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NIMBUS HRIR EQUIPMENT DIAGNOSTIC TEST PROGRAM

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GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND

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NIMBUS HRIR EQUIPMENT DIAGNOSTIC TEST PROGRAM

DESCRIPTION OF PROGRAM

This program is designed to aid in checking and maintaining the HRIR equipment associated with the Nimbus HRIR digitizing system.* Using it, all equipment function select and sense codes may be tested and any particular selection of HRIR equipment modules and settings may be easily established for subsequent checks of data and time inputs. Either FM data only or simultaneous FM data (Channel 1) and time data (Channel 5) may be input a block at a time or continuously in a loop mode. As an option, all data read into the computer may be stored on digital tape for later analysis.

A data analysis routine is available in the program which computes and prints out the following information:

1. The number of FM data words (24 bit) read in during vehicle time frames.

2. The number of FM data samples between FM data sync patterns.

3. A table of first and second differences for the data samples derived from the linear calibration portion of the data simulator input.

In deriving these values the routine uses one block of FM data and one block of time data with associated interrupt location information. The block of data may have just been read in from the external equipment or may be read in from digital tape where it was stored by an earlier operation. To aid in locating a desired block of data on the digital tape for analysis by this routine, a tape search routine which will locate a desired record anywhere on the digital tape and read it into core, is provided.

Finally, a routine is provided to print out the raw FM and Time data as it was originally read into the computer. Associated 30 and 40 interrupt information and the results of certain external sense codes will also be printed.

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* For a brief description of the HRIR digitizing system see NASA X-545-65-88

The program is modular in design so that additional test functions and routines can readily be added.

OPERATING PROCEDURE

For system checkout purposes the program is designed to be operated on line. The user can switch at will from one program function to another as he proceeds through any diagnostic or checkout procedures he deems advisable. During operation the program directs the user through messages on the typewriter so that there is little that the operator need remember. Any erroneous jump key settings or typewriter inputs from the operator are rejected by the program. The operator is given two main opportunities to select program functions. The first occasion occurs when the program types "select run mode". This is described below. The second occurs when the program types "select operation" following the input of data. The responses to this message are also described below. Finally the operator is given a high degree of flexibility in each run mode or operation through the use of jump switches. The settings of the jump switches and the resulting actions are described in the paragraphs concerning each run mode or operation.

RUN MODES

The computer types out "select run mode". Permissible replies are described below.

Codes

This mode enables the operator to quickly step through all HRIR equipment select and sense instructions. Following type in of codes the program stops with 11111111_8 in the A register. The operator may now step through each select and sense code used by the external HRIR equipment. The select codes are stored consecutively in core while the sense codes are separated by a UJP *+1 instruction to allow for a skip exit from the sense code. After the last sense code is executed the operator should push start and the message "select run mode" will be typed again, allowing the operator to repeat the test or go on to another test.

Sense

This mode enables the operator to dynamically test any sense instruction. It gives him a chance to type in the desired sense code instruction and to either loop through the instruction on a normal exit and stop on a skip exit or vice versa.

At any time he may reverse the response (from stop on exit, loop on skip exit, to stop on skip exit, loop on exit), terminate the present sense instruction testing and type in another, or go back to select another run mode.

Following the selection of the "sense mode" the program types "type sense instruction." The operator should type $747CXXXX_8$ where C is the desired channel and XXXX is the desired sense code pattern. The program will immediately start executing the sense code under the following conditions:

Jump switch 1 on:	Loop on skip exit, stop on exit
Jump switch 1 off:	Stop on skip exit, loop on exit

In either case above, pushing start after the computer has stopped will repeat the same cycle, subject to the settings of jump switches 2 and 3 as described below. Jump switch 1 may be changed dynamically at any time to alter the response.

Jump switch 3 on:	Normal setting
Jump switch 3 off:	Terminate the present test and request another sense code through the typewriter
Jump switch 2 on:	Normal setting
Jump switch 2 off:	Terminate the present test and request selection of another run mode through the typewriter

Jump switches 2 and 3 may be changed at any time during the test as the test routine loops through them each cycle.

Input A, B, C

This mode allows the operator to cause the external HRIR equipment to be automatically set to a desired data source, sampling rate, and bandwidth as indicated by the parameters A, B and C. The only permissible values for these parameters are given in Table 1. Following correct input of these parameters the program stops with 22222222_8 in the A register and the message "set J. S. 1, 2, 3" on the typewriter. The operator should set the jump switches as desired at this time. The switches have the following effect:

Jump Switch	Setting	Action
1	on	Save FM data (and time if available) on tape unit 3.
1	off	Do not save data on tape.
2	on	Cycle through input routine reactivating channel 1 and channel 5 (if J. S. 3 is on) each time they become inactive. The data is written into the same buffer each record. If J. S. 1 is on each cycle the data is saved on tape before being over-written by the next cycle.
2	off	Terminate the input of data (and time) following the completion of the present input record.
3	on	Read in time over channel 5.
3	off	Supress read in of time. Read data on channel 1 only. Following completion of the input operation the program types out "select operation".

OPERATIONS

The computer types out "select operation" following an input of data. Permissible replies are described below.

ANALYZE: The block of data in core is analyzed and the results are printed out as described in Table 2. To dynamically supress the printing at any time, turn jump switch 2 on. (Turning JS2 on and off quickly will skip portions of the printout)

SEARCH: Tape unit 3 will be searched forward or backward for a desired record. The record number must be entered into the A register when the program stops with 44444444 in the A register.

PRINT: Print out the raw input data and time data according to the format given in Table 3. Printing may be dynamically suppressed at any time by turning jump switch 2 on. With jump switch 2 on the program enters a delay loop while indexing through the print lines. Therefore turning J. S. 2 on and off quickly will skip portions of the printout if one is only interested in the end of the data.

SYSTEM: Return control to the resident system in order to utilize the tape print routine (TDMP), the Dump routine (DUMP A B) or to end the program.

REPEAT: Repeat the last data input operation. Control returns to the data input section of the program and the same external equipment select codes will be used.

RESET: The operator is given a chance to reset the jump switches, and return control to the very beginning of the program. The program will type "select run mode". At this time another input operation may be requested using different equipment selections, or a different run mode may be selected.

Table 1

Parameter Values for External Equipment Selections

Parameter	Value	Selection
A	0	Forward vehicle time and FM data from simulator
A	2	Reverse vehicle time and FM data from simulator
A	4	Forward ground time and FM data from simulator
A	6	Forward time and data from analog tape
A	8	Reverse time and data from analog tape
B	0	2 kc sampling rate
B	1	4 kc sampling rate
B	2	8 kc sampling rate
B	3	16 kc sampling rate
B	4	local oscillator sampling
C	0	narrow (A) bandwidth
C	1	medium (B) bandwidth
C	2	wide (C) bandwidth

Table 2

Printer Format From Analyze Routine

Line 1

Word 1	Record Number (if data was read from tape)
Word 2	0 normal 1 FM, time absent during record (74717040)
Word 3	0 normal 1 FM carrier absent during record (74717045)
Word 4	0 normal 1 FM sample lost (74717043)
Word 5	0 normal 1 time carrier absent during record (74717046)
Word 6	0 normal 1 time character lost during record (74717044)
Words 7-10	0 normal 1 not used

Line 2

Number of computer words between successive 30 interrupts (computer words in data input buffer)

Line 3

Number of computer words between successive 40 interrupts

Line 4

Number of data samples between successive data sync flags in the data.

ALL Succeeding Lines

Word 1	sample number from start of linear calibration portion of data curve
Word 2	data sample in octal
Word 3	first difference of data samples (octal)
Word 4	second difference of data samples

Table 3

Printer Format From Raw Data Print Routine

Line 1	Same as line one of Table 2
Line 2	30 interrupt locations
Line 3	40 interrupt locations
Lines 4 to 14	Time characters (1 per word)
Lines 15 to end	Data samples (2 per word)

Table 4

Programmed 'A ' Register Flags

A Register	Meaning
11111111	Program has stopped in Codes Routine. Operator should now step the computer through each select and sense code. See Table 5.
22222222	Program has stopped to give the operator an opportunity to make any changes to the jump switches prior to a data input operation.
33333333	Program has now selected external equipment settings and is ready to begin an input of data. At this time the operator may verify the settings and change them if desired. When he is ready to start the input he should push start.
44444444	Program has stopped to enable operator to enter an octal record number in the 'A' register. When the program is restarted tape unit 3 will be searched for the record containing this number.

Table 5

HRIR Equipment Sense and Select Codes

NIMBUS HRIR SYSTEM

(1604 mode - data)
(160 mode - time)

SELECT

Read Operations

1-7000 Select Nimbus FM data mode

Control Operations

1-7001 Start oscillograph recording
1-7002 Stop oscillograph recording

1-7003 Initialize all NIMBUS external equipment

1-7004 Set sampling rate 2 kc
1-7005 Set sampling rate 4 kc
1-7006 Set sampling rate 8 kc
1-7007 Set sampling rate 16 kc
1-7010 Set local-oscillator sampling

1-7011 Select forward tape data
1-7012 Select reverse tape data

1-7013 Set flywheel bandwidth 100 cps (C)
1-7014 Set flywheel bandwidth 500 cps (B)
1-7015 Set flywheel bandwidth 1 kc (A)
1-7016 Interrupts enable
1-7017 Interrupts inhibit

1-7020 Select simulator input - FM data and forward Veh time
1-7021 Select simulator input - FM data and reverse Veh time
1-7022 Select simulator input - FM data and forward Gnd time
1-7023
1-7024 Select tape input
1-7025 Remove data frame sync interrupt (40)
1-7026 Remove Veh time frame sync interrupt (30)

