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**Technical Note**

**1966-4**

**BASELINE**  
**A Man-Machine Program**  
**for Data Analysis**

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20 January 1966

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
LINCOLN LABORATORY

BASELINE: A MAN-MACHINE PROGRAM FOR DATA ANALYSIS

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## ABSTRACT

BASELINE was designed to perform a statistical analysis of radar pulse data previously read by the Laboratory's high precision computer controlled film reader. A computer controlled display oscilloscope, a light pen and a set of function coded sense switches provide a real time interface between an analyst and the data reduction program in the computer. The computer performs all necessary display, computation and outputting functions. All operations are under direct control of the analyst. He sets the operating criteria, exercises the required judgments and steers the program through the required analysis.

Analytical results are quickly available and rapidly documented. Output consists of a statistical distribution of the input data displayed on a large oscilloscope. This display may easily be documented photographically. Key parameters describing the statistical distribution may be output on the typewriter at the command of the analyst. A very large saving in data reduction time results since the necessity of repeated test runs through a large computer and subsequent study of the numerical printouts is eliminated.

Accepted for the Air Force  
Franklin C. Hudson  
Chief, Lincoln Laboratory Office

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## I. Introduction

BASELINE performs a statistical analysis of radar pulse data. The program provides an effective interface between the analyst and the mathematical reduction in the computer. The presence of the analyst is required.

The program uses the techniques of computer graphics to present both raw data and processed data to the analyst. Primary control is exercised by the analyst with a light pen and a set of function coded sense switches.

All processing takes place directly under the analyst's control. He may intervene in the processing at any point. The required outputs may be documented immediately upon completion of the analysis. The reduction process is continuous from raw data entry to final documentation. A production run of data typically requires about 15 minutes to complete. This program replaces a series of test data runs previously handled on the IBM 7094 computer which, because of their necessarily discontinuous nature, required about four days to complete and analyze.

This program was written for the Digital Equipment Company PDP-1 computer equipped with 16,000 words of storage. The word length of this machine is 18 bits. The primary man-machine interface is accomplished with the DEC Type 340 computer controlled display oscilloscope, which is used for all the displays in the program. A light pen is used by the analyst to provide direct graphical communication with the program. The six sense switches and the eighteen test word switches located on the computer control panel are paralleled and brought out to a special control box which may be conveniently moved about at the oscilloscope control station. These switches are equipped with indicator lights and accept overlay cards which are marked in terms of the program functions which they control. These switches, function coded by the program, form a primary communication medium with the data reduction program so that the operating analyst need not be familiar with the details of the computer or its programming.

The control station is shown in Fig. 1. The oscilloscope, the light pen and the control box form the primary man-machine interface. The input-output typewriter is

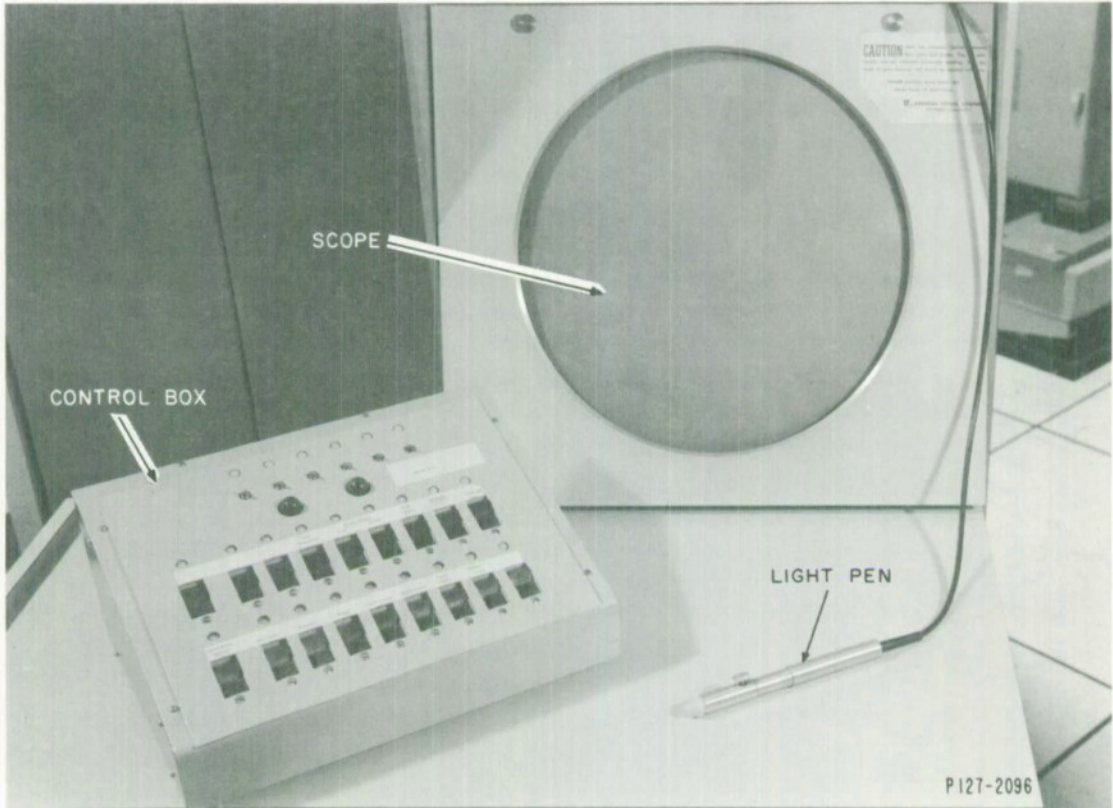


Fig. 1. The Computer Control Station.

also available as a two way interface but its use is limited to title modification on the display and as a selectable printer for typed output.

It has been found that an analyst familiar with the data reduction problem can learn to use BASELINE in about 15 minutes.

The control box is activated by the computer program through a special instruction so that the programmer may make the control box available to the analyst and still preserve the normal use of the panel switches if he so desires.

The graphical display is fully titled. Control functions are identified by title and are accessible to light pen operation. Appropriate parameters of the statistical analysis are continuously updated and displayed.

Graphical documentation is available by photographing the display. Typewriter printout of the statistical parameters and the identification data form the normal output. At the option of the analyst, this documentation may be recorded on high speed punched tape for later printing on a Flexowriter.

## II. The Purpose of the Program

An automatic computer controlled film reader is regularly used at the Laboratory to digitize radar pulse data recorded on film from the face of a cathode ray tube. Data is recorded in rows or "channels" on a continuously moving 35 mm film. Up to four channels of data may be recorded on one film and the reading of the data is completely automatic. A section of film showing radar pulses as recorded from the CRT is shown in Fig. 2. The system has successfully recorded data with bandwidths up to 17 Mcps.

These digitized pulse data are analyzed by a series of programs written for the IBM 7094 computer. Before a meaningful analysis can be accomplished it is necessary to determine the position of the leading edge of each pulse return with respect to its location on the digitized oscilloscope trace. A pattern recognition program written for the IBM 7094 performs this function by passing a mathematical filter through each recorded pulse. This FILTER program requires a threshold number for proper operation. The threshold number is based on the noise statistics of the baseline of the

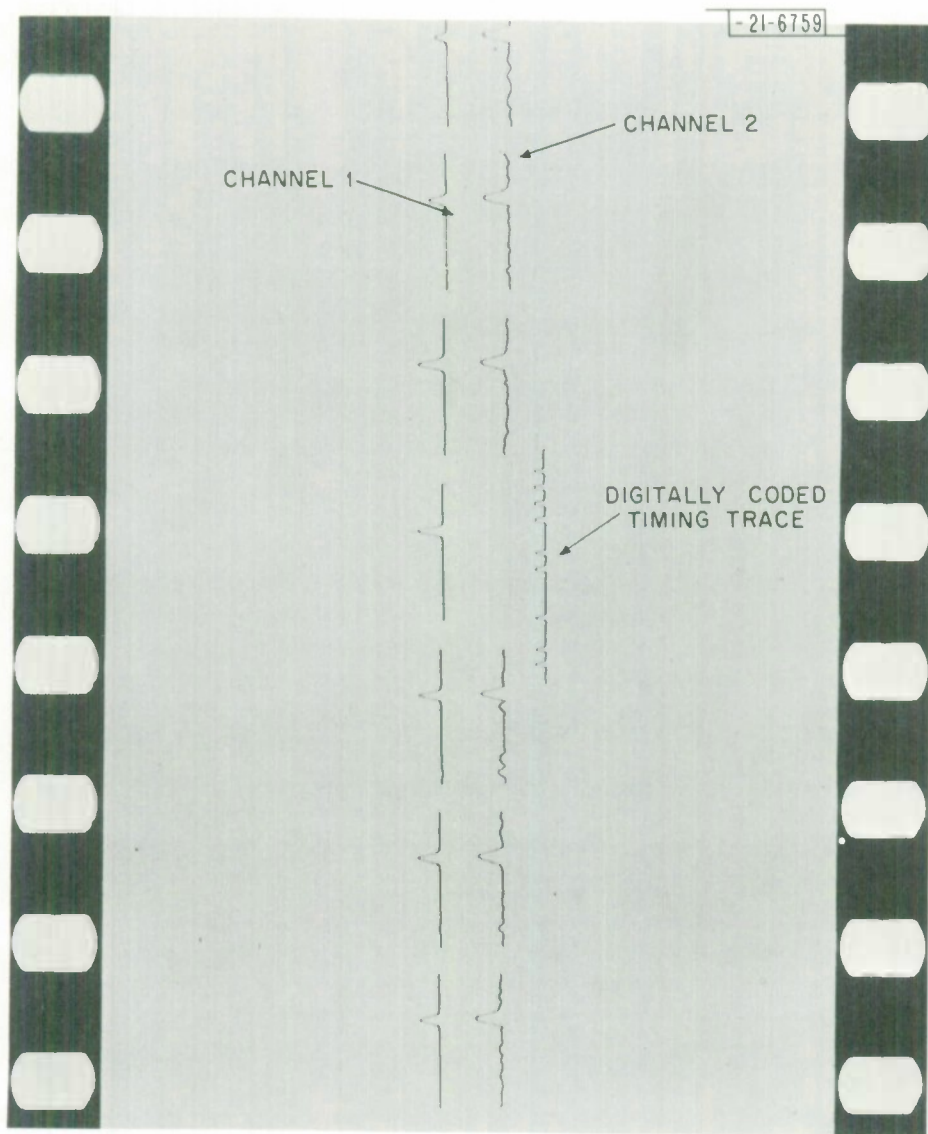


Fig. 2. Typical Radar Film.

traces which also contain the pulses. BASELINE is designed primarily to perform a statistical analysis to obtain this threshold number.

The region of the data traces to be used to obtain the baseline noise statistics is selected by the analyst. For noise statistics, areas of the traces that do not include the pulses are selected. The analyst may, however, select the pulse data for analysis and the program will then produce pulse statistics. This feature has proven particularly useful in handling data recorded in phase quadrature as it allows a separate statistical study of each quadrature channel so that any inequalities in gain settings on the quadrature channels can be measured. The subsequent analysis is then adjusted to account for any measured gain difference in the quadrature data channels.

The use of BASELINE allows one to enter a series of extensive and time consuming 7094 programs with high confidence that the operating parameters of these programs have been properly chosen to match the particular set of data that is being processed.

### III. General Description of the Program

The output data from the film reader recorded on magnetic tape serves as input to BASELINE. This same tape is later used as input data to the 7094 reduction programs.

Reading BASELINE into the PDP-1 computer starts the sequence of operations. The program first reads the title information recorded on the film reader output tape and displays this as a title on the CRT. This includes the test identification numbers, the type of data read and time codes appropriate to the experimental data being studied.

The analyst then selects a data channel with the light pen. One of up to four channels of data may be selected. The channels are defined on the original filmed record as shown in Fig. 2.

The raw data is introduced into the computer and displayed trace by trace for the inspection of the analyst. Successive traces may be displayed manually or automatic sequencing is available at several selectable rates. In this way the raw data

traces may be sequentially examined. The computer counts the traces displayed and adjusts the time reference.

When a statistical analysis is desired the analyst sets one or more pairs of gates on the data trace to designate those regions that are to be included in the statistical analysis (Fig. 3). The program then plots a histogram of the distribution of the deflections (from the calculated zero deflection position as determined by the film reader) for each data point within the designated gates (Fig. 4). The traces typically contain about 200 data points. The data from the trace is entered into the analysis subsequent to viewing so that the analyst may reject a trace when he wishes without upsetting the statistical analysis. The distribution of trace displacements is updated and plotted on a trace-by-trace basis. The histogram is renormalized for every entry and the limits of the distribution are automatically rescaled. The program is designed to handle both bipolar and unipolar data.

The program continuously displays the total number of traces handled, the total number of data points used in the statistical analysis, the mean and the standard deviation of the accumulated data. On demand, the computer will calculate the Gaussian distribution with the same standard deviation and mean as the experimental data and display this plotted function along with the measured distribution (Fig. 5).

The analyst may determine when a sufficient amount of data has been included in the analysis by noting when the experimentally determined distribution has become stationary. Documentation of the significant statistical parameters is then initiated by the analyst using a control switch. The analyst may also designate any single point on the measured distribution curve with a light pen. The value of the integral distribution about the mean up to the selected value of trace displacement is then calculated and included in the documentation.

The program is designed with "fail safe" features. An error in the operating sequence will stop the program. An error message will appear on the display to tell the analyst how to rectify the error.

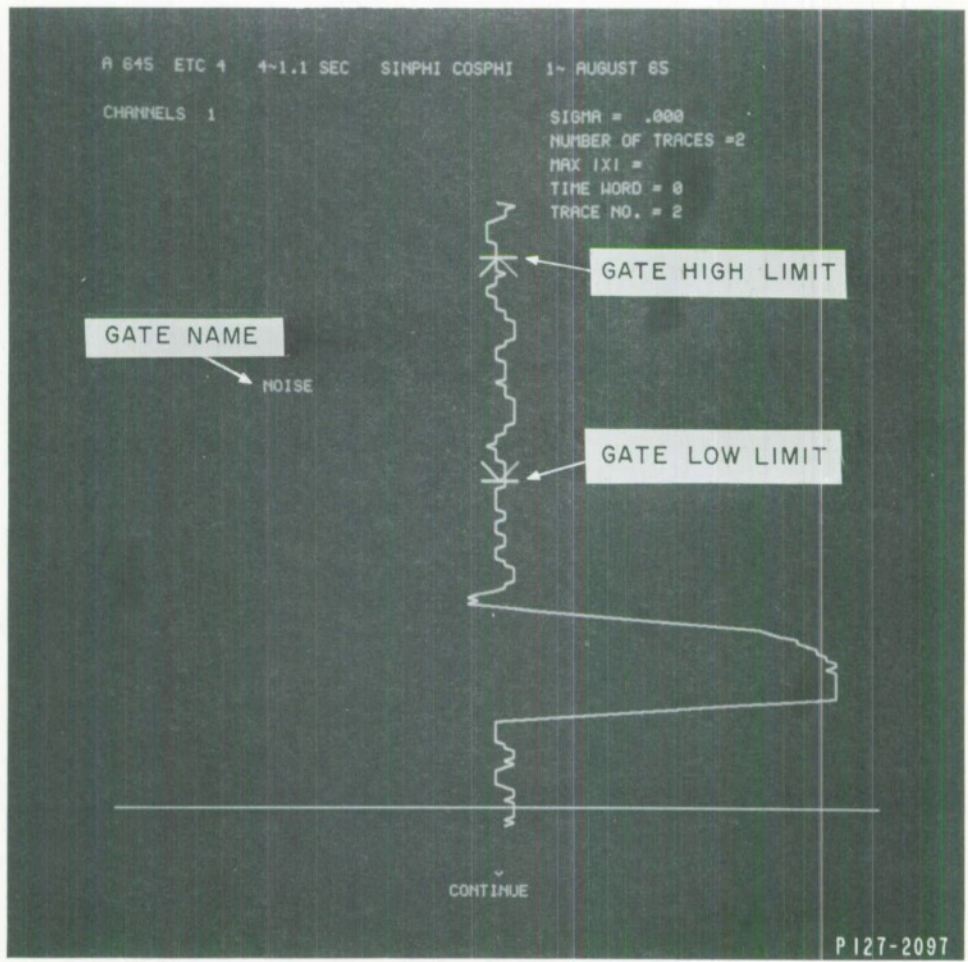


Fig. 3. Radar Data Trace Showing Typical Gate Limits for a BASELINE Distribution of Analysis.

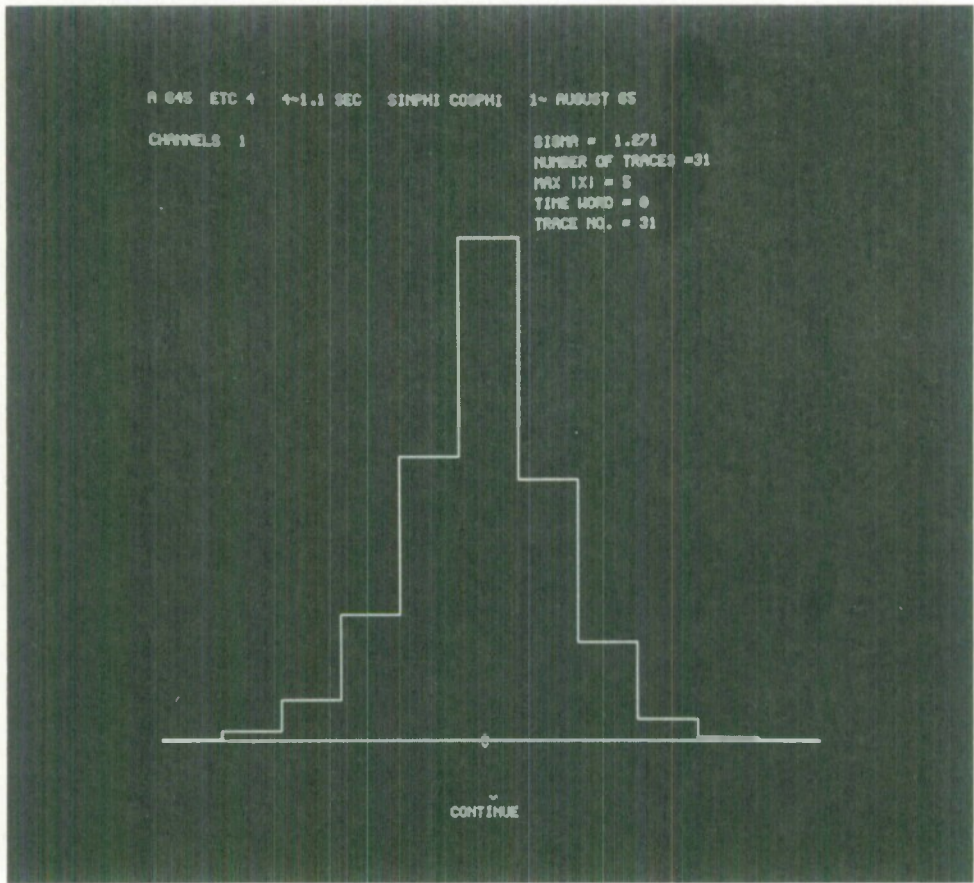


Fig. 4. Typical Distribution of "Noise" Data from 31 Traces.

