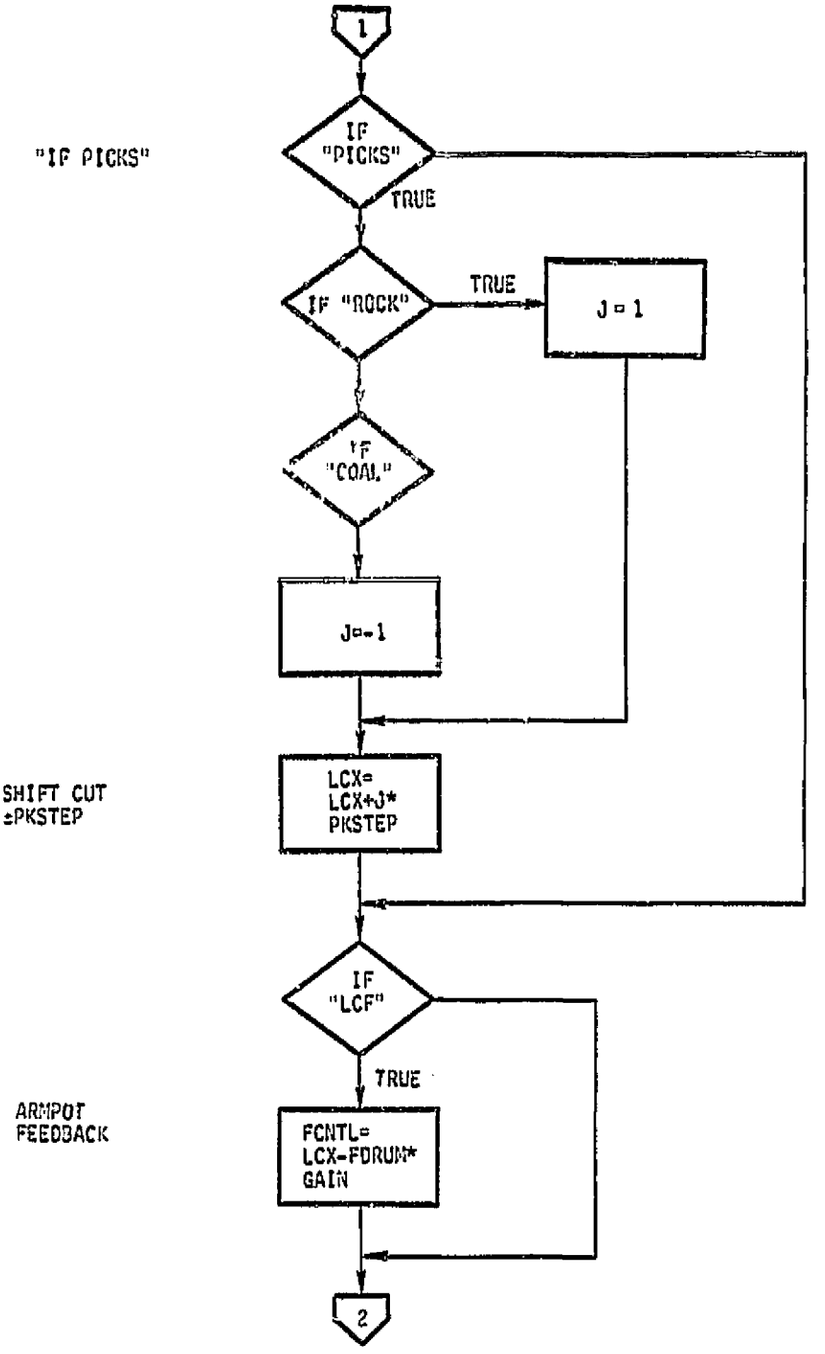


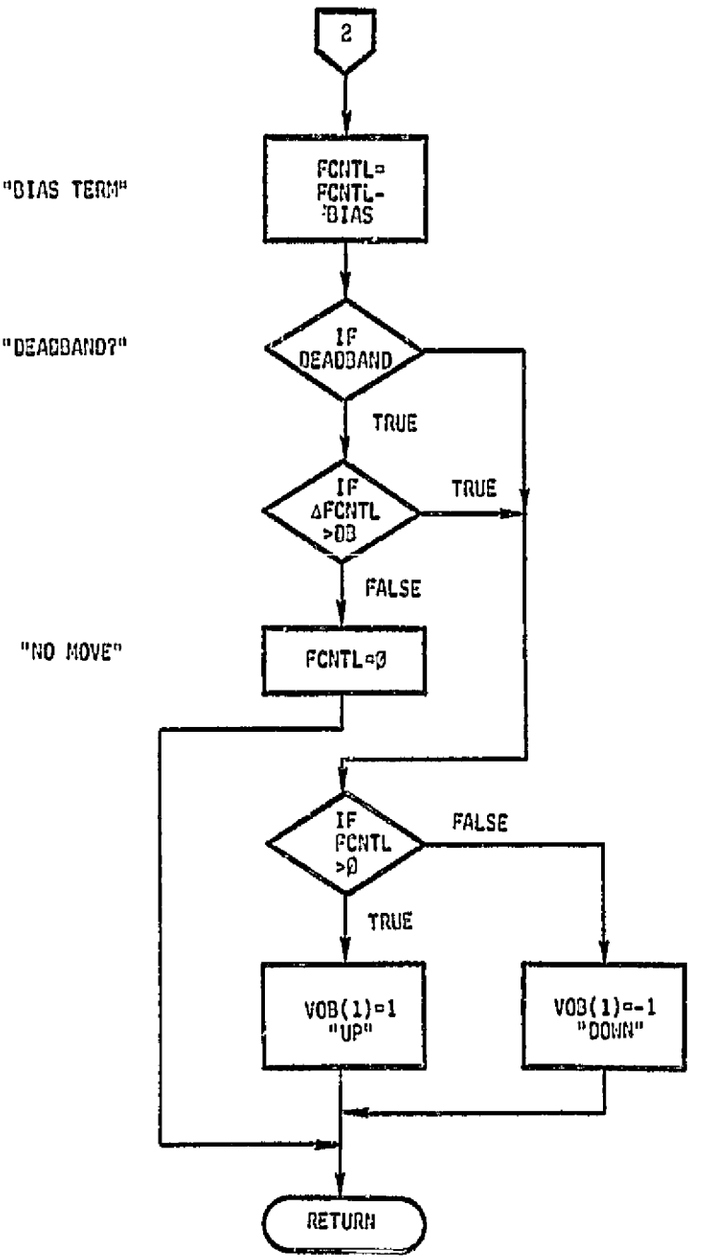
VCS OLD BEN CONTROL ALGORITHM "MODE II"

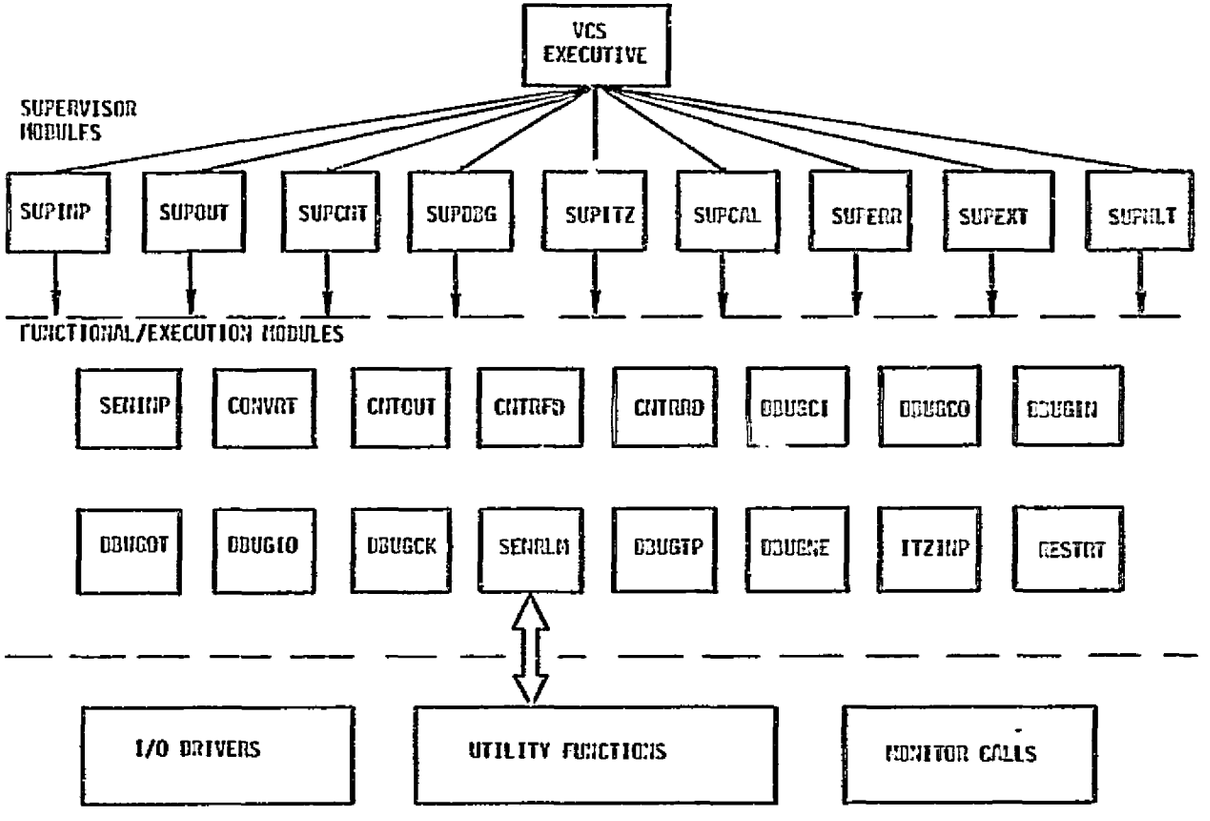
DELAYED SENSORS
NO PICK AVERAGE

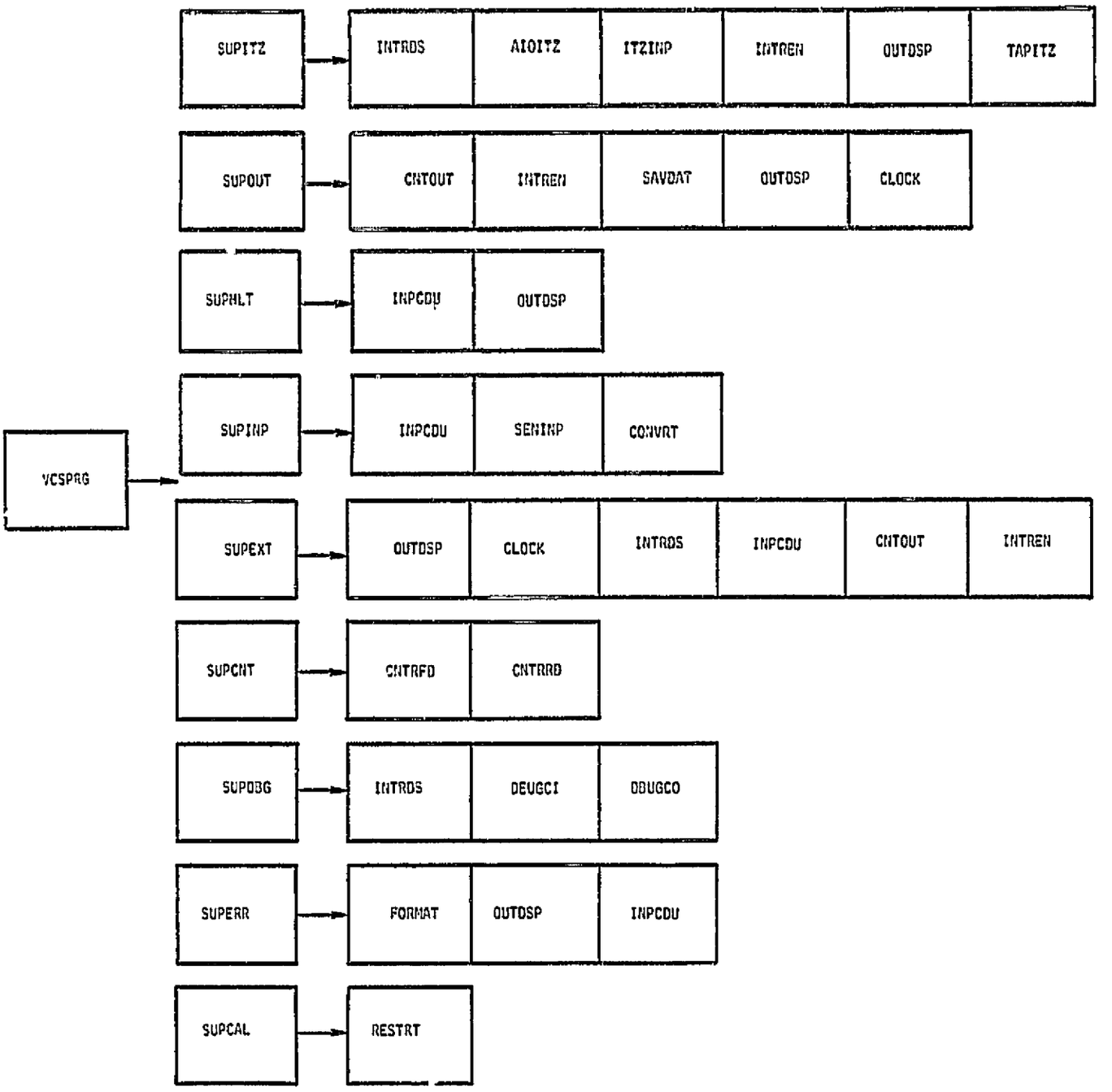


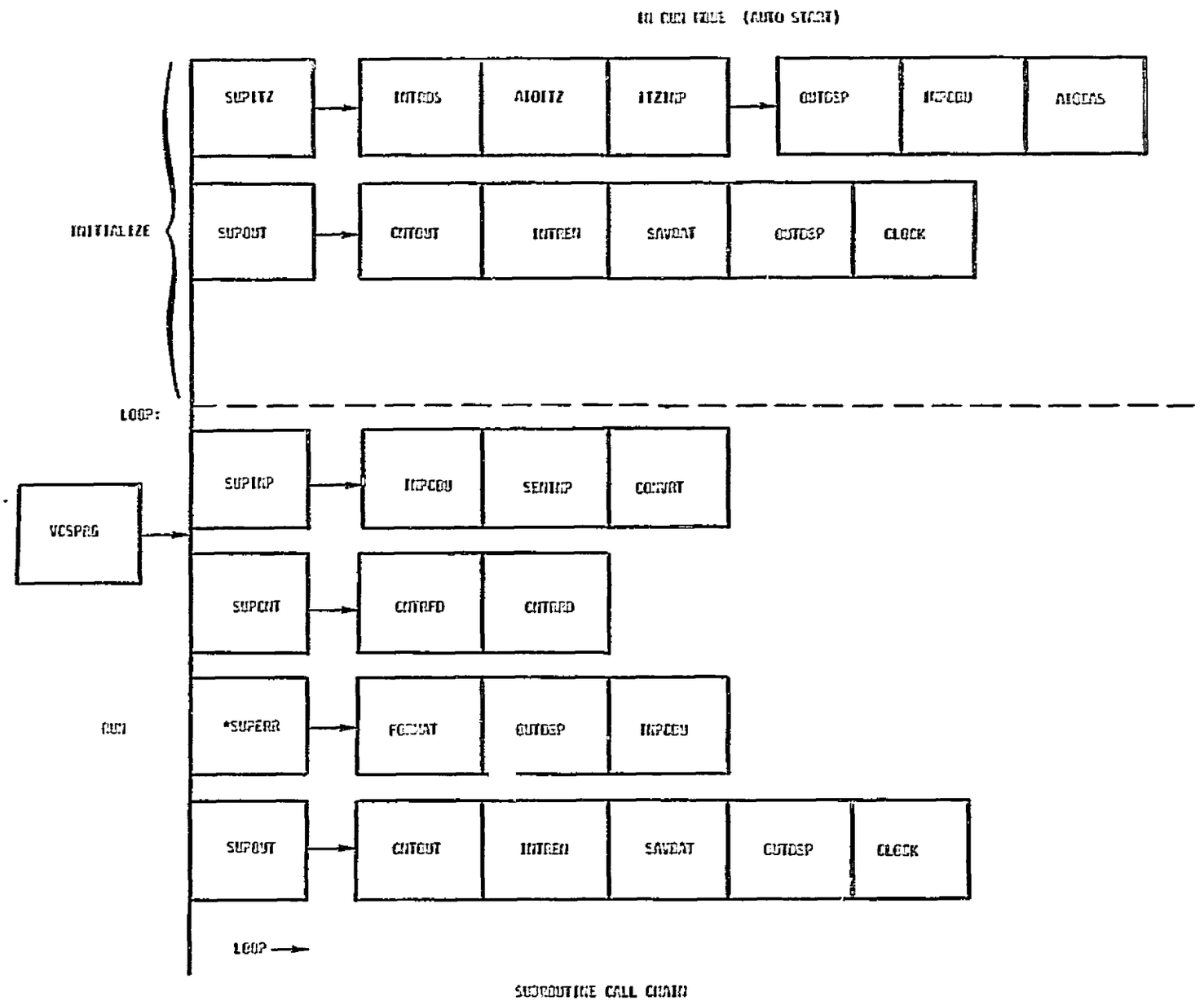
LCX = DELAYED
(LCF + FDRUM * GAIN;


1
IF "PICKS"
"IF PICKS"
TRUE
IF "ROCK"
TRUE
J = 1
IF "COAL"
J=-1
LCX= LCX+J* PKSTEP
SHIFT CUT ±PKSTEP
IF "LCF"
TRUE
FCNTL= LCX-FDRUM* GAIN
ARMPOT FEEDBACK
2

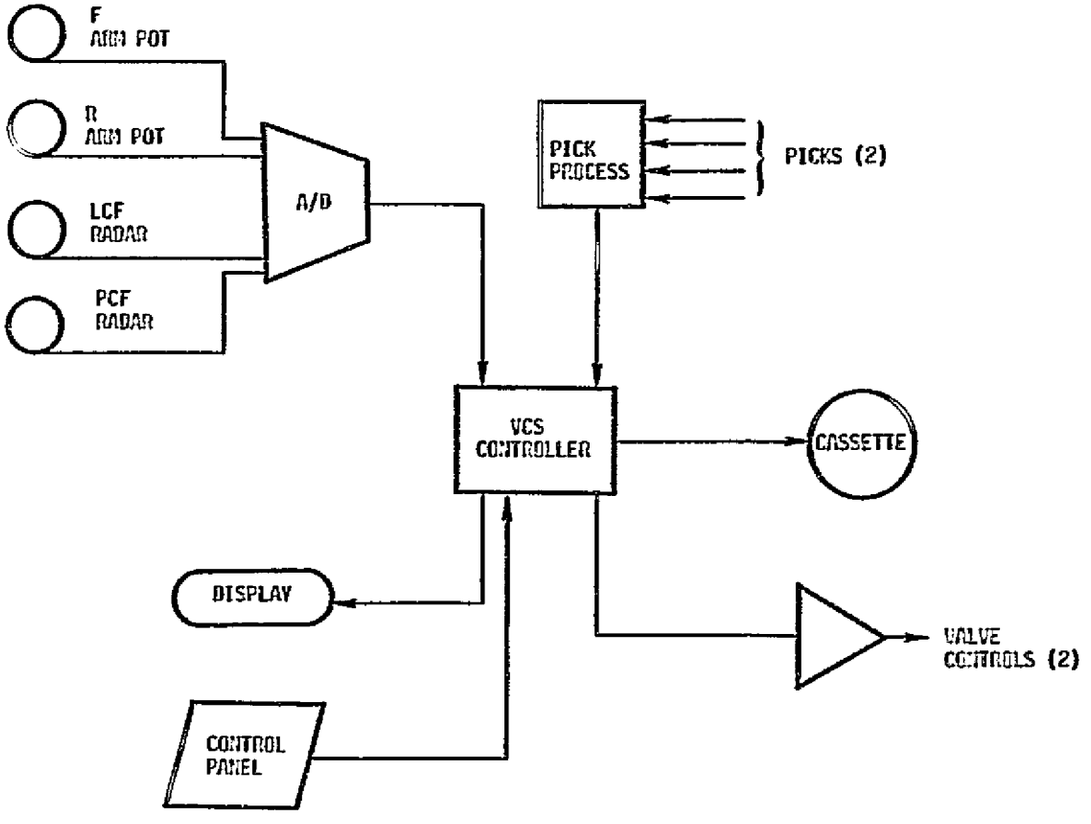

2
"BIAS TERM"
FCNTL=
FCNTL-
BIAS
"DEADBAND?"
IF
DEADBAND
TRUE
IF
ΔFCNTL
>ØB
TRUE
FALSE
"NO MOVE"
FCNTL=Ø
IF
FCNTL
>Ø
FALSE
TRUE
VOB(1)=1
"UP"
VOB(1)=-1
"DOWN"
RETURN


VCS
EXECUTIVE
SUPERVISOR
MODULES
SUPINP
SUPOUT
SUPCHT
SUPDBG
SUPITZ
SUPCAL
SUPERR
SUPEXT
SUPHLT
FUNCTIONAL/EXECUTION MODULES
SERINP
CONVRT
CHTOUT
CHTRFS
CHTRAD
DBUGCI
DBUGCO
DBUGIN
DBUGOT
DBUGIO
DBUGCK
SENRLM
DBUGTP
DBUGHE
ITZINP
RESTRT
I/O DRIVERS
UTILITY FUNCTIONS
MONITOR CALLS


VCSPRG
SUPITZ
INTRDS
AIOITZ
ITZINP
INTREN
OUTDSP
TAPITZ
SUPOUT
CNTOUT
INTREN
SAVDAT
OUTDSP
CLOCK
SUPHLT
INPCDU
OUTDSP
SUPINP
INPCDU
SENINP
CONVRT
SUPEXT
OUTDSP
CLOCK
INTRDS
INPCDU
CNTOUT
INTREN
SUPCNT
CNTRFD
CNTRRD
SUPDBG
INTRDS
DEUGCI
DBUGCO
SUPERR
FORMAT
OUTDSP
INPCDU
SUPCAL
RESTRT



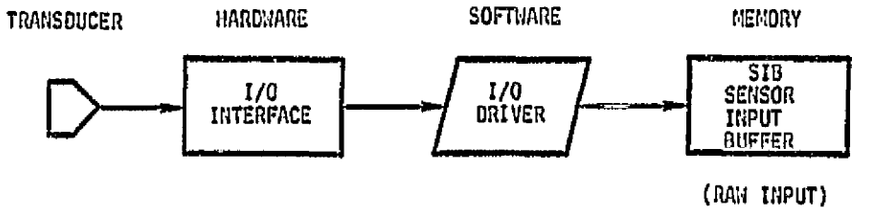
SUBROUTINE CALL CHAIN



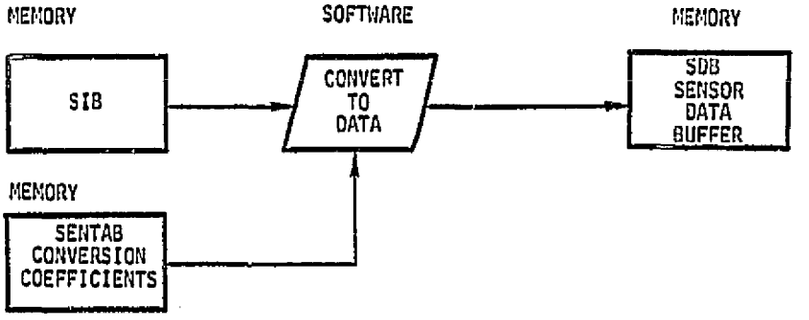
VCS [DEUCETON/WOLF OLD-DEN] HARDWARE

VCS DATA INPUT/CONVERSION

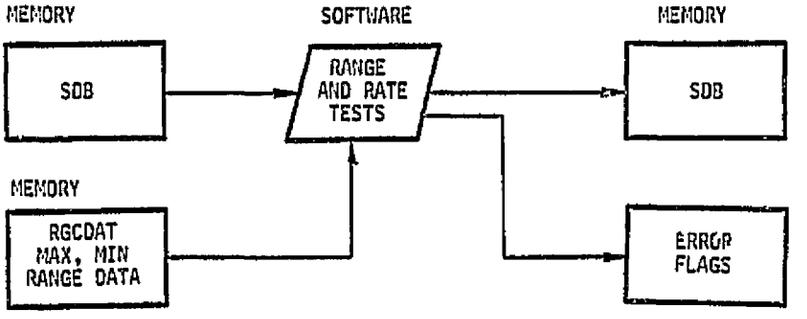
1) INPUT:

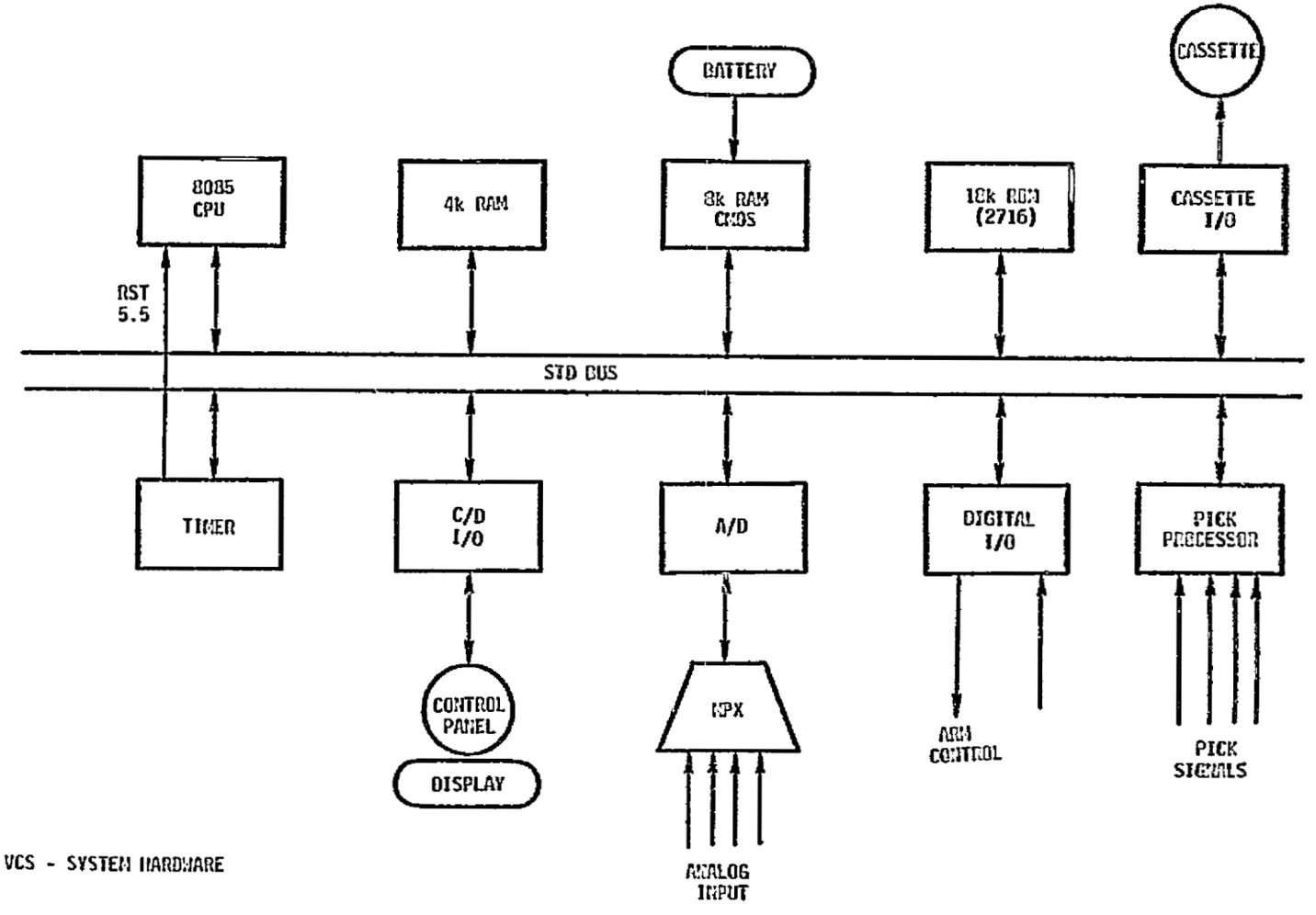


2) CONVERSION:



3) RANGE CHECK:





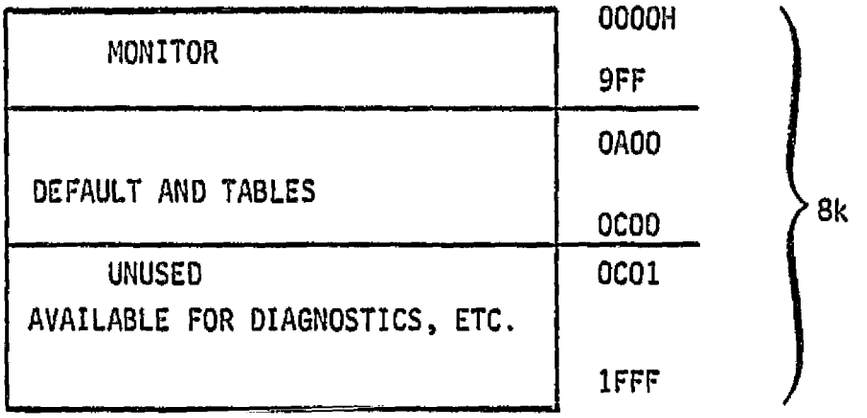
VCS - SYSTEM HARDWARE

VCS MEMORY ALLOCATION

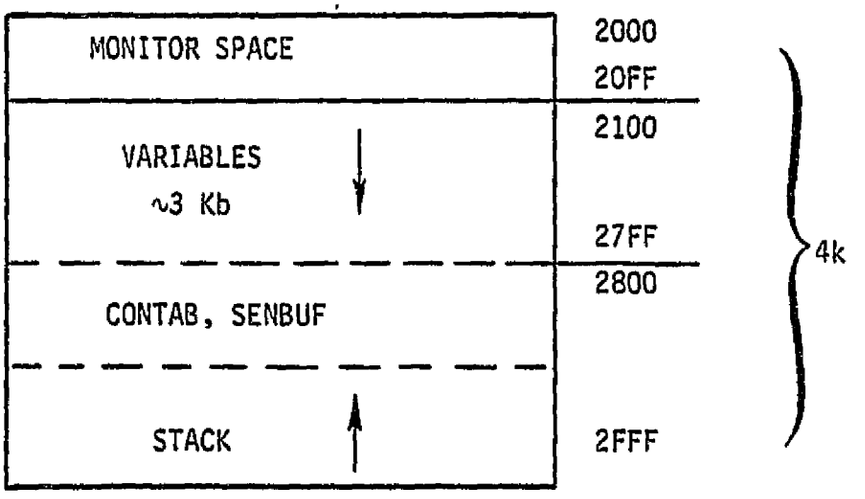
	LOC	
MONITOR CODE	0000H 9FFH	CPU ROM
DATA TABLES (DEFAULT) MESSAGE CODES	A00H 1FFFH	
VARIABLE SPACE COMMUNICATION BUFFERS STACK SPACE	2000H 2FFFH	CPU RAM
NOT AVAILABLE	3000H 3FFFH	-
VCS PROGRAM • EXECUTIVE • SUPERVISORS • EXECUTION MODULES • UTILITY FUNCTIONS • I/O DRIVERS • FORTRAN RTL • MISCELLANEOUS	4000H 67FFH	ROM
SENSOR DATA SPECIAL VARIABLES	7000H 9000H	CMOS RAM

VCS MEMORY ALLOCATION

LOW ROM



LOW RAM



I/O PORT NUMBERS

Tape Recorder

	08	OUT	RECHI	; Recorder Data HI byte
	09	OUT	RECLC	; Recorder Data LO byte
	0A	OUT	RECCTL	; Recorder Control
	0B	IN	RECSTA	; Recorder Status
Picks	10	OUT	PICC1	; Pick Control 1
	11	IN	PICS1	; Pick Status 1
	12	OUT	PICC2	
	13	IN	PICS2	
	14	OUT	PICC3	These may not be required.
	15	IN	PICS3	
	16	OUT	PICC4	
	17	IN	PICS4	
Clock	20	Unit 0		
	21	Unit 1		
	22	Unit 2		
	23	Control Port		
	24	Counter Output Bit Port (3 bits)		
	25	Gate Port		
NBS	30			
	31			
	32			
	33			
	34			

A/D Converter

```
80      OUT       MROUT     ; Multiplexer out reg.
81      IN        MSRIN     ; Multiplexer Status Port
82      OUT       MROUTC    ; Multiplexer Out Control Port
83      OUT       MSRINC    ; Multiplexer Control Port
84      IN        DATA1     ; Data Port, MSB
85      IN        DATA 2    ; Data Port, LSB
```

Keyboard Display Card

```
D0      IN        KDSW      ; Keyboard/Display Switch Port
D0      OUT       KDDATA    ; Keyboard/Display Data Port
D1      OUT       KDCNTL    ; Keyboard/Display Control Port
DC      IN/OUT    CDATA     ; EPROM/UART Console Data Port
DD      IN/OUT    CSTAT     ;             Console Status Port
DE      OUT       SCNTL     ;             System Control Port


03      OUT       ARMS        Arm Control
04      IN        SWTCH 1   ; Front Panel Switches
05      IN        SWTCH 2   ; Front Panel Switches
06      OUT       STAT1     ; Front Panel Indicators
07      OUT       STAT2     ; Front Panel Indicators
```

LINKAGE OF ASSEMBLY ROUTINES

ORG	Absolute origin
ASEG	Absolute segment
CSEG	Relocatable code segment
DSEG	Relocatable data segment
PUBLIC	Define symbols as public for use by other programs
EXTRN	Symbols from other programs

LINKAGE

```
  Call name (A, B)

  REG BC = Address (A)
      DE = Address (B)
```

See INTEL FORTRAN User's Guide

VCS COMMON BLOCKS

/CLOCK/		CLOCK FLAG + COUNTERS
/COMBUF/		COMMUNICATION BUFFERS
/CONTAB/		CONVERSION TABLES
/CNTVEC/		CONTROL VECTORS
/CPANEL/		CONTROL PANEL ARRAY
/DEBUG/		DEBUG MASKS
/DEFALT/	ROM	DEFAULT DATA
/DEFOPS/		
/DEFTAB/	ROM	DEFAULT DATA
/DEFMOS/		
/ERRFLG/		ERROR FLAG ARRAY
/ERRBUF/		
/IOFVEC/		I/O MASK VECTOR
/MESTAB/	ROM	MESSAGE TABLES I
/MESTB2/	ROM	MESSAGE TABLES II
/MESTB3/	ROM	MESSAGE TABLES III
/OPPARM/		OPERATION PARAMETERS
/OPSPNT/		OPERATION POINTERS
/OPSVEC/		OPERATION VECTOR
/PARAMS/		PARAMETER STORAGE
/PIKBUF/		PICK DATA STORAGE
/SENBUF/		SENSOR INPUT, DATA BUFFER
/SENDEL/		SENSOR DELAY LINES
/SENMEM/	CMOS	NONVOLATILE STORAGE
/SENPNT/		
/SAVER/		
/WORK/		G.P. WORK SPACE

/OPPARM/

NMAX(1)	=	NMXSEN
NMAX(2)	=	NMXERR
NMAX(3)	=	NMXSIR
NMAX(4)	=	NMXIPM
NMAX(5)	=	NMXOUT
NMAX(6)	=	NMXDSP
NMAX(7)	=	NMXIOF
NMAX(8)	=	NMXCNM,CTV
NMAX(9)	=	NMXDBG
NMAX(1Ø)	=	NMXCBF

```
/OPPARM/
      NMAX(11)   =  NMXTAP
      NMAX(12)   =  NMXKIB
      NMAX(13)   =  NMXPRM
      NMAX(14)   =  NMXOPS
      NMAX(15)   =  NMXPNT


/IOFVEC/
      IOFVEC(1)    =  IOFSEN
      IOFVEC(2)    =  IOFDFD
      IOFVEC(3)    =  IOFPCF
      IOFVEC(4)    =  IOFLCF
      IOFVEC(5)    =  IOFLAP
      IOFVEC(6)    =  IOFRAP
      IOFVEC(7)    =  IOFCID
      IOFVEC(8)    =  IOFPKF
      IOFVEC(9)    =  IOFPKR
      IOFVEC(10)   =  IOFVCF
      IOFVEC(11)   =  IOFVCR
      IOFVEC(12)   =  IOFVOT
      IOFVEC(13)   =  IOFDSP
      IOFVEC(14)   =  IOFKEY
      IOFVEC(15)   =  IOFCAS
      IOFVEC(16)   =  IOFCRT
      IOFVEC(17)   =  IOFCDU


/CNTVEC/
      CNTVEC(1)    =  CTVCID      CID
      CNTVEC(2)    =  CTVLCF      LAST CUT
      CNTVEC(3)    =  CTVPKF      PICK F
      CNTVEC(4)    =  CTVPKR      PICK R
      CNTVEC(5)    =  CTVPCF      PAST CUT
      CNTVEC(6)    =  CTVVCF      VALVE F
      CNTVEC(7)    =  CTVVCR      VALVE R
      CNTVEC(8)    =  CTVFRT      FRONT CNTL
      CNTVEC(9)    =  CTVRER      REAR CNTL
      CNTVEC(1Ø)   =  CTVOUT      CNTL OUTPUT


/PARAMS/
      DMAX     -  DRUM MAY
      DMIN     -  DRUM MIN
      ERRLMT   -  MAX# ERRORS FOR TRIP
      SEAM     -  SEAM HEIGHT
      PIKAVE   -  PICK AVERAGE #
      PKSTEP   -  PICK STEP VALUE
      DEDBDF   -  FRONT DEAD BAND
      DEDBDR   -  REAR DEAD BAND
      ARMLNG   -  ARM LENGTH POT GAIN = 1
```

/PARAMS/

DRMRAD	-	DRUM RADIUS
LCPOS	-	LCF MOUNTING POS (DFD UNITS)
PCPOS	-	PCF MOUNTING POS (DFD UNITS)
CIDPOS	-	CID MOUNTING POS (DFD UNITS)
FTRLOC	-	FRONT TO REAR DIST. (DFD UNITS)
DFDFCT	-	DFD GAIN FACTOR = 1
SNDSTP	-	CMOS STEP UPDATE DISTANCE
DBIASF	-	BIAS FRONT
DBIASR	-	BIAS REAR
SRKVAL	-	SENSOR RATE LIMIT VALUE
TRGFCT	-	TRIG COMPENSATION FACTOR

/OPSVEC/

OPMODE	-	OPERATION MODE
MODECT	-	CONTROL MODE
RNGMSK	-	RANGE CHECK FLAG
OPSENR	-	SENSOR DELAY FLAG
RATECK	-	RATE CHECK FLAG
STAT	-	SYSTEM STATUS
FDVGN	-	FRONT CONTROL GAIN
FDCAL	-	FRONT TRIG FACTOR
RDVGN	-	REAR CONTROL GAIN
RDCAL	-	REAR TRIG FACTOR

PROGRAM OPERATION PARAMETERS

/OPPARM/ ICMPNT(10), NMXVEC(16), NMXIPX(6)

ICMPNT(1)	7	CID MAP CONTROL SET INTO MESSAGE VECTOR
(2)	4	LCF
(3)	8	PKF
(4)	9	PKR
(5)	3	TCF
(6)	10	VCF
(7)	11	VCR
(8)	18	FRT
(9)	19	RER
(10)	20	OUT

NMXVEC(1)	8	NMXSEN
(2)	8	NMXERR
(3)	Ø	NMXSIR
(4)	6	NMXIPM
(5)	Ø	NMXOUT
(6)	8	NMXDSP

NMXVEC	(7)	2Ø	NMXIOF
	(8)	1Ø	NMXCNM, CTV
	(9)	9	NMXDBG
	(10)	8	NMXCBF
	(11)	128	NMXTAP
	(12)	8	NMXKIB
	(13)	2Ø	NMXPRM
	(14)	Ø	NMXOPS
	(15)	8	NMXPNT
	(16)	Ø	DUMMY

NMXIPX	(1)	17	I/O	NUMBER OF PROMPTS TO ASK
	(2)	1Ø	CONTROL	FOR EACH TYPE
	(3)	4	OPERATION	
	(4)	1Ø	PARAMETERS	
	(5)	1	CMOS MEM TABLE	
	(6)	32	SENSOR TABLES	

```
/MESTAB/
ERRMES:     CHARACTER*4  (2Ø)

        1   $SEN
            $DFD
            $PCF
            $LCF
        5   $LAP
            $RAP
            $CID
            $PKF
            $PKR
       1Ø   $VCF
            $VCR
            $VOT
            $DSP
            $KEY
       15   $CAS
            $CRT
            $CDU
            $FRT
            $RER
       2Ø   $COT

DBGMES:     CHARACTER*4  (2Ø)

        1   @DBG
            OUT?
            INP?
            DAT?
        5   ITZ?
            TAP?
            I/O?
            CLK?
            MEM?
       1Ø   DUMP
            END?
            @SYS
            PORT
            CHNL
       15   UP
            DOWN
            MAN
            MODE
            WRIT
       2Ø   ADR?
```

```
RUNMES:     CHARACTER*4 (2Ø)

        1       ?I/O
                ?CNT
                ?OPS
                ?VRB
        5,6     *RUN-OK*
        7,8     *DEBUG *
        9,1Ø    ?CALBRAT
                ØPAUSE Ø
                MASK
                PARM
       15       ERR
                Ø-STOP-Ø
                *-EXIT-*
       2Ø        ##

DSPCODE:    CHARACTER*1 (1Ø)

       1:       Ø * # & Ø
       6:       @ ?   = /
```

PARAMETER MESSAGE TABLE

PARMES (20) CHARACTER*4

/MESTB2/

```
 1      DMAX
 2      DMIN
 3      ERLM
 4      SEAM
 5      PAVE
 6      PKSP
 7      DBDF
 8      DBDR
 9      LENG
10      DRAD
11      LCPS
12      PCPS
13      CDPS
14      FLOC
15      DFCT
16      DSTP
17      FBAS
18      RBAS
19      SKRV
20      TRGF
```

```
/MESTB3/
OPSMES:     CHARACTER*4 (1Ø)

      1:    OPER
            MODE
            RANG
            OSDL
      5:    RATE
            STAT
            FDVG
            FCAL
            RDVG
            RCAL
```

OPERATION VARIABLE VALUES

OPMODE:	-1	REBOOT
	Ø	STOP
	1	RUN
	2	DEBUG
	3	HALT
	4	MANUAL
	5	CALIBRATE
MODECT:	Ø	NO CONTROL
	1	MODE II
	2,4	MODE I
	3	REAR SLAVE
RANG:	Ø	NO CHECK
	1	RANGE CHECK
OPSENR:	Ø	DIRECT
	1	DELAYED (PREVIEW)
RATECK:	Ø	NO CHECK
	1	RATE CHECK
STATUS:	Ø	SYSTEM COLD START
	1	RUNNING

SENSOR INDEX POINTER

SINPNT:

1	DFD
2	PCF
3	LCF
4	LAP
5	RAP
6	CID
7	PKF
8	PKR

USED FOR CONTROL OF A/D AND CONVERSION AND RANGE CHECK TABLE ENTRIES

POINTS INTO SIB OR SDB ENTRIES FOR APPROPRIATE VALUE

VCS ERROR CODES

ERROR(1) = I (SINPNT) FOR SENSOR INPUT RANGE ERROR POSITIVE
I + 1Ø FOR NEGATIVE

ERROR(2) = 1 IF 39 VOLT FAILURE

ERROR(3) = 1 CAL SWITCH $\overline{\text{RUN}}$ FROM RUN MODE

ERROR(4) RATE CHECKING
= 1 LCF ERROR
= 1Ø PCF
= 11 BOTH

ERROR(5) = N; CASSETTE ERROR (DUMMY(2))
ERROR FLAG BYTE = STATUS FROM CASSETTE

ERROR(6) CMOS DATA NOT READY MODE I MODECT = 2 or 4

PROGRAM MODULES

VCS SUPERVISOR PROGRAM

Main program: VCSSUP

Main program calls supervisor routines based on flags and of modes.

Inputs: Control information buffers

Outputs: Nothing

Calls: SUPINP, SUPOUT, SUPCNT, SUPDBG, SUPITZ, SUPCAL, SUPERR, SUPEXT, SUPHLT

Destroys: Nothing

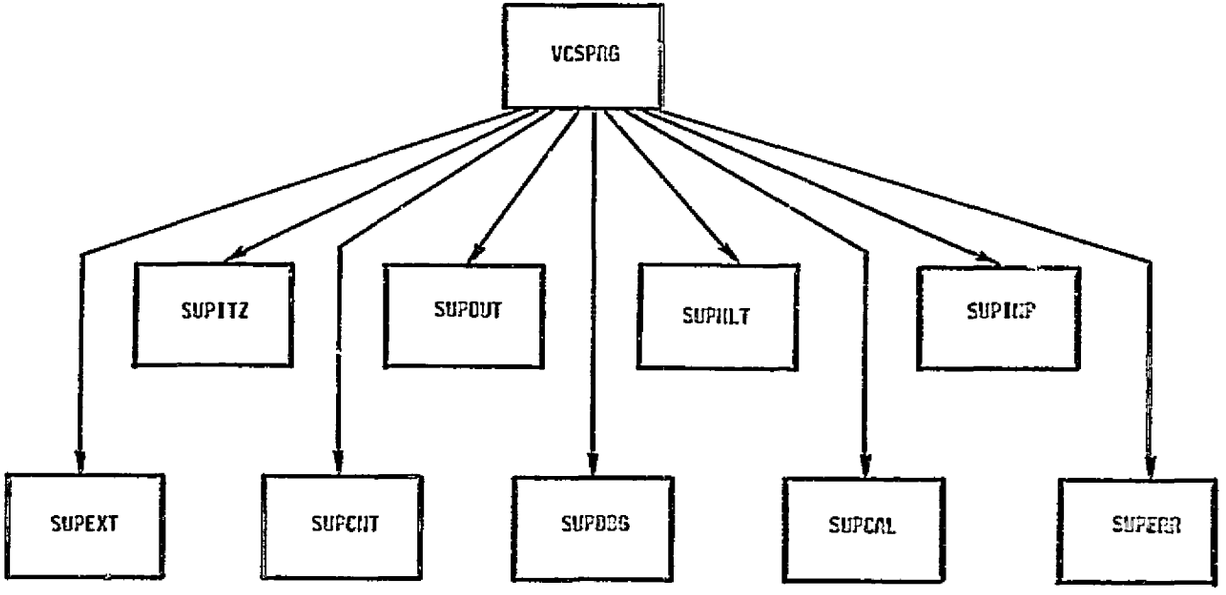
Modifies: Nothing

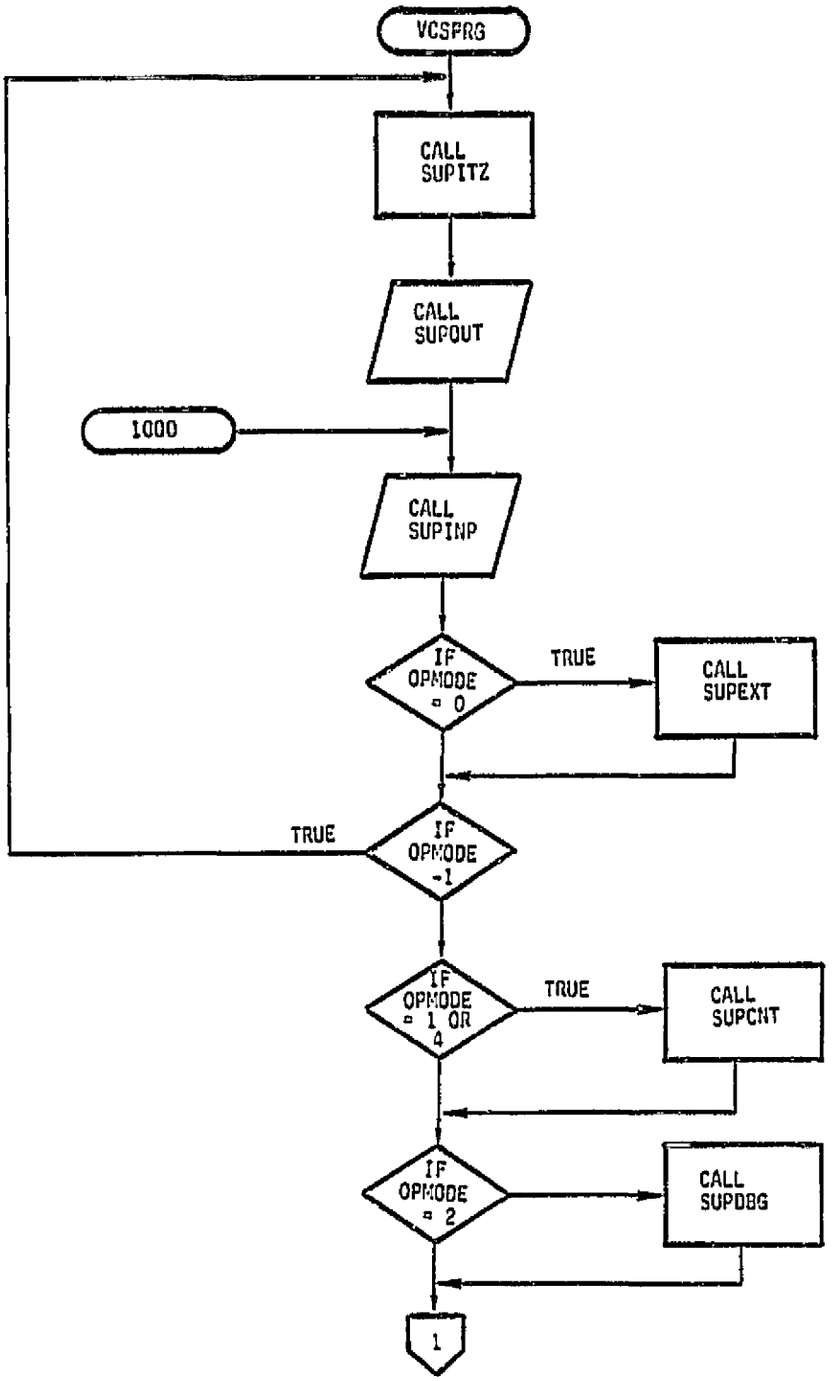
Language: FORTRAN 80

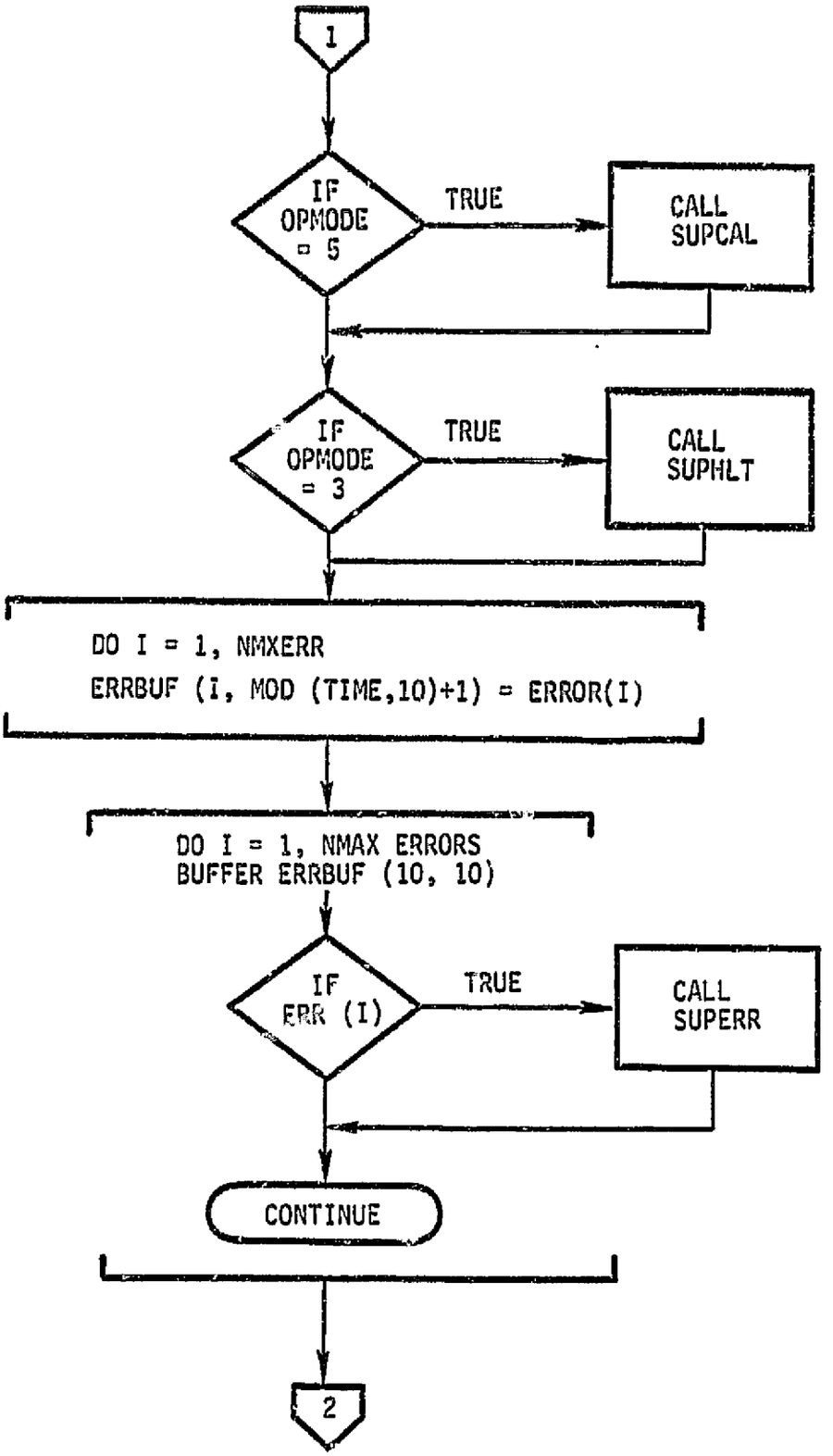
L-V-A: Version 1, Level 1
Roger B. Fish

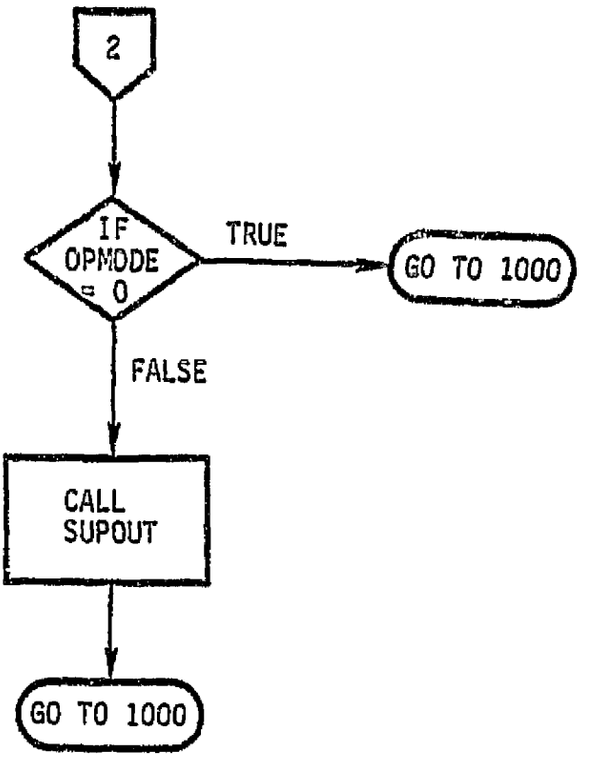
MODULE: VCSPRG

VCSPRG is the main program executive module of the VCS software. The main program supervises operation of the VCS by calling the appropriate supervisor routines to perform the required operations. VCSPRG continuously monitors operation parameters (OPMODE, ERROR(I)) and calls the relevant routines to handle the condition. (For example, DEBUG, RUN, INITIALIZE, ERROR PROCESSING.) Communication between modules in the VCS software, except for certain I/O drivers, is via global COMMON blocks. VCS operates by continuously scanning the mode and status data and looping through its test code. The routine first inputs all sensor and control variables and then tests for supervisor routines to be called. Unless the supervisor causes a program termination, the system outputs are then updated and the process repeats.


VCSPRG
SUPITZ
SUPOUT
SUPILT
SUPEXT
SUPCNT
SUPDBG
SUPCAL


VCSPRG
CALL SUPITZ
CALL SUPOUT
1000
CALL SUPINP
IF OPMODE = 0
TRUE
CALL SUPEXT
TRUE
IF OPMODE -1
IF OPMODE = 1 OR 4
TRUE
CALL SUPCNT
IF OPMODE = 2
CALL SUPDBG
1


1
IF OPMODE = 5
TRUE
CALL SUPCAL
IF OPMODE = 3
TRUE
CALL SUPHLT
DO I = 1, NMXERR
ERRBUF (I, MOD (TIME,10)+1) = ERROR(I)
DO I = 1, NMAX ERRORS
BUFFER ERRBUF (10, 10)
IF ERR (I)
TRUE
CALL SUPERR
CONTINUE
2


2
IF
OPMODE
= 0
TRUE
GO TO 1000
FALSE
CALL
SUPOUT
GO TO 1000

SUPERVISOR SUBROUTINES

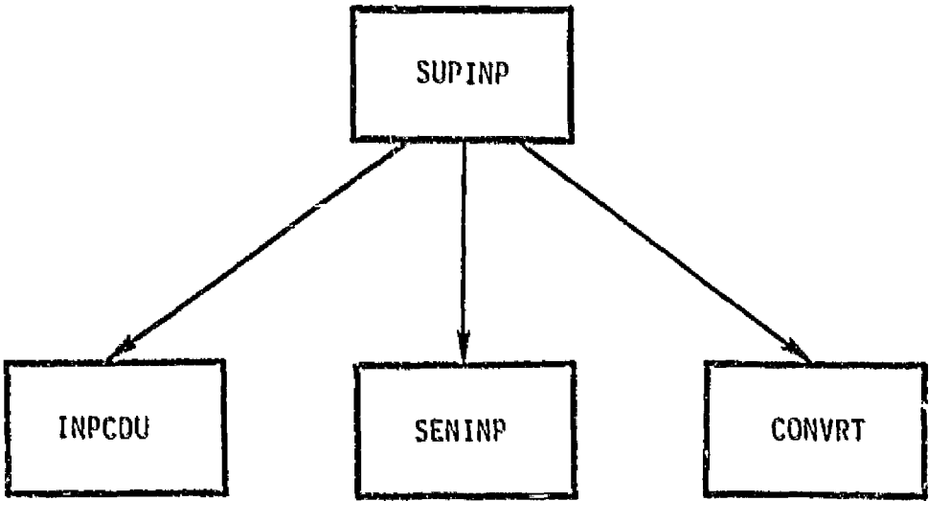
SUPINP	Input supervisor (sensors)
SUPOUT	Output supervisor
SUPCNT	Control supervisor
SUPDBG	Debug supervisor
SUPITZ	Initialization routine
SUPERR	Error handler
SUPEXT	Exit routine
SUPCAL	Calibration routines (restart)
SUPHLT	Program hard pause

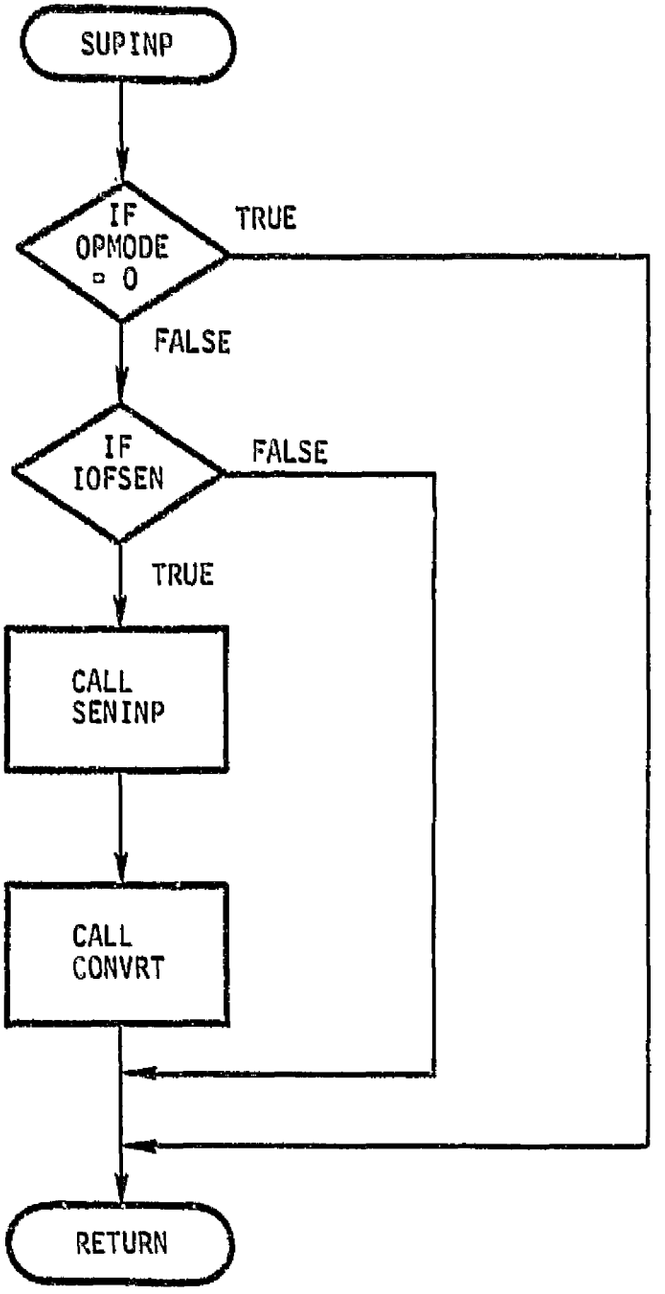
SUPERVISOR CONTROL ROUTINE

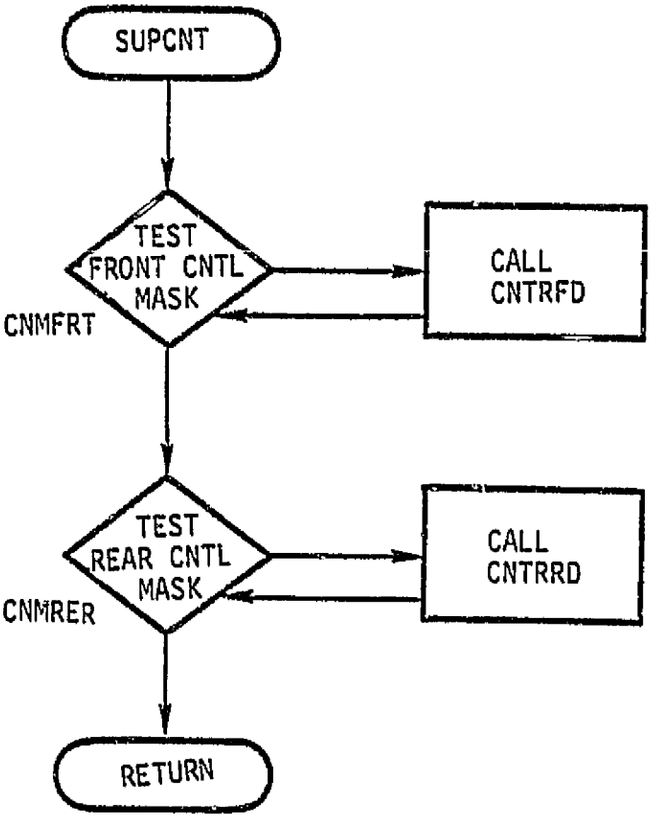
SUBROUTINE:	SUPINP
SUPINP	Control input to the VCS
Inputs:	I/O control buffer
Outputs:	Nothing
Calls:	SENINP, INPCDU, CONVRT
Destroys:	Nothing
Modifies:	Sensor input buffer
Language:	FORTRAN 80
L-V-A:	Version 1, Level 1 Roger B. Fish

MODULE: SUPINP

SUPINP is the supervisor routine which inputs sensor and control data to the VCS. The routine reads the operator control panel switches and then tests if sensor I/O is enabled by an I/O flag. If the flag, IOFSEN, is true, the sensor input routines SENINP for LCF, PCF, etc. is called. The sensor conversion routine CONVRT is called to convert the raw sensor data into appropriate engineering units.


SUPINP
INPCDU
SENINP
CONVRT


SUPINP
IF
OPMODE
= 0
TRUE
FALSE
IF
IOFSEN
FALSE
TRUE
CALL
SENINP
CALL
CONVRT
RETURN


SUPCNT
TEST
FRONT CNTL
MASK
CNMFRT
CALL
CNTRFD
TEST
REAR CNTL
MASK
CNMRER
CALL
CNTRRD
RETURN

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPOUT

SUPOUT controls outputs from the VCS

Inputs: I/O control vector

Outputs: Nothing

Calls: CNTOUT, SAVDAT, FORMAT, CLOCK, INTREN, OUTDSP, OUTPUT

Destroys: Nothing

Modifies: Nothing

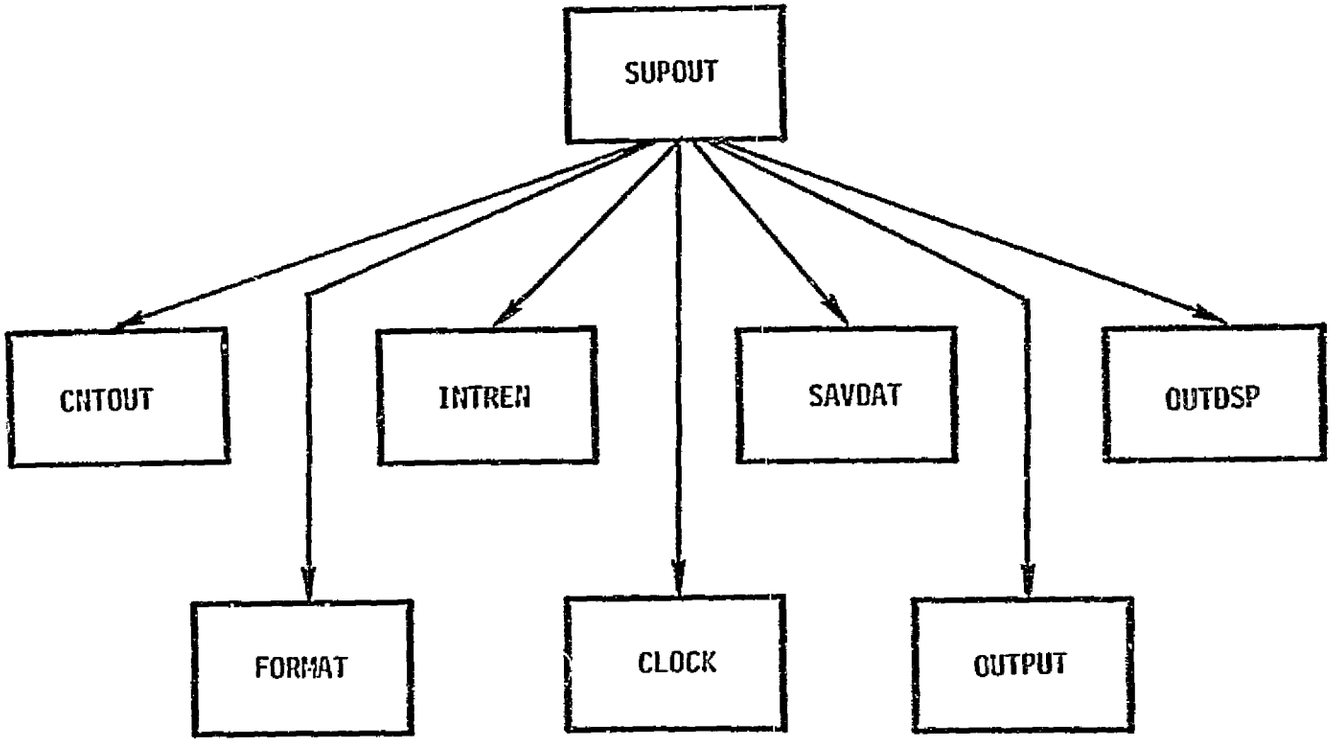
Language: FORTRAN 80

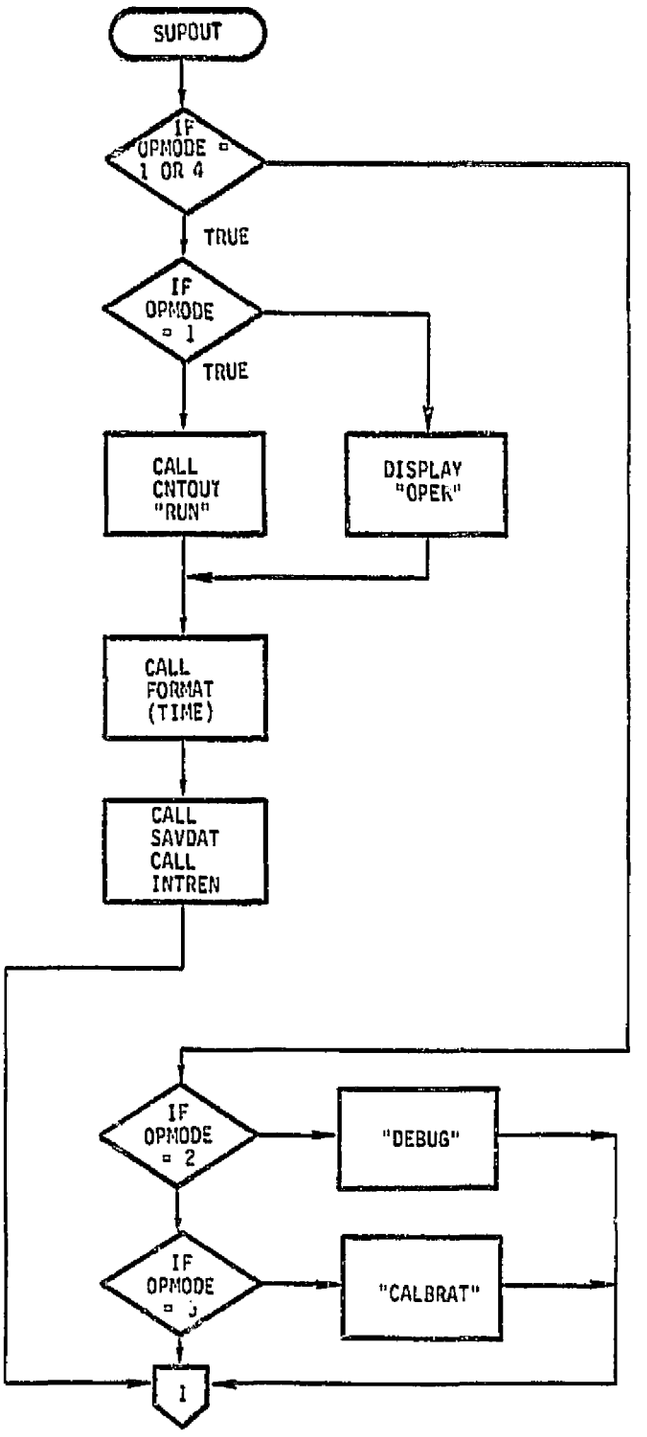
L-V-A: Version 1, Level 1
Roger B. Fish

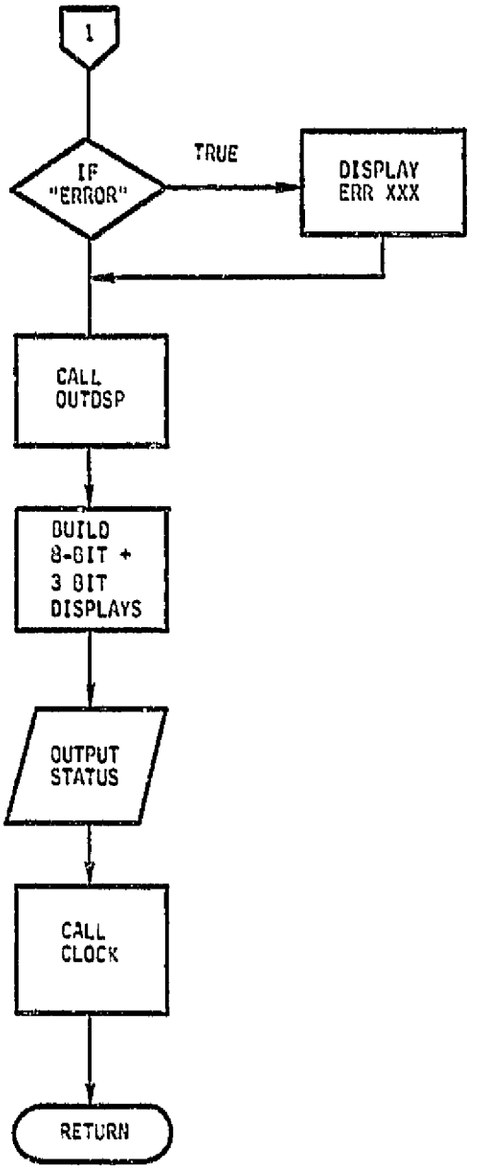
MODULE: SUPOUT

SUPOUT is the supervisor routine which outputs data from the VCS to the various control devices, control indicators, and operator control panel.

The operation mode value (OPMODE) is tested and an appropriate message is displayed on the display panel, and appropriate output routines are called. Display information for the control display is formatted and output. Finally, CLOCK is called for system synchronization.


SUPOUT
CNTOUT
INTREN
SAVDAT
OUTDSP
FORMAT
CLOCK
OUTPUT


SUPOUT
IF OPMODE = 1 OR 4
TRUE
IF OPMODE = 1
TRUE
CALL CNTOUT "RUN"
DISPLAY "OPER"
CALL FORMAT (TIME)
CALL SAVDAT CALL INTREN
IF OPMODE = 2
"DEBUG"
IF OPMODE = 3
"CALBRAT"
1


1
IF "ERROR"
TRUE
DISPLAY ERR XXX
CALL OUTDSP
BUILD 8-BIT + 3 BIT DISPLAYS
OUTPUT STATUS
CALL CLOCK
RETURN

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPCNT

SUPCNT controls VCS control algorithm use and signal generation.

Inputs: Operation control vectors

Outputs: Nothing

Calls: CNTRFD, CNTRRD

Destroys: Nothing

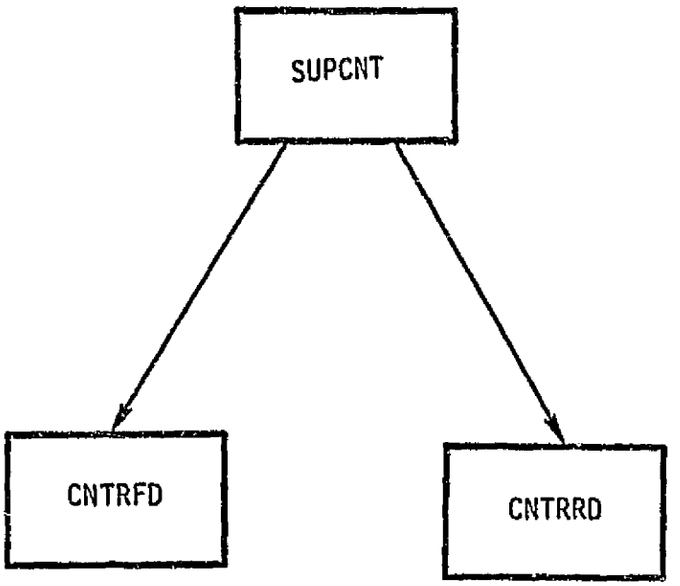
Modifies: Nothing

Language: FORTRAN 80

L-V-A Version 1, Level 1
Roger B. Fish

MODULE: SUPCNT

SUPCNT is the VCS control algorithm supervisor routine. This routine tests the control operation flags and control words and calls the appropriate routine to control the front, rear, or output the valve control signals.


SUPCNT
CNTRFD
CNTRRD

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPDBG

SUPDBG is the debug operation routine

Inputs: Debug control vector

Outputs: None

Calls: DBUGCI, DBUGCO, DBUGIN, DBUGOT, DBUGTP, ITZINP, DBUGCK, DBUGME, DBUGIO, INTRDS

Destroys: Nothing

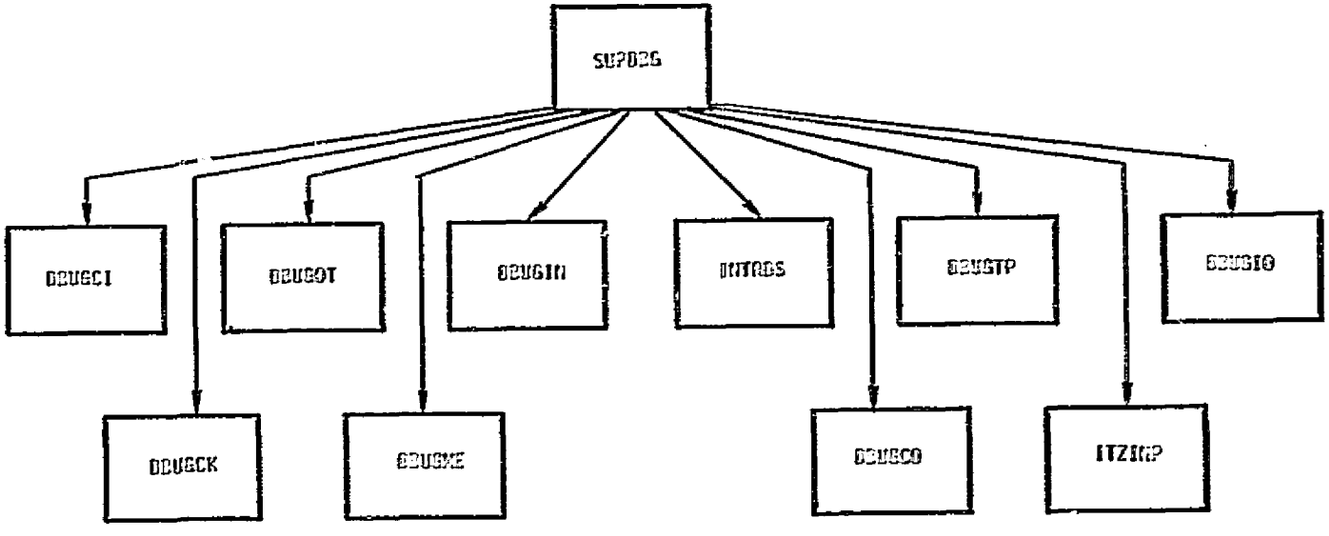
Modifies: Nothing

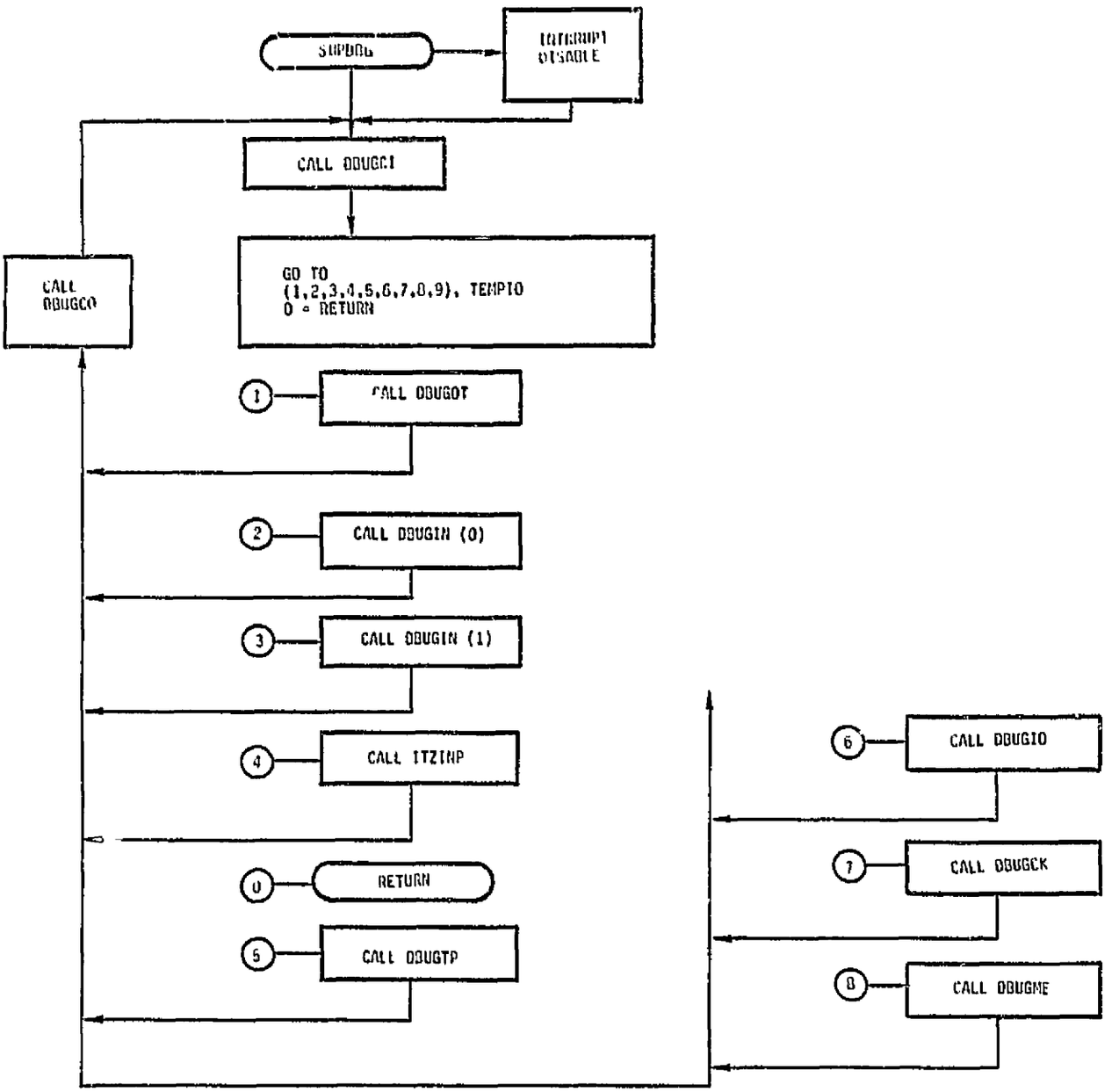
Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish

MODULE: SUPDBG

SUPDBG is the debug interaction supervisor. SUPDBG is called by *MAIN* when OPMODE is set to the debug value. SUPDBG then calls the debug control input routine DBUGCI which prompts the user for the appropriate control input to select one of the debug options. When debug is complete, the routine returns to *MAIN*. SUPDBG can also call the interactive initialization routine ITZINP if the operator wishes to modify any variables.


SUPDBG
DBUGCI
DBUGOT
DBUGIN
INTRDS
DBUGTP
DBUGIO
DBUGCK
DBUGXE
DBUGCO
ITZINP


SUPDBG
INTERRUPT DISABLE
CALL DBUGCI
GO TO (1,2,3,4,5,6,7,8,9), TEMPIO 0 = RETURN
CALL DBUGCO
1
CALL DBUGOT
2
CALL DBUGIN (0)
3
CALL DBUGIN (1)
4
CALL ITZINP
0
RETURN
5
CALL DBUGTP
6
CALL DBUGIO
7
CALL DBUGCK
8
CALL DBUGME

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPITZ

SUPITZ initializes the program variables buffers and control variables.

Inputs: None

Outputs: System initialized

Calls: INTRDS, INTRAN, OUTDSP, AIOITZ, ITZINP, INPCDU, RESTRT, TAPITZ

Destroys: Nothing

Modifies: Input buffers, parameters, interrupts, control information

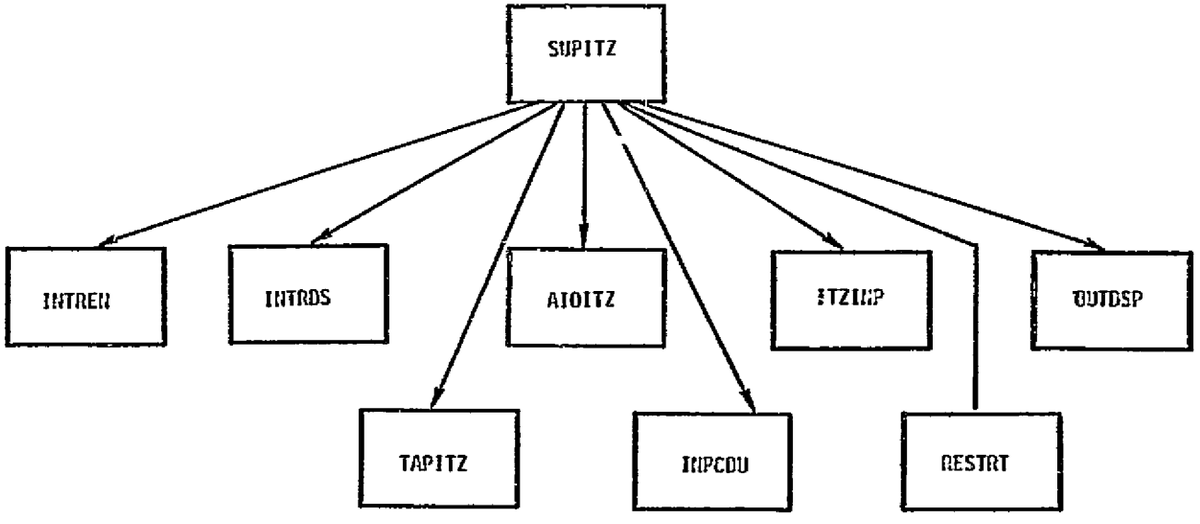
Language: FORTRAN 80

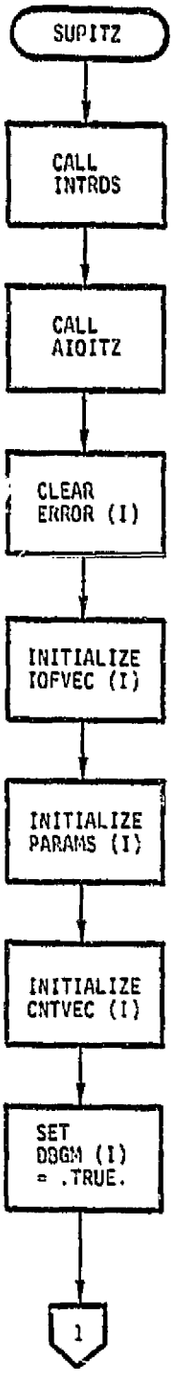
L-V-A: Version 1, Level 1
Roger B. Fish

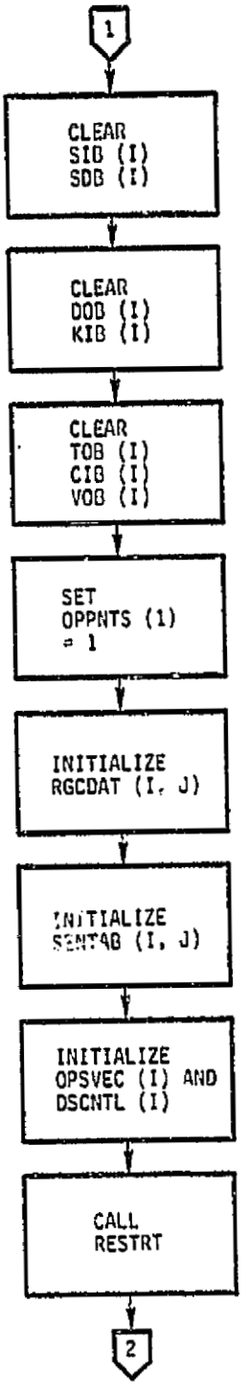
MODULE: SUPITZ

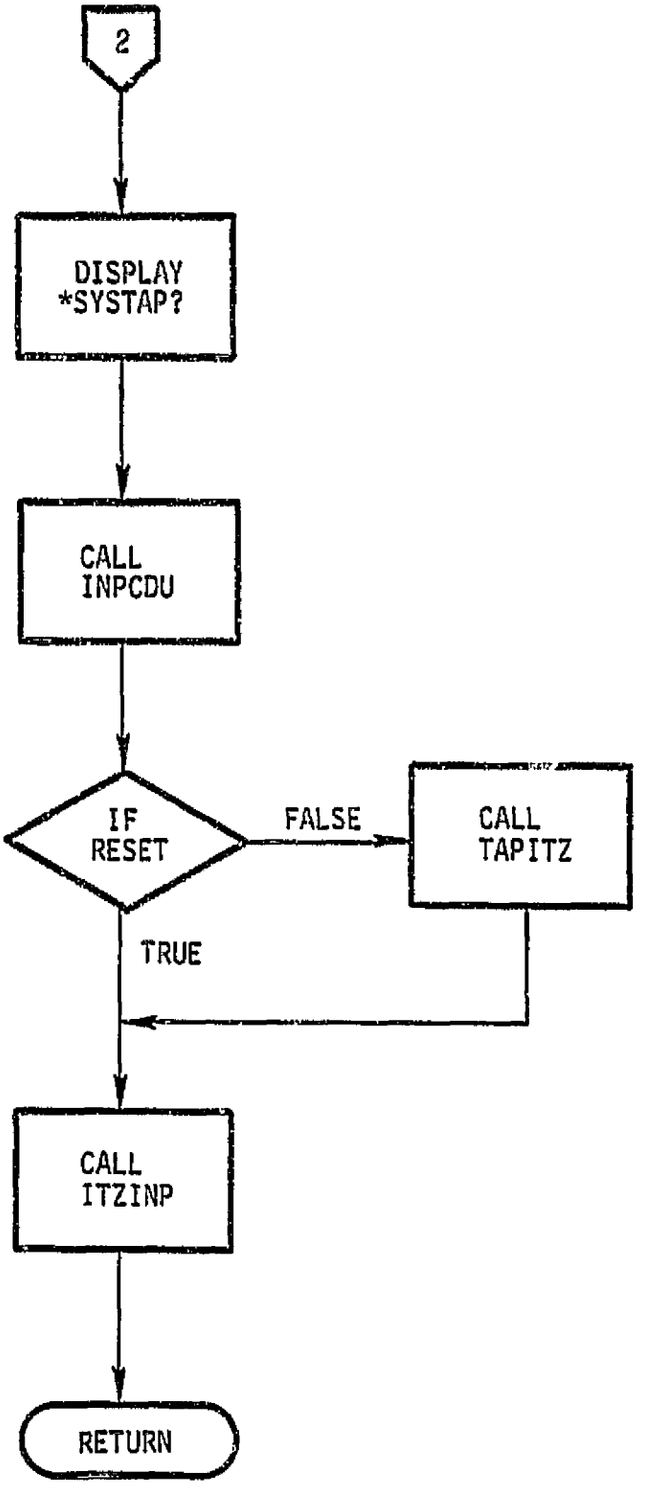
SUPITZ is the program initialization routine. SUPITZ takes care of initializing I/O interfaces via AIOITZ, clears I/O buffers to zero, and loads common blocks from the default ROM areas. The default values are copied into RAM memory so that the values can be modified via routine ITZINP.