SENSE

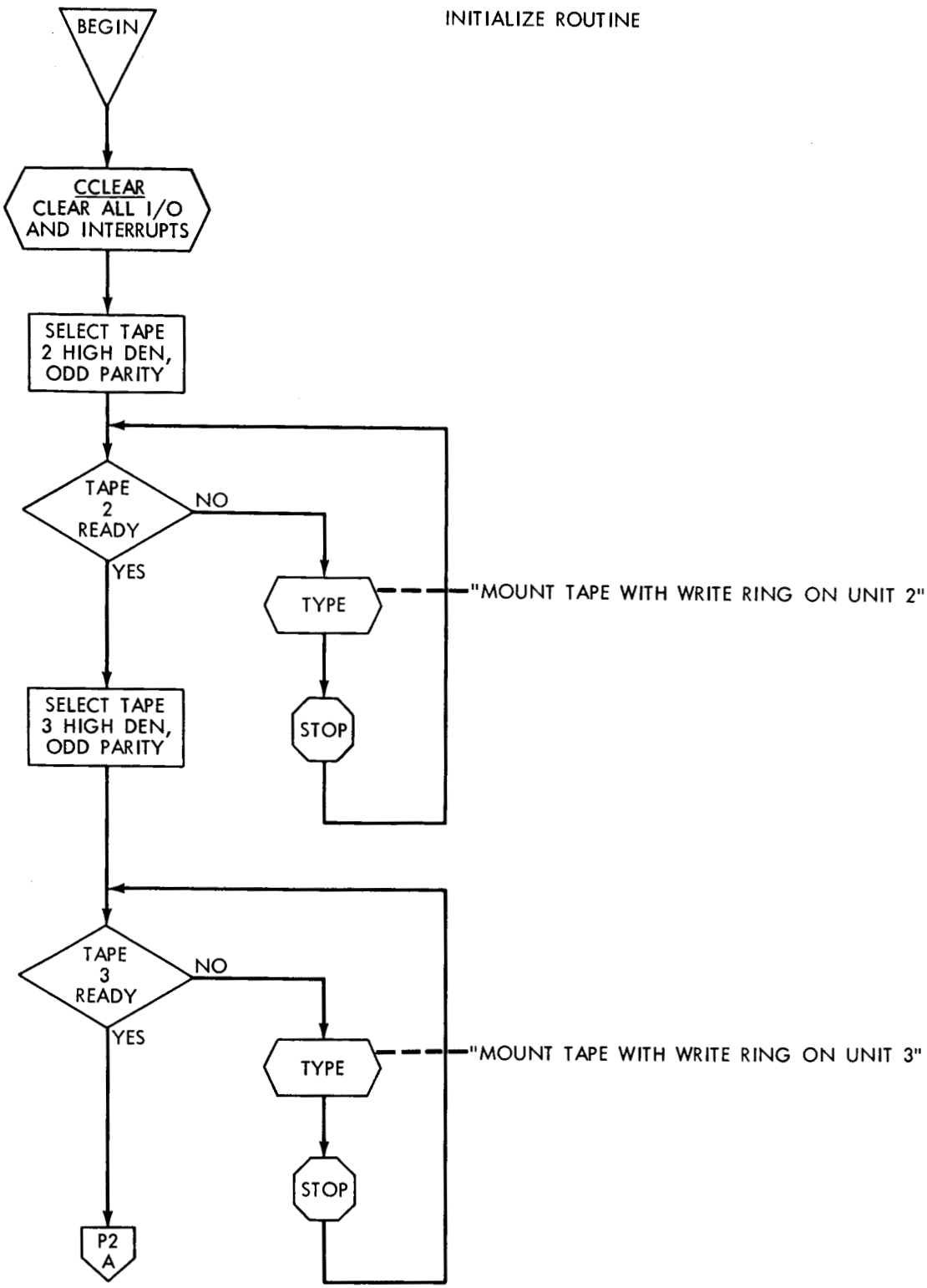
1-7030 Skip on all NIMBUS external equipment ready
1-7032 Skip on FM unit ready
1-7033 Skip on time unit ready
1-7040 Skip on FM data and time present during interval
1-7042 Skip on tape track pair one active
1-7043 Skip on FM data not accepted
1-7044 Skip on time data not accepted
1-7045 Skip on FM data carrier absent during an interval
1-7046 Skip on time carrier absent during an interval