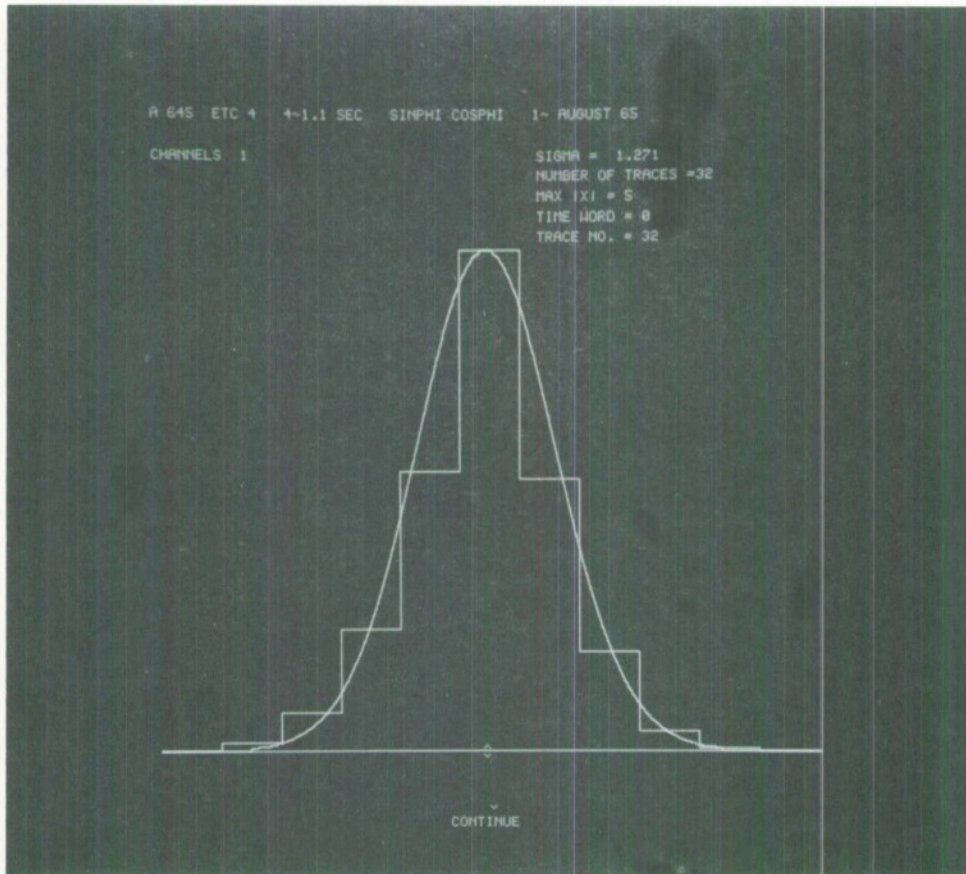


Fig. 5. Distribution of Fig. 4 with a Theoretical Gaussian of the Same Mean and Standard Deviation Superimposed.

#### IV. Detailed Description of the Program

The data are read into the computer and right-justified by a division of  $2^8$ . The program is capable of handling data values of any size provided they do not exceed one register, that is, one 18-bit word. However, the core area allocated to the cumulative frequency tally table used to produce the histogram has been limited to a maximum range of 915 decimal units or between  $\pm 457$ . This range was chosen since, after allowing for margins, there are 915 decimal increments across the Type 340 scope, thereby permitting only 915 distinct quantum increments, or cells, in the histogram display. If it is necessary to display a larger range of data within the 915 increments available, the data must be regrouped or granulated. To do this the contents of each two consecutive cells in the original tally table are added together to form one new cell. This process is repeated until the entire range of the data can be accommodated in the 915 available cells.

A section of the tally table before and after regrouping is shown in Table 1.

After the data have been read into the computer and the trace has been displayed, the operator may designate up to seven different areas of the data trace to be analyzed. These areas can be overlapping, entirely within one another, or completely different. It should be noted, however, that data contained within more than one area will be accordingly weighted.

The total set of  $N$  data points ( $x_n$ ) will be collected in the cumulative frequency tally table which covers the region:

$$x_{-1} \leq x_n \leq x_1$$

Such that:

$$f_i = f(x_i)$$

TABLE I

Tally Table Before Regrouping

Histogram Increments	Populations
-6;	0
-5;	1
-4;	3
-3;	4
-2;	7
-1;	8
0;	12
+1;	9
+2;	6
+3;	3
+4;	2
+5;	2

Tally Table After Regrouping

-5, -6 → -3;	1+0=1
-3, -4 → -2;	4+3=7
-1, -2 → -1;	8+7=15
0, +1 → 0;	12+9=21
+2, +3 → +1;	6+3=9
+4, +5 → +2;	2+2=4

where  $f_i$  is the population in the  $i$ th cell or quantum increment, and  $x_i$  is the value of the  $i$ th cell or quantum increment. Note that:

$$N = \sum_{-I}^I f_i$$

This histogram is continuously displayed and modified as each new trace is read in, but the display does not include the data in the trace being viewed. In this manner the operator can, if the data are bad, skip a trace at any time by means of a button on the control box and in no way affect the value of the histogram.

The standard deviation of the distribution is also continuously displayed and updated. It is calculated with the formula:

$$\sigma = \sqrt{\frac{\sum x_i^2}{N} - \frac{(\sum x_i)^2}{N^2}}$$

The square root is approximated by:

$$a(n+1) = \left( \frac{Y}{a(n)} + a(n) \right) / 2$$

where the initial approximation for  $a(1)$  is equal to  $Y/2$ . This approximation is continued until,

$$\begin{aligned} a(n+1) - a(n) &= 0 && \text{or} \\ a(n+1) &= a(20). \end{aligned}$$

For these calculations double and quadruple precision mathematical routines are used.

For the sum of the x squared values, four 18-bit registers have been reserved so this value can be as large as  $2^{70} - 1$ . For the sum of the x values, two 18-bit registers have been reserved so this value can be as large as  $2^{35} - 1$ . This also holds for the registers containing the total number of points analyzed. The entire tally table is also double-precision, thereby enabling the frequency for any individual value to be as large as  $2^{35} - 1$ . The standard deviation and the average are each allowed only one register since neither value is expected to exceed the maximum data value within a register. These two values and their associated probability values are multiplied by 1000, thereby allowing for three places of accuracy after the decimal point.

Other information continuously displayed is the total number of points analyzed, the maximum absolute value of x, and the first and second time words of the trace then being displayed. The analyst may also display a theoretical normal distribution superimposed on the histogram with the mean given by

$$\bar{x} = \frac{\sum_{-I}^{+I} (f_i) (x_i)}{N} = \frac{\sum_{1}^N x_n}{N}$$

and the standard deviation as defined above.

The values for the theoretical normal curve are derived from the formula

$$G(x_i) = \frac{1}{\sqrt{2\pi}} \cdot \frac{1}{\sigma} \cdot e^{-\frac{(x_i - \bar{x})^2}{2\sigma^2}}$$

where

$$e^{-x} \sim \frac{1}{[1 + a(1) \cdot x + a(2) \cdot x^2 + a(3) \cdot x^3]^4} \quad *$$

\*This approximation is from Approximations for Digital Computers by Cecil Hastings, p. 182.

with:

$$a(1) = .2507213$$

$$a(2) = .0292732$$

$$a(3) = .0038278$$

with an error usually better than  $\pm .0002$ .

The analyst can stop the program at any time and delete any area of calculation or change any given data area. He also can stop the calculations and then select an x value on the histogram and/or document what he has done so far, skip to the next file, return to the beginning of the file he is viewing, or simply continue from where he left off.

The document option provides either an on-line typeout or a punched paper-tape output. Both include the following: the title of the file; the channel number viewed; the number of data points analyzed; the value of the mean of the distribution; the probability of the mean; the value of the standard deviation of the distribution; the integral probability for  $\pm 1\sigma$ ,  $\pm 2\sigma$ , and  $\pm 3\sigma$ ; the granularity of the data; and the maximum and minimum data values. If an x value had been selected on the histogram before documentation, the documentation will also include the displacement from the mean of the selected x value and the integral probability of this selected bandwidth about the mean.

A diagram of the push-button panel is shown in Fig. 6.

#### V. Operating Procedures

1. Load data tape on tape drive and select #5.
2. Turn off all test-word switches, address switches and the extended switch.
3. a) Put up module switch 2 and read in paper-tape binary for module 2;  
b) put up module switch 1 and read in paper-tape binary for module 1; c) put down all module switches and read in paper-tape binary for module 0.

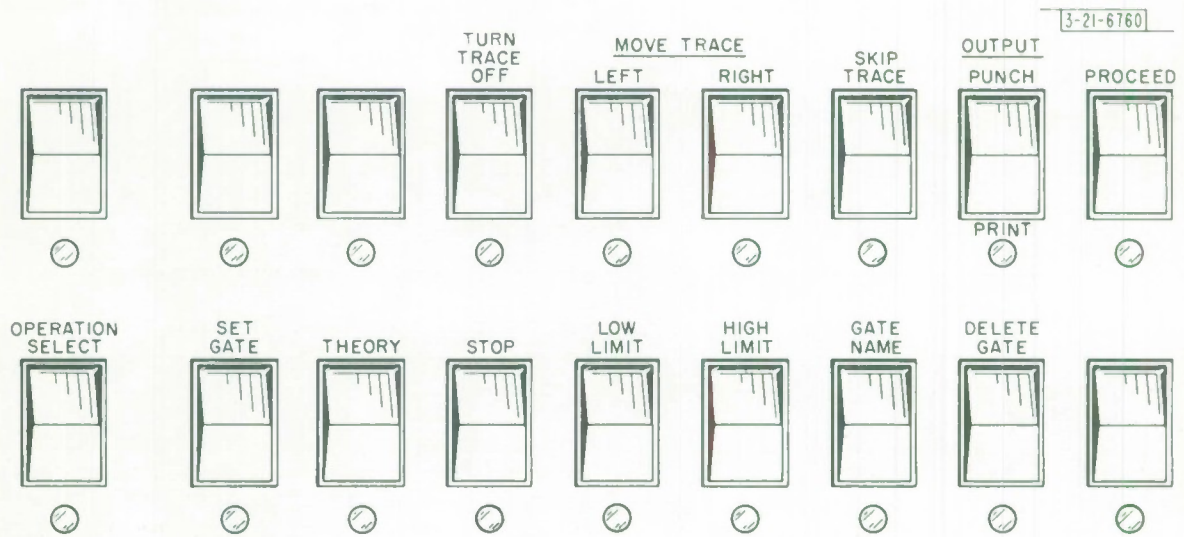


Fig. 6. Control Box Switch Assignments.

4. Put 0100 in the address switches, with all module switches down, and press the START button.

5. The display on the DEC Type 340 scope will be as shown below.

```
THE TITLE FOR THIS FILE
CHANNELS 1 2 3 4

NEXT FILE      THIS FILE      TYPE IN      TYPE OUT
                CONTINUE
```

TITLE - the title record on the tape for that file. A light-pen response has no effect.

CHANNELS 1 2 3 4 - a) a light-pen response on a number will cause that channel in the input data to be selected to view and analyze, and will turn off all other channel numbers; b) a light-pen response on a number which is greater than the number of data channels on the input tape will cause an error message to be displayed; c) a light-pen response on the word CHANNELS will cause all numbers to be displayed and delete any previous channel selection.

NEXT FILE - a light-pen response will cause the tape to be advanced to the next end-of-file marker.

THIS FILE - a light-pen response will cause the tape to be reset at the beginning of this file.

TYPE IN - a) a light-pen response will cause only CONTINUE to be displayed and will wait for a new title to be typed in; b) a light-pen response on

CONTINUE will terminate input from the typewriter; c) a new title will then be displayed.

TYPE OUT - a light-pen response will cause the title and the channel number selected to be typed out for a permanent record.

CONTINUE - a) a light-pen response before a channel selection is made will cause an error message to be displayed; b) a light-pen response after typing in a new title will terminate input from the typewriter; c) a light-pen response with set title and an appropriate channel number selected will cause the first trace in the selected channel to be read into the computer and displayed.

6. The trace display options are listed below and are illustrated in Fig. 3.

A. Change the status of the PROCEED button and the next trace in the selected channel will be read in and displayed. No calculations are being done.

B. Determine the areas of the trace that are to be analyzed by turning on the SET GATE button on the panel.

1. Turn on the GATE NAME button also.

a. Track the raster with the light-pen to the desired area of the scope.

b. Type in a name no longer than six characters for that limit set, and terminate with a carriage return.

c. Turn off the GATE NAME button.

2. Turn on the HIGH LIMIT button also.

a. A light-pen response on the trace will cause an upper-limit caret to be displayed at the point of response and set the upper limit of the area to be analyzed.

b. Turn off the HIGH LIMIT button.

3. Turn on the LOW LIMIT button.

a. A light-pen response on the trace will cause a lower limit caret to be displayed at the point of response and will set the lower limit of the area to be analyzed.

- b. Turn off the LOW LIMIT button
  4. Turn off the main SET GATE button.
    - a. If this button is turned off before a proper set definition is made, an error message will be displayed. Turn button back on and continue.
    - b. If more than one set of limit areas is desired, the above process can be repeated for as many as seven different areas. Each separate area definition is set by turning off the main SET GATE button.

7. To start the calculations:

- A. A change in the status of the PROCEED button will cause:
  1. values in the designated areas of the trace to be ordered into a cumulative frequency tally table and displayed in the form of a histogram;
  2. sigma to be calculated and displayed; and
  3. the average to be calculated and displayed by means of a caret along the baseline.

B. The status of the time counter can be changed from the initialized mode of operation, frame by frame, by turning on the OPERATION SELECT button. The different options will be displayed as light buttons.

1. "Frame" will have a caret over it designating the mode of operation currently in use. This means that a change in the PROCEED button is necessary before the computer will continue to the next frame.
2. "Slow" - a light-pen response will cause a caret to be displayed over the word.
3. "Moderate" - same as 2 above.
4. "Fast" - same as 2 above.
5. When the OPERATION SELECT button is turned off, the calculations will continue under program control in the mode of operation designated by the caret when the button was turned off.

8. To delete the limit areas:

A. turn on the SET GATE and DELETE GATE buttons.

1. The calculation will stop.

2. The names of the limit areas will be displayed.

3. A light-pen response on either the upper or lower limit caret of the area to be deleted will cause a caret to be placed over the name of the area. The area can be changed simply by hitting a different limit caret until the desired area name has a caret over it.

4. A light-pen response on anything below the baseline will cause all carets over names to disappear.

5. When the DELETE GATE and SET GATE buttons are turned off, the set deleted will be the one whose name has a caret over it.

9. To see the theoretical normal distribution with the given average and standard deviation of the data (Fig. 5), turn on the THEORY button. This button should not be left on continuously as it will slow down the calculations considerably.

10. When this section of data is completed, turn on the STOP button and get light-pen button options:

DOCUMENT - a) A light-pen response from a point on the histogram will cause the displacement of the selected X and the probability of the selected bandwidth to be added into the documentation; b) a light-pen response from the word DOCUMENT will cause the typewriter to type out the following items:

the title

channel

number of data points =

mean =

probability of the mean =

sigma =

integral probability for 1 sigma =

integral probability for 2 sigma =

integral probability for 3 sigma =

granularity =  
maximum X =  
minimum X =

THIS FILE - a) A light-pen response rewinds the tape to the previous end of file mark; b) the options for continuing the calculations are the same as at the start of the program; c) the old tally registers are cleared.

NEXT FILE - a) A light-pen response advances the tape to the next end of file mark; b) the options for continuing the calculations are the same as at the start of the program; c) the old tally registers are cleared.

CONTINUE - a) A light-pen response continues calculations where they were stopped; b) no tally registers are cleared.

11. At any time that it would clarify the display, the MOVE TRACE RIGHT and MOVE TRACE LEFT buttons simply move the trace in the desired direction one increment at a time until the button is turned off.

12. For purposes of photography, the trace and limits can be removed from the display by means of the TURN TRACE OFF button. Turning the button off will return the trace and limits. The removal is only on the displays, thus calculations can proceed in either case.

## VI. Input Tape Format

The input tape is a magnetic tape written at 800 bits per inch. The first record of each file should be a title record, identifying the following data, of up to and not exceeding 150 BCD characters. The second record through to the end of file are binary data records. There is one record per trace in each channel so that if, for example, there are three channels, there will be a record for the trace in the first channel, then a record for the trace in the second channel, and finally a record for the trace in the third channel.

The format for each record is as follows:

Word #1 - the first time word giving the number of the time block and the channel number of this trace in bits 7-8.

Word #2 - the second time word giving the number of the trace within the time block.

Word #3 - number of points along the trace = K.

Word #4 - the first Y value of the trace (not used).

Word #5 - the X value of the baseline (not used).

Word #6 - the leading edge of the trace (not used).

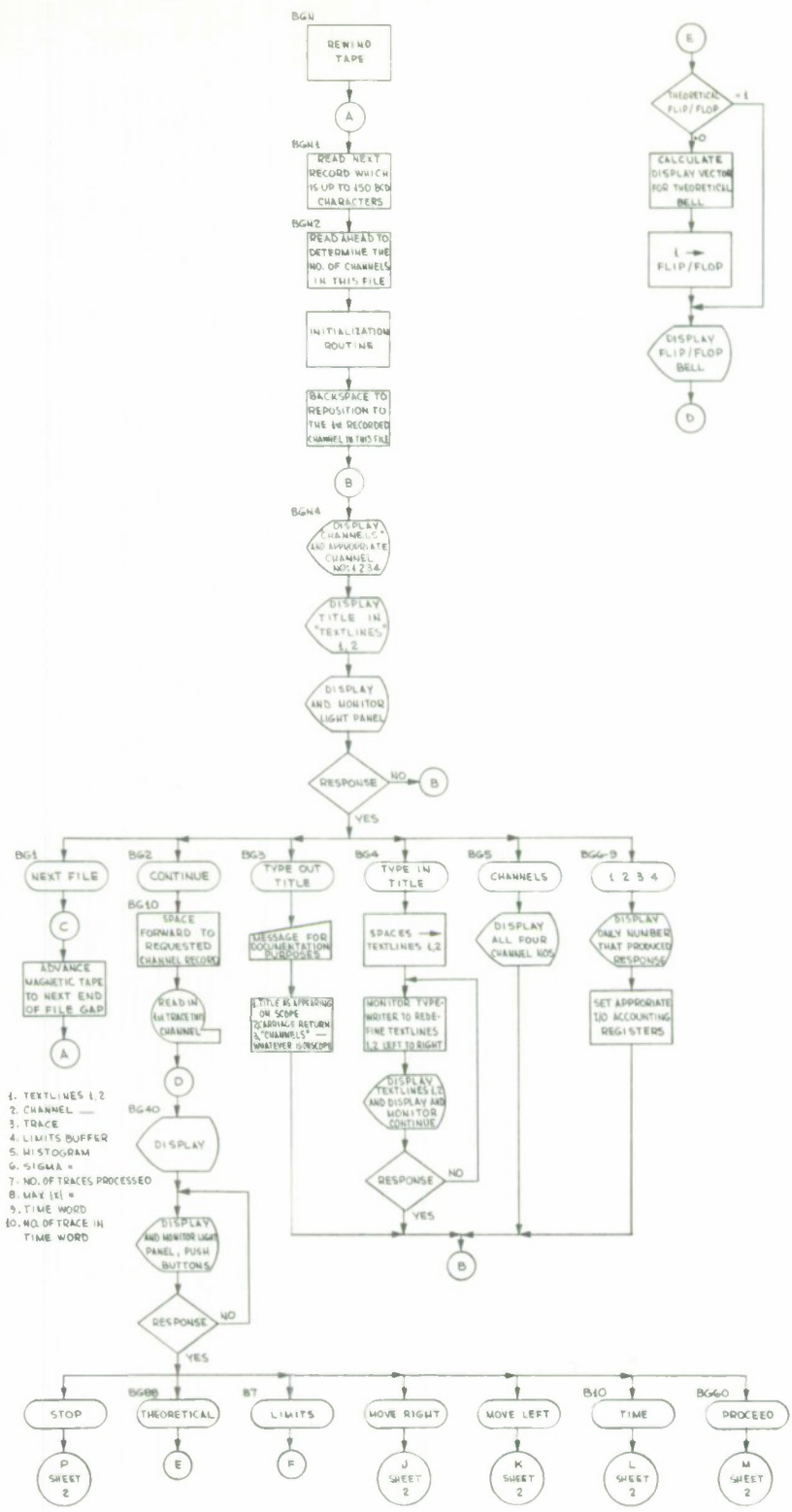
Word #7 to 7+K-1 - the X values of the trace with the baseline removed.

These values have been multiplied by  $2^8$  so in this program they are divided by  $2^8$ , i. e., right justified, before all calculations.