SUPITZ also calls INTRDS to disable system interrupts.


SUPITZ
INTREN
INTRDS
AIOITZ
TAPITZ
INPCOU
RESTRT
OUTDSP


SUPITZ
CALL INTRDS
CALL AIOITZ
CLEAR ERROR (I)
INITIALIZE IOFVEC (I)
INITIALIZE PARAMS (I)
INITIALIZE CNTVEC (I)
SET DBGM (I) = .TRUE.
1


1
CLEAR
SIB (I)
SDB (I)
CLEAR
DOB (I)
KIB (I)
CLEAR
TOB (I)
CIB (I)
VOB (I)
SET
OPPNTS (1)
= 1
INITIALIZE
RGCDAT (I, J)
INITIALIZE
SENTAB (I, J)
INITIALIZE
OPSVEC (I) AND
DSCNTL (I)
CALL
RESTRT
2


2
DISPLAY
*SYSTAP?
CALL
INPCDU
IF
RESET
FALSE
CALL
TAPITZ
TRUE
CALL
ITZINP
RETURN

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPERR

SUPERR processes error condition flags and outputs message.

Inputs: Error flag vector

Outputs: D/C error message

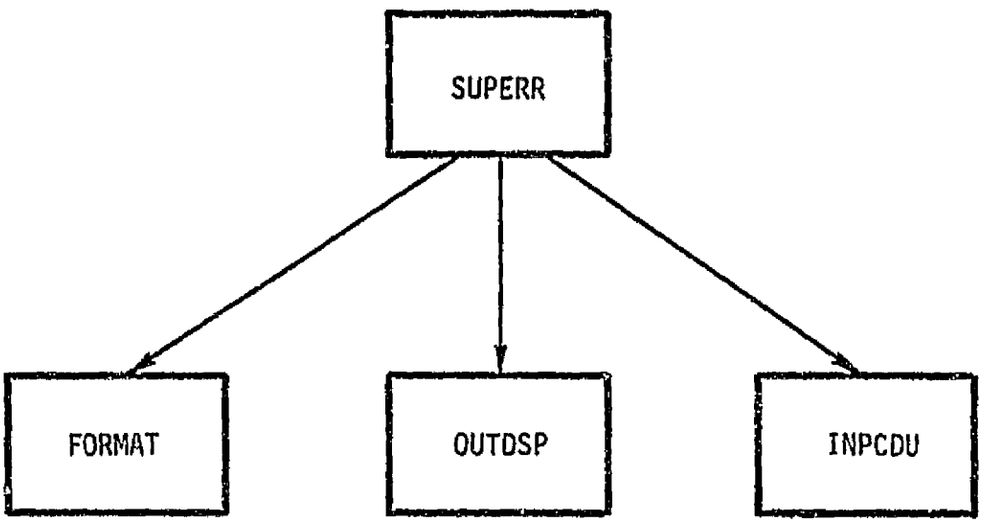
Calls: OUTDSP, INPCDU, FORMAT

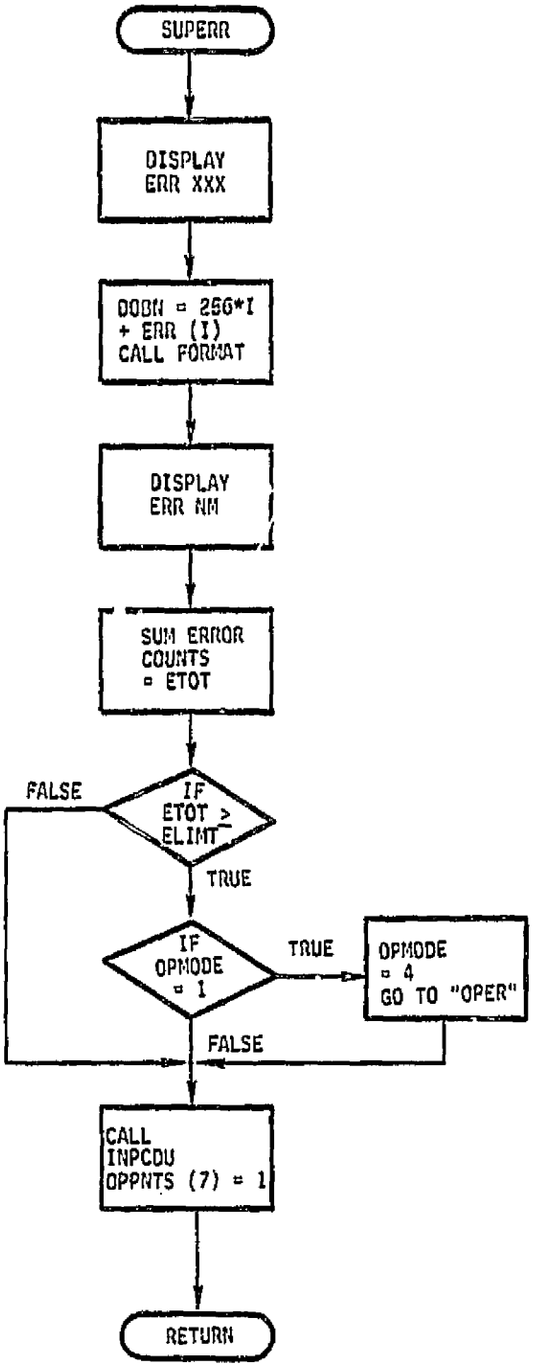
Destroys: Error flags

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SUPERR
FORMAT
OUTDSP
INPCDU


SUPERR
DISPLAY
ERR XXX
DOBN = 256*I
+ ERR (I)
CALL FORMAT
DISPLAY
ERR NM
SUM ERROR
COUNTS
= ETOT
IF
ETOT ≥
ELIMT
FALSE
TRUE
IF
OPMODE
= 1
TRUE
OPMODE
= 4
GO TO "OPER"
FALSE
CALL
INPCDU
OPPNTS (7) = 1
RETURN

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPEXT

SUPEXT exits from the VCS program after closing data base.

Inputs: None

Outputs: None

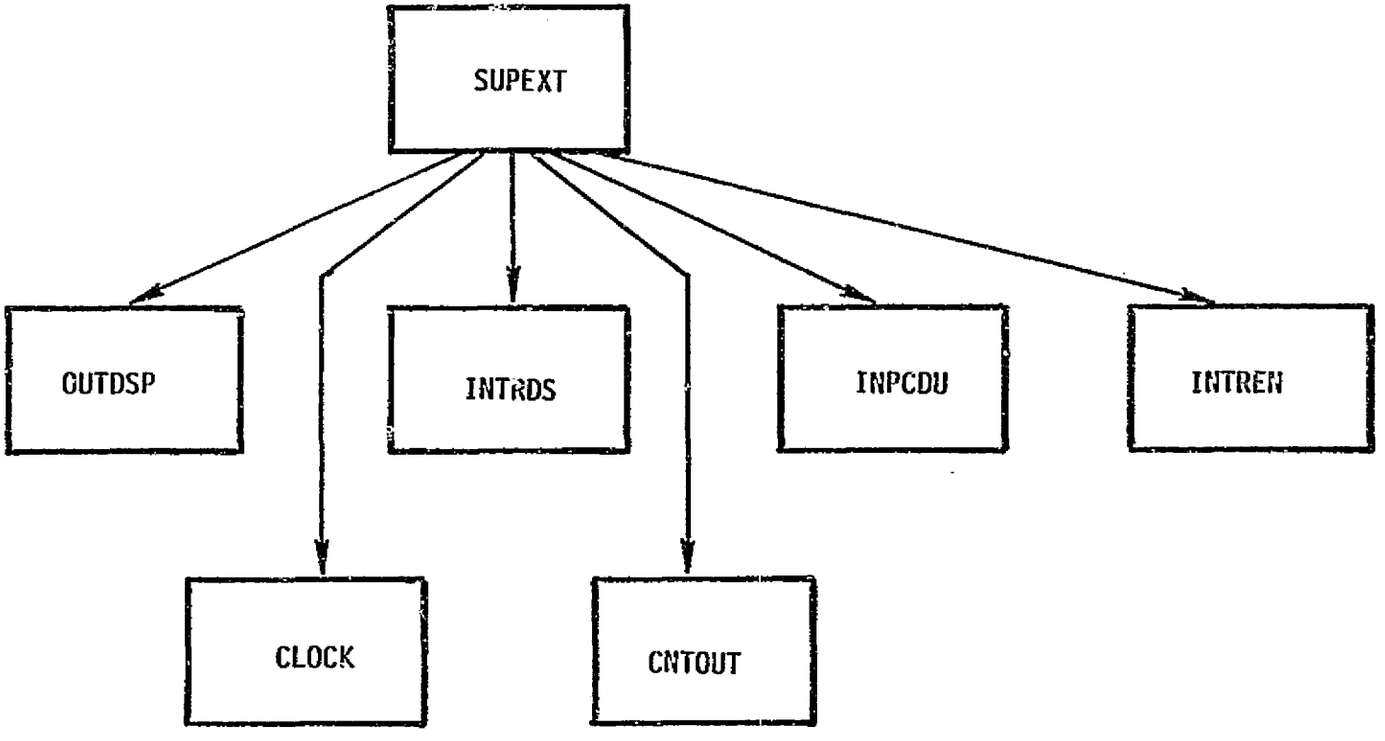
Calls: CLOCK, INTRDS, INPCDU, OUTDSP, CNTOUT, INTREN

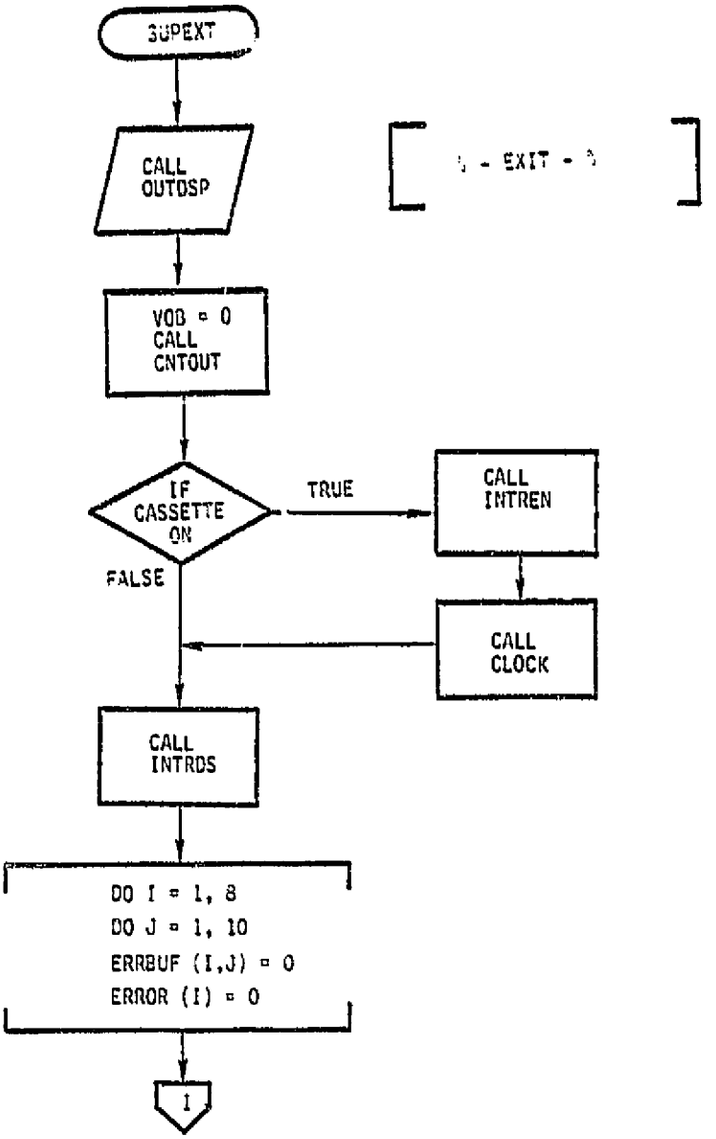
Destroys: S1B, SDB, ERRORS

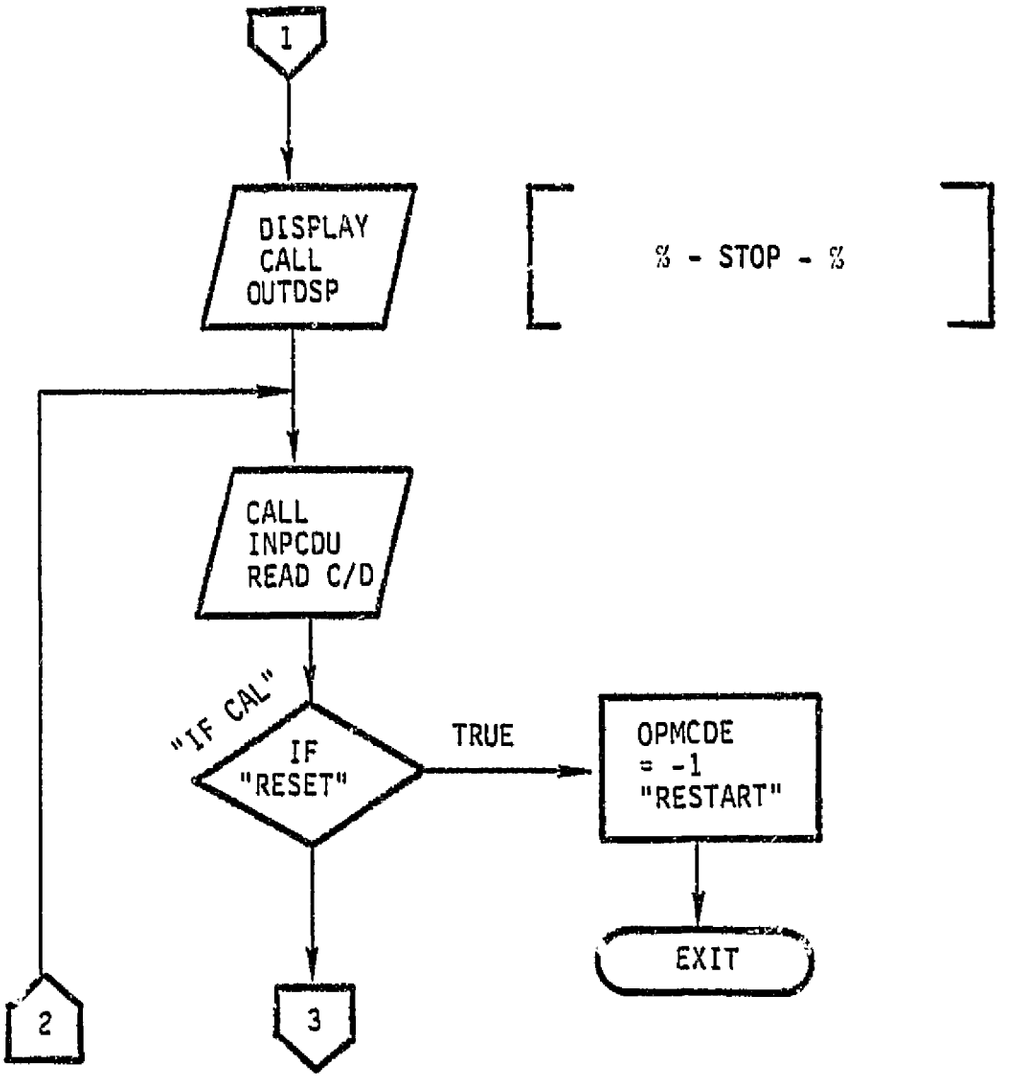
Modifies: Pointers, control words

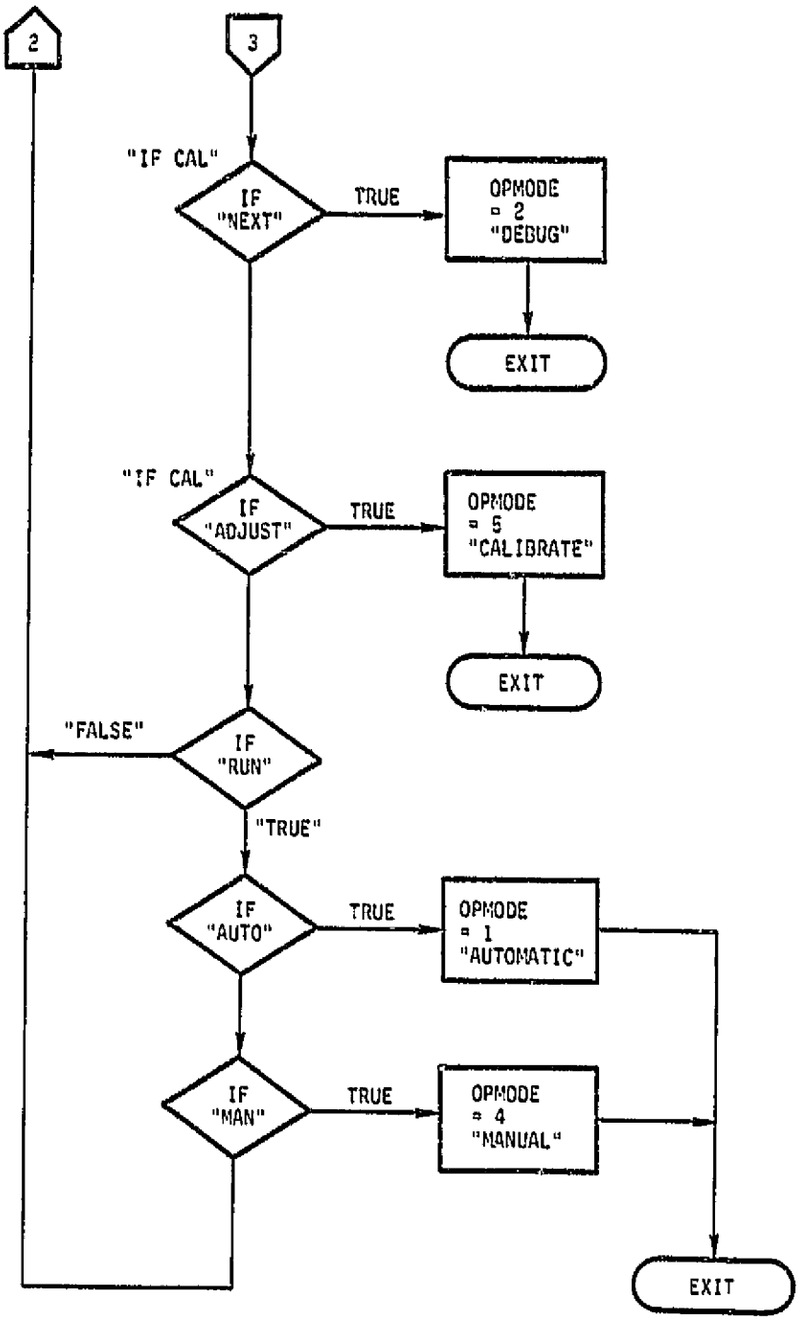
Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SUPEXT
OUTDSP
INTRDS
INPCDU
INTREN
CLOCK
CNTOUT


SUPEXT
CALL OUTDSP
VOB = 0
CALL CNTOUT
IF CASSETTE ON
TRUE
CALL INTREN
CALL CLOCK
FALSE
CALL INTRDS
DO I = 1, 8
DO J = 1, 10
ERRBUF (I,J) = 0
ERROR (I) = 0
I


1
DISPLAY
CALL
OUTDSP
% - STOP - %
CALL
INPCDU
READ C/D
"IF CAL"
IF
"RESET"
TRUE
OPMCDE
= -1
"RESTART"
EXIT
2
3


2
3
"IF CAL"
IF
"NEXT"
TRUE
OPMODE
= 2
"DEBUG"
EXIT
"IF CAL"
IF
"ADJUST"
TRUE
OPMODE
= 5
"CALIBRATE"
EXIT
"FALSE"
IF
"RUN"
"TRUE"
IF
"AUTO"
TRUE
OPMODE
= 1
"AUTOMATIC"
IF
"MAN"
TRUE
OPMODE
= 4
"MANUAL"
EXIT

SUPERVISOR CONTROL ROUTINE

Subroutine: SUPCAL

SUPCAL calls the system restart (warm start) routine.

Inputs: None

Outputs: OPMODE

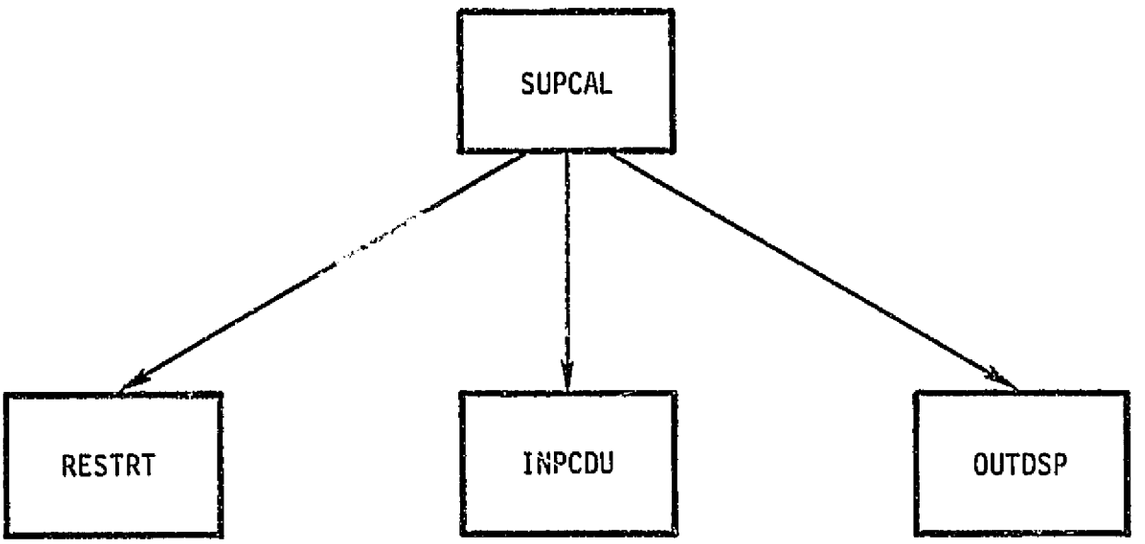
Calls: RESTRT, INPCDU, OUTDSP

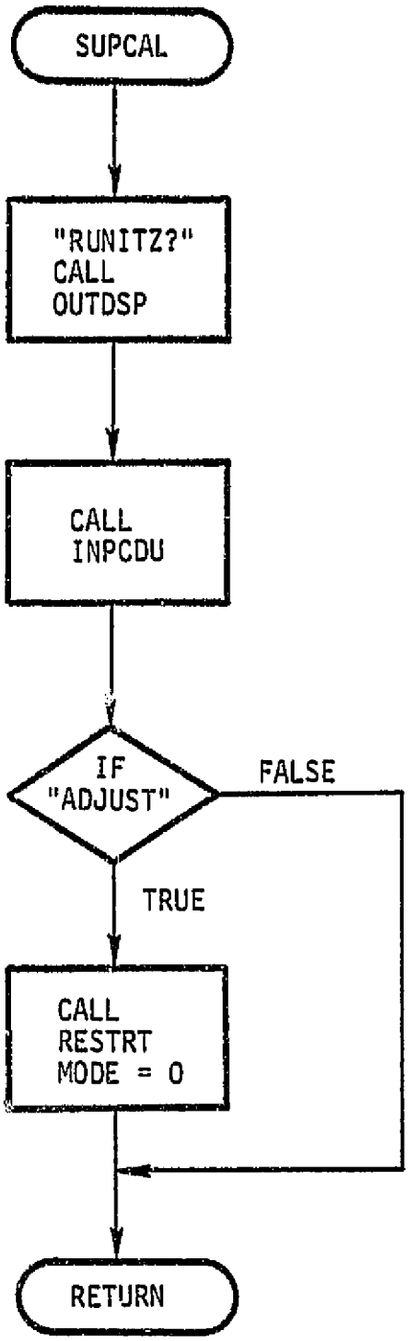
Destroys: Nothing

Modifies: OPSVEC, DOB

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SUPCAL
RESTRT
INPCDU
OUTDSP


SUPCAL
"RUNITZ?"
CALL
OUTDSP
CALL
INPCDU
IF
"ADJUST"
FALSE
TRUE
CALL
RESTRT
MODE = 0
RETURN

SUPERVISOR CONTROL MODULE

SUBROUTINE: SUPHLT

SUPHLT stops VCS program operation by stopping clock interrupts and blocks program flow.

Inputs: None

Outputs: OPMODE

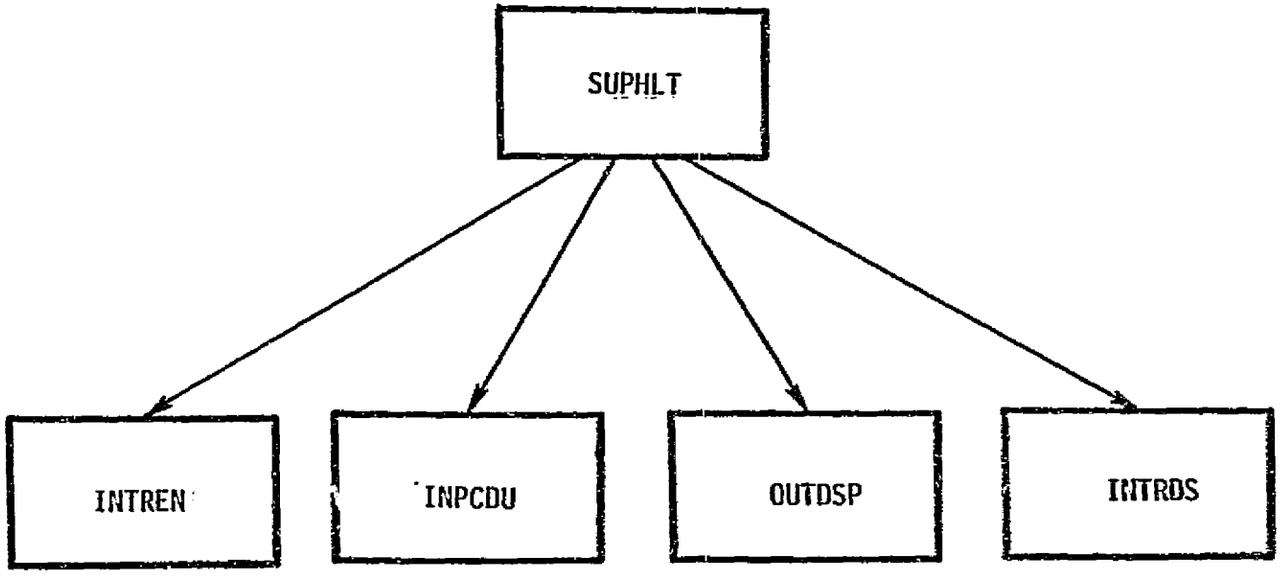
Calls: INTREN, INTRDS, INPCDU, OUTDSP

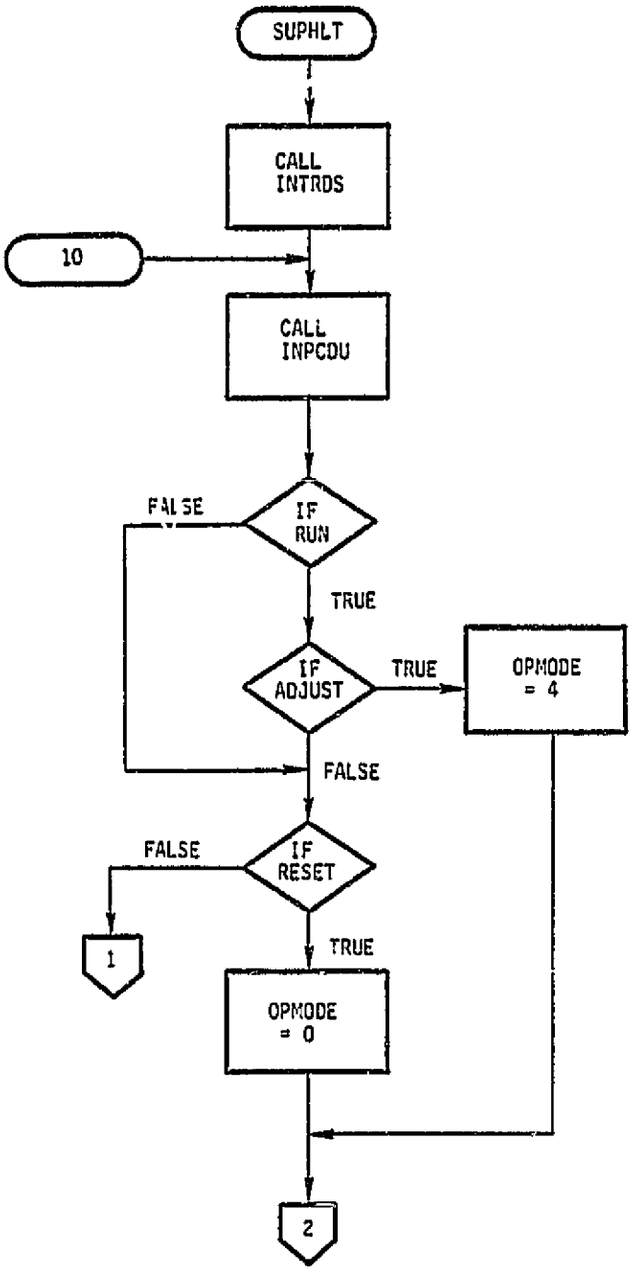
Destroys: DOB

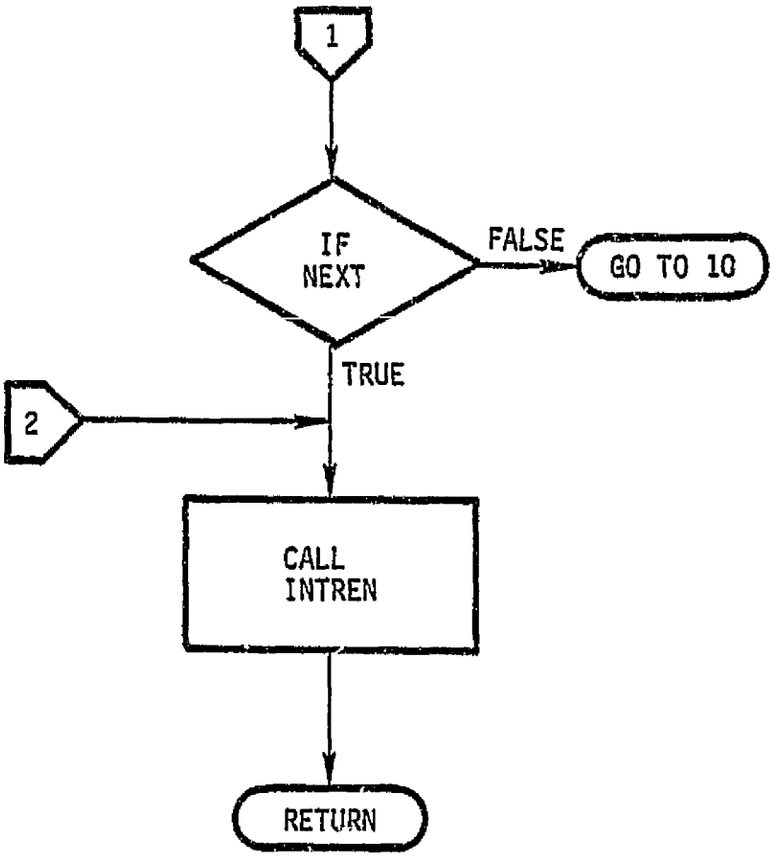
Modifies: OPSVEC

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SUPHLT
INTREN
INPCDU
OUTDSP
INTRDS


SUPHLT
CALL INTRDS
10
CALL INPCDU
IF RUN
FALSE
TRUE
IF ADJUST
TRUE
OPMODE = 4
FALSE
IF RESET
FALSE
TRUE
1
OPMODE = 0
2


1
IF
NEXT
FALSE
GO TO 10
TRUE
2
CALL
INTREN
RETURN

SUPERVISOR EXECUTION MODULES:

SENINP	-	Sensor input
CONVRT	-	Sensor conversion
CNTOUT	-	Control signal output
ITZINP	-	Initialization routine
RESTRT	-	Reset system, cold start

SUPERVISOR EXECUTION MODULE

Subroutine: SENINP

SENINP calls sensor input routines under I/O mask control.

Inputs: I/O mask buffer

Outputs: None

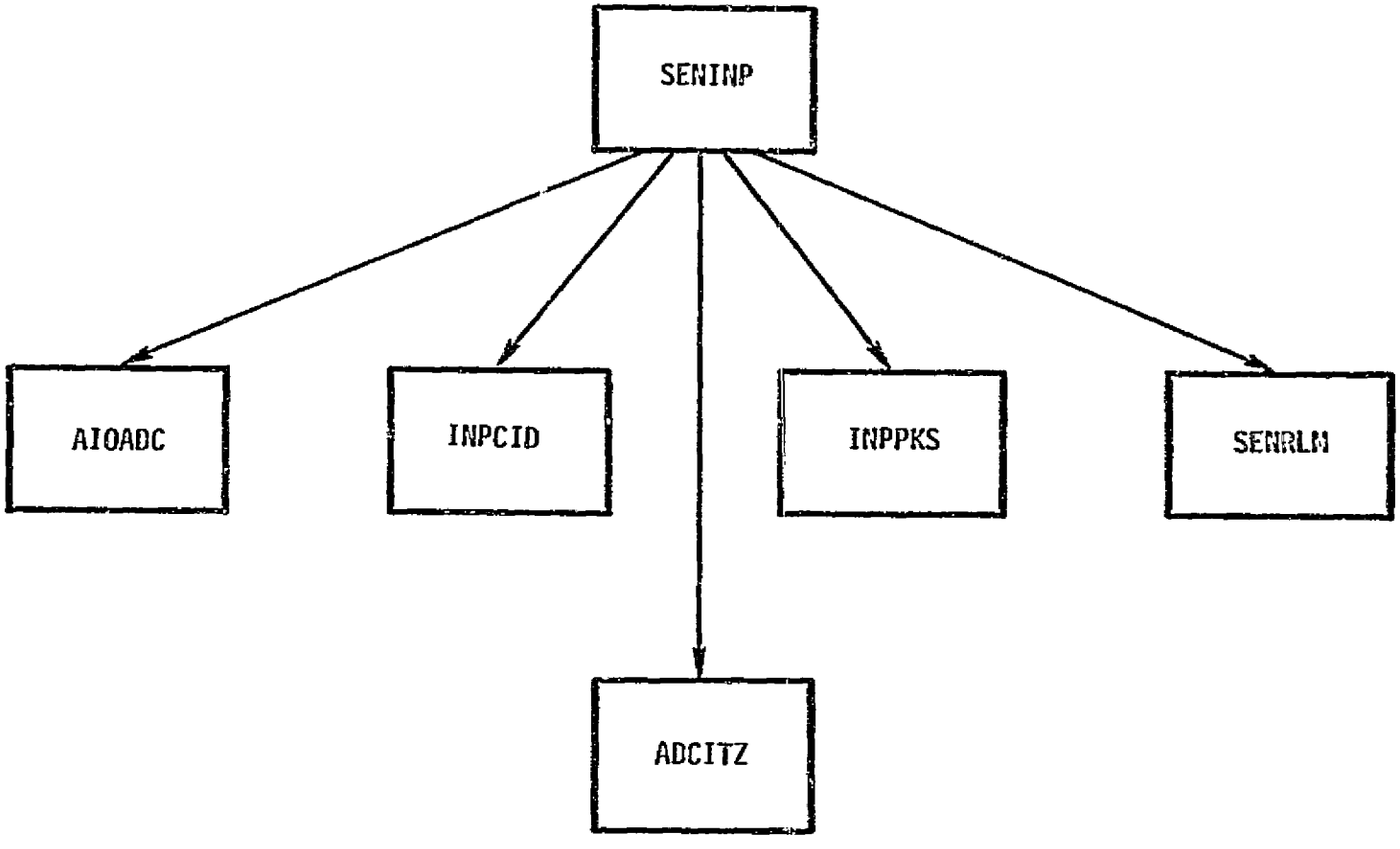
Calls: AIOADC, SENRLM, INPCID, INPPKS, ADCITZ

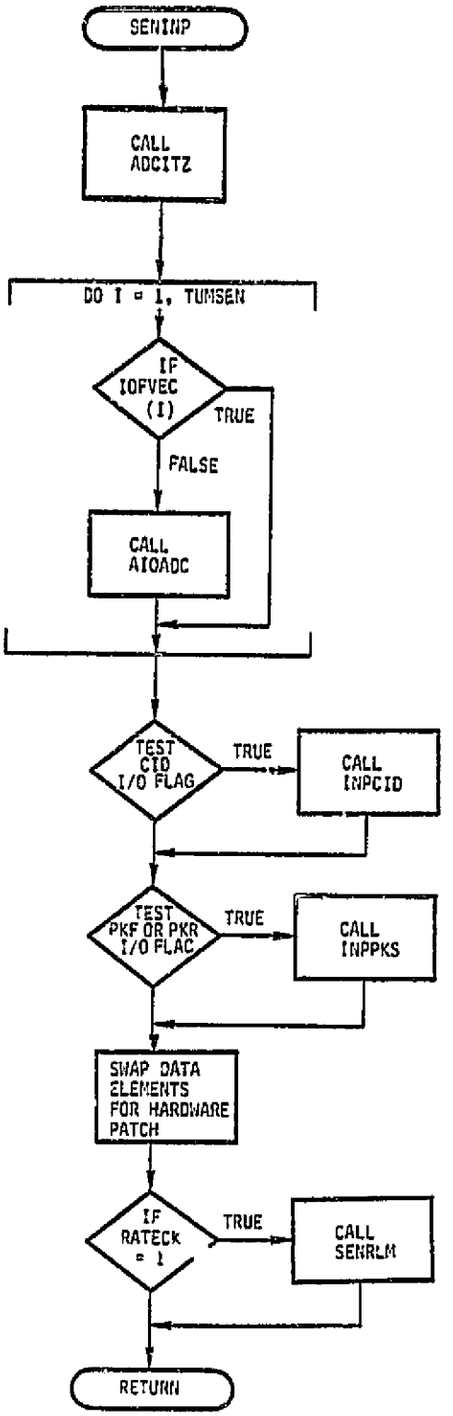
Destroys: Nothing

Modifies: Sensor input buffer

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SENINP
AIOADC
INPCID
INPPKS
SENRLN
ADCITZ


SENINP
CALL ADCITZ
DO I = 1, TUMSEN
IF IOFVEC (I)
TRUE
FALSE
CALL AIOADC
TEST CID I/O FLAG
TRUE
CALL INPCID
TEST PKF OR PKR I/O FLAC
TRUE
CALL INPPKS
SWAP DATA ELEMENTS FOR HARDWARE PATCH
IF RATECK = 1
TRUE
CALL SENRLM
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: CONVRT

CONVRT converts sensor input data to engineering units, and does range checking.

Inputs: Sensor input data

Outputs: None

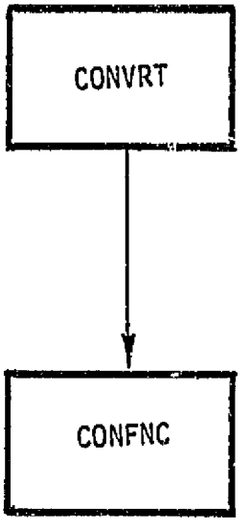
Calls: CONFNC

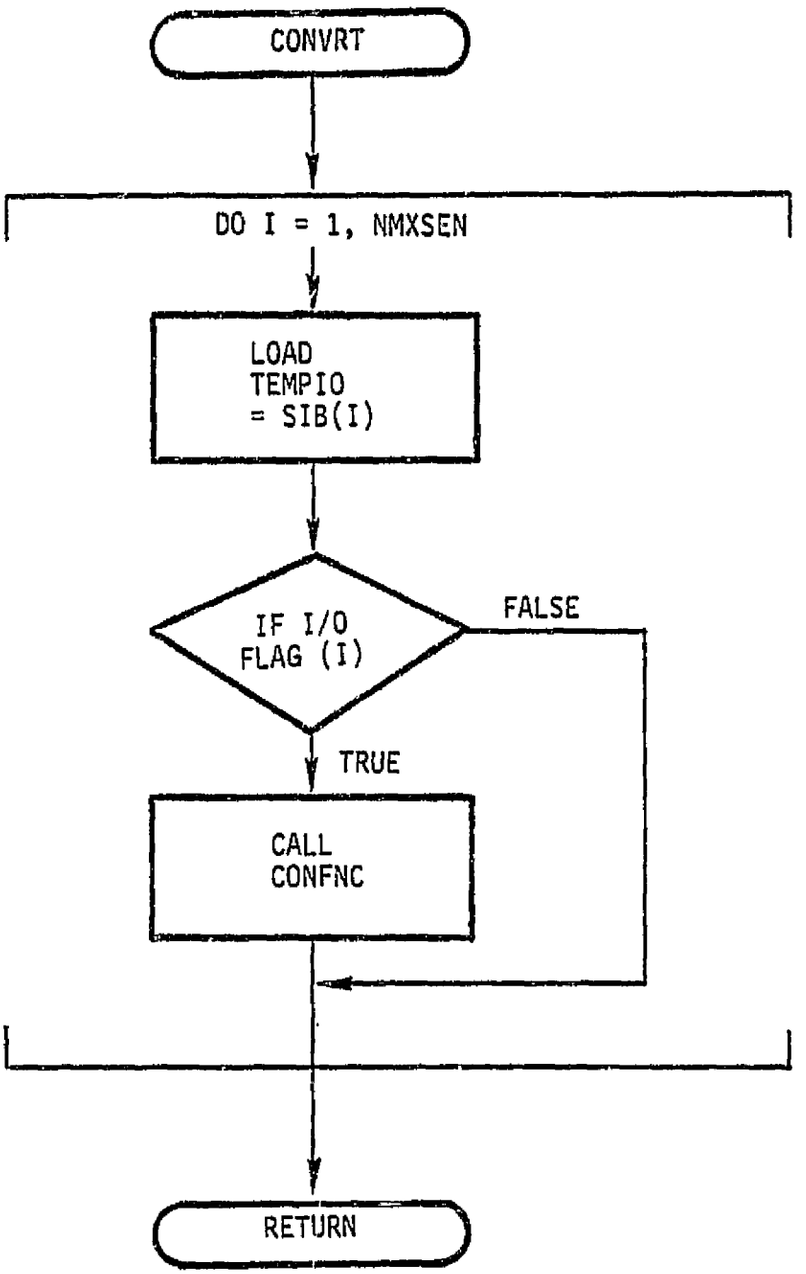
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


CONVRT
CONFNC


CONVRT
DO I = 1, NMXSEN
LOAD
TEMPIO
= SIB(I)
IF I/O
FLAG (I)
FALSE
TRUE
CALL
CONFNC
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: CNTOUT

CNTOUT is the controller output routine. This calls the appropriate output routines as per the I/O controls.

Inputs: I/O control vectors, controller outputs

Outputs: None

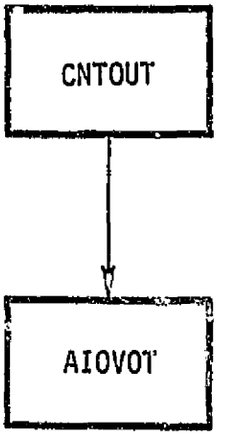
Calls: AIOVOT

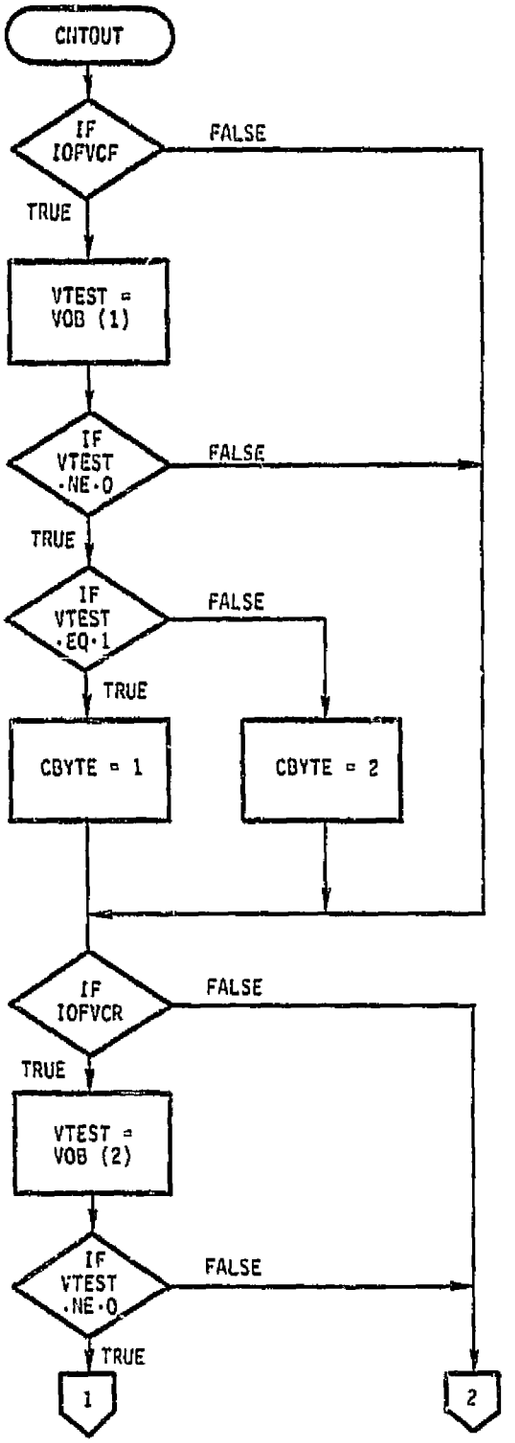
Destroys: Nothing

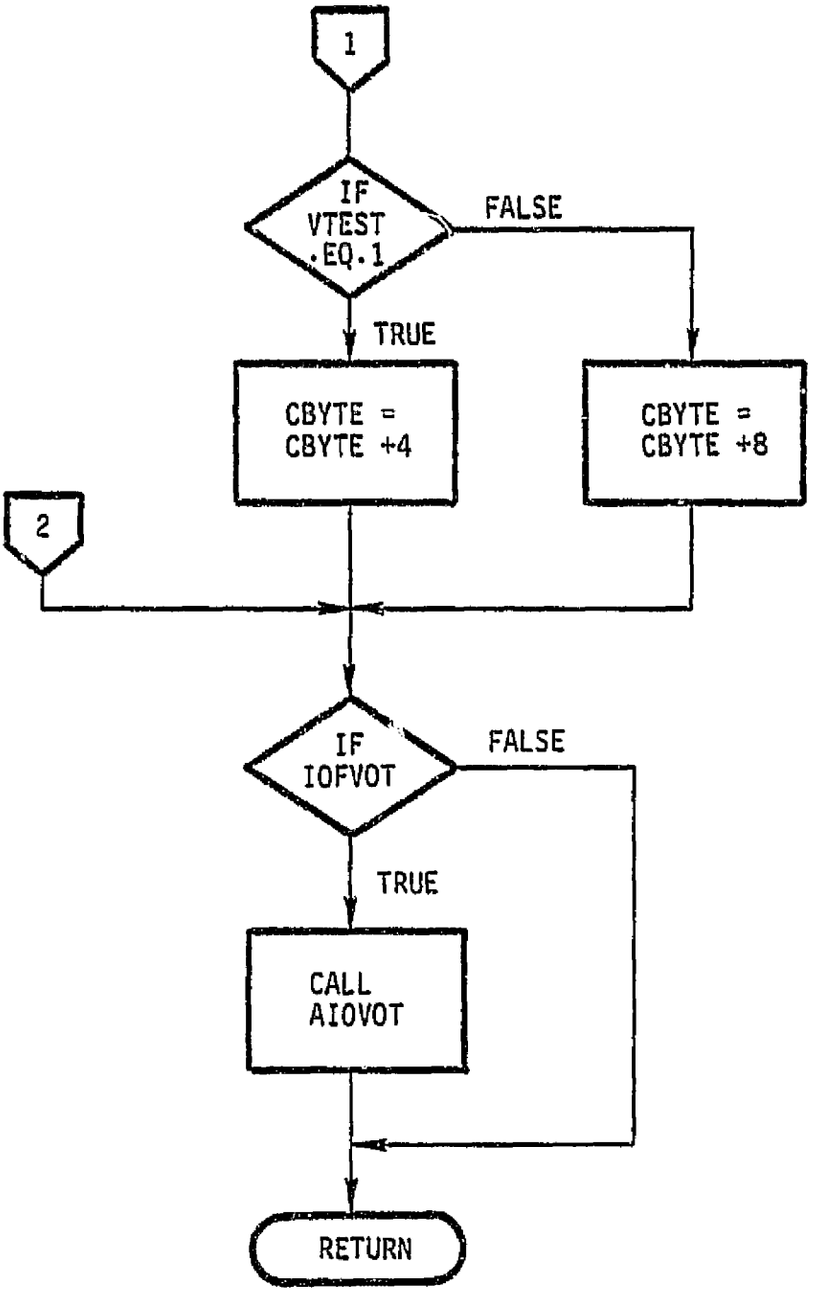
Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


CNTOUT
AIOVOT


CHTOUT
IF IOFVCF
FALSE
TRUE
VTEST = VOB (1)
IF VTEST .NE. 0
FALSE
TRUE
IF VTEST .EQ. 1
FALSE
TRUE
CBYTE = 1
CBYTE = 2
IF IOFVCR
FALSE
TRUE
VTEST = VOB (2)
IF VTEST .NE. 0
FALSE
TRUE
1
2


1
IF
VTEST
.EQ.1
FALSE
TRUE
CBYTE =
CBYTE +4
CBYTE =
CBYTE +8
2
IF
IOFVOT
FALSE
TRUE
CALL
AIOVOT
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: ITZINP

ITZINP prompts the user and updates the value of some variables in the program.

Inputs: None

Outputs: None

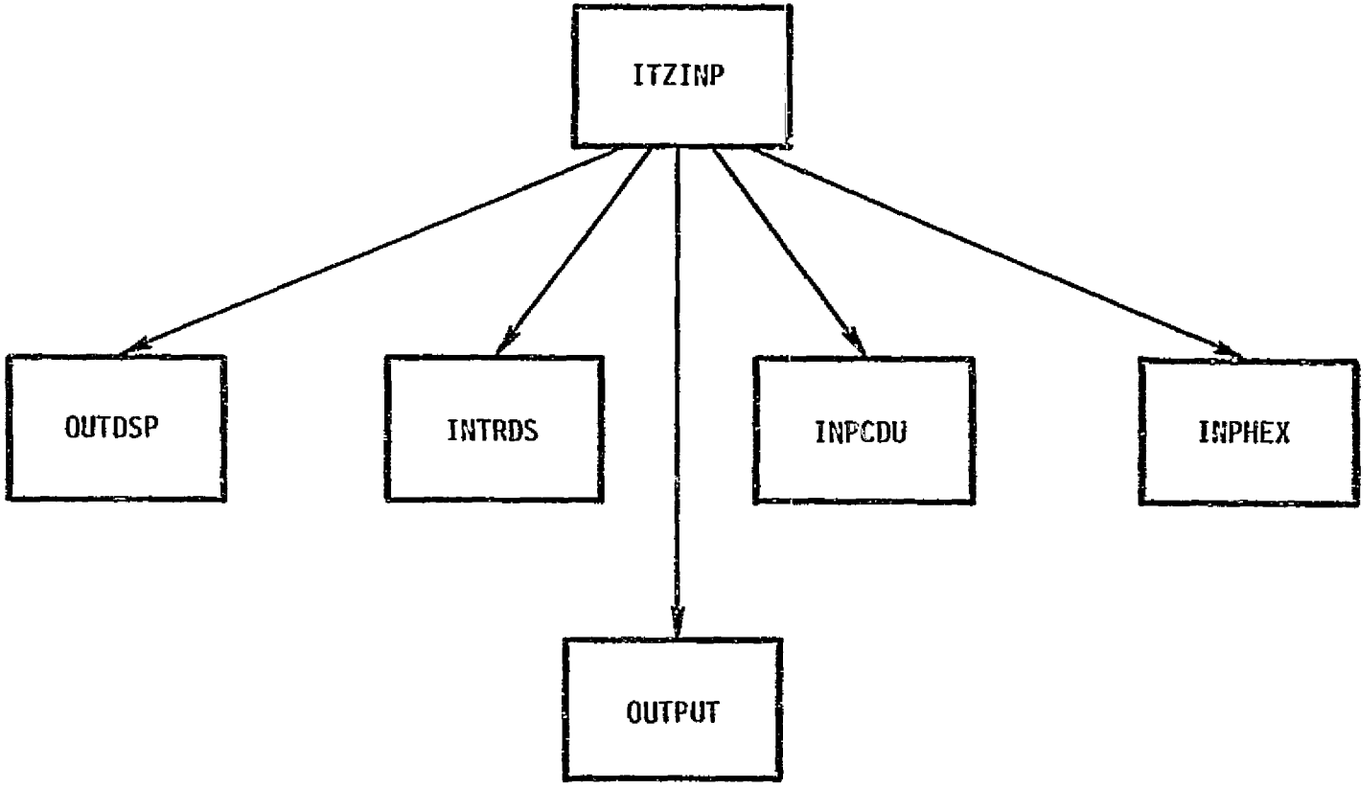
Calls: OUTDSP, INPCDU, INTRDS, INPHEX, OUTPUT

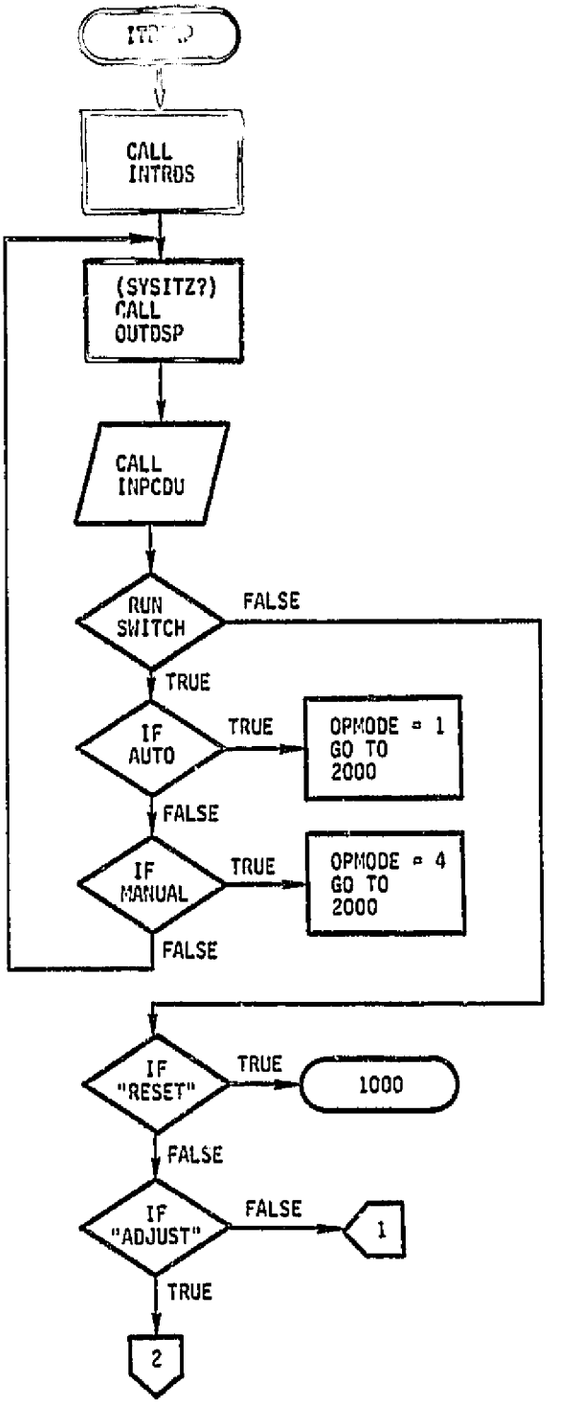
Destroys: CMOS (Optional)

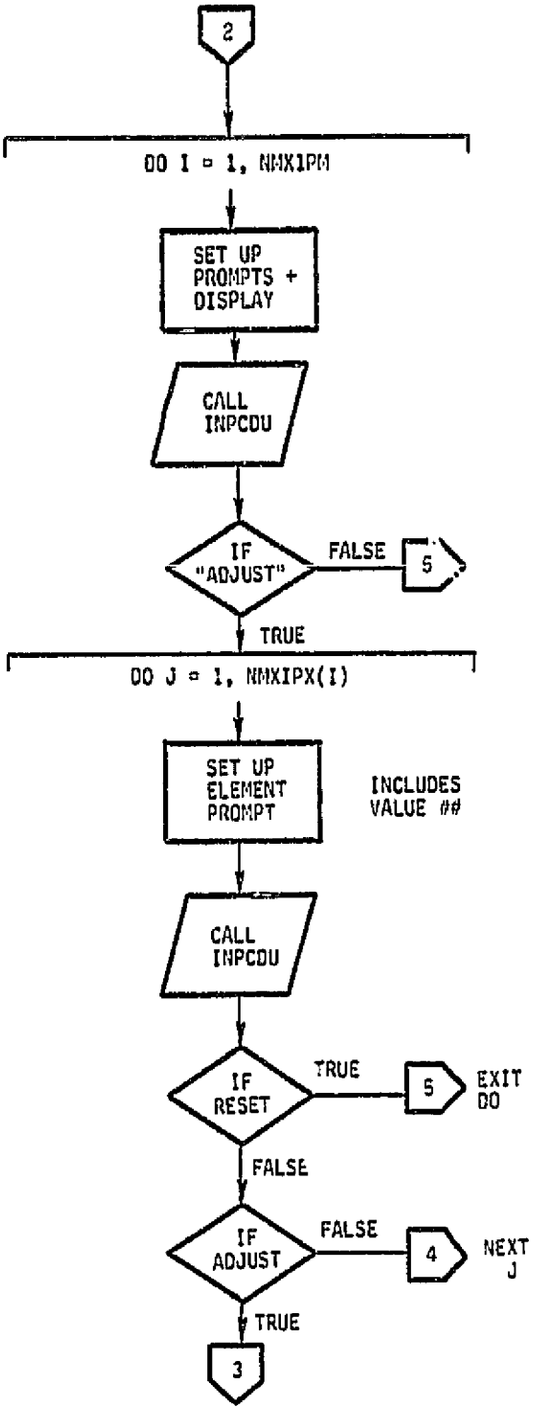
Modifies: Variable input by user

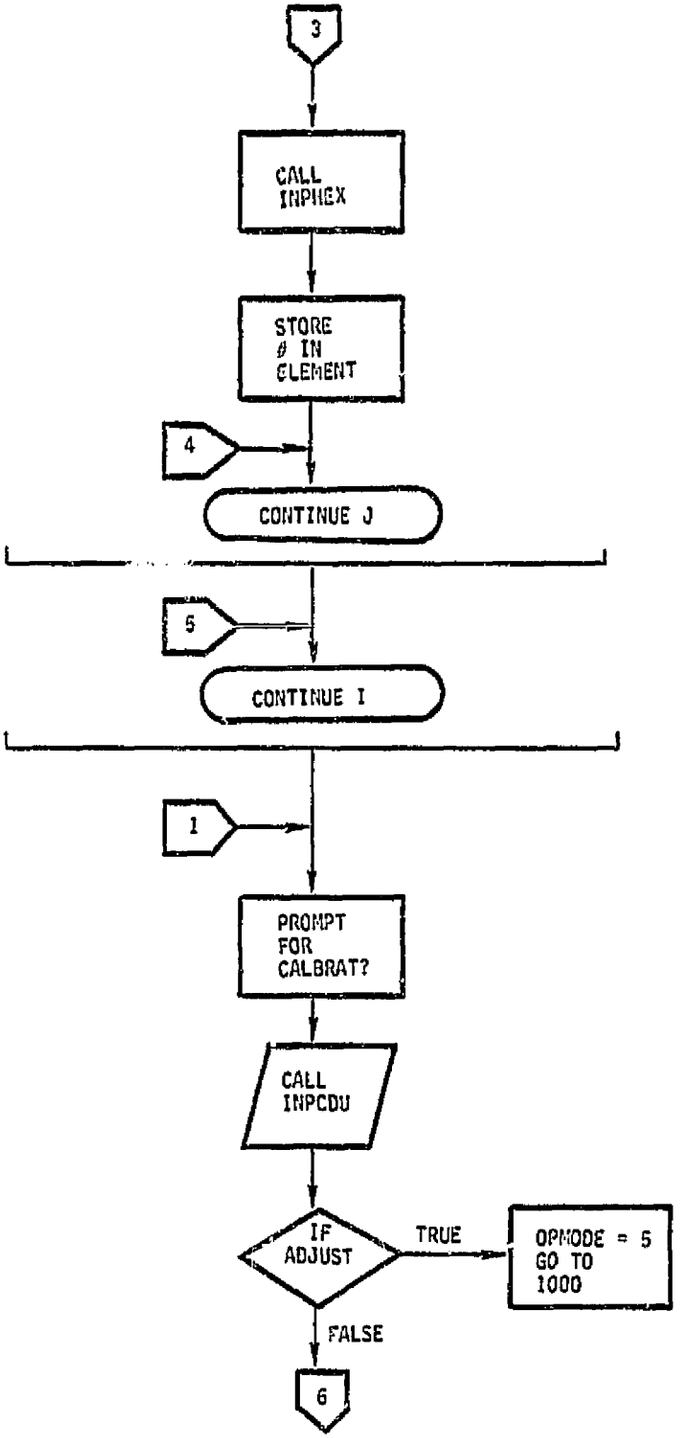
Language: FORTRAN 80

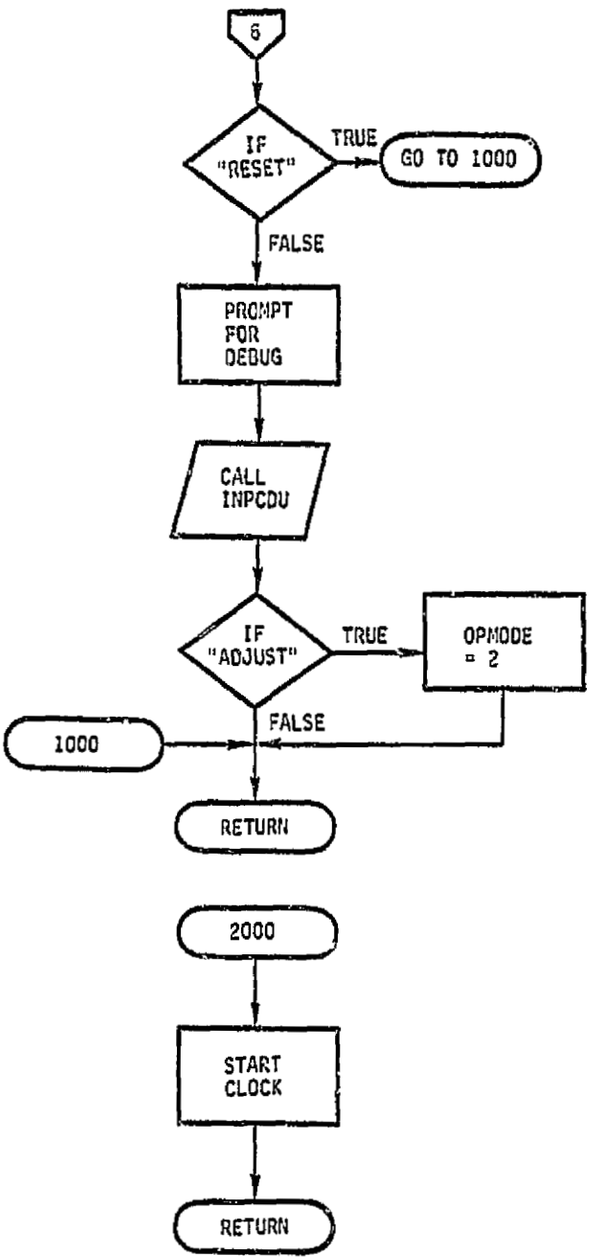
L-V-A: Version 1, Level 1
Roger B. Fish


ITZINP
OUTDSP
INTRDS
INPCDU
INPHEX
OUTPUT


CALL
INITROS
(SYSITZ?)
CALL
OUTDSP
CALL
INPCDU
RUN
SWITCH
FALSE
TRUE
IF
AUTO
TRUE
OPMODE = 1
GO TO
2000
FALSE
IF
MANUAL
TRUE
OPMODE = 4
GO TO
2000
FALSE
IF
"RESET"
TRUE
1000
FALSE
IF
"ADJUST"
FALSE
1
TRUE
2


2
DO I = 1, NMX1PM
SET UP PROMPTS + DISPLAY
CALL INPCDU
IF "ADJUST"
FALSE
5
TRUE
DO J = 1, NMXIPX(I)
SET UP ELEMENT PROMPT
INCLUDES VALUE ##
CALL INPCDU
IF RESET
TRUE
5
EXIT DO
FALSE
IF ADJUST
FALSE
4
NEXT J
TRUE
3


3
CALL INPHEX
STORE # IN ELEMENT
4
CONTINUE J
5
CONTINUE I
1
PROMPT FOR CALBRAT?
CALL INPCDU
IF ADJUST
TRUE
OPMODE = 5
GO TO 1000
FALSE
6


6
IF "RESET"
TRUE
GO TO 1000
FALSE
PROMPT FOR DEBUG
CALL INPCDU
IF "ADJUST"
TRUE
OPMODE = 2
FALSE
1000
RETURN
2000
START CLOCK
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: RESTRT

RESTRT initializes and clears data which is run dependent for restart.

Inputs: None

Outputs: None

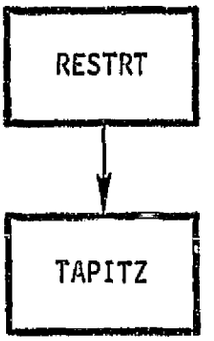
Calls: TAPITZ

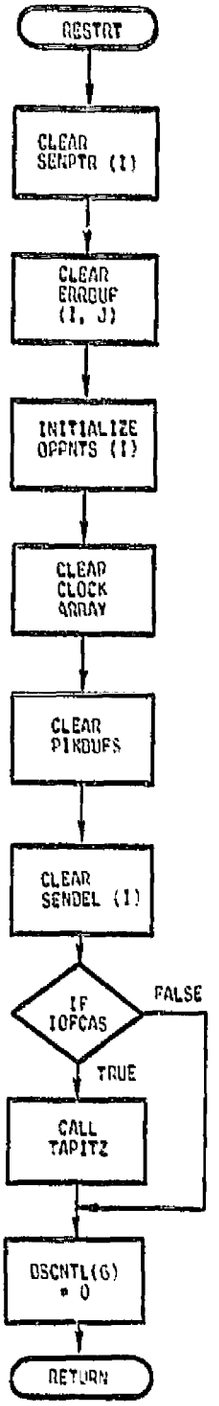
Destroys: SENPTR(I), ERRBUF(I), TFLAG(I), PKBUFS, SENDEL(I)

Modifies: Status, pointers, OPMODE

Language: FORTRAN

L-V-A: Version 1, Level 1
Roger B. Fish


RESTRT
TAPITZ


RESTRT
CLEAR SENPTR (I)
CLEAR ERROUF (I, J)
INITIALIZE OPPNTS (I)
CLEAR CLOCK ARRAY
CLEAR PIKOUFS
CLEAR SENDEL (I)
IF IOFCAS
FALSE
TRUE
CALL TAPITZ
DSCNTL(6) = 0
RETURN

SUPERVISOR EXECUTION MODULE:

Control Routines

CNTRFD	-	Front drum control
CNTRRD	-	Rear drum control

SUPERVISOR EXECUTION MODULE

Subroutine: CNTRFD

CNTRFD computes the front drum control signal. Algorithm is controlled by inputs and mode control.

Inputs: Sensor data, control information

Outputs: Front drum control signal

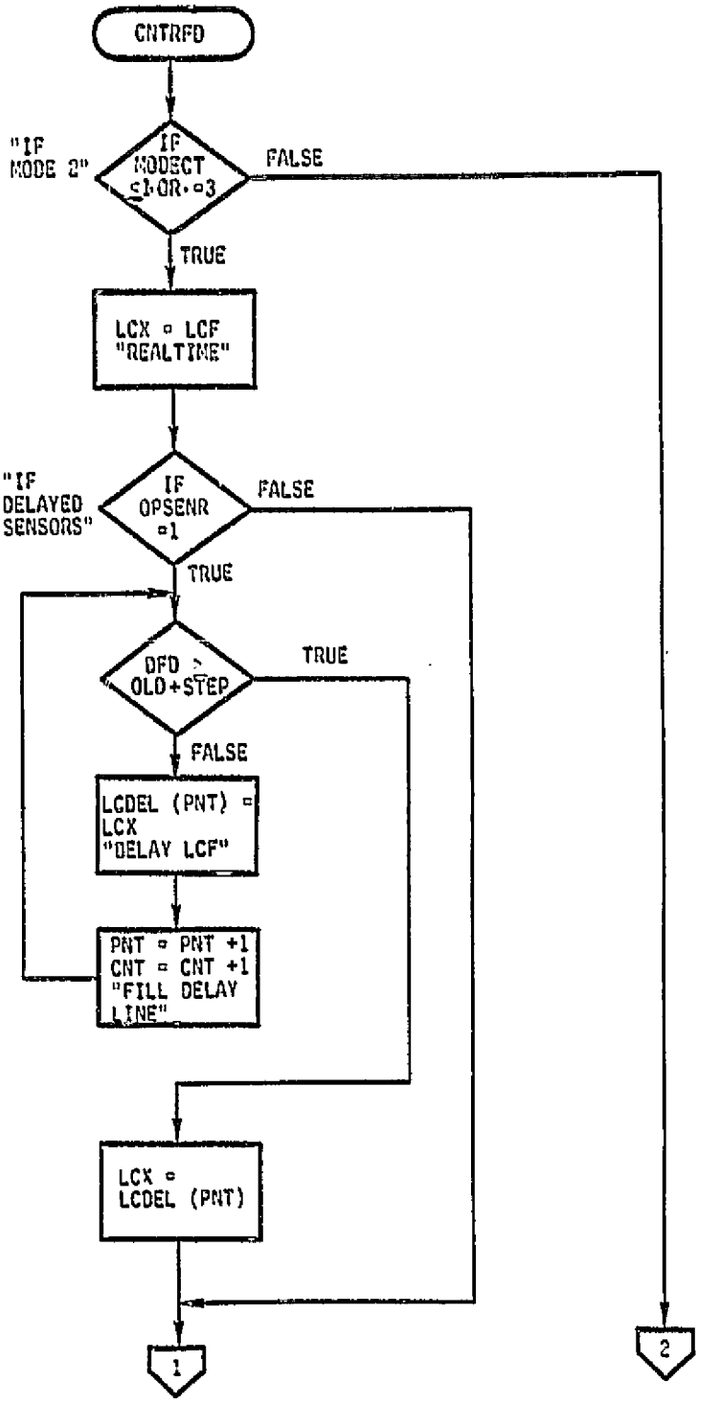
Calls: Nothing

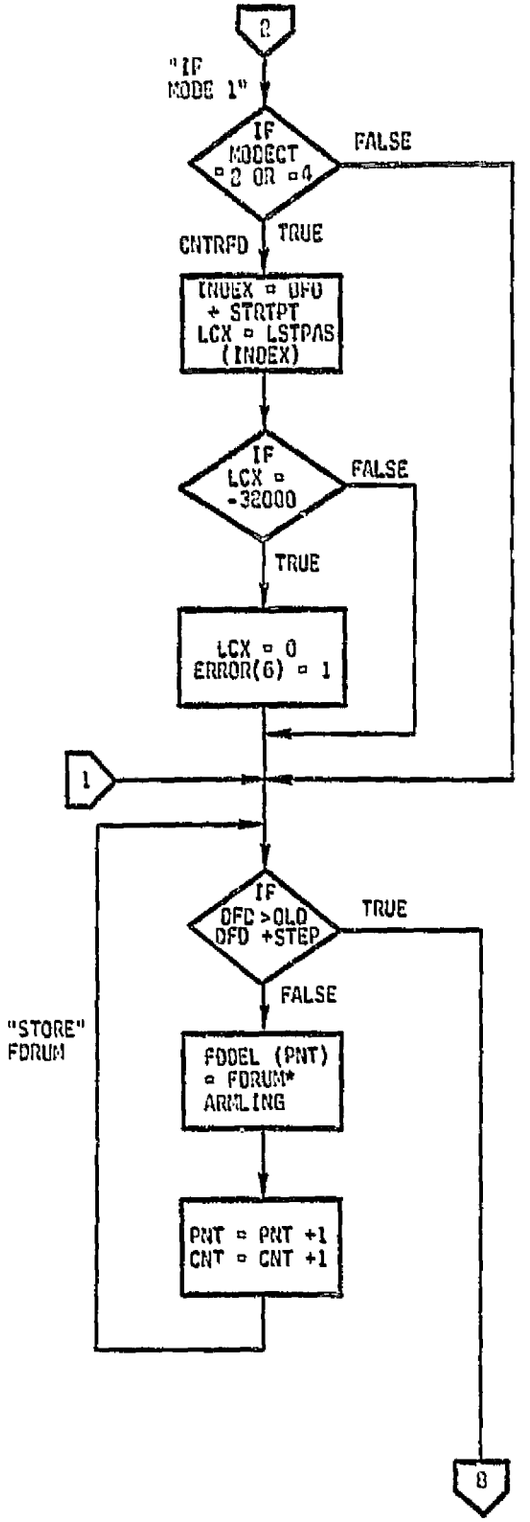
Destroys: Nothing

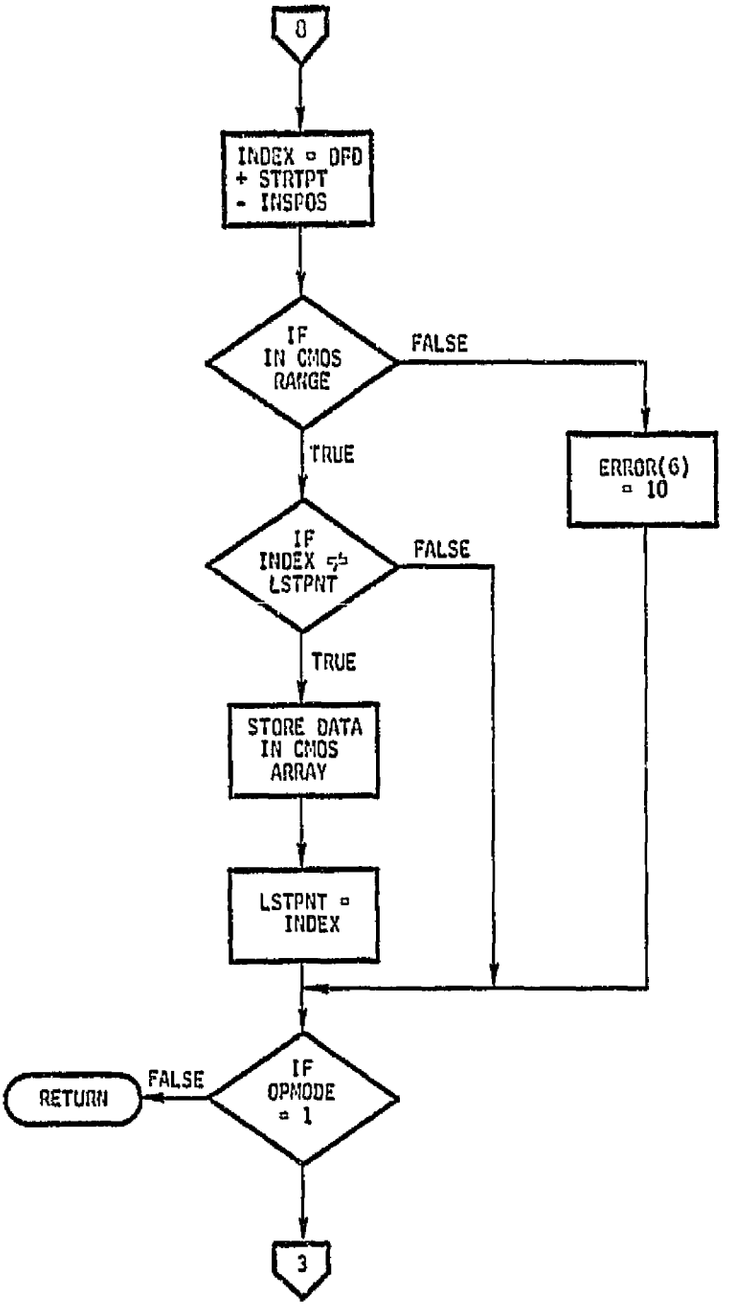
Modifies: Control output, front (VOB)

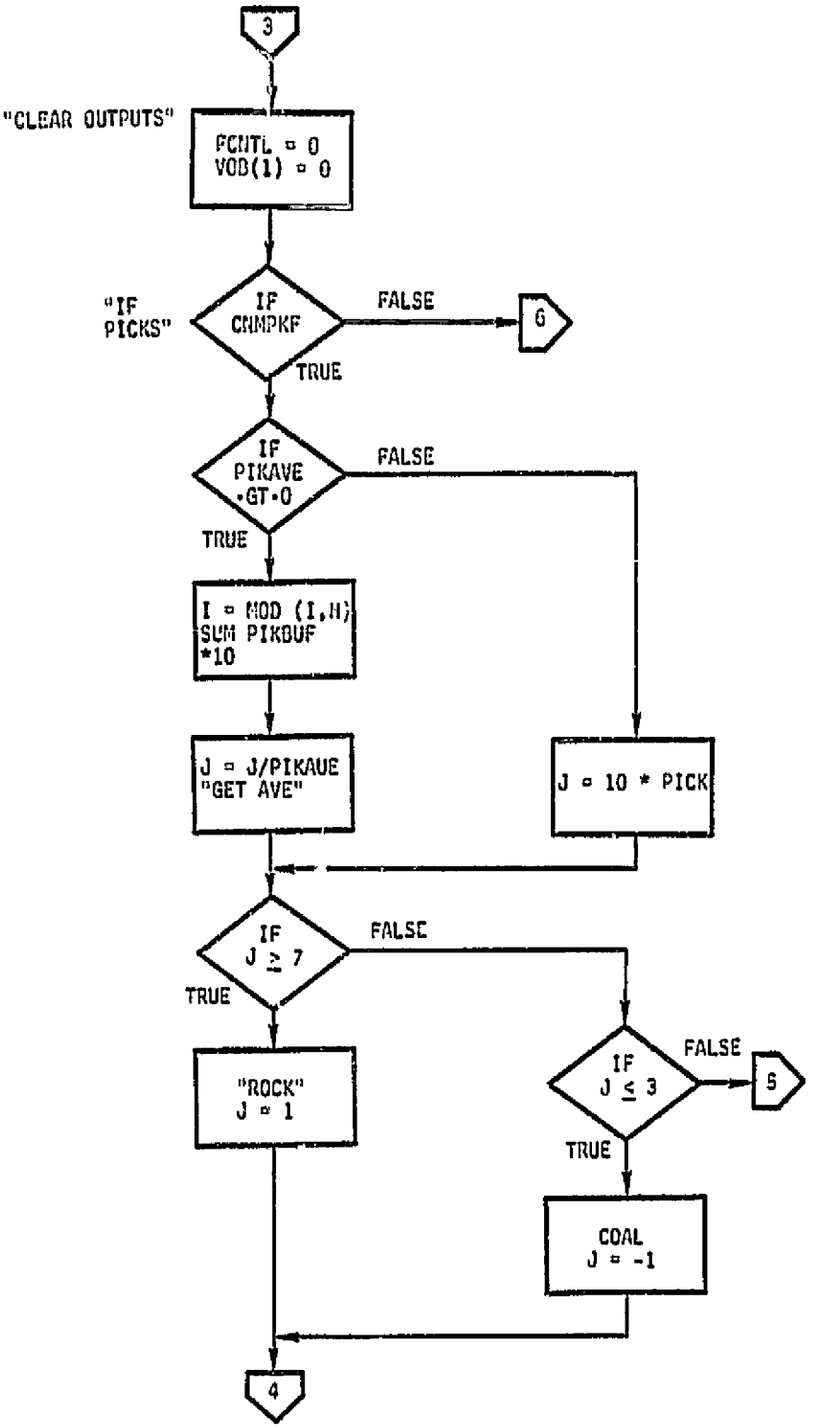
Language: FORTRAN 80

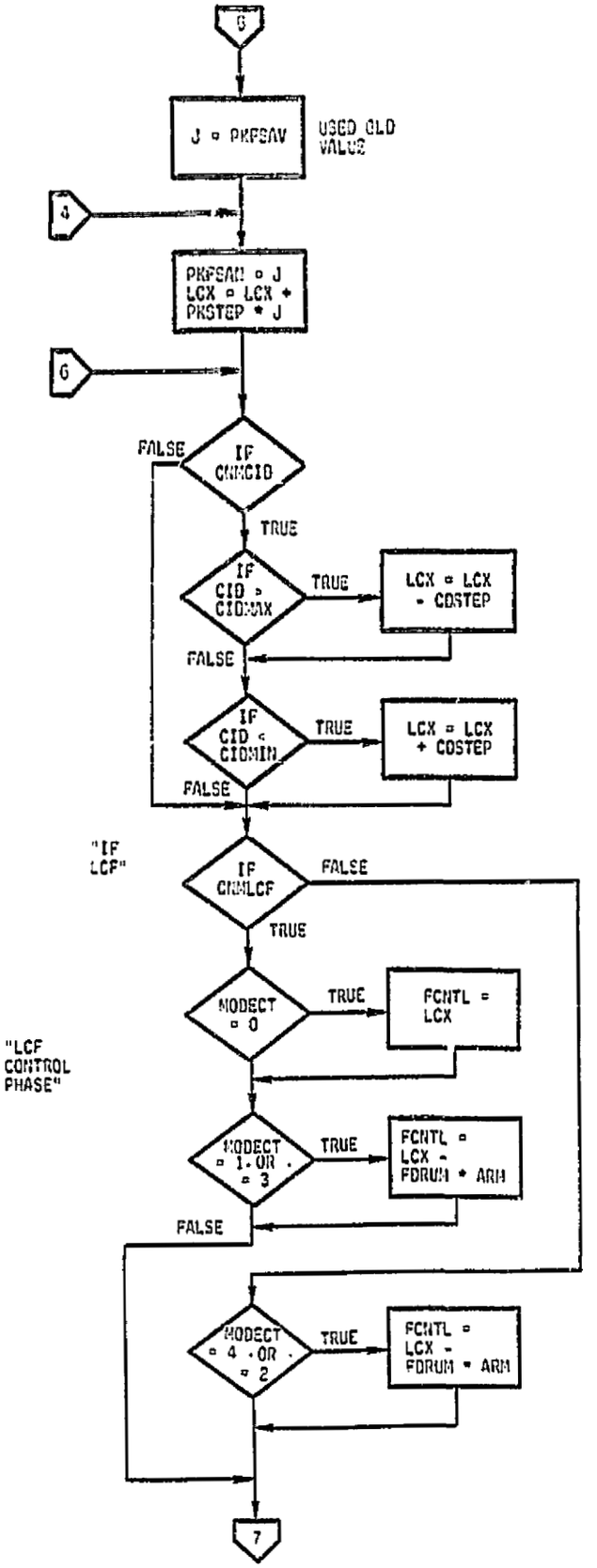
L-V-A: Version 1, Level 1
Roger B. Fish

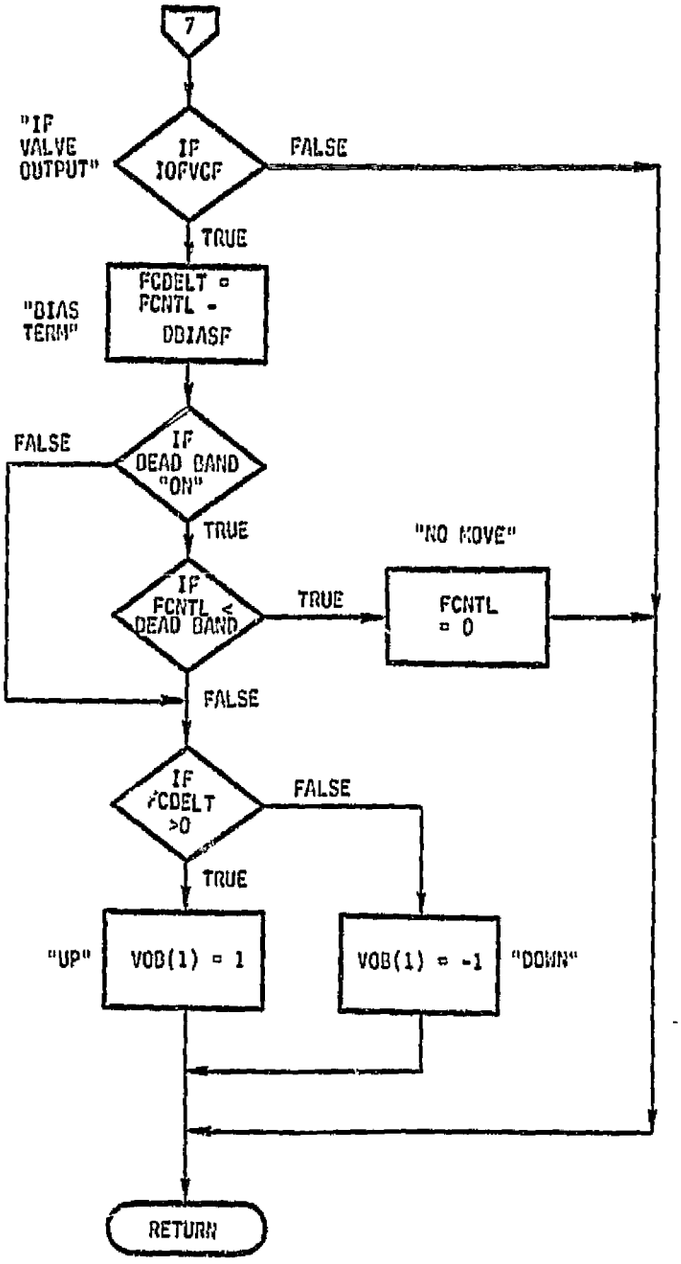

CNTRFD
"IF MODE 2"
IF MODECT ≤1.OR.=3
FALSE
TRUE
LCX = LCF "REALTIME"
"IF DELAYED SENSORS"
IF OPSENR =1
FALSE
TRUE
DFD > OLD+STEP
TRUE
FALSE
LCDEL (PNT) = LCX "DELAY LCF"
PNT = PNT +1 CNT = CNT +1 "FILL DELAY LINE"
LCX = LCDEL (PNT)
1
2


2
"IF MODE 1"
IF MODECT = 2 OR = 4
FALSE
CNTRFD
TRUE
INDEX = DFD + STRTPT
LCX = LSTPAS (INDEX)
IF LCX = -32000
FALSE
TRUE
LCX = 0
ERROR(6) = 1
1
IF DFD > OLD DFD +STEP
TRUE
FALSE
"STORE" FORUM
FDDEL (PNT) = FORUM* ARMLING
PNT = PNT +1
CNT = CNT +1
8


8
INDEX = DFD
+ STRTPT
- INSPOS
IF
IN CMOS
RANGE
FALSE
TRUE
ERROR(6)
= 10
IF
INDEX <> LSTPNT
FALSE
TRUE
STORE DATA
IN CMOS
ARRAY
LSTPNT =
INDEX
IF
OPMODE
= 1
FALSE
RETURN
3


3
"CLEAR OUTPUTS"
PCNTL = 0
VOD(1) = 0
"IF PICKS"
IF CNMPKF
FALSE
6
TRUE
IF PIKAVE .GT. 0
FALSE
TRUE
I = MOD (I,H)
SUM PIKBUF
*10
J = J/PIKAUE
"GET AVE"
J = 10 * PICK
IF J ≥ 7
FALSE
TRUE
"ROCK"
J = 1
IF J ≤ 3
FALSE
5
TRUE
COAL
J = -1
4


5
J = PKFSAV
USED OLD VALUE
4
PKFSAV = J
LCX = LCX + PKSTEP * J
6
FALSE
IF CNRCID
TRUE
IF CID > CIDMAX
TRUE
LCX = LCX - COSTEP
FALSE
IF CID < CIDMIN
TRUE
LCX = LCX + COSTEP
FALSE
"IF LCF"
IF CNMLCF
FALSE
TRUE
"LCF CONTROL PHASE"
MODECT = 0
TRUE
FCNTL = LCX
MODECT = 1 .OR. = 3
TRUE
FCNTL = LCX - FDRUM * ARM
FALSE
MODECT = 4 .OR. = 2
TRUE
FCNTL = LCX - FDRUM * ARM
7


7
"IF VALVE OUTPUT"
IF IOFVCF
FALSE
TRUE
"BIAS TERM"
FCDELT = FCNTL - DBIASF
FALSE
IF DEAD BAND "ON"
TRUE
"NO MOVE"
IF FCNTL < DEAD BAND
TRUE
FCNTL = 0
FALSE
IF FCDELT >0
FALSE
TRUE
"UP"
VOB(1) = 1
VOB(1) = -1
"DOWN"
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: CNTRRD

CNTRRD computes the rear drum control signal. Algorithm is controlled by inputs and mode control.