SELECT

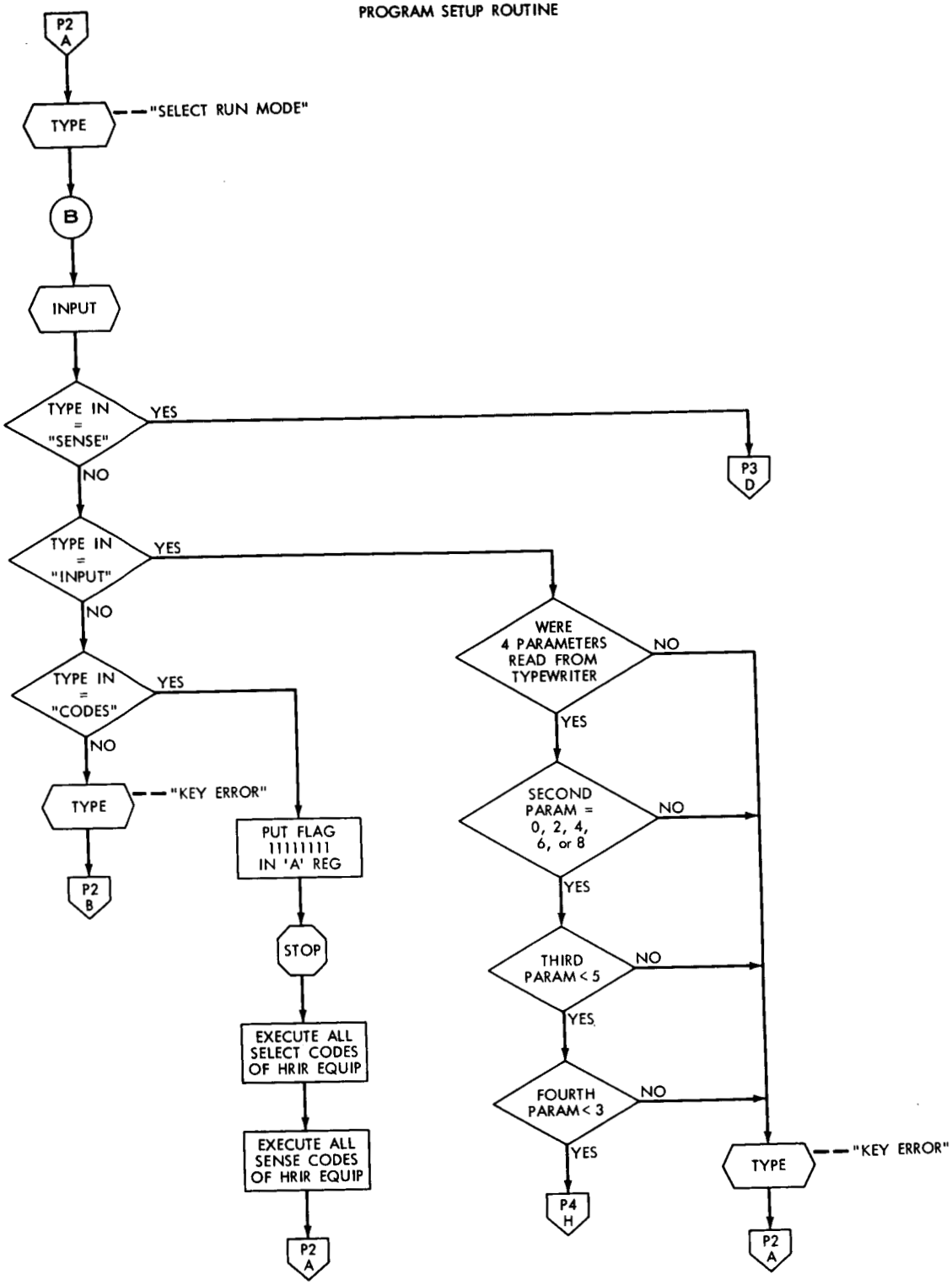
Read Operation

5-7000 Select NIMBUS time mode

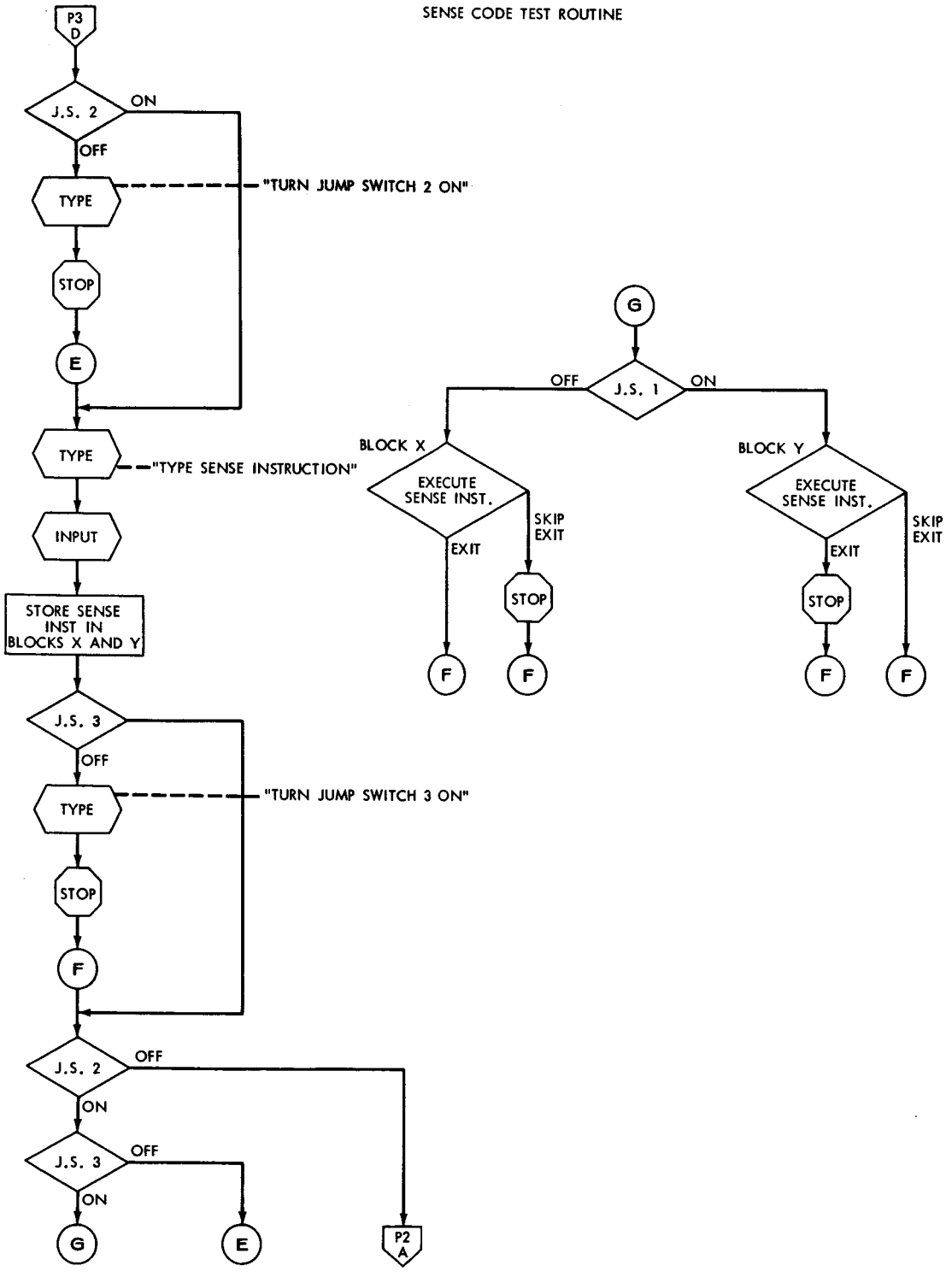
FLOW DIAGRAMS



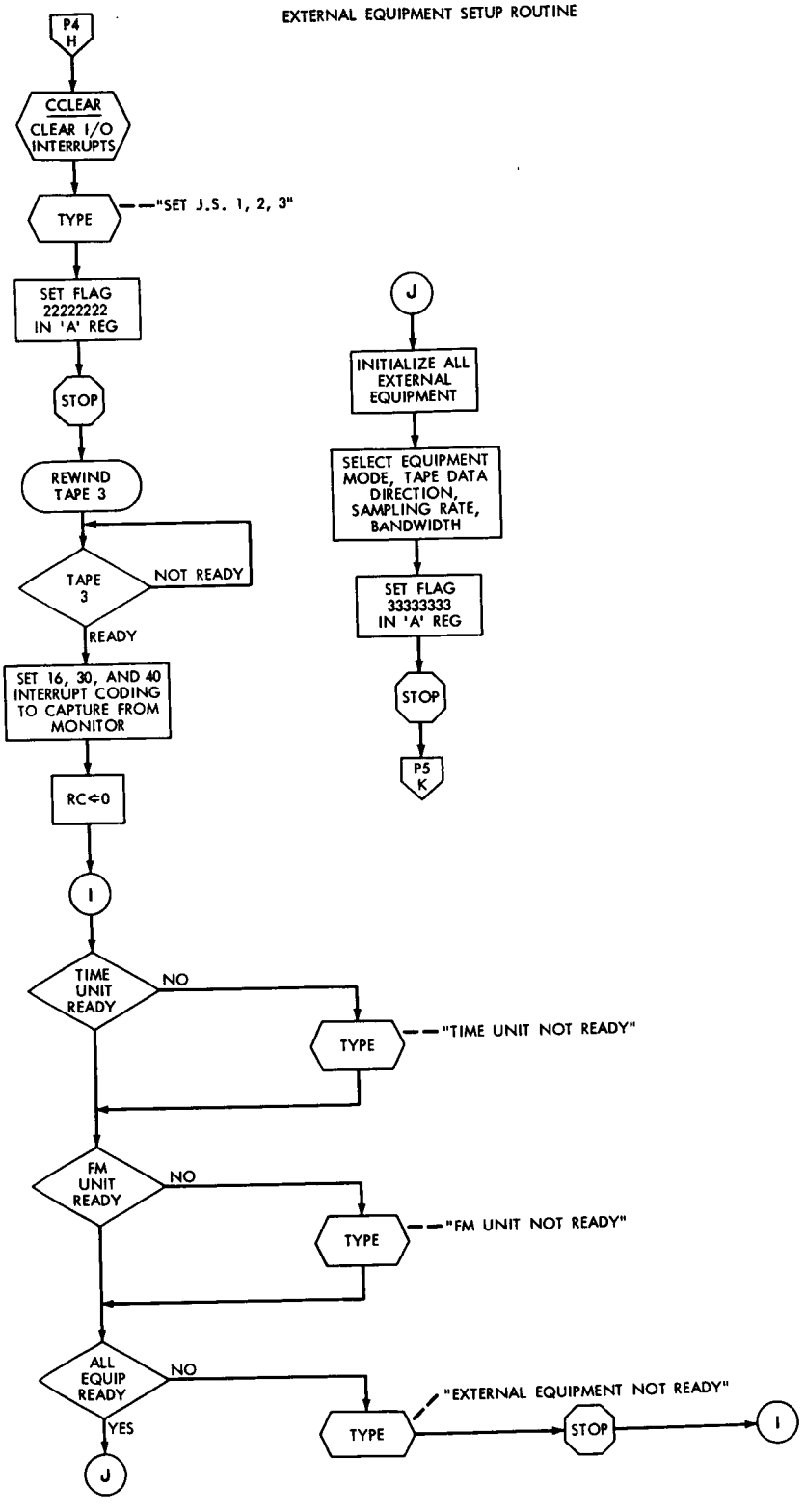
PROGRAM SETUP ROUTINE



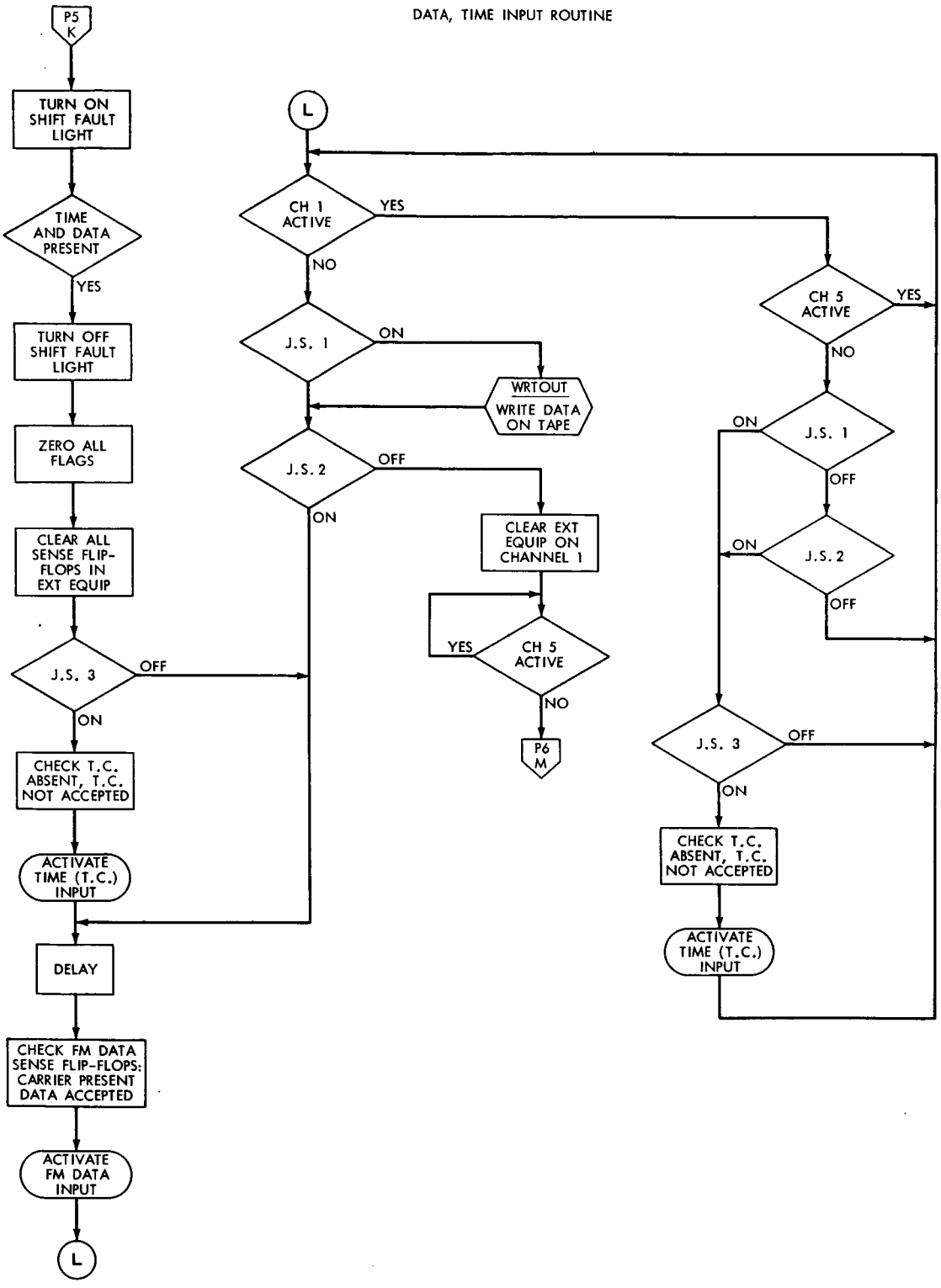
SENSE CODE TEST ROUTINE

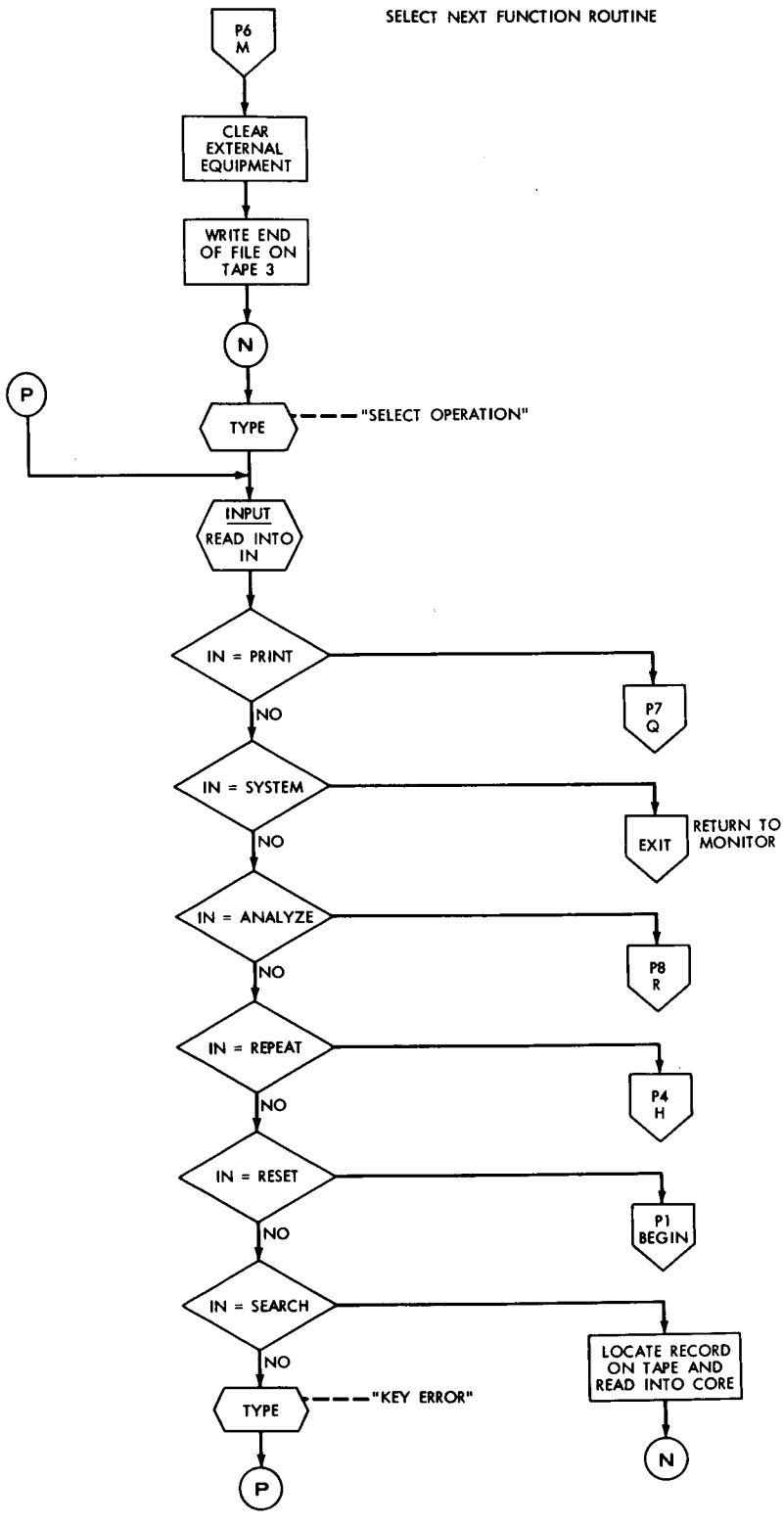


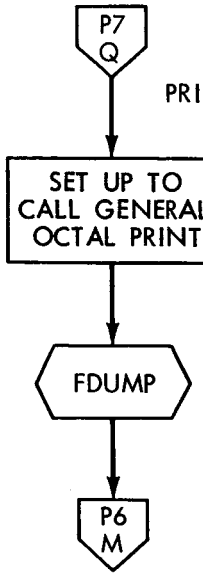
EXTERNAL EQUIPMENT SETUP ROUTINE