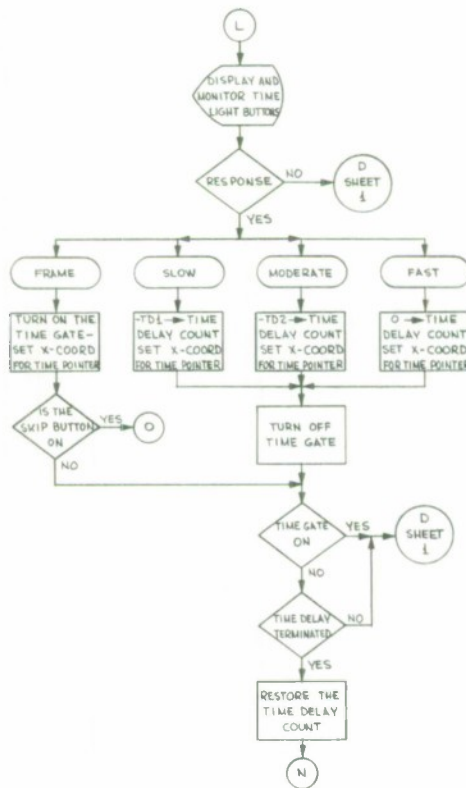
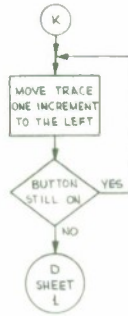
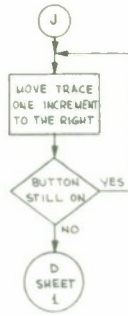
APPENDIX:

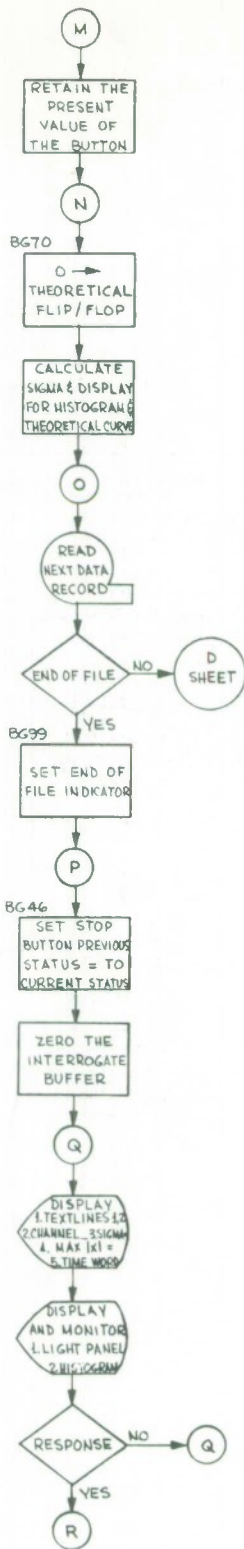
Flow Charts and Program Listing

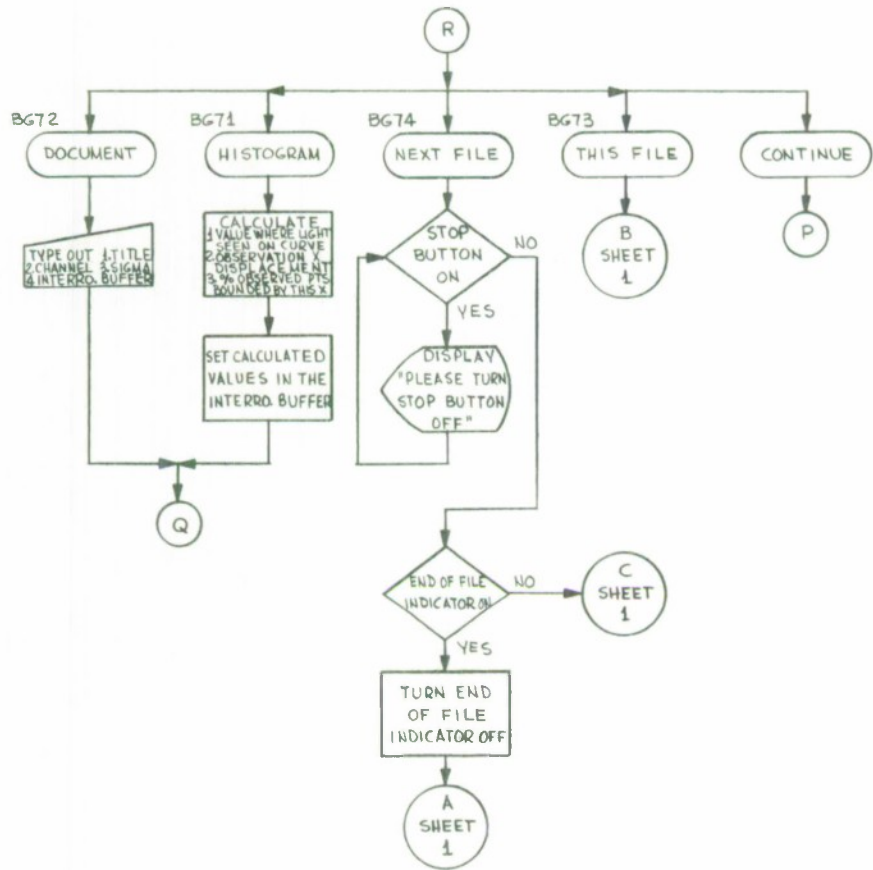


- 1. TEXTLINES 1,2
- 2. CHANNEL —
- 3. TRACE
- 4. LIMITS BUFFER
- 5. LOG STOGRAM
- 6. SIGMA =
- 7. NO. OF TRACES PROCESSED
- 8. MAX |X| \*
- 9. TIME WORD
- 10. NO. OF TRACE IN TIME WORD









/BASELINE STUDY PROGRAM

/CONSTANTS

```

100 004033          JMP 0GN
      777777          FLIPFLOP,      .-.          /1=DISPLAY, 0=CALCULATE
      777777          REOFFN,      .-.          /REDEFINE BUTTON STATUS
      777777          TIME,        .-.          /TIME BUTTON STATUS
104 777777          THEORY,      .-.          /THEORETICAL BUTTON STATUS
      777777          EOFNO,      .-.          /E.O.F. REACHED
      777777          PROCFO,     .-.          /CONSOLE BUTTON STATUS
      001000          T01,        1000         /SLOW COUNT PORTIME DELAY CLOCK
110 000100          T02,        100          /MODERATE COUNT FOR T.D.C.
      777777          TOC,        .-.          /TIME DELAY CLOCK
      777777          NUMCHN,     .-.          /NUMBER OF CHANNELS ON TAPE
      777777          CHNSL,      .-.          /CHANNEL NUMBER SELECTED BY USER
114 777777          TIMGAT,      .-.          /TIME GATE
      777777          STYLE,      .-.          /MODE OF OPERATION 0=FRAME, 1=SLOW
      777777          NCP,        .-.          /2=MODERATE, 3= FAST
116 777777          MU,          REPEAT 2,0    /NO CHANGE PROCESS SWITCH
      777777          SIGMA,      .-.          /AVERAGE=1000.
      777777          XYNOW,      .-.          /STO: OEV.=1000.
      730003          IO,         TYO          /X AND Y COORDINATES LAST SEEN
124 475000          GRANULE,     SAR 0       /OUTPUT INSTRUCTION
      720025          OLA=720025          /GRANULATION OF X AXIS ON HYSTOGRAM
      720125          CRS=720125
      720227          CSS=720227
      720225          OCF=720225
      720026          ORA=720026
      720126          ORC=720126
      721427          DSE=721427
      720127          OSP=720127
      000005          TAPE=5           /INPUT ON TAPE UNIT 5
      001000          DNSTY=000          /INPUT TAPE AT 000 0PI.
      040500          SZM=SZA-SMA
      050100          SNA=SZA I
      TOTAL,        REPEAT 2,          0
      SXS,          REPEAT 4,          0
      SX,           REPEAT 2,          0

```

/SYSTEM MACROS

```

DEFINE STZ A,B,C,O,E,F,G,H,I
IRP Z,,A,B,C,O,E,F,G,H,I$
OZM Z
ENDIRP
TERMINATE
DEFINE SET A,B
LAW B
OAC A
TERMINATE

```

```

DEFINE    SETUP A,B
          LAC B
          DAC A
TERMINATE
DEFINE    ISET A,B
          LAW I B
          DAC A
TERMINATE
DEFINE    IF A,B,C,D
          LAC A
          ADD 10
          SZA I
          JMP C
          SPA
          JMP B
          JMP D
TERMINATE
DEFINE    ENDDFMDULE /ZZ
          VARIABLES
          CDNSTANTS
ZZ,      HLT
          WORD JMP ZZ
TERMINATE
DEFINE    TRACKS
          JSP I (LPFOLL+10000
          LID I (YPT+10000
          RIL 9S
          LAC I (XPT+10000
          RCL 9S
          DAC XYNOW
TERMINATE
DEFINE    PUNCH
          CLF 6
          LAT
          RAL 7S
          SPA
          STF 6
          LAC (TYD-I
          SZF 6
          LAC (PPA-I
          DAC ID
TERMINATE
DEFINE    RETRACK
          DZM I (WRXL +10000
          DZM I (WRYB+10000
          IRP B,,RPX,WPX,RPY,WPY*
          SET I (B+10000,500
          ENDIRP
          SET I (WRXR+10000,1777
          SET I (WRYT+10000,1777
TERMINATE

```

```

/REPLAY A,B,C,D,
/A=1 MEANS CONTINUE DISPLAYING WHAT IS NOW ON.
/A=0 MEANS STOP
/B=1 MEANS ENABLE THE LIGHT PEN
/B=0 MEANS DISABLE THE LIGHT PEN
/B=2 MEANS LEAVE LIGHT PEN STATUS ALONE
/C=EXTENDED ADDRESS OF NEW THING TO DISPLAY
/D=EXTENDED ADDRESS OF THING TO NOT DISPLAY

```

```

DEFINE REPLAY A,B,C,0/ZZ

```

```

G=.

```

```

TEXT / C /
TEXT / D /

```

```

ZZ,

```

```

ZZZ=ZZ-G

```

```

G/ /RESET THE LOCATION COUNTER

```

```

H=0

```

```

REPEAT 0IF VZ A+B, REPEAT 1IF VZ A+2*B-5, H=1

```

```

L=1

```

```

REPEAT 1IF VP ZZZ-3, L=0

```

```

REPEAT 1IE VZ ZZZ-3, L=0 /INSURE THIS CASE

```

```

REPEAT 1IF VZ L*B-1, JSP I (RPIOA STOP

```

```

/THE ABOVE IS THE SHORT CALL TO REPLAY
/AND IT OCCURS ONLY FOR A REPLAY 1,2

```

```

DIO X*CD
LAC {C*0
LIO {D*0
JCA REPAX
REPEAT 1IE VZ A+B, 0
REPEAT 0IF VZ A+B, A+2*B
LIO XCD

```

```

TERMINATE

```

```

DEFINE NEXTCRT A
LAC 1A
JOA PNXCT

```

```

TERMINATE

```

```

139 77777
247111

```

```

PNXCT,

```

```

--
DAC PNXCTX
IRP B,,CRTCON,CRTNF,CRTTO,CRTTI,CRTTF,CRTDDC4
REPLAY 1,2,0,B
ENDIRP
CRTCON, REPLAY 1,2,0,CRTCN
CRTNF, REPLAY 1,2,0,CRTNF
CRTTO, REPLAY 1,2,0,CRTTO
CRTTI, REPLAY 1,2,0,CRTTI
CRTTE, REPLAY 1,2,0,CRTTF
CRTDDC, REPLAY 1,2,0,CRTDDC

```

208	200135			LAC PNXC7	
209	600207		JMP +3		
			REPLAY 1,2,CRTCON		
213	617111		JMP 1 PNXC7TX		
214	240321	RP10A,	OAC REPXX		
	827112		DIO *XCD		
	600274		JMP RP10		
217	777777	REPAX,	--	/ADDRESS OF NEW THING TO DISPLAY	
220	240321		OAC REPXX	/SAVE RETURN ADDRESS	
	527113		DIO R*EP1	/SAVE ADDRESS OF THING TO NOT DISPLAY	
	230321		LID 1 REPXX	/GET INSTRUCTIONS	
	440321		ICX REPXX	/EORM PROPER EXIT ADDRESS	
224	673001		RCR 1S	/GET DISPLAY COMMAND	
	640400		SMA	/CONTINUE DISPLAYING\$	
	600336		JMP REP7	/NO, GO ERASE BUFFER	
	673003	REP2,	RCR 2S	/YES, SO GET NEXT COMMAND	
230	650400		SMA 1	/SHOULD THE LIGHT PEN BE CHANGED	
	600236		JMP REP4	/NO	
	027170		AND 1200000	/MASK OUT ALL BUT PEN COMMAND	
	047171		IOR 1400000		
234	671037		RAR 5S	/ALIGN WITH 340 COMMAND	
	240434		OAC PENSTS	/PUT IN PEN STATUS REGISTER	
	200217	REP4,	LAC REPAX	/NO, SO IS THERE ONE NEW ENTITY	
	640100		SZA		
240	600435		JMP RP12	/YES, SO PUT ON LIST	
	640100		SZA	/BUT FIRST BE SURE IT IS NOT DUPLICATED	
	440432	RP11,	IDX RPNT	/AND UPDATE POINTER	
	207113		LAC *REP1	/IS THERE ONE ENTITY TO DELETE\$	
244	650100		SZA 1		
	600274		JMP RP10	/NO	
	700350		LAW BPLY	/GET DISPLAY BUFFER ADDRESS	
	247114		OAC *NPNT	/SET A POINTER	
250	217114	RP9,	LAC 1 NPNT	/GET A DISPLAY ENTITY	
	607113		SAD REP1	/IS IT THE ONE TO BE DELETED\$	
	600257		JMP RPB	/YES	
	650100		SZA 1	/NO, BUT ARE WE AT END OF TABLES	
254	600274		JMP RP10	/YES, SO ALREADY DELETED	
	447114		ICX NPNT	/UPDATE POINTER	
	600250		JMP RP9	/AND GO BACK FOR NEXT ENTITY	
	207114	RP8,	LAC NPNT	/GET PRESENT POINTER	
260	247113		OAC REP1	/AND SAVE SO WE CAN MOVE	
	447114		IDX NPNT	/TABLE DOWN ONE ENTRY	
	217114		LAC 1 NPNT	/GET I+1 ENTRY	
	257113		OAC 1 REP1	/PUT IN I TH ENTRY	
264	650100		SZA 1	/AT END OF TABLE YETS	
	600271		JMP RP100	/YES	
	447114		ICX NPNT	/NO	
	447113		ICX REP1		
270	600262		JMP RPB+3	/GO BACK FOR REST OF TABLE	
	710001	RP100,	LAW 1 1		
	400432		ADD RPNT		

273	240432		DAC RPNT	/MOVE BACK ENTRY POINTER
274	721427	RPT0,	DSE	/HAS PREVIOUS DISPLAY STOPPED
	600300		JMP .+3	
	720225		DCF	
	600302		JMP .+3	
300	720227		DSS	
	600331		JMP REPBBK	/NO, SD CHECK IF TOO LONG
	710764	REPS,	LAW I 500.	
	247115		DAC REP9*9K	/RESET ERROR COUNTER
304	210433		LAC I NPNT	
	650100		SZA I	/HAS TABLE BEEN EXHAUSTED
	600322		JMP REP6	/YES, SO GO RESET
	240217		DAC REPAX	
310	210217		LAC I REPAX	
	827172		AND (-14002	
	840434		IOR PENSTS	
	250217		DAC I REPAX	
314	220217		LIO REPAX	
	440433		ICX NPNT	/UPDATE TABLE POINTER
	720025		DLA	/LOAD DISPLAY ADDRESS AND START
	227112		LIO XCD	
320	610321		JMP I .+1	
	600321	REPXX,	JMP .	/RETURN
	700350	REP6,	LAW BPLY	/INITIAL ADDRESS OF DISPLAY BUFFER
	240433		DAC NPNT	/RESET POINTER
324	100304		XCT REP5+2	/IS THERE ANYTHING TO DISPLAY
	640100		SZA	
	600307		JMP REP5+5	/YES
	227112		LID XCC	
330	610321		JMP I REPXX	/NO, SD RETURN
	227112	REPBBK,	LIO XCD	
	467115		ISP REP99K	
	610321		JMP I REPXX	/NORMAL RETURN
334	720225		DCE	
	600302		JMP REP5	/DISPLAY HAS STOPPED TOO LONG, SD ERROR
	700350	REP7,	LAW BPLY	
	260340		DAP .+1	
340	340000		OZM .-	
	440340		IDX .-1	
	527173		SAS (DZM BPLY+49.	
	600340		JMP .-3	
344	700350		LAW BPLY	/GET DISPLAY BUFFER ADDRESS
	240433		DAC NPNT	/RESET PICKUP POINTER
	240432		DAC RPNT	/RESET END OF LIST POINTER
	600227		JMP REP2	/CONTINUE
		BPLY,	REPEAT 50., 0	/DISPLAY BUFFER CONTAINS ADDRESSES OF SCOPE BUFFERS
432	600350	RPNT,	BPLY	/ADDRESS OF DISPLAY ENTITIES
	600350	NPNT,	BPLY	/POINTER TO NEXT OPEN REGISTER
434	600000	PENSTS,	0	/POINTER TO NEXT ITEM TO DISPLAY
	700350		0	/PEN STATUS (ENABLE OR DISABLE)
	247114	RP12,	LAW BPLY	/INITIALIZE POINTER
	217114		DAC NPNT	/TO START OF TABLE
440	500217		LAC I NPNT	/GET NEXT ENTITY
			SAC REPAX	/COMPARE TO NEW ENTITY

```

443 800243      JMP RP11+1      /ENTITY IS ALREADY BEING DISPLAYED
450100      SZA I      /ARE WE AT END OF TABLE
      800446      JMP .+3      /YES
444 447114      ICX NPNT      /GO LOOK AT NEXT ENTITY
      800437      JMP RP12+2      /CONTINUE
      200217      LAC REPAX      /NEW ENTITY
      250432      DAC I RPNTX      /SO ENTER IT INTO TABLE
450 800242      JMP RP11      /RETURN TO INDEX POINTER

```

/TAPE ROUTINES AND MACROS

/NOTE THAT 2=EVEN PARITY

/ 1=ODD PARITY  
/ 800 OCTAL MEANS 800 RPI  
/ 556 OCTAL MEANS 556 RPI  
/ 200 OCTAL MEANS 200 RPI

```

DEFINE REWIND UNIT
      LAW UNIT      /TAPE UNIT NUMBER
      DAC I IQCCOUNT+10000
      JSP I IQCCREW+10000

```

TERMINATE

```

DEFINE TAPWRT DENSITY,UNIT,PARITY,FIRST,LAST,ENDPOINT
REPEAT IIF VZ DENSITY=800,      LAW 2
REPEAT IIF VZ DENSITY=200,      CLA
REPEAT IIF VZ DENSITY=556,      LAW 1
      DAC I IQCCDEN+10000      /DENSITY {800,556,OR200}
      LAW UNIT      /UNIT NUMBER {0-7}
      OAC I IQCCOUNT+10000
      LAW PARITY      /PARITY (EVEN OR ODD)
      SUB I
      OAC I IQCCPAR+10000
      JSP T IQCCWR+10000
      FIRST      /ADDRESS OF START OF BLOCK
      LAST+1      /ADDRESS OF END OF BLOCK
      JSP BACTAP      /BAD TAPE RETURN
      ENDPOINT      /END OF TAPE RETURN

```

TERMINATE

```

DEFINE TAPRD DENSITY,UNIT,PARITY,FIRST,LAST,EDF
REPEAT IIF VZ DENSITY=800,      LAW 2
REPEAT IIF VZ DENSITY=200,      CLA
PEPEAT IIF VZ DENSITY=556,      LAW 1
      DAC I IQCCDEN+10000      /TAPE DENSITY
      LAW UNIT
      DAC I IQCCOUNT+10000      /TAPE UNIT NUMBER {0-7}
      LAW PARITY
      SUB I      /PARITY (ODD OR EVEN)
      DAC I IQCCPAR+10000
      JSP T IQCCRD+10000      /GO READ THE TAPE
      FIRST      /STARTING ADDRESS OF BLOCK
      LAST+1      /END ADDRESS OF BUFFER
      JSP BACTAP      /BAD TAPE RETURN
      EOF      /END OF FILE RETURN

```

TERMINATE

```

DEFINE TAPSPC DENSITY,UNIT,PARITY,NUM,EOF
REPEAT IIF VZ DENSITY=800,          LAW 2
REPEAT IIF VZ DENSITY=200,         LAW 0
REPEAT IIF VZ DENSITY=556,         LAW 1
OAC I (QQCDEN+10000                /TAPE DENSITY
LAW UNIT
OAC I (QQCUNT+10000                /TAPE UNIT NUMBER (0-7)
LAW PARITY
SUB I 1                             /TAPE PARITY
OAC I (QQOPAR+10000
JSP I (QQQSP+10000                /GO SPACE THE RECDRS
NUM                                /NUMBER OF RECORDS TO SPACE
JSP BADTAP                        /BAD TAPE RETURN
EOF                                /END OF FILE RETURN

```

TERMINATE

```

/ROUTINE FOR TYPING OUT CHARACTERS
/JDA TYPE WITH EXTENDED ADDRESS IN AC AND
/NUMBER OF CHARACTERS TO TYPE IN ID