Inputs: Sensor data, control information

Outputs: Front drum control signal

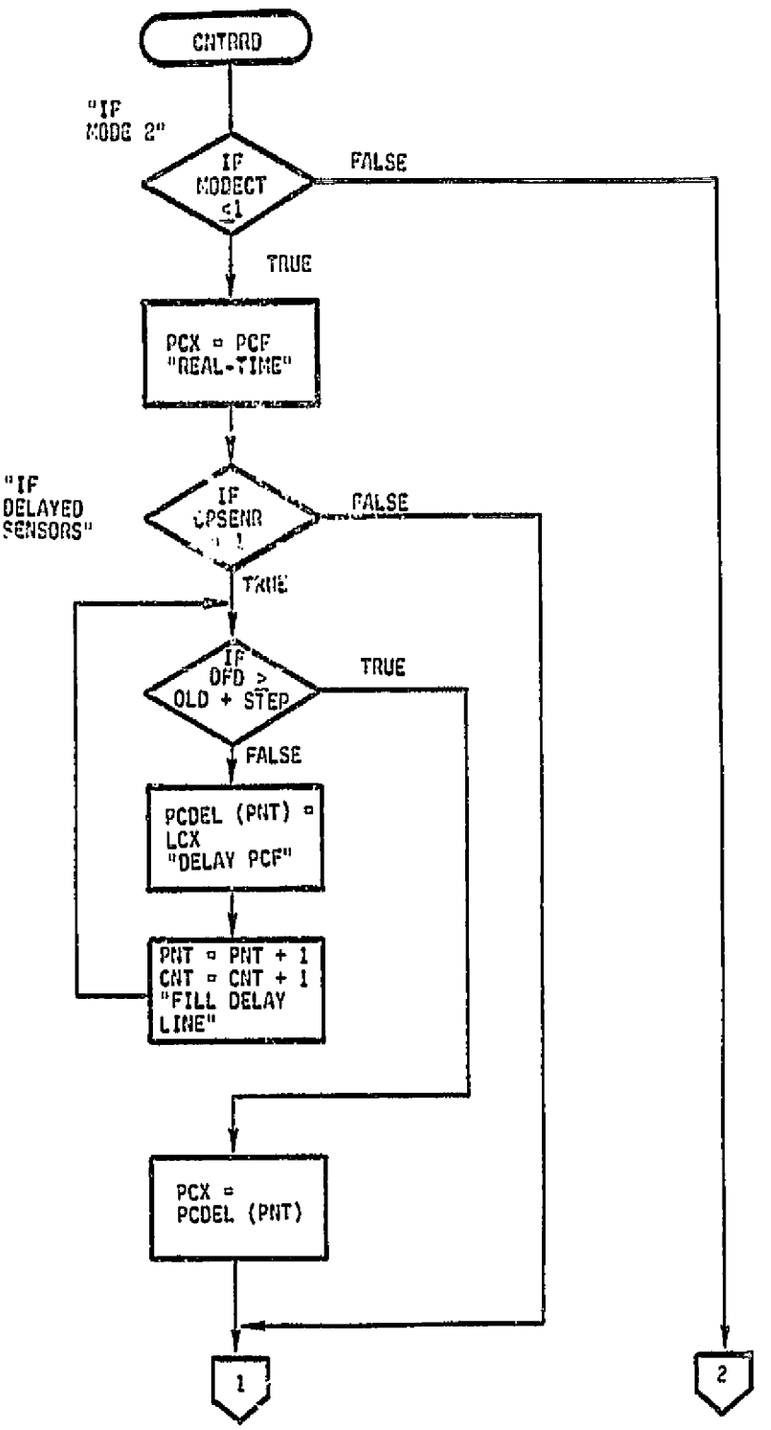
Calls: Nothing

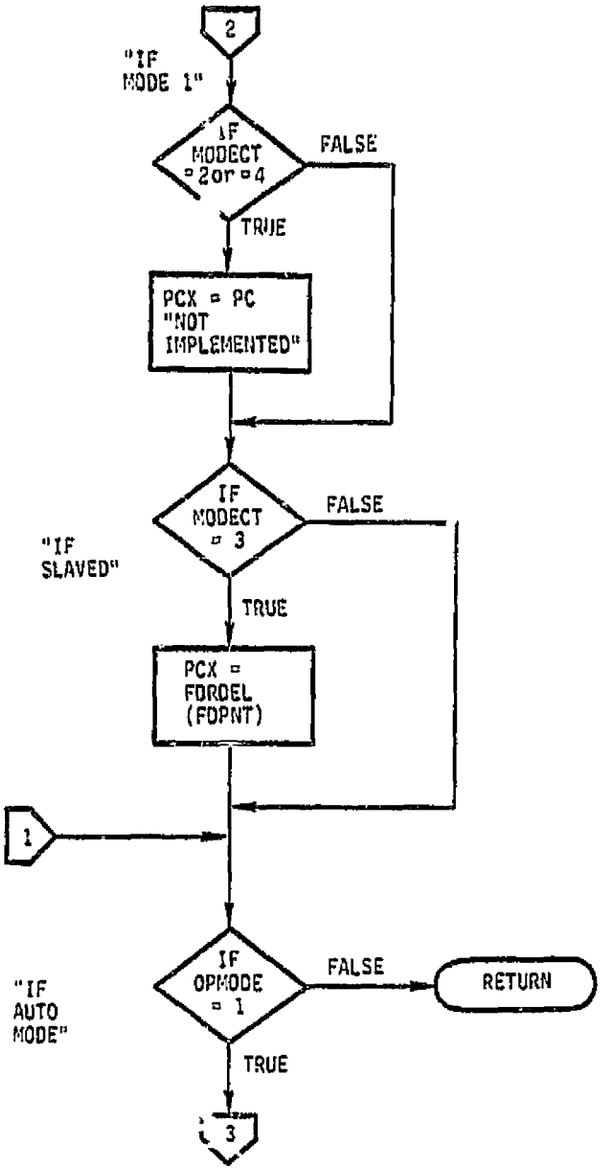
Destroys: Nothing

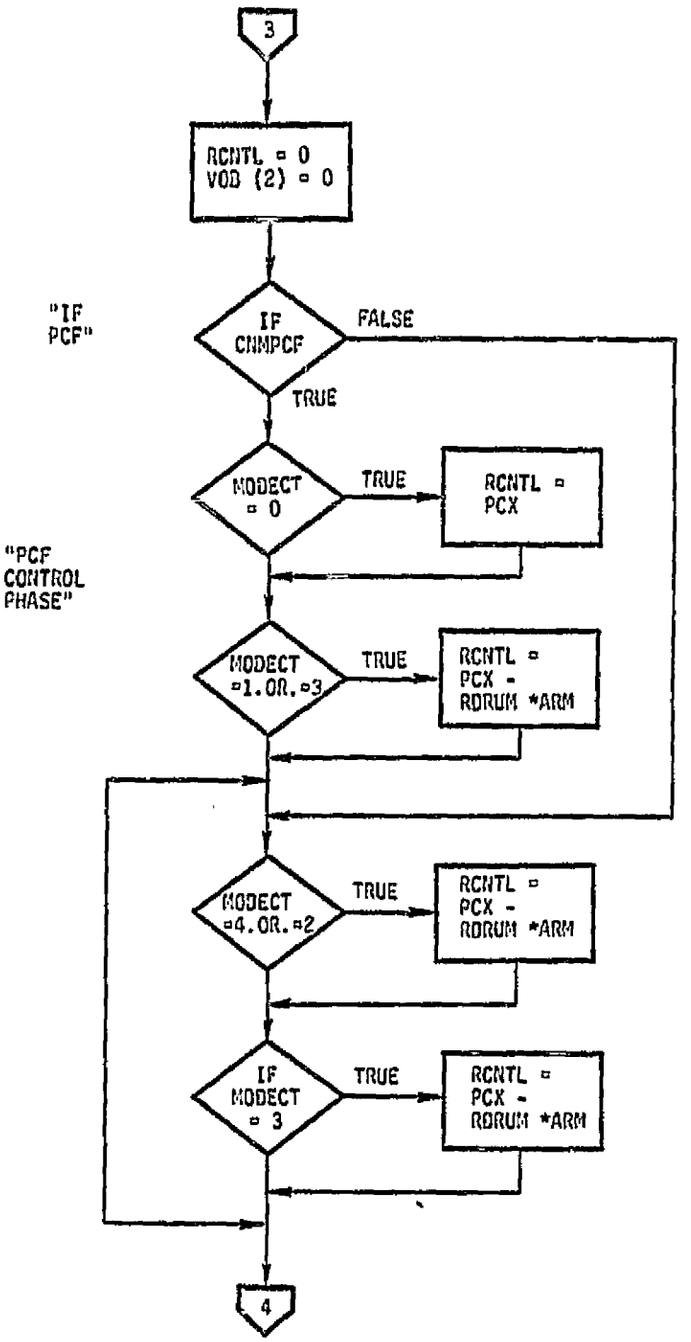
Modifies: Control output, rear (VOB)

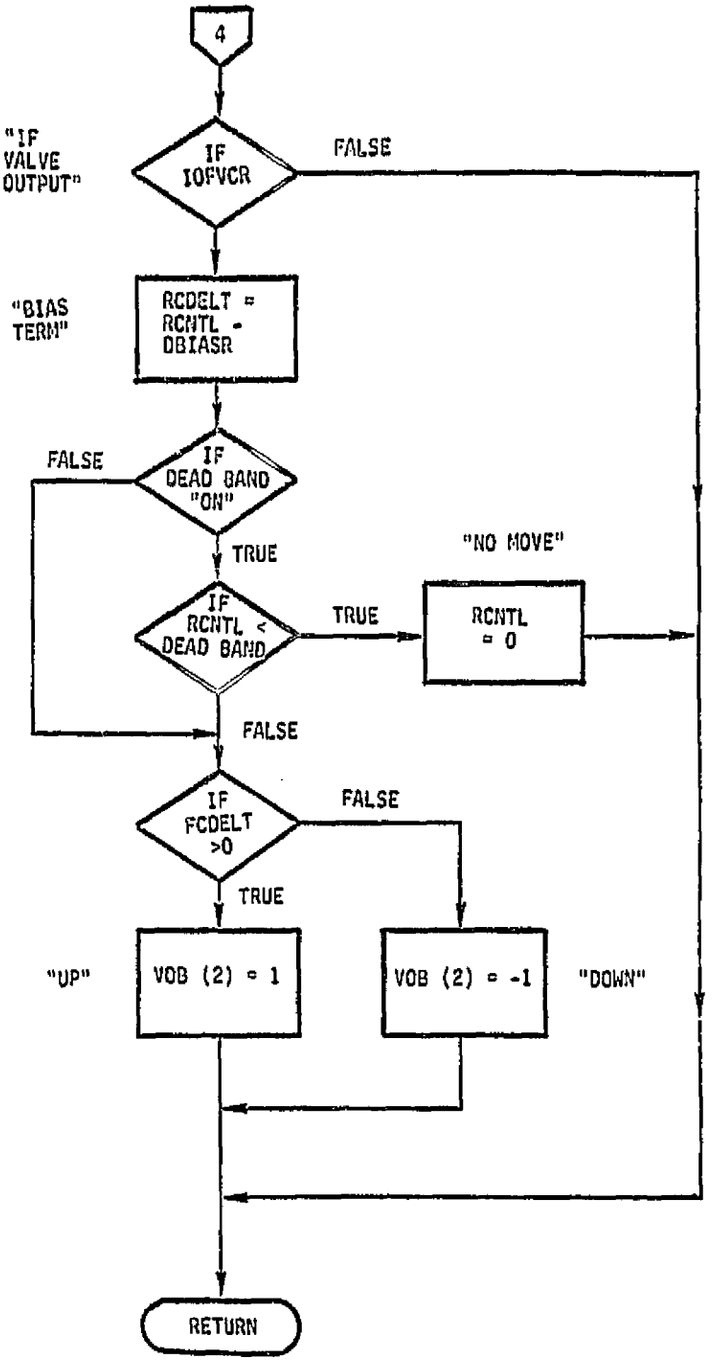
Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


CNTRRD
"IF MODE 2"
IF MODECT ≤1
FALSE
TRUE
PCX ← PCF "REAL-TIME"
"IF DELAYED SENSORS"
IF LPSENR
FALSE
TRUE
IF DFD > OLD + STEP
TRUE
FALSE
PCDEL (PNT) ← LCX "DELAY PCF"
PNT ← PNT + 1 CNT ← CNT + 1 "FILL DELAY LINE"
PCX ← PCDEL (PNT)
1
2


2
"IF MODE 1"
IF MODECT = 2 or = 4
FALSE
TRUE
PCX = PC "NOT IMPLEMENTED"
IF MODECT = 3
FALSE
"IF SLAVED"
TRUE
PCX = FORDEL (FDPNT)
1
IF OPMODE = 1
FALSE
RETURN
"IF AUTO MODE"
TRUE
3


3
RCNTL = 0
VOD (2) = 0
"IF PCF"
IF CHMPCF
FALSE
TRUE
MODECT = 0
TRUE
RCNTL = PCX
"PCF CONTROL PHASE"
MODECT =1.OR.=3
TRUE
RCNTL = PCX - RDRUM *ARM
MODECT =4.OR.=2
TRUE
RCNTL = PCX - RDRUM *ARM
IF MODECT = 3
TRUE
RCNTL = PCX - RDRUM *ARM
4


4
"IF VALVE OUTPUT"
IF IOFVCR
FALSE
"BIAS TERM"
RCDELT = RCNTL - OBIASR
IF DEAD BAND "ON"
FALSE
TRUE
"NO MOVE"
IF RCNTL < DEAD BAND
TRUE
RCNTL = 0
FALSE
IF FCDELT >0
FALSE
TRUE
"UP"
VOB (2) = 1
VOB (2) = -1
"DOWN"
RETURN

SUPERVISOR EXECUTION MODULES:

Debugger Routines

DBUGCI	-	Input control
DBUGCO	-	Output
DBUGIN	-	Sensor scan
DBUGOT	-	Output (valve)
DBUGIO	-	I/O channel test
DBUGTP	-	Tape check
DBUGCK	-	Clock test
DBUGME	-	Memory display/modify

Subroutine: DBUGCI

DBUGCI reads debug control information from control/ display panel.

Inputs: Debug control vector

Outputs: None

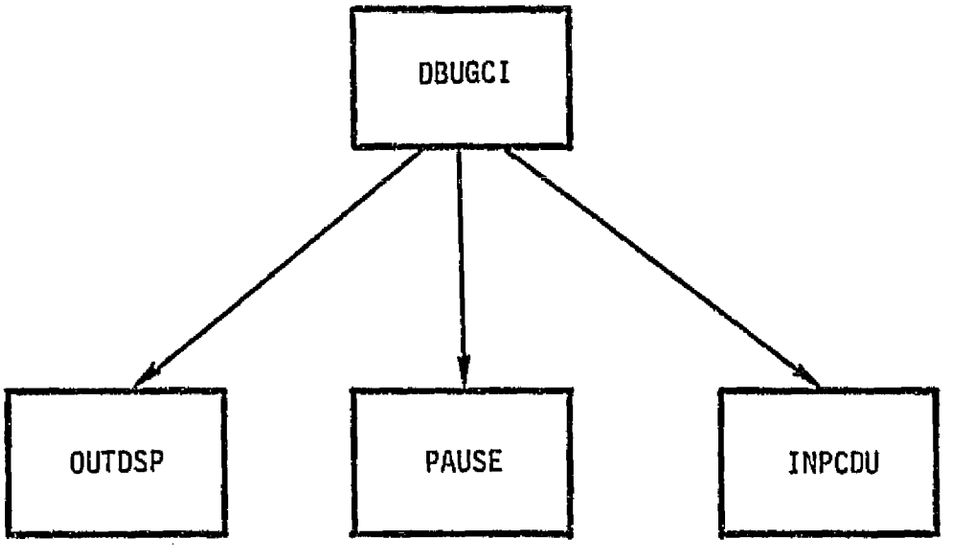
Calls: INPCDU, OUTDSP, PAUSE

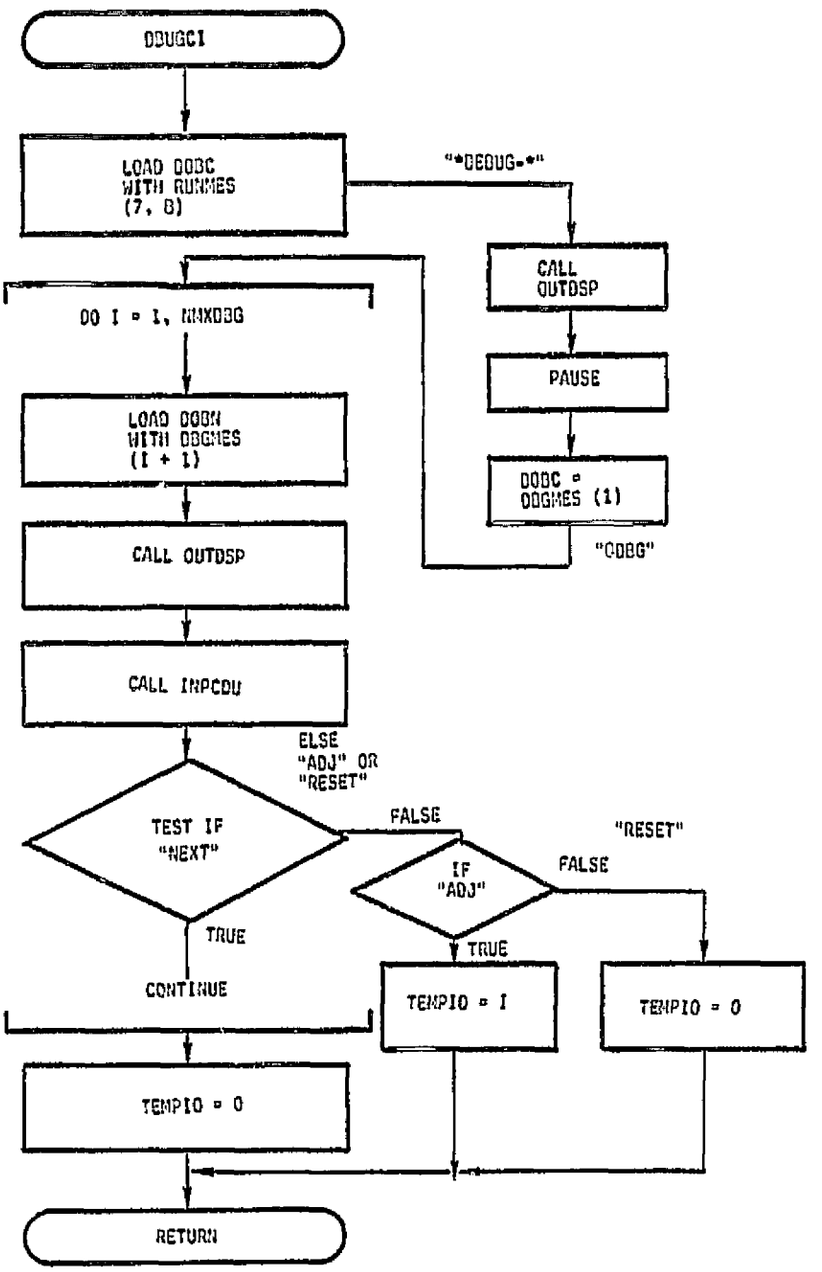
Destroys: Nothing

Modifies: Debug control vector

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGCI
OUTDSP
PAUSE
INPCDU


DDUGCI
LOAD DODC
WITH RUNMES
(7, 8)
"*DEDUG-*"
CALL
OUTDSP
PAUSE
DODC =
DDGMES (1)
"DDBG"
DO I = 1, MMXDBG
LOAD DDBM
WITH DDGMES
(I + 1)
CALL OUTDSP
CALL INPCDU
ELSE
"ADJ" OR
"RESET"
TEST IF
"NEXT"
FALSE
"RESET"
IF
"ADJ"
FALSE
TRUE
TRUE
CONTINUE
TEMPIO = I
TEMPIO = 0
TEMPIO = 0
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGCO

DBUGCO outputs debug information to control/display panel.

Inputs: Debug control vector

Outputs: Debug messages

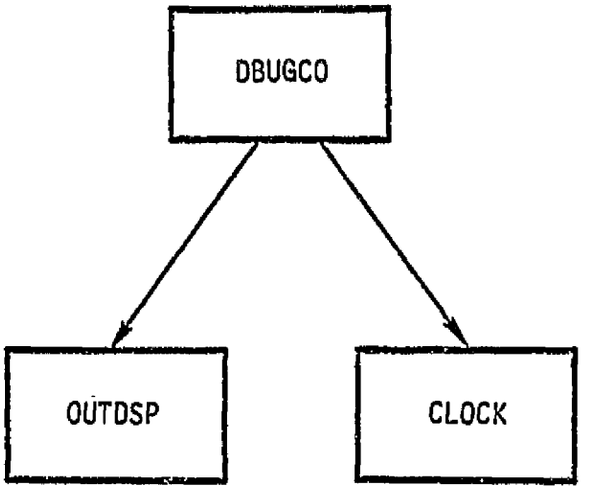
Calls: OUTDSP, CLOCK

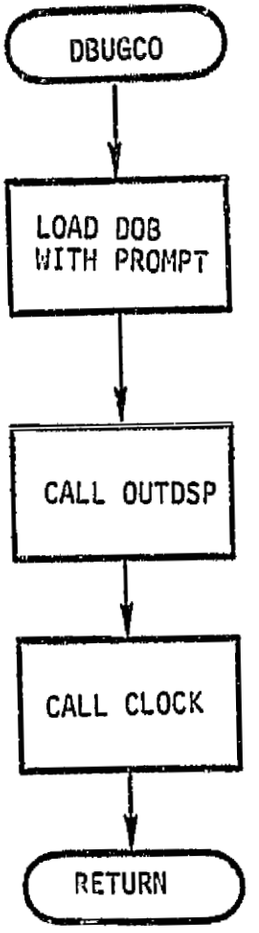
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGCO
OUTDSP
CLOCK



"@DBG"

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGIN (FLAG)

DBUGIN reads sensor data via I/O routines as per input.

Inputs: Sensor buffer, control vector

Outputs: None

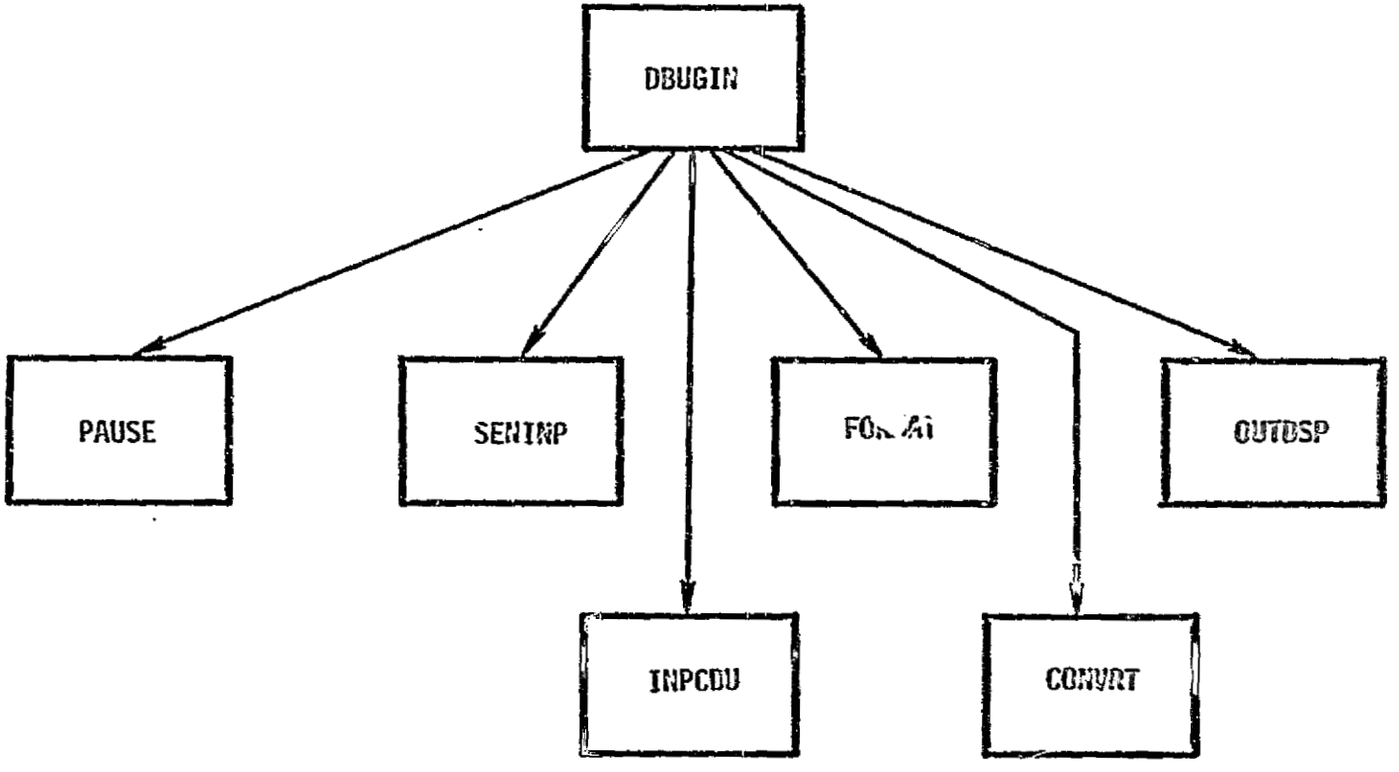
Calls: SENINP, PAUSE, OUTDSP, FORMAT, INPCDU, CONVRT

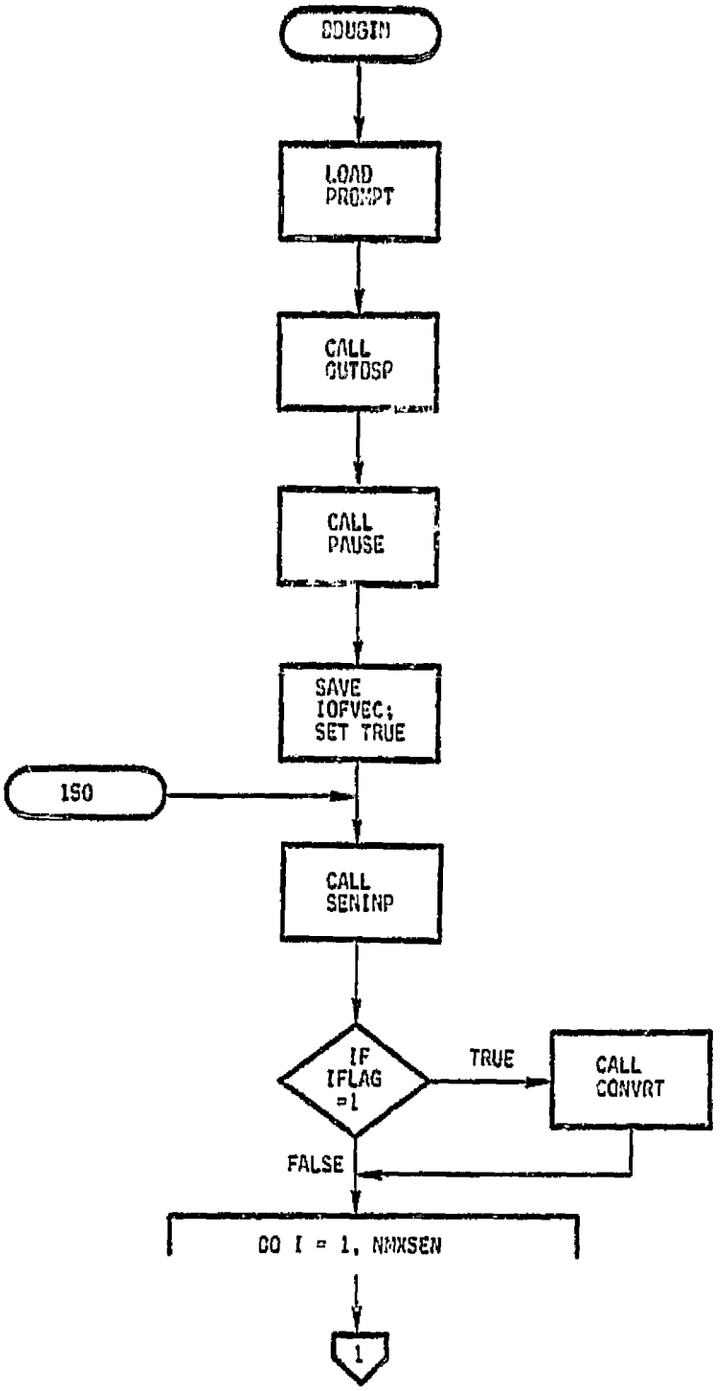
Destroys: Nothing

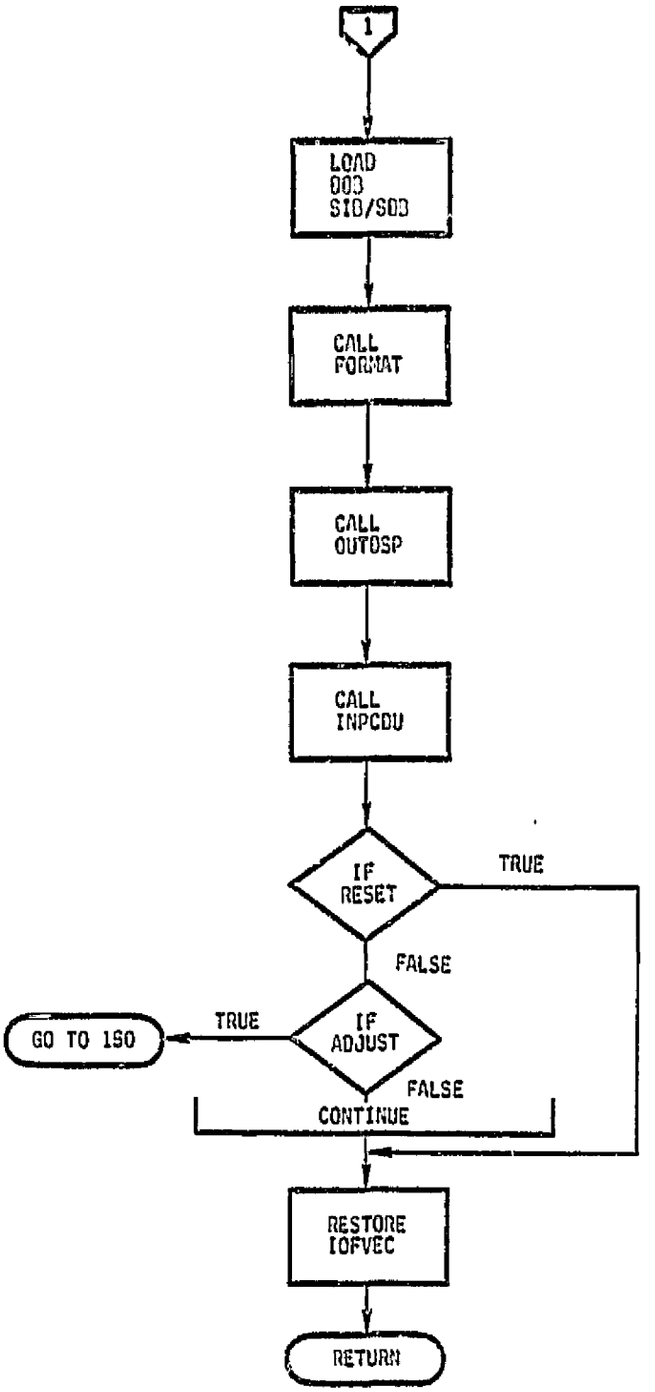
Modifies: Sensor input data (SDB)

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGIN
PAUSE
SENINP
FORMAT
OUTDSP
INPCDU
CONVRT


SDUGIN
LOAD PROMPT
CALL OUTDSP
CALL PAUSE
SAVE IOFVEC; SET TRUE
1S0
CALL SENINP
IF IFLAG =1
TRUE
CALL CONVRT
FALSE
DO I = 1, NMXSEN
1


1
LOAD
OOD
SIO/SOD
CALL
FORMAT
CALL
OUTOSP
CALL
INPCDU
IF
RESET
TRUE
FALSE
IF
ADJUST
TRUE
GO TO 150
FALSE
CONTINUE
RESTORE
IOFVEC
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGOT

DBUGOT outputs debug control signals to front and rear arms.

Inputs: Debug control vector

Outputs: Drum control signals

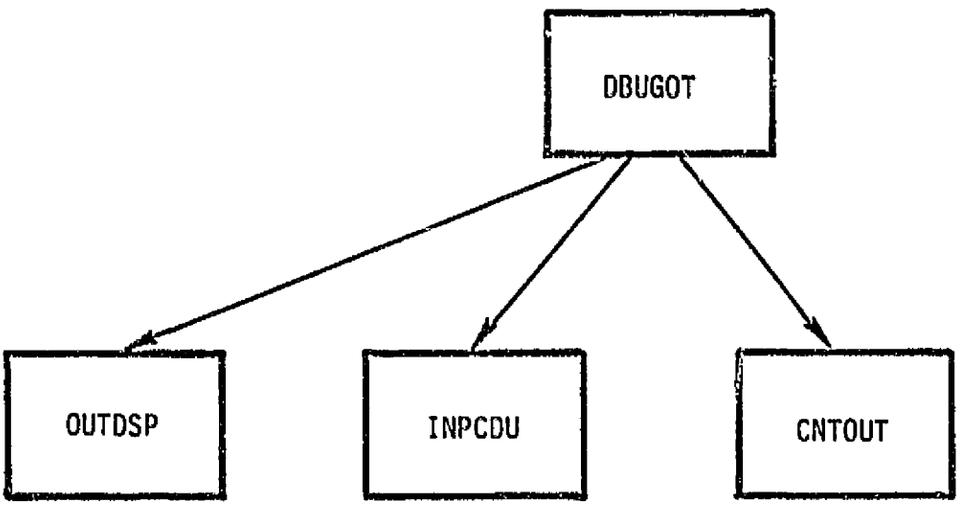
Calls: INPCDU, CNTOUT, OUTDSP

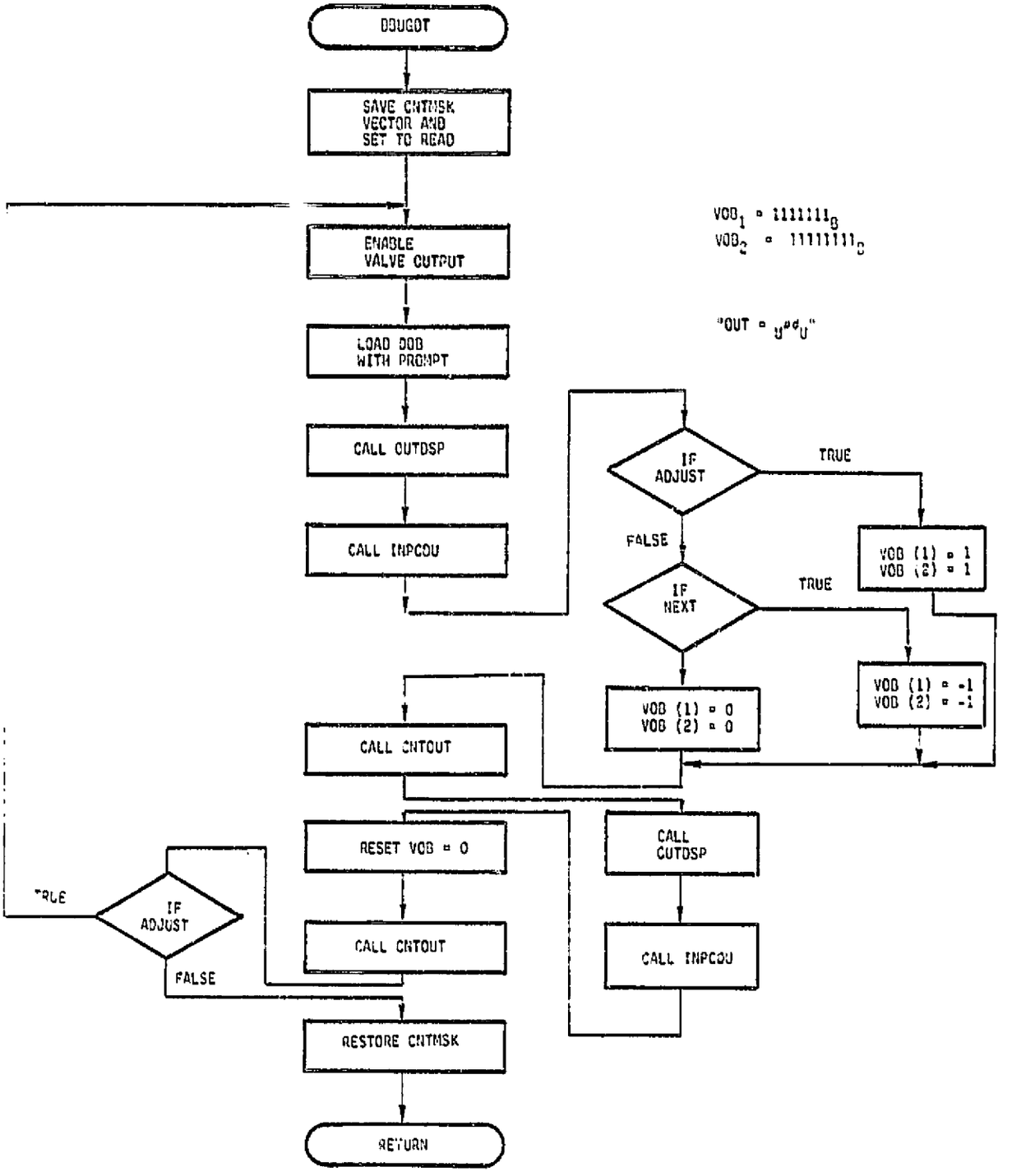
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGOT
OUTDSP
INPCDU
CNTOUT


DOUGOT
SAVE CNTMSK VECTOR AND SET TO READ
ENABLE VALVE OUTPUT
LOAD DOB WITH PROMPT
CALL OUTDSP
CALL INPCOU
IF ADJUST
TRUE
FALSE
IF NEXT
TRUE
VOB (1) = 1
VOB (2) = 1
VOB (1) = -1
VOB (2) = -1
VOB (1) = 0
VOB (2) = 0
CALL CNTOUT
RESET VOB = 0
CALL OUTDSP
CALL INPCOU
TRUE
IF ADJUST
FALSE
CALL CNTOUT
RESTORE CNTMSK
RETURN
VOB1 = 11111118
VOB2 = 11111111B
"OUT = y*dU"

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGIO

DBUGIO reads an I/O channel or port and displays value.

Inputs: None

Outputs: None

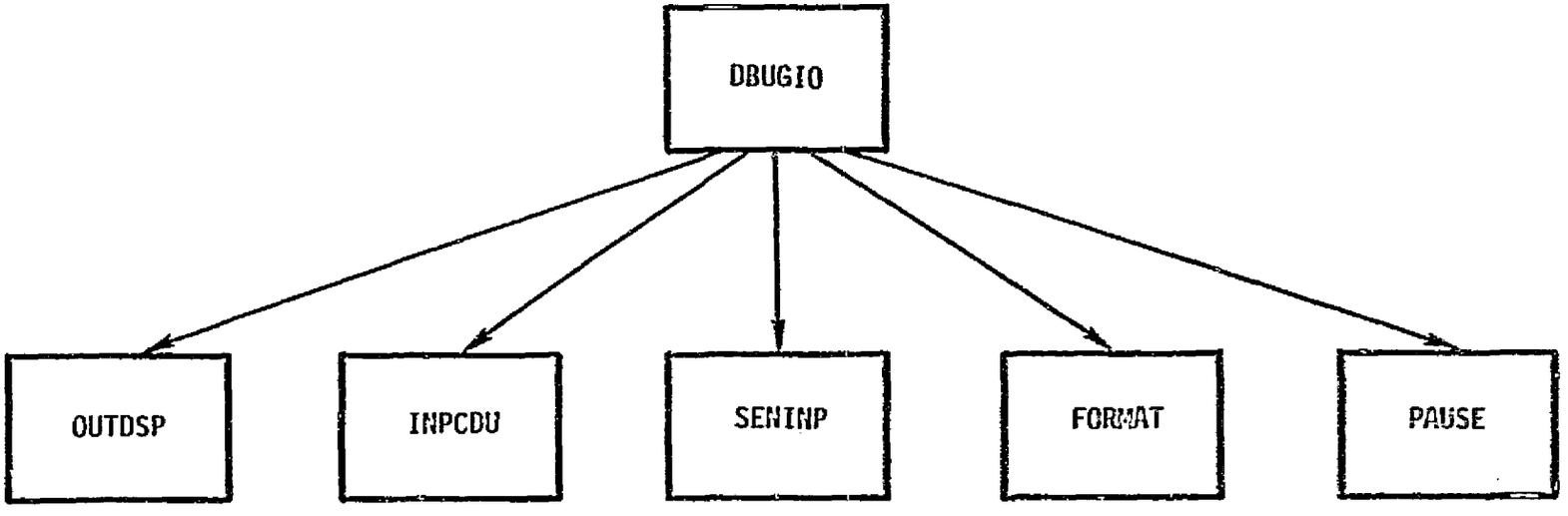
Calls: FORMAT, OUTDSP, PAUSE, INPCDU, SENINP

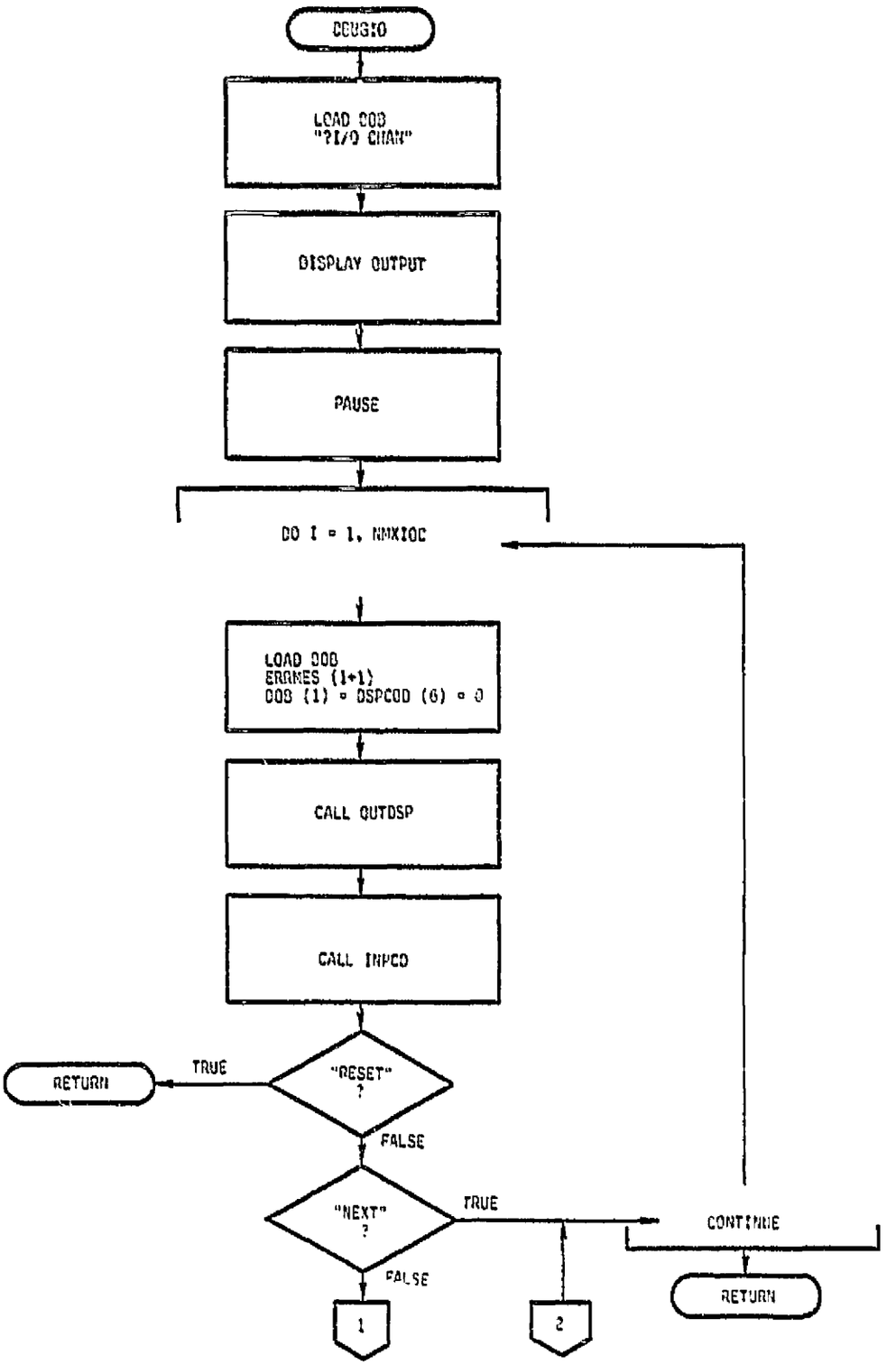
Destroys: Nothing

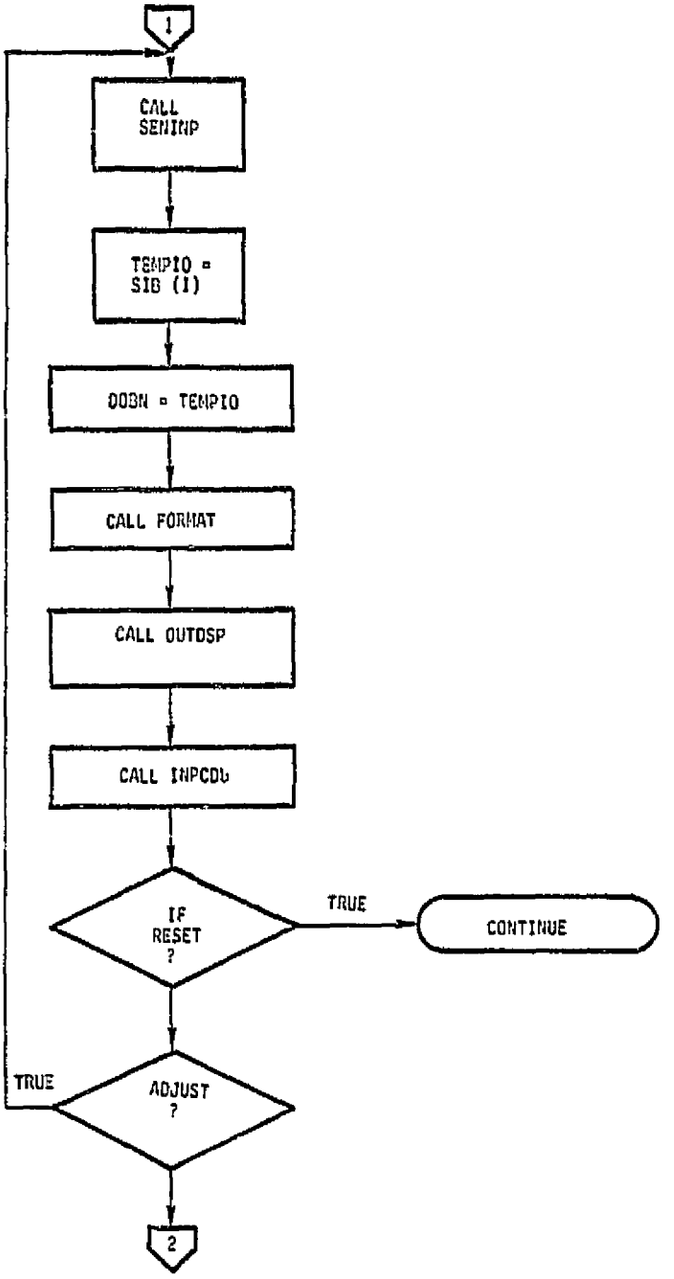
Modifies: DOB

Language: FORTRAN

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGIO
OUTDSP
INPCDU
SENINP
FORMAT
PAUSE


DEBUGIO
LOAD DOB
"I/O CHAN"
DISPLAY OUTPUT
PAUSE
DO I = 1, NMXIOC
LOAD DOB
ERRNES (I+1)
DOB (1) = DSPCOD (6) = 0
CALL OUTDSP
CALL INPCO
"RESET"
?
TRUE
RETURN
FALSE
"NEXT"
?
TRUE
CONTINUE
RETURN
FALSE
1
2


1
CALL SENINP
TEMPIO = SIB (I)
DOSN = TEMPIO
CALL FORMAT
CALL OUTDSP
CALL INPCOD
IF RESET ?
TRUE
CONTINUE
ADJUST ?
TRUE
2

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGTP

DBUGTP checks tape cassette operation.

Inputs: None

Outputs: None

Calls: AIOCAS, MSEC2H, PAUSE, OUTDSP

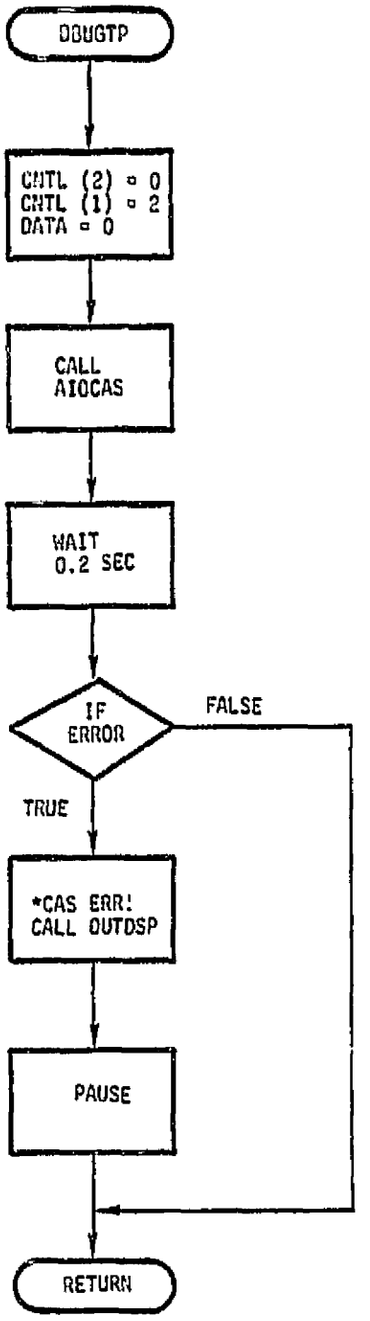
Destroys: Nothing

Modifies: TOB, DOB

Language: FORTRAN

L-V-A: Version 1, Level 1
Roger B. Fish

DBUGTP
PAUSE
OUTDSP
MSEC2H
AIOCAS


DBUGTP
CNTL (2) = 0
CNTL (1) = 2
DATA = 0
CALL
AIOCAS
WAIT
0.2 SEC
IF
ERROR
FALSE
TRUE
*CAS ERR!
CALL OUTDSP
PAUSE
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: DBUGCK

DBUGCK checks the clock timer for VCS synchronization.

Inputs: None

Outputs: None

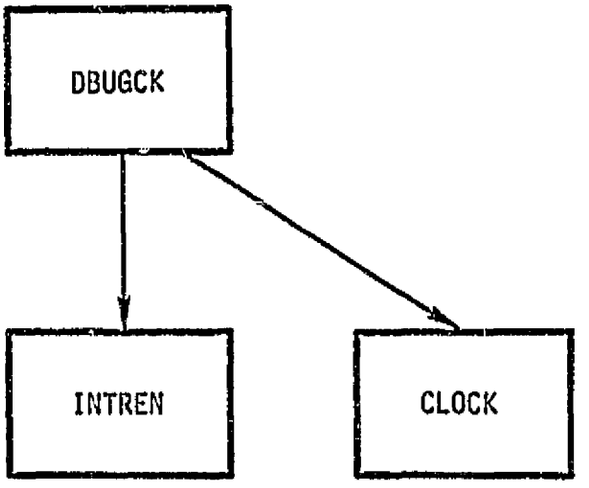
Calls: CLOCK, INTREN

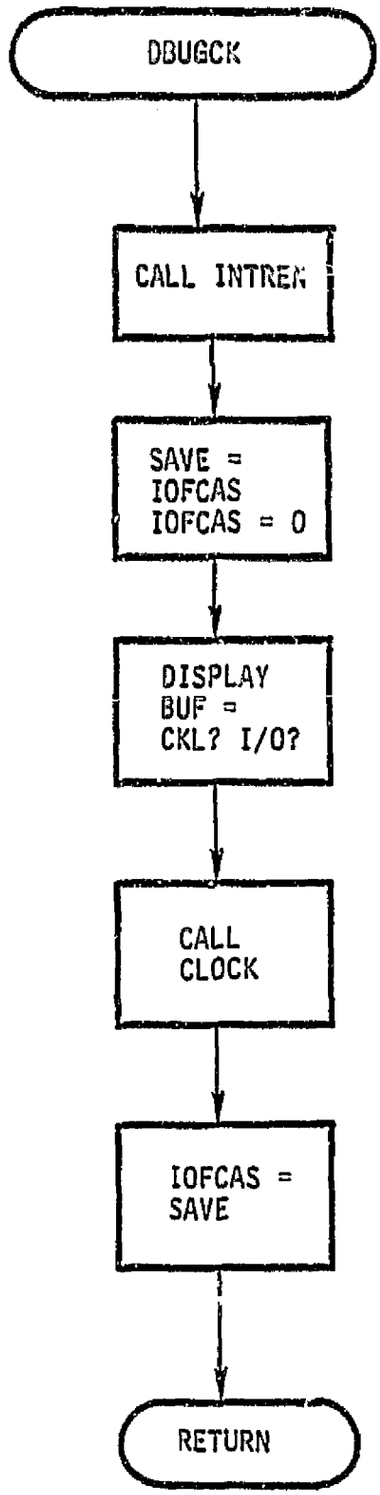
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGCK
INTREN
CLOCK


DBUGCK
CALL INTREN
SAVE =
IOFCAS
IOFCAS = 0
DISPLAY
BUF =
CKL? I/O?
CALL
CLOCK
IOFCAS =
SAVE
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: DDUGME

DBUGME displays memory to the operator via LEDS.

Inputs: None

Outputs: None

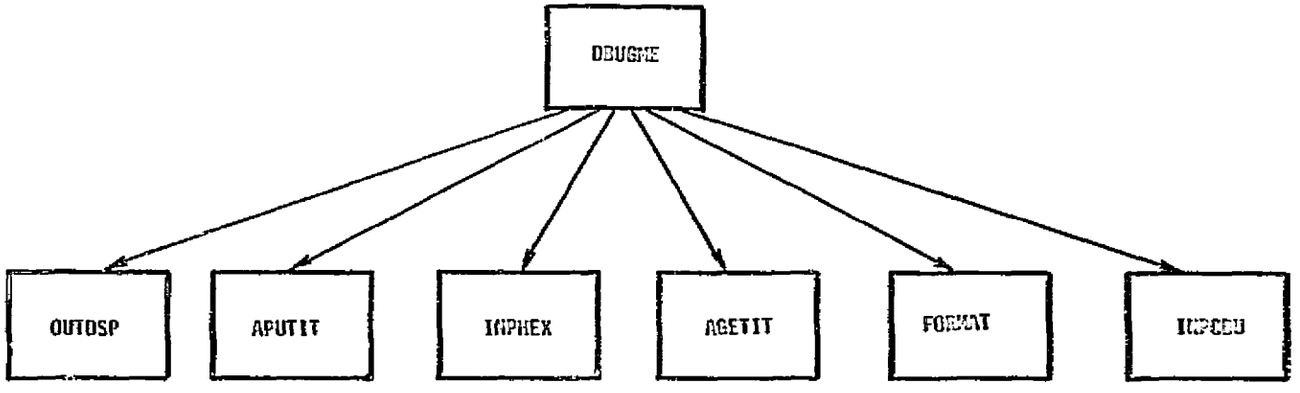
Calls: OUTDSP, INPCDU, AGETIT, INPHEX, FORMAT, APUTIT

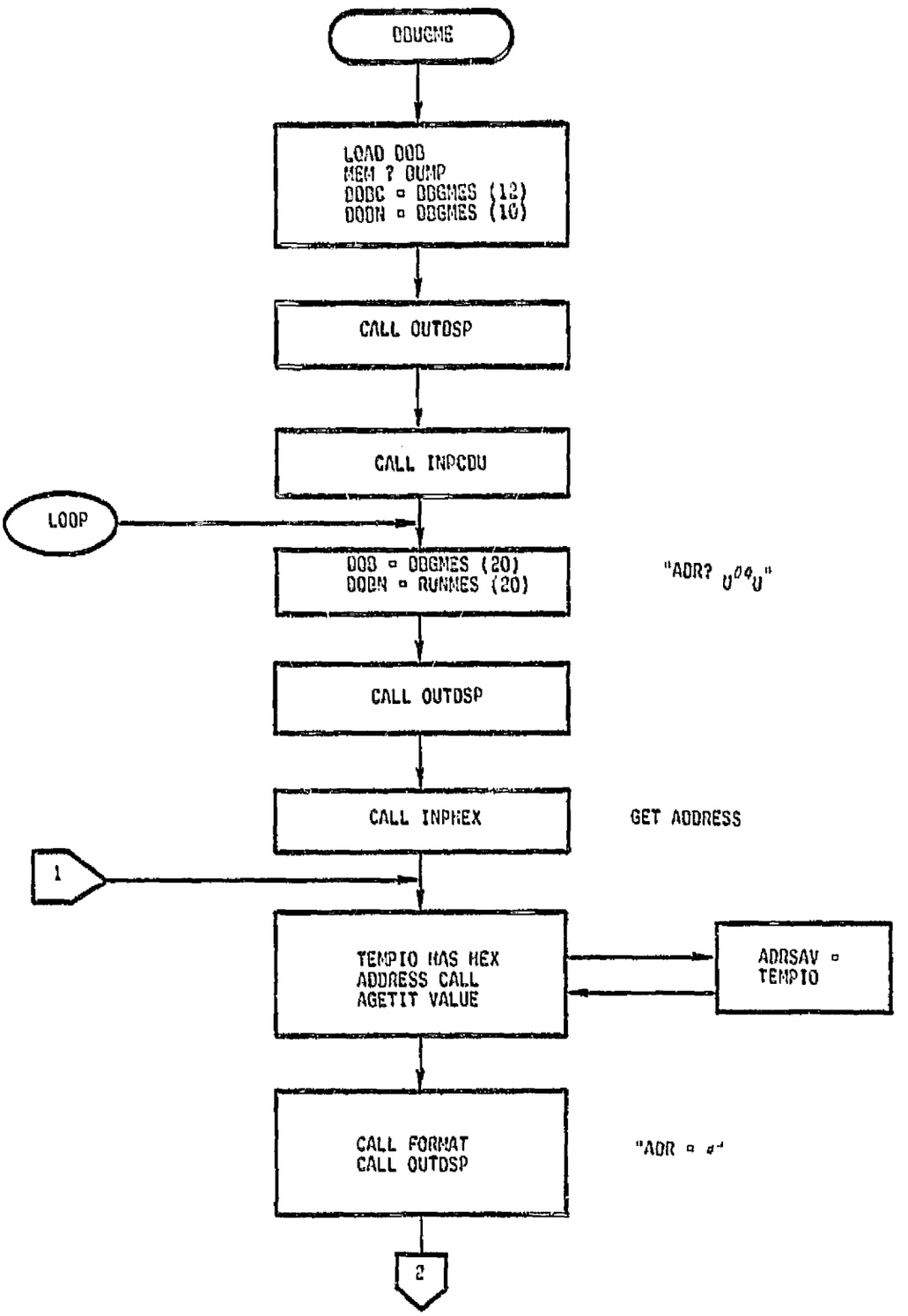
Destroys: Nothing

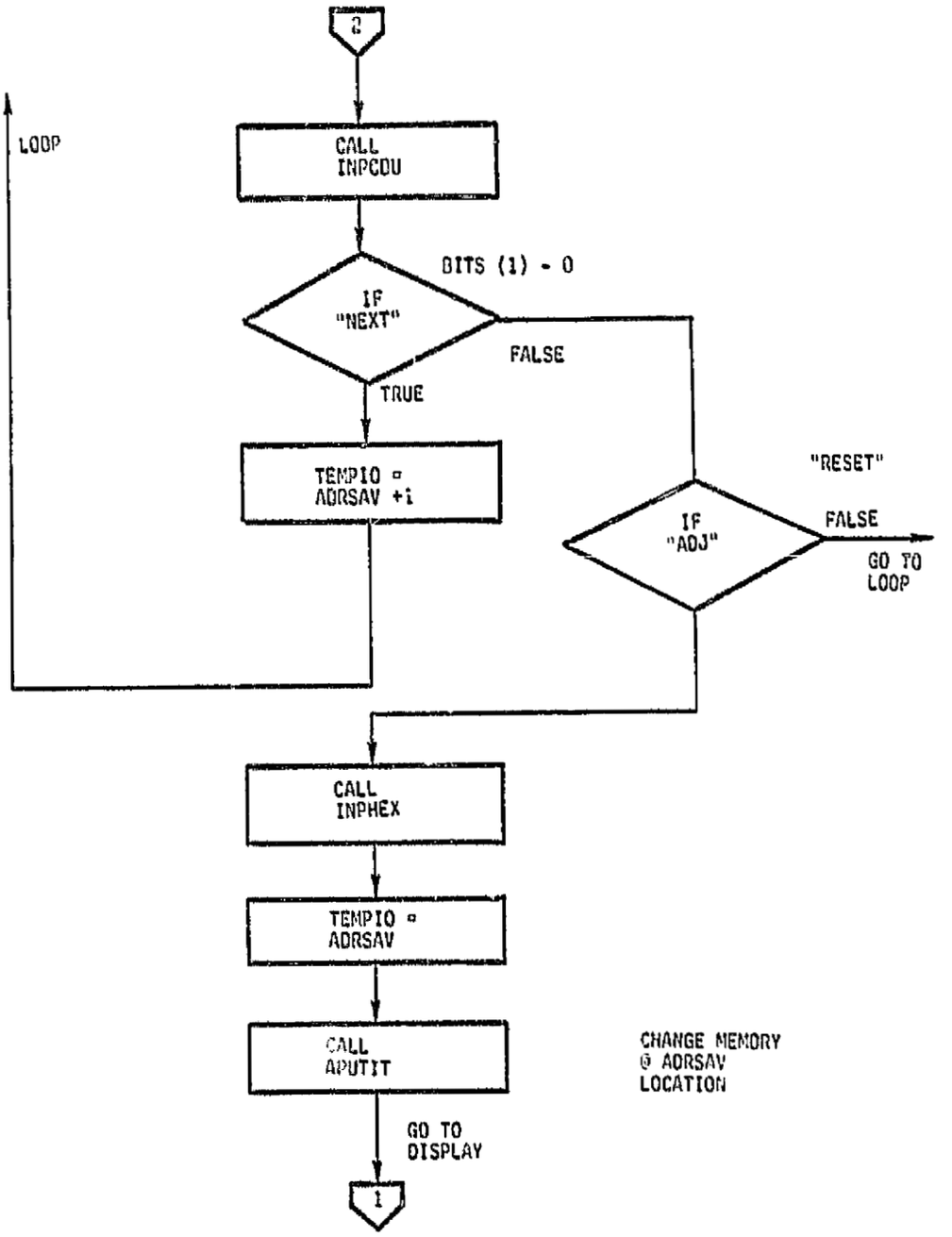
Modifies: DOB, memory location if "PUT"

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


DBUGME
OUTOSP
APUTIT
IMPHEX
AGETIT
FORMAT


DDUGME
LOAD DDB
MEM ? DUMP
DDBC ◻ DDGMES (12)
DDBN ◻ DDGMES (10)
CALL OUTDSP
CALL INPCDU
LOOP
DDB ◻ DDGMES (20)
DDBN ◻ RUNMES (20)
"ADR? $U^{00}U$"
CALL OUTDSP
CALL INPHEX
GET ADDRESS
1
TEMPIO HAS HEX
ADDRESS CALL
AGETIT VALUE
ADRSAV ◻
TEMPIO
CALL FORMAT
CALL OUTDSP
"ADR ◻ #"
2


2
LOOP
CALL
INPCDU
BITS (1) - 0
IF
"NEXT"
FALSE
TRUE
TEMPIO ¤
ADRSAV +i
"RESET"
IF
"ADJ"
FALSE
GO TO
LOOP
CALL
INPHEX
TEMPIO ¤
ADRSAV
CALL
APUTIT
CHANGE MEMORY
@ ADRSAV
LOCATION
GO TO
DISPLAY
1

UTILITY ROUTINES

PAUSE	-	Wait at KEYPAD
CLOCK	-	Clock synchronizer
INPCDU	-	Read C/D panel
INPHEX	-	Input a HEX value
CONFNC	-	Convert sensor to data
RANGCK	-	Range check on sensors
SENRLM	-	Sensor rate limit test
INPCID	-	Input CID value
INPPKS	-	Input pick data
OUTCAS	-	Output data to cassette
OUTDSP	-	Display in LEDS
SAVDAT	-	Store data in CMOS and for cassette
TAPITZ	-	Initialize tape header.

Subroutine: PAUSE

PAUSE waits for any key to be pressed on the display/control.

Inputs: None

Outputs: None

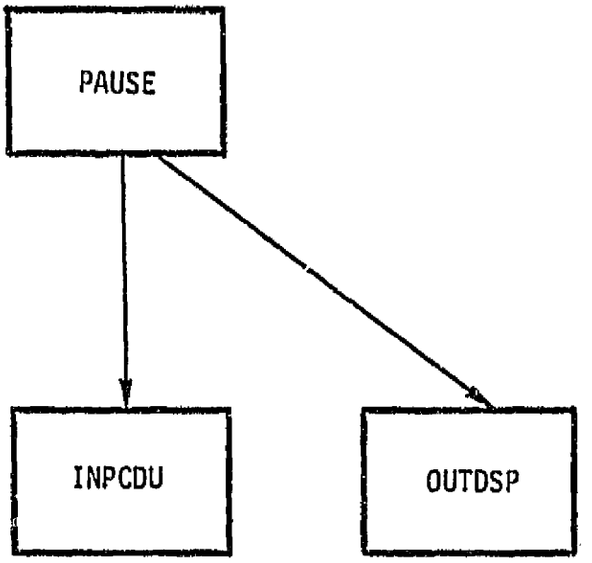
Calls: INPCDU, OUTDSP

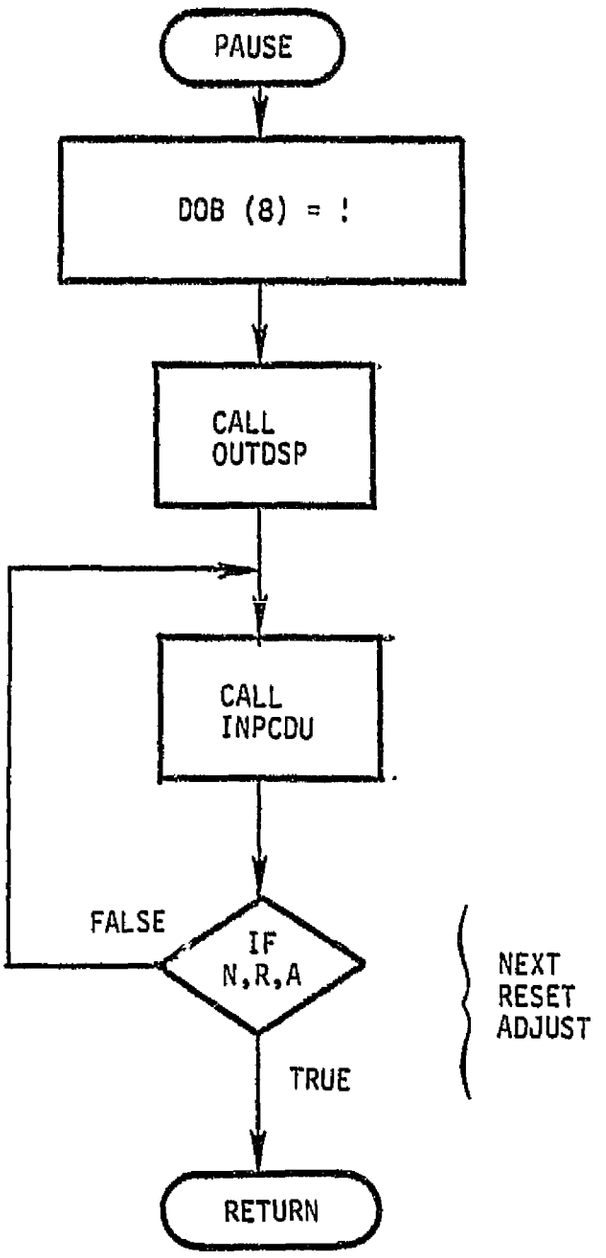
Destroys: Nothing

Modifies: DOB

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


PAUSE
INPCDU
OUTDSP


PAUSE
DOB (8) = !
CALL
OUTDSP
CALL
INPCDU
FALSE
IF
N,R,A
NEXT
RESET
ADJUST
TRUE
RETURN

Subroutine: CLOCK

CLOCK synchronizes VCS timing by waiting for a timer interrupt (1 second), times out after 2 seconds.

Inputs: None

Outputs: None

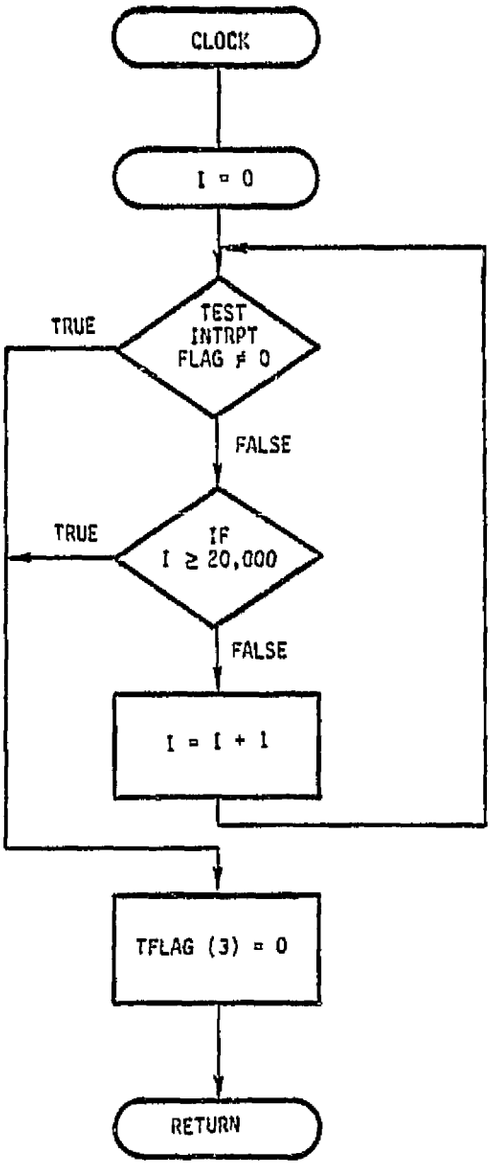
Calls: Nothing

Destroys: Nothing

Modifies: Clears TFLAG (3) = 0

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


CLOCK
I = 0
TEST INTRPT FLAG ≠ 0
TRUE
FALSE
IF I ≥ 20,000
TRUE
FALSE
I = I + 1
TFLAG (3) = 0
RETURN

Subroutine: INPCDU

INPCDU inputs the data from the C/D via port 04.

Inputs: None

Outputs: C/D input in PIB

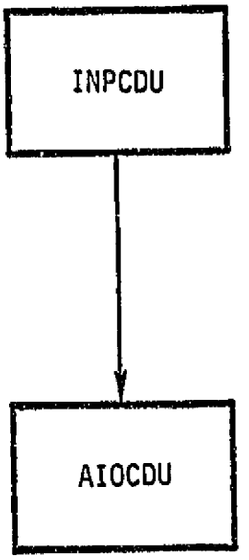
Calls: AIOCDU

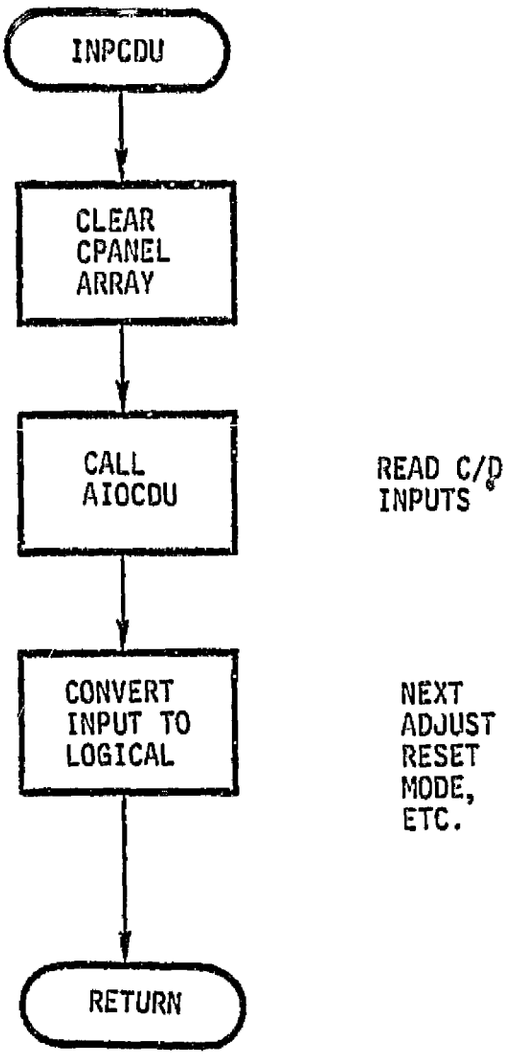
Destroys: Nothing

Modifies: /WORK/, /CPANEL/, /ERRFLG/

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


INPCDU
AIOCDU


INPCDU
CLEAR CPANEL ARRAY
CALL AIOCDU
READ C/D INPUTS
CONVERT INPUT TO LOGICAL
NEXT ADJUST RESET MODE, ETC.
RETURN

I/O UTILITY ROUTINES: INPUT

Subroutine: INPHEX

INPHEX gets a HEX number from the C/D by prompting.

Inputs: None

Outputs: HEX value in TEMPIO

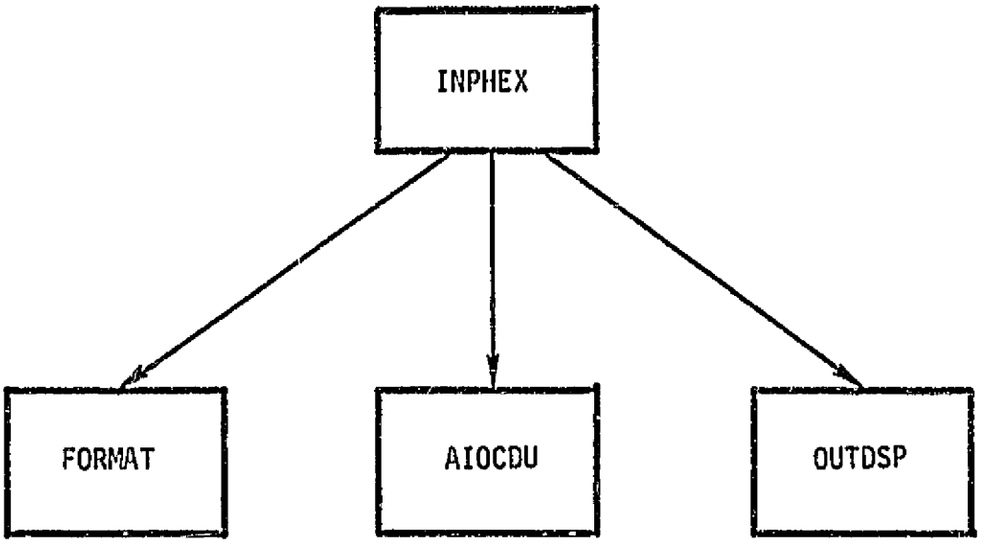
Calls: AIOCDU, OUTDSP, FORMAT

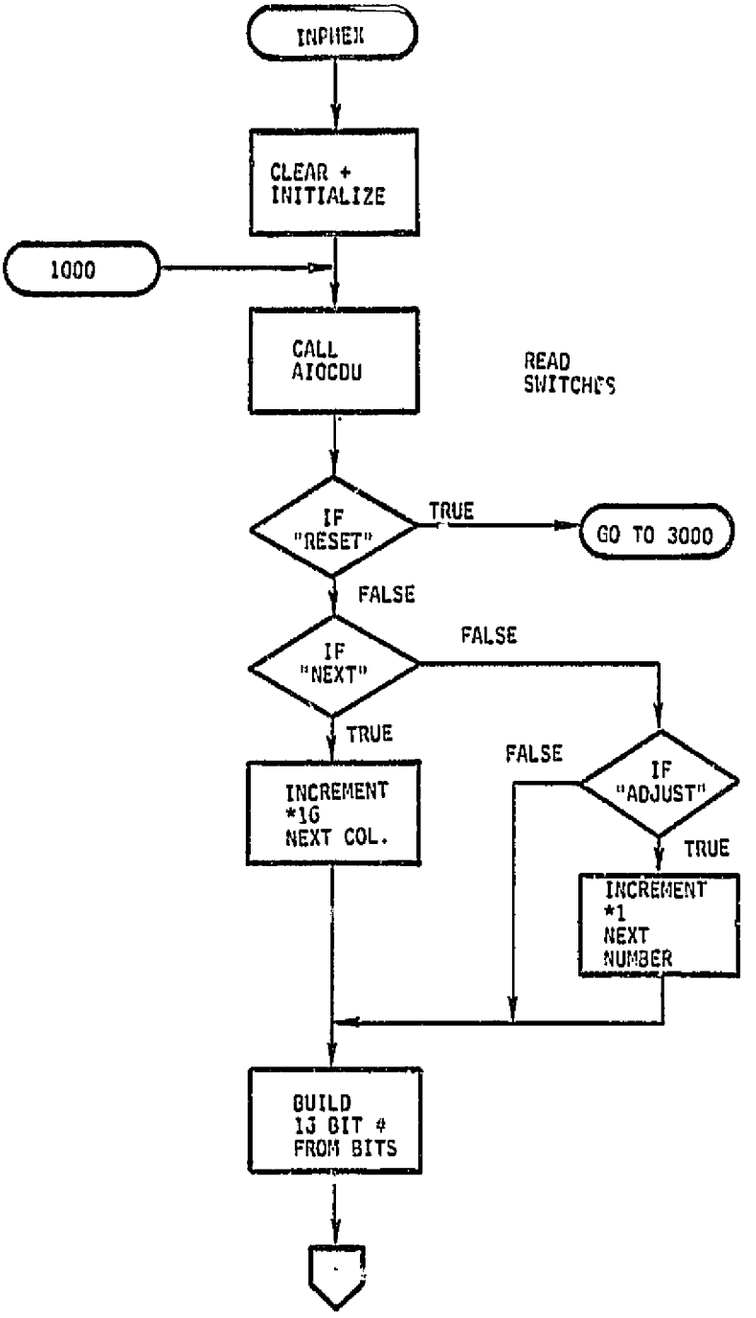
Destroys: Nothing

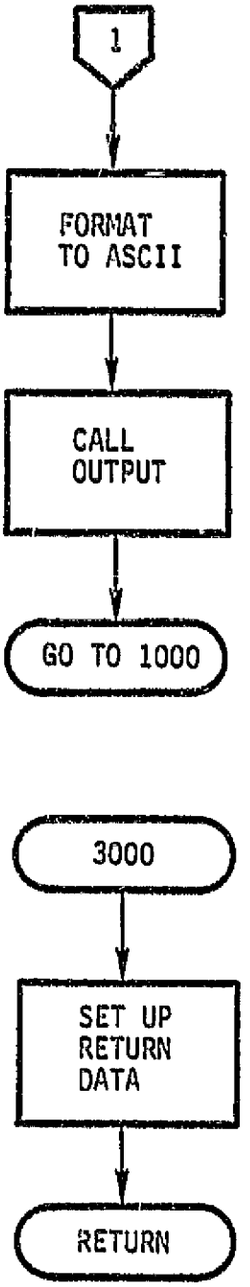
Modifies: /WORK/

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


INPHEX
FORMAT
AIOCDU
OUTDSP


INPHEX
CLEAR +
INITIALIZE
1000
CALL
AIOCDU
READ
SWITCHES
IF
"RESET"
TRUE
GO TO 3000
FALSE
IF
"NEXT"
FALSE
TRUE
INCREMENT
*16
NEXT COL.
FALSE
IF
"ADJUST"
TRUE
INCREMENT
*1
NEXT
NUMBER
BUILD
13 BIT #
FROM BITS


1
FORMAT
TO ASCII
CALL
OUTPUT
GO TO 1000
3000
SET UP
RETURN
DATA
RETURN

I/O UTILITY ROUTINES: CONVERSION

Subroutine: CONFNC

CONFNC is a table driver routine which is used to convert sensor inputs to engineering unit data.

Inputs: Sensor index SENPNT

Outputs: None

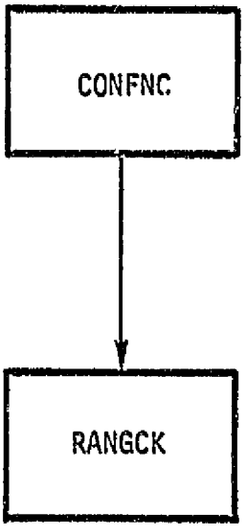
Calls: RANGCK (opt)

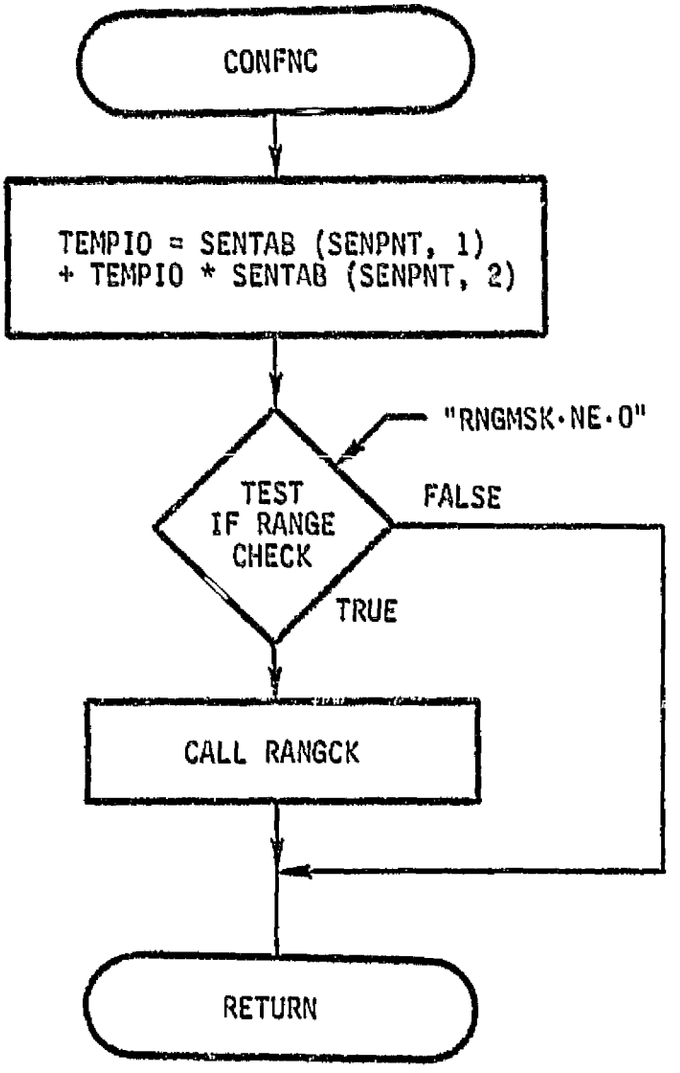
Destroys: Nothing

Modifies: TEMPIO

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


CONFNC
RANGCK


CONFNC
TEMPIO = SENTAB (SENPNT, 1)
+ TEMPIO * SENTAB (SENPNT, 2)
"RNGMSK·NE·0"
TEST
IF RANGE
CHECK
FALSE
TRUE
CALL RANGCK
RETURN

I/O UTILITY ROUTINES: CONVERSION

Subroutine: RANGCK

RANGCK test converted sensor data against max and min stored in table

Inputs: Sensor index pointer

Outputs: ERROR FLAG 1

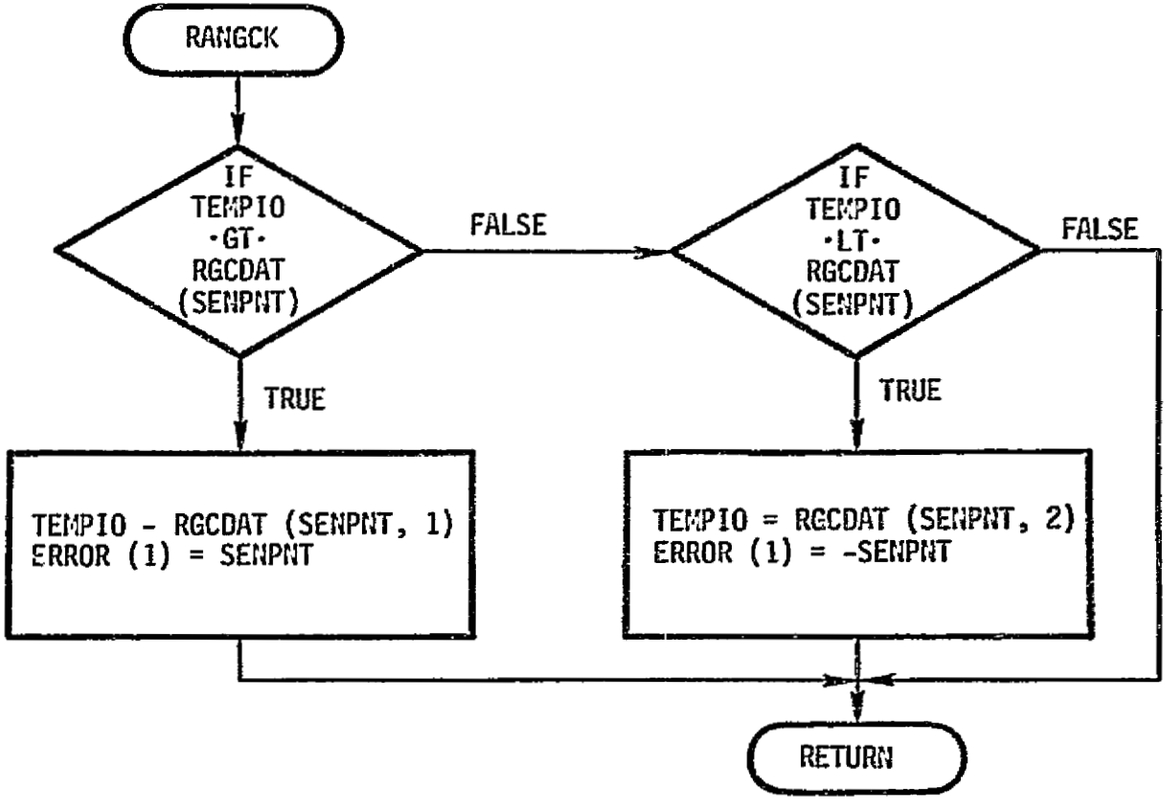
Calls: Nothing

Destroys: Nothing

Modifies: SDB, ERROR (1)

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


RANGCK
IF TEMPIO ·GT· RGCDAT (SENPNT)
FALSE
IF TEMPIO ·LT· RGCDAT (SENPNT)
FALSE
TRUE
TRUE
TEMPIO - RGCDAT (SENPNT, 1)
ERROR (1) = SENPNT
TEMPIO = RGCDAT (SENPNT, 2)
ERROR (1) = -SENPNT
RETURN

I/O UTILITY ROUTINES: SENRLM

Subroutine: SENRLM

SENRLM is the reasonableness check on the LCF, PCF data.