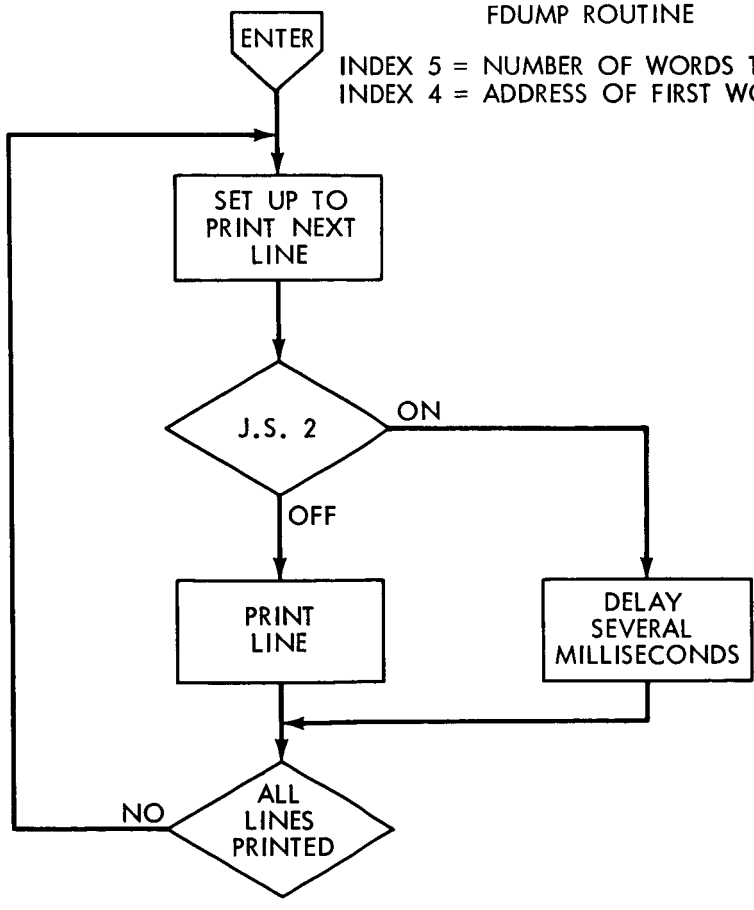
DATA, TIME INPUT ROUTINE




SELECT NEXT FUNCTION ROUTINE
P6
M
CLEAR EXTERNAL EQUIPMENT
WRITE END OF FILE ON TAPE 3
N
P
TYPE
"SELECT OPERATION"
INPUT
READ INTO IN
IN = PRINT
NO
P7
Q
IN = SYSTEM
NO
EXIT
RETURN TO MONITOR
IN = ANALYZE
NO
P8
R
IN = REPEAT
NO
P4
H
IN = RESET
NO
P1
BEGIN
IN = SEARCH
NO
LOCATE RECORD ON TAPE AND READ INTO CORE
N
TYPE
"KEY ERROR"
P