```

451	777777	TYPE,	---	/EXTENDED ADDRESS
	200507		OAP T1	/PROGRAM COUNTER
	820511		OIO NUMBER	/NUMBER OF CHARACTERS
454	840510		DZM CDUNT	/NUMBER OF TYPED CHARACTERS
	710003		LAW I 3	
	240512		OAC M3	/SINCE 3 CHARACTERS PER WORD
	724074		EFM	
460	230451	T3,	LIO I TYPE	
	062077	T2,	RIL 6S	
	827116		DID B3*1M2	
	170550		JOA 9PT	
464	227116		LIO B31M2	
			PUNCH	
476	840510		IDX CDUNT	
	800511		SAD NUMBER	/TEST IF HAVE FINISHED TYPING
500	000507		JMP T1	/YES - LEAVE
	460512		ISP M3	/NO - TEST IF HAVE FINISHED WRD
	000461		JMP T2	/NO - CONTINUE
	440451		IDX TYPE	/YES - GO ON TO NEXT WRD
504	710003		LAW I 3	/YES - REPLACE MINUS 3
	240512		OAC M3	
	000460		JMP T3	
	000507	T1,	JMP ..	/LEAVE
510	777777	COUNTX,	---	
	777777	NUMBER,	---	
	777777	M3,	---	
	000000	DPT,	0	/DECIMAL POINT ROUTINE
514	247117		OAC OP*XXX	
	340547		OZM OPI	
	227176		LID (CHARACTER R-	
	200513	CP4,	LAC OPT	
520	040200		SPA	
	170550	DPO,	JDA 9PT	

S22	640200		SPA	
	761020	DP0,	CMA CHARACTER R0	
S24	240513		DAC DPT	
	240530	DP3,	DAC DP2	
	647177		MUL (11	
	867200		DIV (10.	
S30	000000	DP2,	0	
	520547		SAS DP1	
	000525		JMP DP3	
	063777		RCL 9S	
S34	663777		RCL 9S	
	450100		SZA I	
	200523		LAC DP0	
	663777		RCL 9S	
S40	663777		RCL 9S	
	100521		XCT DP0	
	200530		LAC DP2	
	800513		SAD OPT	
S44	617117	DPX,	JMP I DPXxx	
	240547		DAC DP1	
	000517		JMP DP4	
	000000	DP1,	0	
S50	000000	9PT,	0	
	260401		DAP 9PX	
	710770		LAW I 770	
	673077		RCR 6S	
S54	227201		LID (252002	
	673777		RCR 9S	
	260557		DAP .+1	
	672000		RIR	
S60	042000		SPI	
	020552		AND 9PT+2	
	063777		RCL 9S	
	663077		RCL 6S	
S64	100123		XCT ID	
S73	720033	ZZGF,	REPLAY 1,0	/DISABLE THE DISPLAY
S74	663777		CKS	
	027202		RCL 9S	
	627202		AND (120	
	000505		SAS (120	
	200550		JMP ZZGF	/KEEP DISPLAY GOING
600	600000		LAC 9PT	
		9PX,	JMP	

```

/SUBROUTINE TO RESPOND TO AN INPUT
/ENTRY BY A JDA RESPOND WITH 0 IN AC IF LIGHTPEN, 1 IF BUTTONS
/RDUTINE EXITS N LOCATIONS AFTER THE JSP AS FOLLOWS
/ 0= NO RESPONSE
/ 1= LIGHT PEN /NEXT FILE
/ 2= LIGHT PEN /CONTINUE
/ 3= LIGHT PEN /TYPE OUT TITLE
/ 4= LIGHT PEN /TYPE IN TITLE

```

```

/ 5= LIGHT PEN           /CHANNEL
/ 6-7-8-9= LIGHT PFN   /CHANNEL NO. (1,2,3,4)
/ 10= LIGHT PEN        /FRAME
/ 11= LIGHT PEN        /SLOW
/ 12= LIGHT PEN        /MODERATE
/ 13= LIGHT PEN        /FAST
/ 14= LIGHT PEN        /THIS FILE
/ 15= LIGHT PEN        /CURVE
/ 16= LIGHT PEN        /DOCUMENT
/ 17= LIGHT PEN        /HISTOGRAM
/ 18= LIGHT PEN        /A NAME
/ 19= LIGHT PEN        /TRACE
/ 20= LIGHT PEN        /A LIMIT
/ 1 CONSOLE BUTTON     /REDEFINE
/ 2 CONSOLE BUTTON     /DELETE
/ 3 CONSOLE BUTTON     /NAME
/ 4 CONSOLE BUTTON     /UPPER
/ 5 CONSOLE BUTTON     /LOWER
/ 6 CONSOLE BUTTON     /STOP
/ 7 CONSOLE BUTTON     /THEORETICAL
/ 8 CONSOLE BUTTON     /LIMITS
/ 9 CONSOLE BUTTON     /TIME
/ 10 CONSOLE BUTTON    /PROCEED
DEFINE RESPOND WHICH,NONE,A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11,A12,A13,A14,A15,
ZZ, LAW WHICH          /0=LIGHT PEN, 1=BUTTON
DEFINE PASS A
REPEAT IIF P, REPEAT IIF VZ A+0, JMP A
/LEGAL RESPONSE, SO EXIT ACCORDINGLY.
REPEAT IIF P, REPEAT IIF VZ A+0, JMP ZZ+2
/ILLEGAL RETURNS ARE TREATED AS 'NO RESPONSES'.
REPEAT IIF P, #
/ZERO INSERTED ON PASS 1 TO KEEP LOCATION COUNTER HAPPY
TERMINATE PASS
IRP B,,NONE,A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11,A12,A13,A14,A15,A16,A17
PASS B
ENDIRP
EQUALS PASS,NULL
TERMINATE

```

```

602 877777
    247120
804 200002
    040200
    741000
    247121
410 207121
    027200
    040200
    000635
614 027203
    040200
    000645
    027204

```

```

PRID, .-.
      OAC *PRIX
      LAC PRID
      SPA
      CMA
      OAC *PRAA
      LAC PRAA
      SUB (10.
      SPA
      JMP PR10
      SUB (90.
      SPA
      JMP PR100
      SUB (900.

```

620	840200		SPA		
	800647		JMP PRI000		
	200602		LAC PRI0		
	547177		MUL I1		
624	967205		OIV I1000.		
	740000		NOP		
	827123		DIO *PRIS		
	170513		JDA DPT		
630	207122		LAC PRIS		
	640200		SPA		
	741000		CMA		
	240602		DAC PRI0		
636	400604		JMP PRI0+2		
	420651	PR10,	JSP PRSG		
	227206		LIO I20		
	170550		JDA 9PT		
640	227206		LIO I20		
	170550		JDA 9PT		
	207121		LAC PRAA		
	170513		JDA DPT		
644	617120		JMP I PR1X		
	620651	PR100,	JSP PRSG		
	600640		JMP PRI0+3		
	620651	PR1000,	JSP PRSG		
	600642		JMP PRI0+5		
650					
651	260661	PRSG,	DAP .+0.		
	200602		LAC PRID		
	440400		SMA		
654	600657		JMP .+3		
	227176		LIO ICHARACTER M-		
	170550		JDA 9PT		
	227207		LIO ICHARACTER R.		
660	170550		JDA 9PT		
	400000		JMP .-.		
662	877777	TESPOND,			-. /0= LIGHT PEN, 1= BUTTON
	241173		DAP RESPOX		/SAVE RETURN ADDRESS
664	200662		LAC TESPOND		/GET CODE FOR WHAT TO CHECK
	640100		SZA		/LIGHT PEN OR BUTTNS
	601174		JMP BUTTO		/BUTTNS
	720127	CANE,	DSP		/LIGHT PEN BREAKS
670	601173		JMP RESPOX		/NOT A LIGHT PEN INTERRUPT
	720126		ORC		/SAVE COORDINATES
	320122		OIO XYNOW		/OF POINT JUST SEFN.
	720026		ORA		/GET ADDRESS
674	720225		OCF		/CLEAR ALL THE FLAGS
	720125		ORS		/AND NOW RESUME THE DISPLAY.
	443777		RCL 95		
	443777		RCL 95		
700	427177		SUB I1		
	247123		DAC R*ESPP		/SAVE THE TABLE ADDRESS

```

DEFINE TESTN A,B,C
LAC RESPP
SUB IA
SMA I
JMP .+7
ADD IA
SUB IB
SZM
JMP .+3
LID IC
JMP GONOW

TERMINATE

TESTN DATA,DATA+200R.,17.
TESTN CHANNELS,CHANNELS+5,5
TESTN CHANNELS 5,CHANNELS 6,6
TESTN CHANNELS 6,CHANNELS 7,7
TESTN CHANNELS 7,CHANNELS 8.,8.
TESTN CHANNELS R.,CONTINUE,9.
TESTN CONTINUE, NEXTFILE,2
TESTN NEXTFILE,TYPDUT,1
TESTN TYPDUT,TYPIN,3
TESTN TYPIN,THISFILE,4
TESTN THISFILE,DOCUMENT,14.
TESTN DOCUMENT,FRAME,16.
TESTN FRAME, SLOW,10.
TESTN SLOW,MODERATE,11.
TESTN MODERATE,FAST,12.

TESTN FAST,INFO,13.
TESTN TRACE,THYTB,19.
TESTN LIMITS,LIMITS+8*19.,20.

1166 764000
      663777
1170 663777
      601173
      241173
      601173
1174 762200
      663777
      663777
      760200

GONOW, RCL 9S /GET EXIT CODE
        RCL 9S
        ADD RESPOX /INDEX EXIT ADDRESS
        DAC RESPOX /FORM RETURN ADDRESS
RESPDX, JMP - /RETURN
BUTTD, LAT
        RCL 9S
        RCL 9S
        CLA
DEFINE TEST A
RIR IS
SPI
LAW A
JMP GGNDW

TERMINATE TEST 1 /T.W. 17 = REDEFINE
          TEST 2 /T.W. 16 = DELETE
          TEST 3 /T.W. 15 = NAME
          TEST 4 /T.W. 14 = UPPER
          TEST 5 /T.W. 13 = LOWER

```

1250 611173  
1251 401173  
241173  
611173

TEST 6 /T.W. 12 = STOP  
TEST 7 /T.W. 11 = THEORETICAL  
TEST 8. /T.W. 10 = LIMITS  
TEST 9. /T.W. 9 = TIME  
TEST 10. /T.W. 8 = PROCEED  
/T.W. 7=OUTPUT OPTION  
/T.W. 6 = SKIP FRAME  
JMP I RESPOX /NO RESPONSE  
EQUALS TEST, NULL  
GGNOW, ADO RESPOX /A BUTTON WAS DOWN  
OAC RESPOX /SO FORM RETURN ADDRESS  
JMP I RESPOX /AND EXIT  
START

```

BASELINE 2
DEFINE   DPR SUBR
        OAC I (SURR
        JSP I (SURR+1
TERMINATE
/JSP 'CALCUL'
1254  262520
      201562
      650100
      602150
1260  761000
      241735
      1263  207256
      1264  431563
          547177
          567124
          760000
1270  401532
      241533
      1273  211563
      1274  431564
          547177
          567124
          760000
1300  407177
      761000
      241734
      761000
1304  651600
      400125
      027257
      240125
1310  641000
      440126
      1312  231533
      207260
      1316  211533
          651533
          672001
1320  021535
      241536
          541537
1324  841540
CALCUL,  OAP RETURN /PROGRAM COUNTER
          LAC N /NO. SETS TO PROCESS IN TRACE
          SZA I /TEST IE HAVE BEEN SET
          JMP THOR /NO-GO TO THEORETICAL
          CMA /YES-COMPLIMENT
          OAC NN /FOR INOEXING LATER
NSEC,    REPLAY I,2 /KEEP DISPLAY GOING
          LAC (SCTOSC /FIRST Y VALUE ON SCOPE
          SUB I Y /HIGH Y LIMIT
          MUL (I
          DIV B*CBY
          NOP
          ADD W7 /ADDRESS OF 1ST X VALUE
          OAC COUNTER /BEGINNING OF DESIRED X VALUES
          REPLAY I,2 /KEEP DISPLAY GOING
          LAC I Y
          SUB I Y+I /NO. PTS. W/I LIMITS
          MUL (I
          DIV POBY
          NOP
          ADD (I /WANT INCLUSIVE SECTION
          CMA
          DAC NUM /FOR INOEXING LATER
          CMA
          CLO
          ADD TOTAL /TOTAL NO. OF X SUB I
          ANO (377777
          DAC TOTAL /LOW OROER REGISTER
          SZO
          ICX TOTAL+1 /HIGH OROER REGISTER
LOOP,    LIO I COUNTER /X SUB I VALUE
          LAC (SX /ADDRESS OF SUM X SUB I
          DPR DAD /DOUBLE PRECISION ADD
          LAC I COUNTER
          MUL I COUNTER /X SUB I SQUARED
          RIR IS /EIX SIGN BIT
          DIO TEMP1 /LOW OROER
          OAC TEMP1+1 /HIGH OROER
          DZM TEMP1+2
          DZM TEMP1+3

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1325	341541		DZM TEMP2	
	341542		DZM TEMP2+1	
	341543		DZM TEMP2+2	
1330	341544		DZM TEMP2+3	
	207263		LAC (SX5	/ADDRESS OF CUMULATIVE X SQ.
	227264		LID (TEMP1	/ADDRESS OF SQUARED VALUE
			DPR DDAD	/4 REGISTER PRECISION ADD
			REPLAY 1,2	/KEEP DISPLAY GOING
1336	211533	LDDP1,	LAC I COUNTER	
	450200		SPA I	
1340	401344		JMP .+4	
	407177		ADD (I	
	450100		SZA (	
	401346		JMP .+3	
1344	100124		XCT GRANULE	/SHIFT INSTRUCTION TO THE RIGHT
	440200		SPA	
	427177		SUB (I	
	241535		DAC TEMP1	
1350	440200		SPA	
	741000		CMA	
	427267		SUB 1457.	/MAXIMUM POSSIBLE FOR
	440500		SZM	/SCOPE DISPLAY
1354	417270		JMP I (RESET+10000	
1355	201535		LAC TEMP1	/CORRECT X VALUE
	465001		SAL 15	/SINCE DOUBLE PRECISION
	407271		ADD (ZLOC	
			DPR DINDEX	/TO GET DOUBLE PRECISION INDEX
1362	441533		IDX COUNTER	/TO NEXT X SUB (
	441734		ISP NUM	/TEST IF HAVE FINISHED
1364	401312		JMP LDCP	/NO-CONTINUE
	441735		REPEAT 2,	IDX Y     IDX Y+1
	401262		ISP NN	/TEST IF HAVE FINISHED TRACE
			JMP NSEC	/NO-DO NEXT SECTION
			REPLAY 1,2	/KEEP DISPLAY GOING
1374	207274		LAC (YXYXL	
	241563		DAC Y	
	207275		LAC (YXYXL+1	
	241564		DAC Y+1	
1400	200133		LAC SX	/LDW ORDER PART
	547205		MUL (1000.	/FDR ACCURACY
	472001		RIR 15	
	820117		DID MU	
1404	240120		DAC MU+1	
	200134		LAC SX+1	/HIGH ORDER PART
	547205		MUL (1000.	
	467777		SCL 95	
1410	467377		SCL 85	/CANNOT BE MORE THAN 1 REGISTER

1411	000120		ADD MU+1	
	240120		DAC MU+1	/HAVE SX-1000. IN MU NOW
1413	207276		LAC (ML	
1414	227277		LID (TOTAL	
			DPR DPCIV	
1417	240117		DAC MU	
1420	320120		CID MU+1	/AVERAGE TIMES 1000.
	200125		LAC TOTAL	
	427177		SUB (1	
	241535		DAC TEMP1	
1424	040200		SPA	
	001522		JMP BORROW	
	200126		LAC TOTAL+1	
	241536		DAC TEMP1+1	
1430	207260	TP,	LAC (SX	
	227260		LID (SX	
			DPR DMUL	/4 REGISTER PRODUCT
			TEMP2	/ADDRESS OF PRODUCT
1434	001541		LAC (TEMP2	/ADDRESS OF LOW ORDER PART
	207304		LID (TOTAL	/ADDRESS OF LOW ORDER PART
	227277		DPR DPCIV4	
1441	001541		TEMP2	
	701541		LAW TEMP2	
	201445		DAP .+2	
1444	201447		DAP .+3	
	200000		LAC .-	
	161000		CMA	
	240000		DAC .-	
1450	441447		IDX .-1	
	441445		IDX .-4	
	927307		SAS (LAC TEMP2+4	
	001445		JMP .-6	
1454	227263		LID (SXS	
	207304		LAC (TEMP2	/ADDRESS OF LOW ORDER PART 4 REG. NO.
			DPR DDAD	/4 PRECISION ADDITION
		A,,	IRP A,,0,1,2,3*	
			LAC TEMP2+A	
			DAC I (MAC 10000+4+A	
			ENDIRP	
1460	201541	0,	LAC TEMP2+0	
	257310		DAC I (MAC 10000+4+0	
	201542		1,	LAC TEMP2+1
	257311		DAC I (MAC 10000+4+1	
1464	201543		2,	LAC TEMP2+2
	257312		DAC I (MAC 10000+4+2	
	201544		3,	LAC TEMP2+3
	257313		DAC I (MAC 10000+4+3	
1470	110012		LAW I 10.	
	247135		DAC FLIPF	
	037314		JSP 1 (XSHIFT+10000	
	407135		ISP FLIPF	
1474	001472		JMP .-2	
		A,,	IRP A,,0,1,2,3*	
			LAC I (MAC+10000+4+A	
			DAC TEMP2+A	
			ENDIRP	
1475	217310	0,	LAC I (MAC+10000+4+0	
	241541		DAC TEMP2+0	
	217311		1,	LAC I (MAC+10000+4+1
1500	241542		DAC TEMP2+1	

217312  
241543  
217313  
1504 241544  
287384  
227264

1513 200121

2, LAC I {MAC+10000+4+2  
DAC TEMP2+2  
3 LAC I {MAC+10000+4+3  
DAC TEMP2+3  
LAC {TEMP2  
LIO {TEMP1  
DPR DPR1VF+10000 /QUOTIENT IN AC  
DPR SORT /GET STANDARD DEVIATION FROM VARIANCE  
LAC SIGMA

```

1514 647321          MUL (31.
      867177          OIV (1
      700000          NOP
      240121          OAC SIGMA
1521 601742          REPLAY 1,2      /KEEP OISPLAY GOING
                                      /TO LOAD BUFFER FOR HISTOGRAM OISPLAY
      JMP COMPUTE
1522 807171          BORROW, ACO (400000      /BORROW FORM HIGH ORDER
      241535          OAC TEMP1
1524 710001          LAW I 1
      800126          ADO TOTAL+1
      241536          OAC TEMP1+1
      801430          JMP TP

/TO CALL'. JSP CALCUL
/ RETURN
/
/
/INITIALLY'. SX SET TO ZERO ',REGISTER WITH SUR XI
/ SXS SET TO ZERO ',REGISTER WITH SUB (X12)
/ TOTAL SET TO ZERO ',TOTAL NUMBER OF PTS. IN SAMPLE
/
/
/INPUT'. N NUMBER OF SETS OF LIMITS
/ YH1 HIGH Y LIMIT
/ YL1 LOW Y LIMIT
/ YH2
/ HL2
/ THROUGH
/ YHN
/ YLN
/
/
/OUTPUT'. CUMMULATIVE STO. DEV. IN REGISTER 'SIGMA'
/ CUMMULATIVE FREOUENCFY CURVE IN BUFFER
/ AREA 'TABLE' PLUS NEXT 18300 LOCATIONS
/ WITH BASELINE FREOUENCFY AT LOCATION
/ 'ZLOC' WHICH IS IN MIOOLE OF TABLE.
/
/
/FORMULAS'. SIGMA=SO. RT. ((SUM X SUB 1 SO.--(SUM X SUB 1' SUM X SUB 11/N)/{(N-IISO
/ SO.RT.(Y) * (Y/AN - AN)/2

/LOCATIONS AND CONSTANTS
      010000          MODULE=10200
1530 030002          W3, 30002
      030003          W4, 30003
      030006          W7, 30006
1534 777777          COUNTER,
      777777          TEMP, -. -.
      777777          TEMP1, -. -.
      777777          TEMP1+1,
      '