Inputs: SDB, LCF, PCF ; STATUS

Outputs: SDB, LCF, PCF, ERROR (4)

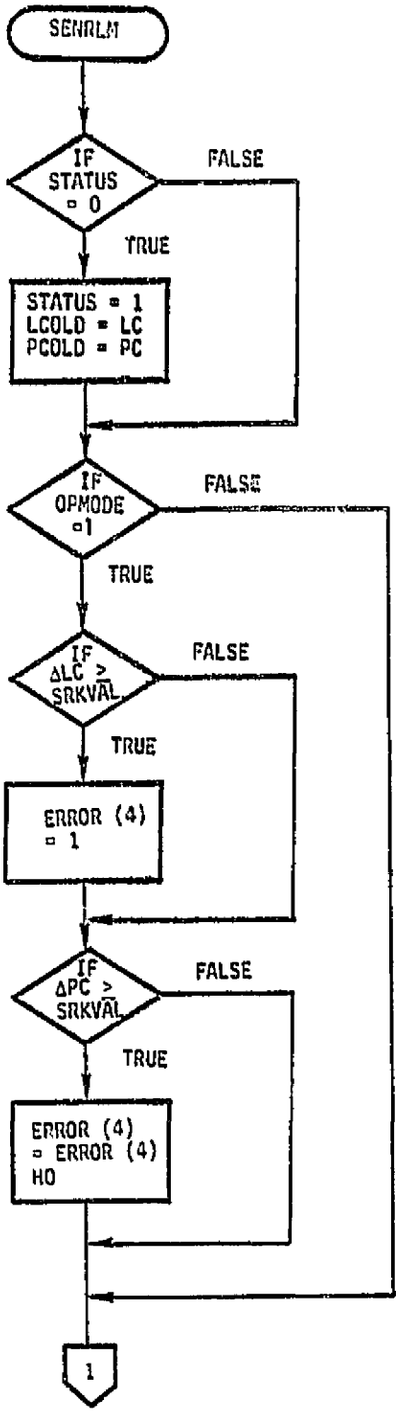
Calls: Nothing

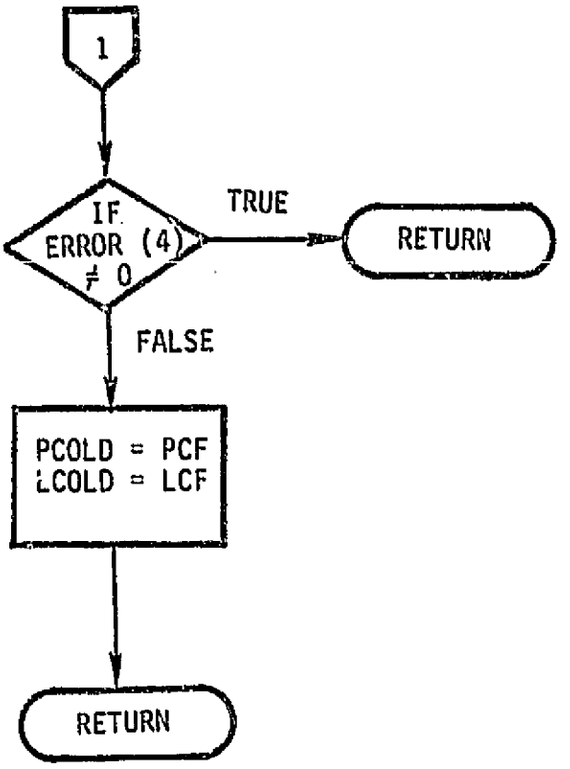
Destroys: Nothing

Modifies: LCF, PCF, ERROR (4), STATUS

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SENRLM
IF STATUS = 0
FALSE
TRUE
STATUS = 1
LCOLD = LC
PCOLD = PC
IF OPMODE =1
FALSE
TRUE
IF ΔLC > SRKVAL
FALSE
TRUE
ERROR (4) = 1
IF ΔPC > SRKVAL
FALSE
TRUE
ERROR (4) = ERROR (4) HO
1


1
IF
ERROR (4)
≠ 0
TRUE
RETURN
FALSE
PCOLD = PCF
LCOLD = LCF
RETURN

Subroutine: INPCID

INPCID inputs the CID data via port 01, control via port 02

Inputs: None

Outputs: CID data in SIB

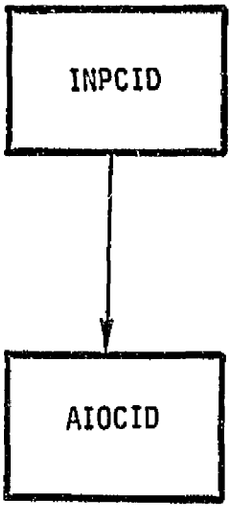
Calls: AIOCID

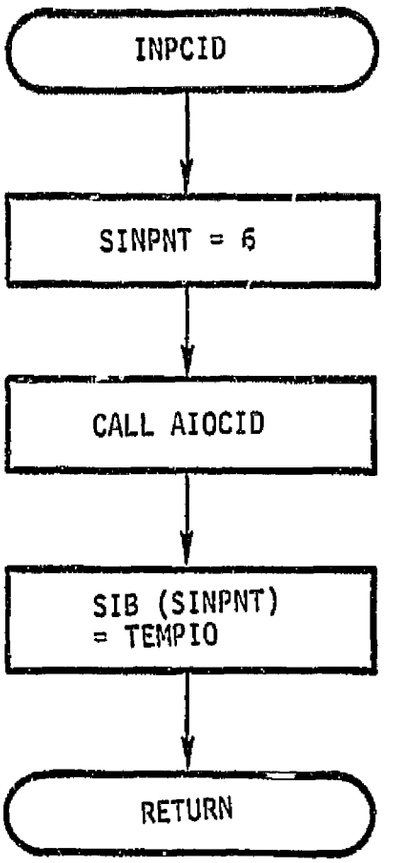
Destroys: Nothing

Modifies: SIB

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


INPCID
AIOCID


INPCID
SINPNT = 6
CALL AIOCID
SIB (SINPNT)
= TEMPIO
RETURN

I/O UTILITY ROUTINES: INPUT

Subroutine: INPPKS

INPPKS inputs the front pick signal via port 10H

Inputs: None

Outputs: Pick (front and rear) data in SIB

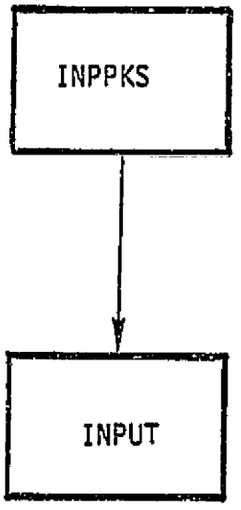
Calls: INPUT (FORTRAN BYTE I/O)

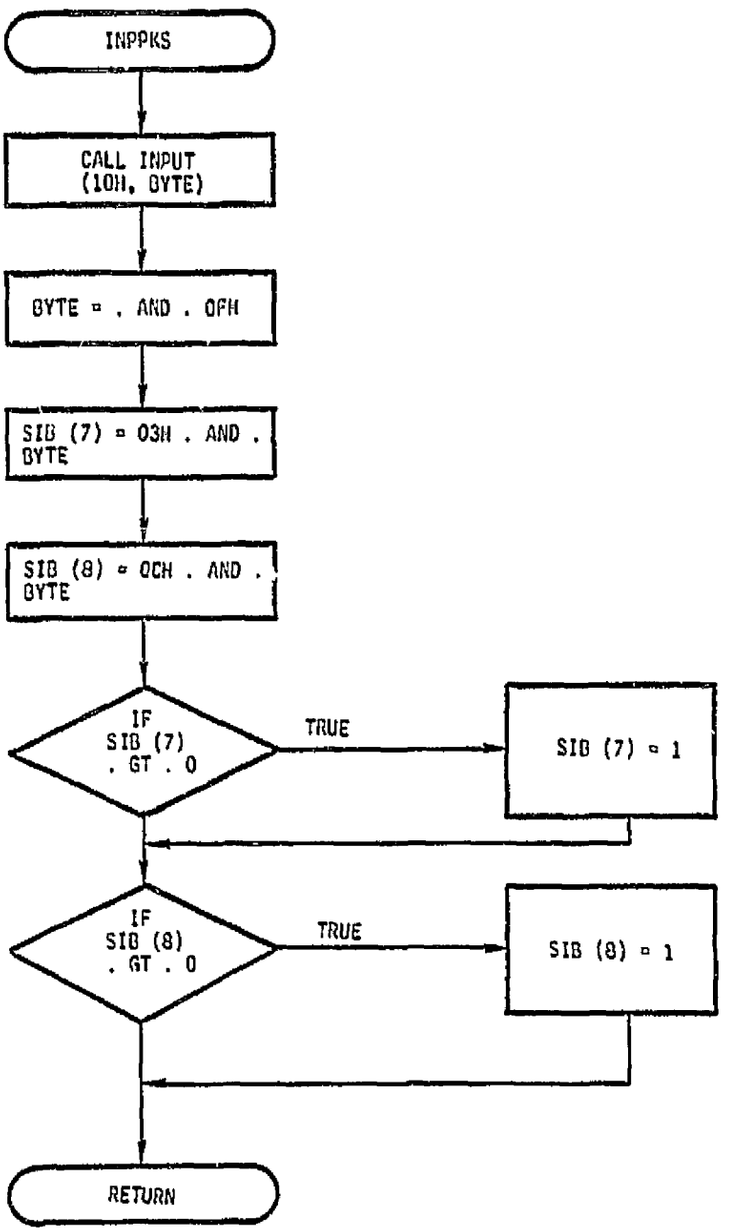
Destroys: Nothing

Modifies: SIB

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


INPPKS
INPUT


INPPKS
CALL INPUT (10H, BYTE)
BYTE = . AND . 0FH
SIB (7) = 03H . AND . BYTE
SIB (8) = 0CH . AND . BYTE
IF SIB (7) . GT . 0
TRUE
SIB (7) = 1
IF SIB (8) . GT . 0
TRUE
SIB (8) = 1
RETURN

I/O UTILITY ROUTINES: OUTPUT

Subroutine: OUTCAS

OUTCAS outputs the cassette output buffer to the digital cassette via port 08, 09, 0A, control port 0B.

Inputs: None

Outputs: TOB

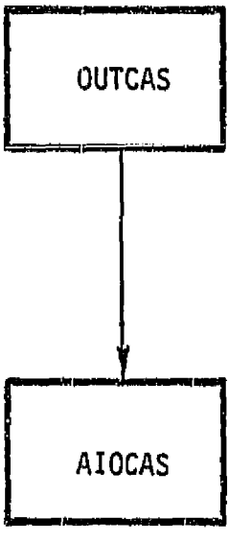
Calls: AIOCAS

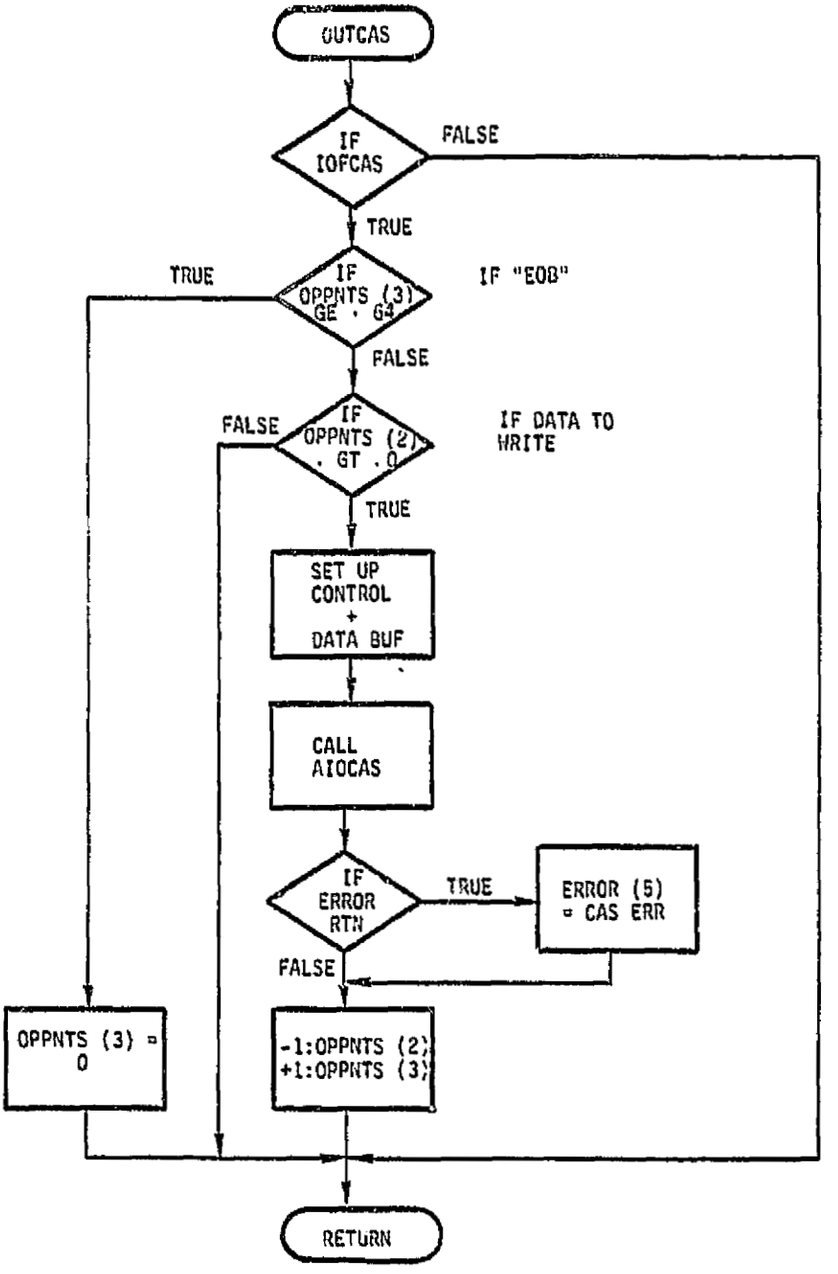
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


OUTCAS
AIOCAS


OUTCAS
IF IOFCAS
FALSE
TRUE
IF OPPNTS (3) GE . 64
TRUE
IF "EOB"
FALSE
IF OPPNTS (2) . GT . 0
FALSE
IF DATA TO WRITE
TRUE
SET UP CONTROL + DATA BUF
CALL AIOCAS
IF ERROR RTN
TRUE
ERROR (5) = CAS ERR
FALSE
OPPNTS (3) = 0
-1:OPPNTS (2)
+1:OPPNTS (3)
RETURN

I/O UTILITY ROUTINES: OUTPUT

Subroutine: OUTDSP

OUTDSP outputs an ASCII character string to the (7303) display.

Inputs: ASCII string in DOB

Outputs: None

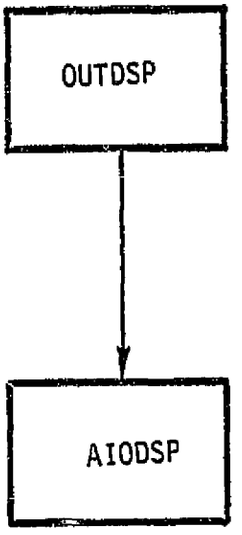
Calls: AIODSP (DOB (1))

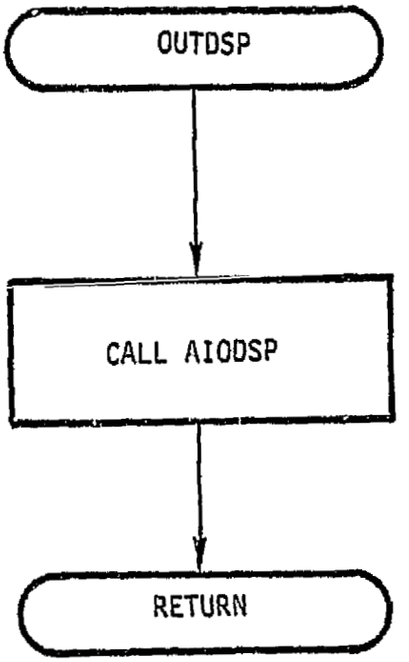
Destroys: Nothing

Modifies: Nothing

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


OUTDSP
AIODSP


OUTDSP
CALL AIODSP
RETURN

SUPERVISOR EXECUTION MODULE

Subroutine: SAVDAT

SAVDAT stores sensor data into CASDAT buffer for tape dump and DFD + LCF into SNDATA buffer (Mode 1).

Inputs: None

Outputs: None

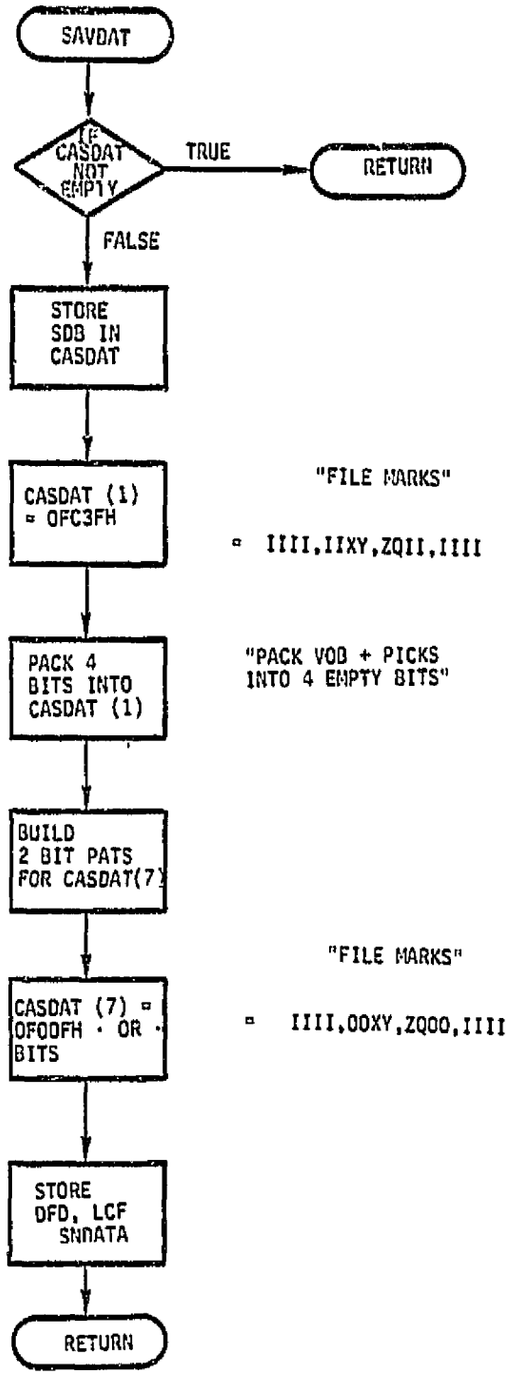
Calls: None

Destroys: Nothing

Modifies: DATPNT, SNDATA BUFFER

Language: FORTRAN 80

L-V-A: Version 1, Level 1
Roger B. Fish


SAVDAT
IF CASDAT NOT EMPTY
TRUE
RETURN
FALSE
STORE SDB IN CASDAT
CASDAT (1) ¤ OFC3FH
"FILE MARKS"
¤ IIII,IIXY,ZQII,IIII
PACK 4 BITS INTO CASDAT (1)
"PACK VOB + PICKS INTO 4 EMPTY BITS"
BUILD 2 BIT PATS FOR CASDAT(7)
"FILE MARKS"
CASDAT (7) ¤ OFOOFH · OR · BITS
¤ IIII,OOXY,ZQOO,IIII
STORE DFD, LCF SNDATA
RETURN

I/O UTILITY ROUTINE: OUTPUT

Subroutine: TAPITZ

TAPITZ writes the data tape file header.

Inputs: None

Outputs: None

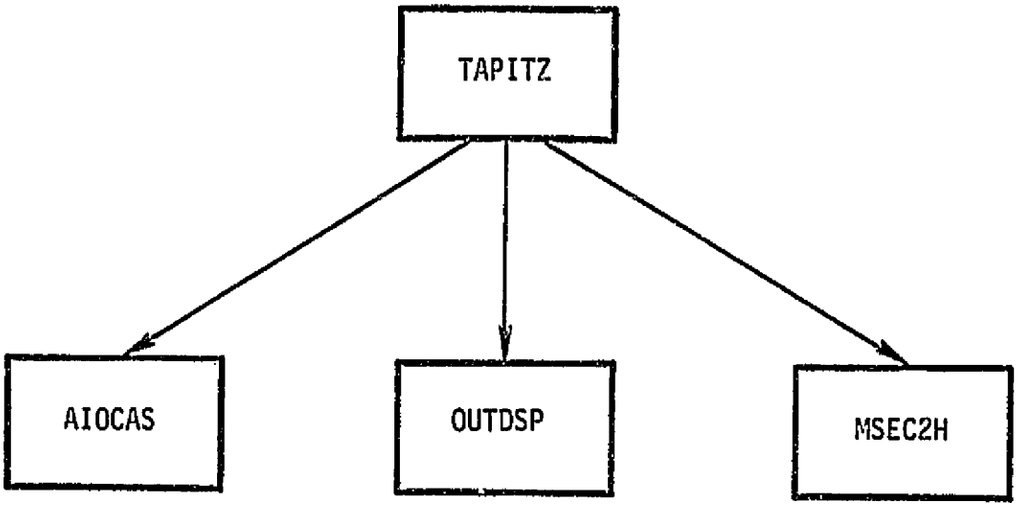
Calls: AIOCAS, OUTDSP, MSEC2H

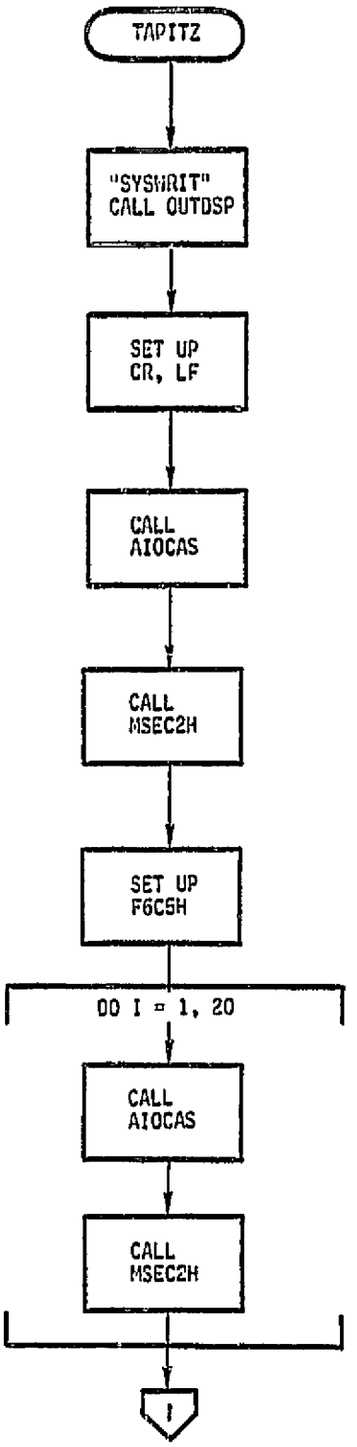
Destroys: WORK/

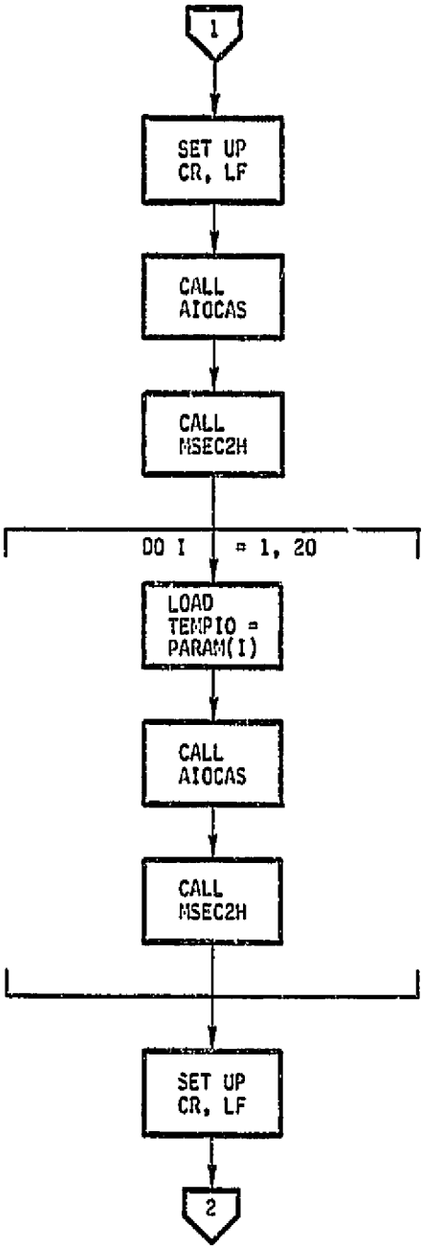
Modifies: DOB

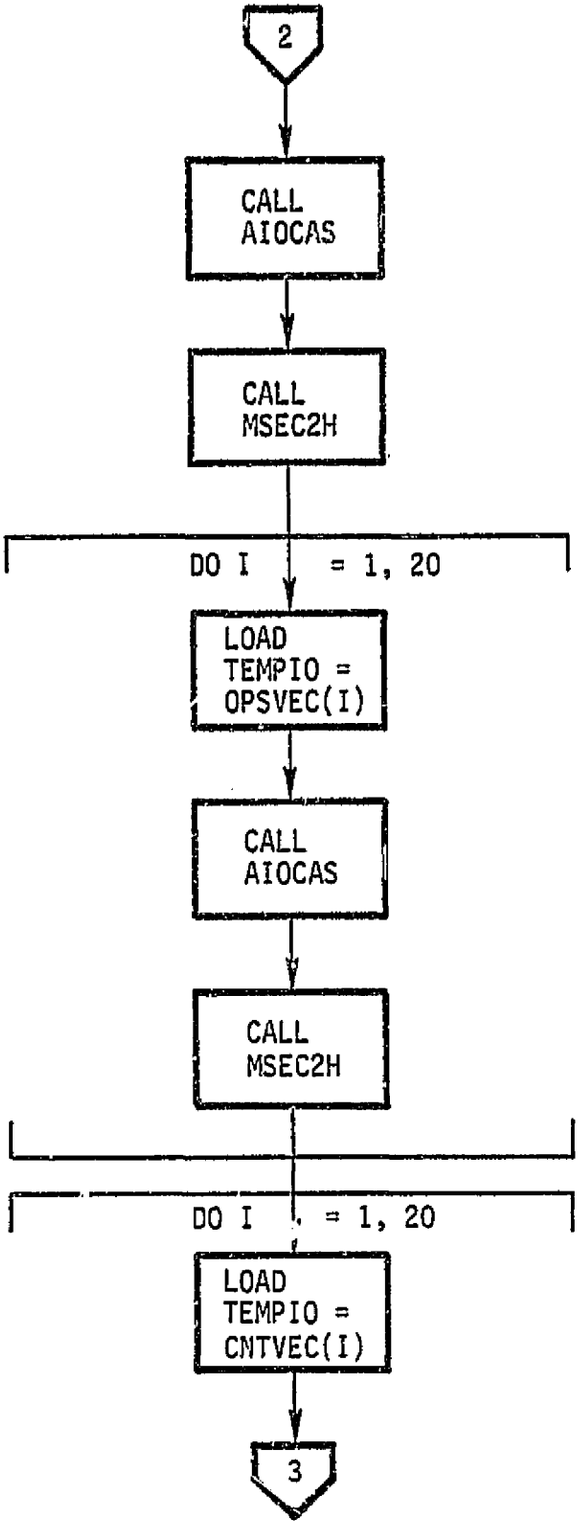
Language: FORTRAN 80

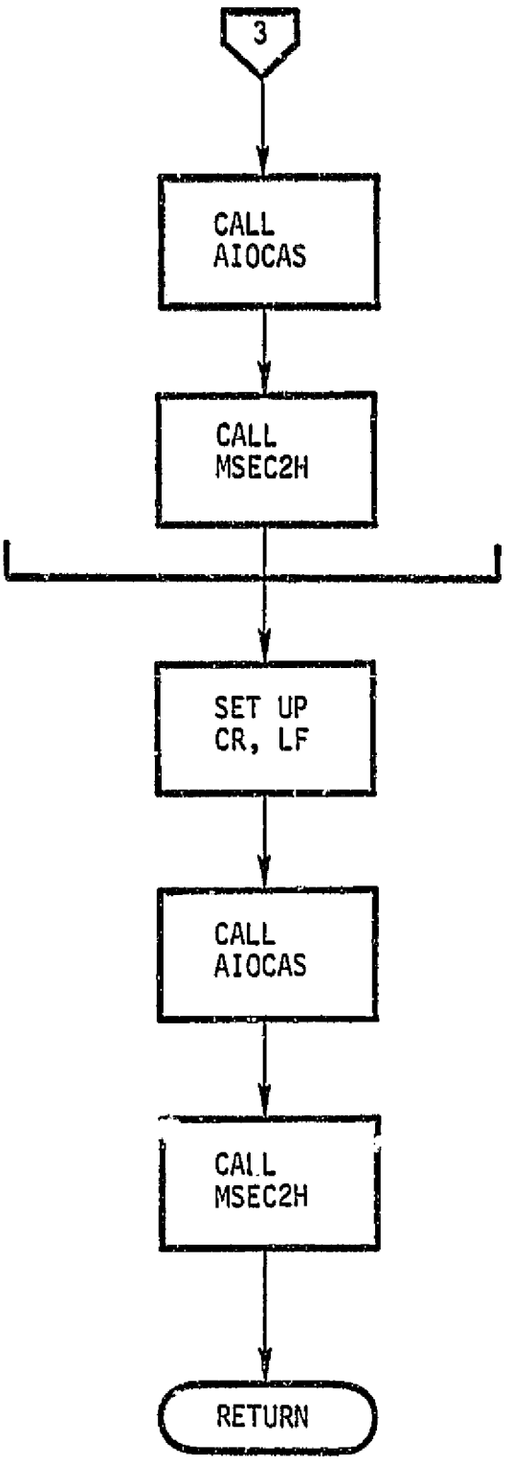
L-V-A Version 1, Level 1
Roger B. Fish


TAPITZ
AIOCAS
OUTDSP
MSEC2H


TAPITZ
"SYSHRIT"
CALL OUTDSP
SET UP
CR, LF
CALL
AIOCAS
CALL
MSEC2H
SET UP
F6C5H
DO I = 1, 20
CALL
AIOCAS
CALL
MSEC2H
I


1
SET UP
CR, LF
CALL
AIOCAS
CALL
MSEC2H
DO I = 1, 20
LOAD
TEMPIO =
PARAM(I)
CALL
AIOCAS
CALL
MSEC2H
SET UP
CR, LF
2


2
CALL
AIOCAS
CALL
MSEC2H
DO I = 1, 20
LOAD
TEMPIO =
OPSVEC(I)
CALL
AIOCAS
CALL
MSEC2H
DO I = 1, 20
LOAD
TEMPIO =
CNTVEC(I)
3


3
CALL
AIOCAS
CALL
MSEC2H
SET UP
CR, LF
CALL
AIOCAS
CALL
MSEC2H
RETURN

I/O DRIVERS + INTERRUPT ROUTINES

AIODSP	-	Display call to monitor
FORMAT	-	Format # into HEX
APUTIT	-	Put a BYTE into memory
AIOCID	-	CID I/O driver
AIOCAS	-	Cassette I/O driver
AIOVOT	-	Valve I/O driver
AIOITZ	-	I/O initializer routine
AIOADC	-	A/D I/O driver
AGETIT	-	Get a BYTE from memory
AIOCDU	-	C/D I/O driver
INTRPT	-	Interrupt handler (timer)
INTREN	-	Interrupt enable
INTRDS	-	Interrupt disable

I/O DRIVER ROUTINES:

Subroutine: AIODSP (DOB (1))

AIODSP writes ASCII data to the display unit (7303) via the monitor from DOB

Inputs: Address of DOB (1) in BC

Outputs: None

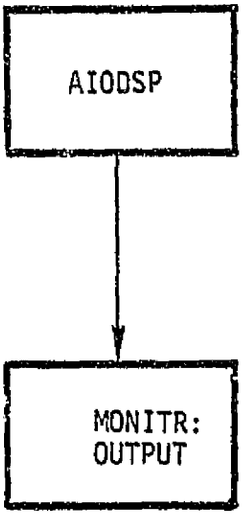
Calls: MONITOR : OUTPT

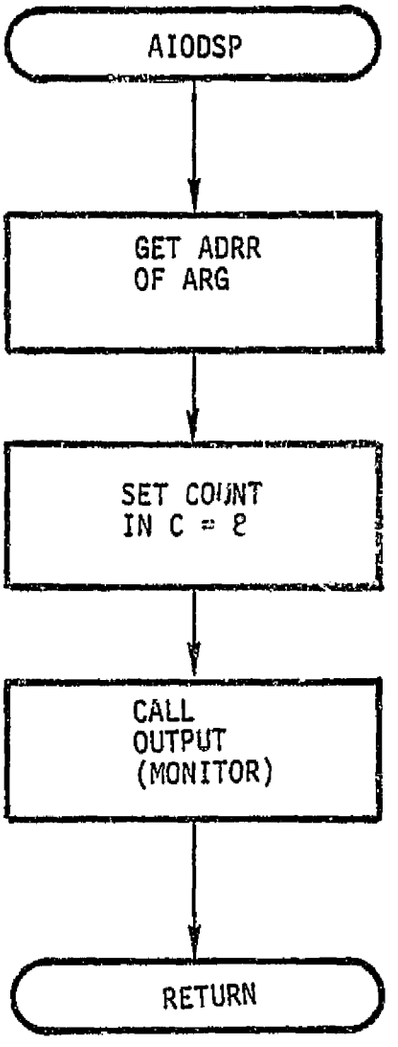
Destroys: F/F's, A

Modifies: Nothing

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level
Roger B. Fish


AIODSP
MONITR:
OUTPUT


AIODSP
GET ADRR
OF ARG
SET COUNT
IN C = 2
CALL
OUTPUT
(MONITOR)
RETURN

I/O UTILITY ROUTINES:

Subroutine: FORMAT (ADDR)

FORMAT turns a HEX value in DOB (5,6) to ASCII code, in (BC 5, 6, 7, 8)

Inputs: None

Outputs: None

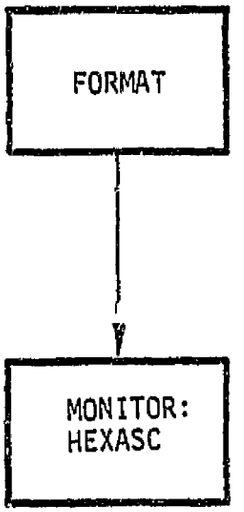
Calls: MONITOR: HEXASC

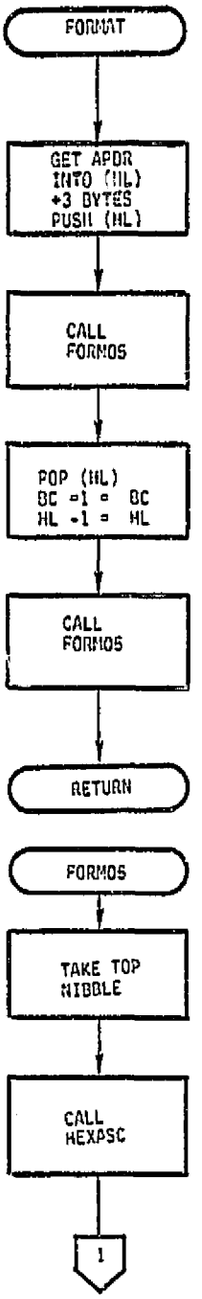
Destroys: A, F/F, BC, HL

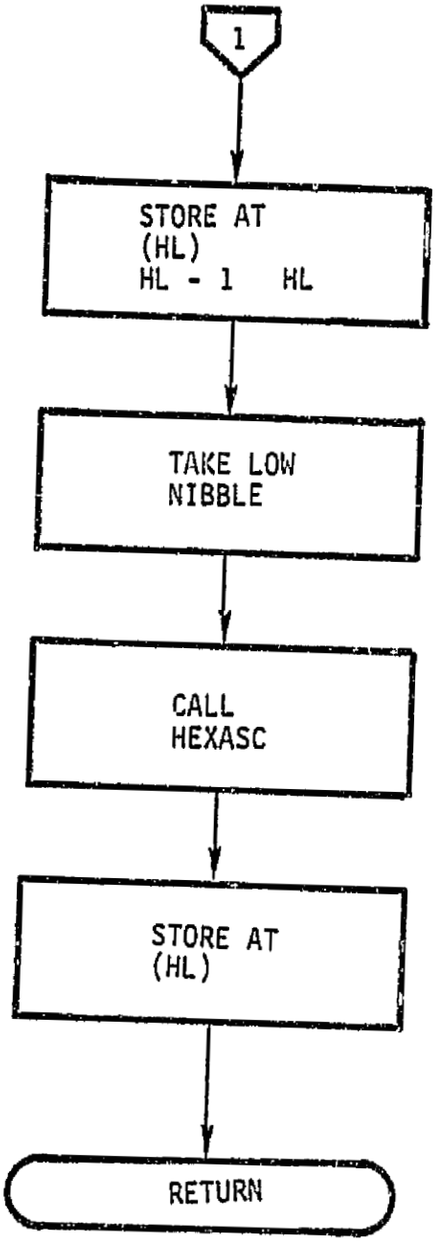
Modifies: DOB

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


FORMAT
MONITOR:
HEXASC


FORMAT
GET ADDR
INTO (HL)
+3 BYTES
PUSH (HL)
CALL
FORMOS
POP (HL)
BC -1 = BC
HL -1 = HL
CALL
FORMOS
RETURN
FORMOS
TAKE TOP
NIBBLE
CALL
HEXASC
1


1
STORE AT
(HL)
HL - 1 HL
TAKE LOW
NIBBLE
CALL
HEXASC
STORE AT
(HL)
RETURN

I/O UTILITY ROUTINES:

Subroutine: APUTIT (TEMPIO)

APUTIT stores a BYTE in memory complementary to AGETIT.

Inputs: Address in TEMPIO and BYTE @ TEMPIO + ±

Outputs: None

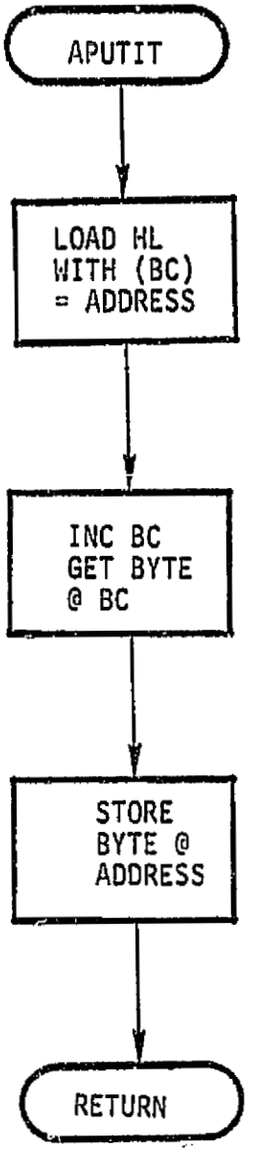
Calls: Nothing

Destroys: A, BC, F/F's, HL

Modifies: BYTE @ TEMPIO

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


APUTIT
LOAD HL
WITH (BC)
= ADDRESS
INC BC
GET BYTE
@ BC
STORE
BYTE @
ADDRESS
RETURN

I/O DRIVER ROUTINES:

Subroutine: AIOCID (I)

AIOCID reads the CID data from port 01, into TEMPIO

Inputs: None

Outputs: None

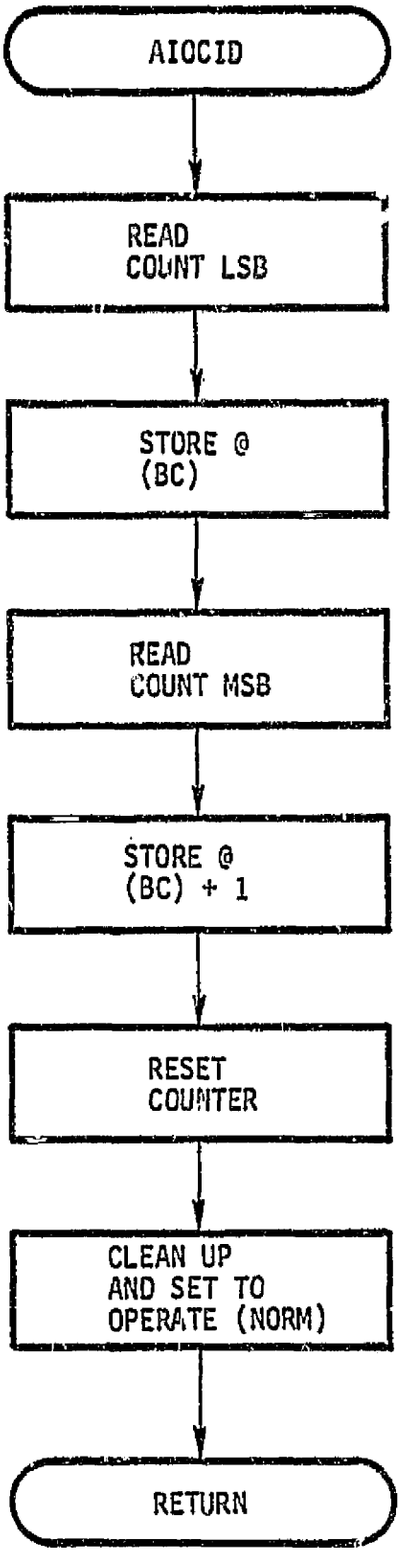
Calls: Nothing

Destroys: F/F's, A

Modifies: TEMPIO

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AIOCID
READ
COUNT LSB
STORE @
(BC)
READ
COUNT MSB
STORE @
(BC) + 1
RESET
COUNTER
CLEAN UP
AND SET TO
OPERATE (NORM)
RETURN

I/O DRIVER ROUTINES:

Subroutine: AIOCAS (BUF)

AIOCAS writes data from the cassette output buffer to tape.

Inputs: None

Outputs: None

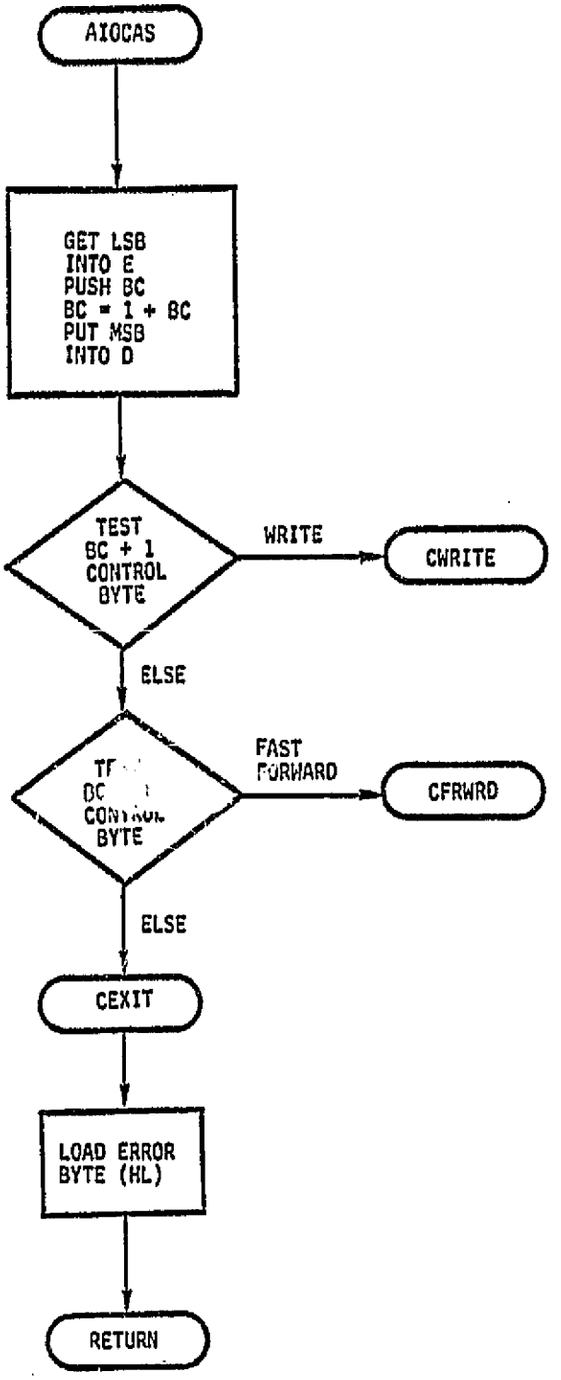
Calls: Nothing

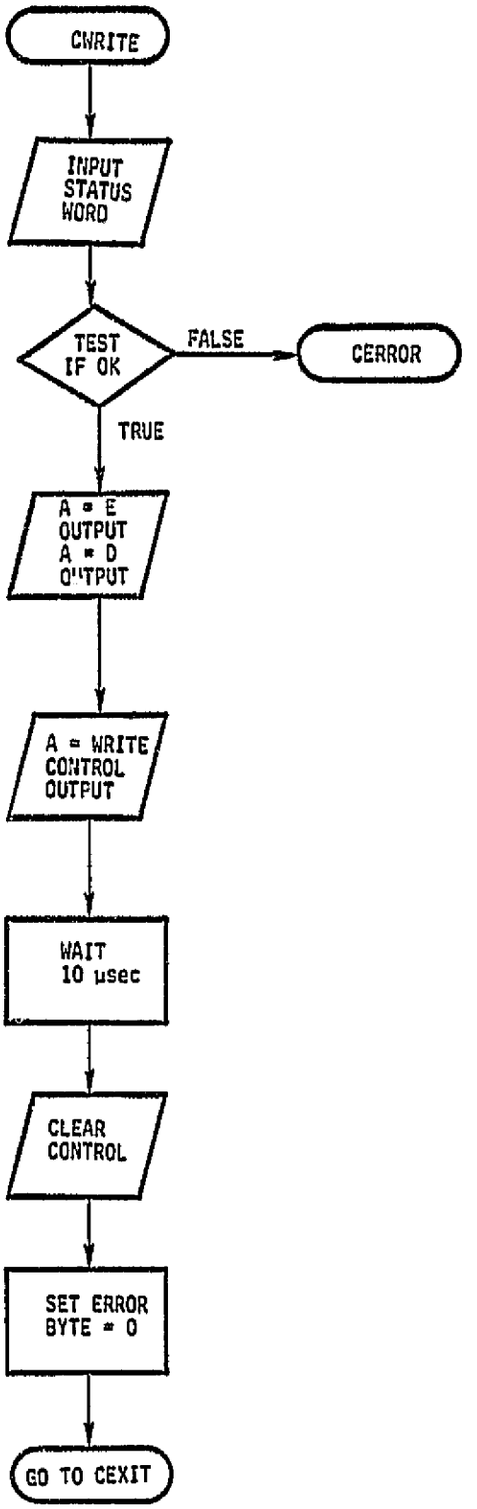
Destroys: F/F's, A

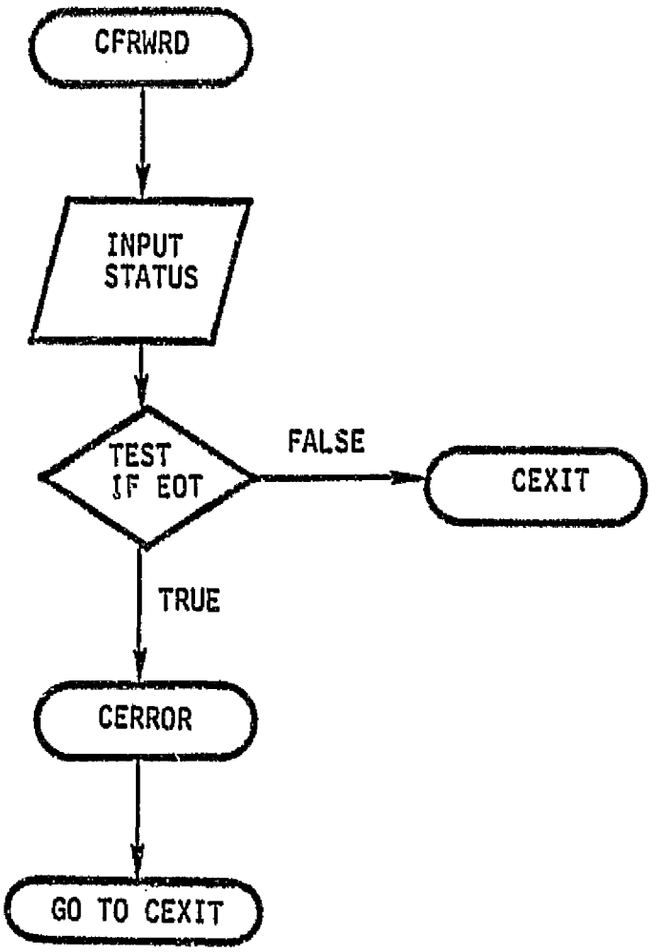
Modifies: Nothing

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AIOCAS
GET LSB
INTO E
PUSH BC
BC = 1 + BC
PUT MSB
INTO D
TEST
BC + 1
CONTROL
BYTE
WRITE
CWRITE
ELSE
FAST
FORWARD
CFRWRD
ELSE
CEXIT
LOAD ERROR
BYTE (HL)
RETURN


CWRITE
INPUT STATUS WORD
TEST IF OK
FALSE
CERROR
TRUE
A = E
OUTPUT
A = D
OUTPUT
A = WRITE CONTROL OUTPUT
WAIT 10 µsec
CLEAR CONTROL
SET ERROR BYTE = 0
GO TO CEXIT


CFRWRD
INPUT STATUS
TEST IF EOT
FALSE
CEXIT
TRUE
CERROR
GO TO CEXIT

I/O DRIVER ROUTINES:

Subroutine: AIOVOT

AIOVOT is the valve control I/O driver routine.

Inputs: CBYTE control word

Outputs: Valve control interface lines

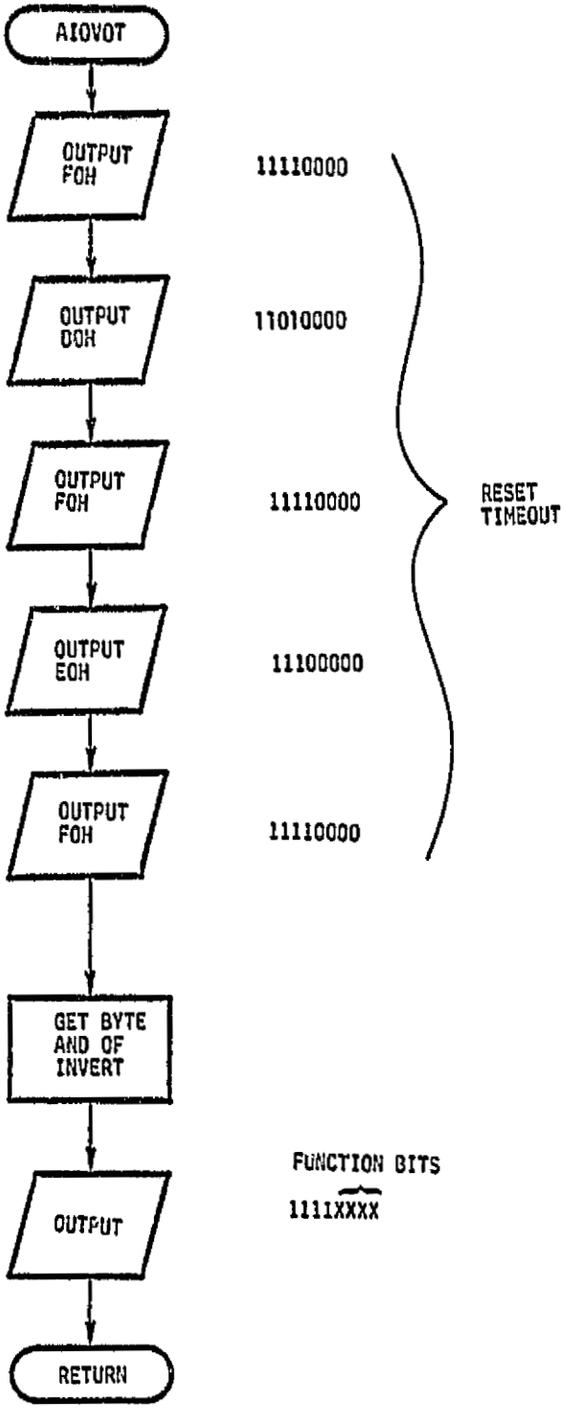
Calls: Nothing

Destroys: A, F/F's, BC

Modifies: Valve control lines

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AIOVOT
OUTPUT F0H
11110000
OUTPUT D0H
11010000
OUTPUT F0H
11110000
RESET TIMEOUT
OUTPUT E0H
11100000
OUTPUT F0H
11110000
GET BYTE AND OF INVERT
OUTPUT
FUNCTION BITS
1111XXXX
RETURN

I/O DRIVER ROUTINES:

Subroutine: AIOIT2

AIOIT2 initializes I/O interfaces for operation at machine startup

Inputs: None

Outputs: None

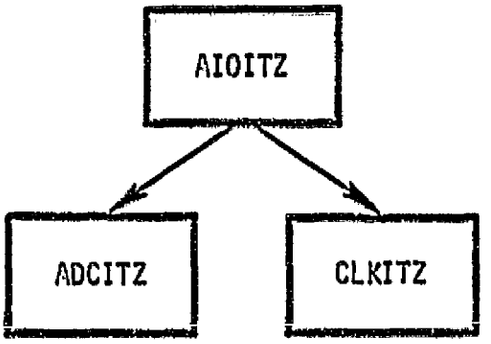
Calls: ADCIT2, CLKIT2 (local subroutines)

Destroys: A, F'F's, BC, DE, HL

Modifies: Interface status

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AIOITZ
ADCITZ
CLKITZ

I/O DRIVER ROUTINES:

Subroutine: AIOADC (I, J)

AIOADC reads signals from the A/D converter into the SIB

Inputs: Sensor index, output data

Outputs: Sensor data to TEMPIO

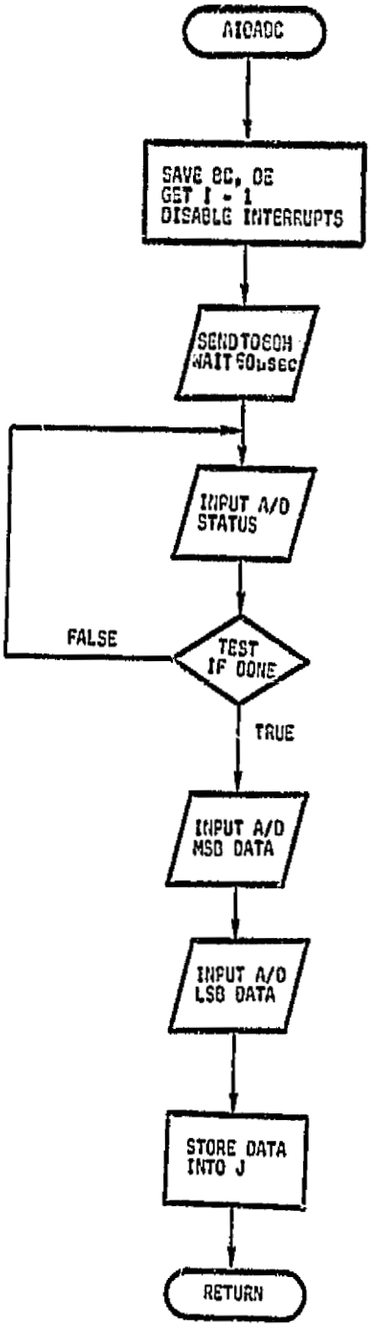
Calls: Nothing

Destroys: F/F's

Modifies: TEMPIO = /WORK/

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AIOADC
SAVE BC, DE
GET I - 1
DISABLE INTERRUPTS
SEND TO80H
WAIT 50μsec
INPUT A/D
STATUS
FALSE
TEST
IF DONE
TRUE
INPUT A/D
MSB DATA
INPUT A/D
LSB DATA
STORE DATA
INTO J
RETURN

G.P. UTILITY ROUTINES:

Subroutine: AGETIT (I, J)

AGETIT takes the HEX address of TEMPIO in BC loads the value and puts it in address held in DE.

Inputs: I = HEX

Outputs: J = HEX value

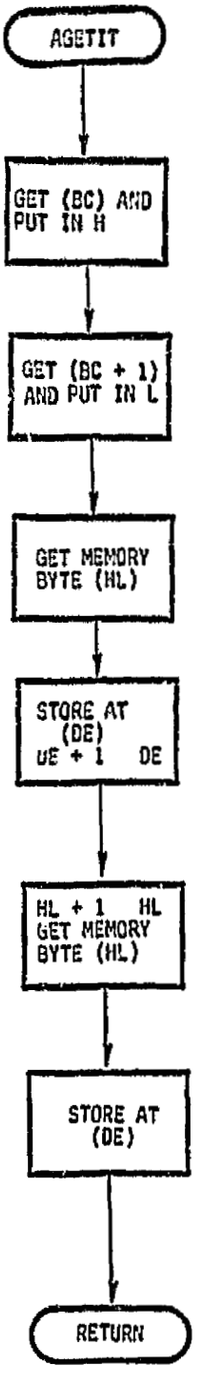
Calls: Nothing

Destroys: BC, DE

Modifies: DOB

Language: ASSEMBLY 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


AGETIT
GET (BC) AND PUT IN H
GET (BC + 1) AND PUT IN L
GET MEMORY BYTE (HL)
STORE AT (DE)
DE + 1 DE
HL + 1 HL
GET MEMORY BYTE (HL)
STORE AT (DE)
RETURN

I/O DRIVER ROUTINES:

Subroutine: AIOCDU (BUF)

AIOCDU reads data from the C/D panel port 04.

Inputs: (BC) points to work buffer

Outputs: None

Calls: None

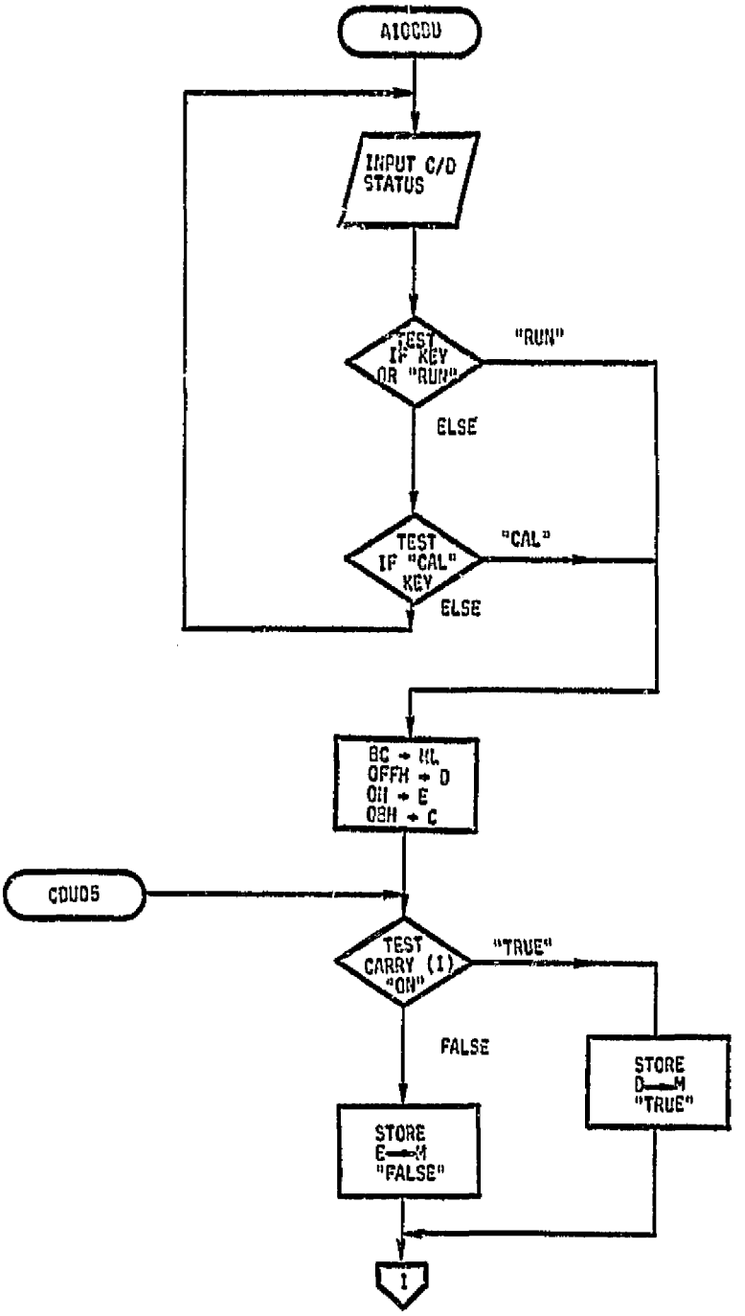
Destroys: A, F/F's, DE, HL

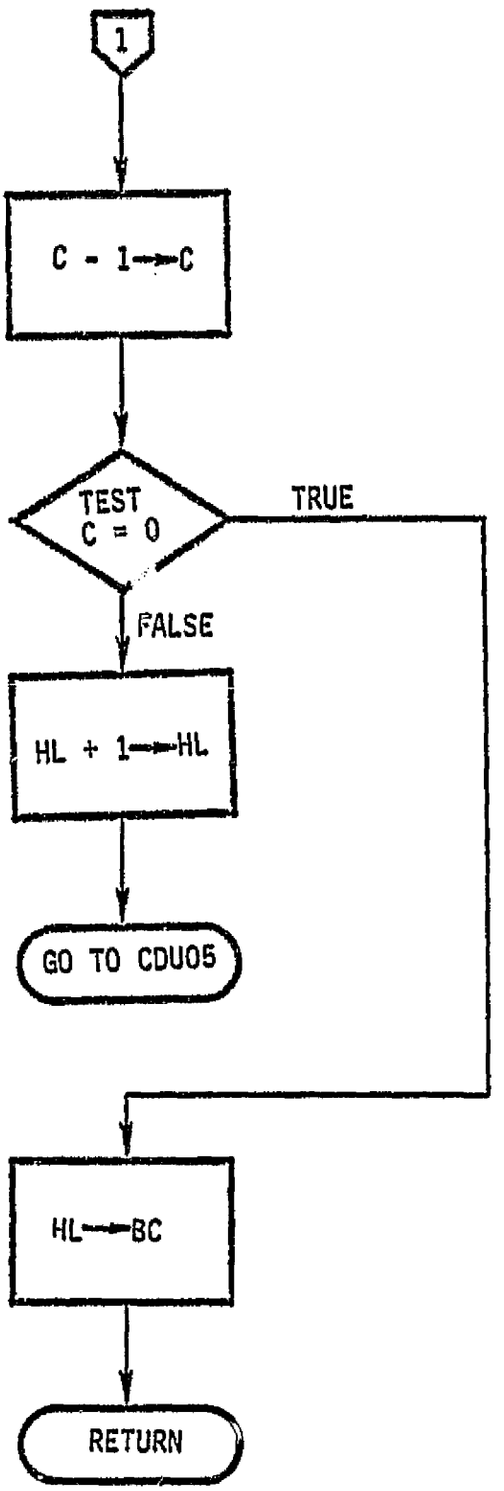
Modifies: Work vector

Description: Generator 8 bytes of local data BUF

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish


A10CDU
INPUT C/D STATUS
TEST IF KEY OR "RUN"
"RUN"
ELSE
TEST IF "CAL" KEY
"CAL"
ELSE
BC → HL
0FFH → D
0H → E
08H → C
CDU05
TEST CARRY (1) "ON"
"TRUE"
FALSE
STORE D⟶M "TRUE"
STORE E⟶M "FALSE"
I


1
C - 1→C
TEST
C = 0
TRUE
FALSE
HL + 1→HL
GO TO CDU05
HL→BC
RETURN

I/O UTILITY ROUTINES: INTERRUPT

Subroutine: INTRPT

INTRPT is the clock interrupt service routine.

Inputs: None

Outputs: None

Calls: OUTCAS

Destroys: Nothing

Modifies: Interrupt counters and flags in monitor code

Language: ASSEMBLER 8080/8085

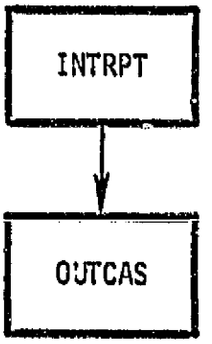
I-V-A: Version 1, Level 1
Roger B. Fish

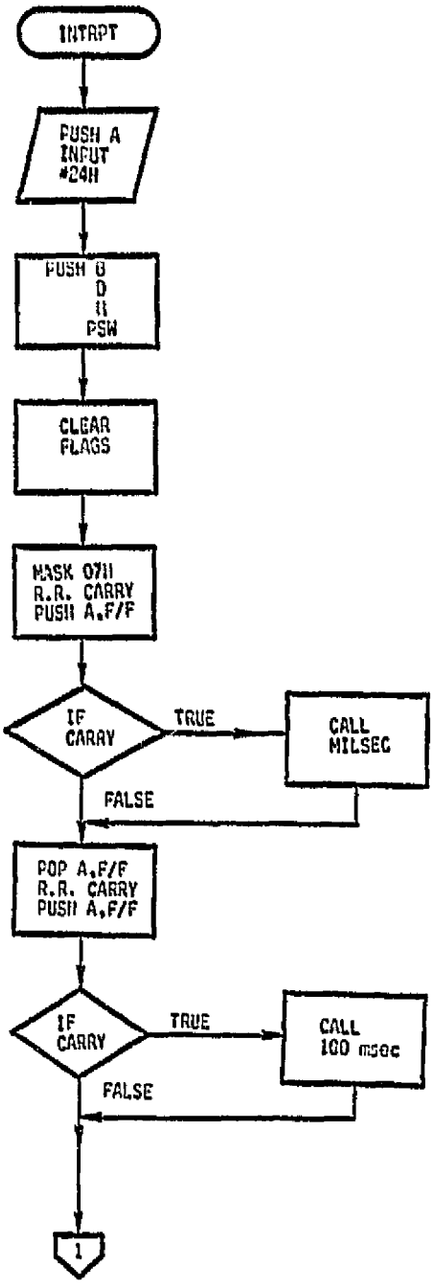
CASSETTE INTERRUPT STRUCTURE

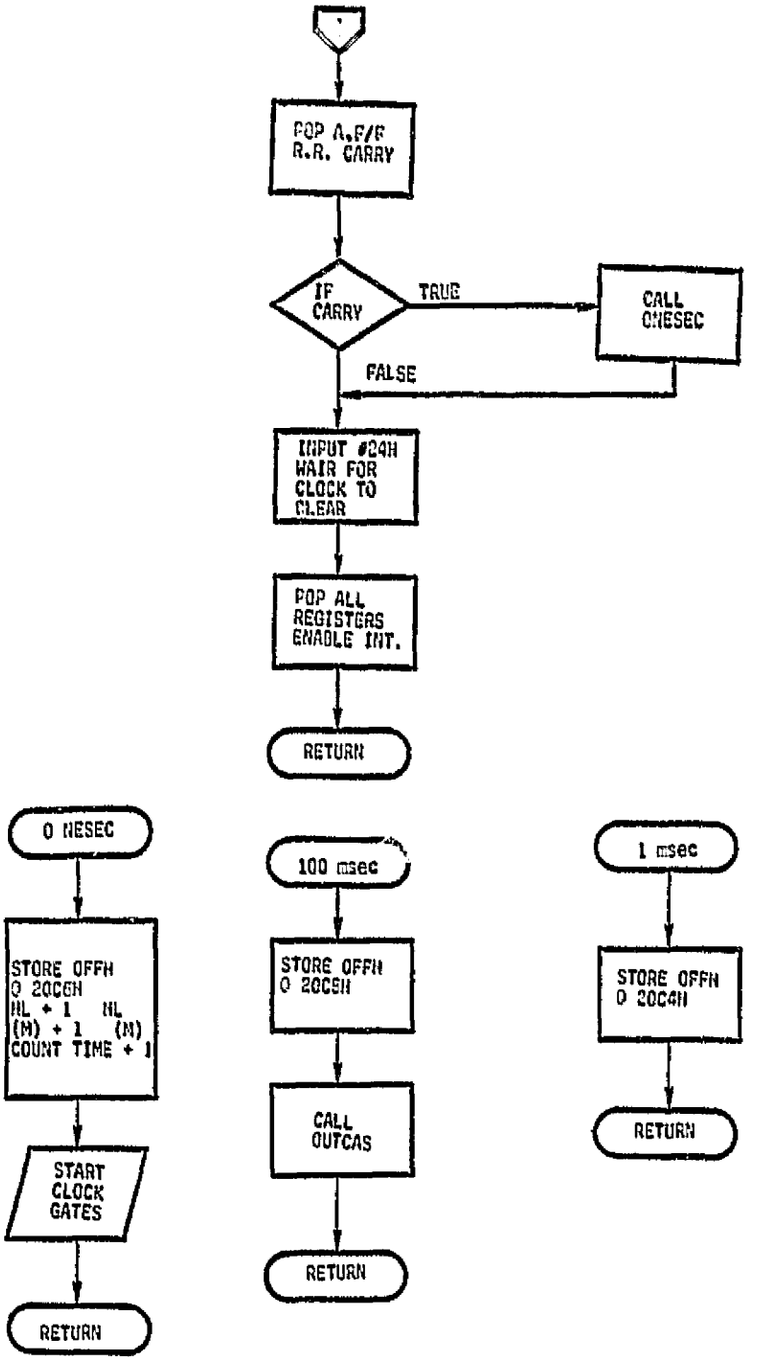
```
Monitor:        RST - 5.5
                Call INTRPT
                RET
                :

INTRPT:         Read clock port
                Test if 1 second
                Test if 100 msec
                Test if 1 msec

ONESEC:         Set flag BYTE (sec)
                Add 1 to count (sec)
                RET

HUNDRED:        Set flag BYTE (100 msec)
                Call OUTCAS
                RET

MILSEC:         Set flag BYTE (1 msec)
                RET
```

Timer generates an interrupt every 1 msec, but only 100 msec and 1 sec are wired to CPU RST 5.5.

```
OUTCAS:

     If test mask

Then:

     If OPPNTS (3) > = 100; OPPNTS (3) = 0, RET

     If OPPNTS (2) > 0, then
         Call cassette output
         OPPNTS (2) = OPPNTS (2) -1
         OPPNTS (3) = OPPNTS (3) +1
         END IF

Else:

     If OPPNTS (3) > = 64
        OPPNTS (3) = 111
        RET
     END

AIOCAS:

     Get ARGS + ADDRESSES
     Test if write; go to write
     Test if F.FORWARD
     ENT

Write:

     Test status
     Error   go to error
     Write 16 bits to ports
     Send write command 5 µsec
     END
```


INTRPT
OUTCAS


INTRPT
PUSH A
INPUT
#24H
PUSH B
D
H
PSW
CLEAR
FLAGS
MASK 07H
R.R. CARRY
PUSH A,F/F
IF
CARRY
TRUE
CALL
MILSEC
FALSE
POP A,F/F
R.R. CARRY
PUSH A,F/F
IF
CARRY
TRUE
CALL
100 msec
FALSE
1


POP A,F/F
R.R. CARRY
IF
CARRY
TRUE
CALL
ONESEC
FALSE
INPUT #24H
WAIR FOR
CLOCK TO
CLEAR
POP ALL
REGISTERS
ENABLE INT.
RETURN
0 NESEC
STORE OFFH
0 20C8H
HL + 1 HL
(M) + 1 (M)
COUNT TIME + 1
START
CLOCK
GATES
RETURN
100 msec
STORE OFFH
0 20C8H
CALL
OUTCAS
RETURN
1 msec
STORE OFFH
0 20C4H
RETURN

I/O UTILITY ROUTINES: INTERRUPT

Subroutine: INTREN

INTREN enables CPU interrupts.

Inputs: None

Outputs: None

Calls: Nothing

Destroys: Nothing

Modifies: CPU interrupt masks

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish

Subroutine: INTRDS

INTRDS disables CPU interrupts.

Inputs: None

Outputs: None

Calls: Nothing

Destroys: Nothing

Modifies: CPU interrupt masks

Language: ASSEMBLER 8080/8085

L-V-A: Version 1, Level 1
Roger B. Fish

APPENDIX B

PROGRAM LISTING

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT VCSFRG
OBJECT MODULE PLACED IN :F1:VCSFRG.OBJ
COMPILER INVOKED BY:  FORTRAN :F1:VCSFRG.FOR


  1          PROGRAM VCSFRG
             C VCS MAIN SUPERVISOR PROGRAM
             C
             C MAIN PROGRAM CALLS SUPERVISOR ROUTINES BASED ON
             C FLAGS AND OPERATION MODE CONTROLS
             C
             C INPUTS: CONTROL INFORMATION BUFFERS
             C OUTPUTS: NONE
             C CALLS: SUPINP,SUPOUT,SUPCHT,SUPDEQ,SUPITZ,
             C        SUPERR,SUPEXT,SUPCAL,SUPHLT
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
    =        C**********************************************************************
    =        C
    =        C VCS SYSTEM MEMORY ALLOCATION
    =        C
  3 =              IMPLICIT INTEGER*2(A-Z)
  4 =              INTEGER*1  CIB,KIB,DOB,TOB,PIB,POB,VOB
  5 =              INTEGER*1 PKFBUF,PKRBUF,PKFSAV,PKRSAV
  6 =              INTEGER*1 MMXIPX(6),TFLAG(6)
  7 =              INTEGER*1 ERRBUF(8,10)
    =        C
  8 =              LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMSK(8),DEQM(8)
  9 =              LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10 =               LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALERT,PWRFAL,AUTO,MANUAL
    =        C
 11 =              CHARACTER*4 PRMES,MOSMES(10)
 12 =              CHARACTER*1 DSPCOD(10)
 13 =              CHARACTER*4 DQEC,DCCN,OPSMES(10)
 14 =              CHARACTER*4 ERRMES(20),DEQMES(20),RUNMES(20)
    =        C
 15 =              DIMENSION DEFFRM(20),DEFPNT(8)
    =        C
    =        C COMMON BLOCK ALLOCATIONS
    =        C
 16 =              COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
    =        C
 17 =              COMMON/MESTB2/ PRMES(20)
    =        C
 18 =              COMMON/MESTB3/OPSMES
    =        C
 19 =              COMMON/MOSMES/MOSMES
    =        C
 20 =              COMMON/SEMPNT/SEMPTR(16)
    =        C
 21 =              COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
    =        C
 22 =              COMMON/CLOCK/TFLAG
```

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```
      C
      C     COMMON/DEBUG/DEBUG
      C
      C     COMMON/SENDEL/LODEL(48),FODEL(48),FREDEL(480)
      C
      C     COMMON/IOFVEC/IOFVEC
      C
      C     COMMON/CNTVEC/CNTVEC
      C
      C     COMMON/OPSVEC/OPSVEC(10)
      C
      C     COMMON/OFFARM/ICHPNT(10),NMAX(16),MAXIPX
      C
      C     COMMON/SENMEM/LSTPAS(3800),DECNTL(16)
      C
      C     COMMON/OPSPNT/OPPNTS(8)
      C
      C     COMMON/WORK/TEMP10,DUMMY(19)
      C
      C     COMMON/SAVER/SAVE(20)
      C
      C     COMMON/PARMS/ PARM(20)
      C
      C     COMMON/ERRBUF/ERRBUF
      C
      C     COMMON/ERRFLG/ ERROR(8)
      C
      C     COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(120),PIB(2),FOB(2),VOB(2)
      C
      C     COMMON/SENBUF/SIB(10),SDB(10)
      C
      C     COMMON/CONTAB/SENTAB(10,2),RECDAT(10,2)
      C
      C     COMMON/MESTAB/ERRMES,DECMES,RUNMES,DSPCOD
      C
      C     COMMON/DEFALT/ DEFIOV,DEFPRN,DEFCTV,DEFPNT
      C
      C     COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
      C
      C     COMMON/DEFOPS/DEFOPS(10)
      C
      C     COMMON/DEFMOS/DEFMOS(16)
      C
      C     SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
      C     SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
      C     SAVE /OFFARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
      C     SAVE /PARMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
      C     SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
      C     SAVE /DEFMOS/
      C
      C     EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOEN)
      C     EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),PAGMSK)
      C     EQUIVALENCE (OPSVEC(4),OPERNR),(OPSVEC(5),RATECK)
      C     EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
      C
      C
      C     EQUIVALENCE (NMAX(3),NMXSIR),(NMAX(2),NMXERR)
```

```
      C
      C*************************************************************
      C
   55 100    CONTINUE
      C PROGRAM INITIALIZATION ENTRY POINT
      C
   56       CALL SUPITZ
      C
   57       CALL SUPOUT
      C
      C NORMAL OPERATION LOOP ENTRY POINT
      C
   58 1000  CONTINUE
      C
      C SENSOR INPUT CALL
      C
   59       CALL SUPINP
      C
      C TEST OPERATION MODE AND CALL SUPERVISOR ROUTINE
      C
      C MODE = 0 EXIT
   60       IF(OPMODE.EQ.0) CALL SUPEXT
      C
      C OPMODE = -1 ; RESTART
   61       IF(OPMODE.EQ.-1) GO TO 100
      C
      C OPMODE = 1 ; NORMAL
   62       IF(OPMODE.EQ.1) CALL SUPCNT
      C
      C OPMODE = 2 ; DEBUG MODE
   63       IF(OPMODE.EQ.2) CALL SUPDEG
      C
      C OPMODE = 4 ; MANUAL MODE
   64       IF(OPMODE.EQ.4) CALL SUPCNT
      C
      C OPMODE = 5 ; CALIBRATE
   65       IF(OPMODE.EQ.5) CALL SUPCAL
      C
      C OPMODE = 3 ; HALT PROCESS
   66       IF(OPMODE.EQ.3) CALL SUPHLT
      C
   67       OPPNTS(7)=0
      C
      C BUFFER ERROR FLAGS FOR TEN SECONDS
      C
   68       DO 1010 I=1,NMXERR
   69       ERRBUF(I,MOD(TIME,10)+1)=ERROR(I)
   70 1010  CONTINUE
      C
      C TEST FOR PRESENT ERROR AND PROCESS THEM
      C
   71       DO 1020 I=1,NMXERR
   72       IF(ERROR(I).NE.0) THEN
   73       TEMPIO=I
      C CALL ERROR PROCESSING ROUTINE
   74        CALL SUPERR
   75       END IF
```

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FORTRAN COMPILER

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```
      C
      C IF MODE CHANGE SKIP OUT
 76         IF(OPMODE.EQ.0) GO TO 1000
      C
 77   1920  CONTINUE
      C
      C OUTPUT ROUTINE
      C
 78         CALL SUPOUT
      C
 79         GO TO 1000
      C
 80         END
```

MODULE INFORMATION:

```
     CODE AREA SIZE     = 0112H    274D
     VARIABLE AREA SIZE = 0014H     20D
     MAXIMUM STACK SIZE = 0002H      2D
     178 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT VCSPRG

     0 TOTAL PROGRAM ERROR(S)
     END OF FORTRAN COMPILATION
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPINP
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSSUP.FOR


  1          SUBROUTINE SUPINP
             C
             C SUPINP CONTROLS INPUT TO THE VCS
             C
             C INPUTS: I/O CONTROL VECTORS
             C OUTPUTS: NOTHING
             C CALLS: SENINP, INPCDU, CONVRT
             C DESTROYS. NOTHING
             C MODIFIES: S.I.B.,P.I.B.
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          LOGICAL*1 IOFVEC, IOFSEN
             C
  4          COMMON/OPSVEC/OPMODE, DUMM(9)
             C
  5          COMMON/IOFVEC/IOFVEC(20)
             C
  6          EQUIVALENCE (IOFVEC(1), IOFSEN)
             C
  7          SAVE /IOFVEC/, /OPSVEC/
             C
             C*****************************************************************
             C
             C INPUT CONTROL PANEL INFORMATION
             C
  8          CALL INPCDU
             C
             C EXIT IF HALT MODE
  9          IF(OPMODE.EQ.0) RETURN
             C
             C TEST SENSOR INPUT MASK AND CALL I/O ROUTINE IF TRUE
             C
 10          IF(IOFSEN) THEN
             C
 11          CALL SENINP
             C
 12          CALL CONVRT
             C
 13          END IF
             C
 14          RETURN
 15          END


MODULE INFORMATION:

    CODE AREA SIZE     = 001EH     30D
    VARIABLE AREA SIZE = 0000H      0D
```

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```
MAXIMUM STACK SIZE = 0002H      2D
44 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPINP
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPOUT
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSSUP.FOR


  1             SUBROUTINE SUPOUT
                C
                C SUPOUT CONTROLS OUTPUTS FROM THE VCS
                C
                C INPUTS: I/O CONTROL VECTORS
                C OUTPUTS: NOTHING
                C CALLS: CNTOUT,OUTDSP,FORMAT,SAVDAT,INTREN,OUTPUT,CLOCK
                C DESTROYS: NOTHING
                C MODIFIES: NOTHING
                C VERSION 1.0
                C
  2             IMPLICIT INTEGER*2 (A-Z)
                C
  3             INTEGER*1 TFLAG(6),BYTE,LEDS
  4             INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
                C
  5             CHARACTER*1 DSPCOD(10)
  6             CHARACTER*4 DOBC,DOBN,ERRMES(20),DBGMES(20),RUNMES(20)

  7             LOGICAL*1 IOFVEC(20),IOFVOT,IOFCAS,CNTVEC(16),CNMPKF
                C
  8             COMMON/OPSPNT/OPPNTS(8)
                C
  9             COMMON/IOFVEC/IOFVEC
                C
 10             COMMON/CLOCK/TFLAG
                C
 11             COMMON/OPSVEC/OPMODE,MODECT,RANGCK,OPSERR,PATECK,OPSVEC(5)
                C
 12             COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
                C
 13             COMMON/CNTVEC/CNTVEC
                C
 14             COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
                C
 15             EQUIVALENCE (BYTE,TEMP),(LEDS,XTEMP)
 16             EQUIVALENCE (DOBX,DOB(5)),(CNMPKF,CNTVEC(3))
 17             EQUIVALENCE (IOFVEC(15),IOFCAS),(IOFVEC(12),IOFVOT)
 18             EQUIVALENCE (TIME,TFLAG(4))
 19             EQUIVALENCE (DOBC,DOB(1)),(DOBN,DOB(5))
                C
 20             SAVE /CLOCK/,/CNTVEC/
 21             SAVE /OPSPNT/,/IOFVEC/,/MESTAB/,/COMBUF/,/OPSVEC/
                C
                C*****************************************************************
                C
                C TEST OUTPUT CONTROL MASK AND CALL IF TRUE
                C
                C IF AUTO RUN OR MANUAL RUN THEN DO THIS
                C
 22             IF(OPMODE.EQ.1.OR.OPMODE.EQ.4) THEN
```

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```
      C
      C IF AUTO RUN
23          IF(OPMODE.EQ.1) THEN
24            CALL CNTOUT
25          DOBC=RUNMES(5)
      C
26          ELSE
      C ELSE MANUAL MODE
27           DOBC=OBGMES(17)
28          END IF
      C
      C PUT TIME INTO DISPLAY
29          DOBX=TIME
30          CALL FORMAT(DOBN)
      C
      C  *RUNXXXX    OR  OPERXXXX
      C
31          CALL SAVDAT
32          CALL INTREN
33          GO TO 100
34          END IF
      C
      C DEBUG MODE
35          IF(OPMODE.EQ.2) THEN
36           DOBC=RUNMES(7)
37           DOBN=RUNMES(8)
      C
      C  *DEBUG *
      C
38          GO TO 100
39          END IF
      C
      C CALIBRATE MODE
40          IF(OPMODE.EQ.5) THEN
41           DOBC=RUNMES(9)
42           DOBN=RUNMES(10)
43           DOB(1)=#2AH
      C
      C *CALBRAT
      C
44          END IF
      C
45    100   CONTINUE
      C
      C IF ERROR PUT IN DISPLAY
46          IF(OPPNTS(7).EQ.1) DOBN=RUNMES(15)
47          CALL OUTDSP
      C
      C BUILD LED DISPLAY BYTE
      C
48          IF(OPMODE.EQ.1) THEN
      C AUTO MODE
49           IOP=2
50          XTEMP=#02H
51          ELSE
52           IF(OPMODE.EQ.4) THEN
      C MANUAL MODE
```

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```
 52           IOP=1
 54           XTEMP=#01H
      C
 55           ENDIF
 56           ENDIF
      C
 57           TEMP=0
 58           TEMP=TEMP+IOP*64
 59           TEMP=TEMP+MODECT*16
 60           TEMP=TEMP+RANGCK*8
 61           TEMP=TEMP+OPSENS*4
      C
      C ERROR BIT
 62           IF(OPPNTS(7).EQ.1) THEN
 62            TEMP=TEMP+1
 64            XTEMP=XTEMP+4
 65           END IF
      C
      C PICK CONTROL
 66           IF(CHMPKF) TEMP=TEMP+2
      C
      C OUTPUT STATUS TO LEDS
 67           CALL OUTPUT(#00CH,BYTE)
      C
      C OUTPUT STATUS TO LEDS
      C INVERT BITS
 68           XTEMP=-(XTEMP+1)
      C XTEMP UPPER 4 BITS MUST BE ZEROS
 69           XTEMP=(XTEMP.AND.#0FH)
 70           CALL OUTPUT(#08H,LEDS)
      C
      C SYNCRONIZE SYSTEM TIMING
 71           CALL CLOCK
      C
 72           RETURN
 73           END
```

```
MODULE INFORMATION:

    CODE AREA SIZE     = 018CH    444D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0040H     64D
    144 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPOUT
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPCNT
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSSUP.FOR


  1          SUBROUTINE SUPCNT
             C
             C SUPCNT CONTROLS VCS CONTROL ALGORITHM USE AND SIGNAL GENERATION
             C
             C INPUTS: OPERATION CONTROL VECTORS
             C OUTPUTS: NOTHING
             C CALLS: CNTRFD,CNTRRD
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          LOGICAL*1 CNTVEC(16),CNMOUT,CNMRER,CNMFRT
             C
  4          COMMON/CNTVEC/CNTVEC
             C
  5          EQUIVALENCE (CNTVEC(8),CNMFRT),(CNTVEC(9),CNMRER),(CNTVEC(10),CNMOUT)
             C
  6          SAVE /CNTVEC/
             C
             C*************************************************************************
             C
             C TEST FRONT CONTROL MASK
             C
  7          IF(CNMFRT) CALL CNTRFD
             C
             C TEST REAR CONTROL MASK
             C
  8          IF(CNMRER) CALL CNTRRD
             C
  9          RETURN
 10          END


MODULE INFORMATION:

     CODE AREA SIZE     = 0015H     21D
     VARIABLE AREA SIZE = 0000H      0D
     MAXIMUM STACK SIZE = 0002H      2D
     33 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPCNT
```

```
[illegible]-II FORTRAN-86 V2.1 COMPILATION OF PROGRAM UNIT SUPDBG
OBJECT MODULE PLACED IN :F1:VOSSUP.OBJ
COMPILER INVOKED BY:  FORT86 :F1:VOSSUP.FOR
```

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```
                SUBROUTINE SUPDBG
                C
                C SUPDBG IS THE DEBUG OPERATION SUPERVISOR
                C
                C INPUTS: DEBUG CONTROL VECTOR
                C OUTPUTS: NONE
                C CALLS:  DBUGCI,DBUGCO,DBUGIN,DBUGOT,INTRDS
                C         DBUGTP,DBUGIO,DBUGCK,DEUGME,ITZINP
                C REENTRANT: NOTHING
                C MODIFIES: NOTHING
                C VERSION 1.0
                C
      2         IMPLICIT INTEGER*2 (A-Z)
                C
      3         LOGICAL*1 DBGM(8)
                C
      4         COMMON/DEBUG/DBGM
                C
      5         COMMON/OPSVEC/OPMODE,MODECT,RANGCK,RESRV(7)
                C
      6         COMMON/WORK/TEMPIO,DUMMY(19)
                C
      7         SAVE /DEBUG/,/OPSVEC/,/WORK/
                C
                C*************************************************************************
                C
                C CALL INTERRUPT DISABLE
      8         CALL INTRDS
                C
      9   100   CONTINUE
                C INPUT DEBUG CONTROL FROM PANEL
                C
     10         CALL DBUGCI
                C
                C TEST IDENT FIELD AND CALL CORRECT ROUTINE
                C
     11         IF(TEMPIO.EQ.0) THEN
                C IF RESET SET TO EXIT MODE
     12         OPMODE=0
     13         RETURN
     14         END IF
                C
     15         IF(TEMPIO.EQ.1) CALL DBUGOT
                C
     16         IF(TEMPIO.EQ.2) CALL DBUGIN (0)
                C
     17         IF(TEMPIO.EQ.3) CALL DBUGIN (1)
                C
     18         IF(TEMPIO.EQ.4) CALL ITZINP
                C
     19         IF(TEMPIO.EQ.5) CALL DBUGTP
```

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```
      :
            IF TEMPIO.EQ.6) CALL [illegible]
      .
            IF TEMPIO.EQ.7) CALL [illegible]
      .
            IF(TEMPIO.EQ.8) CALL [illegible]
      .
C UPDATE CONTROL PANEL AND WAIT FOR CONTINUE INPUT
      .
            CALL DBUSCO
      C
            GO TO 100
            END
```

[illegible]LE INFORMATION

```
CODE AREA SIZE      = 00A8H    168D
VARIABLE AREA SIZE  = 0002H      2D
MAXIMUM STACK SIZE  = 0002H      2D
64 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPDEG
```

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```
VAX-11 FORTRAN-32 V2.1 COMPILATION OF PROGRAM UNIT SUPITZ
OBJECT MODULE PLACED IN DL1:[SIS.P.OBJ
COMPILER INVOKED BY: FORTRAN DL1:[SIS.P.VOSSUP.FOR

     1          SUBROUTINE SUPITZ
                C
                C SUPITZ INITIALIZES THE PROGRAM VARIABLES,BUFFERS, AND CONTROL VECTORS
                C
                C INPUTS: NONE
                C OUTPUTS: INITIALIZED SYSTEM
                C CALLS  INPCOU,INITOS,AIOITZ,INITEN,OUTDSP,ITZINF,AIOCRS,ASEC2H
                C        RESTRT
                C DESTROYS: NOTHING
                C MODIFIES: INPUT BUFFERS,PARAMETERS,INTERRUPTS,CONTROL INFORMATION
                C VERSION 1.0
                C
     2          $INCLUDE(DF1:VOSMEM.FOR)
     =  C**********************************************************************
     =  C
     =  C VOS SYSTEM MEMORY ALLOCATION
     =  C
     3  =       IMPLICIT INTEGER*2(A-Z)
     4  =       INTEGER*1  CIB,MIB,DTB,TCP,PIB,POS,VOB
     5  =       INTEGER*1 PKFBUF,PKFBUF,PKFSAV,PKRSAV
     6  =       INTEGER*1 MAXIPK(5),IFLAG(6)
     7  =       INTEGER*1 ERRBUF(2,10)
     =  C
     8  =       LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMIR(32),DEBM(8)
     9  =       LOGICAL*1 DEFIOV(10),DEFCTV(16)
    10  =        LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALBRT,PWRFAL,AUTO,MANUAL
     =  C
    11  =       CHARACTER*4 PARMES,MOSMES(10)
    12  =       CHARACTER*1 DSPCOD(16)
    13  =       CHARACTER*4 DOBC,DOBN,OPSMES(10)
    14  =       CHARACTER*4 ERRMES(20),DEVMES(20),RUNMES(20)
     =  C
    15  =       DIMENSION DEFPRN(20),DEFPNT(8)
     =  C
     =  C COMMON BLOCK ALLOCATIONS
     =  C
    16  =       COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALBRT
     =  C
    17  =       COMMON/MESTB2/ PARMES(20)
     =  C
    18  =       COMMON/MESTB3/OPSMES
     =  C
    19  =       COMMON/MOSMES/MOSMES
     =  C
    20  =       COMMON/SENPNT/SENPTR(16)
     =  C
    21  =       COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
     =  C
    22  =       COMMON/CLOCK/IFLAG
     =  C
    23  =       COMMON/DEBUG/DEBM
```

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```
      = C
24    =      COMMON/SENDEL/LIMEL(40),PCDEL(60),PTRDEL(400)
      = C
25    =      COMMON/IOFVEC/IOFVEC
      = C
26    =      COMMON/CNTVEC/CNTVEC
      = C
27    =      COMMON/OPSVEC/OPSVEC(10)
      = C
28    =      COMMON/OPPARM/ICMPNT(10),NMAX(16),NMXIPX
      = C
29    =      COMMON/SENMEM/LSTPAS(3000),DSCNTL(16)
      = C
30    =      COMMON/OPSPNT/OPPNTS(8)
      = C
31    =      COMMON/WORK/TEMPIO,DUMMY(19)
      = C
32    =      COMMON/SAVER/SAVE(20)
      = C
33    =      COMMON/PARAMS/ PARAM(20)
      = C
34    =      COMMON/ERRBUF/ERRBUF
      = C
35    =      COMMON/ERRFLG/ ERROR(8)
      = C
36    =      COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),PCB(2)
      = C
37    =      COMMON/SENBUF/SIB(10),SDB(10)
      = C
38    =      COMMON/CONTAB/SENTAB(10,2),PGCDAT(10,2)
      = C
39    =      COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
      = C
40    =      COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
      = C
41    =      COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
      = C
42    =      COMMON/DEFOPS/DEFOPS(10)
      = C
43    =      COMMON/DEFMOS/DEFMOS(16)
      = C
44    =      SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
45    =      SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
46    =      SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
47    =      SAVE /PARAMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
48    =      SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
49    =      SAVE /DEFMOS/
      = C
50    =      EQUIVALENCE (DOB(1),DCSC),(DOB(5),DOBN)
51    =      EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),RNGMSK)
52    =      EQUIVALENCE (OPSVEC(4),OPSENR),(OPSVEC(5),RATECK)
53    =      EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
      = C
        C
54           EQUIVALENCE (NMXSIR,NMAX(3)),(NMXERR,NMAX(2))
            1 ,(NMXIOF,NMAX(7)),(NMXPRM,NMAX(13)),(NMXCTV,NMAX(8)),
            2 (NMXDBG,NMAX(9)),(NMXPNT,NMAX(15)),(NMXSEN,NMAX(1)),
```