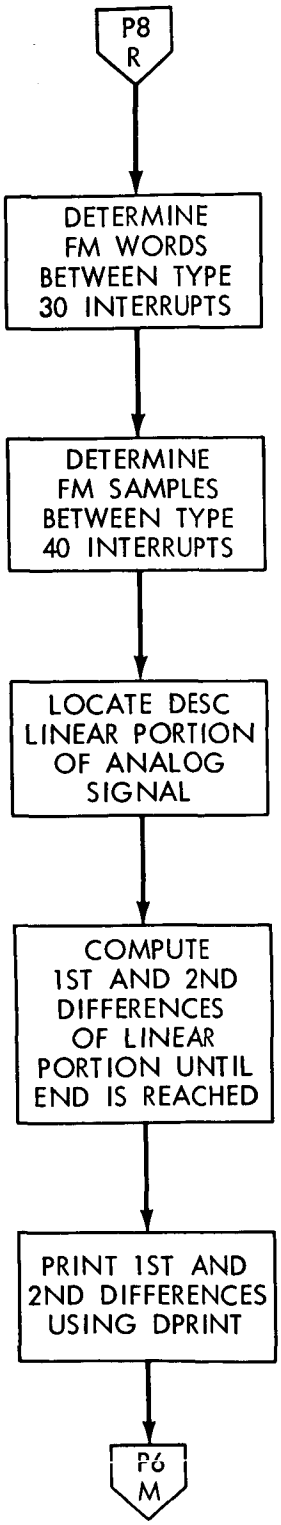
PRINT ROUTINE FOR OCTAL DATA DUMP

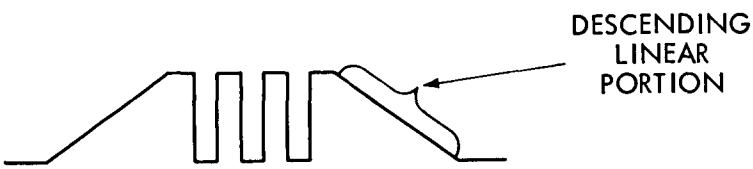


FDUMP ROUTINE

INDEX 5 = NUMBER OF WORDS TO DUMP
INDEX 4 = ADDRESS OF FIRST WORD

GENERAL FLOW OF ANALYZE ROUTINE





DPRINT IS GENERAL DECIMAL PRINT ROUTINE

PROGRAM LISTINGS

```
/ P TTP 4 BCD
        IDENT     TEST                                                  NIM00010
NPUT    EQU       62B                                                   NIM00020
UTPUT   EQU       61B                                                   NIM00030
YPE     EQU       63B                                                   NIM00040
RINT    EQU       67B                                                   NIM00050
LAG     EQU       17742B                                                NIM00060
N30     EQU       17754B                                                NIM00070
N40     EQU       17766B                                                NIM00080
CS      EQU       20000B                                                NIM00090
CE      EQU       20144B                                                NIM00100
CS      EQU       20200B                                                NIM00110
CF      EQU       23720B                                                NIM00120
        ORG       10000B                                                NIM00130
TART    UJP                                                             NIM00140
        URJ       CCLEAR                                                NIM00150
        SEL       04032B                                                NIM00160
        SEL       42021B                                                NIM00170
        SEN       42000B                                                NIM00180
        UJP       *+2                                                   NIM00190
        UJP       *+4                                                   NIM00200
        URJ    7  TYPE                                                  NIM00210
        12        MSG13                                                 NIM00220
        SLS       *-5                                                   NIM00230
        SEL       42031B                                                NIM00240
        SEP       42000B                                                NIM00250
        UJP       *+2                                                   NIM00260
        UJP       *+4                                                   NIM00270
        URJ    7  TYPE                                                  NIM00280
        12        MSG14                                                 NIM00290
        SLS       *-5                                                   NIM00300
        UJP       MODE                                                  NIM00310
CLEAR   UJP       0                                                     NIM00320
        SEL       101B                 INHIBIT INTERNAL INTERRUPTS      NIM00330
        SEL       1001B                REMOVE RT CLOCK INTERRUPT        NIM00340
        SEL       40704                SELECT 924 MODE ALL CHANNELS     NIM00350
        SEL       11B                  REMOVE CHANNEL INTERRUPT SELECNIM00360
        SEL       21B                                                   NIM00370
        SEL       31B                                                   NIM00380
        SEL       41B                                                   NIM00390
        SEL       51B                                                   NIM00400
        SEL       61B                                                   NIM00410
        SEL       10000B               CLEAR CHANNEL SELECTIONS         NIM00420
        SEL       20000B                                                NIM00430
        SEL       30000B                                                NIM00440
        SEL       40000B                                                NIM00450
        SEL       50000B                                                NIM00460
        SEL       60000B                                                NIM00470
        UJP    7  CCLEAR                                                NIM00480
        REM       PROGRAM SETUP ROUTINE ********************************NIM00490
ODE     URJ    7  TYPE                                                  NIM00500
        4         MSG3                                                  NIM00510
ETUP    URJ    7  INPUT                                                 NIM00520
        ZRO       IN                                                    NIM00530
        LDA       IN+1                                                  NIM00540
        EQS       BCDSENS                                               NIM00550
        UJP       *+2                                                   NIM00560
        UJP       SENSETST                                              NIM00570
        EQS       BCDINPU                                               NIM00580
        UJP       *+2                                                   NIM00590
        UJP       IREG                                                  NIM00600
        EQS       BCDCODE                                               NIM00610
        UJP       *+2                                                   NIM00620
        UJP       CODES                                                 NIM00630
        URJ    7  TYPE                                                  NIM00640
        3         MSG2                                                  NIM00650
        UJP       SETUP                                                 NIM00660
```

```
KEG     LDA       IN                                                    NIM00670
        SUB       FOUR                                                  NIM00680
        AJP    0  OKEY1                                                 NIM00690
        URJ    7  TYPE                                                  NIM00700
        2         MSG2                                                  NIM00710
        UJP       MODE                                                  NIM00720
KEY1    LDA       IN+3                                                  NIM00730
        AJP    0  OKEY2                                                 NIM00740
        SUB       TWO                                                   NIM00750
        AJP    0  OKEY2                                                 NIM00760
        LDA       IN+3                                                  NIM00770
        SUB       FOUR                                                  NIM00780
        AJP    0  OKEY2                                                 NIM00790
        LDA       IN+3                                                  NIM00800
        SUB       SIX                                                   NIM00810
        AJP    0  OKEY2                                                 NIM00820
        LDA       IN+3                                                  NIM00830
        SUB       EIGHT                                                 NIM00840
        AJP    0  OKEY2                                                 NIM00850
        URJ    7  TYPE                                                  NIM00860
        2         MSG2                                                  NIM00870
        UJP       MODE                                                  NIM00880
KEY2    LDA       IN+5                                                  NIM00890
        SUB       FIVE                                                  NIM00900
        AJP    3  OKEY3                                                 NIM00910
        URJ    7  TYPE                                                  NIM00920
        2         MSG2                                                  NIM00930
        UJP       MODE                                                  NIM00940
KEY3    LDA       IN+7                                                  NIM00950
        SUB       THREE                                                 NIM00960
        AJP    3  RESTART                                               NIM00970
        URJ    7  TYPE                                                  NIM00980
        2         MSG2                                                  NIM00990
        UJP       MODE                                                  NIM01000
        REM       SENSE CODE TEST ROUTINE ••••••••••••••••••••••••••••  NIM01010
ENSETST SLJ    2  •+4                                                   NIM01020
        URJ    7  TYPE                                                  NIM01030
        6         MSG7                                                  NIM01040
        SLS       •+1                                                   NIM01050
CD      URJ    7  TYPE                                                  NIM01060
        6         MSG6                                                  NIM01070
        URJ    7  INPUT                                                 NIM01080
        ZRO       IN                                                    NIM01090
        LDA       IN+1                                                  NIM01100
        STA       SNI                                                   NIM01110
        STA       LOOPSKIP                                              NIM01120
        SLJ    3  •+4                                                   NIM01130
        URJ    7  TYPE                                                  NIM01140
        6         MSG8                                                  NIM01150
        SLS       •+1                                                   NIM01160
HOICE   SLJ    2  •+2                                                   NIM01170
        UJP       MODE                                                  NIM01180
        SLJ    3  •+2                                                   NIM01190
        UJP       SCD                                                   NIM01200
        SLJ    1  LOOPSKIP                                              NIM01210
 1      SEN       0                    TO STOP ON NO SKIP.  JSI OFF     NIM01220
        UJP       CHOICE               TO LOOP ON NO SKIP EXIT, STOP    NIM01230
        SLS       CHOICE                                                NIM01240
OOPSKIP SEN       0                    ON SKIP                          NIM01250
        SLS       CHOICE                                                NIM01260
        UJP       CHOICE                                                NIM01270
SCD     SEN       0                                                     NIM01280
        REM       CODES ROUTINE ••••••••••••••••••••••••••••            NIM01290
        OCT       11111111                                              NIM01300
ODES    LDA       •-1                                                   NIM01310
        SLS       •+1                                                   NIM01320
        SEL       17000B                                                NIM01330
```

```
         SEL     17001B                                                  NIM01340
         SEL     17002B                                                  NIM01350
         SEL     17003B                                                  NIM01360
         SEL     17004B                                                  NIM01370
         SEL     17005B                                                  NIM01380
         SEL     17006B                                                  NIM01390
         SEL     17007B                                                  NIM01400
         SEL     17010B                                                  NIM01410
         SEL     17011B                                                  NIM01420
         SEL     17012B                                                  NIM01430
         SEL     17013B                                                  NIM01440
         SEL     17014B                                                  NIM01450
         SEL     17015B                                                  NIM01460
         SEL     17016B                                                  NIM01470
         SEL     17017B                                                  NIM01480
         SEL     17020B                                                  NIM01490
         SEL     17021B                                                  NIM01500
         SEL     17022B                                                  NIM01510
         SEL     17023B                                                  NIM01520
         SEL     17024B                                                  NIM01530
         SEL     17025B                                                  NIM01540
         SEL     17026B                                                  NIM01550
         SEN     17030B                                                  NIM01560
         UJP     *+1                                                     NIM01570
         SEN     17031B                                                  NIM01580
         UJP     *+1                                                     NIM01590
         SEN     17032B                                                  NIM01600
         UJP     *+1                                                     NIM01610
         SEN     17034B                                                  NIM01620
         UJP     *+1                                                     NIM01630
         SEN     17040B                                                  NIM01640
         UJP     *+1                                                     NIM01650
         SEN     17042B                                                  NIM01660
         UJP     *+1                                                     NIM01670
         SEN     17043B                                                  NIM01680
         UJP     *+1                                                     NIM01690
         SEN     17044B                                                  NIM01700
         UJP     *+1                                                     NIM01710
         SEN     17045B                                                  NIM01720
         UJP     *+1                                                     NIM01730
         SEN     17046B                                                  NIM01740
         UJP     *+1                                                     NIM01750
         SEL     57000B                                                  NIM01760
         UJP     MODE                                                    NIM01770
         REM     EXTERNAL EQUIPMENT SETUP ROUTINE ******************     NIM01780
ESTART   URJ     CCLEAR                                                  NIM01790
         SEL     32031B                                                  NIM01800
         SEL     32402B                                                  NIM01810
         URJ   7 TYPE                                                    NIM01820
         4       MSG9                                                    NIM01830
         LDA     *+2                                                     NIM01840
         SLS     *+2                                                     NIM01850
         OCT     22222222                                                NIM01860
         SEL     32005B                                                  NIM01870
         SEN     32000B                                                  NIM01880
         UJP     *-1                                                     NIM01890
         LDA     INST1           SET 30 INT CODING                       NIM01900
         STA     30B                                                     NIM01910
         LDA     INST2                                                   NIM01920
         STA     31B                                                     NIM01930
         LDA     INST3                                                   NIM01940
         STA     40B             SET 40 INT CODING                       NIM01950
         LDA     INST4                                                   NIM01960
         STA     41B                                                     NIM01970
         LDA     INST5           SET 16 INT CODING                       NIM01980
         STA     16B                                                     NIM01990
         LDA     INST6                                                   NIM02000
```

```
      STA       17B                                              NIM02010
      ENA       0               RESET RECORD COUNT               NIM02020
      STA       FLAG                                             NIM02030
      SEL       04032B           SEL 1604 MODE C1,2,3,4          NIM02040
      SEL       04041B           SEL 160 MODE C5,6               NIM02050
EQ    SEN       17033B           SKIP ON TIME UNIT NOT READY     NIM02060
      UJP       *+3                                              NIM02070
      URJ    7  TYPE                                             NIM02080
      5         MSG10                                            NIM02090
      SEN       17032B           SKIP FM UNIT READY              NIM02100