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1537 777777 TEMP1+2,      .--
1540 777777 TEMP1+3,      .--
      777777 TEMP2,        .--
      777777 TEMP2+1,     .--
      777777 TEMP2+2,     .--
      777777 TEMP2+3,     .--
1544 000207 SAVEY,      000207 /STARTING Y COORDINATE
      000066 SAVEX,      000066 /STARTING X COORDINATE
      031083 PTHISTD,     DATA+3 /BUFFER FOR DISPLAYING HISTOGRAM
1550 020325 PTRACE,     TRACE+3 /BUFFER FOR DISPLAYING TRACE
      021151 TTBL,       THYTBLL+3 /BUFFER FOR DISPLAYING THEORETICAL
      777777 SAVEXX,     .--
1554 777777 SAVEYY,     .--
      777777 DX,         .--
      777777 DY,         .--
      777777 DY+1,      .--
      777777 DDY,       .--
1560 777777 RRR,        .--
      777777 NNN,       .--
      000000 N,          0 /NUMBER OF LIMIT SETS
      001572 Y,          YXYXL
1564 001573 Y,          YXYXL+1
      001623 K915,      915.
      000000 K915+1,    0
      001274 K700,      700.
1570 000000 K700+1,    0
      777777 COUNT,     .--
      YXYXL REPEAT 20., 0 /TRACE LIMIT PAIRS

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/COORD. SUBR, HISTO BUFFER, THEORY BUFFER, AND TRACE BUFFER SET
/TO COMPUTE INCREMENTS IN MINOR COORDINATE WITH WHOLE
/STEP INCREMENTS IN MAJOR COORDINATE AND FINAL STEP
/INCREMENTS FOR BOTH TO COMPLETE THE VECTOR
/'JSP COORD' WITH X DIFFERENCE IN 'MIN' AND Y DIFFERENCE
/IN 'MAJ'

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1616 261704 COORD,     DAP RTN      /PROGRAM COUNTER
      341741      DZH SW
1620 201733      LAC MIN
      040200      SPA
      701000      CMA
      241736      DAC R      /ABSOLUTE VALUE OF DIFFERENCE
1625 201732      REPLAY 1,2
      040200      LAC MAJ
      701000      SPA
1630 421736      CMA
      040200      SUB R
      001705      SPA      /TEST WHICH IS LARGER
      001705      JMP SWITCH /X IS
1633 201732 COORD01,  LAC MAJ
1634 047177      MUL 11      /SET UP FOR DIVISION

```

1635	867322		OIV (177	/WHOLE STEP
	760000		NCP	
	821736		OID R	/INCREMENT IN PARTIAL STEP FOR MAJ
1640	850100		SZA I	/TEST IE NEED WHOLE STEP
	601713		JMP STEPS	/NO-SET UP EDR ONLY PARTIAL
	640200		SPA	
	761000		CMA	
1644	241734		DAC NUM	/NUMBER OF WHOLE STEPS
	741000		CMA	
	241735		OAC NN	/FDR INDEXING
			REPLAY 1,2	
1650	201733	LAC MIN		
	841736		MUL R	
	861732		DIV MAJ	
	760000		NCP	
1654	241740		OAC RP	/INCREMENT IN PARTIAL STEP FOR MIN
	761000		CMA	
	801733		ACD MIN	
	847177		MUL (1	
1660	501734		DIV NUM	
	760000		NCP	
	640400		SMA	
	601666		JMP +3	
1664	761000		CMA	/TO GET MAGNITUDE
	847323		ICR (200	/PUT IN MINUS SIGN
	241737		DAC W	
	201740		LAC RP	
1670	640400		SMA	
	601674		JMP +3	
	761000		CMA	/TO GET MAGNITUDE
	847323		ICR (200	/PUT IN MINUS SIGN
1674	241740		DAC RP	
	201736		LAC R	
	640400		SMA	
	601703		JMP +4	
1700	761000		CMA	/TO GET MAGNITUDE
	847323		ICR (200	/PUT IN MINUS SIGN
	241736		DAC R	
			REPLAY 1,2	/KEEP DISPLAY GOING
1704	601704	RTN,	JMP ..	/BACK TO PROGRAM
1705	201732	SWITCH,	LAC MAJ	/SO HAVE LARGER DIFFERENCE
	221733		LID MIN	/IN VARIABLE CALLED MAJ
	241733		DAC MIN	/AND SMALLER INCREMENT IN
1710	821732		DIO MAJ	/VARIABLE CALLED MIN
	841741		IDX SW	/SO KNOW THAT HAVE SWITCHED
	601633		JMP COORD1	
1713	841735	STEPS,	DZM NN	/NO WHOLE STEPS
1714	841734		DZM NUM	
	201732		LAC MAJ	
	640400		SMA	

1712	601722	JMP	+3		
1720	741000	CMA			/TO GET MAGNITUDE
	647323	IDR	(200		/MINUS SIGN
	241736	DAC	R		
	201733	LAC	MIN		
1724	440400	SMA			
	401730	JMP	+3		
	741000	CMA			/TO GET MAGNITUDE
	647323	IDR	(200		/MINUS SIGN
1730	241740	DAC	RP		
	401704	JMP	RTN		/BACK TO PROGRAM
1732	777777	MAJ,	.-.		/LARGER INCREMENT
	777777	MIN,	.-.		/SMALLER INCREMENT
1734	777777	NUM,	.-.		/NUMBER OF WHOLE STEPS
	777777	NN,	.-.		/-NUMBER OF WHOLE STEPS, FOR INOXING
	777777	R,	.-.		/INCREMENT IN MAJ. DIR. IN PARTIAL STEP
	777777	M,	.-.		/INCREMENT IN MIN. DIR. IN WHOLE STEP
1740	777777	RP,	.-.		/INCREMENT IN MIN. DIR. IN PARTIAL STEP
	000000	SW,	0		/0 IF Y=MAJ, X=MIN OR 1 IF Y=MIN, X=MAJ
		/LOADS BUEER FOR HISTOGRAM INTO MODULE 3			
1742	447324	COMPUTE,		JSP I (TABTEST	/FIND RANGE OF BUFFER
	201534	LAC	TEMP		
1744	445001	SAL	15		
	407177	ADD	(1		
	701000	CMA			
	241533	DAC	COUNTER		/NO. OF STEPS
1750	461000	CMA			
	647205	MUL	(1000.		/FOR ACCURACY
	647325	OIV	(915.		/NO. HORIZONTAL INCREMENTS ON SLOPE
	460000	NDP			
1754	241554	DAC	DX		/FACTOR FOR X
	207326	LAC	(DATA+3		
	241547	DAC	PTHISTD		
		REPLAY	1,2		/KEEP DISPLAY GOING
1760	217327	LAC	I (MAXIMUM		/LOW ORDER BITS OF Y(MAX)
	447205	MUL	(1000.		
	672001	RIR	15		/SET SIGN BIT
	021535	OIO	TEMP1		
1764	241536	DAC	TEMP1+1		
	217330	LAC	I (MAXIMUM+1		/HIGH ORDER BITS OF Y(MAX)
	447205	MUL	(1000.		
	407777	SCL	95		
1774	407377	SCL	85		
	401636	ADD	TEMP1+1		
	241536	DAC	TEMP1+1		
	207244	LAC	(TEMP)		
1774	227331	LIO	(K700		/POSSIBLE INCREMENTS IN Y
		OPR	OPOIV		
1778	241555	DAC	OY		/DOUBLE PRESIDN

2000	021556	DID DY+1	/FACTDR EDR Y
		REPLAY 1,2	/KEEP DISPLAY GDING
2002	207205	LAC (I000.	
	047177	MUL (1	
2004	561554	DIV DX	
	760000	NDP	
	047177	MUL (1	/SINCE INCREMENT IN
	067322	DIV (177	/X WILL ALWAYS BE THE SAME
2010	760000	NDP	
	021560	DID RRR	/CONSTANT DIFFERENCE IN X DIRECTION
	040100	SZA	
	761000	CMA	
2014	241561	DAC NNN	
	041553	DZM SAVEYY	
		LDDP2, REPLAY 1,2	
2017	201534	LAC TEMP	
2020	005001	SAL TS	/SINCE DOUBLE PRECISION
	761000	CMA	
	007271	ADD (ZLDC	
	227332	LID (KI000	
		DPR DMUL	
2026	001535	TEMP1	
	201536	LAC TEMP1+1	/TEST IF NEED TO DO DOUBLE PRECISION
2030	040100	SZA	/DIVIDE - IF NOT, DISPLAY WILL BE
	002037	JMP .+6	/COMPLETED MUCH FASTER
	201535	LAC TEMP1	
	047177	MUL (1	
2034	561555	DIV DY	
	002037	JMP .+2	
	002043	JMP .+5	
	207264	LAC (TEMP1	
2040	227333	LID (DY	/ADDRESS OF HIGH MANTISSA
		DPR DPDIV	
2043	021553	SUB SAVEYY	/INTERESTED IN DIFFERENCE
2044	241535	DAC TEMP1	/Y DIFFERENCE
	001553	ADD SAVEYY	
	241553	DAC SAVEYY	/SAVE EDR NEXT DIFFERENCE
	201535	LAC TEMP1	
2050	047177	MUL (1	/SET UP EDR DIVISION
	067322	DIV (177	/HOW MANY WHOLE STEPS
	760000	NDP	
	021736	DID R	
2054	050100	SZA I	
	002075	JMP STEP	
	040400	SMA	
	761000	CMA	
2060	241735	DAC NN	/FOR INDEXING
	700177	LAW 177	
	221535	LID TEMP1	
	042000	SPI	

2064	047323		IOR 1200	/MINUS SIGN
	047334		IOR 1400	/INTENSITY
	764000		CLI	
	477777		SCR 95	
2070	677001		SCR IS	
	831547		DIO I PTHISTO	
	041547		IDX PTHISTO	
	061735		ISP NN	/NO. OF WHOLE STEPS
2074	602071		JMP .-3	
2075	201736	STEP,	LAC R	/PUT IN PARTIAL STEP
	650100		SZA I	
	602110		JMP .+9.	
2100	040400		SPA	
	602104		JMP .+3	
	761000		CMA	
	047323		IOR 1200	/MINUS SIGN
2104	047334		IOR 1400	/INTENSITY
	065377		SAL 85	
	251547		DAC I PTHISTO	
	041547		IDX PTHISTO	
			REPLAY I,2	/KEEP DISPLAY GOING
2111	201561		LAC NNN	/NUMBER OF WHOLE STEPS IN X DIRECTION
	650100		SZA I	
	602122		JMP STEP1	
2114	247125		DAC *VARN	
	227335		LTO 1200177	/WHOLE STEPS IN X
	831547		DIO I PTHISTO	
	041547		IDX PTHISTO	
2120	067125		ISP VARN	/NUMBER OF WHOLE STEPS
	602116		JMP .-3	
2122	201560	STEP1,	LAC RRR	/PARTIAL STEP OVER IN X DIRECTION
	650100		SZA I	
2124	602130		JMP .+4	
	047170		IOR 1200000	/INTENSITY BIT
	251547		OAC I PTHISTO	
	041547		IDX PTHISTO	
2130	710001		LAW I 1	
	001534		ADD TEMP	
	241534		DAC TEMP	
	041533		ISP COUNTER	/TEST IF HAVE DONE ALL PTS
2134	602016		JMP LOOP2	/NO-CONTINUE
2135	201553		LAC SAVEYY	
	040200		SPA	
	761000		CMA	
2140	047336		IOR 11000	
	061377		RAL 85	
	251547		DAC I PTHISTO	
	041547		IDX PTHISTO	
2144	703000		LAW 3000	/STOP CODE

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2146 251547      OAC I PTHISTO
      437324      JSP I (TARTEST
                  REPLAY 1,2      /KEEP DISPLAY GOING

/BUFFER FOR THEORETICAL CURVE IN MOOULE 2

2151 207337      THOR,  REPLAY 1,2
      241551      LAC (THYTRL+3
                  OAC TTBL

2153 200104      LAC THEORY
2154 450100      SZA I      /TEST THEOR. BUTTON STATUS
      402352      JMP CTRACE /NOT PUSHEO DOWN
      200101      LAC FLIPFLOP /CN-CHECK IF HAVE CALCULATED YET
      440100      SZA      /TEST IF HAVE CALCULATED VALUES
2160 402352      JMP CTRACE /YES, GO ON TO TRACE BUFFER

2161 440101      CALCU, IOX FLIPFLOP
2162 541553      OZM SAVEYY /SO WON'T CALCULATE TWICE
      437324      JSP I (TARTEST /INITAIL Y COORINATE

                  REPLAY 1,2      /KEEP DISPLAY GOING

2165 200117      LAC MU      /AVERAGE
2170 547205      OPR EXP /TO GET GRESTEST POSSIBLE Y VALUE
      507342      MUL (I000. /SET UP FOR DIVISION
      760000      DIV (700. /POSSIBLE INCREMENTS IN Y DIRECTION
      241555      NOP
2174 200124      OAC OY      /FACTOR FOR Y SCALE
      427343      LAC GRANULE
      242202      SUR (6000 /CREATE DEGRANULATOR
      221534      OAC INS
2200 402001      LIO TEMP
      740200      RIL IS
      777777      CLA
2204 467001      INS,  .-. /DEGRANULATE
      241536      SCL IS
      472001      OAC TEMP1+1
      521535      RIR IS
      201535      OIO TEMP1
2210 451600      LAC TEMP1
      407227      CLO
      027251      ADQ (2
      241535      ANQ (377777
2214 441000      OAC TEMP1
      441536      SZO
      201535      IOX TEMP1+1
      547205      LAC TEMP1
2220 472001      MUL (I000.
      021535      RIR IS
      241537      OIO TEMP1
      201536      OAC TEMP1+2
                  LAC TEMP1+1

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2224	547205	MUL (1000.	
	467777	SCL 95	
	467377	SCL 85	
	401537	ADD TEMP1+2	
2230	241536	DAC TEMP1+1	
	207264	LAC (TEMP1	
	227344	L10 1K915	
		DPR DPDIV	
2235	241535	OAC TEMP1	/INCREMENT EACH TIME
	764000	CLI	
	201534	LAC TEMP	
2240	102202	XCT INS	/LARGEST VALUE
	547345	MUL 1-1000.	
	472001	RIR 15	
	321541	O10 TEMP2	/MOST NEG. NUMBER * 1000.
2244	201541	LAC TEMP2	
	427346	SUB (500.	
	241541	DAC TEMP2	
	700001	LAW 1	
2250	241733	DAC MIN	/X ALWAYS SAME
	541571	D2M COUNT	
	341741	D2M SW	
		NEXTPT, REPLAY 1,2	/KEEP DISPLAY GOING
2254	700001	LAW 1	
	241733	DAC MIN	
	201535	LAC TEMP1	
	541571	MUL COUNT	
2260	567177	DIV 11	/TO GET INTD AC COMPLIMENTED
	760000	NOP	
	401541	ADD TEMP2	/NOW HAVE X VALUE
		DPR EXP	
2265	547205	MUL (1000.	
	541555	DIV DY	/TO GET COORD.
	760000	NOP	
2270	421553	SLB SAVEYY	/TO GET DIFFERENCE
	241732	DAC MAJ	
	401553	ADD SAVEYY	
	241553	DAC SAVEYY	/TO GET NEXT DIFFERENCE
2274	421616	JSP COORD	
	201741	LAC SW	
	440100	SZA	/TEST WHICH IS LARGER
	402345	JMP XMAX	/X IS
2300	201735	LAC NN	/Y IS-CONTINUE
	450100	SZA 1	/TEST IF ANY WHOLE STEPS
	402320	JMP STEP2	/NO-GO DO PARTIAL
	700177	LAW 177	/YES-PUT THEM IN

2304	221732		L10 MAJ	
	042000		SPI	
	047323		IOR 1200	/MINUS SIGN
	047334		ICR 1400	/INTENSITY BIT
2310	065377		SAL B5	
	047161		IOR 10	/X INCREMENT FOR Y WHOLE STEPS
	077777		SCR 95	
	077777		SCR 95	
2314	231551		OIO 1 TTBL	
	041551		IOX TTBL	
	061735		ISP NN	/TEST IF HAVE MORE WHOLE STEPS
	002314		JMP -3	/YES DO AGAIN
		STEP2,	REPLAY 1,2	/NOW DO PARTIAL STEP OVER
2321	201736		LAC R	
	047334	SKEP2,	IOR 1400	/INTENSITY BIT
	065377		SAL B5	
2324	047177		IOR 11	
	251551		DAC 1 TTBL	
	041551		IOX TTBL	
	041571		IOX COUNT	
2330	027325		SAS 1915.	/TEST IF HAVE FINISHED
	002253		JMP NEXTPT	/NO-DO NEXT POINT
2332	710001	ENDUP,	LAW 1 1	/YES - FINISH UP
	001551		ADD TTBL	
2334	241551		DAC TTBL	
	211551		LAC 1 TTBL	/PICK UP LAST WORD AND PUT IN
	047171		IOR 1400000	/ESCAPE BIT
	251551		DAC 1 TTBL	
2340	041551		IOX TTBL	
	703000		LAW 3000	/STOP CODE
	251551		DAC 1 TTBL	
			REPLAY 1,2	/KEEP DISPLAY GOING
2344	002352		JMP CTRACE	/NEXT BUFFER AREA
		XMAX,	REPLAY 1,2	/KEEP DISPLAY GOING
2346	201740		LAC RP	
	002322		JMP SKEP2	
2350	001750	K1000,	1000.	
	000000		0	/TWO REGISTER CONSTANT

/ROUTINE TO SET UP BUFFER FOR TRACE DISPLAY IN MODULE 2

2352	231530	CTRACE,	CMA	LAC I W3	/NO. OF PTS. IN TRACE
	701000		OAC COUNTER		
2354	241533		CMA	/FOR INDEXING	
	701000		MUL (1200.	/FOR ACCURACY	
	607205		OIV 1850.	/NO. OF INCREMENTS IN AREA OF SCOPE	
2360	607347		NOP		
	700000		OAC ODY	/FACTOR FOR Y	
	241557		LAC (TRACE+3		
	207350		OAC PTRACE		
2364	241550		OZM SW		
	501741				
			REPLAY 1,2	/KEEP DISPLAY GOING	
2366	700001		LAW 1		
	647205		MUL (1200.	/Y INCREMENT CONSTANT	
2370	601557		OIV ODY	/FACTOR FOR BOTH SCALES WILL BE	
	700000		NOP	/THE SAME - SET IT USING Y	
	247124		OAC BORY		
	701000		CMA	/SINCE WILL ALWAYS BE NEGATIVE	
2374	241732		OAC MAJ	/CHANGE IN Y EACH TIME	
	841552		OZM SAVEXX		
		PEAT,	REPLAY 1,2	/KEEP DISPLAY GOING	
2377	201741		LAC SW		
2400	050100		SZA 1		
	002404		JMP .+3		
	221733		LIO MIN		
	021732		OIO MAJ		
2404	211532		LAC 1 W7		
	300124		XCT GRANULE		
	647351		MUL (2500.		
	661557		OIV ODY		
2410	700000		NOP		
	021552		SUB SAVEXX	/TO GET DIFFERENCE	
	241733		OAC MIN		
	401552		ADD SAVEXX		
2414	241552		OAC SAVEXX	/SAVE TO GET DIFFERENCE AGAIN	
2418	021616		JSP COCRD		
	201741		LAC SW	/TEST WHICH DIFFERENCE IS LARGER	
	040100		SZA		
2420	002451		JMP XLARGER	/X IS	
	201735		LAC NN		
	050100		SZA 1		
	002434		JMP STEP3		
2424	207352		LAC (377420	/VECTOR MODE WORD	
	001737		IOR W		
	077777		SCR 95		
	077777		SCR 95		
2430	031550		OIO 1 PTRACE		
	441550		IDX PTRACE		
	401735		ISP NN		

2433	002430		JMP -3	
		STEP3,	REPLAY 1,2	/KEEP DISPLAY GOING
2435	201736		LAC R	
	047334		IOR (400	
	005377		SAL 85	
2440	041740		IOR RP	
	251550		DAC I PTRACF	
	441550		IDX PTRACE	
	507250		SAD (THYBL	
2444	002450		JMP -+4	
	441532		IDX W7	/TO NEXT X VALUE
	461533		ISP COUNTER	/TEST IF HAVE FINISHED
	002376		JMP PEAT	/NO-CONTINUE
2450	002504		JMP FINUP	/YES-GO FINISH UP
		XLARGER,	REPLAY 1,2	/KEEP DISPLAY GOING
2452	201735		LAC NN	
	050100		SZA I	
2454	002472		JMP STEP4	
	201737		LAC W	
	047334		IOR (400	
	005377		SAL 85	
2460	047322		IOR (177	
	221732		LIO MAJ	
	042000		SPI	
	047323		IDR (200	/MINUS SIGN
2464	077777		SCR 95	
	077777		SCR 95	
	031550		OIO I PTRACF	
	441550		IDX PTRACE	
2470	401735		ISP NN	/NO OF WHOLE STEPS
	002466		JMP -3	
		STEP4,	REPLAY 1,2	/KEEP OISPLAY GOING
2473	201740		LAC RP	
2474	047334		IOR (400	
	005377		SAL 85	
	041736		IOR R	
2500	251550		DAC I PTRACE	
	441550		IDX PTRACE	
	441532		IDX W7	/TO NEXT X VALUE
	461533		ISP COUNTER	/TEST IF HAVE FINISHED
	002376		JMP PEAT	/NO-CONTINUE
2504	710001	FINUP,	LAW I 1	
	401550		ADO PTRACF	
	241550		OAC PTRACF	
	211550		LAC I PTRACE	/PICK UP LAST WORD AND PUT IN
2510	047171		IDR (400000	/ESCAPE BIT
	251550		DAC I PTRACE	

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2512  441550      IDX PTRACE
      703000      LAW 3000      /STOP CODE
2514  251550      DAC 1 PTRACE
      207353      LAC (3000)6
      241532      DAC W7

2520  600000      RETURN,    REPLAY 1,2      /KEEP DISPLAY GOING
      JMP .-      /BACK TO MAIN PGM.

/BASELINE FUNCTIONS

2521  262525      RADTAP,    DAP .+4
      702526      LAW .+4
      227354      LIO 134.
2524  170451      JDA TYPE
      602525      JMP .
      TEXT /

2526  776261      RA
      640071      D I
2530  454724      NPU
      230023      T T
      614765      APE

2533  776346      CO
2534  856471      NDI
      237146      TIO
      450071      N I
      674546      GNO
2540  516564      REC
2541  737700      .

DEFINE NAMECART N
      LAC N
      MUL (7
      OIV (1
      NOP
      ADD (NAME-6
      OAC XCC
      LAC I XCO
      ADD (20
      DAP I (NAMECRT+1
      ICX XCC
      LAC I XCO
      ACC (30
      OAP I INAMECRT+2
      REPLAY 1,2,NAMECRT

TERMINATE

2542  262731      INIT,      DAP INITX
      STZ FLIPFLOP,REDEFN,TIME,THEORY,ECFIN0,SX,SX 1
      STZ PROCEO,CHNSEL,TIMGAT,STYLE,SXS 3,SXS 2,SXS,SXS 1
      STZ NCP,MU,MU 1,SIGMA,N,STATUS,PRES,TOTAL,TOTAL+1
      STZ F*MCNTR,TEMP,I 1INFO1,I 1INFO1+1,I 1INFO2,I 1INFO2+1,I 1INFO3
      SET TIMGAT,1 /INITIAL STATUS IS FRAME BY FRAME
      IRP 8,,0,1,2,3,4,5,6,7#