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```
     3 (MX,CEF,MAX(5)),CMMXCIB,MMAX(12)),CMMXTRP,MMAX(11)),
     4  (MX,CEF,MMAX(10)),CMMXCPS,MMAX(14))
     :
55        EXTERNALENCE (CMMXIPN,MMAX(4))
     :
     :...........................................................................
     :
     : DISABLE INTERRUPTS
57         CALL INTRDS
     C
     C INITIALIZE I/O INTERFACES
57         CALL AIOITZ
     C
     C CLEAR ERROR FLAGS
     C
58         DO 200 I=1,MMXERR
59         ERROR(I)=0
60    200  CONTINUE
     C
     C SET DEBUG MASKS
     C
61         DO 600 I=1,MMXDBG
62         DBGM(I)=.TRUE.
63    600  CONTINUE
     C
     C CLEAR ALL I/O BUFFERS
     C
64         DO 800 I=1,MMXSEN
65         SIB(I)=0
66         SDB(I)=0
67    800  CONTINUE
     C
68         DO 900 I=1,MMXDSP
69         DOB(I)=0
70    900  CONTINUE
     C
71         DO 1000 I=1,MMXKIB
72         KIB(I)=0
73    1000 CONTINUE
     C
74         DO 1100 I=1,MMXTRP
75         TOB(I)=0
76    1100 CONTINUE
     C
77         DO 1200 I=1,MMXCEF
78         CIB(I)=0
79    1200 CONTINUE
     C
80         VOB(1)=0
81         VOB(2)=0
     C
     C TEST IF OVERRIDE OF PARAMETER BOOT (ONLY IF WARM RESTART IN CMOS)
82         DOBC=DBGMES(12)
83         DOBN=DBGMES(5)
     C @SYSITZ?
84         CALL PROMPT
85         IF(RESET) GO TO 4000
```

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```
      C
      C SET DEFAULT I/O MODE
      C
 96         DO 300 I=1,NDEVOF
 97         IOFVEC(I)=DEFIOV(I)
 98    300  CONTINUE
      C
      C SET DEFAULT PARAMETERS
      C
 89         DO 400 I=1,NMXPRM
 90         PARAM(I)=DEFPRM(I)
 91    400  CONTINUE
      C
      C SET DEFAULT CONTROL VECTOR
      C
 92         DO 500 I=1,NMXCTV
 93         CNTVEC(I)=DEFCTV(I)
 94    500  CONTINUE
      C
 95         OPPNTS(1)=1
      C
 96         DO 1400 I=1,NMXSEN
 97         DO 1400 J=1,2
 98         RSCDAT(I,J)=DEFRNG(I,J)
 99         SENTAB(I,J)=DEFCON(I,J)
100    1400 CONTINUE
      C
      C INITIALIZE THE OPERATION VECTOR
      C
101         DO 1500 I=1,NMXOPS
102         OPSVEC(I)=DEFOPS(I)
103    1500 CONTINUE
      C
      C SET CMOS CONTROL
      C
104         DO 1600 I=1,16
105         DSCNTL(I)=DEFMOS(I)
106    1600 CONTINUE
      C
      C USE RESTART CODE TO CLEAR OTHER ARRAYS
107         CALL RESTRT
      C
      C DISPLAY TAPE MESSAGE
108         DGBC=DBGMES(12)
109         DGBW=DBGMES(6)
      C @SYSTAP?
      C
110         CALL PROMPT
      C TEST IF BLOCK FORMAT PAUSE IF .NOT. RUN MODE
      C SKIP IF RESET
111         IF(RESET) GO TO 3800
      C IF CASSETTE ON,WRITE HEADER FILE
      C
112         CALL TAPITZ
      C
      C CALL INTERACTIVE INITIALIZATION ROUTINE
      C
```

```
113     3000  CONTINUE
114           CALL ITZINP
        C
115     4000  CONTINUE
        C
116           RETURN
117           END
```

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OF POOR QUALITY

MODULE INFORMATION:

```
    CODE AREA SIZE     = 034CH    844D
    VARIABLE AREA SIZE = 0016H     22D
    MAXIMUM STACK SIZE = 0064H    100D
    229 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPITZ
```

ORIGINAL PAGE IS
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```
ISIS-II FORTRAN 80 V2.1 COMPILATION OF PROGRAM UNIT SUFERR
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSSUP.FOR


  1          SUBROUTINE SUFERR
             C
             C SUFERR PROCESSES ERROR CONDITION FLAGS AND OUTPUTS MESSAGE
             C
             C INPUTS: ERROR FLAG VECTOR
             C OUTPUTS: ERROR MESSAGE ON DISPLAY
             C CALLS: OUTDSP,INPCOU,FORMAT
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 ERRBUF(8,10)
  4          INTEGER*1 COB,KIB,DCB,TOB,PIB,POB,VOB
             C
  5          CHARACTER*1 DSPCOD(10)
  6          CHARACTER*4 DOBC
  7          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
             C
  8          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
             C
  9          COMMON/CONBUF/COB(80),KIB(8),DCB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
 10          COMMON/ERRBUF/ERRBUF
             C
 11          COMMON/PARAMS/PARAM(20)
             C
 12          COMMON/OPSVEC/OPMODE,ODUM(9)
             C
 13          COMMON/ERRFLG/ERROR(8)
             C
 14          COMMON/OPSPNT/OPPNTS(8)
             C
 15          COMMON/WORK/TEMPIO,DUMMY(19)
             C
 16          SAVE /OPSPNT/,/ERRFLG/,/OPSVEC/,/PARAMS/,/ERRBUF/
 17          SAVE /MESTAB/,/CONBUF/,/WORK/
             C
 18          EQUIVALENCE (PARAM(2),ERRLMT)
 19          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
             C
             C*****************************************************************
             C
             C LOAD ERROR MESSAGE TO DISPLAY BUFFER
             C
             C   ERR
 20            DOBC=RUNMES(15)
             C
             C PUT ERROR NUMBER IN DOBN
             C
```

```
24          TEMP(X)=TEMP(0)
22          DOSH=256*TEMP(0)+ERROR(TEMP(0))
      C
      C  FORMAT AND DISPLAY
27          CALL FORMAT(DOSH)
24          DOB(5)=DOB(6)
25          DOB(6)=#ODH
      C ERR H-XX  ON DISPLAY
26          CALL OUTDSP
      C
      C TEST FOR ERROR OVERFLOW
27          ETOT=0
28          DO 100 I=1,10
29          ETOT=ETOT+MIN0(1,ERRBUF(TEMPX,I))
30    100   CONTINUE
      C
      C TEST IF ERROR COUNT OVER LIMIT
31          IF(ETOT GT ERRLMT) THEN
32           IF(OPMODE.EQ.1) OPMODE=4
33          END IF
      C
      C PAUSE IF OPL ; ELSE RUN NO PAUSE
24          CALL INPCOU
      C
      C SET ERROR FLAG
25          OPPNTS(7)=1
26          ERROR(TEMPX)=0
      C
37          RETURN
38          END
```

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MODULE INFORMATION:

```
    CODE AREA SIZE     = 00BAH    186D
    VARIABLE AREA SIZE = 0006H      6D
    MAXIMUM STACK SIZE = 000AH     10D
    81 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPERR
```

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```
[SYS-I] FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPEXT
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  A>FORT80 :F1:VCSSUP.FOR


  1          SUBROUTINE SUPEXT
             C
             C SUPEXT STOPS THE VCS PROGRAM AFTER CLOSING DATA BASE
             C  AND WAITS FOR OPERATOR INPUT AT THE C/D
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: OUTDSP, INTRDS, CLOCK, IMPCDU, INTREN, CNTOUT
             C DESTROYS: SIB, SDB, ERRORS
             C MODIFIES: OPMODE
             C VERSION 1.0
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
     =       C*****************************************************************
     =       C
     =       C VCS SYSTEM MEMORY ALLOCATION
     =       C
  3  =            IMPLICIT INTEGER*2(A-Z)
  4  =            INTEGER*1  CID,KID,DOB,TOB,PIB,POB,VOB
  5  =            INTEGER*1 PKFBUF,PKRBUF,PKFSAV,PKRSAV
  6  =            INTEGER*1 MMXIPA(6),TFLAG(6)
  7  =            INTEGER*1 ERRBUF(8,10)
     =       C
  8  =            LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMSK(8),DEGN(8)
  9  =            LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10  =             LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALBRT,PHRFAL,AUTO,MANUAL
     =       C
 11  =            CHARACTER*4 PARMES,MOSMES(10)
 12  =            CHARACTER*1 DSPCOD(10)
 13  =            CHARACTER*4 DOBC,DOBN,OPSMES(10)
 14  =            CHARACTER*4 ERRMES(20),DEGMES(20),RUNMES(20)
     =       C
 15  =            DIMENSION DEFPRM(20),DEFPNT(8)
     =       C
     =       C COMMON BLOCK ALLOCATIONS
     =       C
 16  =            COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PHRFAL,RUN,CALERT
     =       C
 17  =            COMMON/MESTB2/ PARMES(20)
     =       C
 18  =            COMMON/MESTB3/OPSMES
     =       C
 19  =            COMMON/MOSMES/MOSMES
     =       C
 20  =            COMMON/SEMPNT/SEMPTR(16)
     =       C
 21  =            COMMON/PIPBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
     =       C
 22  =            COMMON/CLOCK/TFLAG
     =       C
 23  =            COMMON/DEBUG/DBGN
```

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```
    = C
24  =       COMMON/SENDEL/LCDEL(40),FCDEL(60),FORDEL(400)
    = C
25  =       COMMON/IOFVEC/IOFVEC
    = C
26  =       COMMON/CNTVEC/CNTVEC
    = C
27  =       COMMON/OPSVEC/OPSVEC(10)
    = C
28  =       COMMON/OPPARM/ICMPNT(10),NMRX(16),NMXIPX
    = C
29  =       COMMON/SENMEM/LSTPAS(3000),DSCNTL(16)
    = C
30  =       COMMON/OPSPNT/OPPNTS(8)
    = C
31  =       COMMON/WORK/TEMPIO,DUMMY(19)
    = C
32  =       COMMON/SAVER/SAVE(20)
    = C
33  =       COMMON/PARAMS/ PARAM(20)
    = C
34  =       COMMON/ERRBUF/ERCSUF
    = C
35  =       COMMON/ERRFLG/ ERROR(8)
    = C
36  =       COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),WOB(2)
    = C
37  =       COMMON/SENBUF/SIB(10),SDB(10)
    = C
38  =       COMMON/CONTAB/SENTAB(10,2),RGCDAT(10,2)
    = C
39  =       COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
    = C
40  =       COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
    = C
41  =       COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
    = C
42  =       COMMON/DEFOPS/DEFOPS(10)
    = C
43  =       COMMON/DEFMOS/DEFMOS(16)
    = C
44  =       SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
45  =       SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
46  =       SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
47  =       SAVE /PARAMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
48  =       SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
49  =       SAVE /DEFMOS/
    = C
50  =       EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
51  =       EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),PNGMSK)
52  =       EQUIVALENCE (OPSVEC(4),OPSENR),(OPSVEC(5),RATECK)
53  =       EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
    = C
54          INTEGER*1 BITS(8)
      C
55          LOGICAL*1 IOFCAS
      C
```

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```
56          EQUIVALENCE (IOFVEC(15),IOFCAS)
57          EQUIVALENCE (TEMPIO,BITS(1))
58          EQUIVALENCE (NMAX(1),NMXSEN),(NMXEPR,NMAX(2))
        C
        C*************************************************************
        C
59          DOBC=RUNMES(18)
60          DOBN=RUNMES(19)
61          CALL OUTDSP
        C %-EXIT-%
        C
        C CLEAR VALVE OUTPUTS
62          VOB(1)=0
63           VOB(2)=0
        C
64          CALL CNTOUT
        C
65          TFLAG(2)=0
        C WAIT FOR CASSETTE TO FINISH IF ON
66          IF(IOFCAS) THEN
67          CALL INTREN
68      10    CALL CLOCK
        C WAIT FOR END OF BLOCK
69          END IF
        C
        C DISABLE INTERRUPTS
        C
70          CALL INTDIS
        C
        C CLEAR ERRORS
        C
71          DO 500 I=1,8
72          DO 600 J=1,10
73          ERRBUF(I,J)=0
74      600   CONTINUE
75          ERROR(I)=0
76      500   CONTINUE
        C
        C LOAD STOP MESSAGE INTO DOB
77          DOBC=RUNMES(16)
78          DOBN=RUNMES(17)
        C %-STOP-%
        C
79          CALL OUTDSP
        C
        C LOOP ON CONTROL PANEL TILL ENTRY BY OPERATOR
80      1000   CONTINUE
81           CALL INPCDU
        C
        C IF CALIBRATE ON THEN TEST NEXT AND ADJUST
82          IF(CALBRT) THEN
        C
        C IF RESET REBOOT SYSTEM
83           IF(RESET) THEN
84          OPMODE=-1
85          GO TO 2000
86          END IF
```

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```
      C
      C IF NEXT GO TO DEBUG
 97         IF(NEXT) THEN
 98         OPMODE=2
 99         GO TO 2000
 90         END IF
      C
      C IF ADJUST GO TO CALIBRATE
 91         IF(ADJUST) THEN
 92         OPMODE=5
 93         GO TO 2000
 94         END IF
      C
      C END CALIBRATE SWITCH ON SECTION
 95         END IF
      C
      C IF  RUN SWITCH ON
      C RESTART RUN MODE ,CONTINUE
 96         IF(RUN) THEN
      C
      C IF MANUAL SWITCH
 97         IF(MANUAL) THEN
 98         OPMODE=4
 99         GO TO 2000
100         END IF
      C
      C IF AUTOMATIC SWITCH
101         IF(AUTO) THEN
102         OPMODE=1
103         GO TO 2000
104         END IF
      C
      C END RUN SWITCH ON SECTION
105         END IF
106         GO TO 1000
      C
107   2000  CONTINUE
108         RETURN
109         END
```

```
MODULE INFORMATION:

    CODE AREA SIZE     = 0130H    304D
    VARIABLE AREA SIZE = 0014H     20D
    MAXIMUM STACK SIZE = 000AH     10D
    204 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SUFEXT
```

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```
ISTS-11 FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPCAL
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSSUP.FOR


  1          SUBROUTINE SUPCAL
             C
             C SUPCAL IS THE CALIBRATION ROUTINE SUPERVISOR
             C
             C INPUTS: NONE
             C OUTPUTS: OPMODE AND RESET SYSTEM (HOT RESTART)
             C CALLS: RESTRT,PROMPT
             C DESTROYS: BUFFERS FOR DELAYS AND POINTERS
             C MODIFIES: OPMODE
             C VERSION: 1.0
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
     =       C**********************************************************************
     =       C
     =       C VCS SYSTEM MEMORY ALLOCATION
     =       C
  3  =            IMPLICIT INTEGER*2(A-Z)
  4  =            INTEGER*1  CIB,KIB,DOB,TOB,PIB,POB,VOB
  5  =            INTEGER*1 PKFBUF,PKRBUF,PKFSAV,PKRSAV
  6  =            INTEGER*1 MAXIPX(6),TFLAG(6)
  7  =            INTEGER*1 ERRBUF(3,10)
     =       C
  8  =            LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMSK(8),DBGM(8)
  9  =            LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10  =             LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALERT,PWRFAL,AUTO,MANUAL
     =       C
 11  =            CHARACTER*4 PARMES,MOSMES(10)
 12  =            CHARACTER*1 DSPCOD(10)
 13  =            CHARACTER*4 DOPC,DOBM,OPSMES(10)
 14  =            CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
     =       C
 15  =            DIMENSION DEFPRM(20),DEFPNT(8)
     =       C
     =       C COMMON BLOCK ALLOCATIONS
     =       C
 16  =            COMMON/OPPNEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
     =       C
 17  =            COMMON/MESTB2/ PARMES(20)
     =       C
 18  =            COMMON/MESTB3/OPSMES
     =       C
 19  =            COMMON/MOSMES/MOSMES
     =       C
 20  =            COMMON/SEMPNT/SEMPTR(16)
     =       C
 21  =            COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
     =       C
 22  =            COMMON/CLOCK/TFLAG
     =       C
 23  =            COMMON/DEBUG/DBGM
     =       C
```

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OF POOR QUALITY

```
24  =       COMMON/SENDEL/LCDEL(40),PCDEL(60),PDRDEL(400)
    = C
25  =       COMMON/IOFVEC/IOFVEC
    = C
26  =       COMMON/CNTVEC/CNTVEC
    = C
27  =       COMMON/OPSVEC/OPSVEC(10)
    = C
28  =       COMMON/OPPARM/ICMPNT(10),NMAX(16),NMXIPX
    = C
29  =       COMMON/SENMEM/LSTPAS(3000),DSCNTL(16)
    = C
30  =       COMMON/OPSPNT/OPPNTS(8)
    = C
31  =       COMMON/WORK/TEMPIO,DUMMY(19)
    = C
32  =       COMMON/SAVER/SAVE(20)
    = C
33  =       COMMON/PARAMS/ PARAM(20)
    = C
34  =       COMMON/ERRBUF/ERRBUF
    = C
35  =       COMMON/ERRFLG/ ERROR(8)
    = C
36  =       COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VCB(2)
    = C
37  =       COMMON/SENBUF/SIB(10),SDB(10)
    = C
38  =       COMMON/CONTAB/SENTAB(10,2),RGCDAT(10,2)
    = C
39  =       COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
    = C
40  =       COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
    = C
41  =       COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
    = C
42  =       COMMON/DEFOPS/DEFOPS(10)
    = C
43  =       COMMON/DEFMOS/DEFMOS(16)
    = C
44  =       SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
45  =       SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
46  =       SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
47  =       SAVE /PARAMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
48  =       SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
49  =       SAVE /DEFMOS/
    = C
50  =       EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
51  =       EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),RNGMSK)
52  =       EQUIVALENCE (OPSVEC(4),OPSENR),(OPSVEC(5),RATECK)
53  =       EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
    = C
        C*****************************************************************
        C
54          DOBC=RUNMES(5)
55          DOBN=DBGMES(5)
        C *PUNITZ?
```

FORTRAN COMPILER

ORIGINAL PAGE IS
OF POOR QUALITY

```
55          CALL PROMPT
      C
57          IF(ADJUST) THEN
      C CLEAR WORK VARIABLES FOR RESTART
58          CALL RESTRT
59          END IF
60          OPMODE=0
      C
61          RETURN
62          END
```

MODULE INFORMATION:

```
CODE AREA SIZE     = 003AH     58D
VARIABLE AREA SIZE = 0010H     16D
MAXIMUM STACK SIZE = 000AH     10D
118 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT SUPCAL
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SUPHLT
OBJECT MODULE PLACED IN :F1:VCSSUP.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSSUP.FOR

ORIGINAL PAGE IS
OF POOR QUALITY

```
 1          SUBROUTINE SUPHLT
            C
            C SUPHLT WILL HALT EXECUTION IN A RECOVERABLE WAY
            C
            C INPUTS: NONE
            C OUTPUTS: MODE STATUS
            C CALLS: INTPEN,INTRDS,OUTDSP,INPCDU
            C DESTROYS: NOTHING
            C MODIFIES: OPMODE
            C VERSION 1.0
            C
            C*************************************************
            C
 2            IMPLICIT INTEGER*2 (A-Z)
            C
 3          INTEGER*1 CIB,KIB,DOB,TOB,PIB,POB,VOB
            C
 4          LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALERT,PWRFAL,AUTO,MANUAL
            C
 5          CHARACTER*4 DOBC,DOBN,OPSMES(10)
 6          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
 7          CHARACTER*1 DSPCOD(10)
            C
 8          COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(129),PIB(2),POB(2),VOB(2)
            C
 9          COMMON/OPSVEC/OPMODE,ODUM(9)
            C
10          COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
            C
11          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
            C
12          SAVE /OPSVEC/,/CPANEL/,/COMBUF/,/MESTAB/
            C
13          EQUIVALENCE (DOBC,DOB(1)),(DOBN,DOB(5))
            C
            C*************************************************
            C
14          CALL INTRDS
            C
15          DOBC=RUNMES(11)
16          DOBN=RUNMES(12)
17          CALL OUTDSP
            C
18          10   CALL INPCDU
            C
            C TEST IF MODE SWITCH IS IN RUN
19          IF(RUN) THEN
            C
20           IF(ADJUST) THEN
            C IF RUN AND ADJUST GO TO MANUAL MODE
21            OPMODE=4
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
22            GO TO 100
22           END IF
      C
24           IF (NEXT) GO TO 100
      C IF RUN MODE AND NEXT JUST CONTINUE WHERE LEFT OFF
      C
      C ELSE IT IS IN CALIBRATE POSITION
25           ELSE
26            IF(RESET) THEN
      C IF CALL MODE AND RESET STOP PROGRAM
27             OPMODE=0
28             GO TO 100
29            END IF
      C
30           END IF
      C WAIT
31           GO TO 10
      C
32    100    CALL INTREN
33           RETURN
34           END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 006AH    106D
    VARIABLE AREA SIZE = 0028H     40D
    MAXIMUM STACK SIZE = 000AH     10D
    72 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SUFHLT

    0 TOTAL PROGRAM ERROR(S)
    END OF FORTRAN COMPILATION
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SENINP
OBJECT MODULE PLACED IN :F1:MSEAM.OBJ
COMPILER INVOKED BY:  FORT80 :F1:MSEAM.FOR


  1          SUBROUTINE SENINP
             C
             C SENINP CALLS SENSOR INPUT ROUTINES UNDER I/O MASK CONTROL
             C
             C INPUTS: I/O MASK BUFFER
             C OUTPUTS: NONE
             C CALLS: INPCID,INPPKS,AIOADC,SENRLM,ADCITZ
             C DESTROYS: NOTHING
             C MODIFIES: SENSOR INPUT BUFFER SIB
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-H,J-Z)
             C
  3          IMPLICIT LOGICAL*1(I)
             C
  4          DIMENSION DUMMY(5)
  5          DIMENSION SIB(10),SDB(10)
             C
  6          COMMON/IOFVEC/IOFVEC(5),
            1 IOFCID,IOFPKF,IOFPKR,IOFVCF,IOFVCR,IOFVOT,IOFDEP,IOFKEY,
            2 IOFCAS,IOFCRT,IOFCDU,IOUM(3)
             C
  7          COMMON/OPSVEC/OPMODE,MODECT,RANGCK,OPSENR,RATECK,ODUM(5)
             C
  8          COMMON/WORK/ TEMPIO,SINPNT,WADUM(18)
             C
  9          COMMON/SENBUF/ SIB,SDB
             C
 10          SAVE /WORK/,/OPSVEC/
 11          SAVE /IOFVEC/,/SENBUF/
             C
             C**************************************************************
             C INITIALIZE A/D EVERY TIME FOR SAFETYS SAKE
             C
 12          CALL ADCITZ
             C
 13          DO 100 J=1,5
             C TEST IF I/O FLAG ON (TRUE)
 14          IF(IOFVEC(J+1)) THEN
 15           SINPNT=J
             C CALL A/D DRIVER ROUTINE
 16           CALL AIOADC (SINPNT,TEMPIO)
 17           SIB(SINPNT)=TEMPIO
 18          END IF
 19     100  CONTINUE
             C
             C
             C TEST I/O FLAG FOR CID
             C
 20          IF(IOFCID) CALL INPCID
             C
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      C TEST I/O FLAG FOR  PICKS
      C
 21         IF(IOFFMF.OR.IOFFKR) CALL INFFKS
      C
      C HARDWARE PATCH FOR A/D INPUT WIRES
 22         DO 200 J=1,5
 23         DUMMY(J)=SIB(J)
 24    200  CONTINUE
      C
 25         SIB(2)=DUMMY(4)
 26         SIB(3)=DUMMY(5)
 27         SIB(4)=DUMMY(2)
 28         SIB(5)=DUMMY(3)
      C
      C IF RATE CHECKING ACTIVE CALL SENSOR LIMIT ROUTINE
      C
 29         IF(RATECK.EQ.1) CALL SENRLM
      C
 30         RETURN
 31         END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 005EH    190D
    VARIABLE AREA SIZE = 000CH     12D
    MAXIMUM STACK SIZE = 0002H      2D
    71 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SENINP
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CONVRT
OBJECT MODULE PLACED IN :F1:VOSEIM.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VOSEIM.FOR
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
  1          SUBROUTINE CONVRT
             C
             C CONVRT CONVERTS SENSOR INPUT DATA TO ENGINEERING UNITS, AND
             C       DOES OPTIONAL RANGE CHECK
             C
             C INPUTS: SENSOR INPUT DATA IN SIB
             C OUTPUTS: SENSOR DATA IN SDB
             C CALLS: CONFNC
             C DESTROYS: NOTHING
             C MODIFIES: SDB
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-H,J-Z)
             C
  3          INTEGER*1 NMXIPX
             C
  4          DIMENSION SIB(10),SDB(10)
             C
  5          LOGICAL*1 IOFVEC(20)
             C
  6          COMMON/OPPARM/ICNFNT(10),NMXVEC(16),NMXIPX(6)
             C
  7          COMMON/IOFVEC/ IOFVEC
             C
  8          COMMON/SENBUF/ SIB,SDB
             C
  9          COMMON/WORK/ TEMPIO,SINFNT,DUMMY(18)
             C
 10          EQUIVALENCE (NMXSEN,NMXVEC(1))
             C
 11          SAVE /IOFVEC/,/SENBUF/,/OPPARM/,/WORK/
             C
             C*************************************************************************
             C
 12          DO 100 I=1,NMXSEN
             C TEST IF I/O FLAG ON (TRUE)
 13          IF(IOFVEC(I+1)) THEN
 14           SINFNT=I
 15           TEMPIO=SIB(I)
             C CALL DATA TO ENGINEERING UNITS CONVERSION
 16           CALL CONFNC
 17           SDB(I)=TEMPIO
 18          END IF
 19     100  CONTINUE
             C
 20          RETURN
 21          END
```

MODULE INFORMATION:

```
CODE AREA SIZE     = 0056H     86D
VARIABLE AREA SIZE = 0034H     40
MAXIMUM STACK SIZE = 0002H     2D
47 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT CONVRT
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CNTOUT
OBJECT MODULE PLACED IN :F1:MOSEUM.OBJ
COMPILER INVOKED BY:  FOR780 :F1:MOSEUM.FOR
```

ORIGINAL PAGE IS OF POOR QUALITY

```
 1          SUBROUTINE CNTOUT
          C
          C CNTOUT IS THE CONTROLLER OUTPUT ROUTINE.  THIS CALLS THE
          C       APPROPRIATE OUTPUT ROUTINES AS PER THE I/O MASKS
          C
          C INPUTS: I/O MASKS
          C OUTPUTS: NONE
          C CALLS: AIOVOT
          C DESTROYS: NOTHING
          C MODIFIES: NOTHING
          C VERSION 1.0
          C
 2          IMPLICIT INTEGER*2 (A-H,J-Z)
          C
 3          IMPLICIT LOGICAL*1 (I)
          C
 4          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
          C
 5          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
          C
 6          COMMON/SENBUF/SIB(10),SDB(10)
          C
 7          COMMON/PARAMS/DMAX,DMIN,PDUM(18)
          C
 8          COMMON/IOFVEC/ DUM(9),IOFVCF,IOFVCR,IOFVOT,IBDUM(8)
          C
 9          SAVE /IOFVEC/,/COMBUF/,/PARAMS/,/SENBUF/
          C
10          EQUIVALENCE (SDB(4),FDRUM),(SDB(5),RDRUM)
          C
          C*****************************************************************
          C
          C VOB(1) = FRONT VALVE
          C VOB(2) = REAR VALVE
          C 1 = UP CONTROL
          C -1 = DOWN CONTROL
          C
          C OUTPUT FORMAT TO VALVE DRIVER
          C BIT 0 = FRONT UP
          C BIT 1 = FRONT DOWN
          C BIT 2 = REAR UP
          C BIT 3 = REAR DOWN
          C DRUMS ARE LIMITED TO DMAX UP AND DMIN DOWN
          C
11          CBYTE=0
          C FRONT VALVE ENABLE TEST
12          IF(IOFVCF) THEN
13          VTEST=0
14          VTEST=VOB(1)
          C TEST IF VALVE TO BE CONTROLLED
15           IF(VTEST.NE.0) THEN
```

FORTRAN COMPILER

ORIGINAL PAGE IS OF POOR QUALITY

```
      C
      C TEST IF UP OR DOWN
            IF(VTEST.EQ.1) THEN
 16          IF(FDRUM.LT.DMAX) CBYTE=1
 17         ELSE
 18          IF(FDRUM.GT.DMIN) CBYTE=2
 19          END IF
 20         END IF
 21    C END IOFVOF BLOCK
 22         END IF
      C
      C REAR VALVE ENABLE
 23         IF(IOFVCR) THEN
 24         VTEST=0
 25         VTEST=VOB(2)
      C TEST IF VALVE TO BE CONTROLLED
 26         IF(VTEST.NE.0) THEN
      C
      C TEST IF UP OR DOWN CONTROL
 27          IF(VTEST.EQ.1) THEN
 28           IF(RDFUM.LT.DMAX) CBYTE=CBYTE+4
 29          ELSE
 30           IF(RDRUM.GT.DMIN) CBYTE=CBYTE+8
 31          END IF
 32         END IF
      C END IOFVCR BLOCK
 33         END IF
      C
      C TEST IF VALVE OUTPUT ENABLED
 34         IF(IOFVOT) THEN
 35         CALL RIOVOT(CBYTE)
 36         END IF
      C
 37         RETURN
 38         END
```

MODULE INFORMATION:

```
CODE AREA SIZE     = 0000H    192D
VARIABLE AREA SIZE = 0004H     4D
MAXIMUM STACK SIZE = 0002H     2D
96 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT CNTOUT
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT ITZINP
OBJECT MODULE PLACED IN :F1:VCSEXM.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSEXM.FOR
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
  1          SUBROUTINE ITZINP
             C
             C ITZINP PROMPTS THE USER AND UPDATES THE VALUE OF SOME VARIABLES IN COMMON
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: OUTDSP, INPCDU, INTRDS, INPHEX, OUTPUT
             C DESTROYS: NOTHING
             C MODIFIES: VARIABLES SELECTED BY USER
             C VERSION 1.0
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
     =       C**********************************************************************
     =       C
     =       C VCS SYSTEM MEMORY ALLOCATION
     =       C
  3  =            IMPLICIT INTEGER*2(A-Z)
  4  =            INTEGER*1  CIB,KIB,DOB,TOB,PIB,POB,VOB
  5  =            INTEGER*1 PKFBUF,PKRBUF,PKFSAV,PKRSAV
  6  =            INTEGER*1 MMXIPX(6),TFLAG(6)
  7  =            INTEGER*1 ERRBUF(8,10)
     =       C
  8  =            LOGICAL*1 IOFVEC(20),CNTVEC(15),SINT(8),SMSK(8),DBGM(8)
  9  =            LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10  =             LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALBRT,PWRFAL,AUTO,MANUAL
     =       C
 11  =            CHARACTER*4 PARMES,MOSMES(10)
 12  =            CHARACTER*1 OSPCOD(10)
 13  =            CHARACTER*4 DGBC,DGBN,OPSMES(10)
 14  =            CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
     =       C
 15  =            DIMENSION DEFPRM(20),DEFPNT(8)
     =       C
     =       C COMMON BLOCK ALLOCATIONS
     =       C
 16  =            COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALBRT
     =       C
 17  =            COMMON/MESTB2/ PARMES(20)
     =       C
 18  =            COMMON/MESTB3/OPSMES
     =       C
 19  =            COMMON/MOSMES/MOSMES
     =       C
 20  =            COMMON/SENFNT/SENPTR(16)
     =       C
 21  =            COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
     =       C
 22  =            COMMON/CLOCK/TFLAG
     =       C
 23  =            COMMON/DEBUG/DBGM
     =       C
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
24  =          COMMON/SENDEL/LCDEL(40),FCDEL(60),FDPDEL(400)
    =  C
25  =          COMMON/IOFVEC/IOFVEC
    =  C
26  =          COMMON/CNTVEC/CNTVEC
    =  C
27  =          COMMON/OPSVEC/OPSVEC(10)
    =  C
28  =          COMMON/OPPARM/ICMPNT(10),NMAX(16),NMXIPX
    =  C
29  =          COMMON/SENMEM/LSTPRS(3000),DSCNTL(16)
    =  C
30  =          COMMON/OPSPNT/OPPNTS(8)
    =  C
31  =          COMMON/WORK/TEMPIO,DUMMY(19)
    =  C
32  =          COMMON/SAVER/SAVE(20)
    =  C
33  =          COMMON/PARAMS/ PARAM(20)
    =  C
34  =          COMMON/ERRBUF/ERRBUF
    =  C
35  =          COMMON/ERRFLG/ ERROR(8)
    =  C
36  =          COMMON/CONBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),MOB(2)
    =  C
37  =          COMMON/SENBUF/SIB(10),SDB(10)
    =  C
38  =          COMMON/CONTAB/SENTAB(10,2),RECDAT(10,2)
    =  C
39  =          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
    =  C
40  =          COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
    =  C
41  =          COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
    =  C
42  =          COMMON/DEFOPS/DEFOPS(10)
    =  C
43  =          COMMON/DEFMOS/DEFMOS(16)
    =  C
44  =          SAVE /CPANEL/,/PIXBUF/,/SAVER/,/ERRBUF/,/SENDEL/
45  =          SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
46  =          SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
47  =          SAVE /PARAMS/,/ERRFLG/,/CONBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
48  =          SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
49  =          SAVE /DEFMOS/
    =  C
50  =          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
51  =          EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),PNGMSK)
52  =          EQUIVALENCE (OPSVEC(4),OPSERR),(OPSVEC(5),RATECK)
53  =          EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
    =  C
54             INTEGER*1 BITS(8)
       C
55             CHARACTER*1 CDUM
       C
56             EQUIVALENCE (NMXIPX,NMAX(4))
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
57          EQUIVALENCE (TEMPIO,BITS(1))
58          EQUIVALENCE (OPPNTS(1),DATPNT)
59          EQUIVALENCE (CDUM,DOB(1)),(DOB(5),DOBN)
            C
            C*************************************************************************
            C
60          CALL INTRDS
            C
            C LOAD DOB WITH INITIALIZE CODE DISPLAY AND PAUSE
            C
61          DOBC=DBGMES(12)
62          DOBN=DBGMES(5)
            C @SYSITZ?
63          10    CALL OUTDSP
            C
64          CALL INPCDU
            C IF RUN SWITCH ON WAIT FOR RUN MODE FROM OPERATOR
            C BEGIN BLOCK = RUN
65          IF(RUN) THEN
            C TEST IF AUTOMATIC MODE SWITCH
66          IF(AUTO) THEN
67           OPMODE=1
68           GO TO 2000
69           END IF
            C TEST IF MANUAL MODE
70          IF(MANUAL) THEN
71           OPMODE=4
72           GO TO 2000
73           END IF
74          GO TO 10
75          END IF
            C END BLOCK = RUN
            C
            C ELSE CALIBRATE SWITCH
            C IF RST SKIP OUT OF ROUTINE
76          IF(RESET) GO TO 1000
            C
            C  DATA INITIALIZATION BLOCK DO
            C BEGIN BLOCK = DATA
77          IF(ADJUST) THEN
            C
78          DO 100 I=1,NMXIPM
            C
            C LOAD DOB WITH PROMPT(I)
            C
            C LOAD MESSAGE FROM RUNMES TABLE TO CONTROL PROMP TYPES
            C
            C PROMPTS
            C ?I/OMASK
            C ?CNTMASK
            C ?OPSPARM
            C ?VRBPARM
            C DAT?ITZ?
            C ?SENPARM
            C ?MOSCNTL
            C
79          DOBC=RUNMES(I)
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
 90          DOBN=RUNMES(13)
             C
 91          IF(I.GE.3) DOBN=RUNMES(14)
             C
 92          IF(I.EQ.5) THEN
 93           DOBC=DBGMES(4)
 94           DOBN=DBGMES(5)
 95          END IF
             C
 96          IF(I.EQ.6) THEN
 97          DOBC=ERRMES(1)
 98          DOBN=RUNMES(14)
 99          CDUM=DSPCOD(7)
 90          END IF
             C
 91          IF(I.EQ.7) THEN
 92           DOBC=DBGMES(9)
 93           DOBN=RUNMES(2)
 94          END IF
             C
             C DISPLAY PROMP
             C
 95          CALL OUTDSP
             C
             C READ INPUT FROM C/D PANEL
             C
 96          CALL INPCDU
             C
             C TEST IF MODIFY THIS SET OF VARIABLES
             C BEGIN BLOCK = MODIFY
 97          IF(ADJUST) THEN
             C MODIFY THIS SET
             C
 98          IF(I.EQ.5) GO TO 300
             C
 99          NMXIPT=NMXIPX(I)
100          DO 200 J=1,NMXIPT
101          TEMPIO=0
             C
             C LOAD DOB WITH PROMPT
             C
             C I/O FLAG RESET
102          IF(I.EQ.1) THEN
103          IF(IOFVEC(J)) TEMPIO=TEMPIO+255
104          DOBC=ERRMES(J)
105          GO TO 150
106          END IF
             C
             C CONTROL VECTOR RESET
107          IF(I.EQ.2) THEN
108          DOBC=ERRMES(ICMPNT(J))
109          IF(CNTVEC(J)) TEMPIO=TEMPIO+255
110          GO TO 150
111          END IF
             C
             C OPERATION VECTOR RESET
112          IF(I.EQ.3) THEN
```

```
113           DOBC=OPSMES(J)
114           TEMPIO=TEMPIO+OPSVEC(J+1)
115           GO TO 150
116           END IF
      C
      C PARAMETER RESET
117           IF(I EQ 4) THEN
118           DOBC=PARMES(J)
119           TEMPIO=TEMPIO+PARAM(J)
120           GO TO 150
121           END IF
      C
      C INPUT TABLE RESET
      C BEGIN BLOCK = TABLE
122           IF(I.EQ.6) THEN
123           K=(J-1)/2+1
124           L=MOD(J-1,2)
      C
125           IF(J.LE.16) THEN
126             TEMPIO=SENTAB(K,L+1)
127            ELSE
128             TEMPIO=RGCDAT(K-8,L+1)
129           END IF
130           IF(J.LE.16) THEN
121            DOBC=ERRMES(K+1)
122            COUM=DSPCOD(3)
      C @
133           IF(L.EQ.1) COUM=DSPCOD(2)
      C *
134           END IF
      C
135           IF(J.GE.17) THEN
136            DOBC=ERRMES(K-7)
      C NXXX
137            DOB(1)=#4EH
      C XXXX
138            IF(L.EQ.1) DOB(1)=#58H
139           END IF
140           GO TO 150
      C END BLOCK = TABLE
141           END IF
      C
142           IF(I.EQ.7) THEN
143            DOBC=MOSMES(J)
144            TEMPIO=TEMPIO+DSCNTL(J)
145            GO TO 150
146           END IF
      C
      C ##
147     150   DOBX=TEMPIO
148           CALL FORMAT(DOBX)
      C DISPLAY MESSAGE
      C
149           CALL OUTDSP
      C
150           CALL INPCDU
      C IF RST SKIP OUT OF THIS SET
```

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```
151           IF(RESET) GO TO 100
              C
              C IF ADJ THEN DO , ELSE SKIP TO NEXT
              C BEGIN BLOCK = ADJUST
152           IF(ADJUST) THEN
153           CALL INPHEX
              C
              C BEGIN BLOCK = LOAD
154           IF(TEMPIO.NE.0) THEN
              C LOAD DATA IN TEMPIO+1 INTO DESTINATION
              C
              C I/O FLAG SET UP
              C
155           IF(I.EQ.1) THEN
156            IF(DUMMY(1).GE.1) THEN
157             IOFVEC(J)=.TRUE.
158            ELSE
159             IOFVEC(J)=.FALSE.
160            END IF
161           END IF
              C
              C CONTROL VECTOR SET UP
              C
162           IF(I.EQ.2) THEN
163            IF(DUMMY(1).GE.1) THEN
164             CNTVEC(J)=.TRUE.
165            ELSE
166             CNTVEC(J)=.FALSE.
167            END IF
168           END IF
              C
              C OPERATING CONTROL PARAMETER SET UP
              C
169           IF(I.EQ.3) OPSVEC(J+1)=DUMMY(1)
              C
              C PARAMETER SET UP
              C
170           IF(I.EQ.4) PARAM(J)=DUMMY(1)
              C
              C SENSOR TABLE RESET
              C
171           IF(I.EQ.6) THEN
              C
172           IF(J.LE.16) THEN
173            SENTAB(K,L+1)=DUMMY(1)
174           ELSE
175            RGCDAT(K-8,L+1)=DUMMY(1)
176           END IF
              C END SENSOR SET UP
177           END IF
              C
178            IF(I.EQ.7) DSCNTL(J)=DUMMY(1)
              C
              C END OF DATA LOAD SECTION
179           END IF
              C END BLOCK = LOAD
              C
```

```
      C END OF LOOP FOR SET
190           END IF
      C END BLOCK = ADJUST
      C
191   200   CONTINUE
      C
      C END OF SET OF VARIABLES
192           END IF
      C END BLOCK = MODIFY
      C
193           GO TO 450
      C
      C CLEAR CMOS AND SET DEFAULTS
184   300   DOBN=RUNNES(20)
185           DOB(4)=#41H
186           CALL OUTDSP
      C
187           DO 400 I=1,1000
188           LSTPAS(I)=-32000
189   400   CONTINUE
      C
      C SET CMOS BUFFER POINTER AT START (OPPNTS(1))
190           DATPNT=1
      C
191   450   CONTINUE
      C
192   100   CONTINUE
      C
      C END OF DATA INITIALIZATION BLOCK
193           END IF
      C END BLOCK = DATA
      C
      C*************************************************************************
      C
      C TEST FOR DEBUG OR CALIBRATE MODES
      C
194           DOBC=RUNNES(9)
195           DOBN=RUNNES(10)
      C ?CALERAT
196           CALL OUTDSP
      C
197           CALL INPCOU
      C IF ADJ PRESSED
198           IF(ADJUST) THEN
199            OPMODE=5
200            GO TO 1000
201           END IF
      C IF RESET PRESSED
202           IF(RESET) GO TO 1000
      C *****
      C DEBUG
203           DOBC=RUNNES(7)
204           DOBN=DBGNES(12)
205           CDUM=DSPCOD(7)
      C ?DEBUGSYS
206           CALL OUTDSP
      C
```

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```
207           CALL INPCOM
      C IF ADJ PRESSED THEN DO
209            IF(ADJUST) THEN
209            OPMODE=2
210            GO TO 1000
211           END IF
      C IF RESET SKIP OUT
212           IF(RESET) GO TO 1000
      C
213     1000  CONTINUE
214           RETURN
      C
      C SYNCRONIZE CLOCK TIMER
215     2000  CONTINUE
216           CALL OUTPUT(#25H,0)
217           CALL OUTPUT(#25H,#07H)
      C
218           RETURN
219           END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 062EH   1582D
    VARIABLE AREA SIZE = 001EH     30D
    MAXIMUM STACK SIZE = 000AH     10D
    412 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT ITZINP
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT RESTRT
OBJECT MODULE PLACED IN :F1:VCSEXL.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSEXL.FOR

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```
  1          SUBROUTINE RESTRT
             C
             C RESTRT CLEARS APPROPRIATE DAT TO ALLOW WARM START OF VCS
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: NOTHING
             C DESTROYS: SENPNTS,ERRBUF,OPPNTS,CLOCK,PIKBUFS,SENDELS
             C MODIFIES: OPPNTS(1),STATUS
             C VERSION 1.0
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
     =       C**************************************************************************
     =       C
     =       C VCS SYSTEM MEMORY ALLOCATION
     =       C
  3  =            IMPLICIT INTEGER*2(A-Z)
  4  =            INTEGER*1  CIB,KIB,DCB,TOB,PIB,POB,VOB
  5  =            INTEGER*1 PKFBUF,PKPBUF,PKFSAV,PKRSAV
  6  =            INTEGER*1 MNXIPX(6),TFLAG(6)
  7  =            INTEGER*1 ERRBUF(8,10)
     =       C
  8  =            LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMSK(8),DBGM(8)
  9  =            LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10  =             LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALBRT,PWRFAL,AUTO,MANUAL
     =       C
 11  =            CHARACTER*4 PARMES,MOSMES(10)
 12  =            CHARACTER*1 OSPCOD(10)
 13  =            CHARACTER*4 DOBC,DOBN,OPSMES(10)
 14  =            CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
     =       C
 15  =            DIMENSION DEFPRM(20),DEFPNT(8)
     =       C
     =       C COMMON BLOCK ALLOCATIONS
     =       C
 16  =            COMMON/CPRIEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALBRT
     =       C
 17  =            COMMON/MESTE2/ PARMES(20)
     =       C
 18  =            COMMON/MESTB3/OPSMES
     =       C
 19  =            COMMON/MOSMES/MOSMES
     =       C
 20  =            COMMON/SENPNT/SENPTR(16)
     =       C
 21  =            COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
     =       C
 22  =            COMMON/CLOCK/TFLAG
     =       C
 23  =            COMMON/DEBUG/DBGM
     =       C
```

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```
24  =      COMMON/SENDEL/LCDEL(40),FCDEL(60),FERDEL(400)
    = C
25  =      COMMON/IOFVEC/IOFVEC
    = C
26  =      COMMON/CNTVEC/CNTVEC
    = C
27  =      COMMON/OPSVEC/OPSVEC(10)
    = C
28  =      COMMON/OPPARM/ICHPNT(10),NMAX(16),NMXIPX
    = C
29  =      COMMON/SENMEM/LSTPAS(3000),DSCNTL(16)
    = C
30  =      COMMON/OPSPNT/OPPNTS(8)
    = C
31  =      COMMON/WORK/TEMPIO,DUMMY(19)
    = C
32  =      COMMON/SAVER/SAVE(20)
    = C
33  =      COMMON/PARAMS/ PARAM(20)
    = C
34  =      COMMON/ERRBUF/ERRBUF
    = C
35  =      COMMON/ERRFLG/ ERROR(8)
    = C
36  =      COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
    = C
37  =      COMMON/SENBUF/SIB(10),SDB(10)
    = C
38  =      COMMON/CONTAB/SENTAB(10,2),RECDAT(10,2)
    = C
39  =      COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DEPCOD
    = C
40  =      COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
    = C
41  =      COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
    = C
42  =      COMMON/DEFOPS/DEFOPS(10)
    = C
43  =      COMMON/DEFMOS/DEFMOS(16)
    = C
44  =      SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
45  =      SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
46  =      SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
47  =      SAVE /PARAMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
48  =      SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
49  =      SAVE /DEFMOS/
    = C
50  =      EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
51  =      EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),PNGMSK)
52  =      EQUIVALENCE (OPSVEC(4),OPSENR),(OPSVEC(5),RATECK)
52  =      EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
    = C
       C
54             LOGICAL*1 IOFCHS
       C
55             DIMENSION SENDEL(500)
       C
```

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```
55          EQUIVALENCE (IOPVEC(15),IOFCAS)
57          EQUIVALENCE (SENDEL(1),LCDEL(1))
      C
      C*****************************************************************
      C
53          STATUS=0
      C CLEAR DELAY POINTERS
59          DO 100 I=1,16
60          SENPTR(I)=0
61    100   CONTINUE
      C
      C CLEAR ERROR BUFFERS
62          DO 200 I=1,8
63          DO 200 J=1,10
64          ERRBUF(I,J)=0
65    200   CONTINUE
      C
      C CLEAR OPERATION POINTERS
66          DO 300 I=1,8
67          OPPNTS(I)=DEFPNT(I)
68    300   CONTINUE
69          OPPNTS(1)=1
      C
      C CLEAR CLOCK ARRAY
70          DO 400 I=1,6
71          TFLAG(I)=0
72    400   CONTINUE
      C
      C CLEAR PICK DATA
73          DO 500 I=1,10
74          PKFBUF(I)=0
75          PKRBUF(I)=0
76    500   CONTINUE
      C
      C CLEAR DELAY LINES
77          DO 600 I=1,500
78          SENDEL(I)=0
79    600   CONTINUE
      C
80          IF(IOFCAS) CALL TAPITZ
      C IF CASSETTE ON WRITE TAPE HEADER
      C
      C CMOS POINTER RESET,LSTPNT
81          DSCNTL(6)=0
      C
82          RETURN
83          END
```

MODULE INFORMATION:

```
CODE AREA SIZE     = 013AH    314D
VARIABLE AREA SIZE = 0014H     20D
MAXIMUM STACK SIZE = 0002H      2D
155 LINES READ
```

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```
0 PROGRAM ERROR(S) IN PROGRAM UNIT RESTRT

0 TOTAL PROGRAM ERROR(S)
END OF FORTRAN COMPILATION
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CNTRFD
OBJECT MODULE PLACED IN :F1:MCSCNT.OBJ
COMPILER INVOKED BY:  FORT80 :F1:MCSCNT.FOR
```

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```
  1          SUBROUTINE CNTRFD
             C
             C CNTRFD IS THE FRONT DRUM CONTROL ALGORITHM
             C       THIS VERSION INCLUDES LCF,PICKS,HBS-CID,DEADBAND,BIAS
             C
             C INPUTS: SENSOR DATA,CONTROL INFORMATION
             C OUTPUTS: FRONT DRUM CONTROL SIGNAL
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: CONTROL OUTPUT FOR FRONT
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(6),TOB(128),PIB(2),POB(2),VOB(2)
  4          INTEGER*1 PKFSAV,PKFBUF,PKRSAV,PKRBUF
             C
  5          LOGICAL*1 IOFVCF
  6          LOGICAL*1 CNMCID,CNMLCF,CNMPKF,CNMPKR,CNMPCF,CDUM(11),IOFVEC(20)
             C
  7          COMMON/OPSPNT/OPPNTS(8)
             C
  8          COMMON/CONBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  9          COMMON/SAVER/LCX,FCNTL,FCDELT,TEMPOR(17)
             C
 10          COMMON/SENMEM/ LSTPAS(3000),DSCNTL(16)
             C
 11          COMMON/SENPNT/FORPNT,FDRCNT,LCPNT,LCCNT,PCPNT,PCCNT,DUMMY(10)
             C
 12          COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKRSAV
             C
 13          COMMON/SENBUF/SIB(10),SDB(10)
             C
 14          COMMON/PARAMS/DMAX,DMIN,ERRLMT,CDSTEP,PIKAVE,PKSTEP,DEDBDF,
             1 DEDBDR,ARNLNG,DRMRAD,LCPOS,PCPOS,CIDPOS,FTRLOC,DFDFCT,
             2 SNDSTP,DBIASF,DBIASR,ERRVAL,TRGFCT
             C
 15          COMMON/CNTVEC/CNMCID,CNMLCF,CNMPKF,CNMPKR,CNMPCF,CDUM
             C
 16          COMMON/OPSVEC/ OPMODE,MODECT,RNGMSK,OPSENR,RATECK,STAT,
             1 FDVGN,FDCAL,RDVGN,RDCAL
             C
 17          COMMON/SENDEL/LCDEL(40),PCDEL(60),FORDEL(400)
             C
 18          COMMON/IOFVEC/IOFVEC
             C
 19          COMMON/ERRFLG/ERROR(8)
             C
 20          SAVE /SENMEM/,/IOFVEC/
 21          SAVE /OPSPNT/,/SENDEL/,/SAVER/,/PIKBUF/,/SENPNT/
```

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```
22          SAVE /CNTVEC/,/OPSVEC/,/SENEUF/,/PRRAMS/,/CONEUF/
      C
23          EQUIVALENCE (SDB(1),DFD),(IOFVEC(10),IOFVCF)
24          EQUIVALENCE (SDB(6),CID),(SDB(2),LC),(SDB(4),FDRUM),(SDB(7),FLF)
25          EQUIVALENCE (DSCNTL(1),MAXSLT),(DSCNTL(2),STRTPT)
26          EQUIVALENCE (DSCNTL(3),STEPSZ),(DSCNTL(4),NEGMAX)
27          EQUIVALENCE (DSCNTL(5),POSMAX),(DSCNTL(6),LSTPNT)
29          EQUIVALENCE (DSCNTL(7),ISNIND),(DSCNTL(8),ISNPOS)
29          EQUIVALENCE (DSCNTL(9),CIDMAX),(DSCNTL(10),CIDMIN)
      C
      C*****************************************************************
      C
      C SENSOR SELECT SECTION
      C
      C TEST IF LCF DATA USED
      C BEGIN BLOCK = SENSOR
30          IF((MODECT.LE.1).OR.(MODECT.EQ.3)) THEN
      C
31          LCX=(LC*(20-TRGFCT*((10*FDRUM)/FDCAL)))/20
      C
      C BEGIN BLOCK = DELAY
32          IF(OPSENR.EQ.1) THEN
      C
      C OPSENR = 1 FOR DELAYED SENSORS
      C
      C DELAYED LCF ROUTINE
33    10    CONTINUE
      C
      C IF DFD >= OLD DFD + 1 OR MORE STEPS
34          IF((DFD-LCCNT*DFDFCT).GT.DFDFCT) THEN
35          LCDEL(MOD(LCPNT,LCPOS)+1)=LCX+((FDRUM+FDVGN)/10)*ARMLNG
36           LCPNT=LCPNT+1
37           LCCNT=LCCNT+1
38           GO TO 10
39          END IF
      C
      C TAKE LC FROM DELAYED BUFFER
40          LCX=LCDEL(MOD(LCPNT,LCPOS)+1)
      C
      C END SENSOR IF BLOCK
41          END IF
      C END BLOCK = DELAY
      C
      C *********
      C
      C ELSE NO LCF - RECORDED DATA MODE
42          ELSE
      C
43           IF((MODECT.EQ.2).OR.(MODECT.EQ.4)) THEN
      C LC DATA FROM CMOS BUFFER
44          INDEX=DFD+STRTPT
45          LCX=LSTPAS(INDEX)
      C IF NOT INITIALIZED
46          IF(LCX.EQ.(-32000)) THEN
47           LCX=0
      C ERROR 6 = NO LAST PASS DATA GOOD
48           ERROR(6)=1
```

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```
49          END IF
            C
            C END STORED BLOCK
50          END IF
            C
51          END IF
            C END BLOCK = SENSOR
            C
            C *********
            C
            C BUFFER FRONT POSITION FOR SLAVE OF REAR (MODE 3)
52          20    CONTINUE
            C IF DFD >= OLD DFD + 1 OR MORE STEPS
53          IF((DFD-FDRCNT*DFDFCT).GT.DFDFCT) THEN
54          FDRDEL(MOD(FDRPNT,FTRLOC)+1)=FDRUN*ARMLNG
55          FDRPNT=FDRPNT+1
56          FDRCNT=FDRCNT+1
57          GO TO 20
58          END IF
            C
            C STORE CID/PC IN CMOS
            C
59          INDEX=DFD+STRTPT-INSPOS
60          IF((INDEX.LE.POSMAX).AND.(INDEX.GE.NEGMAX)) THEN
            C OK IN RANGE
61          IF(INDEX.NE.LSTPNT) THEN
62           DO 50 I=LSTPNT+1,INDEX
63           LSTPAS(I)=SDB(ISNIND)
64          50    CONTINUE
65           LSTPNT=INDEX
66          END IF
67          ELSE
68           ERROR(6)=10
69          END IF
            C
            C END SENSOR SEGMENT
            C
            C*************************************************************
            C
            C CONTROL ALGORITHM SECTION
            C
            C IF AUTO MODE DO CONTROL
            C BEGIN BLOCK = CONTROL
70          IF(OPMODE.EQ.1) THEN
            C
71          FCNTL=0
72          VOB(1)=0
            C
            C **********
            C
            C TEST IF PICK CONTROL
            C BEGIN BLOCK = PICKS
73          IF(CHMPKF) THEN
            C
            C TEST IF AVERAGE PICKS
74           IF(PIKAVE.GT.0) THEN
            C STORE PICK DATA FOR AVERAGING
```

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```
                I=MOD(OFFNTS(5),PIKAVE)
                PKFBUF(I+1)=PKF*10
                J=0
      C AVERAGE PICK READINGS
                DO 100 I=1,PIKAVE
                J=J+PKFBUF(I)
      100        CONTINUE
               J=J/PIKAVE
      C
      C ELSE NO AVERAGING ON PICK DATA
               ELSE
                J=PKF*10
               END IF
      C
      C TEST IF OVER OR UNDER THRESHOLDS FOR CHANGES
               IF(J.GE.7) THEN
                J=1
                GO TO 200
               END IF
      C
      C TEST IF COAL
               IF(J.LE.3) THEN
                J=-1
                GO TO 200
               END IF
      C
      C ELSE KEEP OLD VALUE
               J=PKFSAV
      C
      200    PKFSAV=J
      C
      C SHIFT LC DUE TO PICKS
             LCX=LCX+PKSTEP*J
      C
             END IF
      C END BLOCK = PICKS
      C
      C **********
      C
      C BEGIN BLOCK = CID
             IF(CNMCID) THEN
      C
      C DO CID CONTROL AS PICKS ARE DONE
      C
      C IF CID .GT. SET POINT MOVE DRUM DOWN
               IF(CID.GT.CIDMAX) LCX=LCX-CDSTEP
      C
      C IF CID .LT. MIN SET POINT MOVE DRUM UP
               IF(CID.LT.CIDMIN) LCX=LCX+CDSTEP
      C
             END IF
      C END BLOCK = CID
      C
      C **********
      C
      C BEGIN BLOCK = LCF
             IF(CNMLCF) THEN
```

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```
      C
      C TEST IF NULLING CONTROL
102           IF(MODECT.EQ.9) FCNTL=LCX
      C
      C TEST IF NORMAL REAL TIME CONTROL
103           IF((MODECT.EQ.1).OR.(MODECT.EQ.3)) FCNTL=LCX+FDRUM*ARMLNG
      C
104           ELSE
      C NO LCF DATA AVAILABLE DIRECTLY
      C
      C TEST IF STORED DATA (IN CMOS)
105           IF((MODECT.EQ.4).OR.(MODECT.EQ.2)) FCNTL=LCX+FDRUM*ARMLNG
      C
      C END LCF BLOCK
106           END IF
      C
      C ***************************************************************
      C
      C CONTROL SIGNAL GENERATION SECTION
      C
      C TEST IF OUTPUT ENABLED
      C BEGIN BLOCK = OUTPUT
107           IF(IOFVCF) THEN
      C
      C OUTPUT BIAS AND DEAD BAND
108           FCDELT=(FCNTL-OBIASF)
      C
      C TEST IF DEAD BAND ON OUTPUT
109           IF(DEDEDF.GT.0) THEN
110            IF(IABS(FCDELT).LT.DEDEDF) THEN
      C IF CONTROL .LT. DEAD BAND SET TO 0
111             FCNTL=0
112             GO TO 500
113            END IF
114           END IF
      C
      C **********
      C
      C GENERATE VALVE CONTROL
115            IF(FCDELT.GT.0) THEN
116             VOB(1)=1
      C DRUM LOW , GO UP
117            ELSE
118             VOB(1)=-1
      C DRUM HIGH , GO DOWN
119            END IF
      C
120     500   CONTINUE
      C
121           END IF
      C END BLOCK = OUTPUT
      C
122           END IF
      C END BLOCK = CONTROL
      C
123           RETURN
124           END
```

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```
MODULE INFORMATION:

     CODE AREA SIZE     = 030FH    9910
     VARIABLE AREA SIZE = 000AH     10D
     MAXIMUM STACK SIZE = 0004H      4D
     279 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT CNTRFD
```

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```
ISIE-11 FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CNTRRD
OBJECT MODULE PLACED IN :F1:VCSCNT.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSCNT.FOR


  1          SUBROUTINE CNTRRD
             C
             C CNTRRD COMPUTES THE REAR DRUM CONTROL SIGNAL  ALGORITHM IS
             C       CONTROLLED BY INPUTS AND MODE VECTOR
             C
             C INPUTS: SENSOR DATA,CONTROL INFORMATION
             C OUTPUTS: REAR DRUM CONTROL SIGNAL
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: CONTROL OUTPUT FOR REAR
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
  4          LOGICAL*1 IOFVEC(20),IOFVCR
  5          LOGICAL*1 CNMCID,CNMLCF,CNMPKF,CNMPKR,CNMPCF,CNMVCF,CNMVCR,CDUM(9)
             C
  6          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  7          COMMON/SAVER/PCX,RCNTL,RCDELT,TEMPOR(17)
             C
  8          COMMON/SENMEM/ LSTPAS(3000),DSCNTL(16)
             C
  9          COMMON/SENPNT/FDRPNT,FDRCNT,LCPNT,LCCNT,PCPNT,PCCNT,FDUM(10)
             C
 10          COMMON/SENBUF/SID(10),SDB(10)
             C
 11          COMMON/PARAMS/DMAX,DMIN,ERRLMT,SEAM,PIKAVE,PKSTEP,
             1 DEDBDF,DEDBDR,ARMLNG,
             2 DRMRAD,LCPOS,PCPOS,CIDPOS,FTRLOC,DFDFCT,SNDSTP,
             3 OBIASF,OBIASR,SRKVAL,TRGFCT
             C
 12          COMMON/CNTVEC/CNMCID,CNMLCF,CNMPKF,CNMPKR,CNMPCF,CNMVCF,CNMVCR,CDUM
             C
 13          COMMON/OPSVEC/OPMODE,MODECT,RNGMSK,OPSENR,RATECK,STAT,
             1 FDVGN,FDCAL,RDVGN,RDCAL
             C
 14          COMMON/SENDEL/LCDEL(40),PCDEL(60),FDRDEL(400)
             C
 15          COMMON/IOFVEC/IOFVEC
             C
 16          SAVE /OPSPNT/,/IOFVEC/
 17          SAVE /SENDEL/,/SAVER/,/SENMEM/,/PIKBUF/,/SENPNT/
 18          SAVE /CNTVEC/,/OPSVEC/,/SENBUF/,/PARAMS/,/COMBUF/
             C
 19          EQUIVALENCE (SDB(1),DFD),(IOFVEC(11),IOFVCR)
 20          EQUIVALENCE (SDB(2),PC),(SDB(8),PKR),(SDB(5),FDRUN)
             C
             C*****************************************************************
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      C
      C SENSOR SELECT SECTION
      C
      C TEST IF PCF DATA USED
      C BEGIN BLOCK = SENSOR
 21         IF(MODECT.LE.1) THEN
      C
 22         PCX=(PC*(20-TRGFCT*((10*RDRUM)/PDCAL)))/20
      C
      C TEST IF DELAYED SENSOR
      C
      C BEGIN BLOCK = DELAY
 23         IF(OPSENR.EQ.1) THEN
      C
      C PCF DELAY ROUTINE
 24    10     CONTINUE
      C IF DFD >= OLD DFD + 1 OR MORE STEPS
 25         IF((DFD-PCCNT+1+F%CT).GT.DFDFCT) THEN
 26         PCDEL(MOD(PCPNT,PCPOS)+1)=PCX+((PDRUM*RDVGN)/10)*ARMLNG
 27          PCPNT=PCPNT+1
 28          PCCNT=PCCNT+1
 29          GO TO 10
 30         END IF
      C
      C TAKE PC DATA FROM DELAY BUFFER
 31         PCX=PCDEL(MOD(PCPNT,PCPOS)+1)
      C
      C END BLOCK = DELAY
 32         END IF
      C
      C **********
      C
      C ELSE NO PCF - RECORDED DATA MODE
 33         ELSE
      C
      C TEST IF STORED DATA
      C       IF((MODECT.EQ.2).OR.(MODECT.EQ.4)) PCX=PC
      C
      C TEST IF SLAVED DRUM
 34          IF(MODECT.EQ.3) PCX=FDRDEL(MOD(FDRPNT,FTRLOC)+1)
      C
      C END BLOCK = SENSOR
 35         END IF
      C
      C END SENSOR SEGMENT
      C
      C*************************************************************
      C
      C CONTROL ALGORITHM SECTION
      C
      C IF AUTO DO CONTROL
      C BEGIN BLOCK = CONTROL
 36         IF(OPMODE.EQ.1) THEN
      C
 37         RCNTL=0
 38         VOB(2)=0
      C
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      C TEST IF REAR PCF CONTROL
      C BEGIN BLOCK = PCF
 39           IF(CHNPCF) THEN
      C
      C TEST IF NULLING CONTROL
 40            IF(MODECT.EQ.0) RCNTL=PCX
      C
      C TEST IF NORMAL REAL TIME CONTROL
 41           IF((MODECT.EQ.1).OR.(MODECT.EQ.3)) RCNTL=PCX-RDRUM*ARMLNG
      C
      C **********
      C
 42           ELSE
      C NO PCF DATA AVAILABLE
      C
      C TEST IF SLAVED DRUM CONTROL
 43            IF(MODECT.EQ.3) RCNTL=PCX-RDRUM*ARMLNG
      C
      C TEST IF STORED DATA (CMOS)
      C REAR IS SAME AS 1,3 FOR NOW
 44           IF((MODECT.EQ.4).OR.(MODECT.EQ.2)) RCNTL=PCX-RDRUM*ARMLNG
      C
      C END BLOCK = PCF
 45           END IF
      C
      C ***************************************************************
      C
      C CONTROL SIGNAL GENERATION SECTION
      C
      C TEST IF OUTPUT ENABLED FOR VALVE
      C BEGIN BLOCK = OUTPUT
 46           IF(IOFVCR) THEN
      C
      C OUTPUT BIAS AND DEAD BAND
 47           RCDELT=(RCNTL-C0IASR)
      C
      C DEAD BAND ON CONTROL OUTPUT
 48           IF(DEDBDR.GT.0) THEN
 49            IF(IABS(RCDELT).LT.DEDBDR) THEN
 50             RCNTL=0
 51             GO TO 500
 52            END IF
 53           END IF
      C
      C **********
      C
      C GENERATE VALVE CONTROL
 54           IF(RCDELT.GT.0) THEN
      C DRUM LOW , GO UP
 55            VOB(2)=1
 56           ELSE
      C DRUM HIGH , GO DOWN
 57           VOB(2)=-1
 58           END IF
      C
 59     500   CONTINUE
      C END SIGNAL BLOCK
```

```
      C END BLOCK = OUTPUT
 59         END IF
      C
      C END CONTROL BLOCK
      C END BLOCK = CONTROL
 61         END IF
      C
 62         RETURN
 63         END
```

ORIGINAL PAGE IS
OF POOR QUALITY

MODULE INFORMATION:

```
    CODE AREA SIZE     = 01F3H    499D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0004H      4D
    174 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT CNTRPD
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SENRLM
OBJECT MODULE PLACED IN :F1:VCSCNT.OBJ
COMPILER INVOKED BY: F0RT80 :F1:VCSCNT.FOR

ORIGINAL PAGE IS
OF POOR QUALITY

```
  1          SUBROUTINE SENRLM
             C
             C SENRLM IS THE SENSOR INPUT RATE LIMIT ERROR DETECTOR ROUTINE
             C
             C INPUTS: SDB
             C OUTPUTS: ERROR STATUS
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: SIB,SDB,ERROR FLAG
             C VERSION: 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          COMMON/SENBUF/SIB(10),SDB(10)
             C
  4          COMMON/OPSVEC/OPMODE,MODECT,RNGMSK,OPSENB,RATECK,STATUS,OCURR(4)
             C
  5          COMMON/ERRFLG/ ERROR(8)
             C
  6          COMMON/PARAMS/PDUM(18),SRKVAL,DUMD
             C
  7          SAVE /PARAMS/
  8          SAVE /OPSVEC/,/ERRFLG/,/SENBUF/
             C
  9          EQUIVALENCE (SDB(3),LCF),(SDB(2),PCF)
             C
             C*************************************************************
             C
             C IF COLD START INITIALIZE OLD VALUES
             C
 10          IF(STATUS.EQ.0) THEN
 11           LCOLD=LCF
 12           PCOLD=PCF
 13           STATUS=STATUS+1
 14          END IF
             C
             C IF IN AUTOMATIC DO ERROR TEST
             C
 15          IF(OPMODE.EQ.1) THEN
             C TEST IF RATE TOO LARGE ON INPUTS
             C ERROR 4 = INPUT SENSOR RATE OF CHANGE TOO HIGH
 16           IF(IABS(LCF-LCOLD).GE.SRKVAL) ERROR(4)=1
             C
 17           IF(IABS(PCF-PCOLD).GE.SRKVAL) ERROR(4)=ERROR(4)+10
             C
 18          END IF
             C
 19          IF(ERROR(4).NE.0) RETURN
             C
             C USE OLD VALUES IF ERROR
 20          PCOLD=PCF
```

```
 21          LOCLD=LOF
       C
 22          RETURN
 23          END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
MODULE INFORMATION:

    CODE AREA SIZE     = 007FH    127D
    VARIABLE AREA SIZE = 0004H      4D
    MAXIMUM STACK SIZE = 0002H      2D
    55 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SENRLM

    0 TOTAL PROGRAM ERROR(S)
    END OF FORTRAN COMPILATION
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
IBIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DEUGCI
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSDBG.FOR


  1          SUBROUTINE DEUGCI
             C
             C DEUGCI READS DEBUG CONTROL INFORMATION FROM CONTROL/DISPLAY PANEL
             C
             C INPUTS: DEBUG CONTRO VECTOR
             C OUTPUTS: NONE
             C CALLS: INPCDU,OUTDSP,PAUSE
             C DESTROYS: NOTHING
             C MODIFIES: DEBUG CONTROL VECTOR
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          CHARACTER*1 DSPCOD(10)
  4          CHARACTER*4 DOBC,DOBN
  5          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
             C
  6          INTEGER*1 BITS(8)
  7          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
  8          LOGICAL*1 NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
             C
  9          COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
             C
 10           COMMON/OPPARM/NDUM(18),NMXDBG,NDUM(10)
             C
 11          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
 12          COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
             C
 13          COMMON/WORK/ TEMPIO,DUMMY(19)
             C
 14          SAVE /COMBUF/,/MESTAB/,/WORK/,/CPANEL/,/OPPARM/
             C
 15          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
             C
 16          EQUIVALENCE (TEMPIO,BITS(1))
             C
             C*************************************************************
             C
             C LOAD DOB WITH PROMPT
             C
             C *DEBUG!
 17          DOBC=RUNMES(7)
 18          DOBN=RUNMES(8)
             C
             C DISPLAY MESSAGE
             C
 19          CALL OUTDSP
             C
 20          CALL PAUSE
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      C
      C PROMPT FOR MMXDBG DEBUG OPERATIONS
      C
      C LOAD DOBC WITH DEBUG CODE
      C
      C @DBGXXX
 21         DOBC=DBGMES(1)
      C
      C DO FOR ALL DEBUG TYPES
 22         DO 100 I=1,MMXDBG
      C
      C LOAD DOBN WITH SECOND HALF OF PROMPT
 23         DOBN=DBGMES(I+1)
      C
      C DISPLAY AND WAIT FOR RESPONSE
      C
 24         CALL OUTDSP
 25         CALL INPCOU
      C
      C TEST IF ADJ PRESSED
 26         IF(ADJUST) THEN
 27          TEMPIO=I
 28          GO TO 1000
 29         END IF
      C
      C IF RST ; EXIT
 30         IF(RESET) THEN
 31          TEMPIO=0
 32           GO TO 1000
 33         END IF
      C
      C ELSE IF NXT ; CONTINUE
 34    100  CONTINUE
      C
      C DEFAULT EXIT
 35         TEMPIO=0
      C
 36    1000 CONTINUE
 37         RETURN
 38         END
```

```
MODULE INFORMATION:

    CODE AREA SIZE     = 00A5H    165D
    VARIABLE AREA SIZE = 0004H      4D
    MAXIMUM STACK SIZE = 000AH     10D
    91 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT DEUGCI
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DBUGCO
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSDBG.FOR


  1          SUBROUTINE DBUGCO
             C
             C DBUGCO OUTPUTS DEBUG INFORMATION TO CONTROL/DISPLAY PANEL
             C
             C INPUTS: DEBUG CONTROL VECTOR
             C OUTPUTS: DEBUG MESSAGES
             C CALLS: OUTDSP,CLOCK
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          CHARACTER*1 DSPCOD(10)
  4          CHARACTER*4 DOBC,DOBN
  5          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
             C
  6          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
  7          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  8          COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
             C
  9          SAVE /COMBUF/,/MESTAB/
             C
 10          EQUIVALENCE (DOB(1),DOBC),(DOBN,DOB(5))
             C
             C*************************************************************************
             C
             C LOAD DOB WITH PROMPT
             C
 11          DOBC=DBGMES(1)
 12          DOBN=RUNMES(6)
             C @DBG-OK*
             C
             C DISPLAY MESSAGE
             C
 13          CALL OUTDSP
             C
             C USE TIME OUT FEATURE
 14          CALL CLOCK
             C
 15          RETURN
 16          END


MODULE INFORMATION:

    CODE AREA SIZE     = 002DH     45D
    VARIABLE AREA SIZE = 0000H      0D
```

FORTRAN COMPILER

ORIGINAL PAGE IS
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MAXIMUM STACK SIZE = 006AH 106

44 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT DEUGCO

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DEUGOT
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSDBG.FOR


  1          SUBROUTINE DEUGOT
             C
             C DEUGOT OUTPUTS DEBUG CONTROL INFORMATION TO FRONT AND REAR DRUMS
             C
             C INPUTS: DEBUG CONTROL INFORMATION
             C OUTPUTS: DRUM CONTROL SIGNALS
             C CALLS: OUTDSP, INPCDU, CNTOUT
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
  4          CHARACTER*1 DSPCOD(10),DOB4
  5          CHARACTER*4 DOBC,DOBN
  6          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
             C
  7          LOGICAL*1 NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
  8          LOGICAL*1 IOFVEC,IOFVOT
  9          LOGICAL*1 CNTVEC(16),CNMFRT,CNMREP,CNMOUT,SAVVEC(40)
             C
 10          COMMON/IOFVEC/IOFVEC(20)
             C
 11          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
             C
 12          COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
             C
 13          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
 14          COMMON/OPPARM/MDUM(17),NMXCNM,MDUM(11)
             C
 15          COMMON/CNTVEC/CNTVEC
             C
 16          COMMON/SAVER/SAVVEC
             C
 17          SAVE /IOFVEC/,/SAVER/
 18          SAVE /MESTAB/,/COMBUF/,/CNTVEC/ ,/OPPARM/,/CPANEL/
             C
 19          EQUIVALENCE (IOFVOT,IOFVEC(12))
 20          EQUIVALENCE (CNTVEC(8),CNMFRT),(CNTVEC(9),CNMREP),(CNTVEC(10),CNMOUT)
 21          EQUIVALENCE (DOB(1),DOBC),(DOBN,DOB(5)),(DOB(4),DOB4)
             C
             C*****************************************************************
             C
             C SAVE CONTROL MASK VECTOR AND FORCE ELEMENTS
             C
 22          DO 100 I=1,NMXCNM
 23          SAVVEC(I)=CNTVEC(I)
 24          CNTVEC(I)=.TRUE.
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
25      100   CONTINUE
        C
26            SAVVEC(MM(CNM+1)=IOFVOT
27            IOFVOT= TRUE.
        C
        C LOAD DISPLAY WITH PROMPT
        C
28      150    CONTINUE
29            DOBC=DBGMES(2)
30            DOB4=DSPCOD(9)
31            DOBN=ERRMES(12)
        C OUT=#VO!
        C
        C DISPLAY MESSAGE
        C
32            CALL OUTDSP
        C
        C WAIT FOR OPERATOR RESPONSE
        C
        C ADJUST = UP
        C NEXT = DOWN
        C RESET = STOP
        C
33            CALL INPCDU
34            IF(ADJUST) THEN
35            VOB(1)=1
36            VOB(2)=1
        C UP
37            DOBN=DBGMES(15)
38            ELSE
39             IF(NEXT) THEN
40              VOB(1)=-1
41              VOB(2)=-1
        C DOWN
42            DOBN=DBGMES(16)
43             ELSE
44              VOB(1)=0
45              VOB(2)=0
46            DOBN=DBGMES(11)
        C END
47             END IF
48            END IF
        C
        C
        C OUTPUT VALVE CONTROL SIGNALS
        C
49            CALL CNTOUT
        C
        C WAIT FOR OPERATOR RESPONSE
50            CALL OUTDSP
        C
        C OUT?END? OUT? UP  OUT?DOWN
51            CALL INPCDU
        C
        C RESET VOB TO ZERO
        C
52            VOB(1)=0
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
 53          VOB(2)=0
             C
             C OUTPUT VOB SIGNAL
             C
 54          CALL CNTOUT
             C
 55          IF (ADJUST) GO TO 150
             C
             C RESTORE CONTROL MASK VECTOR
             C
 56          DO 200 I=1,NMXCNM
 57          CNTVEC(I)=SAVVEC(I)
 58     200  CONTINUE
 59          IOFVOT=SAVVEC(NMXCNM+1)
             C
 60          RETURN
 61          END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0156H    342D
    VARIABLE AREA SIZE = 0004H      4D
    MAXIMUM STACK SIZE = 00A0H    160D
    125 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT DEVCOT
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DEUGIN
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSDBG.FOR


  1          SUBROUTINE DBUGIN (FLAG)
             C
             C DBUGIN READS SENSOR DATA VIA I/O ROUTINES AS PER INPUT
             C
             C INPUTS: SENSOR BUFFER,CONTROL VECTOR
             C OUTPUTS: NONE
             C CALLS: SENINP,PAUSE,OUTDSP,FORMAT,CONVRT,INPCDU
             C DESTROYS: NOTHING
             C MODIFIES: SENSOR INPUT DATA SIB,SDB
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CBYTE
  4          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
             C
  5          CHARACTER*1 DSPCOD(10),DOB4
  6          CHARACTER*4 DOBC,DOBB
  7          CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
             C
  8          LOGICAL*1 NEXT,AUTO,RUN,RESET,ADJUST,MANUAL,PWRFAL,CALERT
  9          LOGICAL*1 IOFVEC(20),SAVVEC(40)
             C
 10           COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
             C
 11          COMMON/SENBUF/SIB(10),SDB(10)
             C
 12          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
 13          COMMON/IOFVEC/IOFVEC
             C
 14          COMMON/OPPARM/LDUM(10),NMXSEN,NDUM(5),NMXIOF,MDUM(12)
             C
 15          COMMON/WORK/TEMP10,MDUM(3),ZDUM(16)
             C
 16          COMMON/SAVER/SAVVEC
             C
 17          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
             C
 18          SAVE /CPANEL/,/SAVER/,/OPPARM/
 19          SAVE /COMBUF/,/IOFVEC/,/MESTAB/,/WORK/,/SENBUF/
             C
 20          EQUIVALENCE (DOB(5),DOBB),(DOB(4),DOB4)
 21          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
             C
             C*************************************************************
             C
             C LOAD DOB WITH PROMPT FOR DISPLAY
             C
             C FLAG = 1 FOR DATA CONVERSION
 22          IF(FLAG.NE.0) THEN
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
22            DOBC=DBGMES(4)
24           ELSE
25            DOBC=DBGMES(3)
26           END IF
27           DOBB=RUNMES(20)
28           DCB4=DSPCOD(9)
      C INP= ##!