      UJP       *+2                                              NIM02110
      UJP       *+4                                              NIM02120
      URJ    7  TYPE                                             NIM02130
      4         MSG11                                            NIM02140
      SLS       *+1                                              NIM02150
      SEN       17030B            SKIP ALL EXT EQUIP READY       NIM02160
      UJP       *+2                                              NIM02170
      UJP       *+4                                              NIM02180
      URJ    7  TYPE                                             NIM02190
      4         MSG12                                            NIM02200
      SLS       SEU                                              NIM02210
      SEL       17003B           INITIALIZE ALL EXT EQUIP        NIM02220
      SEL       17000B           SEL NIMBUS FM MODE              NIM02230
      SEL       57000B           SEL NIMBUS TIME MODE            NIM02240
      ENA       5555B                                            NIM02250
      LIL    1  IN+3                                             NIM02260
      LIL    2  IN+5                                             NIM02270
      LIL    3  IN+7                                             NIM02280
      XEC    1  EQUIP             SEL EQUIPMENT MODE             NIM02290
      XEC    1  EQUIP+1          SEL TAPE DIREC IF APPLICABLE    NIM02300
      XEC    2  SAMPLING         SEL SAMPLING RATE               NIM02310
      XEC    3  BANDWDTH         SEL BANDWIDTH                   NIM02320
      LDA       *+2                                              NIM02330
      SLS       *+2              SET JUMP SWITCHES               NIM02340
      OCT       33333333                                         NIM02350
      REM       DATA,TIME INPUT ROUTINE ************************ NIM02360
      ARS       66               SET SHIFT FAULT LIGHT ON        NIM02370
      SEN       17040B           SKIP TIME AND DATA PRESENT      NIM02380
      UJP       *-1                                              NIM02390
      SEL       70B              CLEAR FAULT LIGHTS              NIM02400
      ENA       0                                                NIM02410
      STA       FLAG                                             NIM02420
      STA       FLAG+1                                           NIM02430
      STA       FLAG+2                                           NIM02440
      STA       FLAG+3                                           NIM02450
      STA       FLAG+4                                           NIM02460
      STA       FLAG+5                                           NIM02470
      SEN       17046B                                           NIM02480
      SEN       17044B                                           NIM02490
      SEN       17045B                                           NIM02500
      SEN       17043B                                           NIM02510
      SEN       17040B                                           NIM02520
      SEL       17016B           ENABLE 30,40 INTS               NIM02530
      SLJ    3  *+2              JS3 ON ACTIVATES TIME C5        NIM02540
      UJP       NOTIME                                           NIM02550
      ENI    5  0                                                NIM02560
      ENA       TCE                                              NIM02570
      SAL       12B                                              NIM02580
      ENA       0                                                NIM02590
      STA       FLAG+4                                           NIM02600
      STA       FLAG+5                                           NIM02610
      SEN       17046B           SKIP TIME CARRIER ABSENT        NIM02620
      UJP       *+2                                              NIM02630
      RAO       FLAG+4                                           NIM02640
      SEN       17044B           SKIP TIME CHAR NOT ACCEPTED     NIM02650
      UJP       *+2                                              NIM02660
      RAO       FLAG+5                                           NIM02670
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         ACT    5  TCS                                                    NIM02680
UTIME    ENI    6  0                                                      NIM02690
CTDATA   ENA       DCE                                                    NIM02700
         SAL       2B                                                     NIM02710
         ENI    4  10                   DELAY LOOP                        NIM02720
         IJP    4  *                                                      NIM02730
         ENA       0                                                      NIM02740
         STA       FLAG+1                                                 NIM02750
         STA       FLAG+2                                                 NIM02760
         STA       FLAG+3                                                 NIM02770
         SEN       17040B                                                 NIM02780
         RAO       FLAG+1                                                 NIM02790
         SEN       17045B                 EXIT ON FM CARRIER PRESENT      NIM02800
         UJP       *+2                                                    NIM02810
         RAO       FLAG+2                                                 NIM02820
         SEN       17043B               EXIT ON FM DATA NOT ACCEPTED      NIM02830
         RAO       FLAG+3                                                 NIM02840
         ENI    6  0                                                      NIM02850
         ACT    1  DCS                                                    NIM02860
ESTINAC  SEN       11B                                                    NIM02870
         UJP       CHECK5                                                 NIM02880
         SLJ    5  WRTOUT               JS1 ON TO WRITE ON TAPE           NIM02890
         SLJ    2  ACTDATA              JS2 ON TO LOOP IN ACTIVATE        NIM02900
         SEL       17017B                                                 NIM02910
         SEN       51B                                                    NIM02920
         UJP       *-1                                                    NIM02930
         UJP       CLEAREXT                                               NIM02940
HECK5    SEN       51B                                                    NIM02950
         UJP       TESTINAC                                               NIM02960
         SLJ    1  REACT5                                                 NIM02970
         SLJ    2  REACT5                                                 NIM02980
         UJP       TESTINAC                                               NIM02990
EACT5    SLJ    3  *+2                                                    NIM03000
         UJP       TESTINAC                                               NIM03010
         ENI    5  0                                                      NIM03020
         ENA       0                                                      NIM03030
         STA       FLAG+4                                                 NIM03040
         STA       FLAG+5                                                 NIM03050
         SEN       17046B               SKIP TIME CARRIER ABSENT          NIM03060
         UJP       *+2                                                    NIM03070
         RAO       FLAG+4                                                 NIM03080
         SEN       17044B               SKIP TIME CHAR NOT ACCEPTED       NIM03090
         UJP       *+2                                                    NIM03100
         RAO       FLAG+5                                                 NIM03110
         ENA       TCE                                                    NIM03120
         SAL       12B                                                    NIM03130
         ACT    5  TCS                                                    NIM03140
         UJP       TESTINAC                                               NIM03150
         REM       SELECT NEXT FUNCTION ********************              NIM03160
LEAREXT  SEL       17017B               DESELECT EXTERNAL EQUIPMENT       NIM03170
         SEL       17025B                                                 NIM03180
         SEL       17026B                                                 NIM03190
         SEL       17003B                                                 NIM03200
         ENA       -1                                                     NIM03210
         STA    5  IN30                                                   NIM03220
         STA    6  IN40                                                   NIM03230
         SIL    1  SAVE                                                   NIM03240
         SIL    2  SAVE+1                                                 NIM03250
         SIL    3  SAVE+2                                                 NIM03260
         SIL    5  IRS                                                    NIM03270
         SIL    6  IRS+1                                                  NIM03280
         SEN       42000B                                                 NIM03290
         UJP       *-1                                                    NIM03300
         SEL       42003B               WRITE EOF                         NIM03310
         SEN       42000B                                                 NIM03320
         UJP       *-1                                                    NIM03330
         SEL       32031B                                                 NIM03340
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         SEN      32000B                                                  NIM03350
         UJP      *-1                                                     NIM03360
         SEL      32206B               SEARCH EOF BACKWARD                NIM03370
         SEN      32000B                                                  NIM03380
         UJP      *-1                                                     NIM03390
         SEN      32403B                SKIP NOT LOAD POINT               NIM03400
         UJP      SELECT                                                  NIM03410
         SEL      32006B                BACKSPACE 1 RECOFD                NIM03420
         SEN      32000B                                                  NIM03430
         UJP      *-1                                                     NIM03440
         UJP      SELECT                                                  NIM03450
ELECT    URJ    7 TYPE                                                    NIM03460
         4        MSG1                                                    NIM03470
YPEIN    URJ    7 INPUT                                                   NIM03480
         ZRO      IN                                                      NIM03490
         LDA      IN+1                                                    NIM03500
         EQS      BCDPRNT                                                 NIM03510
         UJP      *+2                                                     NIM03520
         UJP      PRINTOUT                                                NIM03530
         EQS      BCDSYST                                                 NIM03540
         UJP      *+2                                                     NIM03550
         UJP      10000B                                                  NIM03560
         EQS      BCDANAL                                                 NIM03570
         UJP      *+2                                                     NIM03580
         UJP      ANALYZE                                                 NIM03590
         EQS      BCDRPT                                                  NIM03600
         UJP      *+2                                                     NIM03610
         UJP      RESET                                                   NIM03620
         EQS      BCDRST                                                  NIM03630
         UJP      *+2                                                     NIM03640
         UJP      10001B                                                  NIM03650
         EQS      BCDSRCH                                                 NIM03660
         UJP      *+2                                                     NIM03670
         UJP      SEARCH                                                  NIM03680
         URJ    7 TYPE                                                    NIM03690
         3        MSG2                                                    NIM03700
         UJP      TYPEIN                                                  NIM03710
SG2      BCD      3KEY ERROR                                              NIM03720
         REM      TAPE SEARCH ROUTINE ***************************         NIM03730
ARCH     SEL      32031B               SEL TAPE 3 READ BIN                NIM03740
         LDA      THREES                                                  NIM03750
         SLS      *+2                  SET RECORD NUMBER FOR SEARCH       NIM03760
REES     OCT      44444444                                                NIM03770
         STA      SRCCNT                                                  NIM03780
         ENA      DCE                                                     NIM03790
         STA      6B                                                      NIM03800
DRCD     ACT    3 FLAG                                                    NIM03810
         SEN      32000B                                                  NIM03820
         UJP      *-1                                                     NIM03830
         SEN      32006B                   SKIP EOF                       NIM03840
         UJP      *+4                                                     NIM03850
         URJ    7 TYPE                                                    NIM03860
         3        MSG15                                                   NIM03870
         UJP      SELECT                                                  NIM03880
         SEN      32402B                  SKIP LOAD POINT                 NIM03890
         UJP      *+4                                                     NIM03900
         URJ    7 TYPE                                                    NIM03910
         3        MSG16                                                   NIM03920
         UJP      SELECT                                                  NIM03930
         LDA      FLAG                                                    NIM03940
         EQS      SRCCNT                                                  NIM03950
         UJP      *+2                                                     NIM03960
         UJP      SELECT                                                  NIM03970
         THS      SRCCNT                                                  NIM03980
         UJP      *+2                                                     NIM03990
         UJP      RDRCD                                                   NIM04000
         SEL      32006B                                                  NIM04010
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         SEN        32000B                                                  NIM04020
         UJP        *-1                                                     NIM04030
         SEL        32006B                                                  NIM04040
         SEN        32000B                                                  NIM04050
         UJP        *-1                                                     NIM04060
         UJP        RDRCD                                                   NIM04070
RCCNT    BSS        1                                                       NIM04080
         REM        PRINTOUT RAW DATA ***********************************   NIM04090
RINTOUT  ENI    5   DCE                                                     NIM04100
         ENA        DCS                                                     NIM04110
         STA        SAVE+3                                                  NIM04120
         ENI    4   20                                                      NIM04130
         LDA    4   IN30                                                    NIM04140
         SUB        SAVE+3                                                  NIM04150
         STA    4   IN30                                                    NIM04160
         IJP    4   *-3                                                     NIM04170
         ENI    4   FLAG                                                    NIM04180
         URJ        FDUMP                                                   NIM04190
         ENI    5   DCE                                                     NIM04200
         ENI    4   20                                                      NIM04210
         LDA    4   IN30                                                    NIM04220
         ADD        SAVE+3                                                  NIM04230