```

		B.,	DZM I (NAME+3+8*7
			DZM I (NAME+4+8*7
			ENDIRP
2606	857362	0,	DZM I (NAME+3+0*7
	857363		DZM I (NAME+4+0*7
2610	857364		1,
	857365		DZM I (NAME+3+1*7
	857366		DZM I (NAME+4+1*7
	857367		2,
2614	857370		DZM I (NAME+3+2*7
	857371		DZM I (NAME+4+2*7
	857372		3,
	857373		DZM I (NAME+3+3*7
2620	857374		DZM I (NAME+4+3*7
	857375		4,
	857376		DZM I (NAME+3+4*7
	857377		DZM I (NAME+4+4*7
2624	857400		5,
	857401		DZM I (NAME+3+5*7
	700100		DZM I (NAME+4+5*7
	257216		6,
			DZM I (NAME+3+6*7
			DZM I (NAME+4+6*7
			7,
			DZM I (NAME+3+7*7
			DZM I (NAME+4+7*7
			LAW 100
			DAC I ICHANNELS*6

2630	700200	LAW 200		
	257220	DAC I (CHANNELS+7		
	700300	LAW 300		
	257222	DAC I (CHANNELS+8.		
2634	700400	LAW 400		
	257402	DAC I (CHANNELS+9.		
	207403	LAC (34117		
	257210	DAC I (DATA		
2640	207404	LAC I220207		
	257405	DAC I (DATA+1		
	207406	LAC I100066		
	257407	DAC I (DATA+2		
2644	207171	LAC (400000		
	257326	DAC I (DATA+3		
	7003000	LAW 3000		
	257410	DAC I (DATA+4		
2650	047120	DZM %FMCNTR		
	207411	LAC (TABLE		
	247127	DAC %KTABLE		
	057127	DZM I KTABLE		
2654	047127	ICX KTABLE		
	027327	SAS IMAX(MUM		
	002053	JMP *-3		
	700200	CLA		
000000				
		B=0		
		REPEAT 8.,	DAP I (LIMITS+1*B	DAP I (LIMITS+2*B DAP
2720	700007	CLF 7		
	227452	LID (INITXL		
	720025	DLA		
		REPLAY		
2731	002731	JMP *		
	034130	34130		
	020006	20066		
2734	261761	261761	/A DISPLAY (DARK) TO SET STOP FLAG	
	000013	13		
	003000	3000		
2737	037453	BG71,	JSP I (SUM	
2740	200124		LAC GRANULE	
	027454		AND (-10000	
	242746		DAC 9500	
	217455		LAC I (TTT+10000	
2744	427271		SUB I2LDC	
	075001	9500,	SAR 15	
	777777		*-	
	247130		DAC 9570D	
2750	217456		LAC I (TT+10000	
	027271		SUB (2LDC	
	075001		SAR 15	
	102746		XCT 9500	
2754	427130		SUB 9570	
	040200		SPA	
	701000		CMA	

2757	243550		OAC 7C8	/AES. VALUE OF DATA-MI
2760	207457		LAC (CUMSIM*10000	
	227332		LIO (K1000	
2764	001535		OPR DMUL	
	207264		TEMP1	
	227277		LAC (TEMP1	
2771	001535		LIO (TCTAL	
	201535		OPR DPO1V4	
	243551		TEMP1	
2774	200122		LAC TEMP1	
	665001		DAC 7C9	
	027460		LAC XYNOW	
	047461		SAL 1S	
3000	277462		AND (1777	
	200122		ICR (2000	
	073777		DAP 1 (DATAx+1	
	061001		LAC XYNOW	
3004	027460		RCR 9S	
	047461		RAL 1S	
	277463		AND (1777	
			ICR (2000	
3015	447131		DAP 1 (DATAx+2	
	605463		REPLAY 1,2,DATAx	
			ICX (INTERPRO	
			JMP BG100	
3017	207465	RG72,	LAC (100*512.+50	
3020	240122		DAC XYNDW	
	637453		JSP 1 (SUM	
3024	217466		NEXTCRT CRTDDC	
	665001		LAC 1 (TEMP	
	761000		SAL 1S	
	407271		CMA	
3030	247132		ADD (ZLDC	
	217132	TAOR,	DAC TOMMY	
	440100		LAC 1 TOMMY	
	603036		SZA	
3034	447132		JMP .+3	
	603031		ICX TOMMY	
	217466		JMP TAOR	
	465001		LAC 1 (TEMP	
3040	407271		SAL 1S	
	247133		ADD (ZLDC	
	217133	TIAER,	DAC TOMMK	
	640100		LAC 1 TOMMK	
3044	603051		SZA	
	710001		JMP .+5	
	407133		LAW 1 1	
	247133		ADD TOMMK	
3050	603042		DAC TOMMK	
	207132		JMP TIAER	
	427271		LAC TOMMY	
			SUB (ZLOC	

3053 475001  
 3054 463777  
       463777  
       200124  
       027454  
 3060 243063  
       463777  
       463777  
       777777  
 3064 243547

SAR IS  
 RCL 9S  
 RCL 9S  
 LAC GRANULE  
 AND (-10000)  
 DAC 7358Y  
 RCL 9S  
 RCL 9S  
 7358Y,     -     /DEGRANULATION  
           DAC 7C7

DEFINE PROBSIG SIG1,SIG2,SIG3  
   DZM SUM1  
   DZM SUM1+1  
   LAC SIGMA  
   SAL SIG1         /SIG3\* SIGMA  
   MUL I1  
   DIV I1000.  
   NOP  
   XCT GRANULE  
   SAL IS           /SINCE DOUBLE PRECISION  
   ADD I2LOC+2  
   DAC TEMP1  
   SUB I2LOC+2  
   CMA  
   ADD I2LDC  
   DAC C\*SUM        /ADDRESS OF -SIG3\*SIGMA TALLY  
   LIO CSUM         /PUT INTO ID  
   LAW SUM1  
   DPR DADD  
   SUM1  
   LAW 2            /GO ON TO NEXT TALLY REGISTERS  
   ADD CSUM  
   DAC CSUM  
   SUB TEMP1  
   SPA  
   JMP -10.  
   LAC ITEMP1  
   LIO I10000  
   DPR CMUL  
   TEMP1  
   LAC ITEMP1  
   LIO I10000  
   DPR OPDIV4       /PROBABILITY OF GETTING A VALUE  
   TEMP1            /BETWEEN \*\* SIGMA\*SIG3  
   LAC TEMP1  
   DAC SIG2