      C DISPLAY MESSAGE
      C
29            CALL OUTDSP
      C
      C WAIT FOR OPERATOR RESPONSE
      C
30            CALL PAUSE
      C
      C SAVE I/O MASK VECTOR AND SET TRUE
      C
31            DO 100 I=1,NMXIOF
32            SAVVEC(I)=IOFVEC(I)
33            IOFVEC(I)=.TRUE.
34      100   CONTINUE
      C
      C CALL SENSOR INPUT ROUTINE
      C
35      150    CALL SENINP
      C
36            IF(FLAG.NE.0) CALL CONVRT
      C
      C DISPLAY VALUE READ IN FOR EACH I/O CHANNEL
      C
37            DO 200 I=1,NMXSEN
38            IF(FLAG.EQ.0) THEN
39             DOBN=SIB(I)
40            ELSE
41             DOBN=SDB(I)
42            END IF
43            DOB(3)=I+'30'H
      C INX=ZZZZ
      C
      C FORMAT HEX VALUE INTO ASCII IN DOB
      C
44            CALL FORMAT(DOBN)
      C
45            CALL OUTDSP
      C
      C WAIT FOR OPERATOR RESPONSE
      C
46            CALL INPCDU
47            IF(RESET) GO TO 250
48            IF(ADJUST) GO TO 150
      C
49      200   CONTINUE
      C
      C RESTORE I/O MASK VECTOR
      C
50      250   DO 300 I=1,NMXIOF
```

FORTRAN COMPILER

```
 51           IOFVEC(I)=SAVVEC(I)
 52     200   CONTINUE
        C
 53           RETURN
 54           END
```

ORIGINAL PAGE IS
OF POOR QUALITY

MODULE INFORMATION:

```
     CODE AREA SIZE     = 0162H    354D
     VARIABLE AREA SIZE = 0007H      7D
     MAXIMUM STACK SIZE = 000AH     10D
     113 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT DEUGIN
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DBUGCK
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY: FOR80 :F1:VCSDBG.FOR

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```
 1          SUBROUTINE DBUGCK
            C
            C DBUGCK CHECKS THE CLOCK TIMER FOR VCS SYNCRONIZATION
            C
            C INPUTS: NONE
            C OUTPUTS: NONE
            C CALLS: CLOCK,INTREN
            C DESTROYS: NOTHING
            C MODIFIES: DOB
            C VERSION 1.0
            C
 2          IMPLICIT INTEGER*2 (A-Z)
            C
 3          INTEGER*1 TFLAG(6)
 4          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
            C
 5          CHARACTER*4 DOBC,DOBN,ERRMES(20),DBGMES(20),RUNMES(20)
 6          CHARACTER*1 DSPCOD(10)
            C
 7          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
            C
 8           COMMON/CLOCK/ TFLAG
            C
 9          COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
            C
10          SAVE /COMBUF/,/MESTAB/,/CLOCK/
            C
11          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
            C
            C*************************************************************************
            C
            C ENABLE CLOCK INTERRUPTS
            C
12          CALL INTREN
13          ISAV=IOFCAS
14          IOFCAS=0
15          DOBC=DBGMES(8)
16          DOBN=DBGMES(7)
            C  CLK?I/O?
            C
17          CALL CLOCK
            C
18          IOFCAS=ISAV
            C
19          RETURN
20          END
```

MODULE INFORMATION:

FORTRAN COMPILER

ORIGINAL PAGE IS
OF POOR QUALITY

```
CODE AREA SIZE     = 003FH     63D
VARIABLE AREA SIZE = 0004H      4D
MAXIMUM STACK SIZE = 0500H    1280
46 LINES READ

0 PROGRAM ERROR(S)  Last PROGRAM UNIT DEUSCK
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DBUGIO
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSDBG.FOR
```

```
1           SUBROUTINE DBUGIO
            C
            C DBUGIO READS AN I/O CHANNEL OR PORT AND DISPLAYS VALUE
            C
            C INPUTS: NONE
            C OUTPUTS: NONE
            C CALLS: OUTDSP, PAUSE, INPCOU, SENINP, FORMAT
            C DESTROYS: NOTHING
            C MODIFIES: DOB, TEMPIO
            C VERSION 1.0
            C
2           IMPLICIT INTEGER*2 (A-Z)
            C
3           INTEGER*1 BITS(8)
4           INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
5           INTEGER*1 DSPCOD(10)
            C
6           LOGICAL*1 NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALBRT
            C
7           CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20),DOBC,DOBN
            C
8           COMMON/SENBUF/SIB(10),SDB(10)
            C
9           COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALBRT
            C
10          COMMON/WORK/ BITS,DUM(16)
            C
11          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
            C
12          COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCOD
            C
13          SAVE /WORK/
14          SAVE /COMBUF/,/MESTAB/,/CPANEL/,/SENBUF/
            C
15          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
16          EQUIVALENCE (DOBX,DOB(5))
            C
            C*****
            C
            C LOAD DOB WITH PROMPT
            C
17          DOBC=RUNMES(1)
18          DOBN=DBGMES(14)
            C ?I/OCHA!
            C
19          CALL OUTDSP
            C
20          CALL PAUSE
            C
21          NMXIOC=6
            C
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
22          DO 100 I=1,NMXIOC
            C
            C LOAD DOB WITH PROMPTS
            C
23          DOBC=ERRMES(I+1)
24          DOB(1)=OSFCOD(6)
25          DOBN=RUNMES(20)
            C  0XXX ##
            C
26          CALL OUTDSP
            C
27          CALL INPCDU
            C
            C TEST IF UPDATE
            C
            C IF RST EXIT
28          IF(RESET) GO TO 1000
            C TEST IF ADJ PRESSED
29          IF(ADJUST) THEN
            C
30          50    CALL SENINP
            C
31          TEMPIO=SIB(I)
            C
32           75   DOBX=TEMPIO
            C
            C FORMAT VALUE AND DISPLAY
33          CALL FORMAT(DOBX)
            C
34          CALL OUTDSP
            C
            C WAIT FOR OPERATOR
35          CALL INPCDU
            C
            C TEST IF NXT PRESSED CONTINUE LOOP
36          IF(NEXT) GO TO 100
            C
            C TEST IF RESET ,EXIT
37          IF(RESET) GO TO 1000
            C ELSE ADJUST ,READ AGAIN
38          GO TO 50
39          END IF
            C
40          100   CONTINUE
            C
            C ELSE NEXT,CONTINUE
41          1000   CONTINUE
42          RETURN
43          END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 00D7H    215D
    VARIABLE AREA SIZE = 0008H      8D
    MAXIMUM STACK SIZE = 000AH     10D
```

ORIGINAL PAGE IS
OF POOR QUALITY

100 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT DBUGIO

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT DEUGTP
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSDBG.FOR

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OF POOR QUALITY

```
1           SUBROUTINE DBUGTP
            C
            C DBUGTP CHECKS OPERATION OF THE TAPE CASSETTE
            C
            C INPUTS: NONE
            C OUTPUTS: NONE
            C CALLS: AIOCAS,OUTDSP,MSEC2H,PAUSE
            C DESTROYS: NOTHING
            C MODIFIES: DOB,TOB
            C VERSION 1.0
            C
2           IMPLICIT INTEGER*2 (A-Z)
            C
3           INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
4           INTEGER*1 CNTL(4)
            C
5           CHARACTER*1 DSPCOD(10)
6           CHARACTER*4 DOBC,DOBN,ERRMES(20),DBGMES(20),RUNMES(20)
            C
7           COMMON/SENBUF/SIB(10),SDB(10)
            C
8           COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
            C
9           COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
            C
10          COMMON/WORK/ TEMPIO,DUMMY(19)
            C
11          SAVE /MESTAB/,/COMBUF/,/WORK/
12          SAVE /SENBUF/
            C
13          EQUIVALENCE (DUMMY(1),CNTL(1))
14          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
            C
            C*****************************************************************
            C
15          CNTL(2)=0
16          CNTL(1)=2
17          TEMPIO=0
18          CALL AIOCAS(TEMPIO)
19          CALL MSEC2H
20          IF(CNTL(2).NE.0) THEN
21          DOBC=ERRMES(15)
22          DOBN=RUNMES(15)
23          CALL OUTDSP
24          CALL PAUSE
25          END IF
26          RETURN
27          END
```

ORIGINAL PAGE IS
OF POOR QUALITY

MODULE INFORMATION:

```
CODE AREA SIZE     = 0055H     85D
VARIABLE AREA SIZE = 0000H      0D
MAXIMUM STACK SIZE = 000AH     10D
48 LINES READ
```

0 PROGRAM ERROR(S) IN PROGRAM UNIT DEUGTP

ORIGINAL PAGE IS
OF POOR QUALITY

```
I515-II FORTRAN-90 V2.1 COMPILATION OF PROGRAM UNIT DBUGME
OBJECT MODULE PLACED IN :F1:VCSDBG.OBJ
COMPILER INVOKED BY:  FORT90 :F1:VCSDBG.FOR


  1          SUBROUTINE DBUGME
           C
           C DBUGME DISPLAYS MEMORY TO THE OPERATOR VIA THE DISPLAY
           C
           C INPUTS: NONE
           C OUTPUTS: NONE
           C CALLS: OUTDSP,FORMAT,INPCDU,PGETIT,PPUTIT,INPHEX
           C DESTROYS: NOTHING
           C MODIFIES: DOB,MEMORY
           C VERSION 1.0
           C
  2          IMPLICIT INTEGER*2 (A-Z)
           C
  3          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
  4          INTEGER*1 BITS(8)
           C
  5          LOGICAL*1 NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
           C
  6          CHARACTER*1 DSPCOD(10),DOB4
  7          CHARACTER*4 DOBC,DOBN,ERRMES(20),DBGMES(20),RUNMES(20)
           C
  8          COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
           C
  9          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
           C
 10          COMMON/WORK/ TEMPIO,DUMMY(19)
           C
 11          COMMON/MESTAB/ ERRMES,DBGMES,RUNMES,DSPCOD
           C
 12          SAVE /COMBUF/,/MESTAB/,/CPANEL/,/WORK/
           C
 13          EQUIVALENCE (TEMPIO,BITS(1))
 14          EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOBN)
 15          EQUIVALENCE (DOB(5),DOBX),(DOB4,DOB(4))
 16          EQUIVALENCE (DOB(2),DOBZ)
           C
           C*****************************************************************
           C
           C LOAD DOB WITH MEMORY DUMP MESSAGE
           C
 17          DOBC=DBGMES(9)
 18          DOBN=DBGMES(10)
           C MEMDUMP
           C
 19          CALL OUTDSP
           C
 20          CALL INPCDU
           C
           C LOAD DOB WITH MEMORY ADDRESS REQUEST
           C
 21     100  DOBC=DBGMES(20)
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
 22           DOBN=RUNMES(20)
              C ADR? ##
              C
 23           CALL OUTDSP
              C
              C INPUT HEX VALUE OF MEMORY BYTE TO DISPLAY
              C
 24           CALL INPHEX
              C
              C SAVE TEMPIO ADDRESS FOR AUTO INCREMENT
 25           TEMPIO=DUMMY(1)
              C VALUE PASSED IN TEMPIO+1 SLOT
 26     200   ADRSAV=TEMPIO
              C
              C CALL AGETIT TO RECOVER CONTENTS OF MEMORY REFERENCED IN TEMPIO
 27     210   CALL AGETIT(TEMPIO,DOBX)
              C
              C DOBX WILL HAVE TWO CONSECUTIVE BYTES,FORMAT AND DISPLAY
              C
 28           CALL FORMAT(DOBX)
 29           DOB(8)=DOB(6)
 30           DOB(7)=DOB(5)
 31           DOB(6)=#2DH
 32           DOBZ=TEMPIO
 33           CALL FORMAT(DOBZ)
              C
 34           CALL OUTDSP
              C
              C INPUT CONTROL VALUE FOR AUTO INCREMENT OR END
 35           CALL INPCOU
              C
              C IF AUTO INCREMENT RECOVER ADDRESS INC BY 1 AND LOOP
              C NXT KEY
 36           IF(NEXT) THEN
 37           TEMPIO=ADRSAV+1
 38           GO TO 200
 39           END IF
              C
              C ADJUST PRESSED, GET NEW VALUE
 40           IF(ADJUST) THEN
 41           DOBC=DBGMES(20)
 42           CALL INPHEX
              C DUMMY(1) = NEW BYTE
 43           TEMPIO=ADRSAV
 44           CALL APUTIT(TEMPIO)
 45           GO TO 210
 46           END IF
              C
              C ELSE RST , EXIT
 47           RETURN
 48           END
```

MODULE INFORMATION:

CODE AREA SIZE = 0004H 212D

```
VARIABLE AREA SIZE = 0002H      2D
MAXIMUM STACK SIZE = 000AH     10D
102 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT DEUGME

0 TOTAL PROGRAM ERROR(S)
END OF FORTRAN COMPILATION
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT PAUSE
OBJECT MODULE PLACED IN :F1:VCSIOU.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOU.FOR


  1           SUBROUTINE PAUSE
              C
              C PAUSE WAITS FOR THE USER TO PRESS ANY KEY ON THE INPUT C/D
              C
              C INPUTS: NONE
              C OUTPUTS: NONE
              C CALLS: INPCDU,OUTDSP
              C DESTROYS: NOTHING
              C MODIFIES: CPANEL
              C VERSION: 1.0
              C
  2           IMPLICIT INTEGER*2 (A-Z)
              C
  3           INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
  4           INTEGER*1 BITS(8),DUMMY(32)
              C
  5           LOGICAL*1 NEXT,ADJUST,RESET,AUTO,MANUAL,RUN,CALERT,PWRFAL
              C
  6           COMMON/CPANEL/ NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
              C
  7           COMMON/WORK/BITS,DUMMY
              C
  8           COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
              C
  9           SAVE /COMBUF/,/CPANEL/,/WORK/
              C
              C**************************************************************
              C
              C  XXXXXXX!
 10           DOB(8)=#21H
              C
 11           CALL OUTDSP
              C
 12     10    CONTINUE
              C
 13           CALL INPCDU
              C
 14           IF(RESET.OR.NEXT.OR.ADJUST) GO TO 500
              C
 15           GO TO 10
 16     500   CONTINUE
 17           RETURN
 18           END


MODULE INFORMATION:

     CODE AREA SIZE     = 001FH     31D
     VARIABLE AREA SIZE = 0000H      0D
     MAXIMUM STACK SIZE = 0002H      2D
```

43 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT PAUSE

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CLOCK
OBJECT MODULE PLACED IN :F1:VCSIOU.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOU.FOR


  1          SUBROUTINE CLOCK
             C
             C CLOCK SYNCRONIZES THE VCS TO THE TIMER UNIT
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION: 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 TFLAG(6)
             C
  4          COMMON/CLOCK/TFLAG
             C
  5          SAVE/CLOCK/
             C
             C*******************************************************************
             C
  6          I=0
             C TEST 1 SECOND FLAG BYTE FLAG FOR INTERRUPT PROCESS SYNC
  7     100  IF(TFLAG(3).NE.0) GO TO 200
  8          I=I+1
             C TIME OUT IF NO INTERRUPT
  9          IF(I.GE.20000) GO TO 200
 10          GO TO 100
 11     200  CONTINUE
 12          TFLAG(3)=0
             C
 13          RETURN
 14          END


MODULE INFORMATION:

   CODE AREA SIZE     = 0035H     53D
   VARIABLE AREA SIZE = 0062H     2D
   MAXIMUM STACK SIZE = 0002H     2D
   33 LINES READ

   0 PROGRAM ERROR(S) IN PROGRAM UNIT CLOCK
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT INPCDU
OBJECT MODULE PLACED IN :F1:VCSIOU.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSIOU.FOR

ORIGINAL PAGE IS
OF POOR QUALITY

```
  1          SUBROUTINE INPCDU
             C
             C INPCDU READS THE C/D PANEL AND RETURNS A LOGICAL ARRAY
             C
             C INPUTS: NONE
             C OUTPUTS: DATA IN /COMMON/
             C CALLS: AIOCDU
             C DESTROYS: NOTHING
             C MODIFIES: CONTROL WORDS
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 BITS(8),DUMMY(22)
             C
  4          LOGICAL*1 LBITS(8),NEXT,ADJUST,RESET,AUTO,MANUAL,RUN,CALERT,PWRFAL
             C
  5          COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
             C
  6          COMMON/WORK/BITS,DUMMY
             C
  7          COMMON/OPSVEC/OPMODE,MODECT,RNGMSK,ARRAY(7)
             C
  8          COMMON/ERRFLG/ ERROR(8)
             C
  9          SAVE /WORK/,/OPSVEC/,/ERRFLG/,/CPANEL/
             C
 10          EQUIVALENCE (LBITS(1),NEXT)
             C
             C*************************************************************
             C
             C BITS(1),NEXT,ACTIVE LOW,0
             C BITS(2),ADJUST,ACTIVE LOW,0
             C BITS(3),RUN/CAL  RUN ACTIVE HIGH,11111111B
             C                  CAL ACTIVE LOW,0
             C BITS(4),RESET,ACTIVE LOW,0
             C BITS(5),AUTO,ACTIVE LOW,0
             C BITS(6),MANUAL,ACTIVE HIGH,11111111B
             C BITS(7),POWER FAIL,ACTIVE HIGH,11111111B
             C
             C CLEAR WORK STORAGE AND READ C/D PANEL
             C
 11          DO 100 I=1,8
 12          BITS(I)=0
 13          LBITS(I)=.FALSE.
 14      100 CONTINUE
             C
 15          CALL AIOCDU(BITS(1))
             C
             C TEST INPUTS AND RESET STATUS WORDS AS APPROPRIATE
             C
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
16          IF(BITS(1).EQ.0) THEN
      C NEXT SWITCH PRESSED
17          NEXT=.TRUE.
18          END IF
      C
19          IF(BITS(2).EQ.0) THEN
      C ADJUST SWITCH PRESSED
20          ADJUST=.TRUE.
21          END IF
      C
22          IF(BITS(3).EQ.0) THEN
      C CALIBRATE MODE SWITCH SET
      C IF IN RUN MODE NOW, EXIT TO HALT
23          CALBRT=.TRUE.
      C IF IN AUTO OR MANUAL MODES
24          IF((OPMODE.EQ.1).OR.(OPMODE.EQ.4)) THEN
25          OPMODE=3
26          RETURN
27          END IF
      C
29          END IF
      C
29          IF(BITS(4).EQ.0) THEN
      C RESET SWITCH PRESSED
30          RESET=.TRUE.
31          END IF
      C
      C IF RUN SWITCH ON
      C
32          IF(BITS(3).NE.0) THEN
      C
33          RUN=.TRUE.
34          IF(BITS(5).EQ.0) THEN
      C AUTOMATIC MODE SWITCH PRESSED
35          AUTO=.TRUE.
36          OPMODE=1
      C RESET TIME OUT ON CONTROL
37          ZERO=0
38          CALL AIOVOT(ZERO)
39          END IF
      C
40          IF(BITS(6).NE.0) THEN
      C MODE = MANUAL DISABLE SYSTEM
41          MANUAL=.TRUE.
42          OPMODE=4
43          END IF
      C
44          END IF
      C
45          IF(BITS(7).NE.0) THEN
      C POWER FAILURE OR SHUT DOWN ON 39 VOLT CONTROL VOLTAGE
      C HALT SYSTEM
46          PWRFAL=.TRUE.
47          OPMODE=0
48          ERROR(2)=1
      C
49          END IF
```

```
      C
  50          RETURN
  51          END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
MODULE INFORMATION:

     CODE AREA SIZE     = 011CH    284D
     VARIABLE AREA SIZE = 0004H      4D
     MAXIMUM STACK SIZE = 0004H      4D
     111 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT INPCDU
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT INPHEX
OBJECT MODULE PLACED IN :F1:VCSIOU.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOU.FOR
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
  1          SUBROUTINE INPHEX
             C
             C INPHEX GETS A HEX NUMBER FROM THE C/D BY DYNAMIC PROMPTING
             C
             C INPUTS: NONE
             C OUTPUTS: HEX VALUE IN TEMPIO
             C CALLS: AIOCDU,OUTDSP,FORMAT
             C DESTROYS: NOTHING
             C MODIFIES: /WORK/,DOB
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 WORK(8),XDUM(8)
  4          INTEGER*1 CIB(80),TOB(128),PIB(2),POB(2),KIB(8),VOB(2)
             C
  5          DIMENSION DNUM(4)
             C
  6          CHARACTER*1 DOB(8)
             C
  7          COMMON/WORK/TEMPIO,DNUM,MAG,ICOL,ICNT,NUM,I,J,WORK,DUMMY(5)
             C
  8          COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  9          SAVE /COMBUF/,/WORK/
             C
 10          EQUIVALENCE (DOB(5),DOBX),(DOB(1),XDUM(1))
             C
             C**************************************************************
             C
             C INITIALIZE PARAMETERS AND CLEAR WORK AREA
             C
 11          DO 100 I=1,4
 12          DNUM(I)=0
 13     100  CONTINUE
             C
 14          DOBX=0
 15          MAG=1
 16          NUM=0
 17          ICOL=0
 18          ICNT=0
 19          GO TO 2150
             C
 20     1000 CONTINUE
 21          CALL AIOCDU (WORK(1))
             C
             C TEST IF RESET (ENTER) KEY PRESSED
             C
 22          IF(WORK(4).EQ.0) GO TO 3000
             C
             C TEST IF NEXT KEY PRESSED
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
 22           IF(WORK(1).EQ.0) THEN
 24            DNUM(ICOL+1)=ICNT
 25            ICOL=MOD(ICOL+1,4)
 26            ICNT=0
 27            MAG=16**ICOL
 28            GO TO 2000
 29           END IF
              C
              C TEST IF ADJUST KEY PRESSED
              C
 30           IF(WORK(2).EQ.0) THEN
 31            ICNT=MOD(ICNT+1,16)
 32           DNUM(ICOL+1)=ICNT
 33            GO TO 2000
 34           END IF
              C
              C BUILD VALUE FROM INPUTS
              C
 35     2000  DOBX=0
 36           J=1
 37           DO 2100 I=1,4
 38           DOBX=DOBX+DNUM(I)*J
 39           J=J*16
 40     2100  CONTINUE
 41     2150  CONTINUE
              C
 42           TEMPIO=DOBX
              C
 43           CALL FORMAT(DOBX)
              C
              C # IN UNSET DIGITS
 44           IF(ICOL.LT.3) THEN
 45            J=3-ICOL
 46            DO 2200 I=1,J
 47            %DUM(I+4)=#23H
 48     2200   CONTINUE
 49           END IF
 50           CALL OUTDSP
              C
 51           GO TO 1000
              C
 52     3000  CONTINUE
 53           DNUM(1)=TEMPIO
 54           TEMPIO=#FH
              C
 55           RETURN
 56           END
```

```
MODULE INFORMATION:

    CODE AREA SIZE     = 017DH    381D
    VARIABLE AREA SIZE = 0002H      2D
    MAXIMUM STACK SIZE = 0002H      2D
    98 LINES READ
```

FORTRAN COMPILER

0 PROGRAM ERROR(S) IN PROGRAM UNIT INPHEX

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT PROMPT
OBJECT MODULE PLACED IN :F1:VCSIOU.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOU.FOR
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
1           SUBROUTINE PROMPT
            C
            C   PT DISPLAYS A PROMPT IN LEDS AND INPUTS C/D
            C
            C INPUTS: NONE
            C OUTPUTS: NONE
            C CALLS: INPCDU,AIODSP
            C DESTROYS  NOTHING
            C MODIFIES: NOTHING
            C VERSION: 1.0
            C
2           INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
            C
3           COMMON/COMBUF/CIB,KIB,DOB,TOB,PIB,POB,VOB
            C
4           SAVE /COMBUF/
            C
            C**********************************************************
            C
5           CALL AIODSP(DOB(1))
            C
6           CALL INPCDU
            C
7           RETURN
8           END
```

```
MODULE INFORMATION:

    CODE AREA SIZE     = 000AH     10D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0002H      2D
    25 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT PROMPT

    0 TOTAL PROGRAM ERROR(S)
    END OF FORTRAN COMPILATION
```

FORTRAN COMPILER

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT CONFNC
OBJECT MODULE PLACED IN :F1:VCSCON.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSCON.FOR

ORIGINAL PAGE IS
OF POOR QUALITY

```
1           SUBROUTINE CONFNC
            C
            C CONFNC IS A TABLE DRIVEN ROUTINE WHICH IS USED TO CONVERT
            C       SENSOR DATA TO ENGINEERING UNITS AS A+B*X=Y
            C
            C INPUTS: SENSOR INDEX AND DATA
            C OUTPUTS: NONE
            C CALLS: RANGCK (OPTION)
            C DESTROYS: NOTHING
            C MODIFIES: TEMPIO
            C VERSION: 1.0
            C
2           IMPLICIT INTEGER*2 (A-Z)
            C
3           DIMENSION SENTAB(10,2),RGCDAT(10,2)
            C
4           COMMON/WORK/ TEMPIO,SINPNT,DUMMY(18)
            C
5           COMMON/CONTAB/SENTAB,RGCDAT
            C
6           COMMON/OPSVEC/ OPMODE,MODECT,RNGMSK,ARRAY(7)
            C
7           SAVE /CONTAB/,/OPSVEC/,/WORK/
            C
            C*****************************************************************
            C
            C CONVERT VALUE IN TEMPIO TO ENGINEERING UNITS Y = A+B*X
            C
8           TEMPIO=SENTAB(SINPNT,1)+TEMPIO*SENTAB(SINPNT,2)
            C
            C TEST IF RANGE CHECK NEEDED
            C
9           IF(RNGMSK.NE.0) THEN
10           CALL RANGCK
11          END IF
            C
12          RETURN
13          END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 003AH     58D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0004H      4D
    38 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT CONFNC
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT RANGCK
OBJECT MODULE PLACED IN :F1:VCSCON.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSCON.FOR


  1          SUBROUTINE RANGCK
             C
             C RANGCK TESTS CONVERTED SENSOR DATA AGAINST MAX AND MIN LIMITS
             C
             C INPUTS: INDEX POINTER,DATA
             C OUTPUTS: ERROR FLAG 1
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: SDB
             C VERSION: 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          DIMENSION RGCDAT(10,2),SENTAB(10,2)
             C
  4          COMMON/CONTAB/ SENTAB,RGCDAT
             C
  5          COMMON/ERRFLG/ ERROR(9)
             C
  6          COMMON/WORK/ TEMP10,SINPNT,DUMMY(18)
             C
  7          SAVE /WORK/,/CONTAB/,/ERRFLG/
             C
             C*************************************************************************
             C
             C TEST DATA AGAINST MAX AND PROCESS
             C
  8          IF(TEMP10.GT.RGCDAT(SINPNT,2)) THEN
  9           TEMP10=RGCDAT(SINPNT,2)
 10           ERROR(1)=SINPNT
 11           RETURN
 12          END IF
             C
             C TEST DATA AGAINST MINIMUM AND PROCESS
             C
 13          IF(TEMP10.LT.RGCDAT(SINPNT,1)) THEN
 14           TEMP10=RGCDAT(SINPNT,1)
 15           ERROR(1)=10+SINPNT
 16           RETURN
 17          END IF
             C
 18          RETURN
 19          END



MODULE INFORMATION:

    CODE AREA SIZE     = 0064H    100D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0002H      2D
```

43 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT RANGCK

0 TOTAL PROGRAM ERROR(S)
END OF FORTRAN COMPILATION

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT INPCID
OBJECT MODULE PLACED IN :F1:VCSINP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSINP.FOR


  1          SUBROUTINE INPCID
             C
             C INPCID INPUTS THE CID DATA VIA PORT 01, CONTROL VIA PORT 02
             C
             C INPUTS: NONE
             C OUTPUTS: CID DATA IN SIB
             C CALLS: @AIOCID
             C DESTROYS: NOTHING
             C MODIFIES: SIB
             C VERSION: 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          DIMENSION SIB(10),SDB(10)
             C
  4          COMMON/SENBUF/ SIB,SDB
             C
  5          COMMON/WORK/ TEMPIO,SINPNT,DUMMY(10)
             C
  6          SAVE /SENBUF/,/WORK/
             C
             C*******************************************************************
             C
             C SET SINPNT TO CID VALUE
             C
  7          SINPNT=6
             C
  8          CALL AIOCID (TEMPIO)
             C
  9          SIB(SINPNT)=TEMPIO
             C
 10          RETURN
 11          END


MODULE INFORMATION:

    CODE AREA SIZE     = 001EH     30D
    VARIABLE AREA SIZE = 0000H      0D
    MAXIMUM STACK SIZE = 0002H      2D
    32 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT INPCID
```

ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT INPPKS
OBJECT MODULE PLACED IN :F1:VCSINP.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSINP.FOR

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```
  1          SUBROUTINE INPPKS
             C
             C INPPKS INPUTS THE FRONT AND REAR PICK SIGNALS VIA PORTS 11,13/CNT 10,12
             C
             C INPUTS: NONE
             C OUTPUTS: PICK  DATA IN SIB
             C CALLS: INPUT (FORTRAN ROUTINE)
             C DESTROYS: NOTHING
             C MODIFIES: SIB
             C VERSION: 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 I
             C
  4          DIMENSION SIB(18),SDB(18)
             C
  5          COMMON/SENBUF/ SIB,SDB
             C
  6          COMMON/WORK/TEMPIO,SIMPNT,DUMMY(18)
             C
  7          SAVE /SENBUF/,/WORK/
             C
             C*************************************************************************
             C
  8          CALL INPUT(#10H,I)
             C INPUT PORT WITH 4 PICK BITS
             C
  9          I=I.AND.#0FH
             C
 10          SIB(7)=I.AND.#03H
             C
 11          SIB(8)=I.AND.#0CH
             C
 12          IF(SIB(7).GT.0) SIB(7)=1
             C
 13          IF(SIB(8).GT.0) SIB(8)=1
             C
 14          RETURN
 15          END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0048H     72D
    VARIABLE AREA SIZE = 0001H      1D
    MAXIMUM STACK SIZE = 0002H      2D
    40 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT INPPKS
```

0 TOTAL PROGRAM ERROR(S)
END OF FORTRAN COMPILATION

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ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT OUTCAS
OBJECT MODULE PLACED IN :F1:VCSIOZ.OBJ
COMPILER INVOKED BY: FORT80 :F1:VCSIOZ.FOR

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```
  1          SUBROUTINE OUTCAS
             C
             C OUTCAS OUTPUTS THE CASSETTE OUTPUT BUFFER TO THE DIGITAL CASSETTE
             C       VIA PORT 08,09,0A, CONTROL PORT 0B
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: AIOCAS
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2           IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2) VOB(2)
  4           INTEGER*1 DUMMY(2),IOFVEC(20),TFLAG(6),CASWRK(4)
             C
  5          LOGICAL*1 IOFCAS
             C
  6          COMMON/ERRFLG/ERROR(8)
             C
  7          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  8          COMMON/IOFVEC/IOFVEC
             C
  9          COMMON/OPSPNT/OPPNTS(8)
             C
 10          COMMON/CLOCK/TFLAG
             C
 11          DIMENSION CASDAT(10)
             C
 12          EQUIVALENCE (CASWRK(1),TEMPIO),(CASWRK(3),DUMMY(1))
 13          EQUIVALENCE (CASWRK(4),DUMMY(2))
 14          EQUIVALENCE (CASDAT(1),TOB(1))
 15          EQUIVALENCE (IOFCAS,IOFVEC(15))
             C
 16          SAVE /ERRFLG/,/OPSPNT/,/COMBUF/,/IOFVEC/,/CLOCK/
             C
             C*****************************************************************
             C
             C FORMAT OF CASSETTE CONTROL BUFFER
             C TO AIOCAS IO DRIVER
             C
             C CASWRK(4)  INTEGER*1
             C TEMPIO,DUMMY(1),DUMMY(2)
             C  DATA   CNTL     ERROR
             C  WORD   BYTE      BYTE
             C
             C CONTROL =1 WRITE; =2 FAST FORWARD
             C
             C ERROR =0 OK ; =1 EOT
```

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```
      C
      C OPPNTS(2) = POINTER TO ENTRY
      C OPPNTS(3) = NUMBER OF WORDS IN BLOCK
      C
      C**********
      C
 17         TFLAG(2)=0
 18         IF(IOFCAS) THEN
      C TEST IF END OF BLOCK 64 WORDS
 19         IF(OPPNTS(3).GE.64) GO TO 100
      C TEST IF DATA LEFT IN BUFFER
      C IF 0 DONE,SKIP ELSE WRITE DATA
 20         IF(OPPNTS(2).GT.0) THEN
      C
 21         DUMMY(1)=1
 22         DUMMY(2)=0
 23         TEMPIO=CASDAT(OPPNTS(2))
      C
      C CALL CASSETTE IO DRIVER ROUTINE
 24         CALL AIOCAS(TEMPIO)
      C
      C TEST IF ERROR CONDITION RETURNED BY AIOCAS
 25         IF(DUMMY(2).NE.0) ERROR(5)=DUMMY(2)
 26         OPPNTS(2)=OPPNTS(2)-1
 27         OPPNTS(3)=OPPNTS(3)+1
      C
 28         END IF
      C END SECOND IF ,(OPPNTS)
 29         END IF
      C END FIRST IF ,(IOFCAS)
 30         RETURN
      C
      C RESET POINTER FOR DATA BUFFER; WAIT ONE 100MSEC INTERRUPT
 31    100  OPPNTS(3)=0
 32         RETURN
 33         END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0074H    116D
    VARIABLE AREA SIZE = 0004H      4D
    MAXIMUM STACK SIZE = 0002H      2D
    97 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT OUTCAS
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT OUTDSP
OBJECT MODULE PLACED IN :F1:VCSIOZ.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOZ.FOR


  1          SUBROUTINE OUTDSP
             C
             C OUTDSP OUTPUTS THE DISPLAY BUFFER TO THE LED DISPLAY UNIT
             C
             C INPUTS: NONE
             C OUTPUTS: NONE
             C CALLS: AIODSP
             C DESTROYS: NOTHING
             C MODIFIES: NOTHING
             C VERSION 1.0
             C
  2          IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(9),TOB(129),PIB(2),POB(2),VOB(2)
             C
  4          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  5          SAVE /COMBUF/
             C
             C*************************************************************
             C
  6          CALL AIODSP(DOB(1))
             C
  7          RETURN
  8          END


MODULE INFORMATION:

     CODE AREA SIZE     = 0007H     7D
     VARIABLE AREA SIZE = 0000H     0D
     MAXIMUM STACK SIZE = 0002H     2D
     25 LINES READ

     0 PROGRAM ERROR(S) IN PROGRAM UNIT OUTDSP
```

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```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT SAVDAT
OBJECT MODULE PLACED IN :F1:VCSIOZ.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSIOZ.FOR


  1          SUBROUTINE SAVDAT
             C
             C SAVDAT LOADS DATA TO BE STORED ON CASSETTE INTO BUFFER
             C AND SETS UP POINTERS
             C
             C INPUTS: NONE
             C OUTPUTS: TAPE OUTPUT BUFFER AND POINTERS
             C CALLS: NOTHING
             C DESTROYS: NOTHING
             C MODIFIES: TOB,POINTERS
             C VERSION 1.0
             C    .
  2           IMPLICIT INTEGER*2 (A-Z)
             C
  3          INTEGER*1 CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
  4          INTEGER*1 TFLAG(6)
             C
  5          COMMON/CLOCK/TFLAG
             C
  6          COMMON/COMBUF/ CIB,KIB,DOB,TOB,PIB,POB,VOB
             C
  7          COMMON/SENBUF/ SIB(10),SDB(10)
             C
  8          COMMON/OPSPNT/OPPNTS(8)
             C
  9          COMMON/PARAMS/PARMS(20)
             C
 10          COMMON/OPSVEC/OPMODE,MODECT,ODUM(8)
             C
 11          DIMENSION CASDAT(10)
             C
 12          EQUIVALENCE (CASDAT(1),TOB(1)),(PARMS(17),ENDSTP)
             C
 13          SAVE /OPSPNT/,/PARAMS/,/OPSVEC/
 14          SAVE /COMBUF/,/SENBUF/,/OPSPNT/,/SENMEM/,/CLOCK/
             C
             C*************************************************************************
             C
 15          IF(OPPNTS(2).NE.0) GO TO 1000
             C
             C LOAD SENSOR DATA (5 WORDS) INTO BUFFER
 16          DO 100 I=2,6
 17          CASDAT(I)=SDB(I-1)
 18     100  CONTINUE
             C
             C FORM = 111111XXYYY111111 FOR MARKING RECORD
 19          CASDAT(1)=#0FC3FH
             C CLEAR CASDAT(1) AND PACK 4 NUMBERS (NIBBLES) INTO IT
             C
 20          IF(VOB(2).NE.0) CASDAT(1)=CASDAT(1).OR.#0040H
             C
```

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```
 21           IF(VOB(1).NE.0) CASDAT(1)=CASDAT(1).OR.#0080H
      C
 22           IF(SDB(3).NE.0) CASDAT(1)=CASDAT(1).OR.#0100H
      C
 23           IF(SDB(7).NE.0) CASDAT(1)=CASDAT(1).OR.#0200H
      C
      C FORM = 111100XXYY001111 FOR MSPKING RECORD
 24           IF(OPMODE.EQ.1) THEN
 25            TEMPX=#0200H
 26           ELSE
 27            TEMPX=#0100H
 28           END IF
      C
 29           IF(MODECT.EQ.1) THEN
 30            TEMPY=#0080H
 31           ELSE
 32            TEMPY=#0040H
 33           END IF
      C
 34           CASDAT(7)=#0F00FH+TEMPX+TEMPY
      C
 35           TFLAG(2)=0
      C
      C SET COUNTER FOR DATA WORDS TO WRITE
 36           OPPNTS(2)=7
      C
 37      1000  CONTINUE
      C
 38           RETURN
 39           END
```

MODULE INFORMATION:

```
    CODE AREA SIZE     = 0102H    258D
    VARIABLE AREA SIZE = 0006H      6D
    MAXIMUM STACK SIZE = 0002H      2D
    91 LINES READ

    0 PROGRAM ERROR(S) IN PROGRAM UNIT SAVDAT

    0 TOTAL PROGRAM ERROR(S)
    END OF FORTRAN COMPILATION
```

```
ISIS-II FORTRAN-80 V2.1 COMPILATION OF PROGRAM UNIT TAPITZ
OBJECT MODULE PLACED IN :F1:VCSTAP.OBJ
COMPILER INVOKED BY:  FORT80 :F1:VCSTAP.FOR


  1          SUBROUTINE TAPITZ
             C
             C TAPITZ WRITES THE TAPE HEADER
             C
  2          $INCLUDE(:F1:VCSMEM.FOR)
     =       C*****************************************************************
     =       C
     =       C VCS SYSTEM MEMORY ALLOCATION
     =       C
  3  =            IMPLICIT INTEGER*2(A-Z)
  4  =            INTEGER*1  CIB,KIB,DOB,TOB,PIB,POB,VOB
  5  =            INTEGER*1 PKFBUF,PKRBUF,PKFSAV,PKPSAV
  6  =            INTEGER*1 MMXIPX(6),TFLAG(6)
  7  =            INTEGER*1 ERRBUF(8,10)
     =       C
  8  =            LOGICAL*1 IOFVEC(20),CNTVEC(16),SINT(8),SMSK(8),DBGM(8)
  9  =            LOGICAL*1 DEFIOV(20),DEFCTV(16)
 10  =             LOGICAL*1 NEXT,ADJUST,RESET,RUN,CALERT,PWRFAL,AUTO,MANUAL
     =       C
 11  =            CHARACTER*4 PARMES,MOSMES(10)
 12  =            CHARACTER*1 DSPCOD(10)
 13  =            CHARACTER*4 DOBC,DOEN,OPSMES(10)
 14  =            CHARACTER*4 ERRMES(20),DBGMES(20),RUNMES(20)
     =       C
 15  =            DIMENSION DEFPRM(20),DEFPNT(8)
     =       C
     =       C COMMON BLOCK ALLOCATIONS
     =       C
 16  =            COMMON/CPANEL/NEXT,ADJUST,RESET,AUTO,MANUAL,PWRFAL,RUN,CALERT
     =       C
 17  =            COMMON/MESTB2/ PARMES(20)
     =       C
 18  =            COMMON/MESTB3/OPSMES
     =       C
 19  =            COMMON/MOSMES/MOSMES
     =       C
 20  =            COMMON/SENPNT/SENPTR(16)
     =       C
 21  =            COMMON/PIKBUF/PKFBUF(10),PKRBUF(10),PKFSAV,PKPSAV
     =       C
 22  =            COMMON/CLOCK/TFLAG
     =       C
 23  =            COMMON/DEBUG/DBGM
     =       C
 24  =            COMMON/SENDEL/LCDEL(40),PCDEL(60),FORDEL(400)
     =       C
 25  =            COMMON/IOFVEC/IOFVEC
     =       C
 26  =            COMMON/CNTVEC/CNTVEC
     =       C
 27  =            COMMON/OPSVEC/OPSVEC(10)
```

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```
    = C
 29 =       COMMON/OPPARM/ICMENT(10),NMAX(16),NMXIPX
    = C
 28 =       COMMON/SENMEM/LSTPAS(3000),DSCNTL(16)
    = C
 30 =       COMMON/OPSPNT/OPPNTS(8)
    = C
 31 =       COMMON/WORK/TEMPIO,DUMMY(19)
    = C
 32 =       COMMON/SAVER/SAVE(20)
    = C
 33 =       COMMON/PARAMS/ PARAM(20)
    = C
 34 =       COMMON/ERRBUF/ERRBUF
    = C
 35 =       COMMON/ERRFLG/ ERROR(8)
    = C
 36 =       COMMON/COMBUF/CIB(80),KIB(8),DOB(8),TOB(128),PIB(2),POB(2),VOB(2)
    = C
 37 =       COMMON/SENBUF/SIB(10),SDB(10)
    = C
 38 =       COMMON/CONTAB/SENTAB(10,2),RECDAT(10,2)
    = C
 39 =       COMMON/MESTAB/ERRMES,DBGMES,RUNMES,DSPCCD
    = C
 40 =       COMMON/DEFALT/ DEFIOV,DEFPRM,DEFCTV,DEFPNT
    = C
 41 =       COMMON/DEFTAB/ DEFRNG(10,2),DEFCON(10,2)
    = C
 42 =       COMMON/DEFOPS/DEFOPS(10)
    = C
 43 =       COMMON/DEFMOS/DEFMOS(16)
    = C
 44 =       SAVE /CPANEL/,/PIKBUF/,/SAVER/,/ERRBUF/,/SENDEL/
 45 =       SAVE /DEBUG/,/IOFVEC/,/CNTVEC/,/OPSVEC/
 46 =       SAVE /OPPARM/,/SENMEM/,/OPSPNT/,/CLOCK/,/WORK/,/DEFTAB/
 47 =       SAVE /PARAMS/,/ERRFLG/,/COMBUF/,/SENBUF/,/CONTAB/,/MESTAB/,/DEFALT/
 48 =       SAVE /SENPNT/,/MESTB2/,/MESTB3/,/DEFOPS/
 49 =       SAVE /DEFMOS/
    = C
 50 =       EQUIVALENCE (DOB(1),DOBC),(DOB(5),DOEN)
 51 =       EQUIVALENCE (OPSVEC(1),OPMODE),(OPSVEC(2),MODECT),(OPSVEC(3),ENGMEM)
 52 =       EQUIVALENCE (OPSVEC(4),OPSENR),(OPSVEC(5),PATECK)
 53 =       EQUIVALENCE (OPSVEC(6),STATUS),(TIME,TFLAG(4))
    = C
      C
 54          INTEGER*1 CNTL(4)
      C
 55          DIMENSION CASWRK(8)
      C
 56           EQUIVALENCE(CNTVEC(1),CASWRK(1))
 57          EQUIVALENCE (CNTL(1),DUMMY(1))
      C
      C*******************************************************************
      C
      C IF CASSETTE ON,WRITE HEADER FILE
      C
```

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```
 58           DOBN=D2GMES(19)
 59           CALL OUTDSP
              C WRITE FILE GAP TO START
 60           CRLF=#0A6DH
 61           CNTL(2)=0
 62           CNTL(1)=1
              C WRITE A CARRIAGE RETURN LINE FEED
 63           TEMPIO=CRLF
 64           CALL AIOCAS(TEMPIO)
 65           CALL MSEC2H
              C
              C WRITE F6C5H PATTERN
 66           TEMPIO=#0F6C5H
 67           DO 1800 I=1,20
 68           CALL AIOCAS(TEMPIO)
 69           CALL MSEC2H
 70      1800 CONTINUE
              C
 71           TEMPIO=CRLF
 72           CALL AIOCAS(TEMPIO)
 73           CALL MSEC2H
              C
              C WRITE 20 WORDS THEN CR/LF
 74           DO 2000 I=1,20
 75           TEMPIO=PARAM(I)
 76           CALL AIOCAS(TEMPIO)
 77           CALL MSEC2H
 78      2000 CONTINUE
              C
 79           TEMPIO=CRLF
 80           CALL AIOCAS(TEMPIO)
 81           CALL MSEC2H
              C WRITE OPERATION PARAMS
 82           DO 1900 I=1,10
 83           TEMPIO=OPSVEC(I)
 84           CALL AIOCAS(TEMPIO)
 85           CALL MSEC2H
 86      1900 CONTINUE
              C
 87           DO 1950 I=1,10
 88           TEMPIO=CASWRK(I)
 89           CALL AIOCAS(TEMPIO)
 90           CALL MSEC2H
 91      1950 CONTINUE
              C
 92           TEMPIO=CRLF
 93           CALL AIOCAS(TEMPIO)
 94           CALL MSEC2H
              C
 95           RETURN
 96           END
```

MODULE INFORMATION:

CODE AREA SIZE = 012AH 2980

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```
VARIABLE AREA SIZE = 0014H      20D
MAXIMUM STACK SIZE = 000AH      10D
159 LINES READ

0 PROGRAM ERROR(S) IN PROGRAM UNIT TAPITZ

0 TOTAL PROGRAM ERROR(S)
END OF FORTRAN COMPILATION
```

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```
ASM80 :F1:VCSUTL.ASM MACROFILE MOD85

ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        VCSUTL   PAGE   1


 LOC  OBJ        LINE       SOURCE STATEMENT

                   1 ;
                   2  NAME VCSUTL
                   3 ;
                   4  PUBLIC FORMAT,AIODSP,APUTIT
                   5 ;
                   6  EXTRN HEXASC,OUTPT
                   7 ;
                   8  CSEG
                   9 ;
                  10 ;*****************************************************************
                  11 ;
                  12 ; SUBROUTINE AIODSP
                  13 ;
                  14 ;  AIODSP IS THE DISPLAY DRIVER INTERFACE FOR THE VCS
                  15 ;
                  16 ;
                  17 ; INPUTS: ADDRESS OF DOB(1) IN BC PAIR
                  18 ; OUTPUTS: NONE
                  19 ; CALLS: MONITR:OUTPT
                  20 ; DESTROYS: F/F'S
                  21 ; MODIFIES: NOTHING
                  22 ; VERSION 1.0
                  23 ;
                  24 AIODSP:
0000 C5           25  PUSH B ; GET BC ONTO STACK
0001 E1           26  POP H ; POP IT INTO HL PAIR FOR MEMORY REFERENCE
0002 0E08         27  MVI C,08H ; SET CHARACTER COUNT OF 9 IN C
0004 CD0000   E   28  CALL OUTPT ; CALL DISPLAY DRIVER IN MONITOR
0007 C1           29  POP B ; RECOVER BC PAIR
0008 C9           30  RET ; RETURN TO FORTRAN CALLING ROUTINE
                  31 ;
                  32 ;*****************************************************************
                  33 ;
                  34 ; SUBROUTINE FORMAT
                  35 ;
                  36 ; FORMAT TURNS 2 HEX BYTES IN DOB(5,6) INTO ASCII IN DOB(5,6,7,8)
                  37 ;
                  38 ; INPUTS: ADDRESS OF DOB(5) IN BC PAIR
                  39 ; OUTPUTS: ASCII CODE IN DOB(5,6,7,8)
                  40 ; CALLS: MONITR:HEXASC
                  41 ; DESTROYS: A,F/F'S,H,L
                  42 ; MODIFIES: NOTHING
                  43 ; VERSION: 1.0
                  44 ;
                  45 FORMAT:
0009 C5           46  PUSH B ; PUSH BC ONTO STACK
000A E1           47  POP H ; POP ADDRESS INTO HL PAIR
000B 23           48  INX H ; SET HL TO POINT TO DOB(8)
000C 23           49  INX H
000D 23           50  INX H
000E C5           51  PUSH B ; SAVE BC ADDRESS OF DOB(5) ONTO STACK
000F CD1900   C   52  CALL FORM85 ; CALL DECODING ROUTINE
0012 C1           53  POP B ; GET BACK POINTER TO DOB(5)
0013 03           54  INX B ; SET BC TO SECOND BYTE
```

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```
 LOC  OBJ        LINE       SOURCE STATEMENT

 0014 2B           55  DCX H ; MOVE HL -1 TO DOB(3)
 0015 CD1900   C   56  CALL FORM05 ; CALL DECODING ROUTINE
 0018 C9           57  RET ; RETURN TO FORTRAN
                   58 ;
                   59 FORM05:
 0019 0A           60  LDAX B ; GET # (BC)
 001A 57           61  MOV D,A ; SAVE IN D
 001B E60F         62  ANI 0FH ; KEEP LOWER NIBBLE
 001D CD0000   E   63  CALL HEXASC ; CALL MONITOR HEX TO ASCII
 0020 77           64  MOV M,A ; STORE ASCII INTO DOB
 0021 2B           65  DCX H ; MOVE HL -1 IN DOB
 0022 7A           66  MOV A,D ; GET FROM D
 0023 0F           67  RRC
 0024 0F           68  RRC ; KEEP UPPER NIBBLE
 0025 0F           69  RRC
 0026 0F           70  RRC
 0027 CD0000   E   71  CALL HEXASC ; CALL MONITOR HEX TO ASCII ROUTINE
 002A 77           72  MOV M,A ; STORE ASCII (HL)
 002B C9           73  RET ; RETURN TO FORMAT CALL
                   74 ;
                   75 ;*****************************************************************
                   76 ;
                   77 ; SUBROUTINE APUTIT
                   78 ;
                   79 ;  APUTIT PUTS A BYTE INTO MEMORY FROM FORTRAN (POKE)
                   80 ;
                   81 ; INPUTS: BC -> TEMP10=ADDR,BYTE
                   82 ; OUTPUTS: NONE
                   83 ; CALLS: NOTHING
                   84 ; DESTROYS: A,F/F'S,BC
                   85 ; MODIFIES: MEMORY AT ADDR
                   86 ; VERSION: 1.0
                   87 ;
                   88 APUTIT:
 002C 0A           89  LDAX B  ; GET ADDR LSB
 002D 6F           90  MOV L,A
 002E 03           91  INX B  ; POINT TO MSB
 002F 0A           92  LDAX B  ; GET MSB
 0030 67           93  MOV H,A
                   94 ; HL -> MEMORY PATCH ADDR
 0031 03           95  INX B  ; BC -> BYTE
 0032 0A           96  LDAX B  ; ACC = BYTE
 0033 77           97  MOV M,A  ; SET BYTE IN RAM
 0034 C9           98  RET
                   99 ;
                  100  END


PUBLIC SYMBOLS
AIODSP C 0000    APUTIT C 002C    FORMAT C 0009

EXTERNAL SYMBOLS
HEXASC E 0000    OUTPT  E 0000

USER SYMBOLS
```

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ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        VCEUTL  PAGE   2

AIODSP C 0000   APUTIT C 002C   FORM05 C 0019   FORMAT C 0009   HEXASC E 0000   OUTPT  E 0000

ASSEMBLY COMPLETE,  NO ERRORS
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ASM80 :F1:VCS10X.ASM MACROFILE MOD85

ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        AIOIOX   PAGE   1


 LOC  OBJ        LINE       SOURCE STATEMENT

                   1 ;
                   2  NAME AIOIOX
                   3 ;
                   4  PUBLIC AIOCID,AIOVOT ,AIOCRS
                   5 ;
                   6  EXTRN MSEC2H
                   7 ;
                   8  CSEG
                   9 ;
                  10 ;*****************************************************************
                  11 ;
                  12 ; SUBROUTINE AIOCID
                  13 ;
                  14 ;  AIOCID IS THE INPUT DRIVER FOR THE CID UNIT
                  15 ;
                  16 ; INPUTS: ADDRESS OF TEMPIO IN BC
                  17 ; OUTPUTS: CID DATA IN TEMPIO
                  18 ; CALLS: NOTHING
                  19 ; DESTROYS: A,F/F'S
                  20 ; MODIFIES: TEMPIO
                  21 ; VERSION 1.0
                  22 ;
                  23 AIOCID:
                  24 ; GET ADDR BC - TEMPIO
 0000 69          25  MOV L,C
 0001 60          26  MOV H,B
 0002 D833        27  IN 033H  ; LATCH COUNT
 0004 D832        28  IN 032H  ; RESET TO START COUNT
 0006 D831        29  IN 031H  ; INPUT MSB
 0008 47          30  MOV B,A  ; PUT MSB INTO B
 0009 D830        31  IN 030H  ; GET LSB
 000B 4F          32  MOV C,A  ; PUT INTO C
                  33 ; HL NOW POINTS TO TEMPIO FOR STORE
 000C 71          34  MOV M,C  ; PUT LSB AT TEMPIO
 000D 23          35  INX H  ; HL=HL+1
 000E 70          36  MOV M,B  ; PUT MSB AT TEMPIO +1
                  37 ;
 000F C9          38  RET ; RETURN TO FORTRAN
                  39 ;
                  40 ;*****************************************************************
                  41 ;
                  42 ; SUBROUTINE AIOVOT
                  43 ;
                  44 ;  AIOVOT IS THE VALVE DRIVER IO ROUTINE
                  45 ;
                  46 ; INPUTS: ADDRESS OF CBYTE IN BC
                  47 ; OUTPUTS: VALVE CONTROL BITS TO PORT 3,RESET+LEDS
                  48 ; CALLS: NOTHING
                  49 ; DESTROYS: A,F/F'S
                  50 ; MODIFIES: TEMPIO
                  51 ; VERSION 1.0
                  52 ;
                  53 AIOVOT:
 0010 3E0F        54  MVI A,0FH  ; CLEAR ACC - OUTPUT = 00001111
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

0012 D306         55  OUT 06  ; SEND TO CLEAR PORT BITS
0014 C5           56  PUSH B  ; WASTE TIME
0015 C1           57  POP B
0016 3E2F         58  MVI A,02FH  ; LOAD 1 BIT TO RESET LINE FOR ONE SHOT
0018 D306         59  OUT 06  ; SEND BIT TO UNIT - OUTPUT 00101111
001A C5           60  PUSH B  ; WASTE TIME
001B C1           61  POP B
001C 3E0F         62  MVI A,0FH  ; SEND 00001111
001E D306         63  OUT 06
0020 C5           64  PUSH B  ; WASTE TIME
0021 C1           65  POP B
0022 3E1F         66  MVI A,01FH  ; LOAD TRIGGER BIT
0024 D306         67  OUT 06  ; SEND 00011111
0026 C5           68  PUSH B  ; WASTE TIME
0027 C1           69  POP B
0028 3E0F         70  MVI A,0FH  ; CLEAR BITS
002A D306         71  OUT 06  ; SEND 00001111
                  72 ;
002C 0A           73  LDAX B  ; GET CBYTE FOR OUTPUT
002D E60F         74  ANI 0FH  ; KEEP LOW NIBBLE
002F D303         75  OUT 03  ; TRANSMITT TO VALVE DRIVER
                  76 ;
0031 C9           77  RET ; RETURN TO FORTRAN
                  78 ;
                  79 ;*****************************************************************
                  80 ;
                  81 ; SUBROUTINE AIOCAS
                  82 ;
                  83 ;  AIOCAS IS THE CASSETTE OUTPUT DRIVER ROUTINE
                  84 ;
                  85 ; INPUTS: ADDRESS OF TEMPIO IN BC
                  86 ; OUTPUTS: DATA TO CASSETTE
                  87 ; CALLS: NOTHING
                  88 ; DESTROYS: A,F/F'S,B,C,D,E
                  89 ; MODIFIES: NOTHING
                  90 ; VERSION 1.0
                  91 ;
                  92 ; USE FROM FORTRAN CALL:
                  93 ;
                  94 ; CALL AIOCAS (TEMPIO)
                  95 ;
                  96 ; TEMPIO = 16 BIT DATA WORD
                  97 ; TEMPIO+1 = CONTROL FLAG BYTE
                  98 ; TEMPIO+2 = ERROR FLAG BYTE
                  99 ;
0000             100 CSCNTL EQU 0H ; NULL CONTROL BYTE
0001             101 COK EQU 1H ; CASSETTE OK STATUS
0000             102 CBEOT EQU 0H ; CASSETTE BEOT STATUS
0009             103 COUTM EQU 09H ; MSB OUTPUT PORT
0008             104 COUTL EQU 08H ; LSB OUTPUT PORT
000B             105 CSTAT EQU 0BH ; STATUS PORT
000A             106 CCNTL EQU 0AH ; CONTROL PORT
0001             107 CWCNTL EQU 1H ; WRITE CONTROL BYTE
0002             108 CFCNTL EQU 2H ; FORWARD CONTROL BYTE
                 109 ;
```

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LOC  OBJ        LINE       SOURCE STATEMENT

                  110 ; STATUS BYTE D0 = NOT.BEOT,D1 - D7 SPARES
                  111 AIOCAS:
                  112 ; BC POINTS TO TEMPIO ADDRESS
0032 0A           113  LDAX B ; GET LSB OF DATA
0033 5F           114  MOV E,A ; PUT IT IN E
0034 C5           115  PUSH B ; SAVE BC ON STACK
0035 03           116  INX B ; INCREMENT BC TO MSB
0036 0A           117  LDAX B ; GET MSB INTO ACC
0037 57           118  MOV D,A ; PUT IT IN D
                  119 ; DE HOLDS DATA (TEMPIO)
0038 03           120  INX B ; POINT TO CONTROL BYTE
0039 0A           121  LDAX B  ; GET CONTROL BYTE
003A 03           122  INX B ; POINT BC TO ERROR FLAG BYTE
                  123 ;
                  124 ; TEST INPUT CONTROL BYTE FOR FUNCTION
003B FE01         125  CPI 01H ; TEST IF CONTROL = 1
003D CA4A00   C   126  JZ CWRITE ; IF EQUAL GO TO WRITE
0040 FE02         127  CPI 02H ; TEST IF CONTROL = 2
0042 CA6C00   C   128  JZ CFRWRD ; IF EQUAL GO TO FORWARD
0045 3E02         129  MVI A,02H  ; SET ERROR = 2 FOR ILLEGAL COMMAND
0047 C38900   C   130  JMP CEXIT ; UNDEFINED OPERATION , EXIT
                  131 ;
                  132 CWRITE:
004A DB08         133  IN CSTAT ; READ STATUS WORD
004C E601         134  ANI 01H  ; KILL ALL BUT BEOT BIT
004E FE01         135  CPI COK ; TEST IF STATUS OK
0050 C25300   C   136  JNZ CERROR ; IF ERROR GO TO PROCESS
0053 7B           137  MOV A,E ; GET LSB INTO ACC
0054 D300         138  OUT COUTL ; SEND BYTE TO PORT
0056 7A           139  MOV A,D ; GET MSB INTO ACC
0057 D309         140  OUT COUTM ; OUTPUT BYTE TO PORT
0059 3E01         141  MVI A,CWCNTL ; GET WRITE CONTROL BYTE
005B D30A         142  OUT CCNTL ; SEND TO CONTROL PORT
                  143 ; HOLD START PULSE FOR 10 USEC (MIN)
005D 3E05         144  MVI A,05H ; SET COUNT IN ACC
005F 3D           145 CLOOP: DCR A ; DECREMENT COUNTER
0060 C25F00   C   146  JNZ CLOOP ; IF NOT ZERO LOOP
0063 3E00         147  MVI A,CSCNTL ; SEND NULL CODE TO CASSETTE
0065 D30A         148  OUT CCNTL ; SEND TO CONTROL PORT
0067 3E00         149  MVI A,0 ; LOAD ZERO FOR ERROR FLAG
0069 C38900   C   150  JMP CEXIT
                  151 ;
                  152 CFRWRD:
006C DB08         153  IN CSTAT ; TEST STATUS
006E E601         154  ANI 01H ; KEEP BEOT BIT
0070 FE00         155  CPI CBEOT ; TEST IF B OR E OF TAPE FLAG
0072 CA8300   C   156  JZ CERROR  ; IF BEOT LOW ERROR
0075 3E02         157  MVI A,CFCNTL  ; LOAD FFWRD BYTE
0077 D30A         158  OUT CCNTL
0079 CD0000   E   159  CALL MSEC2H
007C 3E00         160  MVI A,0
007E D30A         161  OUT CCNTL
0080 C38900   C   162  JMP CEXIT
                  163 ;
                  164 CERROR:
```

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ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        AIOIOX   PAGE   4


 LOC  OBJ        LINE       SOURCE STATEMENT

 0083 3E00        155  MVI A,CSCNTL  ; STOP BYTE
 0085 D30A        166  OUT CCNTL
 0087 3E01        167  MVI A,01  ; SET ERROR FLAG EEOT
                  168 CEXIT:
 0089 02          169  STAX B  ; STORE ERROR BYTE IN MEMORY LOCATION (BC)
 008A C1          170  POP B ; SET BC BACK AS IN CALL
 008B C9          171  RET ; RETURN TO FORTRAN
                  172 ;
                  173  END


PUBLIC SYMBOLS
AIOCAS C 0032   AIOCID C 0000   AIOVOT C 0010

EXTERNAL SYMBOLS
MSEC2H E 0000

USER SYMBOLS
AIOCAS C 0032   AIOCID C 0000   AIOVOT C 0010   CEEOT  A 0000   CCNTL  A 000A   CEFROR C 0033   CEXIT  C 0089
CFCNTL A 0002   CFRNRD C 006C   CLOOP  C 005F   CMK    A 0001   COUTL  A 0009   COUTM  A 0004   CSCNTL A 0000
CSTAT  A 000B   CWCNTL A 0001   CWRITE C 004A   MSEC2H E 0000

ASSEMBLY COMPLETE,  NO ERRORS
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```
-ASM80 -F1:VCS100.ASM MACROFILE M0085

ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        VCS100   PAGE    1


  LOC  OBJ        LINE       SOURCE STATEMENT

                     1 ;
                     2  NAME VCS100
                     3 ;
                     4  PUBLIC AIOITZ,AIOADC,AGETIT,AIOCOU,CLKITZ,ADCITZ
                     5 ;
                     6  EXTRN MSEC2H  ; CALL TO MONITOR WAIT 200 M SEC
                     7 ;
                     8  CSEG
                     9 ;
                    10 ;*************************************************************************
                    11 ;
                    12 ; SUBROUTINE AIOADC (I,J)
                    13 ;
                    14 ; AIOADC IS THE A/D CONVERTER I/O DRIVER ROUTINE
                    15 ;
                    16 ; INPUTS: BC,DE ADDRESS POINTERS
                    17 ; OUTPUTS: DATA IN (DE)
                    18 ; CALLS: NOTHING
                    19 ; DESTROYS: A,F,F'S
                    20 ; MODIFIES: WORK
                    21 ; VERSION: 1.0
                    22 ;
                    23 AIOADC:  ; (SINPNT,TEMPIO)
                    24 ;
                    25 ; BC POINTS TO SINPNT - CHANNEL #,DE POINTS TO STORAGE LOCATION
                    26 ;
  0000 C5           27  PUSH B ; SAVE BC ON STACK
  0001 D5           28  PUSH D ; SAVE DE ON STACK
  0002 0A           29  LDAX B ; GET VALUE OF SINPNT INTO A
  0003 3D           30  DCR A  ; SET POINTER -1 TO 0-7 FROM 1-8
  0004 F3           31  DI  ; DISABLE INTERRUPTS
  0005 260A         32  MVI H,0AH  ; SET UP TIME OUT COUNTER
  0007 D380         33  OUT MPXOTR ; SEND CHAN SELECT TO MPX OUTPUT REGISTER
  0009 CD2600   C   34  CALL WAIT50
                    35 ADC05:
  000C 25           36  DCR H  ; DECREMENT COUNT
  000D CA1700   C   37  JZ ADCGO  ; IF TIME OUT EXIT LOOP
  0010 DB81         38  IN MPXSIP ; SAMPLE A/D DONE
  0012 E680         39  ANI 80H ; TEST MSB
  0014 CA0C00   C   40  JZ ADC05 ; IF NOT READY LOOP
  0017 DB84         41 ADCGO:  IN MPXDA1 ; GET M.S.BYTE
  0019 E60F         42  ANI 0FH ; KEEP 12 BITS
  001B 47           43  MOV B,A ; SAVE IN B REG
  001C DB85         44  IN MPXDA2 ; GET L.S. BYTE
  001E 12           45  STAX D ; STORE AT TEMPIO LSB
  001F FB           46  EI  ; REENABLE INTERRUPTS
  0020 78           47  MOV A,B ; GET M.S.BYTE INTO A
  0021 13           48  INX D ; SET POINTER TO MSB OF TEMPIO
  0022 12           49  STAX D ; STORE AT TEMPIO MSB
  0023 D1           50  POP D ; RESTORE DE
  0024 C1           51  POP B ; RESTORE BC
  0025 C9           52  RET ; RETURN TO FORTRAN
                    53 ;
                    54 ; DELAY ROUTINE
```


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LOC  OBJ        LINE       SOURCE STATEMENT

0026 060A         55 WAIT50: MVI B,0AH ; LOAD COUNT FOR 50 USEC DELAY
0028 05           56 WAITDC: DCR B
0029 C22800   C   57  JNZ WAITDC
002C C9           58  RET
                  59 ;
0084              60 MPXDA1 EQU 84H ; MPX DATA 1
0085              61 MPXDA2 EQU 85H ; MPX DATA 2 HEX 85 PORT
0080              62 MPXOTR EQU 80H ; MPX OUTPUT REGISTER HEX 80 PORT
0081              63 MPXSIP EQU 81H ; MPX STATUS INPUT REGISTER HEX 81 PORT
                  64 ;
                  65 ;*****************************************************************
                  66 ;
                  67 ; SUBROUTINE AGETIT (I,J)
                  68 ;
                  69 ; AGETIT TAKES THE HEX ADDRESS OF TEMP10 IN BC AND
                  70 ;       LOADS THE VALUE AND PUTS IT IN (DE)
                  71 ;
                  72 ; INPUTS: BC,DE
                  73 ; OUTPUTS: HEX VALUE IN J AT (DE)
                  74 ; CALLS: NOTHING
                  75 ; DESTROYS: A,F/F'S
                  76 ; MODIFIES: TEMP10
                  77 ; VERSION: 1.0
                  78 ;
                  79 AGETIT:
002D 0A           80  LDAX B ; LOAD A WITH (BC)
002E 6F           81  MOV L,A ; STORE LSB IN L FOR MEM REF
002F 03           82  INX B ; INCREMENT BC
0030 0A           83  LDAX B ; LOAD A WITH (BC)
0031 67           84  MOV H,A ; STORE IN H MSB FOR POINT TO SINPNT
                  85 ;          HL IS ADDRESS TO GET FOR DISPLAY
0032 7E           86  MOV A,M ; LOAD A WITH DATA 1
0033 13           87  INX D ; POINT DE TO DOB(6) FOR FORMAT PACK REVERSE
0034 12           88  STAX D ; STORE DATA AT (DE)
0035 1B           89  DCX D ; DECREMENT DC TO DOB(5) FOR NEXT BYTE
0036 23           90  INX H ; INCREMENT HL
0037 7E           91  MOV A,M ; LOAD A WITH DATA 2
0038 12           92  STAX D ; STORE AT (DE)
0039 C9           93  RET ; RETURN TO FORTRAN
                  94 ;
                  95 ;*****************************************************************
                  96 ;
                  97 ; SUBROUTINE AIOITZ
                  98 ;
                  99 ; AIOITZ INITIALIZES THE I/O INTERFACES
                 100 ;
                 101 ; INPUTS: NONE
                 102 ; OUTPUTS: NONE
                 103 ; CALLS: NOTHING
                 104 ; DESTROYS: A,F/F'S,BC,DE,HL
                 105 ; MODIFIES: NOTHING
                 106 ; VERSION: 1.0
                 107 ;
                 109 AIOITZ:
003A F3          109  DI ; DISABLE INTERRUPTS
```

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```
LOC  OBJ        LINE      SOURCE STATEMENT

                  110 ;
0028 3E00         111  MVI A,0  ; LOAD A REG WITH 0
002D D307         112  OUT 07  ; PANEL
002F D308         113  OUT 08  ; CASSETTE
0041 D309         114  OUT 09  ; CASSETTE
0043 D30A         115  OUT 0AH ; CASSETTE
0045 3EFF         116  MVI A,0FFH  ; LOAD ALL ONES (NEGATIVE LOGIC)
0047 D303         117  OUT 03  ; ARM VALVES
0049 3EF0         118  MVI A,0F0H  ; SEND 00001111
004B D306         119  OUT 06  ; PANEL
                  120 ;
                  121 ; CALL A/D INITIALIZE
0040 CD5A00   C   122  CALL ADCITZ
                  123 ;
                  124 ; CALL CLOCK INITIALIZE
0050 CD6F00   C   125  CALL CLKITZ
                  126 ;
                  127 ; SET UP NBS
0053 0B35         128  IN 035H  ; SET NBS TO DIS COUNT
0055 DB33         129  IN 033H  ; LATCH DATA
0057 DB32         130  IN 032H  ; RESET SYSTEM
                  131 ;
0059 C9           132  RET  ; RETURN
                  133 ;
                  134 ;*************************************************
                  135 ;
                  136 ; SUBROUTINE ADCITZ
                  137 ;
                  138 ; ADCITZ INITIALIZES THE DATA TRANSLATION A/D
                  139 ;
                  140 ADCITZ:  ; ENTRY POINT
                  141 ;
005A 3E0F         142  MVI A,0FH ; LOAD PORT A MODE 0
005C D382         143  OUT MPXOCP ; MULTIPLEXOR OUTPUT CONTROL PORT
005E 3E07         144  MVI A,07H ; DISABLE INTERRUPT
0060 D382         145  OUT MPXOCP ; MUX OUT CONTROL PORT
0062 3ECF         146  MVI A,0CFH ; LOAD PORT B MODE 3
0064 D383         147  OUT MPXSCP ; MULTIPLEXOR STATUS CONTROL PORT
0066 3EFF         148  MVI A,0FFH  ; SET FOR INPUT BITS
0068 D383         149  OUT MPXSCP ;
006A 3E07         150  MVI A ,07H ; DISABLE INTERRUPTS
006C D382         151  OUT MPXSCP
006E C9           152  RET  ; RETURN
                  153 ;
0083              154 MPXSCP EQU 083H ; 83 HEX FOR MPX STAT CONTROL PORT
0082              155 MPXOCP EQU 082H ; 82 HEX FOR MPX OUT CONTROL PORT
                  156 ;
                  157 ;*************************************************
                  158 ;
                  159 ; SUBROUTINE CLKITZ
                  160 ;
                  161 ; CLKITZ INITIALIZES THE TIMER UNITS FOR NORMAL OPERATION
                  162 ;
0023              163 CLKCNT EQU 023H ; CLOCK CONTROL PORT
                  164 ;
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

006F 3E00        165 CLKITZ: MVI A,0 ; CLEAR ACC
0071 D325        166  OUT 25H ; STOP TIMER GATE 0,1,2
                 167 ; INITIALIZE TIMER 0 TO 1 MSEC
0073 3E34        168  MVI A,34H  ; 00110100 CTL 0,L-M,MODE 2,BIN C4H
0075 D323        169  OUT CLKCNT  ; CONTROL PORT
0077 3E71        170  MVI A,71H  ; LSB OF 0271H
0079 D320        171  OUT 20H  ; COUNTER PORT 0
007B 3E02        172  MVI A,02H  ; MSB OF 0271H
007D D320        173  OUT 20H  ; COUNTER PORT 0
                 174 ; INITIALIZE TIMER 1 TO 100 MSEC
007F 3E74        175  MVI A,74H  ; 01110100 CTL 1,L-M,MODE 2,BIN 74H
0081 D323        176  OUT CLKCNT  ; CONTROL PORT
0083 3E64        177  MVI A,064H  ; LSB OF 0064H
0085 D321        178  OUT 21H  ; COUNTER PORT 1
0087 3E00        179  MVI A,00H  ; MSB OF 0064H
0089 D321        180  OUT 21H  ; COUNTER PORT 1
                 181 ; INITIALIZE TIMER 2 TO 1 SEC
008B 3EB4        182  MVI A,0B4H  ; 10110100 CTL 2,L-M,MODE 2,BIN B4H
008D D323        183  OUT CLKCNT  ; CONTROL PORT
008F 3EE8        184  MVI A,0E8H  ; LSB OF 03E8H
0091 D322        185  OUT 22H  ; COUNTER PORT 2
0093 3E03        186  MVI A,03H  ; MSB OF 03E8H
0095 D322        187  OUT 22H  ; COUNTER PORT 2
                 188 ; START COUNTERS
0097 3E07        189  MVI A,07H  ; 0111, GATE 1,2,3
0099 D325        190  OUT 25H  ; GATE PORT
009B C9          191  RET ; RETURN
                 192 ;
                 193 ;*******************************************************************************
                 194 ;
                 195 ; SUBROUTINE AIOCDU (BUF)
                 196 ;
                 197 ; AIOCDU READS DATA FROM THE C/D PANEL PORT 04
                 198 ;
                 199 ; INPUTS: BC POINT TO WORK BUFFER
                 200 ; OUTPUTS: NONE
                 201 ; CALLS: MSEC2H
                 202 ; DESTROYS: A,F/F'S,DE,HL
                 203 ; MODIFIES: /WORK/
                 204 ; VERSION 1.0
                 205 ;
                 206 AIOCDU:
009C 16FF        207  MVI D,0FFH  ; SET D AS FLAG TO FF
                 208 ;  FRONT PANEL I/O DRIVER
                 209 ;    CLEAR LATCHES,READ PORT AND CLEAR LATCHES
                 210 ; NOTE : LATCHES INVERT SWITCH DATA LINES TO BUS
                 211 ;
                 212 CDURD:   ; LOOP ENTRY POINT
009E 3E00        213  MVI A,00H  ; LOAD 00000000B INTO A
00A0 D306        214  OUT CDUCLR  ; SEND CLEAR PULSE
00A2 3E80        215  MVI A,080H  ; TURN ON LATCH BIT ONLY
00A4 D306        216  OUT CDUCLR  ; REMOVE CLEAR PULSE
                 217 ;
00A6 DB04        218  IN CDUINP ; READ C/D PORT
00A8 2F          219  CMA  ; INVERT BITS FROM INTERFACE (NEG LOGIC)
```

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LOC  OBJ          LINE       SOURCE STATEMENT

00A9 E67F          220  ANI 7FH ; MASK NON EXSISTANT BIT
                   221 ; TEST IF RUN MODE OR CALIBRATE
00AB 5F            222  MOV E,A  ; SAVE INPUT IN E REG
00AC E604          223  ANI 04H ; AND WITH 00000100 TO SEE RUN BIT
00AE FE04          224  CPI 04H ; TEST IF ON
00B0 CAC800   C    225  JZ CDUGO  ; TEST IF EQUAL (ON) AND JUMP TO GO
                   226 ; CALIBRATE MODE
00B3 7B            227  MOV A,E  ; RESTORE INPUT
00B4 E60B          228  ANI 0BH  ; 00001011 TEST NXT,RST,ADJ BITS FOR ON
00B6 FE0B          229  CPI 0BH   ;
00B8 CAC100   C    230  JZ CCTEST  ; IF = 0 SET ZERO FLAG SO JUMP TO TEST
                   231 ;
00BB 1600          232  MVI D,0  ; CLEAR FLAG IN D
00BD 63            233  MOV H,E ; SAVE NON ZERO INPUT IN H REG
00BE C39E00   C    234  JMP CDURD  ; GO BACK AND CONTINUE READ
                   235 ;
00C1 7A            236 CCTEST: MOV A,D  ; TEST FLAG IN D
00C2 FE00          237  CPI 0
00C4 CACA00   C    238  JZ CDUGOX  ; IF FLAG CLEARED GO TO UNPACK BITS
00C7 C39E00   C    239  JMP CDURD
                   240 ;
00CA 5C            241 CDUGOX:  MOV E,H  ; MOVE DATA TO E IF CAL MODE
                   242 CDUGO:
00CB 7B            243  MOV A,E  ; RESTORE INPUT BEFORE 0
00CC F5            244  PUSH PSW  ; SAVE A AND FLAGS
00CD C5            245  PUSH B ; PUT ADDRESS IN HL
00CE E1            246  POP H ; VIA STACK
00CF 16FF          247  MVI D,0FFH ; SET D TO 11111111 .TRUE.
00D1 1E00          248  MVI E,0H ; SET E TO 00000000 .FALSE.
00D3 0E08          249  MVI C,8 ; LORD C WITH 8 COUNT
00D5 1F            250 CDU05: RAR ; ROTATE ACC INTO CARRY (RIGHT)
00D6 DADD[illegible]   C    251  JC CDUTRU ; IF BIT ON GO TO TRUE (CARRY ON (CMA) SEE NOTE)
00D9 73            252  MOV M,E ; STORE .FALSE. IN ARRAY(I)
00DA C3DE00   C    253  JMP CDUDCR ; GO TO COUNT TEST
00DD 72            254 CDUTRU: MOV M,D ; STORE .TRUE. IN ARRAY(I)
00DE 0D            255 CDUDCR: DCR C ; DECREMENT COUNTER C
00DF CAE600   C    256  JZ CDUDON ; DONE ALL BITS
00E2 23            257  INX H ; HL = HL+1
00E3 C3D500   C    258  JMP CDU05 ; LOOP BACK FOR NEXT BIT
                   259 CDUDON:
00E6 F1            260  POP PSW  ; RECOVER INPUT BITS
00E7 E604          261  ANI 04H  ; KEEP RUN BIT
00E9 FE04          262  CPI 04H  ; TEST IF RUN MODE
00EB CAF100   C    263  JZ CDUD10  ; SKIP WAIT IF RUN MODE
00EE CD0000   E    264  CALL MSEC2H  ; WAIT FOR SWITCH DEBOUNCE
                   265 CDUD10:
00F1 E5            266  PUSH H  ; PUT ADDRESS BACK IN
00F2 C1            267  POP B ; BC VIA STACK
00F3 C9            268  RET ; RETURN TO FORTRAN
                   269 ;
006B               270 CLTEST EQU 06BH ; MASK FOR CALIBRATE TEST
0004               271 CDUINP EQU 04H ; PORT 4 FOR C/D INPUT
006F               272 CDTEST EQU 06FH ; MASK FOR RUN TEST
0006               273 CDUCLR EQU 06H ; PORT 6 FOR CDU LATCH CLEAR
                   274 ;
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
RSX-11 9998-0095 (MACRO) ASSEMBLER, V3.0        VCS1CO  PAGE   5

LOC  OBJ        LINE        SOURCE STATEMENT

                275 ;              8  7   6   5   4   3       2   1
                276 ; POPT 04 = X, PWR, MAN, AUT, PST, RUN/CAL, PO!, NNT
                277 ;  TYPE        NC  NC  NO  NC  NC      NC  NC
                278 ;  VALUE     X  1   1   0   1   1       1   1
                279 ;  NC - 0 ACTIVE WHEN PRESSED
                280 ;
                281 END


PUBLIC SYMBOLS
ADCIT2  C 005A    AGETIT  C 002D    AIOASC  C 0000    AIOCDU  C 009C    AIOIT2  C 003A    CLKIT2  C 006F

EXTERNAL SYMBOLS
MSEC2H  E 0000

USER SYMBOLS
ADC05   C 000C    ADC00   C 0017    ADCIT2  C 005A    AGETIT  C 002D    AIOASC  C 0000    AIOCDU  C 009C    AIOIT2  C 003A
CCTEST  C 00C1    COTEST  A 006F    CDU05   C 0005    CDUCLP  A 0004    CDUD10  C 00F1    CDUDCR  C 000E    CDUOCN  C 00E6
CDUGO   C 00CB    CDUGOX  C 00CA    CDUINP  A 0004    CDURD   C 009E    CDUTRU  C 0000    CLKCNT  A 0023    CLKIT2  C 006F
CLTEST  A 006B    MPXDA1  A 0084    MPXDA2  A 0085    MPXOCP  A 0082    MPXOTR  A 0050    MPXSCP  A 0083    MPXSIP  A 0081
MSEC2H  E 0000    WAIT50  C 0025    WAITDC  C 0029

ASSEMBLY COMPLETE,  NO ERRORS
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
LOC  OBJ        LINE       SOURCE STATEMENT

                    1 ;
                    2  NAME INTRPT
                    3 ;
                    4  PUBLIC INTRPT,INTROS,INTREN
                    5 ;
                    6  EXTRN OUTCAS
                    7 ;
                    8 ; CLOCK INTERRUPT SERVICE ROUTINE
                    9 ;
                   10  CSEG
                   11 ;
                   12 ;*******************************************************************************
                   13 ;
                   14 ; SUBROUTINE INTRPT
                   15 ;
                   16 ; INTRPT IS THE CLOCK INTERRUPT SERVICE ROUTINE
                   17 ;
                   18 ; INPUTS: NONE
                   19 ; OUTPUTS: NONE
                   20 ; CALLS: OUTCAS
                   21 ; DESTROYS: NOTHING
                   22 ; MODIFIES: CLOCK STATUS AND COUNTER BYTES
                   23 ; VERSION: 1.0
                   24 ;
                   25 INTRPT:
0000 F5            26  PUSH PSW ; SAVE A,F/F'S
0001 DB24          27  IN 024H  ; READ CLOCK DATA FAST
0003 E5            28  PUSH H ; SAVE HL
0004 D5            29  PUSH D ; SAVE DE
0005 C5            30  PUSH B ; SAVE BC
0006 F5            31  PUSH PSW ; SAVE INPUT FROM CLOCK
                   32 ;
                   33 ; INTERRUPTS ARE DISABLED,READ CLOCK
                   34 ;
                   35 ; CLEAR BYTE FLAGS
0007 3E00          36  MVI A,0 ; CLEAR ACC
0009 21C220        37  LXI H,20C2H ; POINT M TO FIRST FLAG
000C 77            38  MOV M,A ; CLEAR FLAG
000D 23            39  INX H
000E 77            40  MOV M,A ; CLEAR 100 FLAG
000F 23            41  INX H
0010 77            42  MOV M,A ; CLEAR SECOND FLAG
0011 F1            43  POP PSW  ; GET INPUT BACK IN A REG
0012 2F            44  CMA  ; INVERT BITS TO GET LOW DATA ACTIVE = 1
0013 E607          45  ANI 07H ; MASK UPPER 5 BITS
0015 0F            46  RRC ; SHIFT 1 SEC LINE INTO CARRY
0016 F5            47  PUSH PSW ; SAVE A,F/F'S
0017 DC5700   C    48  CC MILSEC ; TEST FOR BIT SET IN CARRY
001A F1            49  POP PSW ; RESTORE A AFTER CALL
001B 0F            50  RRC ; SHIFT 100 MSEC BIT TO CARRY
001C F5            51  PUSH PSW ; SAVE A,F/F'S
001D DC4000   C    52  CC HUNDRD ; TEST FOR BIT SET
0020 F1            53  POP PSW
0021 0F            54  RRC ; SHIFT 1 MSEC BIT TO CARRY
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
LOC  OBJ        LINE      SOURCE STATEMENT

0022 DC3400  C    55  CC ONESEC ; TEST FOR BIT SET
                  56 ;
                  57 EXIT:
                  58 ; WAIT FOR LINES TO GO HIGH AGAIN
0025 0824         59  IN 024H
0027 E607         60  ANI 07H
0029 FE07         61  CPI 07H
002B C22500  C    62  JNZ EXIT
                  63 ;
002E C1           64  POP B ; RESTORE BC
002F D1           65  POP D ; RESTORE DE
0030 E1           66  POP H ; RESTORE HL
0031 F1           67  POP PSW ; RESTORE A,F/F'S
                  68 ;
0032 FB           69 EI ; ENABLE INTERRUPTS
0033 C9           70  RET ; RETURN TO MONITOR CALLING POINT
                  71 ;
                  72 ONESEC:
0034 21C420       73  LXI H,20C4H ; SET HL TO SECOND FLAG BYTE
0037 3EFF         74  MVI A,0FFH ; LOAD A WITH 11111111
0039 77           75  MOV M,A ; SET FLAG BYTE
003A 23           76  INX H ; POINT HL TO COUNT BYTE
003B 3E01         77  MVI A,01H ; SET A TO 1
003D 86           78  ADD M  ; ADD COUNT TO ACC
003E 77           79  MOV M,A ; STORE COUNT BACK IN MEMORY BYTE
003F 23           80  INX H  ; POINT TO MSB
0040 3E00         81  MVI A,00H  ; ADD ZERO AND CARRY TO MSB COUNT
0042 8E           82  ADC M  ; ADD CARRY TO COUNT MSB
0043 77           83  MOV M,A  ; SAVE IT AWAY
                  84 ;
0044 3E00         85  MVI A,0
0046 D325         86  OUT 25H ; SET GATE TRIGGER LOW-HIGH TO SYNCPONIZE
0048 3E07         87  MVI A,07H
004A D325         88  OUT 25H
004C C9           89  RET
                  90 ;
                  91 HUNDRD:
004D 21C320       92  LXI H,20C3H ; SET HL TO 100 MSEC FLAG BYTE
0050 3EFF         93  MVI A,0FFH ; SET ACC TO 11111111
0052 77           94  MOV M,A ; SET FLAG BYTE
0053 CD0000  E    95  CALL OUTCRS
0056 C9           96  RET
                  97 ;
                  98 MILSEC:
0057 21C220       99  LXI H,20C2H ; HL POINTS TO 1 MSEC FLAG BYTE
005A 3EFF        100  MVI A,0FFH ; SET ACC TO 11111111
005C 77          101  MOV M,A ; SET FLAG BYTE TRUE
005D C9          102  RET
                 103 ;
                 104 ;*******************************************************************
                 105 ;
                 106 ; SUBROUTINE INTRDS
                 107 ;
                 108 ;  INTRDS DISABLES THE CPU INTERRUPT LINES
                 109 ;
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
 LOC  OBJ       LINE       SOURCE STATEMENT

                  110 ; INPUTS: NONE
                  111 ; OUTPUTS: NONE
                  112 ; CALLS: NOTHING
                  113 ; DESTROYS: NOTHING
                  114 ; MODIFIES: INTERRUPT MASK FOR CPU
                  115 ; VERSION: 1.0
                  116 ;
                  117 INTRDS:
 005E F3          118  DI
 005F C9          119  RET ; RETURN AFTER DISABLING INTERRUPTS
                  120 ;
                  121 ;*****************************************************************
                  122 ;
                  123 ; SUBROUTINE INTREN
                  124 ;
                  125 ;   INTREN ENABLES THE CPU INTERRUPT LINES
                  126 ;
                  127 ; INPUTS: NONE
                  128 ; OUTPUTS: NONE
                  129 ; CALLS: NOTHING
                  130 ; DESTROYS: A,F/F'S
                  131 ; MODIFIES: CPU INTERRUPT MASK
                  132 ; VERSION: 1.0
                  133 ;
                  134 INTREN:
 0060 3E08        135  MVI A,08H ; LOAD A WITH INTERRUPT MASK
 0062 30          136  SIM ; SET INTERRUPT MASK
 0063 FB          137  EI ; ENABLE INTERRUPTS
 0064 C9          138  RET ; RETURN
                  139 ;
                  140  END


PUBLIC SYMBOLS
INTRDS C 005E    INTREN C 0060    INTRPT C 0000

EXTERNAL SYMBOLS
OUTCAS E 0000

USER SYMBOLS
EXIT   C 0025    HUNDRD C 004D    INTRDS C 005E    INTREN C 0060    INTRPT C 0000    MILSEC C 0057    ONESEC C 0034
OUTCAS E 0000

ASSEMBLY COMPLETE,  NO ERRORS
```

```
ASM90  F1 DEFALT.ASM MACROFILE MOD85
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V2.0        DEFALT   PAGE   1


 LOC  OBJ        LINE       SOURCE STATEMENT

                   1 ;
                   2 ; SUBROUTINE DEFALT
                   3 ;
                   4 ;  DEFALT IS A TABLE OF OPERATION DEFAULT DATA IN ROM
                   5 ;
                   6 ;*****************************************************************
                   7 ;
                   8 ; COMMON/DEFALT/ DEFIOF,DEFCTV,DEFPRM,DEFPNT,ICMPNT,NMXVEC,NMXIPX
                   9 ;
                  10 ; DEFIOV(20) LOG*1
                  11 ; DEFPRM(20) INT*2
                  12 ; DEFCTV(16) LOG*1
                  13 ; DEFPNT(8) INT*2
                  14 ; ICMPNT(10) INT*2
                  15 ; NMXVEC(16) INT*2
                  16 ; NMXIPX(6) INT*1
                  17 ;
                  18  NAME DEFALT
                  19 ;
                  20 PUBLIC DEFALT
                  21 ;
 0850             22  ORG 0850H
                  23 ;
                  24 DEFALT:      ; PUBLIC SYMBOL ENTRY POINT
 0850 FF          25 DEFIOV: DB 0FFH ; IOFVEC(1) = SEN
 0851 FF          26  DB 0FFH ; DFD
 0852 FF          27  DB 0FFH ; PCF
 0853 FF          28  DB 0FFH ; LCF
 0854 FF          29  DB 0FFH ; LAP
 0855 FF          30  DB 0FFH ; RAP
 0856 FF          31  DB 0FFH ; CID
 0857 FF          32  DB 0FFH ; PKF
 0858 00          33  DB 000H ; PKR
 0859 FF          34  DB 0FFH ; VCF
 085A FF          35  DB 0FFH ; VCR
 085B FF          36  DB 0FFH ; VOT
 085C FF          37  DB 0FFH ; DSP
 085D 00          38  DB 00H ; KEY
 085E 00          39  DB 00H : CAS
 085F 00          40  DB 00H ; CRT
 0860 FF          41  DB 0FFH ; CDU
 0861 00          42  DB 00H ; DUMMY
 0862 00          43  DB 00H ; DUMMY
 0863 00          44  DB 00H ; DUMMY
                  45 ;
                  46 DEFPRM: ; /DEFPRM/  ; INT*2 PARAMETERS
 0864 0008        47  DW 0800H  ; MAX DRUM VALUE DMAX
 0866 00FE        48  DW -200H  ; MIN DRUM VALUE DMIN
 0868 0900        49  DW 9  ; ERROR LIMIT COUNT FOR TRIP MODE
 086A F000        50  DW 0F0H  ; CID STEP
 086C 0000        51  DW 0   ; PICK AVERAGING NUMBER
 086E F000        52  DW 0F0H  ; PICK STEP
 0870 6000        53  DW 60H  ; FRONT DEAD BAND
 0872 6000        54  DW 60H   ; REAR DEAD BAND
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
LOC  OBJ       LINE      SOURCE STATEMENT

0874 0100        55  DW 1  ; LENGTH OF KICKOFF ARMS
0876 3F00        56  DW 54  ; RADIUS OF DRUMS
0878 0A00        57  DW 10   ; LAST CUT POSITION
087A 1100        58  DW 17   ; PRESENT CUT POSITION
087C 0000        59  DW 0   ; CID POSITION
087E 6800        60  DW 68H  ; FTRLOC
0880 0100        61  DW 1  ; DFDFCT
0882 0100        62  DW 1  ; DSTP
0884 E000        63  DW 0E0H  ; FRONT DBIAS
0886 0000        64  DW 0  ; REAR DRUM BIAS
0888 0000        65  DW 0  ; SRKVAL
088A 0000        66  DW 0  ; TRGFCT
                 67 ;
088C FF          68 DEFCTV: DB 0FFH ; LOG+1 CNMVEC(1) CID
088D FF          69  DB 0FFH ; LCF
088E 00          70  DB 00H ; PKF
088F 00          71  DB 000H ; PKR
0890 FF          72  DB 0FFH ; PCF
0891 FF          73  DB 0FFH ; VCF
0892 FF          74  DB 0FFH ; VCR
0893 FF          75  DB 0FFH ; FRT
0894 FF          76  DB 0FFH ; RER
0895 FF          77  DB 0FFH ; CUT
0896 00          78  DB 0 ; DUMMY
0897 00          79  DB 0 ; DUMMY
0898 00          80  DB 0 ; DUMMY
0899 00          81  DB 0 ; DUMMY
089A 00          82  DB 0 ; DUMMY
089B 00          83  DB 0 ; DUMMY
                 84 ;
089C 0000        85 DEFPNT: DW 0 ; INT*2
089E 0000        86  DW 0
08A0 0000        87  DW 0
08A2 0000        88  DW 0
08A4 0000        89  DW 0
08A6 0000        90  DW 0
08A8 0000        91  DW 0
08AA 0000        92  DW 0
                 93 ;
                 94 ;  /DPPARM/
                 95 ;
08AC 0700        96 ICNPNT: DW 7 ; INT*2 (1)
08AE 0400        97  DW 4
08B0 0800        98  DW 8
08B2 0900        99  DW 9
08B4 0300       100  DW 3
08B6 0A00       101  DW 10
08B8 0B00       102  DW 11
08BA 1200       103  DW 18
08BC 1300       104  DW 19
08BE 1400       105  DW 20
                106 ;
08C0 0000       107 NMXVEC: DW 0 ; INT*2 SEN
08C2 0000       108  DW 0 ; ERR
08C4 0000       109  DW 0 ; SIR
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
LOC  OBJ        LINE       SOURCE STATEMENT

08C6 0700        110  DW 7 ; IPM
08C8 0000        111  DW 0
08CA 0800        112  DW 8 ; DSP
08CC 1400        113  DW 20 ; IOF
08CE 0A00        114  DW 10 ; CHNL CTV
08D0 0800        115  DW 8 ; DBG
08D2 0800        116  DW 8 ; CBF
08D4 8000        117  DW 128 ; TAP
08D6 0800        118  DW 8 ; KIB
08D8 1400        119  DW 20 ; PRM
08DA 0A00        120  DW 10 ; OPS
08DC 0800        121  DW 8 ; PNT
08DE 0000        122  DW 0 ; DUMMY
                 123 ;
08E0 11          124 NMXIPX: DB 17 ; NMXIPX(1) IOF VECTOR  PATCHING
08E1 0A          125  DB 10  ; CONTROL VECTOR PATCHING
08E2 09          126  DB 9  ; OPERATION CONTROL PATCHING
08E3 14          127  DB  20  ; PARAMETERS TO BE RESET
08E4 01          128  DB 1 ; DATA INITIALIZE , CLEAR CMOS BUFFERS
08E5 20          129  DB 32 ; SENSOR TABLES
08E6 0A          130  DB 10  ; MOS CONTROL WORDS
                 131 ;
0C90             132  ORG 0C90H
                 133 ;
                 134 DEFOPS:
                 135 ; COMMON /DEFOPS/ DEFOPS(10)
0C90 0200        136  DW 2  ; OPMODE
0C92 0100        137  DW 1  ; MODECT
0C94 0100        138  DW 1  ; RNGMSK
0C96 0100        139  DW 1  ; SENDEL
0C98 0000        140  DW 0  ; RATE CHECK
0C9A 0000        141  DW 0  ; STATUS
0C9C 0D00        142  DW 13  ; FDVGN
0C9E 0002        143  DW 300H  ; FDCAL
0CA0 0600        144  DW 6  ; RDVGN
0CA2 0003        145  DW 300H  ; RDCAL
                 146 ;
0CA4             147  ORG 0CA4H
                 148 ;
                 149 DEFMOS:
                 150 ; COMMON /DEFMOS/ DEFMOS(10)
0CA4 0060        151  DW 6000H  ; MAXSLT
0CA6 0000        152  DW 0  ; STRTPT
0CA8 0000        153  DW 0  ; STEPSZ
0CAA 00A0        154  DW 0A000H  ; NEGMAX
0CAC 0060        155  DW 6000H  ; POSMAX
0CAE 0000        156  DW 0  ; LSTPNT
0CB0 0600        157  DW 6  ; ISNIND
0CB2 0000        158  DW 0  ; ISNPOS
0CB4 1801        159  DW 0118H  ; CIDMAX
0CB6 FA00        160  DW 0FAH  ; CIDMIN
                 161 ;
                 162  END
```

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OF POOR QUALITY


```
PUBLIC SYMBOLS
DEFALT A 0E50

EXTERNAL SYMBOLS


USER SYMBOLS
DEFALT A 0B50   DEFCTV A 088C   DEFIOV A 0B50   DEFMOS A 0CA4   DEFOPS A 0C30   DEFPNT A 089C   DEFPRM A 0B64
ICMPNT A 08AC   MAXIPX A 08E0   MAXVEC A 08C0

ASSEMBLY COMPLETE,  NO ERRORS
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
LOC  OBJ        LINE       SOURCE STATEMENT

                    1  NAME TABLE
                    2 ;
                    3 PUBLIC ASCTAB
                    4 ;
                    5 ;*************************************************************************
                    6 ;
                    7 ;          COMMON /MESTAB/
                    8 ;
                    9 ; DATA INITIALIZATION OF ASCII TABLES
                   10 ;
0A00                11  ORG 0A00H
                   12 ; /MESTAB/ STARTS AT 0A00 HEX
                   13 ;
                   14 ASCTAB:
                   15 ; ALLOCATION OF ERRMES(20) CHARACTER*4 ARRAY
0A00 2453454E      16  DB '$SEN'
0A04 24444E44      17  DB '$DND'
0A08 24504346      18  DB '$PCF'
0A0C 244C4346      19  DB '$LCF'
0A10 244C4150      20  DB '$LAP'
0A14 24524150      21  DB '$RAP'
0A18 24434944      22  DB '$CID'
0A1C 24504B46      23  DB '$PKF'
0A20 24504B52      24  DB '$PKR'
0A24 24564346      25  DB '$VCF'
0A28 24564352      26  DB '$VCR'
0A2C 24564F54      27  DB '$VOT'
0A30 24445350      28  DB '$DSP'
0A34 244B4559      29  DB '$KEY'
0A38 24434153      30  DB '$CAS'
0A3C 24435254      31  DB '$CRT'
0A40 24431455      32  DB '$COU'
0A44 24465254      33  DB '$FRT'
0A48 24524552      34  DB '$RER'
0A4C 24434F54      35  DB '$COT'
                   36 ;
                   37 ; ALLOCATION OF DBGMES(20) CHARACTER*4 ARRAY
                   38 ;
0A50 44425547      39  DB 'DBUG'
0A54 4F55543F      40  DB 'OUT?'
0A58 494E503F      41  DB 'INP?'
0A5C 4441543F      42  DB 'DAT?'
0A60 49545A3F      43  DB 'ITZ?'
0A64 5441503F      44  DB 'TAP?'
0A68 492F4F3F      45  DB 'I/O?'
0A6C 434C4B3F      46  DB 'CLK?'
0A70 404540 3F     47  DB 'MEM?'
0A74 5244593F      48  DB 'RDY?'
0A78 454E443F      49  DB 'END?'
0A7C 53595320      50  DB 'SYS '
0A80 504F5254      51  DB 'PORT'
0A84 43484E4C      52  DB 'CHNL'
0A88 20555020      53  DB ' UP '
0A8C 444F574E      54  DB 'DOWN'
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
 LOC  OBJ        LINE       SOURCE STATEMENT

 0A90 4D414E2D     55  DB 'MAN-'
 0A94 4D4F4445     56  DB 'MODE'
 0A98 57524954     57  DB 'WRIT'
 0A9C 4144523F     58  DB 'ADR?'
                   59 ;
                   60 ; ALLOCATION OR RUNMES(20) CHARACTER*4 ARRAY
                   61 ;
 0AA0 3F492F4F     62  DB '?I/O'
 0AA4 3F434E54     63  DB '?CNT'
 0AA8 3F4F5053     64  DB '?OPS'
 0AAC 3F565242     65  DB '?VRB'
 0AB0 2A52554E     66  DB '*RUN-OK*'
 0AB4 2D4F4B2A
 0AB8 2A444542     67  DB '*DEBUG *'
 0ABC 5547202A
 0AC0 3F43414C     68  DB '?CALBRAT'
 0AC4 42524154
 0AC8 2A204841     69  DB '* HALT *'
 0ACC 4C54202A
 0AD0 4D41534B     70  DB 'MASK'
 0AD4 5041524D     71  DB 'PARM'
 0AD8 45525220     72  DB 'ERR '
 0ADC 252D5354     73  DB '%-STOP-%'
 0AE0 4F502D25
 0AE4 2A2D4558     74  DB '*-EXIT-*'
 0AE8 49542D2A
 0AEC 20232320     75  DB ' ## '
                   76 ;
                   77 ; ALLOCATION OF DSPCODE(10) CHARACTER*1 ARRAY
                   78 ;
 0AF0 242A2326     79  DB '$*#&%@? =/'
 0AF4 25403F20
 0AF8 3D2F
                   80 ;
                   81 ;  /MEST02/  STARTS AT 0AFAH
                   82 ;
                   83 ;  ALLOCATION OF PARMES(20)  CHARATER*4
                   84 ;
 0AFA 444D4158     85  DB 'DMAX'  ; MAX DRUM VALUE
 0AFE 444D494E     86  DB 'DMIN'  ; MIN DRUM VALUE
 0B02 45524C4D     87  DB 'ERLM'  ; ERROR LIMIT
 0B06 43445354     88  DB 'CDST'  ; CID STEP
 0B0A 50415645     89  DB 'PAVE'   ; NUMBER OF PICK SIGNALS TO AVERAGE
 0B0E 50485350     90  DB 'PHSP'  ; PICK STEP
 0B12 44424446     91  DB 'DBDF'   ; FRONT DEAD BAND FOR CONTROLLER
 0B16 44424452     92  DB 'DBDR'  ; REAR DEAD BAND
 0B1A 4C454E47     93  DB 'LENG'   ; LENGTH OF ARM
 0B1E 44524144     94  DB 'DRAD'   ; DRUM RADIUS
 0B22 4C435053     95  DB 'LCPS'   ; LAST CUT POSITION
 0B26 50435053     96  DB 'PCPS'   ; PRESENT CUT POSITION
 0B2A 43445053     97  DB 'CDPS'   ; CID POSITION
 0B2E 464C4F43     98  DB 'FLOC'  ; FRONT TO REAR DISTANCE
 0B32 44464354     99  DB 'DFCT'  ; DFD FACTOR
 0B36 44535450    100  DB 'DSTP'  ; DFD STEP UPDATE FOR CMOS
 0B3A 46424153    101  DB 'FBAS'  ; FRONT DRUM BIAS
```

ORIGINAL PAGE IS
OF POOR QUALITY