         STA    4   IN30                                                    NIM04240
         IJP    4   *-3                                                     NIM04250
         UJP        SELECT                                                  NIM04260
ESET     LIL    1   SAVE                                                    NIM04270
         LIL    2   SAVE+1                                                  NIM04280
         LIL    3   SAVE+2                                                  NIM04290
         UJP        RESTART                                                 NIM04300
         REM        ANALYZE ROUTINE ********************************         NIM04310
NALYZE   URJ    7   OUTPUT                                                  NIM04320
         UJP        ERRORD                                                  NIM04330
         UJP        PSPACED                                                 NIM04340
         02         HDNGI                                                   NIM04350
         ZRO        30120                                                   NIM04360
         04         1                                                       NIM04370
         ZRO        0                                                       NIM04380
SPACED   ENI    5   FLAG+8                                                  NIM04390
         ENI    4   FLAG                                                    NIM04400
         URJ        DDUMP                                                   NIM04410
         LIL    5   IRS                                                     NIM04420
         LIL    6   IRS+1                                                   NIM04430
         ENI    3   20                                                      NIM04440
         ENI    4   0                                                       NIM04450
         ENA        0                                                       NIM04460
         STA    3   DIF3040                                                 NIM04470
         IJP    3   *-1                                                     NIM04480
         SIL    5   ISK4                                                    NIM04490
         RSO        ISK4                                                    NIM04500
         LDA        IN30+1                                                  NIM04510
         AJP    3   CHK40INT                                                NIM04520
         ENI    5   1                                                       NIM04530
00       LDA    5   IN30                                                    NIM04540
         SUB    5   IN30-1                                                  NIM04550
         STA    4   DIF3040                                                 NIM04560
SK4      ISK    5   *                                                       NIM04570
         UJP        *+2                                                     NIM04580
         UJP        CHK40INT                                                NIM04590
         INI    4   1                                                       NIM04600
         UJP        000                                                     NIM04610
HK40INT  SIL    6   ISK5                                                    NIM04620
         RSO        ISK5                                                    NIM04630
         LDA        IN40+1                                                  NIM04640
         AJP    3   PRINTINT                                                NIM04650
         ENI    4   10                                                      NIM04660
         ENI    6   1                                                       NIM04670
XX       LDA    6   IN40                                                    NIM04680
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         SUB    6  IN40-1                                   NIM04690
         STA    4  DIF3040                                  NIM04700
SK5      ISK    6  *                                        NIM04710
         UJP       *+2                                      NIM04720
         UJP       PRINTINT                                 NIM04730
         INI    4  1                                        NIM04740
         UJP       XXX                                      NIM04750
RINTINT  ENI    5  DIF3040+16                               NIM04760
         ENI    4  DIF3040                                  NIM04770
         URJ       DDUMP                                    NIM04780
         ENI    3  20                                       NIM04790
         ENA       0                                        NIM04800
         STA    3  DIF3040                                  NIM04810
         IJP    3  *-1                                      NIM04820
         ENI    3  0                                        NIM04830
         ENI    5  DCS                                      NIM04840
         INI    5  5                                        NIM04850
         LDQ       DSMASK                                   NIM04860
OOKA     LDL    5  0                                        NIM04870
         AJP    1  SYNCFLG                                  NIM04880
         ISK    5  DCE                                      NIM04890
         UJP       LOOKA                                    NIM04900
         UJP       PRNTSPCE                                 NIM04910
YNCFLG   ARS       12                                       NIM04920
         AJP    0  *+3                                      NIM04930
         ENI    4  2                                        NIM04940
         UJP       LOOKB-1                                  NIM04950
         ENI    4  1                                        NIM04960
         INI    5  1                                        NIM04970
OOKB     LDL    5  0                                        NIM04980
         AJP    1  SYNCEND                                  NIM04990
         INI    4  2                                        NIM05000
         ISK    5  DCE                                      NIM05010
         UJP       LOOKB                                    NIM05020
         UJP       PRNTSPCE                                 NIM05030
YNCEND   ARS       12                                       NIM05040
         AJP    0  *+3                                      NIM05050
         INI    4  1                                        NIM05060
         UJP       SAVECNT                                  NIM05070
         INI    4  2                                        NIM05080
AVECNT   SIL    4  SAVE+4                                   NIM05090
         LDA       SAVE+4                                   NIM05100
         SAL    3  DIF3040                                  NIM05110
         SIL    5  SAVE+4                                   NIM05120
         ENA       5                                        NIM05130
         RSB       SAVE+4                                   NIM05140
         LIL    5  SAVE+4                                   NIM05150
         ISK    3  10                                       NIM05160
         UJP       LOOKA                                    NIM05170
RNTSPCE  ENI    5  DIF3040+8                                NIM05180
         ENI    4  DIF3040                                  NIM05190
         URJ       DDUMP                                    NIM05200
         ENI    6  0                                        NIM05210
         ENA       0                                        NIM05220
         STA       MAX                                      NIM05230
         ENI    5  DCS                                      NIM05240
OCMAX    LDQ    5  0                                        NIM05250
         ENA       0                                        NIM05260
         LLS       8                                        NIM05270
         THS       MAX                                      NIM05280
         STA       MAX                                      NIM05290
         QLS       8                                        NIM05300
         ENA       0                                        NIM05310
         LLS       8                                        NIM05320
         THS       MAX                                      NIM05330
         STA       MAX                                      NIM05340
         ISK    5  DCE                                      NIM05350
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         UJP       LOCMAX                          NIM05360
         LDA       IN40                            NIM05370
         AJP   3   BADQ                            NIM05380
         ATI   5                                   NIM05390
         INI   5   10                              NIM05400
OCTOP    LDQ   5                                   NIM05410
         ENA       0                               NIM05420
         LLS       8                               NIM05430
         EQS       MAX                             NIM05440
         UJP       NOTOP                           NIM05450
         QLS       4                               NIM05460
         ENA       0                               NIM05470
         LLS       8                               NIM05480
         EQS       MAX                             NIM05490
         UJP       NOTOP                           NIM05500
         LDQ   5   1                               NIM05510
         ENA       0                               NIM05520
         LLS       8                               NIM05530
         EQS       MAX                             NIM05540
         UJP       NOTOP                           NIM05550
         QLS       4                               NIM05560
         ENA       0                               NIM05570
         LLS       8                               NIM055[illegible]
         EQS       MAX                             NIM05590
         UJP       NOTOP                           NIM05600
         UJP       STRTDWN                         NIM05610
OTOP     ISK   5   DCE                             NIM05620
         UJP       LOCTOP                          NIM05630
         SLS       SELECT                          NIM05640
ADQ      SLS       SELECT                          NIM05650
TRTDWN   LDQ   5   0                               NIM05660
         ENA       0                               NIM05670
         LLS       8                               NIM05680
         EQS       MAX                             NIM05690
         UJP       LEFT                            NIM05700
         QLS       4                               NIM05710
         ENA       0                               NIM05720
         LLS       8                               NIM05730
         EQS       MAX                             NIM05740
         UJP       RIGHTS                          NIM05750
         ISK   5   DCE                             NIM05760
         UJP       STRTDWN                         NIM05770
         SLS       SELECT                          NIM05780
EFT      LDQ   5   -1                              NIM05790
         QLS       12                              NIM05800
         ENA       0                               NIM05810
         LLS       8                               NIM05820
         STA       LAST                            NIM05830
         STA       BIN                             NIM05840
         UJP       ANOTHER                         NIM05850
IGHTS    STA       LAST                            NIM05860
         STA       BIN                             NIM05870
         INI   5   1                               NIM05880
NOTHER   LDQ   5   0                               NIM05890
         ENA       0                               NIM05900
         LLS       8                               NIM05910
         EQS       LAST                            NIM05920
         UJP       THSINA                          NIM05930
         URJ       TSTEND                          NIM05940
HSINA    THS       LAST                            NIM05950
         UJP       LINE                            NIM05960
         INI   6   1                               NIM05970
         STA   6   BIN                             NIM05980
         STA       LAST                            NIM05990
IGHT     ENA       0                               NIM06000
         QLS       4                               NIM06010
         LLS       8                               NIM06020
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          EQS         LAST                                          NIM06030
          UJP         THSINB                                        NIM06040
          URJ         TSTEND                                        NIM06050
HSINB     THS         LAST                                          NIM06060
          UJP         LINE                                          NIM06070
          INI   6     1                                             NIM06080
          STA   6     BIN                                           NIM06090
          STA         LAST                                          NIM06100
          ISK   5     DCE                                           NIM06110
          UJP         ANOTHER                                       NIM06120
          SLS         LINE                                          NIM06130
INE       SIL   6     ISKINST1                                      NIM06140
          SIL   6     ISKINST2                                      NIM06150
          ENI   6     0                                             NIM06160
NDIF      LDA   6     BIN                                           NIM06170
          SUB   6     BIN+1                                         NIM06180
          STA   6     DIF1                                          NIM06190
          SIL   6     TEMP                                          NIM06200
          LDA         TEMP                                          NIM06210
          SAL   6     CBIN                                          NIM06220
SKINST1   ISK   6     *                                             NIM06230
          UJP         FRDIF                                         NIM06240
          ENI   6     0                                             NIM06250
          RSO         ISKINST2                                      NIM06260
NDIF      LDA   6     DIF1                                          NIM06270
          SUB   6     DIF1+1                                        NIM06280
          STA   6     DIF2                                          NIM06290
SKINST2   ISK   6     *                                             NIM06300
          UJP         SNDDIF                                        NIM06310
          LIL   6     ISKINST1                                      NIM06320
          URJ         PRNTDIF                                       NIM06330
          UJP         SELECT                                        NIM06340
OFLAG     URJ   7     TYPE                                          NIM06350
          5           MSG5                                          NIM06360
          UJP         SELECT                                        NIM06370
STEND     UJP         *                                             NIM06380
          STA         TS                                            NIM06390
          STQ         TS+1                                          NIM06400
          LDQ   5     2                                             NIM06410
          ENA         0                                             NIM06420
          LLS         8                                             NIM06430
          EQS         LAST                                          NIM06440
          UJP         *+2                                           NIM06450
          UJP         LINE                                          NIM06460
          THS         LAST                                          NIM06470
          UJP         LINE                                          NIM06480
          ENA         2                                             NIM06490
          RAD         TSTEND                                        NIM06500
          LDA         TS                                            NIM06510
          LDQ         TS+1                                          NIM06520
          UJP   7     TSTEND                                        NIM06530
          REM         GENERAL OCTAL PRINT ROUTINE ********************  NIM06540
UMP       UJP   0                                                   NIM06550
          SIL   5     DONE+1                                        NIM06560
          URJ   7     OUTPUT                                        NIM06570
          UJP         ERROR                                         NIM06580
          UJP         LINES                                         NIM06590
          02          HDNG1                                         NIM06600
          ZRO         30120                                         NIM06610
          04          1                                             NIM06620
          ZRO         0                                             NIM06630