TERMINATE  
  
 PROBSIG 0,7C2,1  
 PROBSIG 15,7C3,2  
 PROBSIG 25,7C4,3  
  
 EQUALS PROBSIG,NULL

```

3247 217456 LAC 1 (TT+10000
3250 227332 LIO (K1000
OPR OMUL
TEMP1
3253 001535 LAC (TEMP1
3254 207264 LIO (TOTAL
227277 DPR DPCIV4
TEMP1
3260 001535 LAC TEMP1
201535 OAC 7C1 /PROB. OF MU FOR DOCUMENTATION
243541 LAC TDMMK
207133 SUB (7LOC
3264 027271 SAR 15
075001 XCT 7350Y
103063 DAC 7C6
243546 BINT, LAC GRANULE
3270 200124 ANO (777
027473 ACD (1
007177 OAC 7C5 /GRANULARITY
243545

DEFINE CARRIAGE
LIO (77
JDA 9PT

TERMINATE

DEFINE MEMBER A,B,C,O
LAC (A
LIO (B /CHARACTER COUNT
JCA TYPE
CLI
JOA 9PT
CLI
JDA 9PT /GENERATE TWO SPACES
LAC C
REPEAT 11F V7 D+0, JOA OPT
REPEAT 01F V7 D+0, JDA PRIO
CARRIAGE

TERMINATE

3276 703301 CARRIAGE
264563 LAW 8C43
3300 004515 DAP MDVTR-1
704213 JMP BG3
264563 LAW BGN4
8C43, DAP MDVTR-1
CARRIAGE
CARRIAGE
LAC (8C1
3307 207475 LIO (8CC1
3310 227476 JDA TYPE
170451 CLI
1764000 JCA 9PT
170550

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3314	764000		CLI
	170550		JCA 9PT
	200125		LAC TOTAL
	347177		MUL (1
3320	567477		DIV (100000.
	760000		NOP
	650100		SZA 1
	603335		JMP 8CB7
3324	440124		IDX TOTAL+1
	663777	8CB4,	RCL 9S
	663777		RCL 9S
	240125		DAC TOTAL
3330	200126		LAC TOTAL+1
	170513		JCA DPT
	200125	8CB6,	LAC TOTAL
	170513		JCA DPT
3334	603341		JMP 8CB5
	200126	8CB7,	LAC TOTAL+1
	640100		SZA
	603325		JMP 8CB4
3340	603332		JMP 8CB6
		8CB5,	CARRIAGE
			MEMBER 8C2,8CC2,MU,1
			MEMBER 8C3,8CC3,7C1,1
			MEMBER 8C3A,8CC3A,7C1A,1
			MEMBER 8C4,8CC4,7C2,1
			MEMBER 8C5,8CC5,7C3,1
			MEMBER 8C6,8CC6,7C4,1
			MEMBER 8C7,8CC7,7C5
			MEMBER 8C8,8CC8,7C6
			MEMBER 8C9,8CC9,7C7
			LAC INTER*RO
			SZA 1
3506	207131		JMP 8C72X
	650100		MEMBER 8C10,8CC10,7C8
3510	603537		MEMBER 8C11,8CC11,7C9,1
3537	347131	8G72x,	DJM INTERRC
3540	605463		JMP 8G100
3541	777777	7C1,	.-.
	000121	7C1A=510MA	
3542	777777	7C2,	.-.
	777777	7C3,	.-.
3544	777777	7C4,	.-.
	777777	7C5,	.-.
	777777	7C6,	.-.
	777777	7C7,	.-.
3550	777777	7C8,	.-.
	777777	7C9,	.-.
000033		8CC1=27.	,

#####12  
#####31  
#####46  
#####46  
#####46  
#####22  
#####17  
#####17  
#####48  
#####68  
#####13

BCC2=10.  
BCC3=25.  
BCC4=38.  
BCC5=38.  
BCC6=38.  
BCC7=18.  
BCC8=15.  
BCC9=15.  
BCC10=32.  
BCC11=48.  
BCC3A=11.

SUM1, REPEAT 2, 0

3554	203634		DSDS1,	DAP DSDS1X	/DISPLAY INFO
	023635		JSP DINIT1	/SET UP DECIMAL PRINT TO PACK	
	020221		INFD1		
	200121		LAC SIGMA		
3560	170602		JDA PRID		
	023635		JSP DINIT1		
	020236		INFD2		
	207126		LAC F1MCNTR		
3564	170513		JCA DPT		
	201554		LAC DX		
	407161		ADD I0		
	050100		SZA 1		
3570	003633		JMP DSDS1X-1		
	023635		JSP DINIT1		
	020251		INFD3		
	201534		LAC TEMP		
3574	050100		SZA 1		
	003603		JMP .+6		
	200124		LAC GRANULE		
	427343		SUB I6000	/CREATE DEGRANULATOR	
3600	243602		DAC .+2		
	201534		LAC TEMP		
	777777		-.-	/DEGRANULATION	
	170513		JCA DPT		
3604	701750		LAW I000.		
	047177		MUL I1		
	061554		DIV DX		
	700000		NDP		
3610	247135		DAC FLIPF	/DELTA X	
	201534		LAC TEMP		
	047205		MUL I1000.		
	067177		DIV I1		
3614	760000		NDP		
	400117		ADD MU		
	407346		ADD I500.		
	047135		MUL FLIPF		
3620	067205		DIV I1000.		
	760000		NDP		
	407521		ADD I66		
	277522		DAP 1 (CRTMU+2		
3624	277523		DAP 1 (CRTMU+6		
			REPLAY I,2,CRTMU		
3630	023663		JSP DINIT2		
3634	003634	DSDS1X,	JMP .		
3638	263662	DINIT1,	DAP IDNT		
	207525		LAC (XCT BG15		
	244466		DAC BG14		
3640	720074		LEM		
	213662		LAC 1 IDNT		
	724074		EEM		
	247135		DAC FLIP*F		
3644	057135		DZM I FLIPF		

3649	047135		IDX FLIPF
	057135		DZM I FLIPF
	447135		ICX FLIPF
3650	357135		DZM I FLIPF
	710002		LAW I 2
	407135		ADD FLIPF
	247135		DAC FLIPF
3654	443662		ICX IDNT
	207526		LAC (JMP 0G14
	240123		DAC ID
	207527		LAC (JMP 7ZGF
3660	244476		DAC M4Z
	244503		DAC M3Z
	003662	IDNT,	JMP .
3663	263700	DINIT2,	DAP IDOZ
			PUNCH
3675	207530		LAC (JMP 0G13
	244476		DAC M4Z
	244503		DAC M3Z
3700	003700	IDOZ,	JMP .
3701	263714	DSDS2,	DAP DSDX
	423635		JSP DINIT1
	020264		TAPINF
3704	217531		LAC I (30000
	027473		AND (777
	170513		JDA DPT
	423635		JSP DINIT1
3710	020277		TAPINK
	217532		LAC I (30001
	170513		JDA DPT
	423663		JSP DINIT2
3714	000000	DSDX,	JMP

START

BASELINE 3  
OCTAL

3713	203724	7W1,	OAP .+7
	003777		RCL 9S
	003777		RCL 9S
3720	071077		RAR 6S
	027533		ANO (770000
	003777		RCL 9S
	003777		RCL 9S
3726	003724		JMP .
3729	203734	7W2,	OAP .+7
	003777		RCL 9S
	003777		RCL 9S
3730	001077		RAL 6S
	027534		ANO (7700
	003777		RCL 9S
	003777		RCL 9S
3736	003734		JMP .
3739	263743	7W3,	OAP .+6
	003777		RCL 9S
	003777		RCL 9S
3740	027474		ANO (77
	003777		RCL 9S
	003777		RCL 9S
	003743		JMP .
		XTAG,	REPLAY 1,2,0,TRACE
		IRP	B,,0,1,2,3,4,5,6,7*
		B,,	REPLAY 1,2,0,LIMITS+B*19.
			ENDIRP
		0,	REPLAY 1,2,0,LIMITS+0*19.
		1,	REPLAY 1,2,0,LIMITS+1*19.
		2,	REPLAY 1,2,0,LIMITS+2*19.
		3,	REPLAY 1,2,0,LIMITS+3*19.
		4,	REPLAY 1,2,0,LIMITS+4*19.
		5,	REPLAY 1,2,0,LIMITS+5*19.
		6,	REPLAY 1,2,0,LIMITS+6*19.
		7	REPLAY 1,2,0,LIMITS+7*19.
			JMP XTAG1
0032	005050		
0033	024074	BGN,	EEM
0034	020211		IDT 211 /SELECT THE CONSOLE BUTTONS FOR CONTROL
			REWIND TAPE /INPUT TAPE IS ON UNIT 5
0040	047136	BGN1,	OZM O'LYT
	207546		LAC (TEXTLINES+3
	247112		OAC XCO
	227547		LTO (200200
0046	007112		DIO I XCO
	047112		IDX XCO
	027550		SAS (CHANNELS-2 /INPUT TITLE BUFFER INITIALIZED
	004044		JMP .-3 /TO IBM TAPE BLANKS.
			PUNCH
			TAPRED ONSTY,TAPE,2,TEXTLIES+3,20066,JMP BGN1
0077	207546	BGN2,	ISET NUMCHN,1 /INITIALIZE NUMBER OF CHANNELS
0100	247112		LAC (TEXTLINES+3
			OAC XCO
		0HH,	ISET 5*HH,3

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4103 237112          L10 I XCO

4104 760200          4HH,   CLA
      663077          RCL 6S
      760005          CLF S
      650100          SZA I
4110 760015          STF S
      907206          SAD (20
      760200          CLA
      640100          SZA
4114 604117          JMP .+2+1
      640005          SZF S
      700020          LAW 20          /ZEROS AND BLANKS SWAPPED IN TITLE
      673077          RCR 6S
4120 662077          RIL 6S
      467137          ISP 5HH
      604104          JMP 4HH
      837112          DIO I XCD
4124 447112          IOX XCD
      627550          SAS (CHANNELS-2
      604101          JMP 6HH

4143 217531          BGN3,  TAPRED DNSTY,TAPE,1,30000,37777,JMP BGN2
4144 661777          LAC I (30000 /GET CHANNEL NUMBER
      027232          RAL 9S /RIGHT JUSTIFY
      420112          ANO I3 /MASK OUT GARBAGE
      007161          SUB NUMCHN /COMPARE WITH PREVIOUS VALUE
4150 640400          ADD I0 /ELEMENTATE -0
      005552          SMA /HAVE WE FOUND ALL THE CHANNELS YET?
      207554          JMP BGN3 /NO SO KEEP GOING
      244165          LAC INOP
      OAC .+10.

4162 604154          BGK,  TAPSPC DNSTY,TAPE,1,-40,JMP BGK1
      JMP BGK

4204 822542          BGK1,  TAPRED DNSTY,TAPE,2,30000,37777,JMP BGN2
      /THE ABOVE RESETS THE TAPE
      /GO INITIALIZE THE PROGRAM

4254 467136          BGN4,  REPLAY 0,1,CHANNELS
      604213          REPLAY 1,2,CHANNELS
      847136          PUNCH
      REPLAY 1,1,TEXTLINES
      REPLAY 1,2,CONTINUE
      REPLAY 1,2,NEXTFILE
      ISP OL*YT
      JMP BGN4
      OZM OLYT

4330 604305          BG1,  RESPOND 0,BGN4,BG1,BG2,BG3,BG4,BG5,BG6, BG7,BG8,BG9
      840113          REPLAY 1,0
      700100          NEXTCRT CRTNF
      257216          TAPSPC DNSTY,TAPE,1,40,JMP BGN1
      700200          JMP BG1 /SPACE TO NEXT E.O.F.
      257220          OZM CHNSEL /RESET CHANNEL SELECT REGISTER
      257220          LAW I00
      4334 700200          DAC I (CHANNELS+6 /RESET DISPLAY BUFFER
      257220          LAW 200 /TO GIVE ALL FOUR NUMBERS
      OAC I (CHANNELS+7 /I.E., *CHANNELS 1234*

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DEFINE BUTEST A,B
LAT
REPEAT 11F VZ A-17., RAR 1S
REPEAT 11F VZ A-16., RAR 2S
REPEAT 11F VZ A-15., RAR 3S
REPEAT 11F VZ A-14., RAR 4S
REPEAT 11F VZ A-13., RAR 5S
REPEAT 11F VZ A-12., RAR 6S
REPEAT 11F VZ A-11., RAR 7S
REPEAT 11F VZ A-10., RAR 8S
REPEAT 11F VZ A-9., RAR 9S
REPEAT 11F VZ A-8., RAL 8S
REPEAT 11F VZ A-7., RAL 7S
REPEAT 11F VZ A-6., RAL 6S
REPEAT 11F VZ A-5., RAL 5S
REPEAT 11F VZ A-4., RAL 4S
REPEAT 11F VZ A-3., RAL 3S
REPEAT 11F VZ A-2., RAL 2S
REPEAT 11F VZ A-1., RAL 1S
SPA /IS BUTTON A ON
JMP B /YES, SO EXIT ACCORDINGLY

TERMINATE
LAW 300
DAC 1 (CHANNELS +8.
LAW 400
DAC 1 (CHANNELS+9.
JMP BG11 /RETURN AND DISPLAY
BG6, LAW 1 /CHANNEL 1 SELECTED
JMP .+6
BG7, LAW 2 /CHANNEL 2 SELECTED
JMP .+4
BG8, LAW 3 /CHANNEL 3 SELECTED
JMP .+2
BG9, LAW 4 /CHANNEL 4 SLECTED
DAC CHNSEL /SAVE CHANNEL NO.
REPLAY 1,2,,CHNMS
LAW 1
DAC .+3 /INITIALIZE CHANNEL NO. GENERATOR
LAC (CHANNELS+6 /GET INITIAL GUTPUT ADDRESS
DAC *FLIPF /SAVE ADDRESS
BG10, .-. /LAW TO CHANNEL NO.

SAD CHNSEL /IS THIS THE SELECTED CHANNEL
JMP .+2 /YES, SO SAVE IT.
DZM 1 FLIPF /NO, SO DESTROY THIS NO. DISPLAY
ICX FLIPF /UPDATE OUTPUT ADDRESS
IOX BG10 /UPDATE CHANNEL GENERATOR
SAS (LAW 5 /ARE WE DONE
JMP BG10 /NO, SO CONTINUE
BG11, JMP BGN4 /YES, SO RETURN TO DISPLAY
BG4, LAC (TEXTLINES+3 /GET STARTING ADDRESS DF TEXT
DAC FLIPF /SAVE FOR INDIRECT ADDRESSING
NEXTCRT CRTTI
DZM 1 FLIPF /INITIALIZE TEXT TO SPACES

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4336 700300
      257222
4340 700400
      257402
      004375
      700001
4344 004352
      700002
      004352
      700003
4350 004352
      700004
      240113

4361 207560
      244365
      207216
4364 247135
      777777

4366 500118
      004371
4370 057135
      447135
      444365
      527561
4374 004365
      004213
      207546
      247135

4402 057135

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4403	407135	ICX FLIPF	/UPDATE TEXT BUFFER POINTER
4404	527550	SAS (CHANNELS-2	/ARE WE DONE YFT\$
	404402	JMP -3	
	207546	LAC (TEXTLINES+3	/GET STARTING ADDRESS OF TEXT
	247135	DAC FLIPF	/SAVE FOR INDIRECT ADDRESS
			/INITIALIZE PRCKED WORD
4410	207525	LAC (XCT BG15	/INITIALY PACKER
	244466	OAC BG14	
	760001	CLF 1	
		REPLAY 0,0	/RESET THE DISPLAY
		REPLAY 1,2,TEXTLINES	
		REPLAY 1,1,CONTINUE	
		RESPOND 0,BG12,,BG5N4	
4463	650001	SZF 1 1	/TYPEWRITER INPUT\$
4464	604421	JMP BG13	/NO
	720004	TYI	/YES
	777777		
	063777		
4470	063777	RCL 95	/PUT CHARACTER IN AC
	057135	RCL 95	
	257135	IDR 1 FLIPF	/PUT CHARACTER IN TEXT
	760001	DAC 1 FLIPF	
	044466	CLF 1	
4474	527562	IOX BG14	
	004421	SAS (XCT BG15+3	/HAVE WE DONE 3 CHARACTERS
	207525	JMP BG13	/NO
	244466	LAC (XCT BG15	/YES, SD RESET PACKER
4500	447135	OAC BG14	
	527550	IOX FLIPF	/UPCATE TFXT POINTER
	004421	SAS (CHANNELS-2	/HAVE WE EXCEEDED THE BUFFER
4504	004213	JMP BG13	/NO
		JMP BGN4	/YES, SD 'HIT' 'CONTINUE'
		BGSN4,	NEXTCRT 0
			ISCT D'LYT,1000
			JMP BGN4
4512	604213	JSP 7W1	
	423715	JSP 7W2	/PACKING INSTRUCTIONS
	023725	JSP 7W3	
4514	023735	LIO 177	
	227474	JDA 9PT	/TYPE A CARRIAGE RETURN
	170550	NEXTCRT CPTO	
		REPLAY 1,0	
4527	207546	LAC (TEXTLINES+3	
4530	247112	OAC XCD	
	347135	OZM FLIPF	
	217112	LAC I XCD	
	040100	SZA	
4534	004542	JMP +6	
	047135	IOX FLIPF	
	047112	IOX XCD	
	527550	SAS (CHANNELS-2	
4540	004532	JMP GB	
	004544	JMP +2	
	347135	OZM FLIPF	
	004536	JMP -5	

0544	207563		LAC (3*CHANNELS-3*TEXTLINES-15.
	027135		SUB FLIPF
	027135		SUB FLIPF
	027135		SUB FLIPF
4550	003777		RCL 95
	003777		RCL 95
	207546		LAC (TEXTLINES 3
	170451		JDA TYPE /TYPE OUT TITLE
4554	227474		LIO (77
	170550		JDA 9PT
	207564		LAC (CHANNEL5+3
	227200		LIO (10. /TYPE THE WORD 'CHANNELS'
4560	170451		JDA TYPE
	220113		LIO CHNSEL
	170550		JDA 9PT /TYPE THE CHANNEL NUMBER SELECTED
	004213		JMP BGN4 /GO BACK AND MONITOR DISPLAY
4564	247112	MOVTR,	DAC XCD
	064636		ISP MOVDEL
	005037		JMP B6
	207112		LAC XCD
4570	073001		RCL 15
	207171		LAC (ADD
	052000		SPI I
	207565		LAC (SUB
4574	004576		DIP MOVDIR
	217566		LAC I (TRACE+2
	007177	MOVDIR,	AND (1
	027460		AND (1777
4600	047567		IDR (100000
	257566		DAC I (TRACE+2
	201562		LAC N
	050100		SZA I
4604	004633		JMP B044
	761000		CMA
	247112		DAC XCD
	207413		LAC (LIMITS+2
4610	247135		DAC FLIPF
	217135	MOVBC,	LAC I FLIPF
	104576		XCT MOVDIR
	027460		AND (1777
4614	047567		IDR (100000
	257135		DAC I FLIPF
	700011		LAW 9.
	007135		ADD FLIPF
4620	247135		DAC FLIPF
	217135		LAC I FLIPF
	104576		XCT MOVDIR
	027460		AND (1777
4624	047567		IDR (100000
	257135		DAC I FLIPF
	700012		LAW 10.
	007135		ACD FLIPF
4630	247135		DAC FLIPF

4631	467112		ISP XCD
	604611		JMP MOVBCK
	710003	B644,	LAW I 3
4634	244636		DAC MOVDEL
	605037		JMP B6
	000000	MOVDEL,	R
4637	200113	BG2,	LAC CHNSEL
4640	650100		SZA I
	005626		JMP B69B /ILLEGAL CHANNEL SELECT
	420112		SUB NUMCHN
	040500		SZM
4644	005626		JMP B69B /NOT THAT MANY CHANNELS ON THE TAPE
			NEXTCRT CRTCDN
4653	200113		REPLAY 1,0,0,CHNMES
	427177		LAC CHNSEL
	244670		SUB (1 /GET NO. OF RECORDS TO SHIP
			DAC +9. /TO START OF JOB
			TAPSPC DNSTY,TAPE,1,0,JMP B6N1
			TAPRED DNSTY,TAPE,1,30000,37777,JMP B699
4707	625707		JSP FIXDAT
		BG40,	REPLAY 1,0
			REPLAY 1,2,TEXTLINES,NEXTFILE
			REPLAY 1,2,CHANNELS,CONTINUE
			REPLAY 1,2,BASELN
			REPLAY 1,2,INFD
			REPLAY 1,2,TRACE
			REPLAY 1,2,DATA
			BUTEST 11,0,000 /IS THE THEORETICAL BUTTON ON?
4766	005226		JMP B999 /NO
	200101	B88,	LAC FLIPFLOP
4770	650100		SZA I
	605226		JMP B999
			REPLAY 1,2,THYTEL
5000	201562	B999B,	LAC N
	650100		SZA I
	605024		JMP B5 /NO LIMITS, SO DON'T DISPLAY
	761000		CMA
5004	247135		DAC FLIPF
	207252		LAC ILIMITS
	247137		DAC 5HF
	207137	B887,	LAC 5HH
5010	005013		JMP +3 /SKIP OVER AC PICKUP
			REPLAY 1,2,LIMITS
5017	207137		LAC 5HF
5020	407251		ADD (19.
	247137		OAC 5HH
	067135		ISP FLIPF /ARE ALL LIMIT PAIRS DISPLAYED
	605007		JMP B887 /NO SO LOOP BACK FOR REST.
5030	764000	B5,	BUTEST 12,0,BG46 /STOP
	762200		CLI
	673777		LAT
	673007		RGR 95
			RGR 35

6034	027232		AND I3
	040100		SZA
	004564		JMP MOVTR
6043	340104	B6,	BUTEST 11.,BG47 /THEORY
			DZM THEORY /DO NOT CALCULATE THEORETICAL BELL
		B7,	BUTEST 10.,BG48 /LIMITS
		XTAG1,	BUTEST 3,XTAG
			REPLAY 1,2,TRACE
		B,,	1RP 0,,0,1,2,3,4,5,6,7*
			REPLAY 1,2,LIMITS+B*19.
			ENDIRP
		0,	REPLAY 1,2,LIMITS+0*19.
		1,	REPLAY 1,2,LIMITS+1*19.
		2,	REPLAY 1,2,LIMITS+2*19.
		3,	REPLAY 1,2,LIMITS+3*19.
		4,	REPLAY 1,2,LIMITS+4*19.
		5,	REPLAY 1,2,LIMITS+5*19.
		6,	REPLAY 1,2,LIMITS+6*19.
		7,	REPLAY 1,2,LIMITS+7*19.
		BB,	BUTEST 9.,BG49 /TIME
			REPLAY 1,2,0,FRAME
			REPLAY 1,2,0,TIMCRT
			REPLAY 1,2,0,TIMCRT+6
			REPLAY 1,2,0,TIMCRT+12.
			REPLAY 1,2,0,TIMCRT+18.
5204	200114	B10,	LAC TIMGAT /TIME GATE
	040100		SZA /CN OR OFF*
	005235		JMP BG60 /ON
	400111		ISP TOC /LPOATE TIME DELAY CLOCK
5210	004716		JMP BG40 /CLOCK NOT YET DONE
	200115		LAC STYLE /TIME TO GET NEXT FRAME
	227574		LIO (-1
	307227		SAO (-2 /MODERATE SPEED
5214	220110		LIO TD2
	307177		SAD (-1 /SLOW SPEED
	220107		LIO TD1
	050100		SZA 1 /FRAME BY FRAME
5220	227257		LIO (377777
	063777		RCL 9S
	003777		RCL 9S
	701000		CMA
5224	240111		OAC TOC /RESET TIME DELAY CLOCK
	005406		JMP BG70
5234	005000	B999,	REPLAY 1,2,0,THYTB
	762200		JMP B999B
	075777	BG60,	LAT /GET BUTTONS
	027177		SAR 9S /ELIMINATE ALL BUT PROCEED BUTTON
5240	300106		ANO (-1
	005244		SAO PROCEED /CHAR. BUTTON CHANGED*
	240106		JMP BG7B2 /NO, SO CHECK IF FRAME SHOULD BE SKIPPED
	005406		DAC PROCEED /YES, SO SAVE PRESENT ATAIUS
			JMP BG70
5250	004716	BG7B2,	BUTEST 5,RG7B1
			JMP BG40
5254	005412	BG7B1,	BUTEST 6,RG7B1K
			JMP BG70K
5257	005251	BG7B1K,	REPLAY 1,2
5260	700001		JMP BG7B1
	240104	BG47,	LAW 1
	005044		DAC THEORY /SET THEORY BUTTON STATUS TO ON
			JMP B7 /TEST REMAINING BUTTONS

	700001	BG49,	LAW 1	
5264	240103			OAC TIME
				REPLAY 1,1,FRAME
				REPLAY 1,2,0,TIMCRT
				REPLAY 1,2,0,TIMCRT+6
				REPLAY 1,2,0,TIMCRT+12
				REPLAY 1,2,0,TIMCRT+18
5323	200115			LAC STYLE
5324	347217			MUL 16
	567177			DIV 11
	760200			NOP
5330	005333			ADD (TIMCRT
				JMP .+3 /JUMP OVER FAKE AC PICKUP
				REPLAY 1,1 /DISPLAY CARET
				RESPDNC 0,BG40,,,,,,,,,BGG00,BGG01,BGG02,BGG03
5365	700001	BGG00,	LAW 1	
	240114			DAC TIMGAT /TURN ON TIME GATE
	340115			DZM STYLE /SELECT FRAME MODE
5370	604716			JMP BG40
	200107	BGG01,	LAC TUI	/SLDW
	227177		LIO 11	
	605401		JMP .+6	
5374	200110	BGG02,	LAC TD2	/MOODERATE
	227227		LIO 12	
	605401		JMP .+3	
	710001	BGG03,	LAW 1 1	/FAST
5400	227232		LIO 13	
	761000		CMA	
	240111		DAC TDC	/SET UP TIME CLOCK
	320115		DIO STYLE	/SELECT PROPER MODE
5404	340114		OZM TIMGAT	/TURN OFF TIME GATE
	604716		JMP BG40	
	340101	BG70,	DZM FLIPFLDP	/INSURE NEW THEORETICAL BELL
	621254		JSP CALCUL	/CALCULATE HYSTOGRAM AND BELL
5410	447126		IOX F*MCNTR	
	623554		JSP DS051	/DISPLAY INFO
	710001	BG70K,	LAW 1 1	
	300112		ADD NUMCHN	
5414	245425		OAC .+9	
			TAPSPC DNSTY,TAPE,1,0,JMP BGN1	
			TAPRED DNSTY,TAPE,1,30000,37777,JMP BG99	
5444	625707		JSP FIXDAT	
	217575		LAC 1 (30002	
	427217		SUR 16	
	640200		SPA	
5450	605412		JMP BG70K	
	427576		SUB (5000	
	640400		SMA	
	605412		JMP BG70K	/THIS FRAME HAS TOO MANY POINTS
5454	623701		JSP DS052	/EMPTY FRAME SO SKIP AND DISPLAY TAPE I.D.
	104716		LAW BG40	
	262520		OAP RETURN	
	602352		JMP TRACE	
5460	700001	BG99,	LAW 1	
	240105		DAC EOFIND	/MARK END OF FILE CONDITIDN

5462	347131	BG46, BG122,	DZM INTERRO /ZERO INTERRO BUFFER REPLAY 1,1,INFO REPLAY 1,2,THISFILE REPLAY 1,2,DOCUMENT REPLAY 1,2,CHANNELS PUNCH
5552	400112 240112	BGNN3,	RESPOND 0,BG120,BG74,ABC4,,,,,,,,,,,,,BG73,BG71,BG72,BG71 ADD NUMCHN /LOOKING FOR NO. OF CHANNELS
5554	404127	OAC NUMCHN JMP BGN3	/SAVE THIS INTERUM VALUE /AND HEEP GOING
5563	200105	BG74,	BUTEST 12., BG76 /IS STOP BUTION ON\$ NEXTCRT CRTNE LAC EOFIND
5564	450100 604305 340105 604040		SZA I /NO, SO IT E20.F. INDICATOR ON\$ JMP BG1 /NO, SO CONTINUE WITH THIS FILE. OZM EOFIND /YES, SO TURN OFF JMP BGN1 /AND TAKE NEXT FILE
5576	605555	BG76, JMP BG74	REPLAY 1,0,SORRY /IS STOP BUTION ON\$
5605	404154	BG73, NEXTCRT CRTTF JMP BGN	BUTEST 12.,BG77 /IS STOP BUTION ON\$ /START THIS FILE OVER AGAIN
5625	405577	BG77, PUNCH JMP BG73	REPLAY 1,0,SORRY /START THIS FILE OVER AGAIN
5634	604213	BG9A, JMP BGN4	REPLAY 1,2,CHNMES /START THIS FILE OVER AGAIN
5673	200105	ABC4,	NEXTCRT CRTCON BUTEST 12.,ABC5 REPLAY 1,2,0,SORRY REPLAY 1,2,0,THISFILE REPLAY 1,2,0,DOCUMENT REPLAY 1,2,0,DATA LAC EOFIND
5674	450100 604716 340105 604040		SZA I JMP BG40 OZM EOFIND JMP BGN1
5706	605635	ABC5, JMP ABC4	REPLAY 1,2,SORRY /START THIS FILE OVER AGAIN
5707	265724	FIXOAT,	DAP .+13. LAC I W3 ADD I2 CPA OAC ELIPF LAC I W7 SAR B5 OAC I W7 IDX W7 ISP ELIPF JMP .-5 LAC (30006 DAC W7 JMP .-.
5710	211530 407227 761000 247135		
5714	211532 675377 251532 441532		
5720	467135 605714 207353 241532		
5724	600000		

/LIMIT BUTTON PROCESS CONTROL

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DEFINE   SETNAME
        LAC 'FIRSTX   /0 MEANS NOT WORKING ON A NEW SET.
        SZA I
        JMP .+4       /LEAVE SET DEFN ALDNE
        IDX N         /SET UP FDR NEW LIMITS SET.
        DZM 'FIRSTX
        DZM 'SETDEF   /DEFN COMPLETE INDICATOR
TERMINATE

DEFINE   PDT
        LAC NCP       /LIMIT SET DEFINITION IS COMPLETE
        IDR SETDEF    /WHEN SETDEF EQUALS 34 BASE 8
        DAC SETDEF
TERMINATE

DEFINE   SBLMNDW
        JSP FM
TERMINATE

5729    265734
        702200
        027600
5730    265732
        473377
        700000
        027321
5734    405734

FM,     DAP .+7
        LAT
        AND 1237
        DAP .+2
        RCR 05
        LAW .-.
        AND 137
        JMP .

BG40,   REPLAY 1,2,0,DATA
        SBLMNDW
        DAC 'PRES     /SFT PRESENT STATUS
        DZM NCP
        DZM 'STATUS
        LAW I
        DAC 'FIRSTX
        DZM SETDEF
        REPLAY 1,2,0,THYBL

5744    247140
        340110
        347141
        700001
5750    247142
        347156

5760    201562
        050100
        006004
        701000
5764    247135
        207001
        247137
        207137
5770    405773

3H4,    REPLAY 1,2,NAME
        LAC 5HH
        ADD 17
        DAC 5HH

5777    207137
        407221
        247137

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0002	067135		ISP FLIPP
	005767		JMP 3H4
		G1,	REPLAY 1,2,CHANNEL
			REPLAY 1,2,0,LSONC
0021	247140	G2,	SBLMNOW
	052000		DAC PRES
	006647		SPI 1
0024	327141		JMP G11
	006424		SAS STATUS
			JMP G10
		DEFINE	TESTA B
			RCR 1S
			SPI
			JMP B
		TERMINATE	
		G3,	PUNCH
0037	200116		LAC NCP
0040	073001		RCR 1S
			IRP A, G6, G7, G8, G9*
		A,	TESTA A
			ENDIRP
		G6,	TESTA G6
			G7, TESTA G7
			G8, TESTA G8
			G9, TESTA G9
0059	720127	G4,	OSP
	006060		JMP .+2 /IGNORE THE LIGHT PEN
	720125		DRS /BY RESUMING AFTER A HIT
0060	200122	G31,	LAC XYNDW
	027473		AND 1777
	027603		SUB 1103
	050200		SPA 1
0064	006073		JMP G3B5G
			REPLAY 1,2,0,NAMCRT
0073	201562	G3B5G,	LAC N
0074	050100		SZA 1
	006004		JMP G1 /SKIP IF NO LIMITS
	761000		CMA
	241552		DAC SAVEXX
			SETUP SAVEYY, (LIMITS
6102	006105	G40,	JMP .+3 /SKIP OVER DUMMY AC LOAD
			REPLAY 1,2,LIMITS
6111	041552		ISP SAVEXX
	006114		JMP .+2
	006004		JMP G1
6114	700023		LAW 19.
	001553		ADD SAVEYY
	006102		JMP G40
		G6,	REPLAY 1,1,NAME
6150	207123	G3L,	RESPOND 0,G31,,,,,,,,,,,,,0,G3L,,G4L
	027601		LAC RESP /A NAME
	347177		SUB INAME
	567221		MUL 11
			DIV 17

6160	760000		NOP	
	407177	G5L,	AOD (1	
	247143		DAC 'SETODELETE	
6206	606060		NAMECARET SETODELETE	
			JMP G31	
6207	207123			
6210	427252	G4L,	LAC RESPP	
	547177		SUR 1L1PITS	
	567251		MUL 11	
	760000		OIV (19.	
6214	606161		NOP	
			JMP G5L	
		G7,	POT	
6226	650001		TRACKS	
	606055		SZF 1 1	
			JMP G4	
		G44,	REPLAY 1,2	
6231	720004		TYI	
	740001		CLF 1	
	760200		CLA	
6234	673077		RCR 6S	
	807533		SAD 1770000	
	806257		JMP G45	
	863077		RCL 6S	
6240	217157		LAC 1 GXG3	
	337157		DIO 1 GXG3	
	661077		RAL 6S	
	057157		IDR 1 GXG3	
6244	257157		DAC 1 GXG3	
	467144		ISP 'GXG1	
	606055		JMP G4	
	447157		IDX GXG3	
			ISET GXG1,3	
6252	467145		ISP G'XC2	
	606055		JMP G4	
6254	706272		LAW ENDOFT	
	227215		L10 15	
	370451		JDA TYPE	
	760001	G45,	CLF 1	
6260	207144		LAC GXG1	
	427177		SUR (1	
	247144		DAC GXG1	
	467144		ISP GXG1	
6264	606266		JMP +2	
	606004		JMP G1	
	217157		LAC 1 GXG3	
	661077		RAL 6S	
6270	257157		DAC 1 GXG3	
	606263		JMP -6	
	222346	ENDOFT,	TEXT /STO	
6273	477700	/	P	

/WE ARE NOW PUSHING SECOND HALF OF NAME  
/OVER WHEN LESS THAN THREE LETTERS ARE  
/USED.

	G8,	ISET 'DWNDRUP,1	
	G8T,	PCT	
		REPLAY 1,I,TRACF	
		RESPOND 0,G31,,,,,,,,,,,,,,,,,,,,,G53	
0330	227146	G53,	LID DWNDRUP
	700012		LAW 1R.
	042000		SPI
0340	007613		ADD (-9.
	007252		ADD (LIMITS
	247147		DAC G'XG1T
	201562		LAC N
0344	027177		SUB (1
	047251		MUL (19.
	067177		DIV (1
	760000		NDP
0350	007147		ADD GXGIT
	247147		DAC GXGIT
	200122		LAC XYNDW
	027473		AND (777
0354	005001		SAL 15
	247150		DAC GXG'2T
	247135		DAC FLIPF
	217147		LAC I GXGIT
0360	027614		AND (776000
	047150		IDR GXG2T
	257147		DAC I GXGIT
	047147		IDX GXGIT
0364	200122		LAC XYNDW
	764000		CLI
	073777		RCR 95
	061001		RAL 15
0370	247150		DAC GXG2T
	217147		LAC I GXGIT
	027614		AND (776000
	047150		IDR GXG2T
0374	257147		DAC I GXGIT
	227146		LID DWNDRUP
	207135		LAC FLIPF
	042000		SPI
0400	247151		DAC '433H
	052000		SP1 I
	247152		DAC '433L
	207151		LAC 433H
0404	027152		SUB 433L
	247153		DAC 'DELLIM
	227146		LID DWNDRUP
	201562		LAC N
0410	001562		ADD N
	007615		ADD (YXXL-2
	052000		SP1 I
	007177		ADD (1
0414	247147		DAC GXGIT
	200122		LAC XYNDW