```
LOC  OBJ       LINE     SOURCE STATEMENT

0B3E 52424152    102  DB 'REAR' ; REAR DRUM BIAS
0B42 534B5256    103  DB 'SKRV' ; RATE CHECK PARAMETER
0B46 54524746    104  DB 'TRGF' ; TRIG FACTOR
                 105 ;
0C40             106  ORG 0C40H
                 107 ;
                 108 ; /MESTB3/ STARTS AT 0C40H
                 109 ;
                 110 ; ALLOCATION OF OPSMES(10) CHARACTER*4
                 111 ;
0C40 4D4F4445    112  DB 'MODE' ; MODE MODE
0C44 52414E47    113  DB 'RANG' ; RANGE CHECK
0C48 5344454C    114  DB 'SDEL' ; OPERATION SENSOR DELAY FLAG
0C4C 52415445    115  DB 'RATE' ; SENSOR RATE TEST
0C50 53545553    116  DB 'STUS' ; STATUS WORD
0C54 46445647    117  DB 'FDVG' ; FRONT DRUM GAIN
0C58 4644434C    118  DB 'FDCL' ; FRONT DRUM CAL
0C5C 52445647    119  DB 'RDVG' ; REAR DRUM GAIN
0C60 5244434C    120  DB 'RDCL' ; REAR DRUM CAL
0C64 20202020    121  DB '    '
                 122 ;
0CC8             123  ORG 0CC8H
                 124 ;
                 125 ; /MOSMES/ STARTS AT 0CC8H
                 126 ;
                 127 ; ALLOCATION OF MOSMES(16) CHARACTER*4
                 128 ;
0CC8 40585354    129  DB 'MXST'
0CCC 53545054    130  DB 'STPT'
0CD0 5350535A    131  DB 'SPSZ' ; STEP SIZE
0CD4 4E474D58    132  DB 'NGMX' ; NEGMAX
0CD8 50534D58    133  DB 'PSMX' ; POSMAX
0CDC 4C535054    134  DB 'LSPT' ; LSTPNT
0CE0 534E4944    135  DB 'SNID' ; ISNIND
0CE4 534E5053    136  DB 'SNPS' ; ISNPOS
0CE8 43444D58    137  DB 'CDMX' ; CIDMAX
0CEC 43444D4E    138  DB 'CDMN' ; CIDMIN
0CF0 20202020    139  DB '    '
0CF4 20202020    140  DB '    '
0CF8 20202020    141  DB '    '
0CFC 20202020    142  DB '    '
0D00 20202020    143  DB '    '
0D04 20202020    144  DB '    '
                 145 ;
                 146  END
```

PUBLIC SYMBOLS
ASCTAB A 0A00

EXTERNAL SYMBOLS

USER SYMBOLS
ASCTAB A 0A00

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ASSEMBLY COMPLETE, NO ERRORS

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```
ASM80 -F1:DEFTAB.ASM MACROFILE MOD85

ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0        DEFTAB   PAGE   1


 LOC  OBJ        LINE       SOURCE STATEMENT

                   1 ;
                   2 ; SUBROUTINE DEFTAB
                   3 ;
                   4 ;
                   5 ; DEFAULT TABLE FOR CONVERSION AND RANGE DATA
                   6 ;
                   7 ;*************************************************************
                   8 ;
                   9  NAME DEFTAB
                  10 ;
                  11  PUBLIC DEFTBL
                  12 ;
 0BE8             13  ORG 0BE8H   ; ORIGIN FOR COMMON
                  14 ;
                  15 ; COMMON/DEFTAB/ DEFRNG,DEFCON
                  16 ;
                  17 ; DEFRNG(10,2)    INT*2
                  18 ; DEFCON(10,2)    INT*2
                  19 ;
                  20 ; RANGE CHECK TABLE
                  21 ;
                  22 DEFTBL:    ;
                  23 ;    MINIMUMS
                  24 DEFRNG:  ; RANGE DEFAULTS
 0BE8 00F0        25  DW -1000H  ; DFD
 0BEA 00F0        26  DW -1000H  ; PCF
 0BEC 00F0        27  DW -1000H  ; LCF
 0BEE 00F0        28  DW -1000H  ; LAP
 0BF0 00F0        29  DW -1000H  ; RAP
 0BF2 0000        30  DW 00000  ; NBS CID MIN = 0
 0BF4 8000        31  DW -32760  ;
 0BF6 8000        32  DW -32760  ;
 0BF8 8000        33  DW -32760  ;
 0BFA 8000        34  DW -32760  ;
                  35 ;    MAXIMUMS
 0BFC F97F        36  DW 32760  ; DFD
 0BFE F87F        37  DW 32760  ; PCF
 0C00 F87F        38  DW 32760  ; LCF
 0C02 0010        39  DW 1000H  ; LAP
 0C04 0010        40  DW 1000H  ; RAP
 0C06 1027        41  DW 10000  ; NBS CID MAX
 0C08 F87F        42  DW 32760  ;
 0C0A F87F        43  DW 32760  ;
 0C0C F87F        44  DW 32760  ;
 0C0E F87F        45  DW 32760  ;
                  46 ;
                  47 ; CONVERSION TABLE
                  48 ;
                  49 ;  OFFSET TERMS
 0C10 97FB        50 DEFCON:  DW 0FB97H  DFD
 0C12 6006        51  DW 0660H  ; PCF
 0C14 6006        52  DW 0660H  ; LCF
 0C16 00F3        53  DW 0F800H  ; LAP
 0C18 00F3        54  DW 0F800H  ; RAP
```

ORIGINAL PAGE IS
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```
 LOC  OBJ        LINE        SOURCE STATEMENT

 0C1A 0000         55  DW 0  ; NBS CID
 0C1C 0000         56  DW 0  ;
 0C1E 0000         57  DW 0  ;
 0C20 0000         58  DW 0  ;
 0C22 0000         59  DW 0  ;
                   60 ;   GAIN TERMS
 0C24 0100         61  DW 1  ;  DFD
 0C26 FFFF         62  DW -1  ; PCF
 0C28 FFFF         63  DW -1  ;  LCF
 0C2A 0400         64  DW 4  ; LAP
 0C2C 0400         65  DW 4  ; RAP
 0C2E 0100         66  DW 1  ; CID
 0C30 0100         67  DW 1  ;
 0C32 0100         68  DW 1  ;
 0C34 0000         69  DW 0  ;
 0C36 0000         70  DW 0  ;
                   71 ;
                   72  END


PUBLIC SYMBOLS
DEFTBL A 0BE8

EXTERNAL SYMBOLS


USER SYMBOLS
DEFCON A 0C10   DEFRNG A 0BE8   DEFTBL A 0BE8

ASSEMBLY COMPLETE,  NO ERRORS
```

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```
ASM80 :F1:MONITR.REN MACROFILE M0085

ISIS-II 8080/8085 MACRO ASSEMBLER, V3.0      MONITR   PAGE   1

 LOC  OBJ        LINE       SOURCE STATEMENT

                   1 ;*************************************************
                   2 ;
                   3 ;                  PROGRAM: STDMON MONITOR REP 1.0
                   4 ;
                   5 ;                  ORIGINAL SOURCE SDK-85.SRC-80.10 MONITOR5 PRO-LOG
                   6 ;                  7303 KEYBOARD MONITOR
                   7 ;
                   8 ;                  MODIFIED BY FOSTER-MILLER ASSOC
                   9 ;                  NOVEMBER 01,1979
                  10 ;                  FOR PRO-LOG STD BUS 8085 WITH 7202 AND UART
                  11 ;                  VCS HARDWARE CONFIGURATION
                  12 ;
                  13 ;*************************************************
                  14 ;
                  15 ; ABSTRACT
                  16 ; ========
                  17 ;
                  18 ; THIS PROGRAM IS A 2K MONITOR FOR THE INTEL 8085   AND
                  19 ; PROVIDES A MINIMUM LEVEL OF UTILITY FUNCTIONS FOR THE USER EMPLOYING
                  20 ; EITHER AN INTER-ACTIVE CONSOLE (I E. TELETYPE) OR THE USER EMPLOYING
                  21 ; THE KEYBOARD-DISPLAY  THE KEYBOARD MONITOR ALLOWS THE USER TO PERFORM
                  22 ; SUCH FUNCTIONS AS MEMORY AND REGISTER MANIPULATION PROGRAM LOADING
                  23 ; PROGRAM EXECUTION, INTERRUPTION OF AN EXECUTING PROGRAM AND
                  24 ; SYSTEM RESET. THE MONITOR ALSO PROVIDES MININAL TAPE I-O
                  25 ;
                  26 ; PROGRAM ORGANIZATION
                  27 ; ======= ============
                  28 ;
                  29 ; THE PROGRAM IS ORGANIZED AS FOLLOWS :-
                  30 ;       1) COLD START ROUTINE (RESET)
                  31 ;       2) WARM START - REGISTER SAVE ROUTINE
                  32 ;       3) INTERRUPT VECTORS
                  33 ;       4) KEYBOARD MONITOR
                  34 ;       5) TTY MONITOR
                  35 ;       6) LAYOUT OF RAM USAGE
                  36 ;
                  37 ;  THE KEYBOARD MONITOR BEGINS WITH THE COMMAND RECOGNIZER, FOLLOWED BY
                  38 ; THE COMMAND ROUTINE SECTION, UTILITY ROUTINE SECTION AND MONITOR
                  39 ; TABLES. THE COMMAND AND UTILITY ROUTINES ARE IN ALPHABETICAL ORDER
                  40 ; WITHIN THEIR RESPECTIVE SECTIONS.
                  41 ; THROUGHOUT THE KEYBOARD MONITOR, A COMMENT FIELD BEGINNING
                  42 ; WITH "ARG - " INDICATES A STATEMENT WHICH LOADS A VALUE INTO
                  43 ; A REGISTER AS AN ARGUMENT FOR A FUNCTION, WHEN THE DESIRED  VALUE
                  44 ; LIST OF KEYBOARD MONITOR ROUTINES
                  45 ; ==== == ======== ======= ========
                  46 ;
                  47 ; CMMND
                  48 ; -----
                  49 ; EXAM
                  50 ; GOCMD
                  51 ; SSTEP
                  52 ; SUBST
                  53 ; -----
                  54 ; CLEAR
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                    55 ; CLDIS
                    56 ; CLOST
                    57 ; DISPC
                    58 ; ERR
                    59 ; GTHEX
                    60 ; HXDSP
                    61 ; ININT
                    62 ; INSDG
                    63 ; NXTRG
                    64 ; OUTPT
                    65 ; RDKBD
                    66 ; RETF
                    67 ; RETT
                    68 ; RGLOC
                    69 ; RSTOR
                    70 ; SETRG
                    71 ; UFDAD
                    72 ; UPDDT
                    73 ;
                    74  NAME MONITR
                    75 ;
                    76 ;*****************************************************************
                    77 ;
                    78 ;                   SET CONDITIONAL ASSEMBLY FLAG
                    79 ;
                    80 ;*****************************************************************
                    81 ;
                    82 ;
                    83 ;WAITS SET 0 ;0=NO WAIT STATES
                    84                       ;1=A WAIT STATE IS GENERATED FOR EVERY M CYCLE
                    85                       ;THE APPROPRIATE DELAY TIME MUST BE USED FOR
                    86                       ;TTY DELAY OR SET UP SINGLE
                    87                       ;STEP TIMER FOR EACH CASE
                    88 ;
                    89 ;
                    90 ;*****************************************************************
                    91 ;
                    92 ;                   MOITOR EQUATES
                    93 ;
                    94 ;*****************************************************************
                    95 ;
2000                96 RAMST EQU 2000H ;START ADDRESS OF RAM - THIS PROGRAM ASSUMES
                    97 ; THAT 256 BYTES OF RANDOM ACCESS MEMORY BEGIN AT THIS ADDRESS.
                    98 ; THE PROGRAM USES STORAGE AT THE END OF THIS SPACE FOR VARIABLES,
                    99 ; SAVING REGISTERS AND THE PROGRAM STACK.
                   100 ;
0017               101 RMUSE EQU 23 ; RAM USAGE - CURRENTLY 23 BYTES ARE USED FOR
                   102                      ; /SAVING REGISTERS AND VARIABLES
                   103 ;
0012               104 SKLN EQU 18 ; MONITOR STACK USAGE - MAX OF 9 LEVELS
                   105 ;
000F               106 UBRLN EQU 15 ; 5 USER BRANCHES - 3 BYTES EACH
                   107 ;
0000               108 ADFLD EQU 0 ; INDICATES USE OF ADDRESS FIELD OF DISPLAY
0090               109 ADISP EQU 90H ; CONTROL CHARACTER TO INDICATE OUTPUT TO
```

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OF POOR QUALITY


```
LOC  OBJ        LINE       SOURCE STATEMENT

                  110                         ; /ADDRESS FIELD OF DISPLAY
0001              111 CNTRL EQU 001H ; ADDRESS FOR SENDING CONTROL CHARACTERS TO
                  112                           ; /DISPLAY CHIP
0011              113 COMMA EQU 11H ; COMMA FROM KEYBOARD
0000              114 CSNIT EQU 0 ; INITIAL VALUE FOR COMMAND STATUS REGISTER
0020              115 CSR EQU 20H ; OUTPUT PORT FOR COMMAND STATUS REGISTER
0094              116 DDISP EQU 94H ; CONTROL CHARACTER TO INDICATE OUTPUT TO
                  117                         ; /DATA FIELD OF DISPLAY
0001              118 DOT EQU 1 ; INDICATOR FOR DOT IN DISPLAY
00D0              119 DSPLY EQU 0D0H ; ADDRESS FOR SENDING CHARACTERS TO DISPLAY
0001              120 DTFLD EQU 1 ; INDICATES USE OF DATA FIELD OF DISPLAY
0080              121 EMPTY EQU 80H ; HIGH ORDER 1 INDICATES EMPTY INPUT BUFFER
20E9              122 MNSTK EQU RAMST + 256 - RMUSE ; START OF MONITOR STACK
0000              123 NODOT EQU 0 ; INDICATOR FOR NO DOT IN DISPLAY
                  124 ;NUMC - DEFINED LATER ; NUMBER OF COMMANDS
                  125 ;NUMARG - DEFINED LATER ; NUMBER OF REGISTER SAVE LOCATIONS
0010              126 PERIO EQU 10H ; PERIOD FROM KEYBOARD
00FD              127 PRMPT EQU 0FDH ; PROMPT CHARACTER FOR DISPLAY (DASH)
000E              128 UNMSK EQU 0EH ; UNMASK INPUT INTERRUPT
20C8              129 USRER EQU RAMST + 256 - (RMUSE + SKLN + LEPLN) ; START OF USER
                  130                         ; /BRANCH LOCATIONS
                  131 ;
                  132 ; ***** PULIC SYMBOLS FOR PROGRAM LINKAGE
                  133 ;
                  134  PUBLIC CO,CI,RDKBD,DISP1,CNVBN,HEXASC,MSEC1H
                  135  PUBLIC DELAY,SECDT,MSEC2H,MSEC20,OUTPT,GO,MONITR
                  136 ;
                  137  EXTRN INTRPT
                  138 ;
                  139 ;*************************************************************
                  140 ;
                  141 ;                    MONITOR MACROS
                  142 ;
                  143 ;*************************************************************
                  144 ;
                  145 TRUE MACRO WHERE ; BRANCH IF FUNCTION RETURNS TRUE
                  146  JC WHERE
                  147  ENDM
                  148 ;
                  149 FALSE MACRO WHERE ; BRANCH IF FUNCTION RETURNS FALSE
                  150  JNC WHERE
                  151  ENDM
                  152 ;
                  153 ;
                  154 ;*************************************************************
                  155 ;
                  156 ;              USART INITIALIZATION CODE
                  157 ;
                  158 ;*************************************************************
                  159 ;
                  160 ;   THE USART IS RESUMED TO COME UP IN THE RESET POSITION (THIS
                  161 ;   FUNCTION IS TAKEN CARE OF BY THE HARDWARE). THE USART WILL
                  162 ;   BE INITIALIZED IN THE SAME WAY FOR EITHER TTY OR CRT
                  163 ;   INTERFACE. THE FOLLOWING PARAMETERS ARE USED:
                  164 ;
```

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```
LOC  OBJ        LINE      SOURCE STATEMENT

                 165 ;     MODE INSTRUCTION
                 166 ;     ==== ===========
                 167 ;
                 168 ;     2 STOP BITS
                 169 ;     PARITY DISABLED
                 170 ;     8 BIT CHARACTERS
                 171 ;     BAUD RATE FACTOR OF 64
                 172 ;
                 173 ;     COMMAND INSTRUCTION
                 174 ;     ======= ===========
                 175 ;
                 176 ;     NO HUNT MODE
                 177 ;     NOT(RTS) FORCED TO 0
                 178 ;     RECIEVE ENABLED
                 179 ;     TRANSMIT ENABLED
                 180 ;
                 181 ;*****************************************************************
                 182 ;
                 183 ; PRO-LOG KEYBOARD LAYOUT
                 184 ;
                 185 ;  14 - TTY  15 - SNGL 16 - **** 17 - EXAM  RESET
                 186 ;       MON       STEP              REGS   SYSTEM
                 187 ;-----------------------------------------------------
                 188 ;                                       I
                 189 ;   C       D       E       F-FLAG      I 13 - SUBS
                 190 ;                                       I    MEM
                 191 ;                                       I
                 192 ;   8 - H   9 - L   A       B           I 12 - GO
                 193 ;                                       I
                 194 ;                                       I
                 195 ;   4 - SPH 5 - SPL 6 - PCH 7 - PCL     I 11 - , - NEXT
                 196 ;                                       I
                 197 ;                                       I
                 198 ;   0       1       2       3           I 10 - . - EXEC
                 199 ;                                       I
                 200 ;                                       I
                 201 ;*****************************************************************
                 202 ;
                 203 ;
                 204 ; ***** "RESET" KEY ENTRY POINT - COLD START
                 205 ; ***** RST 0 ENTRY POINT
                 206 ;
0000             207  ORG 0
                 208 MONITR:   ; MONITOR ENTRY POINT
0000 3E00        209 INITUT: MVI A,0 ; CLEAR ACCUMULATOR
                 210 ;
                 211 ;*****************************************************************
                 212 ;
0002 C31C01      213  JMP CLDST ; GO FINISH COLD START
                 214 CLDRK: ; THEN JUMP BACK HERE
0005 C31F00      215  JMP RES10 ; SKIP OVER WARM START CODE
                 216 ;
                 217 ; ***** RST 1 ENTRY POINT - WARM START
                 218 ;
0008             219  ORG 8
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                  220 ;       SAVE REGISTERS
0009 22EF10       221  SHLD LSAV ; SAVE H & L REGISTERS
0008 E1           222  POP H ; GET USER PROGRAM COUNTER FROM TOP OF STACK
000C 22F110       223  SHLD PSAV ; /AND SAVE IT
000F F5           224  PUSH PSW
                  225 ; ***** 010H IS RST 2 ENTRY POINT (NOT USED)
0010 E1           226  POP H ; LOAD A/F/F'S INTO HL
0011 22ED10       227  SHLD FSAV ; SAVE FLIP/FLOPS & REGISTER A
0014 210000       228  LXI H,0 ;CLEAR H & L
0017 39           229  DAD SP ; GET USER STACK POINTER
                  230 ; ***** 018H IS RST 3 ENTRY POINT (NOT USED)
0018 22F410       231  SHLD SSAV ; /AND SAVE IT
001B 31ED10       232  LXI H,SSAV+1 ; SET STACK POINTER FOR SAVING
001E F9           233  SPHL ; /REMAINING REGISTERS
001F C5           234  PUSH B ; SAVE B & C
                  235 ; ***** 020H IS RST 4 ENTRY POINT (NOT USED)
0020 D5           236  PUSH D ; SAVE D & E
0021 C32F00       237  JMP RES10 ; LEAVE ROOM FOR VECTORED INTERRUPTS
                  238 ;
                  239 ;*************************************************************
                  240 ;
                  241 ; ***** TRAP ENTRY POINT
                  242 ;
0024              243  ORG 24H
0024 C39107       244  JMP TRAPPR
                  245 ;
                  246 ; ***** RST 5 ENTRY POINT
                  247 ;
0028              248  ORG 28H
0028 C39107       249  JMP RESET5 ; RST 5 JMP VECTOR
                  250 ;
                  251 ; ***** RST 5.5 ENTRY POINT
                  252 ;
002C              253  ORG 2CH
002C CD0000   E   254  CALL INTPT ; CALL SERVICE ROUTINE
002F C9           255  RET ; RETURN TO CODE WHERE INTERRUPT HAPPENED
                  256 ;
                  257 ; ***** RST 6 ENTRY POINT
                  258 ;
0030              259  ORG 30H
0030 C39107       260  JMP RESET6 ; RST 6 JMP VECTOR
                  261 ;
                  262 ; ***** RST 6.5 ENTRY POINT
                  263 ;
0034              264  ORG 34H
0034 C39107       265  JMP RSET65 ; RST 6.5 JUMP VECTOR
                  266 ;
                  267 ; ***** RST 7 ENTRY POINT
                  269 ;
0038              269  ORG 38H
0038 C39107       270  JMP RESET7 ; RST JMP VECTOR
                  271 ;
                  272 ; ***** RST 7.5 ENTRY POINT
003C              273  ORG 3CH
003C C39107       274  JMP RSET75 ; RST 7.5 JUMP LOCATION
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                 275 ;
                 276 ;*****************************************************************
                 277 ;
                 278 RES10: ; CONTINUE SAVING USER STATUS
003F 20          279  RIM ; GET USER INTERRUPT STATUS AND INTERRUPT MASK
0040 E60F        280  ANI 0FH ; KEEP STATUS AND MASK BITS
0042 32F120      281  STA ISAV ; SAVE INTERRUPT STATUS AND MASK
0045 3E0E        282  MVI A,UNMSK ; UNMASK INTERRUPTS FOR MONITOR USE
0047 30          283  SIM
0048 F3          284  DI ; INTERRUPTS DISABLED WHILE MONITOR IS RUNNING
                 285                        ; (EXCEPT WHEN WAITING FOR INTERRUPT)
                 286 ; CHECK FOR 7303 INSTALLATION
0049 DB00        287  IN 00H ; READ S1,S2
004B E6C0        288  ANI 0C0H  ; KEEP UPPER TWO BITS
004D 47          289  MOV B,A  ; SAVE BITS
004E E680        290  ANI 080H
0050 C24004      291  JNZ 4000H  ; IF 8 BIT ON GO TO PROGRAM
0053 78          292  MOV A,B  ; GET BITS BACK
0054 E640        293  ANI 040H
0056 C21000      294  JNZ 1000H  ; IF BIT 7 ON GO TO PROLOG MONITOR AT 1000H
                 295 ;
0059 CD9703      296  CALL MSEC2H ; CALL 200 MSEC DELAY
                 297 ;
                 298 ;*****************************************************************
                 299 ;
                 300 ;                    BEGINNING OF KEYBOARD MONITOR CODE
                 301 ;
                 302 ;*****************************************************************
                 303 ;
005C CDCD01      304  CALL CLEAR
005F 3E80        305  MVI A,80H ; LOAD BUFFER EMPTY FLAG
0061 32FE20      306  STA IBUFF ; SET INPUT BUFFER EMPTY FLAG
                 307 ;
                 308 ;*****************************************************************
                 309 ;
                 310 ; FUNCTION: CMMND - COMMAND RECOGNIZER
                 311 ; INPUTS: NONE
                 312 ; OUTPUTS: NONE
                 313 ; CALLS: RDKBD,ERR,SUBST,EXAM,GOCMD,SSTEP
                 314 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 315 ;
                 316 CMMND:
0064 21E920      317  LXI H,MNSTK ; INITIALIZE MONITOR STACK POINTER
0067 F9          318  SPHL ; HL TO STACK POINTER STORE
0068 21F303      319  LXI H,RDYTBL ; LOAD ADDRESS OF READY MESSAGE TO HL
006B 0E08        320  MVI C,8 ; LOAD C WITH CHARACTER COUNT
006D CD9E02      321  CALL OUTPT ; DISPLAY MESSAGE
                 322 ; READ KEYBOARD FUNCTION KEYS
0070 3E0F        323  MVI A,0FH ; 00001111
0072 D300        324  OUT 00H ; OUTPUT TO D0
0074 DB00        325 NOKEY: IN 00H ; INPUT FROM D0
0076 E630        326  ANI 030H ; AND IN A 00110000
0078 CA7400      327  JZ NOKEY ; LOOP BACK IF NO KEY PRESSED
007B CDCD01      328  CALL CLEAR ; CLEAR DISPLAY
007E CDC002      329 MONRDK: CALL RDKBD , READ KEYBOARD
```

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LOC  OBJ       LINE      SOURCE STATEMENT

0081 210F00     330  LXI B,NUMC ; COUNTER FOR NUMBER OF COMMANDS IN C
0084 21E502     331  LXI H,CMDTB ; GET ADDRESS OF COMMAND TABLE
                332 CMD10:
0087 BE         333  CMP M ; RECOGNIZE COMMAND ?
0088 CA9100     334  JZ CMD15 ; YES - GO PROCESS IT
008B 23         335  INX H ; NO - NEXT COMMAND TABLE ENTRY
008C 0D         336  DCR C ; END OF TABLE
008D C28700     337  JNZ CMD10 ; NO - GO CHECK NEXT ENTRY
                338                ; YES - COMMAND UNKNOWN
0090 C3FF01     339  JMP ERR ; DISPLAY ERROR MESSAGE AND GET ANOTHER COMMAND
                340 CMD15:
0093 21E803     341  LXI H,CMDAD ; GET ADDRESS OF COMMAND ADDRESS TABLE
0096 0D         342  DCR C ; ADJUST COMMAND COUNTER
                343                ; COUNTER ACTS AS POINTER TO COMMAND ADDRESS TABLE
0097 09         344  DAD B ; ADD POINTER TO TABLE ADDRESS TWICE BECAUSE
0098 09         345  DAD B ; TABLE HAS 2 BYTE ENTRIES
0099 7E         346  MOV A,M ; GET LOW ORDER BYTE OF COMMAND ADDRESS
009A 23         347  INX H
009B 66         348  MOV H,M ; GET HIGH ORDER BYTE OF COMMAND ADDRESS IN H
009C 6F         349  MOV L,A ; PUT LOW ORDER BYTE IN L
                350                ; COMMAND ROUTINE ADDRESS IS NOW IN H & L
009D E9         351  PCHL ; BRANCH TO ADDRESS IN H & L BY LOADING PC
                352 ;
                353 ;*****************************************************************
                354 ;
                355 ;                   COMMAND ROUTINES
                356 ;
                357 ;*****************************************************************
                358 ;
                359 ; FUNCTION: EXAM - EXAMINE AND MODIFY REGISTERS
                360 ; INPUTS: NONE
                361 ; OUTPUTS: NONE
                362 ; CALLS: CLEAR,SETRG,ERR,RGNAM,RGLOC,UPDDT,GTHEX,NXTPG
                363 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                364 ;
                365 EXAM:
009E CDCD01     366  CALL CLEAR ; CLEAR DISPLAY
00A1 21EB03     367  LXI H,XMSG ; DISPLAY EXAMINE MESSAGE
00A4 0E04       368  MVI C,4
00A6 CD9E02     369  CALL OUTPT
00A9 CD5403     370  CALL SETRG ; GET REGISTER DESIGNATOR FROM KEYBOARD AND
                371                ; /SET REGISTER POINTER ACCORDINGLY
                372                ; WAS CHARACTER A REGISTER DESIGNATOR ?
                373  FALSE ERR ; NO - DISPLAY ERROR MSG  AND TERMINATE COMMAND
00AC D2FF01     374+ JNC ERR
                375 EXM05:
00AF CD1A03     376  CALL RGNAM ; OUTPUT REGISTER NAME TO ADDRESS FIELD
00B2 CD0003     377  CALL RGLOC ; GET REGISTER SAVE LOCATION IN H & L
00B5 7E         378  MOV A,M ; GET REGISTER CONTENTS
00B6 32F820     379  STA CURDT ; STORE REGISTER CONTENTS AT CURRENT DATA
00B9 CD7003     380  CALL UPDDT ; UPDATE DATA FIELD OF DISPLAY
00BC 0601       381  MVI B,DTFLD ; ARG - USE DATA FIELD OF DISPLAY
00BE CD0002     382  CALL GTHEX ; GET HEX DIGITS - WERE ANY DIGITS RECEIVED ?
                383  FALSE EXM10 ; NO - DO NOT UPDATE REGISTER CONTENTS
00C1 D2C900     384+ JNC EXM10
```

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LOC  OBJ        LINE       SOURCE STATEMENT

00C4 CD0D03      385  CALL RGLOC ; YES - GET REGISTER SAVE LOCATION IN H & L
00C7 73          386  MOV M,E ; UPDATE REGISTER CONTENTS
                 387 EXM10:
00C8 FE10        388  CPI PERIO ; WAS LAST CHARACTER A PERIOD ?
00CA CAD601      389  JZ CLDIS ; YES - CLEAR DISPLAY AND TERMINATE COMMAND
00CD FE11        390  CPI COMMA ; WAS LAST CHARACTER ',' ?
00CF C2FF01      391  JNZ ERR ; NO - DISPLAY ERROR MSG. AND TERMINATE COMMAND
00D2 CD8F02      392  CALL NXTRG ; YES - ADVANCE REGISTER POINTER TO
                 393                    ;/NEXT REGISTER
                 394                    ; ANY MORE REGISTERS ?
                 395  TRUE EXM05 ; YES - CONTINUE PROCESSING WITH NEXT REGISTER
00D5 DAAF00      396+ JC EXM05
00D8 C2D601      397  JMP CLDIS ; NO - CLEAR DISPLAY AND TERMINATE COMMAND
                 398 ;
                 399 ;*****************************************************************
                 400 ;
                 401 ; FUNCTION: GOCMD - EXECUTE USER PROGRAM
                 402 ; INPUTS: NONE
                 403 ; OUTPUTS: NONE
                 404 ; CALLS: DISPC,RDKBD,CLEAR,GTHEX,ERR,OUTPT
                 405 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 406 ;
                 407 GOCMD:
00DB CDE301      408  CALL DISPC ; DISPLAY USER PROGRAM COUNTER
00DE CDC002      409  CALL RDKBD ; READ FROM KEYBOARD
00E1 FE10        410  CPI PERIO ; IS CHARACTER A PERIOD ?
00E3 CAFA00      411  JZ G10 ; YES - GO EXECUTE THE COMMAND
                 412                    ; NO - ARG - CHARACTER IS STILL IN A
00E6 32FE20      413  STA IBUFF ; REPLACE CHARACTER IN INPUT BUFFER
00E9 CDCD01      414  CALL CLEAR ; CLEAR DISPLAY
00EC 0600        415  MVI B,ADFLD ; ARG - USE ADDRESS FIELD
00EE CD0D02      416  CALL GTHEX ; GET HEX DIGITS
00F1 FE10        417  CPI PERIO ; WAS LAST CHARACTER A PERIOD ?
00F3 C2FF01      418  JNZ ERR ; NO - DISPLAY ERROR MSG. AND TERMINATE COMMAND
00F6 EB          419  XCHG ; PUT HEX VALUE FROM GTHEX TO H & L
00F7 22F220      420  SHLD PSAV ; HEX VALUE IS NEW USER PC
                 421 G10:
00FA CDCD01      422  CALL CLEAR ; CLEAR DISPLAY
00FD 21E703      423  LXI H,EXMSG ; GET ADDRESS OF EXECUTION MESSAGE IN H & L
0100 0E04        424  MVI C,4 ; LOAD C WITH COUNT OF 4
0102 CD9E02      425  CALL OUTPT ; DISPLAY EXECUTION MESSAGE
0105 C32B03      426  JMP PSTOR ; RESTORE USER REGISTERS INCL. PROGRAM COUNTER
                 427                    ;/I.E. BEGIN EXECUTION OF USER PROGRAM
                 428 ;
                 429 ;*****************************************************************
                 430 ;
                 431 ; FUNCTION SSTEP - SINGLE STEP (EXECUTE ONE USER INSTRUCTION)
                 432 ; INPUTS: NONE
                 433 ; OUTPUTS: NONE
                 434 ; CALLS: DISPC,RDKBD,CLEAR,GTHEX,ERR
                 435 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 436 ;
                 437 SSTEP:
0108 CDE301      438  CALL DISPC ; DISPLAY USER PROGRAM COUNTER
010B CDC002      439  CALL RDKBD ; READ FROM KEYBOARD
```

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LOC  OBJ        LINE      SOURCE STATEMENT

010E FE10        440  CPI PERIO ; WAS CHARACTER A PERIOD ?
0110 CAD601      441  JZ CLDIS ; YES - CLEAR DISPLAY AND TERMINATE COMMAND
0113 FE11        442  CPI COMMA ; WAS LAST CHARACTER A COMMA ?
0115 CA2D01      443  JZ STP20 ; YES - GO SET TIMER
                 444 ; NO - CHARACTER FROM KEYBOARD WAS NIETER PERIOD OR COMMA
0118 32FE20      445  STA IBUFF ; REPLACE THE CHARACTER IN THE INPUT BUFFER
011B CDCD01      446  CALL CLEAR ; CLEAR DISPLAY
011E CD0002      447  CALL GTHEX ; GET HEX DIGITS - WERE ANY DIGITS RECIEVED ?
                 448  FALSE ERR ; NO - DIPLAY ERROR MSG. AND TERMINATE COMMAND
0121 D2FF01      449+ JNC ERR
0124 EB          450  XCHG ; HEX VALUE FROM GTHEX TO H & L
0125 22F220      451  SHLD PSAV ; HEX VALUE IS NEW USER PC
0128 FE10        452  CPI PERIO ; WAS LAST CHARACTER FROM GTHEX A PERIOD ?
012A CAD601      453  JZ CLDIS ; YES - CLEAR DISPLAY AND TERMINATE COMMAND
                 454                   ; NO - MUST HAVE BEEN A COMMA
                 455 STP20:
012D 3AF120      456  LDA ISAV ; GET USER INTERRUPT MASK
0130 E608        457  ANI 08H ; KEEP INTERRUPT STATUS
0132 32FD20      458  STA TEMP ; SAVE USER INTERRUPT STATUS IN TEMP
0135 2AF220      459  LHLD PSAV ; GET USER PC
0138 7E          460  MOV A,M ; GET USER INSTRUCTION
0139 FEF3        461  CPI (DI) ; DI INSTRUCTION ?
013B C24101      462  JNZ STP21 ; NO
013E AF          463  XRA A ; YES - RESET USER INTERRUPT STATUS
013F C34901      464  JMP STP22
                 465 STP21:
0142 FEFB        466  CPI (EI) ; EI INSTRUCTION ?
0144 C24C01      467  JNZ STP23 ; NO
0147 3E08        468  MVI A,08H ; YES - SET USER INTERRUPT STATUS
                 469 STP22:
0149 32FD20      470  STA TEMP ; SAVE NEW USER INTERRUPT STATUS
                 471 STP23:
014C C32B03      472  JMP RSTOR ; RESTORE USER REGISTERS
                 473 ;
                 474 STP25: ; BRANCH HERE WHEN TIMER INTERUPTS AFTER
                 475                   ;/ONE USER INSTRUCTION
014F F5          476  PUSH PSW ; SAVE PSW
0150 3AFF20      477  LDA USCSR ; GET USER IMAGE OF WHAT'S IN CSR
0153 E63F        478  ANI 3FH ; CLEAR 2 HIGH ORDER BITS
0155 F1          479  POP PSW ; RETRIEVE PSW
0156 22EF20      480  SHLD LSAV ; SAVE H & L
0159 E1          481  POP H ; GET USER PROGRAM COUNTER FROM TOP OF STACK
015A 22F220      482  SHLD PSAV ; SAVE USER PC
015D F5          483  PUSH PSW
015E E1          484  POP H
015F 22ED20      485 SHLD FSAV ; SAVE FLIP/FLOPS AND A REGISTER
0162 210000      486  LXI H,0 ; CLEAR H & L
0165 39          487  DAD SP ; GET USER STACK POINTER
0166 22F420      488  SHLD SSAV ; SAVE USER STACK POINTER
0169 21ED20      489  LXI H,BSAV+1 ; SET MONITOR STACK POINTER FOR
016C F9          490  SPHL ; /SAVING REMAINING USER REGISTERS
016D C5          491  PUSH B ; SAVE B & C
016E D5          492  PUSH D ; SAVE D & E
016F 20          493  RIM ; GET USER INTERRUPT MASK
0170 E607        494  ANI 07H ; KEEP MASK BITS
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LOC  OBJ       LINE      SOURCE STATEMENT

0172 21F020     495  LXI H,TEMP ; GET USER INTERRUPT STATUS
0175 B6         496  ORA M ; OR IT INTO MASK
0176 32F120     497  STA ISAV ; SAVE INTERRUPT STATUS AND MASK
0179 3E0E       498  MVI A,UNMSK ; UNMASK INTERRUPTS FOR MONITOR USE
017B 30         499  SIM
017C C30801     500  JMP SSTEP ; GO GET READY FOR ANOTHER INSTRUCTION
                501 ;
                502 ;*****************************************************************
                503 ;
                504 ; FUNCTION: SUBST - SUBSTITUTE MEMORY
                505 ; INPUTS: NONE
                506 ; OUTPUTS: NONE
                507 ; CALLS: CLEAR,GTHEX,UPDAD,UPDDT,ERR
                508 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                509 ;
                510 SUBST:
017F CDCD01     511  CALL CLEAR ; CLEAR THE DISPLAY
0182 21EF03     512  LXI H,SMSG ; DISPLAY SUBSTITUTE MESSAGE
0185 0E04       513  MVI C,4
0187 CD9E02     514  CALL OUTPT
018A CD0D02     515  CALL GTHEX ; GET HEX DIGITS - WERE ANY DIGITS RECIEVED ?
                516  FALSE ERR ; NO - DISPLAY ERROR MSG. AND TERMINATE COMMAND
018D D2FF01     517+ JNC ERR
0190 EB         518  XCHG ; ASSIGN HEX VALUE RETURNED BY GTHEX TO
0191 22F620     519  SHLD CURAD ; / CURRENT ADDRESS
                520 SUB05:
0194 FE11       521  CPI COMMA ; WAS ',' THE LAST CHARACTER FROM KEYBOARD ?
0196 C2C501     522  JNZ SUB15 ; NO - GO TERMINATE THE COMMAND
0199 0E00       523  MVI B,NODOT ; ARG - NO DOT IN ADDRESS FIELD
019B CD6F03     524  CALL UPDAD ; UPDATE ADDRESS FIELD OF DISPLAY
019E 2AF620     525  LHLD CURAD ; GET CURRENT ADDRESS IN H & L
01A1 7E         526  MOV A,M ; GET DATA BYTE POITED TO BY CURRENT ADDRESS
01A2 32F920     527  STA CURDT ; STORE DATA BYTE AT CURRENT DATA
01A5 CD7C03     528  CALL UPDDT ; UPDATE DATA FIELD OF DISPLAY
01A8 0601       529  MVI B,DTFLD ; ARG - USE DATA FIELD
01AA CD0D02     530  CALL GTHEX ; GET HEX DIGITS - WERE ANY HEX DIGITS RECIEVED ?
01AD F5         531  PUSH PSW ; (SAVE LAST CHARACTER)
                532  FALSE SUB10 ; NO - LEAVE DATA UNCHANGED AT CURRENT ADDRESS
01AE D2BA01     533+ JNC SUB10
01B1 2AF620     534  LHLD CURAD ; YES - GET CURRENT ADDRESS IN H & L
01B4 73         535  MOV M,E ; STORE NEW DATA AT CURRENT ADDRESS
                536          ; MAKE SURE DATA WAS ACTUALLY STORED IN CASE
                537          ;/CURRENT ADDRESS IS IN ROM OR IS NON-VOLITILE
01B5 7B         538  MOV A,E ; DATA TO A FOR COMPARISON
01B6 BE         539  CMP M ; WAS DATA STORED CORRECTLY
01B7 C2FF01     540  JNZ ERR ; NO - DISPLAY ERROR MSG. AND TERMINATE COMMAND
                541 SUB10:
01BA 2AF620     542  LHLD CURAD ; INCREMENT CURRENT ADDRESS
01BD 23         543  INX H
01BE 22F620     544  SHLD CURAD
01C1 F1         545  POP PSW ; RETRIEVE LAST CHARACTER
01C2 C39401     546  JMP SUB05 ;
                547 SUB15:
01C5 FE10       548  CPI PERIO ; WAS LAST CHARACTER A PERIOD ?
01C7 C2FF01     549  JNZ ERR ; NO - DISPLAY ERROR MSG. AND TERMINATE COMMAND
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LOC  OBJ        LINE       SOURCE STATEMENT

01C9 C3D601      550  JMP CLDIS ; YES - CLEAR DISPLAY AND TERMINATE COMMAND
                 551 ;
                 552 ;
                 553 ;*******************************************************************
                 554 ;
                 555 ;                    UTILITY ROUTINES
                 556 ;
                 557 ;*******************************************************************
                 558 ;
                 559 ; FUNCTION: CLEAR - CLEAR DISPLAY
                 560 ; INPUTS: NONE
                 561 ; OUTPUTS: NONE
                 562 ; CALLS: OUTPT
                 563 ; DESTROYES: A,B,C,D,E,H,L,F/F'S
                 564 ; DESCRIPTION: CLEAR SENDS BLANK CHARACTERS TO BOTH THE ADDRESS FIELD
                 565 ;              AND THE DATA FIELD OF THE DISPLAY.  IF THE DOT FLAG IS
                 566 ;              SET THEN A DOT WILL APPEAR AT THE RIGHT EDGE OF THE
                 567 ;              ADDRESS FIELD
                 568 ;
                 569 CLEAR:
01CC 21D803      570  LXI H,BLANKS ; ARG - ADDRESS OF BLANKS FOR DISPLAY
01CF 0E08        571  MVI C,8 ; LOAD C WITH CHARACTER COUNT
01D1 CD9E02      572  CALL OUTPT ; OUTPUT BLANKS TO ADDRESS FIELD
01D4 C9          573  RET ;RETURN
                 574 ;
                 575 ;*******************************************************************
                 576 ;
                 577 ; FUNCTION: CLDIS - CLEAR DISPLAY AND TERMINATE COMMAND
                 578 ; INPUTS: NONE
                 579 ; OUTPUTS: NONE
                 580 ; CALLS: CLEAR
                 581 ; DESTROYES: A,B,C,D,E,H,L,F/F'S
                 582 ; DESCRIPTION: CLDIS IS JUMPED TO BY COMMAND ROUTINES WISHING TO
                 583 ;              TERMINATE NORMALLY.  CLDIS CLEARS THE DISPLAY AND
                 584 ;              BRANCHES TO THE COMMAND RECOGNIZER.
                 585 ;
                 586 CLDIS:
01D6 CDCC01      587  CALL CLEAR ; CLEAR THE DISPLAY
01D9 C36400      588  JMP CMND ; GO GET ANOTHER COMMAND
                 589 ;
                 590 ;*******************************************************************
                 591 ;
                 592 ; FUNCTION: CLDST - COLD START
                 593 ; INPUTS: NONE
                 594 ; OUTPUTS: NONE
                 595 ; CALLS: NOTHING
                 596 ; DESTROYES: A
                 597 ; DESCRIPTION: CLDST IS JUMPED TO BY THE MAIN COLD START PROCEDURE.
                 598 ;              COMPLETES THE COLD START INITIALIZATION,
                 599 ;              AND JUMPS BACK TO THE MAIN COLD START PROCEDURE.
                 600 ;
                 601 CLDST:
01DC 3EE0        602  MVI A,URTPC ; LOAD UART PORT CONTROL BYTE
01DE D3D0        603  OUT CONCP ; OUTPUT PORT CONTROL BYTE
01E0 3E03        604  MVI A,URTSPC ; LOAD UART SYSTEM CONTROL BYTE
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LOC  OBJ        LINE       SOURCE STATEMENT

01E2 D3DE        605  OUT CONSCP ; OUTPUT SYSTEM CONTROL BYTE TO SYSTEM PORT
                 606 ;
01E4 21E920      607  LXI H,MNSTK ; LOAD HL WITH STACK START ADDRESS
01E7 F9          608  SPHL ; STACK POINTER SET UP
                 609 ;
01E8 C30500      610  JMP CLDBK ; BACK TO MAIN PROCEDURE
                 611 ;
                 612 ;*****************************************************************
                 613 ;
                 614 ; FUNCTION: DISPC - DISPLAY PROGRAM COUNTER
                 615 ; INPUTS: NONE
                 616 ; OUTPUTS: NONE
                 617 ; CALLS: UPDAD,UPDDT
                 618 ; DESTROYES: A,B,C,D,E,H,L,F/F'S
                 619 ; DESCRIPTION: DISPC DISPLAYS THE USER PROGRAM COUNTER IN THE ADDRESS
                 620 ;              FIELD OF THE DISPLAY,WITH A DOT AT THE RIGHT EDGE
                 621 ;              OF THE FIELD. THE BYTE OF DATA ADDRESSED BY TH E PROGRAM
                 622 ;              COUNTER IS DISPLAYED IN THE DATA FIELD OF THE DISPLAY.
                 623 ;
                 624 DISPC:
01EB CD0D01      625  CALL CLEAR ; CLEAR DISPLAY
01EE 2AF220      626  LHLD PSAV ; GET USER PROGRAM COUNTER
01F1 22F620      627  SHLD CURAD ; MAKE IT THE CURRENT ADDRESS
01F4 7E          628  MOV A,M ; GET THE INSTRUCTION AT THAT ADDRESS
01F5 32F820      629  STA CURDT ; MAKE IT THE CURRENT DATA
01F8 CD6F03      630  CALL UPDAD ; UPDATE ADDRESS FIELD OF DISPLAY
01FB CD7C03      631  CALL UPDDT ; UPDATE DATA FIELD OF DISPLAY
01FE C9          632  RET ; RETURN
                 633 ;
                 634 ;*****************************************************************
                 635 ;
                 636 ; FUNCTION: ERR - DISPLAY ERROR MESSAGE
                 637 ; INPUTS: NONE
                 638 ; OUTPUTS: NONE
                 639 ; CALLS: OUTPT
                 640 ; DESTROYES: A,B,C,D,E,H,L,F/F'S
                 641 ; DESCRIPTION: ERR IS JUMPED TO BY COMMAND ROUTINES WISHING TO
                 642 ;                TERMINATE BECAUSE OF AN ERROR.
                 643 ;                ERR OUTPUTS AN ERROR MESSAGE TO THE DISPLAY AND
                 644 ;                BRANCHES TO THE COMMAND RECOGNIZER.
                 645 ;
                 646 ERR:
01FF 21E303      647  LXI H,ERMSG ; ARG - ADDRESS OF ERROR MESSAGE
0202 0E04        648  MVI C,4 ; LOAD 4 COUNT
0204 CD9E02      649  CALL OUTPT ; OUTPUT ERROR MESSAGE TO ADDRESS FIELD
0207 CD9103      650  CALL SECDT ; DELAY FOR 2 SECONDS
                 651 ;
020A C36400      652  JMP CMMND ; GO GET A NEW COMMAND
                 653 ;
                 654 ;*****************************************************************
                 655 ;
                 656 ; FUNCTION: GTHEX - GET HEX DIGITS
                 657 ; INPUTS: NONE
                 658 ; OUTPUTS: A - LAST CHARACTER READ FROM KEYBOARD
                 659 ;          DE - HEX DIGITS FROM KEYBOARD EVALUATED MODULO 256**2
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LOC  OBJ        LINE       SOURCE STATEMENT

                  660 ;          CARRY - SET IF AT LEAST ONE VALID HEX DIGIT WAS READ
                  661 ;                - RESET OTHERWISE
                  662 ; CALLS: RDKBD, INSDG, HXDSP, OUTPT
                  663 ; DESTROYS: A, B, C, D, E, H, L, F/F'S
                  664 ; DESCRIPTION: GTHEX ACCEPTS A STRING OF HEX DIGITS FROM THE KEYBOARD,
                  665 ;              DISPLAYS THEM AS THEY ARE RECIEVED, AND RETURNS THEIR
                  666 ;              VALUE AS A 16 BIT INTEGER.  IF MORE THAN 4 HEX DIGITS
                  667 ;              ARE RECIEVED, ONLY THE LAST 4 ARE USED.
                  668 ;              THE LAST FOUR HEXIDECIMAL
                  669 ;              DIGITS ARE DISPLAYED IN THE ADDRESS FIELD OF THE
                  670 ;              DISPLAY.  A CHARACTER WHICH IS NOT
                  671 ;              A HEX DIGIT TERMINATES THE STRING AND IS RETURNED AS
                  672 ;              AN OUTPUT OF THE FUNCTION.  IF THE TERMINATOR IS NOT
                  673 ;              A PERIOD OR A COMMA THEN ANY HEX DIGITS WHICH MAY HAVE
                  674 ;              BEEN RECIEVED ARE CONSIDERED TO BE INVALID.  THE
                  675 ;              FUNCTION RETURNS A FLAG INDICATING WHETHER OR NOT ANY
                  676 ;              VALID HEX DIGITS WERE RECEIVED.
                  677 ;
                  678 GTHEX:
0200 0E00         679  MVI C,0 ; RESET HEX DIGIT FLAG
0202 110000       680  LXI D,0 ; SET HEX VALUE TO ZERO
0205 C5           681  PUSH B ; SAVE BC
0206 D5           682  PUSH D ; SAVE HEX VALUE
                  683 GTH05:
0207 CDC002       684  CALL RDKBD ; READ KEYBOARD
020A FE10         685  CPI 10H ; IS CHARACTER A HEX DIGIT ?
020C D21502       686  JNC GTH20 ; NO - GO CHECK FOR TERMINATOR
                  687                    ; YES = ARG - NEW HEX DIGIT IS IN A
020F D1           688  POP D ; ARG - RETRIEVE HEX VALUE
0210 CD8602       689  CALL INSDG ; INSERT NEW DIGIT IN HEX VALUE
0213 C1           690  POP B ; RETRIEVE DISPLAY FLAG
0214 0E01         691  MVI C,1 ; SET HEX DIGIT FLAG
                  692                    ; /(I.E  A HEX DIGIT HAS BEEN READ)
0216 C5           693  PUSH B ; SAVE BC
0217 D5           694  PUSH D ; SAVE HEX VALUE
0218 78           695  MOV A,B ; TEST DISPLAY FLAG
0219 0F           696  RRC ; SHOULD ADDRESS FIELD OF DISPLAY BE USED ?
021A D22102       697  JNC GTH10 ; YES - USE HEX VALUE AS IS
                  698                    ; NO - ONLY LOW ORDER BYTE OF HEX VALUE SHOULD
                  699                    ; /BE USED FOR DATA FIELD OF DISPLAY
021D 53           700  MOV D,E ; PUT LOW ORDER BYTE OF HEX VALUE IN D
021E CD8003       701  CALL DSPDT2
0221 C30702       702  JMP GTH05
                  703 GTH10:
                  704                    ; ARG - HEX VALUE TO BE EXPANDED IS IN D & E
0224 CD7303       705  CALL DSPDT4 ; GO DO 2 CHARACTER OUTPUT
                  706 ;
0227 C30702       707  JMP GTH05 ; GO GET NEXT CHARACTER
                  708 GTH20:
                  709                    ; LAST CHARACTER WAS NOT A HEX DIGIT
022A D1           710  POP D ; RETRIEVE HEX VALUE
022B FE11         711  CPI COMMA ; WAS LAST CHARACTER A COMMA ?
022D CA4802       712  JZ GTH25 ; YES - READY TO RETURN
0230 FE10         713  CPI PERIO ; NO - WAS LAST CHARACTER A PERIOD ?
0232 CA4802       714  JZ GTH25 ; YES - READY TO RETURN
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LOC  OBJ        LINE       SOURCE STATEMENT

                  715                   ; NO - INVALID TERMINATOR - IGNORE ANY HEX DIGITS READ
0242 110000       716  LXI D,0 ; SET HEX VALUE TO ZERO
0245 C30303       717  JMP RETF ; RETURN FALSE
                  718 GTH25:
0248 C1           719  POP B ; POP BC
0249 47           720  MOV B,A ; SAVE LAST CHARACTER
024A 79           721  MOV A,C ; SHIFT HEX DIGIT FLAG TO
024B 0F           722  RRC ; /CARRY BIT
024C 78           723  MOV A,B ; RESTORE LAST CHARACTER
024D C9           724  RET ; RETURN
                  725 ;
                  726 ;*****************************************************************
                  727 ;
                  728 ; FUNCTION: HXDSP - EXPAND HEX DIGITS FOR DISPLAY
                  729 ; INPUTS: DE - 4 HEX DIGITS
                  730 ; OUTPUTS: HL - ADDRESS OF OUTPUT BUFFER
                  731 ; CALLS: NOTHING
                  732 ; DESTROYS: A,H,L,F/F'S
                  733 ; DESCRIPTION: HXDSP EXPANDS EACH INPUT BYTE TO 2 BYTES IN A FORM
                  734 ;              SUITABLE FOR DISPLAY BY THE OUTPUT ROUTINES. EACH INPUT
                  735 ;              BYTE IS DIVIDED INTO 2 HEX DIGITS. EACH HEX DIGIT IS
                  736 ;              STORED IN THE OUTPUT BUFFER. THE FUNCTION RETURNS THE
                  737 ;              ADDRESS OF THE OUTPUT BUFFER.
                  738 ;
                  739 HXDSP:
024E 7A           740  MOV A,D ; GET FIRST DATA BYTE
024F 0F           741  RRC ; CONVERT 4 HIGH ORDER BITS
0250 0F           742  RRC ; /TO A SINGLE CHARACTER
0251 0F           743  RRC
0252 0F           744  RRC
0253 21F920       745  LXI H,OBUFF ; GET ADDRESS OF OUTPUT BUFFER
0256 CD7402       746  CALL HEXASC ; CONVERT BITS TO ASCII CODE IN A
0259 77           747  MOV M,A ; STORE CHARACTER IN OUTPUT BUFFER
025A 7A           748  MOV A,D ; GET FIRST DATA BYTE AND CONVERT 4 LOW ORDER
025B 23           749  INX H ; NEXT BUFFER POSITION
025C CD7402       750  CALL HEXASC
025F 77           751  MOV M,A ; STORE CHARACTER IN BUFFER
0260 7B           752 HXDSP2: MOV A,E ; GET SECOND DATA BYTE
0261 0F           753  RRC ; CONVERT 4 HIGH ORDER BITS
0262 0F           754  RRC ; /TO A SINGLE CHARACTER
0263 0F           755  RRC
0264 0F           756  RRC
0265 23           757  INX H ; NEXT BUFFER POSITION
0266 CD7402       758  CALL HEXASC
0269 77           759  MOV M,A ; STORE CHARACTER IN BUFFER
026A 7B           760  MOV A,E ; GET SECOND DATA BYTE AND CONVERT LOW ORDER
026B 23           761  INX H ; NEXT BUFFER POSITION
026C CD7402       762  CALL HEXASC
026F 77           763  MOV M,A ; STORE CHARACTER IN BUFFER
0270 21F920       764  LXI H,OBUFF ; RETURN ADDRESS OF OUTPUT BUFFER IN H & L
0273 C9           765  RET ; RETURN
                  766 ;
                  767 ;*****************************************************************
                  768 ;
                  769 ; FUNCTION: HEXASC
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LOC  OBJ       LINE       SOURCE STATEMENT

                770 ; INPUTS: HEX DIGIT IN ACCUMULATOR
                771 ; OUTPUTS: ASCII CODE IN A
                772 ; CALLS: NOTHING
                773 ; DESTROYS: A,F/F'S
                774 ; DESCRIPTION: HEXASC CONVERTS A HEX NIBBLE IN A TO AN ASCII CODE
                775 ;
                776 HEXASC:
0274 E60F       777  ANI 0FH ; CLEAR UPPER BITS TO ZERO
0276 FE0A       778  CPI 0AH ; TEST BITS IF A-F
0278 DA7E02     779  JC HEX85 ; JUMP IF 0-9
027B C637       780  ADI 037H ; ADD 37 TO FORM ASCII
027D C9         781  RET ; RETURN
                782 HEX85:
027E F630       783  ORI 030H ; OR IN A 30 TO 0-9
0280 C9         784  RET ; RETURN
                785 ;
                786 ;*****************************************************************
                787 ;
                788 ; FUNCTION: ININT - INPUT INTERRUPT PROCESSING
                789 ; INPUTS: NONE
                790 ; OUTPUTS: NONE
                791 ; CALLS: NOTHING
                792 ; DESTROYS: NOTHING
                793 ; DESCRIPTION: ININT IS ENTERED BY MEANS OF AN INTERRUPT VECTOR (IV2).
                794 ;
                795 ININT:
0281 E5         796  PUSH H ; SAVE H & L
0282 F5         797  PUSH PSW ; SAVE F/F'S & REGISTER A
                798 ; ***** INTERRUPT CODE GOES HERE
0283 F1         799  POP PSW ; RESTORE F/F'S & REGISTER A
0284 E1         800  POP H ; RESTORE H & L
0285 C9         801  RET ;RETURN
                802 ;
                803 ;*****************************************************************
                804 ;
                805 ; FUNCTION: INSDG - INSERT HEX DIGIT
                806 ; INPUTS: A - HEX DIGIT TO BE INSERTED
                807 ;         DE - HEX VALUE
                808 ; OUTPUTS: DE - HEX VALUE WITH DIGIT INSERTED
                809 ; CALLS: NOTHING
                810 ; DESTROYES: A,F/F'S
                811 ; DESCRIPTION: INSDG SHIFTS THE CONTENTS OF D & E LEFT 4 BITS
                812 ;              (1 HEX DIGIT) AND INSERTS THE HEX DIGIT IN THE LOW
                813 ;              ORDER DIGIT POSITION OF THE RESULT. A IS ASSUMED TO
                814 ;              CONTAIN A SINGLE HEX DIGIT IN THE LOW ORDER 4 BITS AND
                815 ;              ZEROS IN THE HIGH ORDER 4 BITS.
                816 ;
                817 INSDG:
0286 EB         818  XCHG ; PUT D & E IN H & L
0287 29         819  DAD H ; SHIFT H & L LEFT 4 BITS
0288 29         820  DAD H
0289 29         821  DAD H
028A 29         822  DAD H
028B 85         823  ADD L ; INSERT LOW ORDER DIGIT
028C 6F         824  MOV L,A ; BY ADDING L+A = A
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LOC  OBJ        LINE       SOURCE STATEMENT

029D EB          875  XCHG ; PUT H & L BACK IN D & E
029E C9          876  RET ; RETURN
                 877 ;
                 878 ;*******************************************************************
                 879 ;
                 880 ; FUNCTION: NXTRG - ADVANCE REGISTER POINTER TO NEXT REGISTER
                 881 ; INPUTS: NONE
                 882 ; OUTPUTS: CARRY - 1 IF POINTER IS ADVANCED SUCCESSFULLY
                 883 ;                - 0 OTHERWISE
                 884 ; CALLS: NOTHING
                 885 ; DESTROYS: A,F/F'S
                 886 ; DESCRIPTION: IF THE REGISTER POINTER POINTS TO THE LAST REGISTER IN
                 887 ;              THE EXAMINE REGISTER SEQUENCE, THE POINTER IS NOT
                 888 ;              CHANGED AND THE FUNCTION RETURNS FALSE. IF THE REGISTER
                 889 ;              POINTER DOES NOT POINT TO THE LAST REGISTER THEN THE
                 890 ;              POINTER IS ADVANCED TO THE NEXT REGISTER IN THE SEQUENCE
                 891 ;              AND THE FUNCTION RETURNS TRUE.
                 892 ;
                 893 NXTRG:
028F 3AFD20      894  LDA RGPTR ; GET REGISTER POINTER
0292 FE0C        895  CPI NUMRG-1 ; DOES POINTER POINT TO LAST REGISTER ?
0294 D29803      896  JNC RETF ; YES - UNABLE TO ADVANCE POINTER - RETURN FALSE
0297 3C          897  INR A ; NO - ADVANCE REGISTER POINTER
0298 32FD20      898  STA RGPTR ; SAVE REGISTER POINTER
029B C30E03      899  JMP RETT ; RETURN TRUE
                 900 ;
                 901 ;*******************************************************************
                 902 ;
                 903 ; FUNCTION: OUTPT - OUTPUT CHARACTERS TO DISPLAY
                 904 ; INPUTS:
                 905 ;         C - CHARACTER COUNT
                 906 ;        HL - ADDRESS OF CHARACTERS TO BE OUTPUT
                 907 ; CALLS: NOTHING
                 908 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 909 ; DESCRIPTION: OUTPT SENDS CHARACTERS TO THE DISPLAY. THE ADDRESS
                 910 ;              OF THE CHARACTERS IS RECIEVED AS AN ARGUMENT
                 911 ;
                 912 OUTPT:
029E 1E07        913  MVI E,7 ; CLEAR E TO 7 FOR ZERO CHARACTER POSITION
02A0 56          914 OUT05: MOV D,M ; LOAD CHARACTER IN (HL)
02A1 CDAB02      915  CALL DISP1 ; CALL DISPLAY ROUTINE FOR 1 CHARACTER
02A4 1D          916  DCR E ; DECREMENT E FOR POSITION COUNT
02A5 23          917  INX H ; INCREMENT ADDRESS REGISTER HL TO NEXT CHARACTER
02A6 0D          918  DCR C ; DECREMENT CHARACTER COUNT
02A7 C2A002      919  JNZ OUT05 ; LOOP BACK IF NOT DONE DISPLAY
02AA C9          920  RET ; RETURN
                 921 ; ********
                 922 ; PRO-LOG 7303 DISPLAY OUTPUT CODE
02AB 7A          923  DISP1: MOV A,D ; OUTPUT DISPLAY DATA
02AC F680        924  ORI 080H ; TURN ON BIT 8 FOR PRO-LOG
02AE D3D0        925  OUT 0D0H ; PORT D0,SEND DATA
02B0 7B          926  MOV A,E ; OUTPUT DISPLAY ADDRESS,SET NOTWR HIGH
02B1 E6F7        927  ANI 0F7H ; AND TO FORM CODE 11110111
02B3 D3D1        928  OUT 0D1H ; PORT D1 ,SEND POSITION TO D1
02B5 7B          929  MOV A,E ; SET NOT WR LOW
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

02B6 F608        880  ORI 08H ; OR IN A 00001000
02B8 D3D1        881  OUT 0D1H ; PORT D1
02BA 7B          882  MOV A,E
02BB E6F7        883  ANI 0F7H ; AND IN A 11110111
02BD D3D1        884  OUT 0D1H ; PORT D1
02BF C9          885  RET ; RETURN
                 886 ;
                 887 ;*****************************************************************
                 888 ;
                 889 ; FUNCTION: RDKBD - READ KEYBOARD
                 890 ; INPUTS: NONE
                 891 ; OUTPUTS: A - CHARACTER READ FROM KEYBOARD
                 892 ; CALLS: NOTHING
                 893 ; DESTROYS: A,H,L,F/F'S
                 894 ; DESCRIPTION: RDKBD DETERMINES WHETHER OR NOT THERE IS A CHARACTER IN
                 895 ;              THE INPUT BUFFER. IF NOT, THE FUNCTION ENABLES
                 896 ;              INTERRUPTS AND LOOPS UNTIL THE INPUT INTERRUPT
                 897 ;              ROUTINE STORES A CHARACTER IN THE BUFFER. WHEN
                 898 ;              THE BUFFER CONTAINS A CHARACTER, THE FUNCTION FLAGS
                 899 ;              THE BUFFER AS EMPTY AND RETURNS THE CHARACTER
                 900 ;              AS OUTPUT.
                 901 ;
                 902 RDKBD:
                 903 ; ********
                 904 ; PRO-LOG 7303 KEYBOARD INPUT DRIVER
02C0 D5          905   PUSH D ; SCAN KEYBOARD BY ENABLING
02C1 C5          906  PUSH B ; ONE COLUMN AT A TIME AND
                 907 ;
02C2 1688        908  MVI D,88H ; LOOKING FOR A KEY CLOSURE, 10001000
02C4 7A          909  NXTCOL: MOV A,D
02C5 07          910  RLC ; ROTATE A LEFT AND SET CARRY
02C6 57          911  MOV D,A ; SAVE SHIFTED PATTERN
02C7 E60F        912  ANI 0FH ; AND IN A 00001111
02C9 D3D0        913  OUT 0D0H ; PORT D0
02CB DBD0        914  IN 0D0H ; PORT D0
02CD E63F        915  ANI 3FH ; AND IN A 00111111
02CF EAC402      916  JPE NXTCOL
02D2 5F          917  MOV E,A ; LOAD E WITH INPUT
02D3 CDA303      918  CALL MSEC20 ; WAIT 20 MSEC
02D6 DBD0        919  IN 0D0H ; PORT D0
02D8 E63F        920  ANI 3FH ; AND IN A 00111111
02DA A8          921  XRA E ; EOR E INTO ACC
02DB C2C402      922  JNZ NXTCOL ; IF NOT SAME IGNORE AND NEXT COLUMN
02DE 010000      923  LXI B,0 ; CLEAR BC
02E1 7A          924  MOV A,D ; LOAD PATTERN
02E2 1F          925 COLCNT: RAR ; CONVERT COLUMN OUTPUT TO A COUNT K
02E3 DAEA02      926  JC ROWCNT ; JUMP ON CARRY TO ROW COUNT
02E6 04          927  INR B
02E7 C3E202      928  JMP COLCNT
02EA 7B          929 ROWCNT: MOV A,E ; CONVERT ROW INPUT TO A COUNT J
02EB 1F          930  RAR
02EC 0C          931  INR C
02ED D2F302      932  JC ENCODE ; JUMP ON CARRY TO ENCODE
02F0 C3ED02      933  JMP ROWCNT+1
02F3 0D          934 ENCODE: DCR C ; DECREMENT REGISTER C
```

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LOC  OBJ       LINE       SOURCE STATEMENT

02F4 78         935  MOV A,B ; ;ORD ACC WITH ROW
02F5 C9FE02     936  JZ RKEXIT
02F8 C604       937 ADDROW: ADI 04H ; IF J.NE.0 ADD J*M (# OF COLS)
02FA 0D         938  DCR C
02FB C2F802     939  JNZ ADDROW
                940 RKEXIT:
02FE F5         941  PUSH PSW
02FF E5         942  PUSH H
0300 CD9703     943  CALL MSEC2H
0303 E1         944  POP H
0304 F1         945  POP PSW
0305 C1         946  POP B ; RESTORE ALL REGISTERS
0306 D1         947  POP D ; POP STACK FOR DE
0307 C9         948  RET ; RETURN
                949 ;
                950 ;*****************************************************************
                951 ;
                952 ; FUNCTION: RETF - RETURN FALSE
                953 ; INPUTS: NONE
                954 ; OUTPUTS: CARRY = 0 (FALSE)
                955 ; CALLS: NOTHING
                956 ; DESTROYS: CARRY
                957 ; DESCRIPTION: RETF IS JUMPED TO BY FUNCTIONS WISHING TO RETURN FALSE
                958 ;              RETF RESETS CARRY TO 0 AND RETURNS TO THE CALLER OF
                959 ;              THE ROUTINE INVOKING RETF.
                960 ;
                961 RETF:
0308 37         962  STC ; SET CARRY TRUE
0309 3F         963  CMC ; COMPLEMENT CARRY TO  MAKE IT FALSE
030A C9         964  RET ;RETURN
                965 ;
                966 ;*****************************************************************
                967 ;
                968 ; FUNCTION RETT - RETURN TRUE
                969 ; INPUTS: NONE
                970 ; OUTPUTS: CARRY = 1 (TRUE)
                971 ; CALLS: NOTHING
                972 ; DESTROYS: CARRY
                973 ; DESCRIPTION: RETT IS JUMPED TO BY ROUTINES WISHING TO RETURN TRUE
                974 ;              RETT SETS CARRY TO 1 AND RETURNS TO THE CALLER OF
                975 ;              THE ROUTTINE INVOKING RETT.
                976 ;
                977 RETT:
030B 37         978  STC ; SET CARRY TRUE
030C C9         979  RET ; RETURN
                980 ;
                981 ;*****************************************************************
                982 ;
                983 ; FUNCTION: RGLOC - GET REGISTER SAVE LOCATION
                984 ; INPUTS: NONE
                985 ; OUTPUTS: HL - REGISTER SAVE LOCATION
                986 ; CALLS: NOTHING
                987 ; DESTROYS: B,C,H,L,F/F'S
                988 ; DESCRIPTION: RGLOC RETURNS THE SAVE LOCATION OF THE REGISTER
                989 ;              INDICATED BY THE CURRENT REGISTER POINTER VALUE
```

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LOC  OBJ       LINE      SOURCE STATEMENT

                 990 ;
                 991 RGLOC:
0300 2AFD20      992  LHLD RGPTR ; GET REGISTER POINTER
0310 2600        993  MVI H,0 ; /IN H & L
0312 013C04      994  LXI B,RGTBL ; GET REGISTER SAVE LOCATION TABLE ADDRESS
0315 09          995  DAD B ; POINTER INDEXES TABLE
0316 6E          996  MOV L,M ; GET LOW ORDER BYTE OF REGISTER SAVE LOC.
0317 2620        997  MVI H,(RAMST SHR 8) ; GET HIGH ORDER BYTE OF
                 998                      ; /REGISTER SAVE LOCATION
0319 C9          999  RET ; RETURN
                1000 ;
                1001 ;*****************************************************************
                1002 ;
                1003 ; FUNCTION: RGNAM - DISPLAY REGISTER NAME
                1004 ; INPUTS: NONE
                1005 ; OUTPUTS: NONE
                1006 ; CALLS: OUTPT
                1007 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                1008 ; DESCRIPTION: RGNAM DISPLAYS, IN THE ADDRESS FIELD OF THE DISPLAY,
                1009 ;              THE REGISTER NAME CORRESPONDING TO THE CURRENT
                1010 ;              REGISTER POINTER VALUE
                1011 ;
                1012 RGNAM:
031A 2AFD20      1013  LHLD PGPTR ; GET REGISTER POINTER
031D 2600        1014  MVI H,0
031F 29          1015  DAD H ; MULTIPLY POINTER VALUE BY 4
0320 29          1016  DAD H ;/(REGISTER NAME TABLE HAS 4 BYTE ENTRIES)
0321 010804      1017  LXI B,NMTBL ; GET ADDRESS OF START OF REGISTER NAME TABLE
0324 09          1018  DAD B ; ARG - ADD TABLE ADDRESS TO POINTER
                 1019                   ; /ADDRESS OF APPROPRIATE REGISTER NAME IN H & L
0325 0E04        1020  MVI C,4
0327 CD9E02      1021  CALL OUTPT ; OUTPUT REGISTER NAME TO ADDRESS FIELD
032A C9          1022  RET ;RETURN
                1023 ;
                1024 ;*****************************************************************
                1025 ;
                1026 ; FUNCTION: RSTOR - RESTOR USER REGISTERS
                1027 ; INPUTS: NONE
                1028 ; OUTPUTS: NONE
                1029 ; CALLS: NOTHING
                1030 ; DEVSTROYS: A,B,C,D,E,H,L,F/F'S
                1031 ; DESCRIPTION: RSTOR RESTORES ALL CPU REGISTERS, FLIP/FLOPS,
                1032 ;              INTERRUPT STATUS, INTERRUPT MASK, TACK POINTER
                1033 ;              AND PROGRAM COUNTER FROM THEIR RESPECTIVE SAVE
                1034 ;              LOCATIONS IN MEMORY. BY RESTORING THE PROGRAM
                1035 ;              COUNTER, THE ROUTINE EFFECTIVELY TRANSFERS CONTROL TO
                1036 ;              THE ADDRESS IN THE PROGRAM COUNTER SAVE LOCATION.
                1037 ;
                1038 ;              THE TIMING OF THIS ROUTINE IS CRITICAL TO THE
                1039 ;              CORRECT OPERATION OF THE SINGLE STEP ROUTINE.
                1040 ;              IF ANY MODIFICATION CHANGES THE NUMBER OF CPU
                1041 ;              STATES NEEDED TO EXECUTE THIS ROUTINE THEN THE
                1042 ;                   TIMER VALUE MUST BE ADJUSTED BY THE SAME NUMBER.
                1043 ;
                1044 ;       THIS IS ALSO THE ENTRY POINT FOR THE TTY MONITOR
```

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LOC  OBJ       LINE       SOURCE STATEMENT

                1045 ;       TO RESTORE REGISTERS.
                1046 ;
                1047 RSTOR:
0328 3AF120     1048  LDA ISAV ; GET USER INTERRUPT MASK
032E F618       1049  ORI 18H ; ENABLE SETTING INTERRUPT MASK AND
                1050                  ; /RESET IV3C FLIP FLOP
0330 30         1051  SIM ; RESTORE USER INTERRUPT MASK
                1052 ;       RESTORE USER INTERRUPT STATUS
0331 3AF120     1053  LDA ISAV ; GET USER INTERRUPT MASK
0334 E608       1054  ANI 08H ; SHOULD USER INTERRUPTS BE ENABLED ?
0336 CA3D03     1055  JZ RSR05 ; NO - LEAVE INTERRUPTS DISABLED
0339 FB         1056  EI ; YES - ENABLE INTERRUPTS FOR USER PROGRAM
033A C34103     1057  JMP RSR10
                1058 RSR05:
033D 37         1059  STC ; DUMMY INSTRUCTIONS - WHEN SINGLE STEP ROUTINE
033E D24103     1060  JNC RSR10 ; /IS BEING USED, THE TIMER IS RUNNING AND
                1061                  ; /EXECUTE TIME FOR THIS ROUTINE MUS
                1062                  ; /VARY.
                1063 RSR10:
0341 21E920     1064  LXI H,MNSTK ; SET MONITOR STACK POINTER TO START OF STACK
0344 F9         1065  SPHL ; /WHICH IS ALSO END OF REGISTER SAVE AREA
0345 D1         1066  POP D ; RESTORE REGISTERS
0346 C1         1067  POP B
0347 F1         1068  POP PSW
0348 2AF420     1069  LHLD SSAV ; RESTORE USER STACK POINTER
034B F9         1070  SPHL
034C 2AF220     1071  LHLD PSAV
034F E5         1072  PUSH H ; PUT USER PROGRAM COUNTER ON STACK
0350 2AEF20     1073  LHLD LSAV ; RESTORE H & L REGISTERS
0353 C9         1074  RET ; RETURN
                1075 ;
                1076 ;**********************************************************************
                1077 ;
                1078 ; FUNCTION: SETRG - SET REGISTER POINTER
                1079 ; INPUTS: NONE
                1080 ; OUTPUTS: CARRY - SET IF CHARACTER FROM KEYBOARD IS A REGISTER DESIGNATOR
                1081 ;                 RESET OTHERWISE
                1082 ; CALLS: RDKBD
                1083 ; DESTROYS: A,B,C,H,L,F/F'S
                1084 ; DESCRIPTION: SETRG READS A CHARACTER FROM THE KEYBOARD.  IF THE
                1085 ;              CHARACTER IS A REGISTER DESIGNATOR, IT IS CONVERTED TO
                1086 ;              THE CORRESPONDING REGISTER POINTER VALUE, THE POINTER IS
                1087 ;              SAVED, AND THE FUNCTION RETURNS 'TRUE'  OTHERWISE, THE
                1088 ;              FUNCTION RETURNS 'FALSE'
                1089 ;
                1090 SETRG:
0354 CDC002     1091  CALL RDKBD ; READ FROM KEYBOARD
0357 FE10       1092  CPI 10H  ; IS CHARACTER A DIGIT ?
0359 D20803     1093  JNC RETF ; NO - RETURN FALSE - CHARACTER IS NOT A
                1094                  ; /REGISTER DESIGNATOR
035C D603       1095  SUI 3 ; YES - TRY TO CONVERT REGISTER DESIGNATOR TO
                1096                  ; / INDEX INTO REGISTER POINTER TABLE
                1097                  ; WAS CONVERSION SUCCESSFUL ?
035E D20803     1098  JC RETF ; NO - RETURN FALSE
0361 4F         1099  MOV C,A ; INDEX TO B & C
```

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LOC  OBJ       LINE       SOURCE STATEMENT

0362 0600      1100  MVI B,0 ;
0364 21F302    1101  LXI H,RGPTB ; GET ADDRESS OF REGISTER POINTER TABLE
0367 09        1102  DAD B ; INDEX POINTS INTO TABLE
0368 7E        1103  MOV A,M ; GET REGISTER POINTER FROM TABLE
0369 32FD20    1104  STA RGPTR ; SAVE REGISTER POINTER
036C C30803    1105  JMP RETT ; RETURN TRUE
               1106 ;
               1107 ;*******************************************************************
               1108 ;
               1109 ; FUNCTION: UPDAD - UPDATE ADDRESS FIELD OF DISPLAY
               1110 ; INPUTS: NONE
               1111 ; OUTPUTS: NONE
               1112 ; CALLS: HXDSP,OUTPT
               1113 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
               1114 ; DESCRIPTION: UPDAD UPDATES THE ADDRESS FIELD OF THE DISPLAY USING
               1115 ;              THE CURRENT ADDRESS.
               1116 ;
               1117 UPDAD:
036F 2AF620    1118  LHLD CURAD ; GET THE CURRENT ADDRESS
0372 EB        1119  XCHG ; ARG - PUT CURRENT ADDRESS IN D & E
               1120 DSPDT4: ; ENTRY POINT FOR 4 CHARACTER ADDRESS OUTPUT
0373 CD4E02    1121  CALL HXDSP ; EXPAND CURRENT ADDRESS FOR DISPLAY
               1122                    ; ARG - ADDRESS OF EXPANDED ADDRESS IS IN H & L
0376 0E04      1123  MVI C,04H ; LOAD 4 CHARACTER COUNT
0378 CD9E02    1124  CALL OUTPT ; OUTPUT CURRENT ADDRESS TO ADDRESS FIELD
037B C9        1125  RET ; RETURN -
               1126 ;
               1127 ;*******************************************************************
               1128 ;
               1129 ; FUNCTION: UPDDT - UPDATE DATA FIELD OF DISPLAY
               1130 ; INPUTS: NONE
               1131 ; OUTPUTS: NONE
               1132 ; CALLS: HXDSP,OUTPT
               1133 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
               1134 ; DESCRIPTION: UPDDT UPDATES THE DATA FIELD OF THE DISPLAY USING
               1135 ;              THE CURRENT DATA BYTE.
               1136 ;
               1137 UPDDT:
037C 3AF820    1138  LDA CURDT ; GET CURRENT DATA
037F 57        1139  MOV D,A ; ARG - PUT CURRENT DATA IN D
               1140 DSPDT2: ; ENTRY POINT FOR 2 CHARACTER DISPLAY
0380 CD4E02    1141  CALL HXDSP ; EXPAND CURRENT DATA FOR DISPLAY
               1142                    ; ARG - ADDRESS OF EXPANDED DATA IS IN H & L
0383 0E02      1143  MVI C,2
0385 1E02      1144  MVI E,2 ; SET TO 6TH SLOT
0387 CDA902    1145  CALL OUT05 ; ENTER OUTPUT ROUTINE
038A C9        1146  RET ; RETURN
               1147 ;
               1148 ;*******************************************************************
               1149 ;
               1150 ; FUNCTION: DELAYS
               1151 ; INPUTS: NONE
               1152 ; OUTPUTS: NONE
               1153 ; CALLS: NOTHING
               1154 ; DESTROYS: A,B,C,F/F'S
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LOC  OBJ        LINE       SOURCE STATEMENT

                1155 ; DESCRIPTION. DELAYS IS THE DELAY TIME FUNCTION BLOCK
                1156 ;              FROM THE PRO-LOG MONITOR.  THE ENTRY POINTS
                1157 ;              INCLUDE 1 SEC, 200 MSEC, 100 MSEC, 20 MSEC, AND 1 MSEC.
                1158 ;              THE DELAY ROUTINES ARE CALLED AND RETURN
                1159 ;              WHEN DELAY FINISHES.
                1160 ;
038B 010100     1161 DELAY: LXI B,1 ; LOAD BC WITH A 1
038E C3A603     1162  JMP MSECDT ; GO TO 1 MSEC DELAY LOOP
                1163 SECDT:
0391 01E803     1164  LXI B,03E8H ; LOAD BC WITH 1000 DECIMAL
0394 C3A603     1165  JMP MSECDT
0397 01C800     1166 MSEC2H: LXI B,00C8H ; LOAD BC WITH 200 DECIMAL
039A C3A603     1167  JMP MSECDT
039D 016400     1168 MSEC1H: LXI B,0064H  ; LOAD BC WITH 100 DECIMAL
03A0 C3A603     1169  JMP MSECDT
03A3 011400     1170 MSEC20: LXI B,0014H ; LOAD BC WITH 20 DECIMAL
03A6 0B         1171 MSECDT: DCX B ; DELAY N MILLISECONDS
03A7 C5         1172  PUSH B ; WHERE N16=(BC)
03A8 0ED8       1173  MVI C,0DBH
03AA 0D         1174 DELENT: DCR C
03AB C2AA03     1175  JNZ DELENT
03AE C1         1176  POP B ; POP BC OFF STACK
03AF 78         1177  MOV A,B
03B0 B1         1178  ORA C
03B1 C2A603     1179  JNZ MSECDT ; JUMP BACK TO MSECDT IF NOT DONE
03B4 C9         1180  RET ; RETURN
                1181 ;
                1182 ;*************************************************************************
                1183 ;
                1184 ;                          MONITOR TABLES
                1185 ;
                1186 ;*************************************************************************
                1187 ;
                1188 ; COMMAND TABLE
                1189 ;   COMMAND CHARATERS AS RECIEVED FROM KEYBOARD
                1190 CMDTB:
03B5 12         1191  DB 12H ; GO COMMAND
03B6 13         1192  DB 13H ; SUBSTITUTE COMMAND
03B7 17         1193  DB 17H ; EXAMINE REGISTERS COMMAND
03B8 15         1194  DB 15H ; SINGLE STEP COMMAND
                1195 ; DB 10H ; EXEC KEY
                1196 ; DB 11H ; NEXT KEY
                1197 ; DB 16H ; DUMMY
03B9 14         1198  DB 14H ; TTY MONITOR
                1199 ;
0005            1200 NUMC EQU $-CMDTB ; NUMBER OF COMMANDS
                1201 ;
                1202 ;*************************************************************************
                1203 ;
                1204 ; COMMAND ROUTINE ADDRESS TABLE
                1205 ; (MUST BE IN REVERSE ORDER OF COMMAND TABLE)
                1206 CMDAD:
                1207 ; DW DUMMY COMMAND 1
                1208 ; DW DUMMY COMMAND 2
                1209 ; DW DUMMY COMMAND 3
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LOC  OBJ        LINE       SOURCE STATEMENT

03EA 4904       1210  DW GO  ; TTY MONITOR
03EC 0801       1211  DW SSTEP ; ADDRESS OF SINGLE STEP ROUTINE
03EE 9E00       1212  DW EXAM ; ADDRESS OF EXAMINE REGISTERS ROUTINE
03C0 7F01       1213  DW SUBST ; ADDRESS OF SUBSTITUTE MEMORY ROUTINE
03C2 D800       1214  DW GOCMD ; ADDRESS OF GO ROUTINE
                1215 ;
                1216 ;*****************************************************************
                1217 ;
                1218 DSPNUM: ; DISPLAY TABLE FOR HEX DIGITS
                1219 ;
                1220 DSPTB: ; TABLE FOR TRANSLATING CHARACTERS FOR OUTPUT
                1221 ;
                1222 ;            DISPLAY
                1223 ;            FORMAT   CHARACTERS
                1224 ;            ======   ==========
                1225 ;
                1226 ; PRO-LOG 7303 USES 8 BIT ASCII,7 BIT PLUS BIT 8 = 1
                1227 ;
0080            1228 ZERO EQU 0B0H
03C4 B0         1229  DB 0B0H ; 0
03C5 B1         1230  DB 0B1H ; 1
03C6 B2         1231  DB 0B2H ; 2
03C7 B3         1232  DB 0B3H ; 3
03C8 B4         1233  DB 0B4H ; 4
0085            1234 FIVE EQU 0B5H
03C9 B5         1235  DB 0B5H ; 5
03CA B6         1236  DB 0B6H ; 6
03CB B7         1237  DB 0B7H ; 7
0088            1238 EIGHT EQU 0B8H
03CC B8         1239  DB 0B8H ; 8
03CD B9         1240  DB 0B9H ; 9
00C1            1241 LETRA EQU 0C1H
03CE C1         1242  DB 0C1H ; A
00C2            1243 LETRB EQU 0C2H
03CF C2         1244  DB 0C2H ; B
00C3            1245 LETRC EQU 0C3H
03D0 C3         1246  DB 0C3H ; C
00C4            1247 LETRD EQU 0C4H
03D1 C4         1248  DB 0C4H ; D
00C5            1249 LETRE EQU 0C5H
03D2 C5         1250  DB 0C5H ; E
00C6            1251 LETRF EQU 0C6H
03D3 C6         1252  DB 0C6H ; F
00C8            1253 LETRH EQU 0C8H
03D4 C8         1254  DB 0C8H ; H
00CC            1255 LETRL EQU 0CCH
03D5 CC         1256  DB 0CCH ; L
00D0            1257 LETRP EQU 0D0H
03D6 D0         1258  DB 0D0H ; P
00C9            1259 LETRI EQU 0C9H
03D7 C9         1260  DB 0C9H ; I
00D2            1261 LETRR EQU 0D2H
03D8 D2         1262  DB 0D2H ; R
00D3            1263 LETRS EQU 0D3H
03D9 D3         1264  DB 0D3H ; S
```

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 LOC  OBJ        LINE       SOURCE STATEMENT