INES      SLJ   2     DELAY1                                        NIM06640
          URJ   7     OUTPUT                                        NIM06650
          UJP         ERROR                                         NIM06660
          UJP         DONE                                          NIM06670
          ZRO   4     0                                             NIM06680
          ZRO         8010                                          NIM06690
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        ZRO   4  1                                                    NIM06700
        ZRO      8020                                                 NIM06710
        ZRO   4  2                                                    NIM06720
        ZRO      8030                                                 NIM06730
        ZRO   4  3                                                    NIM06740
        ZRO      8040                                                 NIM06750
        ZRO   4  4                                                    NIM06760
        ZRO      8050                                                 NIM06770
        ZRO   4  5                                                    NIM06780
        ZRO      8060                                                 NIM06790
        ZRO   4  6                                                    NIM06800
        ZRO      8070                                                 NIM06810
        ZRO   4  7                                                    NIM06820
        ZRO      8080                                                 NIM06830
        ZRO   4  8                                                    NIM06840
        ZRO      8090                                                 NIM06850
        ZRO   4  9                                                    NIM06860
        ZRO      8100                                                 NIM06870
        04       128                                                  NIM06880
        ZRO      0                                                    NIM06890
ONE     INI   4  10                                                   NIM06900
        SKH   4  0                                                    NIM06910
        UJP      FDUMP                                                NIM06920
        UJP      LINES                                                NIM06930
DLAY1   ENI   5  7777B                                                NIM06940
        IJP   5  *                                                    NIM06950
        UJP      DONE                                                 NIM06960
        REM      GENERAL DECIMAL PRINT ROUTINE ************           NIM06970
DUMP    UJP      0                                                    NIM06980
        SIL   5  DONEA+1                                              NIM06990
PRINT   SLJ   2  SELECT                                               NIM07000
        URJ   7  OUTPUT                                               NIM07010
        UJP      ERRORD                                               NIM07020
        UJP      DONEA                                                NIM07030
        03    4  0                                                    NIM07040
        ZRO      10                                                   NIM07050
        03    4  1                                                    NIM07060
        ZRO      20                                                   NIM07070
        03    4  2                                                    NIM07080
        ZRO      30                                                   NIM07090
        03    4  3                                                    NIM07100
        ZRO      40                                                   NIM07110
        03    4  4                                                    NIM07120
        ZRO      50                                                   NIM07130
        03    4  5                                                    NIM07140
        ZRO      60                                                   NIM07150
        03    4  6                                                    NIM07160
        ZRO      70                                                   NIM07170
        03    4  7                                                    NIM07180
        ZRO      80                                                   NIM07190
        03    4  8                                                    NIM07200
        ZRO      90                                                   NIM07210
        03    4  9                                                    NIM07220
        ZRO      100                                                  NIM07230
        04       128                                                  NIM07240
        ZRO      0                                                    NIM07250
ONEA    INI   4  10                                                   NIM07260
        SKH   4  0                                                    NIM07270
        UJP      DDUMP                                                NIM07280
        UJP      DPRINT                                               NIM07290
RRORD   SLS      0                                                    NIM07300
        REM      PRINT DIFFERENCES ROUTINE ************************   NIM07310
RNTDIF  UJP   0                                                       NIM07320
        ENI   4  0                                                    NIM07330
        SIL   6  CYCLE                                                NIM07340
MPLES   SLJ   2  DELAY2                                               NIM07350
        URJ   7  OUTPUT                                               NIM07360
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         UJP       ERRORB                                                  NIM07370
         UJP       CYCLE                                                   NIM07380
         ZRO   4   CBIN                                                    NIM07390
         ZRO       8010                                                    NIM07400
         ZRO   4   BIN                                                     NIM07410
         ZRO       8020                                                    NIM07420
         ZRO   4   DIF1                                                    NIM07430
         ZRO       8030                                                    NIM07440
         ZRO   4   DIF2                                                    NIM07450
         ZRO       8040                                                    NIM07460
         04        12B                                                     NIM07470
         ZRO       0                                                       NIM07480
YCLE     ISK   4   *                                                       NIM07490
         UJP       SMPLFS                                                  NIM07500
         UJP   7   PRNTDIF                                                 NIM07510
ELAY2    ENI   5   7777B                                                   NIM07520
         IJP   5   *                                                       NIM07530
         UJP       CYCLE                                                   NIM07540
RROR     SLS       0                                                       NIM07550
RRORA    SLS   0                                                           NIM07560
RRORB    SLS       0                                                       NIM07570
         REM       INTERRUPT 30 AND 40 ROUTINES ******************         NIM07580
NT30     STA       SV3040                                                  NIM07590
         LDA       3B                                                      NIM07600
         STA   5   IN30                                                    NIM07610
         LDA       SV3040                                                  NIM07620
         SEL       17026B                                                  NIM07630
         ISK   5   9                                                       NIM07640
         UJP       30B                                                     NIM07650
         ENI   5   9                                                       NIM07660
         UJP       30B                                                     NIM07670
NT40     STA       SV3040                                                  NIM07680
         LDA       3B                                                      NIM07690
         STA   6   IN40                                                    NIM07700
         LDA       SV3040                                                  NIM07710
         SEL       17025B                                                  NIM07720
         ISK   6   9                                                       NIM07730
         UJP       40B                                                     NIM07740
         ENI   6   9                                                       NIM07750
         UJP       40B                                                     NIM07760
V3040    BSS       1                                                       NIM07770
         REM       TAPE WRITE ROUTINE ***************************         NIM07780
RTOUT    UJP       *                                                       NIM07790
         ENA       DCE                                                     NIM07800
         SAL       10B                                                     NIM07810
         SEL       42031B                                                  NIM07820
         SEL       42402B                                                  NIM07830
         RAO       FLAG                                                    NIM07840
         SEN       42000B              SKIP READY TO WRITE                 NIM07850
         UJP       *-1                                                     NIM07860
         ACT   4   FLAG                                                    NIM07870
         UJP   7   WRTOUT                                                  NIM07880
         REM       EXTERNAL FUNCTION SELECTION CODE TABLE **********       NIM07890
QUIP     SEL       17020B              SEL SIM FM DATA,FORWARD VT          NIM07900
         ARS       1                                                       NIM07910
         SEL       17021B              SEL SIM FM DATA,REVERSE VT          NIM07920
         ARS       1                                                       NIM07930
         SEL       17022B              SEL SIM FM DATA,GROUND TIME         NIM07940
         ARS       1                                                       NIM07950
         SEL       17024B              SEL TAPE INPUT                      NIM07960
         SEL       17011B              SEL FORWARD TAPE DATA               NIM07970
         SEL       17024B              SEL TAPE INPUT                      NIM07980
         SEL       17012B              SEL REVERSE TAPE DATA               NIM07990
AMPLING  SEL       17004B              SEL 2KC SAMPLING RATE               NIM08000
         SEL       17005B              SEL 4KC SAMPLING RATE               NIM08010
         SEL       17006B              SEL 8KC SAMPLING RATE               NIM08020
         SEL       17007B              SEL 16 KC SAMPLING RATE             NIM08030
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          SEL     170104          SEL LOCAL OSCILLATOR                    NIM08040
ANDWDTH   SEL     170134          SEL A BANDWIDTH(NARROW)                 NIM08050
          SEL     170148          SEL B BANDWIDTH (MEDIUM)                NIM08060
          SEL     170158          SEL C BANDWIDTH (WIDE)                  NIM08070
          REM     STORAGE AREAS,CONSTANTS ************************        NIM08080
NST1      UJP     0                                                       NIM08090
NST2      UJP     INT30                                                   NIM08100
NST3      UJP     0                                                       NIM08110
NST4      UJP     INT40                                                   NIM08120
AX        BSS     1                                                       NIM08130
NST5      UJP     0                                                       NIM08140
NST6      SLS     0                                                       NIM08150
SMASK     OCT     00040004                                                NIM08160
ONE       DEC     1                                                       NIM08170
TWO       DEC     2                                                       NIM08180
THREE     DEC     3                                                       NIM08190
FOUR      DEC     4                                                       NIM08200
FIVE      DEC     5                                                       NIM08210
SIX       DEC     6                                                       NIM08220
SEVEN     DEC     7                                                       NIM08230
EIGHT     DEC     8                                                       NIM08240
NINE      DEC     9                                                       NIM08250
TEMP      BSS     1                                                       NIM08260
LAST      BSS     1                                                       NIM08270
BUFS      BSS     2                                                       NIM08280
SAVE      BSS     5                                                       NIM08290
          BSS     5                                                       NIM08300
IF3040    BSS     30                                                      NIM08310
          ORG     17742B                                                  NIM08320
FLAG      BSS     4000                                                    NIM08330
BIN       BSS     1000                                                    NIM08340
IN        BSS     1000                                                    NIM08350
IF1       BSS     1000                                                    NIM08360
IF2       BSS     1000                                                    NIM08370
SG1       BCD     4SELECT OPERATION                                       NIM08380
SG3       BCD     4SELECT RUN MODE                                        NIM08390
SG5       BCD     5NO DATA SYNC FLAG                                      NIM08400
SG6       BCD     5TYPE SENSE INSTRUCTI                                   NIM08410
          BCD     1ON                                                     NIM08420
SG7       BCD     5TURN JUMP SWITCH 2 0                                   NIM08430
          BCD     1N                                                      NIM08440
SG8       BCD     5TURN JUMP SWITCH 3 0                                   NIM08450
          BCD     1N                                                      NIM08460
SG9       BCD     4SET J.S. 1,2,3                                         NIM08470
SG10      BCD     5TIME UNIT NOT READY                                    NIM08480
SG11      BCD     4FM UNIT NOT READY                                      NIM08490
SG12      BCD     4EXT EQUIP NOT READY                                    NIM08500
SG13      BCD     5MOUNT TAPE WITH WRIT                                   NIM08510
          BCD     5E RING ON UNIT 2                                       NIM08520
SG14      BCD     5MOUNT TAPE WITH WRIT                                   NIM08530
          BCD     5E RING ON UNIT 3                                       NIM08540
SG15      BCD     3END OF FILE                                            NIM08550
SG16      BCD     3LOAD POINT                                             NIM08560
DNG1      BCD     5                                                       NIM08570
          BCD     5                                                       NIM08580
          BCD     5                                                       NIM08590
          BCD     5                                                       NIM08600
          BCD     5                                                       NIM08610
N         BSS     40                                                      NIM08620
CDSENS    BCD     1SENS                                                   NIM08630
CDINPU    BCD     1INPU                                                   NIM08640
CDANAL    BCD     1ANAL                                                   NIM08650
CDSRCH    BCD     1SEAR                                                   NIM08660
CDPRNT    BCD     1PRIN                                                   NIM08670
CDSYST    BCD     1SYST                                                   NIM08680
CDRPT     BCD     1REPE                                                   NIM08690
CDRST     BCD     1REST                                                   NIM08700
CDCODE    BCD     1CODE                                                   NIM08710
          END     START                                                   NIM08720
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