 00A0            1265 BLANK EQU 0A0H
 03DA A0         1266  DB 0A0H ; BLANK
                 1267 ;
                 1268 ;*******************************************************************************
                 1269 ;
                 1270 ; MESSAGES FOR OUTPUT TO DISPLAY
                 1271 ;
 03DB A0         1272 BLANKS: DB BLANK,BLANK,BLANK,BLANK
 03DC A0
 03DD A0
 03DE A0
 03DF A0         1273 BLNKS: DB BLANK,BLANK,BLANK,BLANK ; FOR ADDRESS OR DATA FIELD
 03E0 A0
 03E1 A0
 03E2 A0
 03E3 2A         1274 ERMSG: DB '*',LETRE,LETRR,LETRR ; ERROR MESSAGE FOR ADDR. FIELD
 03E4 C5
 03E5 D2
 03E6 D2
 03E7 C5         1275 EXMSG: DB LETRE,'X',LETRE,'0' ; EXECUTION MESSAGE
 03E8 58
 03E9 C5
 03EA 51
 03EB 2A455848   1276 XMSG: DB '*EXM' ; EXAMINE MESSAGE
 03EF 2A534248   1277 SMSG: DB '*SBM' ; SUBSTITUTE MEMORY
                 1278 ;
                 1279 ; RDYTABLE FOR MONITOR PROMPT '@MONITR'
                 1280 ;
 03F3 2A524541   1281 RDYTBL: DB '*READY *' ; MONITOR PROMPT
 03F7 44592A2A
                 1282 ;
                 1283 ;*******************************************************************************
                 1284 ;
                 1285 RGPTB: ; REGISTER POINTER TABLE
                 1286                    ; THE ENTRIES IN THIS TABLE ARE IN THE SAME ORDER
                 1287                    ; AS THE REGISTER DESIGNATION KEYS ON THE KEYBOARD.
                 1288                    ; EACH ENTRY CONTAINS THE REGISTER POINTER VALUE WHICH
                 1289                    ; CORRESPONDS TO THE REGISTER DESIGNATOR. REGISTER
                 1290                    ; POINTER VALUES ARE USED TO POINT INTO THE REGISTER
                 1291                    ; NAME TABLE (NMTBL) AND REGISTER SAVE LOCATION
                 1292                    ; TABLE (RGTBL).
                 1293 ;
 03FB 06         1294  DB 6 ; INTERRUPT MASK
 03FC 09         1295  DB 9 ; SPH
 03FD 0A         1296  DB 10 ; SPL
 03FE 0B         1297  DB 11 ; PCH
 03FF 0C         1298  DB 12 ; PCL
 0400 07         1299  DB 7 ; H
 0401 08         1300  DB 8 ; L
 0402 00         1301  DB 0 ; A
 0403 01         1302  DB 1 ; B
 0404 02         1303  DB 2 ; C
 0405 03         1304  DB 3 ; D
 0406 04         1305  DB 4 ; E
 0407 05         1306  DB 5 ; FLAGS
```

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LOC  OBJ        LINE       SOURCE STATEMENT

                1307 ;
                1308 ;**********************************************************************
                1309 ;
                1310 NMTBL: ; REGISTER NAME TABLE
                1311                    ; NAMES OF REGISTERS IN DISPLAY FORMAT
0408 A0         1312  DB   BLANK,BLANK,LETRA,BLANK ; A REGISTER
0409 A0
040A C1
040B A0
040C A0         1313  DB  BLANK,BLANK,LETRB,BLANK ; B REGISTER
040D A0
040E C2
040F A0
0410 A0         1314  DB  BLANK,BLANK,LETRC,BLANK ; C REGISTER
0411 A0
0412 C3
0413 A0
0414 A0         1315  DB  BLANK,BLANK,LETRD,BLANK ; D REGISTER
0415 A0
0416 C4
0417 A0
0418 A0         1316  DB  BLANK,BLANK,LETRE,BLANK ; E REGISTER
0419 A0
041A C5
041B A0
041C A0         1317  DB  BLANK,BLANK,LETRF,BLANK ; FLAGS
041D A0
041E C6
041F A0
0420 A0         1318  DB  BLANK,BLANK,LETRI,BLANK ; INTERRUPT MASK
0421 A0
0422 C9
0423 A0
0424 A0         1319  DB  BLANK,BLANK,LETRH,BLANK ; H REGISTER
0425 A0
0426 C8
0427 A0
0428 A0         1320  DB  BLANK,BLANK,LETRL,BLANK ; L REGISTER
0429 A0
042A CC
042B A0
042C D3         1321  DB  LETRS,LETRP,LETRH,BLANK ; STACK POINTER HIGH ORDER BYTE
042D D0
042E C3
042F A0
0430 D3         1322  DB  LETRS,LETRP,LETRL,BLANK ; STACK POINTER LOW ORDER BYTE
0431 D0
0432 CC
0433 A0
0434 D0         1323  DB  LETRP,LETRC,LETRH,BLANK ; PROGRAM COUNTER HIGH BYTE
0435 C2
0436 C8
0437 A0
0438 D0         1324  DB  LETRP,LETRC,LETRL,BLANK ; PROGRAM COUNTER LOW BYTE
0439 C3
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

043A CC
043B A0
                1325 ;
                1326 ;*****************************************************************
                1327 ;
                1328 ; REGISTER SAVE LOCATION TABLE
                1329 ; ADDRESSES OF SAVE LOCATIONS OF REGISTERS IN THE ORDER IN WHICH
                1330 ; THE REGISTERS ARE DISPLAYED BY THE EXAMINE COMMAND
                1331 ;
                1332 RGTBL:
043C EE         1333  DB ASAV AND 0FFH ; A REGISTER
043D EC         1334  DB BSAV AND 0FFH ; B REGISTER
043E EB         1335  DB CSAV AND 0FFH ; C REGISTER
043F EA         1336  DB DSAV AND 0FFH ; D REGISTER
0440 E9         1337  DB ESAV AND 0FFH ; E REGISTER
0441 ED         1338  DB FSAV AND 0FFH ; FLAGS
0442 F1         1339  DB ISAV AND 0FFH ; INTERRUPT MASK
0443 F0         1340  DB HSAV AND 0FFH ; H REGISTER
0444 EF         1341  DB LSAV AND 0FFH ; L REGISTER
0445 F5         1342  DB SPHSV AND 0FFH ; STACK POINTER HIGH ORDER BYTE
0446 F4         1343  DB SPLSV AND 0FFH ; STACK POINTER LOW ORDER BYTE
0447 F3         1344  DB PCHSV AND 0FFH ; PROGRAM COUNTER HIGH ORDER BYTE
0448 F2         1345  DB PCLSV AND 0FFH ; PROGRAM COUNTER LOW ORDER BYTE
0009            1346 NUMRG EQU ($ - RGTBL) ; NUMBER OF ENTRIES IN
                1347                       ; /REGISTER SAVE LOCATION TABLE
                1348 ;
                1349 ;*****************************************************************
                1350 ;*****************************************************************
                1351 ;
                1352 ;                    STDMON TTY MONITOR
                1353 ;
                1354 ;*****************************************************************
                1355 ;:***************************************************************
                1356 ;
                1357 ;
                1358 ; ABSTRACT
                1359 ; ========
                1360 ;
                1361 ; THIS PROGRAM RUNS ON THE 8085 BOARD AND IS DESIGNED TO PROVIDE
                1362 ; THE USER WITH A MINIMAL MONITOR.  BY USING THIS PROGRAM
                1363 ; THE USER CAN EXAMINE AND CHANGE MEMORY OR CPU REGISTERS, LOAD
                1364 ; A PROGRAM (IN ABSOLUTE HEX) INTO RAM, AND EXECUTE INSTRUCTIONS
                1365 ; ALREADY IN MEMORY.  THE MONITOR ALSO PROVIDES THE USER WITH
                1366 ; ROUTINES FOR PERFORMING CONSOLE I/O.
                1367 ;
                1368 ;
                1369 ; PROGRAM ORGANIZATION
                1370 ; ======= ============
                1371 ;
                1372 ; THE LISTING IS ORGANIZED IN THE FOLLOWING WAY.  FIRST THE COMMAND
                1373 ; RECOGNIZER, WHICH IS THE HIGHEST LEVEL ROUTINE IN THE PROGRAM.
                1374 ; NEXT THE ROUTINES TO IMPLEMENT THE VARIOUS COMMANDS.  FINALLY,
                1375 ; THE UTILITY ROUTINES WHICH ACTUALLY DO THE DIRTY WORK.  WITHIN
                1376 ; EACH SECTION, THE ROUTINES ARE ORGANIZED IN ALPHABETICAL
                1377 ; ORDER, BY ENTRY POINT OF THE ROUTINE
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                1378 ;
                1379 ; MACROS USED IN THE TTY MONITOR ARE DEFINED IN THE KEYBOARD MONITOR
                1380 ;
                1381 ; LIST OF FUNCTIONS
                1382 ; ==== == =========
                1383 ;
                1384 ;     GETCN
                1385 ;     ----
                1386 ;
                1387 ;     DCMD
                1388 ;     GCMD
                1389 ;     ICMD
                1390 ;     MCMD
                1391 ;     SCMD
                1392 ;     XCMD
                1393 ;     ----
                1394 ;
                1395 ;     CI
                1396 ;     CNVEN
                1397 ;     CO
                1398 ;     CROUT
                1399 ;     DELAY
                1400 ;     ECHO
                1401 ;     ERROR
                1402 ;     FRET
                1403 ;     GETCH
                1404 ;     GETHX
                1405 ;     GETNM
                1406 ;     HILO
                1407 ;     NMOUT
                1408 ;     PRVAL
                1409 ;     REGDS
                1410 ;     RGADR
                1411 ;     SRET
                1412 ;     STHF8
                1413 ;     STHLF
                1414 ;     VALDG
                1415 ;     VALDL
                1416 ;     ----
                1417 ;
                1418 ;
                1419 ;*****************************************************************
                1420 ;
                1421 ;
                1422 ;                          MONITOR EQUATES
                1423 ;
                1424 ;
                1425 ;*****************************************************************
                1426 ;
                1427 ;
                1428 ; THIS TABLE IS CODED IN 7 BIT ASCII FOR TTY OR CRT
                1429 ;
0018            1430 BRCHR EQU 18H ; CODE FOR BREAK CHARACTER (ESCAPE)
0920            1431 BRTAB EQU 0920H ; LOCATION OF START OF BRANCH TABLE IN ROM
000D            1432 CR EQU 0DH ; CODE FOR CARRIAGE RETURN
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

0018            1433 ESC EQU 18H ; CODE FOR ESCAPE CHARACTER
000F            1434 HCHAR EQU 0FH ; MASK TO SELECT LOWER HEX CHAR FROM BYTE
00FF            1435 INVRT EQU 0FFH ; MASK TO INVERT HALF BYTE FLAG
000A            1436 LF EQU 0AH ; CODE FOR LINE FEED
0000            1437 LOWER EQU 0 ; DENOTES LOWER HALF OF BYTE IN ICMD
                1438 ;LSGNON EQU --- ; LENGTH OF SIGNON MESSAGE - DEFINED LATER
                1439 ;MNSTK EQU --- ; START OF MONITOR STACK - DEFINED IN
                1440                  ; /KEYBOARD MONITOR
                1441 ;NCMDS EQU --- ; NUMBER OF VALID COMMANDS - DEFINED LATER
000F            1442 NEWLN EQU 0FH ; MASK FOR CHECKING MEMORY ADDR DISPLAY
007F            1443 PRTY0 EQU 07FH ; MASK TO CLEAR PARITY BIT FROM CONSOLE CHAR
                1444 ;RAMST EQU --- ; START ADDRESS OF RAM - DEFINED IN
                1445                  ; KEYBOARD MONITOR
                1446 ;RTAB5 EQU --- ; SIZE OF ENTRY IN RTAB TABLE
001B            1447 TERM EQU 1BH ; CODE FOR ICMD TERMINATING CHARACTER (ESCAPE)
00FF            1448 UPPER EQU 0FFH ; DENOTES UPPER HALF OF BYTE IN ICMD
                1449 ;
                1450 ; PRO-LOG EQUATES
00DC            1451 CNIN EQU 0DCH ; UART DATA INPUT PORT
00DC            1452 CNOUT EQU 0DCH ; UART DATA OUTPUT PORT
00DD            1453 CSTAT EQU 0DDH ; CONSOLE STATUS PORT
00DC            1454 CDATA EQU 0DCH ; CONSOLE DATA PORT
00DD            1455 CONCP EQU 0DDH ; CONSOLE CONTROL PORT
00DE            1456 CONSCP EQU 0DEH ; CONSOLE SYSTEM CONTROL PORT
00B0            1457 URTPC EQU 0B0H ; UART PORT CONTROL WORD
0003            1458 URTSPC EQU 03H ; UART SYSTEM PORT CONTROL WORD
0080            1459 TBE EQU 80H ; TERMINAL BUFFER EMPTY FLAG
0040            1460 RBF EQU 40H ; RECIEVE BUFFER FULL FLAG
                1461 ;
                1462 ;
                1463 ;*******************************************************************************
                1464 ;
                1465 ;
                1466 ;                          TTY MONITOR ENTRY POINT
                1467 ;
                1468 ;
                1469 ;*******************************************************************************
                1470 ;
                1471 ;
                1472 ;
                1473 ; PRINT SIGNON MESSAGE
                1474 ;
                1475 GO:
0449 219307     1476  LXI H,SGNON ; GET ADDRESS OF SIGNON MESSAGE
044C 0614       1477  MVI B,LSGNON ; COUNTER FOR CHARACTERS IN MESSAGE
                1478 MSGL:
044E 4E         1479  MOV C,M ; FETCH NEXT CHAR TO C REGISTER
044F CDF405     1480  CALL CO ; SEND IT TO THE CONSOLE
0452 23         1481  INX H ; POINT TO NEXT CHARACTER
0453 05         1482  DCR B ; DECREMENT BYTE COUNTER
0454 C24E04     1483  JNZ MSGL ; RETURN FOR NEXT CHARACTER
                1484 ;
                1485 ;
                1486 ;*******************************************************************************
                1487 ;
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                1488 ;
                1489 ;                          COMMAND RECOGNIZING ROUTINE
                1490 ;
                1491 ;
                1492 ;*********************************************************************
                1493 ;
                1494 ; FUNCTION: GETCM
                1495 ; INPUTS: NONE
                1496 ; OUTPUTS: NONE
                1497 ; CALLS: GETCH, ECHO, ERROR
                1498 ; DESTROYS: A, B, C, H, L, F/F'S
                1499 ; DESCRIPTION: GETCM RECIEVES AN INPUT CHARACTER FROM THE USER
                1500 ;              AND ATTEMPTS TO LOCATE THIS CHARACTER IN ITS COMMAND
                1501 ;              CHARACTER TABLE.  IF SUCCESSFUL, THE ROUTINE
                1502 ;              CORRESPONDING TO THIS CHARACTER IS SELECTED FROM
                1503 ;              A TABLE OF COMMAND ROUTINE ADDRESSES, AND CONTROL
                1504 ;              IS TRANSFERED TO THIS ROUTINE.  IF THE CHARACTER
                1505 ;              DOES NOT MATCH ANY ENTRIES, CONTROL IS PASSED TO
                1506 ;              THE ERROR HANDLER.
                1507 ;
                1508 GETCM:
0457 21E920     1509  LXI H,MNSTK ; ALWAYS WANT TO RESET STACK PTR TO MONITOR
045A F9         1510  SPHL ; /STARTING VALUE SO ROUTINES NEEDN'T CLEAN UP
045B 0E2E       1511  MVI C,'.' ; PROMPT CHARACTER TO C
045D CD0506     1512  CALL ECHO ; SEND PROMPT CHARACTER TO USER TERMINAL
0460 C36304     1513  JMP GTC03 ; WANT TO LEAVE ROOM FOR RST BRANCH
                1514 GTC03:
0463 CD2C06     1515  CALL GETCH ; GET COMMAND CHARACTER TO A
0466 CD0506     1516  CALL ECHO ; ECHO CHARACTER TO USER
0469 79         1517  MOV A,C ; PUT COMMAND CHARACTER INTO ACCUMULATOR
046A 010600     1518  LXI B,NCMDS ; C CONTAINS LOOP AND INDEX COUNT
046D 218507     1519  LXI H,CTAB ; HL POINTS INTO COMMAND TABLE
                1520 GTC05:
0470 BE         1521  CMP M ; COMPARE TABLE ENTRY AND CHARACTER
0471 CA7C04     1522  JZ GTC10 ; BRANCH IF EQUAL - COMMAND RECOGNIZED
0474 23         1523  INX H ; ELSE, INCREMENT TABLE POINTER
0475 0D         1524  DCR C ; DECREMENT LOOP COUNT
0476 C27004     1525  JNZ GTC05 ; BRANCH IF NOT AT TABLE END
0479 C31E06     1526  JMP ERROR ; ELSE, COMMAND CHARACTER IS ILLEGLE
                1527 GTC10:
047C 21A787     1528  LXI H,CADR ; IF GOOD COMMAND, LOAD ADDRESS OF TABLE
                1529                    ; /OF COMMAND ROUTINE ADDRESSES
047F 09         1530  DAD B ; ADD WHAT IS LEFT OF LOOP COUNT
0480 09         1531  DAD B ; ADD AGAIN - EACH ENTRY IN CADR IS 2 BYTES LONG
0481 7E         1532  MOV A,M ; GET LSP OF ADDRESS OF TABLE ENTRY TO A
0482 23         1533  INX H ; POINT TO NEXT BYTE IN TABLE
0483 66         1534  MOV H,M ; GET MSP OF ADDRESS OF TABLE ENTRY TO H
0484 6F         1535  MOV L,A ; PUT LSP OF ADDRESS OF TABLE ENTRY INTO L
0485 E9         1536  PCHL ; NEXT INSTRUCTION COMES FROM COMMAND ROUTINE
                1537 ;
                1538 ;
                1539 ;*********************************************************************
                1540 ;
                1541 ;
                1542 ;                          COMMAND IMPLEMENTING ROUTINES
```

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```
 LOC  OBJ        LINE       SOURCE STATEMENT

                 1543 ;
                 1544 ;
                 1545 ;*********************************************************************
                 1546 ;
                 1547 ;
                 1548 ; FUNCTION: DCMD
                 1549 ; INPUTS: NONE
                 1550 ; OUTPUTS: NONE
                 1551 ; CALLS: ECHO,NMOUT,HILO,GETCM,CROUT,GETNM
                 1552 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 1553 ; DESCRIPTION: DCMD IMPLEMENTS THE DISPLAY MEMORY (D) COMMAND
                 1554 ;
                 1555 DCMD:
 0486 0E02       1556  MVI C,2 ; GET 2 NUMBERS FROM INPUT STREAM
 0488 CD6806     1557  CALL GETNM
 048B D1         1558  POP D ; ENDING ADDRESS TO DE
 048C E1         1559  POP H ; STARTING ADDRESS TO HL
                 1560 DCM05:
 048D CDFF05     1561  CALL CROUT ; ECHO CARRIAGE RETURN/LINE FEED
 0490 7C         1562  MOV A,H ; DISPLAY ADDRESS OF FIRST LOCATION IN LINE
 0491 CD0406     1563  CALL NMOUT
 0494 7D         1564  MOV A,L ; ADDRESS IS 2 BYTES LONG
 0495 CD0406     1565  CALL NMOUT
                 1566 DCM10:
 0498 0E20       1567  MVI C,' '
 049A CD0506     1568  CALL ECHO ; USE BLANK AS SEPARATOR
 049D 7E         1569  MOV A,M ; GET CONTENTS OF NEXT MEMORY LOCATION
 049E CD0406     1570  CALL NMOUT ; DISPLAY CONTENTS
 04A1 CDAD06     1571  CALL HILO ; SEE IF ADDRESS OF DISPLAYED LOCATION IS
                 1572                    ; /GREATER THAN OR EQUAL TO ENDING ADDRESS
                 1573  FALSE DCM15 ; IF NOT , MORE TO DISPLAY
 04A4 D2AD04     1574+ JNC DCM15
 04A7 CDFF05     1575  CALL CROUT ; CARRIAGE RETURN/LINE FEED TO END LINE
 04AA C35704     1576  JMP GETCM ; ALL DONE
                 1577 DCM15:
 04AD 23         1578  INX H ; IF MORE TO GO, POINT TO NEXT LOC TO DISPLAY
 04AE 7D         1579  MOV A,L ; GET LOW ORDER BITS OF NEW ADDRESS
 04AF E60F       1580  ANI NEWLN ; SEE IF LAST HEX DIGIT OF ADDRESS DENOTES
                 1581                    ; /START OF NEW LINE
 04B1 C29804     1582  JNZ DCM10 ; NO - NOT AT END OF LINE
 04B4 C38D04     1583  JMP DCM05 ; YES - START NEW LINE WITH ADDRESS
                 1584 ;
                 1585 ;
                 1586 ;*********************************************************************
                 1587 ;
                 1588 ;
                 1589 ; FUNCTION: GCMD
                 1590 ; INPUTS: NONE
                 1591 ; OUTPUTS: NONE
                 1592 ; CALLS: ERROR,GETHX,RSTTF
                 1593 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 1594 ; DESCRIPTION: GCMD IMPLEMENTS THE BEGIN EXECUTION (G) COMMAND.
                 1595 ;
                 1596 GCMD:
 04B7 CD3306     1597  CALL GETHX ; GET ADDRESS (IF PRESENT) FROM INPUT STREAM
```

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LOC  OBJ        LINE       SOURCE STATEMENT

                1548  FALSE GCM05 ; BRANCH IF NO NUMBER PRESENT
048A D2CC04     1599+ JNC GCM05
048D 7A         1600  MOV A,D ; ELSE, GET TERMINATOR
048E FE0D       1601  CPI CR ; SEE IF CARRIAGE RETURN
04C0 C21E06     1602  JNZ ERROR ; ERROR IF NOT PROPERLY TERMINATED
04C3 21F220     1603  LXI H,PSAV ; WANT NUMBER TO REPLACE SAVE PGM COUNTER
04C6 71         1604  MOV M,C
04C7 23         1605  INX H
04C8 70         1606  MOV M,B
04C9 C3D204     1607  JMP GCM10
                1608 GCM05:
04CC 7A         1609  MOV A,D ; IF NO STARTING ADDRESS, MAKE SURE THAT
04CD FE0D       1610  CPI CR ; /CARRIAGE RETURN TERMINATED COMMAND
04CF C21E06     1611  JNZ ERROR ; ERROR IF NOT
                1612 GCM10:
04D2 C32803     1613  JMP RSTOR ; RESTORE REGISTERS AND BEGIN EXECUTION
                1614                        ; (RSTOR IS IN KEYBOARD MONITOR)
                1615 ;
                1616 ;
                1617 ;**********************************************************************
                1618 ;
                1619 ;
                1620 ; FUNCTION: ICMD
                1621 ; INPUTS: NONE
                1622 ; OUTPUTS: NONE
                1623 ; CALLS: ERROR,ECHO,GETCH,VALDL,VALDG,CNVBN,STHLF,GETNM,CROUT
                1624 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                1625 ; DESCRIPTION: ICMD IMPLEMENTS THE INSERT CODE INTO MEMORY (I) COMMAND.
                1626 ;
                1627 ICMD:
04D5 0E01       1628  MVI C,1
04D7 CD6806     1629  CALL GETNM ; GET SINGLE NUMBER FROM INPUT STREAM
04DA 3EFF       1630  MVI A,UPPER
04DC 32FD20     1631  STA TEMP ; TEMP WILL HOLD THE UPPER/LOWER HALF BYTE FLAG
04DF D1         1632  POP D ; ADDRESS OF START TO DE
                1633 ICM05:
04E0 CD2C06     1634  CALL GETCH ; GET A CHARACTER FROM INPUT STREAM
04E3 4F         1635  MOV C,A
04E4 CD0506     1636  CALL ECHO ; ECHO IT
04E7 79         1637  MOV A,C ; PUT CHARACTER BACK INTO A
04E8 FE1B       1638  CPI TERM ; SEE IF CHARACTER IS A TERMINATING CHARACTER
04EA CA1605     1639  JZ ICM25 ; IF SO, ALL DONE ENTERING CHARACTERS
04ED CD7E07     1640  CALL VALDL ; ELSE, SEE IF VALID DELIMITER
                1641  TRUE ICM05 ; IF SO SIMPLY IGNORE THIS CHARACTER
04F0 DAE004     1642+ JC ICM05
04F3 CD6207     1643  CALL VALDG ; ELSE, CHECK TO SEE IF VALID HEX DIGIT
                1644  FALSE ICM20 ; IF NOT, BRANCH TO HANDLE ERROR CONDITION
04F6 D21005     1645+ JNC ICM20
04F9 CDEB05     1646  CALL CNVBN ; CONVERT DIGIT TO BINARY
04FC 4F         1647  MOV C,A ; MOVE RESULT TO C
04FD CD4407     1648  CALL STHLF ; STORE IN APPROPRIATE HALF WORD
0500 3AFD20     1649  LDA TEMP ; GET HALF BYTE FLAG
0503 B7         1650  ORA A ; SET F/F'S
0504 C20905     1651  JNZ ICM10 ; BRANCH IF FLAG SET FOR UPPER
0507 13         1652  INX D ; IF LOWER, INC ADDRESS OF BYTE TO STORE IN
```

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 LOC  OBJ        LINE       SOURCE STATEMENT

                 1653 ICN10:
 0508 EEFF       1654  XRI INVRT ; TOGGLE STATE OF FLAG
 050A 32FD20     1655  STA TEMP ; PUT NEW VALUE OF FLAG BACK
 050D C3E004     1656  JMP ICM05 ; PROCESS NEXT DIGIT
                 1657 ICM20:
 0510 CD3907     1658  CALL STHF0 ; ILLEGAL CHARACTER
 0513 C31E06     1659  JMP ERROR ; MAKE SURE ENTIRE BYTE FILLED THEN ERROR
                 1660 ICM25:
 0516 CD3907     1661  CALL STHF0 ; HERE FOR ESCAPE CHARACTER - INPUT IS DONE
 0519 CDFF05     1662  CALL CROUT ; ADD CARRIAGE RETURN
 051C C35704     1663  JMP GETCM
                 1664 ;
                 1665 ;
                 1666 ;*****************************************************************
                 1667 ;
                 1668 ;
                 1669 ; FUNCTION: MCMD
                 1670 ; INPUTS: NONE
                 1671 ; OUTPUTS: NONE
                 1672 ; CALLS: GETCM,HILO,GETNM
                 1673 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                 1674 ; DESCRIPTION: MCMD IMPLEMENTS THE MODE DATA IN MEMORY (M) COMMAND.
                 1675 ;
                 1676 MCMD:
 051F 0E03       1677  MVI C,3
 0521 CD6806     1678  CALL GETNM ; GET 3 NUMBERS FROM INPUT STREAM
 0524 C1         1679  POP B ; DESTINATION ADDRESS TO BC
 0525 E1         1680  POP H ; ENDING ADDRESS TO HL
 0526 D1         1681  POP D ; STARTING ADDRESS TO DE
                 1682 MCM05:
 0527 E5         1683  PUSH H ; SAVE ENDING ADDRESS
 0528 62         1684  MOV H,D
 0529 6B         1685  MOV L,E ; SOURCE ADDRESS TO HL
 052A 7E         1686  MOV A,M ; GET SOURCE BYTE
 052B 60         1687  MOV H,B
 052C 69         1688  MOV L,C ; DESTINATION ADDRESS TO HL
 052D 77         1689  MOV M,A ; MOVE BYTE TO DESTINATION
 052E 03         1690  INX B ; INCREMENT DESTINATION ADDRESS
 052F 78         1691  MOV A,B
 0530 B1         1692  ORA C ; TEST FOR DESTINATION ADDRESS OVERFLOW
 0531 CA5704     1693  JZ GETCM ; IF SO, CAN TERMINATE COMMAND
 0534 13         1694  INX D ; INCREMENT SOURCE ADDRESS
 0535 E1         1695  POP H ; ELSE, GET BACK ENDING ADDRESS
 0536 CDAD06     1696  CALL HILO ; SEE IF ENDING ADDR>=SOURCE ADDR
                 1697  FALSE GETCM ; IF NOT, COMMAND IS DONE
 0539 D25704     1698+ JNC GETCM
 053C C32705     1699  JMP MCM05 ; MOVE ANOTHER BYTE
                 1700 ;
                 1701 ;
                 1702 ;*****************************************************************
                 1703 ;
                 1704 ;
                 1705 ; FUNCTION: SCMD
                 1706 ; INPUTS: NONE
                 1707 ; OUTPUTS: NONE
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LOC  OBJ        LINE       SOURCE STATEMENT

                1708 ; CALLS: GETHX, GETCM, NMOUT, ECHO
                1709 ; DESTROYS: A, B, C, D, E, H, L, F/F'S
                1710 ; DESRIPTION: SCMD IMPLEMENTS THE SUBSTITUE INTO MEMORY (S) COMMAND.
                1711 ;
                1712 SCMD:
053F CD3306     1713  CALL GETHX ; GET A NUMBER, IF PRESENT, FROM INPUT
0542 C5         1714  PUSH B
0543 E1         1715  POP H ; GET NUMBER TO HL - DENOTES MEMORY LOCATION
                1716 SCM05:
0544 7A         1717  MOV A,D ; GET TERMINATOR
0545 FE20       1718  CPI ' ' ; SEE IF SPACE
0547 CA4F05     1719  JZ SCM10 ; YES - CONTINUE PROCESSING
054A FE2C       1720  CPI ',' ; ELSE, SEE IF COMMA
054C C25704     1721  JNZ GETCM ; NO - TERMINATE COMMAND
                1722 SCM10:
054F 7E         1723  MOV A,M ; GET CONTENTS OF SPECIFIED LOCATION TO A
0550 CD0406     1724  CALL NMOUT ; DISPLAY CONTENTS ON CONSOLE
0553 0E2D       1725  MVI C,'-'
0555 CD0506     1726  CALL ECHO ; USE DASH FOR SEPARATOR
0558 CD3306     1727  CALL GETHX ; GET NEW VALUE FOR MEMORY LOCATION, IF ANY
                1728  FALSE SCM15 ; IF NO VALUE PRESENT, BRANCH
055B D25F05     1729+ JNC SCM15
055E 71         1730  MOV M,C ; ELSE, STORE LOWER 8 BITS OF NUMBER ENTERED
                1731 SCM15:
055F 23         1732  INX H ; INCREMENT ADDRESS OF MEMORY LOCATION TO VIEW
0560 C34405     1733  JMP SCM05
                1734 ;
                1735 ;
                1736 ;*******************************************************************
                1737 ;
                1738 ;
                1739 ; FUNCTION: XCMD
                1740 ; INPUTS: NONE
                1741 ; OUTPUTS: NONE
                1742 ; CALLS: GETCH, ECHO, REGDS, GETCM, ERROR, RGADR, NMOUT, CROUT, GETHX
                1743 ; DESTROYS: A, B, C, D, E, H, L, F/F'S
                1744 ; DESCRIPTION: XCMD IMPLEMENTS THE REGISTER EXAMINE AND CHANGE (X)
                1745 ;              COMMAND.
                1746 ;
                1747 XCMD:
0563 CD2C06     1748  CALL GETCH ; GET REGISTER IDENTIFIER
0566 4F         1749  MOV C,A
0567 CD0506     1750  CALL ECHO ; ECHO IT
056A 79         1751  MOV A,C
056B FE0D       1752  CPI CR
056D C27605     1753  JNZ XCM05 ; BRANCH IF NOT CARRIAGE RETURN
0570 CDEF06     1754  CALL REGDS ; ELSE, DISPLAY REGISTER CONTENTS
0573 C35704     1755  JMP GETCM ; THEN TERMINATE COMMAND
                1756 XCM05:
0576 4F         1757  MOV C,A ; GET REISTER IDENTIFIER TO C
0577 CD2007     1758  CALL RGADR ; CONVERT IDENTIFIER INTO RTAB TABLE ADDR
057A C5         1759  PUSH B
057B E1         1760  POP H ; PUT POINTER TO REGISTER ENTRY INTO HL
057C 0E20       1761  MVI C,' '
057E CD0506     1762  CALL ECHO ; ECHO SPACE TO USER
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LOC  OBJ        LINE       SOURCE STATEMENT

0591 79         1763  MOV A,C
0592 32FD20     1764  STA TEMP ; PUT SPACE INTO TEMP AS DELIMITER
                1765 XCM10:
0595 3AFD20     1766  LDA TEMP ; GET TERMINATOR
0598 FE20       1767  CPI ' ' ; SEE IF BLANK
059A CA9205     1768  JZ XCM15 ; YES - GO CHECK POINTER INTO TABLE
059D FE2C       1769  CPI ',' ; NO - SEE IF COMMA
059F C25704     1770  JNZ GETCM ; NO - MUST BE CARRIAGE RETURN TO END COMMAND
                1771 XCM15:
05A2 7E         1772  MOV A,M
05A3 B7         1773  ORA A ; SET F/F'S
05A4 C2A905     1774  JNZ XCM18 ; BRANCH IF NOT AT END OF TABLE
05A7 CDFF05     1775  CALL CROUT ; ELSE, OUTPUT CARRIAGE RETURN LINE FEED
05AA C35704     1776  JMP GETCM ; AND EXIT
                1777 XCM18:
05AD E5         1778  PUSH H ; PUT POINTER ON STACK
05AE 5E         1779  MOV E,M
05AF 1620       1780  MVI D,RAMST SHR 8 ; ADDRESS OF SAVE LOCATION FROM TABLE
05B1 23         1781  INX H
05B2 46         1782  MOV B,M ; FETCH LENGTH FLAG FROM TABLE
05B3 D5         1783  PUSH D ; SAVE ADDRESS OF SAVE LOCATION
05B4 D5         1784  PUSH D
05B5 E1         1785  POP H ; MOVE ADDRESS TO HL
05B6 C5         1786  PUSH B ; SAVE LENGTH FLAG
05B7 7E         1787  MOV A,M ; GET 8 BITS OF REGISTER FROM SAVE LOCATION
05B8 CDD406     1788  CALL NMOUT ; DISPLAY IT
05BB F1         1789  POP PSW ; GET BACK LENGTH FLAG
05BC F5         1790  PUSH PSW ; SAVE IT AGAIN
05BD B7         1791  ORA A ; SET F/F'S
05BE CABB05     1792  JZ XCM20 ; IF 8 BIT REGISTER, NOTHING MORE TO DISPLAY
05C1 2B         1793  DCX H ; ELSE, FOR 16 BIT REGISTER, GET LOWER 8 BITS
05C2 7E         1794  MOV A,M
05C3 CDD406     1795  CALL NMOUT ; DISPLAY THEM
                1796 XCM20:
05C6 0E2D       1797  MVI C,'-'
05C8 CD0506     1798  CALL ECHO ; USE DASH AS SEPARATOR
05CB CD3306     1799  CALL GETHX ; SEE IF THERE IS A VALUE TO PUT INTO REGISTER
                1800  FALSE XCM30 ; NO - GO CHECK FOR NEXT REGISTER
05CE D2D605     1801+ JNC XCM30
05D1 7A         1802  MOV A,D
05D2 32FD20     1803  STA TEMP ; ELSE, SAVE THE TERMINATOR FOR NOW
05D5 F1         1804  POP PSW ; GET BACK LENGTH FLAG
05D6 E1         1805  POP H ; PUT ADDRESS OF SAVE LOCATION INTO HL
05D7 B7         1806  ORA A ; SET F/F'S
05D8 CADD05     1807  JZ XCM25 ; IF 8 BIT REGISTER, BRANCH
05DB 70         1808  MOV M,B ; SAVE UPPER 8 BITS
05DC 2B         1809  DCX H ; POINT TO SAVE LOCATION FOR LOWER 8 BITS
                1810 XCM25:
05DD 71         1811  MOV M,C ; STORE ALL OF 8 BIT OR LOWER 1/2 OF 16 BIT REG
                1812  XCM27:
05DE 110200     1813  LXI D,RTABS ; SIZE OF ENTRY IN RTAB TABLE
05E1 E1         1814  POP H ; POINTER INTO REGISTER TABLE RTAB
05E2 19         1815  DAD D ; ADD ENTRY SIZE TO POINTER
05E3 C28505     1816  JMP XCM10 ; DO NEXT REGISTER
                1817 XCM30:
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LOC  OBJ       LINE       SOURCE STATEMENT

05D6 7A        1818  MOV A,D ; GET TERMINATOR
05D7 32FD20    1819  STA TEMP ; SAVE IN MEMORY
05DA D1        1820  POP D ; CLEAR STACK OF LENGTH FLAG AND ADDRESS
05DB D1        1821  POP D ; /OF SAVE LOCATION
05DC C3CE05    1822  JMP XCM27 ; GO INCREMENT REGISTER TABLE POINTER
               1823 ;
               1824 ;
               1825 ;*******************************************************************
               1826 ;
               1827 ;
               1828 ;                        UTILITY ROUTINES
               1829 ;
               1830 ;
               1831 ;*******************************************************************
               1832 ;
               1833 ;
               1834 ; FUNCTION: CI
               1835 ; INPUTS: NONE
               1836 ; OUTPUTS: A CHARACTER FROM TTY
               1837 ; CALLS: NOTHING
               1838 ; DESTROYS: A,F/F'S
               1839 ; DESCRIPTION: CI WAITS UNTIL A CHARACTER HAS BEEN ENTERED AT THE
               1840 ;              TTY AND THEN RETURNS THE CHARACTER, VIA THE A
               1841 ;              REGISTER, TO THE CALLING ROUTINE. THIS ROUTINE
               1842 ;              IS CALLED BY THE USER VIA A JUMP TABLE IN RAM.
               1843 ;
               1844 CI:
05DF DBDD      1845  IN CSTAT ; GET STATUS OF CONSOLE
05E1 E640      1846  ANI RBF ; CHECK FOR RECIEVER BUFFER FULL
05E3 CADF05    1847  JZ CI ; NOT READY YET - WAIT
05E6 DBDC      1848  IN CNIN ; READY, GET CHARACTER
05E8 E67F      1849  ANI 7FH ; AND IN 01111111 TO KILL PARITY BIT
05EA C9        1850  RET ; THAT'S IT
               1851 ;
               1852 ;
               1853 ;*******************************************************************
               1854 ;
               1855 ;
               1856 ; FUNCTION: CNVBN
               1857 ; INPUTS: C - ASCII CHARACTER '0'-'9' OR 'A'-'F'
               1858 ; OUPUTS: A - 0 TO F HEX
               1859 ; CALLS: NOTHING
               1860 ; DESTROYS: A,F.F'S
               1861 ; DESCRIPTION: CNVBN CONVERTS THE ASCII REPRESENTATION OF A HEX
               1862 ;              DIGIT INTO ITS CORRESPONDING BINARY VALUE. CNVBN
               1863 ;              DOES NOT CHECK THE VALIDITY OF ITS INPUT.
               1864 ;
               1865 CNVBN:
05EB 79        1866  MOV A,C
05EC D630      1867  SUI '0' ; SUBTRACT CODE FOR '0' FROM ARGUMENT
05EE FE0A      1868  CPI 10 ; WANT TO TEST FOR RESULT 0 TO 9
05F0 F8        1869  RM ; IF SO, THEN ALL DONE
05F1 D607      1870  SUI 7 ; ELSE, RESULT BETWEEN 17 AND 23 DECIMAL
05F3 C9        1871  RET ; SO RETURN AFTER SUBTRACTING BIAS OF 7
               1872 ;
```

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LOC  OBJ        LINE       SOURCE STATEMENT

                1873 ;
                1874 ;*****************************************************************************
                1875 ;
                1876 ;
                1877 ; FUNCTION: CO
                1878 ; INPUTS: C - CHARACTER TO OUTPUT TO TTY
                1879 ; OUTPUTS: C - CHARACTER OUTPUT TO TTY
                1880 ; CALLS: NOTHING
                1881 ; DESTROYS: A,F/F'S
                1882 ; DESCRIPTION: CO SENDS ITS INPUT ARGUMENT TO THE TTY.
                1883 ;
                1884 CO:
05F4 DED0       1885  IN CSTAT ; GET STATUS OF CONSOLE
05F6 E680       1886  ANI TBE ; SEE IF TRANSMITTER READY
05F8 CAF405     1887  JZ CO ; NOT READY - WAIT
05FB 79         1888  MOV A,C ; LOAD A WITH CHARACTER
05FC D3DC       1889  OUT CNOUT ; SEND CHARACTER
05FE C9         1890  RET ; ALL DONE
                1891 ;
                1892 ;
                1893 ;*****************************************************************************
                1894 ;
                1895 ;
                1896 ; FUNCTION CROUT
                1897 ; INPUTS: NONE
                1898 ; OUTPUTS: NONE
                1899 ; CALLS: ECHO
                1900 ; DESTROYS: A,B,C,F/F'S
                1901 ; DESCRIPTION: CROUT SENDS A CARRIAGE RETURN (AND HENCE A LINE
                1902 ;              FEED ) TO THE CONSOLE
                1903 ;
                1904 CROUT:
05FF 0E0D       1905  MVI C,CR
0601 CD0606     1906  CALL ECHO
0604 C9         1907  RET
                1908 ;
                1909 ;
                1910 ;*****************************************************************************
                1911 ;
                1912 ;
                1913 ; FUNCTION: ECHO
                1914 ; INPUTS: C - CHARACTER TO ECHO TO TERMINAL
                1915 ; OUTPUTS: C - CHARACTER ECHOED TO TERMINAL
                1916 ; CALLS: CO
                1917 ; DESTROYS: A,B,F/F'S
                1918 ; DESCRIPTION. ECHO TAKES A SINGLE CHARACTER AS INPUT AND, VIA
                1919 ;              THE MONITOR, SENDS THAT CHARACTER TO THE USER
                1920 ;              TERMINAL.  A CARRIAGE RETURN IS ECHOED AS A CARRIAGE
                1921 ;              RETURN LINE FEED, AND AN ESCAPE CHARACTER IS ECHOED AS $.
                1922 ;
                1923 ECHO:
0605 41         1924  MOV B,C ; SAVE ARGUMENT
0606 3E1B       1925  MVI A,ESC
0608 B8         1926  CMP B ; SEE IF ECHOING AN ESCAPE CHARACTER
0609 C20E06     1927  JNZ ECH05 ; NO - BRANCH
```

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LOC  OBJ       LINE      SOURCE STATEMENT

060C 0E24      1928  MVI C,'$' ; YES - ECHO AS $
               1929 ECH05:
060E CDF405    1930  CALL CO ; DO OUTPUT THROUGH MONITOR
0611 3E0D      1931  MVI A,CR
0613 B8        1932  CMP B ; SEE IF CHARACTER ECHOED WAS A CARRIAGE RETURN
0614 C21C06    1933  JNZ ECH10 ; NO - NO NEED TO TAKE SPECIAL ACTION
0617 0E0A      1934  MVI C,LF ; YES - WANT TO ECHO LINE FEED, TOO
0619 CDF405    1935  CALL CO
               1936 ECH10:
061C 48        1937  MOV C,B ; RESTORE ARGUMENT
061D C9        1938  RET ; RETURN
               1939 ;
               1940 ;
               1941 ;**********************************************************************
               1942 ;
               1943 ;
               1944 ; FUNCTION: ERROR
               1945 ; INPUTS: NONE
               1946 ; OUTPUTS: NONE
               1947 ; CALLS: ECHO CROUT,GETCM
               1948 ; DESTROYS: A,B,C,F/F'S
               1949 ; DESCRIPTION: ERROR PRINTS THE ERROR CHARACTER (CURRENTLY AN ASTERISK)
               1950 ;      -       ON THE CONSOLE, FOLLOWED BY A CARRIAGE RETURN LINE FEED,
               1951 ;              AND THEN RETURNS CONTROL TO THE COMMAND RECOGNIZER.
               1952 ;
               1953 ERROR:
061E 0E2A      1954  MVI C,'*' ; LOAD ASTERISK INTO REGISTER C
0620 CD0506    1955  CALL ECHO ; SEND * TO CONSOLE
0623 CDFF05    1956 EXIT: CALL CROUT ; SKIP TO BEGINNING OF NEXT LINE
0626 C35704    1957  JMP GETCM ; TRY AGAIN FOR ANOTHER COMMAND
               1958 ;
               1959 ;
               1960 ;**********************************************************************
               1961 ;
               1962 ;
               1963 ; FUNCTION: FRET
               1964 ; INPUTS: NONE
               1965 ; OUTPUTS: CARRY - ALWAYS 0
               1966 ; CALLS: NOTHING
               1967 ; DESTROYS: CARRY
               1968 ; DESCRIPTION: FRET IS JUMPED TO BY ANY ROUTINE THAT WISHES TO
               1969 ;              INDICATE FAILURE ON RETURN. FRET SETS THE CARRY
               1970 ;              FALSE, DENOTING FAILURE, AND THEN RETURNS TO THE
               1971 ;              CALLER OF THE ROUTINE INVOKING FRET.
               1972 ;
               1973 FRET:
0629 37        1974  STC ; FIRST SET CARRY TRUE
062A 3F        1975  CMC ; THEN COMPLEMENT IT TO MAKE IT FALSE
062B C9        1976  RET ; RETURN APPROPRIATELY
               1977 ;
               1978 ;.
               1979 ;**********************************************************************
               1980 ;
               1981 ;
               1982 ; FUNCTION: GETCH
```

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LOC  OBJ       LINE     SOURCE STATEMENT

               1983 ;  INPUTS: NONE
               1984 ;  OUTPUTS: C - NEXT CHARACTER IN INPUT STREAM
               1985 ;  CALLS: CI
               1986 ;  DESTROYS: A, F/F'S
               1987 ;  DESCRIPTION: GETCH RETURNS THE NEXT CHARACTER IN THE INPUT STREAM
               1988 ;               TO THE CALLING PROGRAM
               1989 ;
               1990 GETCH:
062C CDDF05    1991  CALL CI ; GET CHARACTER FROM THE TERMINAL
062F E67F      1992  ANI PRTY0 ; TURN OFF PARITY BIT IN CASE SET BY CONSOLE
0631 4F        1993  MOV C,A ; PUT VALUE IN C REGISTER FOR RETURN
0632 C9        1994  RET ; RETURN
               1995 ;
               1996 ;
               1997 ;*****************************************************************
               1998 ;
               1999 ;
               2000 ; FUNCTION: GETHX
               2001 ; INPUTS: NONE
               2002 ; OUTPUTS: BC - 16 BIT INTEGER
               2003 ;          D - CHARACTER WHICH TERMINATED THE INTEGER
               2004 ;          CARRY - 1 IF FIRST CHARACTER NOT DELIMITER
               2005 ;                - 0 IF FIRST CHARACTER IS DELIMITER
               2006 ; CALLS: ECHO, GETCH, VALDL, VALDG, CHVEN, ERROR
               2007 ; DESTROYS: A, B, C, D, E, F/F'S
               2008 ; DESCRIPTION: GETHX ACCEPTS A STRING OF HEX DIGITS FROM THE INPUT
               2009 ;              STREAM AND RETURNS THIER VALUE AS A 16 BIT BINARY
               2010 ;              INTEGER.  IF MORE THAN 4 HEX DIGITS ARE ENTERED,
               2011 ;              ONLY THE LAST 4 ARE USED.  THE NUMBER TERMINATES WHEN
               2012 ;              A VALID DELIMITER IS ENCOUNTERED.  THE DELIMITER IS
               2013 ;              ALSO RETURNED AS AN OUTPUT OF THE FUNCTION.  ILLEGAL
               2014 ;              CHARACTERS (NOT HEX DIGITS OR DELIMITER) CAUSE AN
               2015 ;              ERROR INDICATION.  IF THE FIRST (VALID CHARACTER
               2016 ;              ENCOUNTERED IN THE INPUT STREAM IS NOT A DELIMITER,
               2017 ;              GETHX WILL RETURN WITH THE CARRY BIT SET TO 1;
               2018 ;              OTHERWISE, THE CARRY BIT IS SET TO 0 AND THE CONTENTS
               2019 ;              OF BC ARE UNDEFINED.
               2020 ;
               2021 GETHX:
0633 E5        2022  PUSH H ; SAVE HL
0634 210000    2023  LXI H,0 ; INITIALIZE RESULT
0637 1E00      2024  MVI E,0 ; INITIALIZE DIGIT FLAG TO FALSE
               2025 GHX05:
0639 CD2C06    2026  CALL GETCH ; GET A CHARACTER
063C 4F        2027  MOV C,A
063D CD0506    2028  CALL ECHO ; ECHO THE CHARACTER
0640 CD7E07    2029  CALL VALDL ; SEE IF DELIMITER
               2030  FALSE GHX10 ; NO - BRANCH
0643 D25206    2031+ JNC GHX10
0646 51        2032  MOV D,C ; YES - ALL DONE, BUT WANT TO RETURN DELIMITER
0647 E5        2033  PUSH H
0648 C1        2034  POP B ; MOVE RESULT TO BC
0649 E1        2035  POP H ; RESTORE HL
064A 7B        2036  MOV A,E ; GET FLAG
064B B7        2037  ORA A ; SET F/F'S
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LOC  OBJ        LINE       SOURCE STATEMENT

064C C22707     2038  JNZ $RET ; IF FLAG NON-0, A NUMBER HAS BEEN FOUND
064F CA2906     2039  JZ FRET ; ELSE, DELIMITER WAS FIRST CHARACTER
                2040 GHX10:
0652 CD6307     2041  CALL VALDG ; IF NOT DELIMITER, SEE IF DIGIT
                2042  FALSE ERROR ; ERROR IF NOT A VALID DIGIT, EITHER
0655 D21E06     2043+ JNC ERROR
0658 CDEB05     2044  CALL CNVBN ; CONVERT DIGIT TO ITS BINARY VALUE
065B 1EFF       2045  MVI E,0FFH ; SET DIGIT FLAG NON-0
065D 29         2046  DAD H ; *2
065E 29         2047  DAD H ; *4
065F 29         2048  DAD H ; *8
0660 29         2049  DAD H ; *16
0661 0600       2050  MVI B,0 ; CLEAR UPPER 8 BITS OF BC PAIR
0663 4F         2051  MOV C,A ; BINARY VALUE OF CHARATER INTO C
0664 09         2052  DAD B ; ADD THIS VALUE TO PARTIAL RESULT
0665 C33906     2053  JMP GHX05 ; GET NEXT CHARATER
                2054 ;
                2055 ;
                2056 ;*****************************************************************
                2057 ;
                2058 ;
                2059 ; FUNCTION: GETNM
                2060 ; INPUTS: C - COUNT OF NUMBERS TO FIND IN INPUT STREAM
                2061 ; OUTPUTS: TOP OF STACK - NUMBERS FOUND IN REVERSE ORDER (LAST ON TOP
                2062 ;                                OF STACK)
                2063 ; CALLS: GETHX,HILO,ERROR
                2064 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                2065 ; DESCRIPTION: GETNM FINDS A SPECIFIED COUNT OF NUMBERS, BETWEEN 1
                2066 ;              AND 3, INCLUSIVE, IN THE INPUT
                2067 ;              STREAM AND RETURNS THEIR VALUES ON THE STACK.  IF 2
                2068 ;              OR MORE NUMBERS ARE REQUESTED, THEN THE FIRST MUST BE
                2069 ;              LESS THAN OR EQUAL TO THE SECOND.  OR THE FIRST AND
                2070 ;              SECOND NUMBERS WILL BE SET EQUAL.  THE LAST NUMBER
                2071 ;              REQUESTED MUST BE TERMINATED BY A CARRIAGE RETURN
                2072 ;              OR AN ERROR INDICATION WILL RESULT.
                2073 ;
                2074 GETNM:
0668 2E03       2075  MVI L,3 ; PUT MAXIMUM ARGUMENT COUNT INTO L
066A 79         2076  MOV A,C ; GET THE ACTUAL ARGUMENT COUNT
066B E603       2077  ANI 3 ; FORCE TO MAXIMUM OF 3
066D C8         2078  RZ ; IF 0, DON'T BOTHER TO DO ANYTHING
066E 67         2079  MOV H,A ; ELSE, PUT ACTUAL COUNT INTO H
                2080 GNM05:
066F CD3306     2081  CALL GETHX ; GET NUMBER FROM INPUT STREAM
                2082  FALSE ERROR ;  ERROR IF NOT THERE - TOO FEW NUMBERS
0672 D21E06     2083+ JNC ERROR
0675 C5         2084  PUSH B ; ELSE, SAVE NUMBER ON STACK
0676 2D         2085  DCR L ; DECREMENT MAXIMUM ARGUMENT COUNT
0677 25         2086  DCR H ; DECREMENT ACTUAL ARGUMENT COUNT
0678 CA8406     2087  JZ GNM10 ; BRANCH IF NO MORE NUMBERS WANTED
067B 7A         2088  MOV A,D ; ELSE, GET NUMBER TERMINATOR TO A
067C FE0D       2089  CPI CR ; SEE IF CARRIAGE RETURN
067E CA1E06     2090  JZ ERROR ; ERROR IF SO - TOO FEW NUMBERS
0681 C36F06     2091  JMP GNM05 ; ELSE, PROCESS NEXT NUMBER
                2092 GNM10:
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LOC  OBJ        LINE       SOURCE STATEMENT

0684 7A         2093  MOV A,D ; WHEN COUNT 0, CHECK LAST TERMINATOR
0685 FE0D       2094  CPI CR
0687 C21E06     2095  JNZ ERROR ; ERROR IF NOT CARRIAGE RETURN
068A 01FFFF     2096  LXI B,0FFFFH ; HL GETS LARGEST NUMBER
068D 7D         2097  MOV A,L ; GET WHAT'S LEFT OF MAXIMUM ARG COUNT
068E B7         2098  ORA A ; CHECK FOR 0
068F CA9706     2099  JZ GNM20 ; IF YES, 3 NUMBERS WERE INPUT
                2100 GNM15:
0692 C5         2101  PUSH B ; IF NOT, FILL REMAINING ARGUMENTS WITH 0FFFFH
0692 2D         2102  DCR L
0694 C29206     2103  JNZ GNM15
                2104 GNM20.
0697 C1         2105  POP B ; GET THE 3 ARGUMENTS OUT
0698 D1         2106  POP D
0699 E1         2107  POP H
069A CDAD06     2108  CALL HILO ; SEE IF FIRST >= SECOND
                2109  FALSE GNM25 ; NO - BRANCH
069D D2A206     2110+ JNC GNM25
06A0 54         2111  MOV D,H
06A1 5D         2112  MOV E,L ; YES - MAKE IT AND EQUAL TO THE FIRST
                2113 GNM25:
06A2 E3         2114  XTHL ; PUT FIRST ON STACK - GET RETURN ADDR
06A3 D5         2115  PUSH D ; PUT SECOND ON STACK
06A4 C5         2116  PUSH B ; PUT THIRD ON STACK
06A5 E5         2117  PUSH H ; PUT RETURN ADDRESS ON STACK
                2118 GNM30:
06A6 3D         2119  DCR A ; DECREMENT RESIDUAL COUNT
06A7 F8         2120  RM ; IF NEGATIVE, PROPER RESULTS ON STACK
06A8 E1         2121  POP H ; ELSE, GET RETURN ADDR
06A9 E3         2122  XTHL ; REPLACE TOP RESULT WITH RETURN ADDR
06AA C3A606     2123  JMP GNM30 ; TRY AGAIN
                2124 ;
                2125 ;
                2126 ;*****************************************************************
                2127 ;
                2128 ;
                2129 ; FUNCTION: HILO
                2130 ; INPUTS DE - 16 BIT INTEGER
                2131 ;         HL - 16 BIT INTEGER
                2132 ; OUTPUTS: CARRY - 0 IF HL<DE
                2133 ;                - 1 IF HL>=DE
                2134 ; CALLS: NOTHING
                2135 ; DESTROYS: F/F'S
                2136 ; DESCRIPTION: HILO COMPARES THE 2 16 BIT INTEGERS IN HL AND DE.  THE
                2137 ;              INTEGERS ARE TREATED AS UNSIGNED NUMBERS.  THE CARRY
                2138 ;              BIT IS SET ACCORDING TO THE RESULT OF THE COMPARISON.
                2139 ;
                2140 HILO:
06AD C5         2141  PUSH B ; SAVE BC
06AE 47         2142  MOV B,A ; SAVE A IN B REGISTER
06AF E5         2143  PUSH H ; SAVE HL PAIR
06B0 7A         2144  MOV A,D ; CHECK FOR DE = 0000H
06B1 B3         2145  ORA E
06B2 CBCE06     2146  JZ HIL05 ; WE'RE AUTOMATICALLY DONE IF IT IS
06B5 23         2147  INX H ; INCREMENT H BY 1
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LOC  OBJ      LINE      SOURCE STATEMENT

06B6 7C       2148  MOV A,H ; WANT TO TEST FOR 0 RESULT AFTER
06B7 B5       2149  ORA L ; /INCREMENTING
06B8 CACE06   2150  JZ HIL05 ; IF SO, HL MUST HAVE CONTAINED 0FFFFH
06BB E1       2151  POP H ; IF NOT, RESTORE ORIGINAL HL
06BC D5       2152  PUSH D ; SAVE DE
06BD 3EFF     2153  MVI A,0FFH ; WANT TO TAKE 2'S COMPLEMENT OF DE CONTENTS
06BF AA       2154  XRR D
06C0 57       2155  MOV D,A
06C1 3EFF     2156  MVI A,0FFH
06C3 AB       2157  XRR E
06C4 5F       2158  MOV E,A
06C5 13       2159  INX D ; 2'S COMPLEMENT OF DE TO DE
06C6 7D       2160  MOV A,L
06C7 83       2161  ADD E ; ADD HL AND DE
06C8 7C       2162  MOV A,H
06C9 8A       2163  ADC D ; THIS OPERATION SETS CARRY PROPERLY
06CA D1       2164  POP D ; RESTORE ORIGINAL DE CONTENTS
06CB 78       2165  MOV A,B ; RESTORE ORIGINAL CONTENTS OF A
06CC C1       2166  POP B ; RESTORE ORIGINAL CONTENTS OF BC
06CD C9,      2167  RET ; RETURN
              2168 HIL05:
06CE E1       2169  POP H ; IF HL CONTAINS 0FFFFH, THEN CARRY CAN
06CF 78       2170  MOV A,B ; /ONLY BE SET TO 1
06D0 C1       2171  POP B ; RESTORE ORIGINAL CONTENTS OF REGISTERS
06D1 C33707   2172  JMP SRET ; SET CARRY AND RETURN
              2173 ;
              2174 ;
              2175 ;*******************************************************************
              2176 ;
              2177 ;
              2178 ; FUNCTION: NMOUT
              2179 ; INPUTS: A - 8 BIT INTEGER
              2180 ; OUTPUTS: NONE
              2181 ; CALLS: ECHO,PRVAL
              2182 ; DESTROYS: A,B,C,F/F'S
              2183 ; DESCRIPTION: NMOUT CONVERTS THE 8 BIT, UNSIGNED INTEGER IN THE
              2184 ;              A REGISTER INTO 2 ASCII CHARACTERS. THE ASCII CHARACTERS
              2185 ;              ARE THE ONES REPRESENTING THE 8 BITS. THESE TWO
              2186 ;              CHARACTERS ARE SENT TO THE CONSOLE AT THE CURRENT PRINT
              2187 ;              POSITION OF THE CONSOLE.
              2188 ;
              2189 NMOUT:
06D4 E5       2190  PUSH H ; SAVE HL - DESTROYED BY PRVAL
06D5 F5       2191  PUSH PSW ; SAVE ARGUMENT
06D6 0F       2192  RRC
06D7 0F       2193  RRC
06D8 0F       2194  RRC
06D9 0F       2195  RRC ; GET UPPER 4 BITS TO LOW 4 BIT POSITIONS
06DA E60F     2196  ANI NCHAR ; MASK OUT UPPER 4 BITS - WANT 1 HEX CHAR
06DC CD7402   2197  CALL HEXASC ; CONVERT HEX TO ASCII IN A
06DF 4F       2198  MOV C,A ; LOAD C WITH CHARACTER CODE
06E0 CD0506   2199  CALL ECHO ; SEND TO TERMINAL
06E3 F1       2200  POP PSW ; GET BACK ARGUMENT
06E4 E60F     2201  ANI NCHAR ; MASK OUT UPPER 4 BITS - WANT 1 HEX CHAR
06E6 CD7402   2202  CALL HEXASC ; CONVERT HEX TO ASCII IN A
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LOC  OBJ       LINE       SOURCE STATEMENT

06E9 4F        2202  MOV C,A ; LOAD C WITH CHARACTER CODE
06EA CD0506    2204  CALL ECHO
06ED E1        2205  POP H ; RESTORE SAVED VALUE OF HL
06EE C9        2206  RET ; RETURN
               2207 ;
               2208 ;
               2209 ;*******************************************************************************
               2210 ;
               2211 ;
               2212 ; FUNCTION: REGDS
               2213 ; INPUTS: NONE
               2214 ; OUTPUTS: NONE
               2215 ; CALLS: ECHO, NMOUT, ERROR, CROUT
               2216 ; DESTROYS: A, B, C, D, E, H, F/F'S
               2217 ; DECRIPTION: REGDS DISPLAYS THE CONTENTS OF THE REGISTER SAVE
               2218 ;             LOCATIONS, IN FORMATTED FORM, ON THE CONSOLE. THE
               2219 ;             DISPLAY IS DRIVEN FROM THE TABLE, RTAB, WHICH CONTAINS
               2220 ;             THE REGISTER'S PRINT SYMBOL, SAVE LOCATION ADDRESS,
               2221 ;             AND LENGTH (8 OR 16 BITS).
               2222 ;
               2223 REGDS:
06EF 21E607    2224  LXI H,RTAB ; LOAD HL WITH ADDRESS OF START OF TABLE
               2225 REG05:
06F2 4E        2226  MOV C,M ; GET PRINT SYMBOL OF REGISTER
06F3 79        2227  MOV A,C
06F4 B7        2228  ORA A ; TEST FOR 0 - END OF TABLE
06F5 C2FC06    2229  JNZ REG10 ; IF NOT END, BRANCH
06F8 CDFF05    2230  CALL CROUT ; ELSE, CARRIAGE RETURN/LINE FEED TO END
06FB C9        2231  RET ; /DISPLAY
               2232  REG10:
06FC CD0506    2233  CALL ECHO ; ECHO CHARACTER
06FF 0E3D      2234  MVI C,'=' 
0701 CD0506    2235  CALL ECHO ; OUTPUT EQUALS SIGN, I.E. A=
0704 23        2236  INX H ; POINT TO START OF SAVE LOCATION ADDRESS
0705 5E        2237  MOV E,M ; GET LSP OF SAVE LOCATION ADDRESS TO E
0706 1620      2238  MVI D,RAMST SHR 8 ; PUT MSP OF SAVE LOC ADDRESS INTO D
0708 23        2239  INX H ; POINT TO LENGTH FLAG
0709 1A        2240  LDAX D ; GET CONTENTS OF SAVE ADDRESS
070A CDD406    2241  CALL NMOUT ; DISPLAY ON CONSOLE
070D 7E        2242  MOV A,M ; GET LENGTH FLAG
070E B7        2243  ORA A ; SET SIGN F/F
070F CA1707    2244  JZ REG15 ; IF 0, REGISTER IS 8 BITS
0712 13        2245  DCX D ; ELSE, 16 BIT REGISTER SO MORE TO DISPLAY
0713 1A        2246  LDAX D ; GET LOWER 8 BITS
0714 CDD406    2247  CALL NMOUT ; DISPLAY THEM
               2248 REG15:
0717 0E20      2249  MVI C,' '
0719 CD0506    2250  CALL ECHO
071C 23        2251  INX H ; POINT TO START OF NEXT TABLE ENTRY
071D C3F206    2252  JMP REG05 ; DO NEXT REGISTER
               2253 ;
               2254 ;
               2255 ;*******************************************************************************
               2256 ;
               2257 ;
```

ORIGINAL PAGE IS
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```
LOC  OBJ        LINE       SOURCE STATEMENT

                2258 ; FUNCTION: RGADR
                2259 ; INPUTS: C - CHARACTER DENOTING REGISTER
                2260 ; OUTPUTS: BC - ADDRESS OF ENTRY IN RTAB CORRESPONDING TO REGISTER
                2261 ; CALLS: ERROR
                2262 ; DESTROYS: A,B,C,D,E,H,L,F/F'S
                2263 ; DESCRIPTION: RGADR TAKES AS SINGLE CHARACTER AS INPUT. THIS CHARACTER
                2264 ;              DENOTES A REGISTER. RGADR SEARCHES THE TABLE RTAB
                2265 ;              FOR A MATCH ON THE INPUT ARGUMENT. IF ONE OCCURS,
                2266 ;              RGADR RETURNS THE ADDRESS OF THE ADDRESS OF THE
                2267 ;              SAVE LOCATION CORRESPONDING TO THE REGISTER. THIS
                2268 ;              ADDRESS POINTS INTO RTAB. IF NO MATCH OCCURS, THEN
                2269 ;              THE REGISTER IDENTIFIER IS ILLEGAL AND CONTROL IS
                2270 ;              PASSED TO THE ERROR ROUTINE.
                2271 ;
                2272 RGADR:
0720 21B807     2273  LXI H,RTAB ; HL GETS ADDRESS OF TABLE START
0723 110300     2274  LXI D,RTABS ; DE GETS SIZE OF A TABLE ENTRY
                2275 RGA05:
0726 7E         2276  MOV A,M ; GET REGISTER IDENTIFIER
0727 B7         2277  ORA A ; CHECK FOR TABLE END (IDENTIFIER IS 0)
0728 CA1E06     2278  JZ ERROR ; IF AT END OF TABLE, ARGUMENT IS ILLEGAL
072B B9         2279  CMP C ; ELSE, COMPARE TABLE ENTRY AND ARGUMENT
072C CA2307     2280  JZ RGA10 ; IF EQUAL, WE'VE FOUND WHAT WE'RE LOOKING FOR
072F 19         2281  DAD D ; ELSE, INCREMENT TABLE POINTER TO NEXT ENTRY
0730 C32607     2282  JMP RGA05 ; TRY AGAIN
                2283 RGA10:
0733 23         2284  INX H ; IF A MATCH, INCREMENT TABLE POINTER TO
0734 44         2285  MOV B,H ; /SAVE LOCATION ADDRESS
0735 4D         2286  MOV C,L ; RETURN THIS VALUE
0736 C9         2287  RET ;RETURN
                2288 ;
                2289 ;
                2290 ;*********************************************************************
                2291 ;
                2292 ;
                2293 ; FUNCTION: SRET
                2294 ; INPUTS: NONE
                2295 ; OUTPUTS: CARRY = 1
                2296 ; CALLS: NOTHING
                2297 ; DESTROYS: CARRY
                2298 ; DESCRIPTION: SRET IS JUMPED TO BY ROUTINES WISHING TO RETURN SUCCESS.
                2299 ;              SRET SETS THE CARRY TRUE AND THEN RETURNS TO THE
                2300 ;              CALLER OF THE ROUTINE INVOKING SRET.
                2301 ;
                2302 SRET:
0737 37         2303  STC ; SET CARRY TRUE
0738 C9         2304  RET ; RETURN APPROPRIATELY
                2305 ;
                2306 ;
                2307 ;*********************************************************************
                2308 ;
                2309 ;
                2310 ; FUNCTION: STHPB
                2311 ; INPUTS: DE - 16 BIT ADDRESS OF BYTE TO BE STORED INTO
                2312 ; OUTPUTS: NONE
```

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```
LOC  OBJ        LINE       SOURCE STATEMENT

                2313 ; CALLS: STHLF
                2314 ; DESTROYS: A,B,C,H,L,F/F'S
                2315 ; DESCRIPTION: STHF0 CHECKS THE HALF BYTE FLAG IN TEMP TO SEE IF
                2316 ;              IT IS SET TO LOWER.  IF SO, STHF0 STORES A 0 TO
                2317 ;              PAD OUT THE LOWER HALF OF THE ADDRESSED BYTE;
                2318 ;              OTHERWISE, THE ROUTINE TAKES NO ACTION.
                2319 ;
                2320 STHF0:
0739 3AFD20     2321  LDA TEMP ; GET HALF BYTE FLAG
073C B7         2322  ORA A ; SET F/F'S
073D C0         2323  RNZ ; IF SET TO UPPER, DON'T DO ANYTHING
073E 0E00       2324  MVI C,0 ; ELSE, WANT TO STORE THE VALUE 0
0740 CD4407     2325  CALL STHLF ; DO IT
0743 C9         2326  RET ; RETURN
                2327 ;
                2328 ;
                2329 ;*****************************************************************
                2330 ;
                2331 ;
                2332 ; FUNCTION: STHLF
                2333 ; INPUTS: C - 4 BIT VALUE TO BE STORED IN HALF BYTE
                2334 ;         DE - 16-BIT ADDRESS OF BYTE TO BE STORED INTO
                2335 ; OUTPUTS: NONE
                2336 ; CALLS: NOTHING
                2337 ; DESTROYS: A,B,C,H,L,F/F'S
                2338 ; DESCRIPTION: STHLF TAKES THE 4 BIT VALUE IN C AND STORES IT IN
                2339 ;              HALF OF THE BYTE ADDRESSED BY REGISTERS DE.  THE
                2340 ;              HALF BYTE USED (EITHER UPPER OR LOWER) IS DENOTED
                2341 ;              BY THE VALUE OF THE FLAG IN TEMP.  STHLF ASSUMES
                2342 ;              THAT THIS FLAG HAS BEEN PREVIOUSLY SET
                2343 ;              (NOMINALLY BY ICMD).
                2344 ;
                2345 STHLF:
0744 D5         2346  PUSH D
0745 E1         2347  POP H ; MOVE ADDRESS OF BYTE INTO HL
0746 79         2348  MOV A,C ; GET VALUE
0747 E60F       2349  ANI 0FH ; FORCE TO 4 BIT VALUE
0749 4F         2350  MOV C,A ; PUT VALUE BACK
074A 3AFD20     2351  LDA TEMP ; GET HALF BYTE FLAG
074D B7         2352  ORA A ; CHECK FOR LOWER HALF
074E C25707     2353  JNZ STH05 ; BRANCH IF NOT
0751 7E         2354  MOV A,M ; ELSE, GET BYTE
0752 E6F0       2355  ANI 0F0H ; CLEAR LOWER 4 BITS
0754 B1         2356  ORA C ; OR IN VALUE
0755 77         2357  MOV M,A ; PUT BYTE BACK
0756 C9         2358  RET ; RETURN
                2359 STH05:
0757 7E         2360  MOV A,M ; IF UPPER HALF, GET BYTE
0758 E60F       2361  ANI 0FH ; CLEAR UPPER 4 BITS
075A 47         2362  MOV B,A
075B 79         2363  MOV A,C ; GET VALUE
075C 0F         2364  RRC
075D 0F         2365  RRC
075E 0F         2366  RRC
075F 0F         2367  RRC ; ALIGN TO UPPER 4 BITS
```

ORIGINAL PAGE IS
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LOC  OBJ        LINE       SOURCE STATEMENT

0750 B0         2368  ORA B ; OR IN ORIGINAL 4 BITS
0751 77         2369  MOV M,A ; PUT NEW CONFIGURATION BACK
0752 C9         2370  RET ;RETURN
                2371 ;
                2372 ;
                2373 ;*******************************************************************;
                2374 ;
                2375 ;
                2376 ; FUNCTION: VALDG
                2377 ; INPUTS: C - ASCII CHARACTER
                2378 ; OUTPUTS: CARRY - 1 IF CHARACTER REPRESENTS VALID HEX DIGIT
                2379 ;                 - 0 OTHERWISE
                2380 ; CALLS: NOTHING
                2381 ; DESTROYS: A,F/F'S
                2382 ; DESCRIPTION: VALDG RETURNS SUCCESS IF ITS INPUT ARGUMENT IS
                2383 ;              AN ASCII CHARACTER REPRESENTING A VALID HEX DIGIT
                2384 ;              (0-9,A-F), AND FAILURE OTHERWISE.
                2385 ;
                2386 VALDG:
0753 79         2387  MOV A,C
0754 FE30       2388  CPI '0' ; TEST IF CHARACTER IS A '0'
0756 FA2906     2389  JM FRET ; IF ASCII CODE LESS, CANNPT BE VALID DIGIT
0759 FE39       2390  CPI '9' ; ELSE, SEE IF IN RANGE '0'-'9'
075B FA3707     2391  JM SRET ; CODE BETWEEN '0' AND '9'
075E CA3707     2392  JZ SRET ; CODE EQUAL '9'
0761 FE41       2393  CPI 'A' ; NOT A DIGIT - TRY FOR A LETTER
0763 FA2906     2394  JM FRET ; NO - CODE BETWEEN '9' AND 'A'
0766 FE47       2395  CPI 'G'
0768 F22906     2396  JP FRET ; NO - CODE GREATER THAN 'F'
076B C33707     2397  JMP SRET ; OKAY - CODE IS 'A' TO 'F' , INCLUSIVE
                2398 ;
                2399 ;
                2400 ;*******************************************************************
                2401 ;
                2402 ;
                2403 ; FUNCTION: VALDL
                2404 ; INPUTS: C - CHARACTER
                2405 ; OUTPUTS: CARRY - 1 IF INPUT ARGUMENT VALID DELIMITER
                2406 ;                 - 0 OTHERWISE
                2407 ; CALLS: NOTHING
                2408 ; DESTROYS: A,F/F'S
                2409 ; DESCRIPTION: VALDL RETURNS SUCCESS IF ITS INPUT ARGUMENT IS A VALID
                2410 ;              DELIMITER CHARACTER (SPACE, COMMA, CARRIAGE RETURN) AND
                2411 ;              FAILURE OTHERWISE
                2412 ;
                2413 VALDL:
076E 79         2414  MOV A,C
076F FE2C       2415  CPI ',' ; CHECK FOR COMMA
0771 CA3707     2416  JZ SRET
0774 FE0D       2417  CPI CR ; CHECK FOR CARRIAGE RETURN
0776 CA3707     2418  JZ SRET
0779 FE20       2419  CPI ' ' ; CHECK FOR SPACE
077B CA3707     2420  JZ SRET
077E C32906     2421  JMP FRET ; ERROR IF NONE OF THE ABOVE
                2422 ;
```

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```
 LOC  OBJ        LINE       SOURCE STATEMENT

                 2423 ;
                 2424 ;**********************************************************************
                 2425 ;
                 2426 ; DUMMY INTERRUPT ROUTINE ENTRY POINTS
                 2427 ;
                 2428 TRAPPR:
                 2429 RESET5:
                 2430 RESET6:
                 2431 RSET65:
                 2432 RESET7:
                 2433 RSET75:
 0791 FB         2434  EI  ; ENABLE INTERRUPTS AGAIN
 0792 C9         2435  RET ; RETURN TO VECTOR POINT
                 2436 ;
                 2437 ;**********************************************************************
                 2438 ;
                 2439 ;
                 2440 ;                          MONITOR TABLES
                 2441 ;
                 2442 ;
                 2443 ;**********************************************************************
                 2444 ;
                 2445 ;
                 2446 SGNON:         ; SIGNON MESSAGE
 0793 0D         2447  DB CR,LF,'STDMON   VER 1.0',CR,LF
 0794 0A
 0795 5254444D
 0799 4F4E2020
 079D 20564552
 07A1 20312E30
 07A5 0D
 07A6 0A
 0014            2448 LSGNON EQU $-SGNON ; LENGTH OF SIGNON MESSAGE
                 2449 ;
                 2450 CADR:          ; TABLE OF ADDRESSES OF COMMAND ROUTINES
 07A7 0000       2451  DW 0 ; DUMMY
 07A9 CE05       2452  DW XCMD
 07AB 3F05       2453  DW SCMD
 07AD 1F05       2454  DW MCMD
 07AF D504       2455  DW ICMD
 07B1 5704       2456  DW GCMD
 07B3 9604       2457  DW DCMD
                 2458 ;
                 2459 CTAB:          ; TABLE OF VALID COMMAND CHARACTERS
 07B5 44         2460  DB 'D'
 07B6 47         2461  DB 'G'
 07B7 49         2462  DB 'I'
 07B8 4D         2463  DB 'M'
 07B9 53         2464  DB 'S'
 07BA 58         2465  DB 'X'
 0006            2466 NCMDS EQU $-CTAB ; NUMBER OF VALID COMMANDS
                 2467 ;
                 2468 RTAB:          ; TABLE OF REGISTER INFORMATION
 07BB 41         2469  DB 'A' ; REGISTER IDENTIFIER
 07BC EE         2470  DB RSAV AND 0FFH ; ADDRESS OF REGISTER SAVE LOCATION
```

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```
LOC  OBJ        LINE     SOURCE STATEMENT

0781 00         2471  DB 0 ; LENGTH FLAG - 0=8 BITS, 1=16 BITS
0002            2472 BTABS EQU $-BTAB ; SIZE OF AN ENTRY IN THIS TABLE
0782 42         2473  DB 'B'
0783 E1         2474  DB BSAV AND 0FFH
0784 00         2475  DB 0
0785 43         2476  DB 'C'
0786 E3         2477  DB CSAV AND 0FFH
0787 00         2478  DB 0
0788 44         2479  DB 'D'
0789 EA         2480  DB DSAV AND 0FFH
078A 00         2481  DB 0
078B 45         2482  DB 'E'
078C E9         2483  DB ESAV AND 0FFH
078D 00         2484  DB 0
078E 46         2485  DB 'F'
078F ED         2486  DB FSAV AND 0FFH
0790 00         2487  DB 0
0791 49         2488  DB 'I'
0792 F1         2489  DB ISAV AND 0FFH
0793 00         2490  DB 0
0794 48         2491  DB 'H'
0795 F0         2492  DB HSAV AND 0FFH.
0796 00         2493  DB 0
0797 4C         2494  DB 'L'
0798 EF         2495  DB LSAV AND 0FFH
0799 00         2496  DB 0
079A 4D         2497  DB 'M'
079B F0         2498  DB HSAV AND 0FFH
079C 01         2499  DB 1
079D 53         2500  DB 'S'
079E F5         2501  DB SSAV+1 AND 0FFH
079F 01         2502  DB 1
07A0 50         2503  DB 'P'
07A1 F3         2504  DB PSW+1 AND 0FFH
07A2 01         2505  DB 1
07A3 00         2506  DB 0  ; END OF TABLE ENTRIES
07A4 00         2507  DB 0
                2508 ;
0920            2509  ORG BRTAB ; BRANCH TABLE FOR USER ACCESSIBLE ROUTINES
                2510 ;
0920 C3F405     2511  JMP CO ; TTY CONSOLE OUTPUT
0923 C3DF05     2512  JMP CI ; TTY CONSOLE INPUT
                2513 ;
                2514 ;
0027            2515 TTYMOV EQU 27H
                2516 ;
                2517 ;**********************************************************
                2518 ;
                2519 ; COMMON/CLOCK/ FLAG1,FLAG2,FLAG3,TIMLSB,TIMMSB,BYTE
                2520 ;
                2521 ; CLOCK FLAGS AND COUNTERS
                2522 ;
1801            2523  ORG USERBR+5 ; 2001
1801 00         2524  DB 0 ; 1 MSEC FLAG
1802 00         2525  DB 0 ; 50 MSEC FLAG
```

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LOC  OBJ          LINE      SOURCE STATEMENT

2004 00           2526  DB 0 ; 1 SEC FLAG
2005 00           2527  DB 0 ; SECOND COUNT LSB
2006 00           2528  DB 0 ; SECOND COUNT MSB
2007 00           2529  DB 0  ; NOT USED
                  2530 ;
                  2531 ;*****************************************************************
                  2532 ;
                  2533 ; IN THE FOLLOWING LOCATIONS, THE USER MAY PLACE JUMP INSTRUCTIONS TO
                  2534 ; ROUTINES FOR HANDLING THE FOLLOWING:-
                  2535 ;       A) RST 5,6 & 7
                  2536 ;       B) HARDWIRED USER INTERRUPT (RST 6.5)
                  2537 ;       C) KEYBOARD "VECTORED INTERRUPT" KEY (RST 7.5)
                  2538 ;
2008              2539  ORG USRBR ; START OF USER BRANCH LOCATIONS
                  2540 ;
2008 00           2541 RSET5: DB 0,0,0 ; JUMP TO RST 5 ROUTINE
2009 00
200A 00
200B 00           2542 RSET6: DB 0,0,0 ; JUMP TO RST 6 ROUTINE
200C 00
200D 00
200E 00           2543 RST65: DB 0,0,0 ; JUMP TO RST 6.5 (HARDWIRED USER INTERRUPT)
200F 00
2010 00
2011              2544 TRAPEP EQU $
2011 00           2545 RSET7: DB 0,0,0 ; JUMP TO RST 7 ROUTINE
2012 00
2013 00
2014 00           2546 USINT: DB 0,0,0 ; JUMP TO "VECTORED INTERRUPT" KEY ROUTINE
2015 00
2016 00
                  2547 ;
                  2548 ;*****************************************************************
                  2549 ;
                  2550   SPACE IS RESERVED HERE FOR THE MONITOR STACK
                  2551 ;
                  2552 ;*****************************************************************
                  2553 ;
20E9              2554  ORG MNSTK ; START OF MONITOR STACK
                  2555 ;
                  2556 ;       SAVE LOCATIONS FOR USER REGISTERS
                  2557 ;
20E9 00           2558 ESAV: DB 0 ; E REGISTER
20EA 00           2559 DSAV: DB 0 ; D REGISTER
20EB 00           2560 CSAV: DB 0 ; C REGISTER
20EC 00           2561 BSAV: DB 0 ; B REGISTER
20ED 00           2562 FSAV: DB 0 ; FLAGS
20EE 00           2563 ASAV: DB 0 ; A REGISTER
20EF 00           2564 LSAV: DB 0 ; L REGISTER
20F0 00           2565 HSAV: DB 0 ; H REGISTER
20F1 00           2566 ISAV: DB 0 ; INTERRUPT MASK
                  2567 PSAV:      ; PROGRAM COUNTER
20F2 00           2568 PCLSV: DB 0 ; LOW ORDER BYTE OF PC
20F3 00           2569 PCHSV: DB 0 ; HIGH ORDER BYTE OF PC
                  2570 SSAV:      ; STACK POINTER
```

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LOC  OBJ        LINE      SOURCE STATEMENT

20F4 00         2571 SPLSV: DB 0 ; LOW ORDER BYTE OF STACK POINTER
20F5 00         2572 SPHSV: DB 0 ; HIGH ORDER BYTE OF STACK POINTER
                2573 ;
                2574 ;*****************************************************************
                2575 ;
                2576 ; MONITOR STORAGE LOCATIONS
                2577 ;
20F6 0000       2578 CURAD: DW 0 ; CURRENT ADDRESS
20F8 00         2579 CURDT: DB 0 ; CURRENT DATA
20F9            2580 OBUFF: DS 4 ; OUTPUT BUFFER
                2581 TEMP:       ; TEMPORARY LOCATION FOR TTY MONITOR
                2582             ; TEMPORARY LOCATION FOR SINGLE STEP ROUTINE
20FD 00         2583 RGPTR: DB 0 ; REGISTER POINTER
20FE 00         2584 IBUFF: DB 0 ; INPUT BUFFER
20FF 00         2585 USCSR: DB 0 ; USER SHOULD STORE IMAGE OF CSR HERE FOR EACH TIME STEP
                2586             ; /CSR IS CHANGED. OTHERWISE, SINGLE STEP
                2587             ; /ROUTINE WILL DESTROY CSR CONTENTS
                2588  END
```

PUBLIC SYMBOLS

CI	A 05CF	CNVEN	A 05EB	CO	A 05F4	DELAY	A 0389	DISP1	A 02AB	GO	A 0449	HEXASC	A 0274
MONITR	A 0000	MSEC1H	A 039D	MSEC20	A 03A3	MSEC2H	A 0397	OUTPT	A 029E	RDKBD	A 0229	SECDT	A 0391

EXTERNAL SYMBOLS

INTRPT	E 0000														

USER SYMBOLS

ADDPOW	A 02F8	ADFLD	A 0000	ADISP	A 0090	ASAV	A 20EE	BLANK	A 0089	BLANKS	A 03DB	BLNKS	A 03D9		
BRKMR	A 001B	BRTAB	A 0320	BSAV	A 20EC	CADR	A 07A7	CDATA	A 000C	CI	A 05DF	CLEAR	A 0005		
CLDIS	A 0156	CLDST	A 01DC	CLEAR	A 01CD	CMD10	A 0087	CMD15	A 0093	CMDAD	A 0399	CMDTB	A 03B5		
CMMND	A 00E4	CNIN	A 00DC	CNOUT	A 00DC	CNTRL	A 0001	CNVEN	A 05EB	CO	A 05F4	COLCNT	A 02E2		
COMMA	A 0011	CONCP	A 00DD	CONSCP	A 00DE	CR	A 000D	CROUT	A 05FF	CSAV	A 20E8	CSNIT	A 0000		
CSR	A 0020	CSTAT	A 00DD	CTAB	A 07B5	CURAD	A 20F6	CURDT	A 20F8	DCM05	A 0429	DCM10	A 0498		
DCM15	A 04AD	DCMD	A 0486	DDISP	A 0094	DELAY	A 038B	DELENT	A 03AA	DISP1	A 02AB	DISPC	A 01EB		
DOT	A 0001	DSAV	A 20EA	DSPDT2	A 0390	DSPDT4	A 0373	DSPLY	A 00D0	DSPNUM	A 03C4	DSPTB	A 03C4		
ECHLD	A 0001	ECH05	A 068E	ECH10	A 061C	ECHO	A 0605	EIGHT	A 0008	EMPTY	A 0080	ENCODE	A 02F3		
ERMSG	A 03E3	ERR	A 01FF	ERROR	A 061E	ESAV	A 20E9	ESC	A 001B	EXAM	A 009E	EXIT	A 0623		
EXM05	A 00AF	EXM10	A 00C8	EXMSG	A 03E7	FALSE	+ 0001	FIVE	A 0005	FRET	A 0625	FSAV	A 20ED		
G10	A 00FA	GCM05	A 04CC	GCM10	A 04D2	GCMD	A 0487	GETCH	A 062C	GETCM	A 0457	GETHX	A 0633		
GETNM	A 0668	GHX05	A 0E39	GHX10	A 0652	GNM05	A 066F	GNM10	A 0684	GNM15	A 0692	GNM20	A 0697		
GNM25	A 06A2	GNM30	A 06A6	GO	A 0449	GOCMD	A 00DB	GTC03	A 0462	GTC05	A 0470	GTC10	A 047C		
GTH05	A 0214	GTH10	A 0231	GTH20	A 0237	GTH25	A 0248	GTHEX	A 020D	HCHAR	A 000F	HEX05	A 027E		
HEXASC	A 0274	HIL05	A 06CE	HILO	A 06AD	HSAV	A 20F0	HXDSP	A 024E	HXDSP2	A 0260	IBUFF	A 20FE		
ICM05	A 04E0	ICM10	A 0508	ICM20	A 0510	ICM25	A 0516	ICMD	A 04D5	ININT	A 0221	INITUT	A 0000		
INSDG	A 0286	INTRPT	E 0000	INVRT	A 00FF	ISAV	A 20F1	LETRA	A 00C1	LETRB	A 00C2	LETRC	A 00C3		
LETRD	A 00C4	LETRE	A 00C5	LETRF	A 00C6	LETRH	A 00C8	LETRI	A 00C9	LETRL	A 00CC	LETRP	A 00D0		
LETRR	A 00D2	LETRS	A 00D3	LF	A 000A	LOWER	A 0000	LSAV	A 20EF	LSGNON	A 0014	MCM05	A 0527		
MCMD	A 051F	MNSTK	A 20E9	MONITR	A 0000	MONRDK	A 007E	MSEC1H	A 039D	MSEC20	A 03A3	MSEC2H	A 0397		
MSECDT	A 03A6	MSGL	A 044E	MCMDS	A 0005	NEWLN	A 000F	NMOUT	A 05D4	NMTBL	A 0409	NOCOT	A 0000		
NOKEY	A 0074	NUMC	A 0005	NUMRG	A 000D	NXTCOL	A 02C4	NXTRG	A 023F	OBUFF	A 20F9	OUT05	A 02A9		
OUTPT	A 029E	PCHSV	A 20F3	PCLSV	A 20F2	PERIO	A 0010	PRMPT	A 00FD	RETV0	A 007F	RSAV	A 20F2		
RAMST	A 2000	REF	A 0040	RDKBD	A 02C0	RDYTBL	A 03F3	REG05	A 06F2	REG10	A 05FC	REG15	A 0717		
REGDS	A 05EF	RES10	A 002F	RESET5	A 0791	RESET6	A 0791	RESET7	A 0791	RETF	A 0103	RETT	A 030B		
RGA05	A 0726	RGA10	A 0732	RGADR	A 0720	RGLOC	A 030D	RGNAM	A 0319	RGPTB	A 03F9	RGPTR	A 20FD		

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RGTBL  A 043C   RKEXIT A 02FE   RMUSE  A 0017   ROWCNT A 02EA   RSET5  A 20C9   RSET6  A 20CB   RSET65 A 0791
RSET7  A 20D1   RSET75 A 0791   RSP05  A 0330   RSP10  A 0341   RST55  A 20CE   RST65  A 0328   RTRE   A 0798
RTABS  A 0003   SCM05  A 0544   SCM10  A 054F   SCM15  A 055F   SCMD   A 052F   SECOT  A 0291   SETR4  A 0354
SGNCN  A 0793   SKLN   A 0012   SMSG   A 03EF   SPHSV  A 20F5   SPLSV  A 20F4   SPET   A 0737   SSAV   A 20F4
SSTEP  A 0109   STH05  A 0757   STHF0  A 0739   STHLF  A 0744   STP20  A 0120   STP21  A 0142   STP22  A 0149
STP23  A 014C   STP25  A 014F   SUB05  A 0194   SUB10  A 019A   SUB15  A 01C5   SUBST  A 017F   TBE    A 0080
TEMP   A 20FD   TERM   A 001B   TRAPEP A 20D1   TRAPPR A 0791   TRUE   + 0000   TTYADV A 0027   UERLN  A 000F
UNMSK  A 000E   UPDAD  A 036F   UPDDT  A 037C   UPPER  A 00FF   URTPC  A 00E0   URTSPC A 0003   USCSR  A 20FF
USINT  A 20D4   USRBR  A 20C8   VALDG  A 0763   VALDL  A 077E   XCM05  A 0576   XCM10  A 0585   XCM15  A 0592
XCM18  A 059D   XCM20  A 05B6   XCM25  A 05CD   XCM27  A 05CE   XCM30  A 05D6   XCMD   A 0552   XMSG   A 03EB
ZERO   A 0000
```

```
ASSEMBLY COMPLETE,  NO ERRORS
```

```
SUBMIT FORTRN(VCSPRG)
SUBMIT FORTRN(VCSSUP)
SUBMIT FORTRN(VCSEXM)
SUBMIT FORTRN(VCSCNT)
SUBMIT FORTRN(VCSDEB)
SUBMIT FORTRN(VCSICU)
SUBMIT FORTRN(VCSCOM)
SUBMIT FORTRN(VCSINP)
SUBMIT FORTRN(VCSIOC)
SUBMIT FORTRN(VCSTAP)
SUBMIT ASMBLR(VCSUTL)
SUBMIT ASMBLR(VCSIOX)
SUBMIT ASMBLR(VCSIOD)
SUBMIT ASMBLR(INTRPT)
SUBMIT ASMBLR(DEFALT)
SUBMIT ASMBLR(TABLES)
SUBMIT ASMBLR(DEFTAB)
SUBMIT ASMBLR(MONITR)
```

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FORT90 FL.30 FOR
COPY FL.30 LST TO LP:
DELETE FL.30 LST

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```
ASM80 :F1:%0 ASM MACROFILE MODIFY
COPY :F1:%0 LST TO :LP:
DELETE :F1:%0 LST
```

```
LOCATE :F1:YCSFPG.LNK TO :F1:YCSRUN &
MAP SYMBOLS PRINT(:F1:YCSLOC.MAP) &
ORDER(DATA,STACK,CODE,MEMORY)&
DATA(2100H) STACK(2E00H)&
CODE(4000H) MEMORY(0C000H)&
/NESTB2/(0C40H) /DEFOFS/(0C00H)&
/NESTAB/(0A00H) /NESTB3/(0FFAH)&
/DEFPLT/(0EE0H) /CLOCK/(0C0CH)&
/OPPARM/(0EAC4H) /DEFTAB/(0EE8H)&
/DEFMOS/(0CA4H) /MOSHES/(0CCEH)&
/OPSVEC/(9000H)&
/CNTVEC/(9014H)&
/IOFVEC/(9024H)&
/PSPAMS/(9038H)&
/OPSENT/(9060H)&
/COMTAB/(9078H)&
/SENBUF/(90C0H)&
/COMBUF/(90E5H)&
/COPNEL/(91CEH)&
/RTYBUF/(91D5H)&
/SENPNT/(91ECH)&
/SENDEL/(920CH)&
/DEBUG/(95F4H)&
/ERRFLG/(95FCH)&
/WORK/(950CH)&
/ERRBUF/(9634H)&
/SAVER/(9684H)&
/SENMEM/(8700H)
COPY :F1:YCSLOC.MAP TO :LP:
DELETE :F1:YCSLOC.MAP
```

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```
LINK :F1:VOSPRG OBJ,:F1:VOSSUP OBJ,&
:F1:VOSEXS LIB,:F1:VOSDBG OBJ,&
:F1:MONTAB LIB,&
:F1:VOSIOS LIB,:F1:VOSIOL LIB,&
:F1:TBELES OBJ,:F1:DEFTAB OBJ,:F1:DEFALT OBJ,&
FSOPUN LIB,FSONIO LIB,FSEF LIB,&
FMALL LIB,PLMSG LIB,&
TO :F1:VOSPR1 LNK
```

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```
DELETE :F1:VCS*.LIB,:F1:DEBUG.LIB,:F1:MONTAB.LIB
LIB
CREATE :F1:VCSSPS.LIB
ADD :F1:VCSSUP.OBJ TO :F1:VCSSPS.LIB
CREATE :F1:VCSIOS.LIB
ADD :F1:VCSINP.OBJ TO :F1:VCSIOS.LIB
ADD :F1:VCSCOM.OBJ TO :F1:VCSIOS.LIB
CREATE :F1:MONTAB.LIB
ADD :F1:MONITR.OBJ TO :F1:MONTAB.LIB
ADD :F1:INTRPT.OBJ TO :F1:MONTAB.LIB
ADD :F1:TABLES.OBJ TO :F1:MONTAB.LIB
ADD :F1:DEFALT.OBJ TO :F1:MONTAB.LIB
ADD :F1:[illegible]TB.OBJ TO :F1:MONTAB.LIB
CREATE :F1:VCSEXS.LIB
ADD :F1:VCSCMT.OBJ TO :F1:VCSEXS.LIB
ADD :F1:VCSEXM.OBJ TO :F1:VCSEXS.LIB
ADD :F1:VCSTAP.OBJ TO :F1:VCSEXS.LIB
CREATE :F1:DEBUG.LIB
ADD :F1:VCSDBG.OBJ TO :F1:DEBUG.LIB
CREATE :F1:VCSIOL.LIB
ADD :F1:VCSIOU.OBJ TO :F1:VCSIOL.LIB
ADD :F1:VCSUTL.OBJ TO :F1:VCSIOL.LIB
ADD :F1:VCSIOD.OBJ TO :F1:VCSIOL.LIB
ADD :F1:VCSIO2.OBJ TO :F1:VCSIOL.LIB
ADD :F1:VCSIOX.OBJ TO :F1:VCSIOL.LIB
EXIT
```

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```
DELETE F1:VCS1CL.LIB
LIB
CREATE F1:VCS1CL.LIB
ADD F1:VCS1CU.OBJ TO F1:VCS1CL.LIB
ADD F1:VCS1CD.OBJ TO F1:VCS1CL.LIB
ADD F1:VCS1CV.OBJ TO F1:VCS1CL.LIB
ADD F1:VCS1CT.OBJ TO F1:VCS1CL.LIB
ADD F1:VCS1CL.OBJ TO F1:VCS1CL.LIB
EXIT
```

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