```

6416 027473          AND (777
      065001          SAL 15
6420 257147          DAC I GXG1T
      006060          JMP G31

6422 347146          G9,      O2M OWNORUP
      006276          JMP G8T

6424 207141          G10,     LAC STATUS
      067140          XDR PRES
      247154          OAC GXG1'M
                    PUNCH
6440 207140          LAC PRES
      027154          AND GXG1M      /GET STATUS CHANGE
      247155          DAC GXG2'M      /0='OFF'

6445 207154          SETUP STATUS,PRES
                    LAC GXG1M
                    IRP A,,G70,G71,G72,G73,G74+
A,,      TESTA A
        ENDIRP
G70,     TESTA G70
        G71,
        G72,          TESTA G71
        G73,          TESTA G72
        G74,          TESTA G73
                    TESTA G74
                    HLT          /ERROR HALT

6465 760400          DEFINE  TESTB A,B
                    LAC GXG2M
                    SZA
                    JMP A
                    JMP B

TERMINATE

G70,     TESTB G12,G14 /ON,OFF REDEFINE
G71,     TESTB G13,G15 /      ODELETE
G72,     TESTB G19,G18 /      NAME
G73,     TESTB G17,G16 /      UPPER
G74,     TESTB G20,G21 /      LOWER

G12,     SET REDEFN,1
G12M,    D2M XYNOW
        JMP G3

6514 340122          G13,     SET NCP,2      /DELETE OFF TO ON
      006026          JMP G12M

6520 006514          G14,     D2M REDEFN  /REDEFINE ON TO OFF
      006523          JMP G99

6523 340116          G99,     D2M NCP
      006020          JMP G2

6525 201562          G18,     LAC N          /NAME ON TO OFF
      065007          SAL 3S
      421562          SUB N
6530 407616          ADD (NAME-7
      247144          DAC GXG1
      407177          ADD (1
      247145          OAC GXG2

```

6538	407177		ADD I1	
	247157		DAC GXG3	
	217145		LAC I GXG2	
	027614		AND (-1777	
6540	057617		IOR I (RPY+10000	
	257145		DAC I GXG2	
	217157		LAC I GXG3	
	027614		AND (-1777	
6544	057620		IOR I (RPX+10000	
	257157		OAC I GXG3	
	207144		LAC GXG1	
	006552		JMP .+3	
6556	006523		REPLAY 1,2,NAME	
			JMP G99	
006523		G16=G99		/UPPER ON TO OFF
006523		G21=G99		/LOWER ON TO OFF
		G17,	SET NCP,1V	/UPPER OFF TO ON
			SETNAME	
6567	006026		JMP G3	
		G20,	SET NCP,20	/LOWER OFF TO ON
			SETNAME	
6600	006026		JMP G3	
		G19,	SET NCP,4	/NAME OFF TO ON
			RETRACK	
			SETNAME	
6627	201562		LAC N	
6630	065007		SAL 35	
	021562		SUB N	
	760001		CLF 1	
	007027		ADD (NAME+3-7+1	
6638	247157		DAC *GXG3	
			ISSET GXG2,2	
			ISSET GXG1,3	
6641	057157		OZM I GXG5	
	207157		LAC GXG3	
	027177		SUB I1	
6644	247157		OAC GXG3	
	057157		DZM I GXG3	
	006026		JMP G3	
6647	207156	G11,	LAC SETDEF	/LIMITS ON TO OFF
6650	050100		SZA I	
	006657		JMP .+6	/NO CHANGE MADE
	027630		SAS (34	
	006756		JMP G91	/NOT A COMPLETE DEFINITION
6654	207153		LAC *DELLIM	
	040200		SPA	
	006756		JMP G91	/UPPER AND LOWER LIMITS REVERSED
		G94,	SELMNDW	/GET SUBLIMIT BUTTON STATUS

6660	440100 406770 347153		SZA JMP G92	/THE SUBLIMIT BUTTONS ARE NOT ALL OFF
6664	347156 340122 700001 247142		OZM DELL1P OZM SETOEF DZM XYNOW LAW 1 OAC FIRSTX REPLAY 1,0,0,NAME	
000007		KKUI=7	REPEAT 7, REPLAY 1,2,0,PTOASL JMP BG40	REPLAY 1,2,0,NAME+KKUI KKUI=KKUI+7
6758	604710		G91, BG91M,	REPLAY 1,0, LSDNC SBLMNOW SPI JMP G1 REPLAY 1,0 JMP BG91M
6769	042000 606004		G92, G15,	REPLAY 1,2,PTOASL JMP G94 LAC XYNOW ANO 1777 SUB 1103 SPA JMP G99
6775	606764		G47K,	/DELETE NULL LAC SETOOELETE SUB 11 DAC 'WHAREN RAL 35 SUB WHAREN ADD (NAME DAC GXG3 SAD (NAME+7*7 JMP G47M ADD 17 DAC GXG2 ISET GXG1,7 LAC 1 GXG2 OAC 1 GXG3 IOX GXG2 IOX GXG3 ISP GXG1 JMP -5 LAW YXYXL 7777 ADD SETODEL ADD SETODEL OAP .+3 SUB 12 OAP .+2 LAC .-+1
7004	606657			
7009	200122 027473 427603			
7010	640200 606523 207143 427177			
7014	247160 401007 027160 407601			
7020	247157 507637 607077 407221			
7024	247145			
7027	217145			
7030	257157 447145 447157 407144			
7034	607027 001572 407143 407143			
7040	267043 427227 267044			

7043	200000		
7044	240000		DAC *-.
	047043		IDX *-2
	047044		IDX *-2
	107043		XCT *-4
7050	107044		XCT *-4
	207143		LAC SETDDEL
	027177		SUB (1
	061017		RAL 45
			REPEAT 3,           ADD WHAREN
	007252		ADD (LIMITS
7060	247157		DAC GXG3
	507543		SAD (LIMITS+19.*7
	007077		JMP G47M
	007251		ADD (19.
7064	247145		DAC GXG2
			ISET GXG1,19.
		G47,	SETUP 1 GXG3,1 GXG2
7071	047145		IDX GXG2
	047157		IDX GXG3
	067144		ISP GXG1
7074	007067		JMP G47
	047143		IDX SETDDEL
	007012		JMP G47K
7077	201562		
7100	027177	G47M,	LAC N
	241562		SUB (1
			DAC N
			REPLAY 1,2,0,NAMCRT
7110	006523		JMP G99

EQUALS TAPSPC,NULL  
 EQUALS TAPRED,NULL  
 EQUALS REWIND,NULL  
 EQUALS RESPOND,NULL  
 EQUALS BUTEST,NULL  
 EQUALS SBLMNDW,NULL  
 EQUALS SETNAME,NULL  
 EQUALS PDT,NULL  
 EQUALS TEST0,NULL

ENDDFMODULE

START

```

BASELINE 4
10000 (0000)
/JMP RESET TO RESET TABLE VALUES SINCE HAVE
/ENCOUNTERED ONE THAT IS TOO LARGE

EQUALS REPLAY, NULL

DEFINE REPLAY A, R
JSP I (RPLCA)

TERMINATE

10000 214411 RESET, LAC I (GRANULE
014411 ACD I (GRANULE
024412 ANO (777
044413 (OR (675000
10004 254411 DAC I (GRANULE /INCREASE SHIFT INSTRUCTION BY ONE

10009 211533 LAC I COUNTER /X VALUE
050200 SRA I
000013 JMR ,+4
10010 004414 ACD (1
050100 SZA (
000015 JMR ,+3
114411 XGT ( (GRANULE /SHIFT INSTRUCTION
10014 040200 SPA
024414 SUB (1
040200 SRA
761000 CMA
10020 404414 ACD (1
240005 DAC TTT /ABSOLUTE VALUE + (

10022 204415 LAC (ZLOC
240044 DAC ADR1
10024 424416 SUB (2
240040 DAC ADR2

10026 204415 LAC (ZLOC
424417 SUB (4
10030 240007 DAC TP1
404420 ACD (6
240010 OAC TR2

10033 220607 ML, LIO TRI /TO MOVE EVERYTHING IN THE
10034 200607 LAC TP1 /IALLY TABLE DOWN
004416 ACD (2
DPR DACC

10040 777777 ADR2, --
220610 LIO TP2
200610 LAC TR2
424416 SUB (2
DPR DACC

10046 777777 ADR1, --
,
```



10129	661001		RAL 1S	
	240605		DAC TTT	/JUST X COORDINATE
	700001		LAW 1	
10130	240611		DAC ONE	
	340612		DZM SUMNEG	/INITIALIZE TO ZERO
	840614		DZM SUMPOS	/INITIALIZE TO ZERO
	840616		DZM CUMSUM	/INITIALIZE TO ZERO
10134	340613		DZM SUMNEG+1	
	340615		DZM SUMPOS+1	
	340617		OZM CUMSUM+1	
10137	200611	REPT,	LAC ONE	
10140	504427		MUL (1000.	
	574430		DIV 1 (DX	/COORDINATE OF THE STEP
	760000		NOP	
	414431		ADD 1 (SAVEX	/SINCE IN MODULE 0
10144	420605		SUB TTT	
	640400		SPA	/TEST IF IN THIS STEP
	600152		JMP FIGURE	/YES-GO FIND STEP FOR MU
	440611		IDX ONE	/NO-GO ON TO NEXT STEP
			REPLAY 1,2	/KEEP DISPLAY GOING
10151	600137		JMP REPT	
10152	214433	FIGURE,	LAC 1 (MU	/MU TIMES 1000.
	644414		MUL (1	/SET UP FOR DIVISION
10154	504427		OIV (1000.	
	760000		NOP	
	650200		SPA 1	
	600163		JMP +4	
10160	404414		ADD (1	
	650100		SZA 1	
	600165		JMP +3	
	114411		XCT 1 (GRANULE	
10164	640200		SPA	
	424414		SUB (1	
	665001		SAL 1S	
	404415		ADD (ZLOC	
10170	240606		DAC TT	/ADDRESS OF TALLY WITH MU
	404416		ADD (2	
	244357		OAC *REG2W	
	214434		LAC I (TEMP	
10174	420611		SUB ONE	/STEP NO. POINT IS IN
	404414		ADD (1	
	761000		CMA	
	665001		SAL 1S	/SINCE DOUBLE PRECISION
10200	404415		ADD (ZLOC	
	240605		DAC TTT	/ADDRESS OF TALLY WITH POINT
	244360		DAC *REG1W	
10203	200606		LAC TT	/ADDRESS OF TALLY WITH MU
10204	420605		SUB TTT	/ADDRESS OF TALLY WITH POINT
	640400		SPA	
	600212		JMP REG1	
	400606		ADD TT	
10210	240605		OAC TTT	/DO NEGATIVE SIDE FIRST
	244360		DAC *REG1W	

10213	204360	REG1,	REPLAY 1,2	/KEEP DISPLAY GOING
10214	224435		LAC REG1W	
10217	010612		LID (SUMNEG+10000	
10220	200606		DPR DADD	/DOUBLE PRECISION ADD
	520605		SUMNEG+10000	
	000232		LAC TT	
	200612		SAS TTT	
10224	240614		JMP .+B.	
	240616		LAC SUMNEG	
	200613		DAC SUMPDS	
	240615		DAC CUMSUM	
10230	240617		LAC SUMNEG+1	
	000307		DAC SUMPDS+1	
	204360		DAC CUMSUM+1	
	404416		JMP FIN1	
10234	244360		LAC REG1W	
	520606		ADD (2	
	000212		DAC REG1W	
			SAS TT	/TEST IF HAVE GOTTEN TO MU
			JMP REG1	/NO-CONTINUE
10237	224360		LID REG1W	
10240	002001		RIL 15	
	444360		IDX REG1W	
	204360		LAC REG1W	
	077001		SCR 15	/WANT ONLY HALF
10244	240621		DAC HALF+1	
	067777		SCL 95	
	067377		SCL 85	
	240620		DAC HALF	
10250	204436		LAC (HALF+10000	
	224435		LID (SUMNEG+10000	
10254	010612		DPR DADD	
	200606		SUMNEG+10000	
	020605		LAC TT	
	000606		SUB TTT	
10260	404416		ADD TT	
	244361		ADD (2	
			DAC *4T4T	
10262	200620		LAC HALF	
	240614		DAC SUMPDS	
10264	200621		LAC HALF+1	
	240615		DAC SUMPDS+1	
10267	204357	REG2,	REPLAY 1,2	/KEEP DISPLAY GOING
10270	224437		LAC REG2W	
10273	010614		LID (SUMPOS+10000	
10274	204357		DPR DADD	
	404416		SUMPDS+10000	
	244357		LAC REG2W	
	024361		ADD (2	
			DAC REG2W	
			SUB 4T4T	

```

10300  840200          SPA
        600266          JMP REG2

10302  204437          LAC (SUMPDS+10000
        224435          LIO (SUMNEG+10000
        010616          DPR DADD
        014356          CUMSUM+10000

FINI,   JMP 1 XFINI

/EXPONENTIAL, SQ. RT., AND TABTEST SUBRS

/SUBROUTINE TO CALCULATE (E TO THE (-X) PDWER * 1/(SIGMA * SQ. RT. (2 * PI) )
/X IS 1000.X AND SIGMA IS SIGMA * 1000.
/ENTRY IS JAD EXP WITH X IN THE AC
/RETURNS WITH ANSW.1000 IN AC

10310  777777          EXP
        244362          *-
        214440          DAC *EXPXX
        244363          LAC 1 (SIGMA
        700012          DAC *SIGTEM
10314  644441          LAW 10.
        644441          MUL (39894.      /1/SQ. RT. 2 PI X100,000
        644363          DIV SIGTEM
        204442          LAC (79780.      /TREAT SIGMA = 0 AS SIGMA = .0005
        244363          DAC SIGTEM      /RESULT IS X1000.

10320  244363          REPLAY 1,2      /KEEP DISPLAY GOING

10322  214443          LAC 1 (EXP
        434433          SUB 1 (MU
10324  254443          DAC 1 (EXP
        654443          MUL 1 (EXP
        574440          DIV 1 (SIGMA
        204444          LAC (100000.      /ERRDR IN DIVISION
10330  254443          DAC 1 (EXP
        644414          MUL (1.
        574440          DIV 1 (SIGMA
        204444          LAC (100000.      /ERRDR IN DIVISION
10334  075001          SAR 15
        024445          SUB (12.      /IF X 12, THEN ANSWER IS ZERD
        040500          SMA-SZA
        000422          JMP EXPW      /RESULT =0

10340  214443          LAC ( (EXP
        544427          MUL (1000.
        574440          DIV 1 (SIGMA
        204444          LAC (100000.
10344  075001          SAR 15      /RESULT IS TIMES 1000.
        254443          DAC 1 (EXP      /X
        644446          MUL (2507.
        664447          DIV (10000.
10350  760000          NDP
        004427          ADD (1000.

```

10352	244364	DAC *EXPTEM
	214443	LAC I (EXP
10354	654443	MUL I (EXP
	864427	DIV (1000.
	760200	CLA
	644450	MUL (2927.
10360	564444	DIV (100000.
	760000	NOP
	804364	ADD EXPTEM
	244364	DAC EXPTEM
		REPLAY I,2 /KEEP DISPLAY GOING
10369	214443	LAC I (EXP
	654443	MUL I (EXP
	864427	DIV (1000.
10370	760200	CLA
	654443	MUL I (EXP
	864427	DIV (1000.
	760200	CLA
10374	644451	MUL (383.
	664444	DIV (100000.
	760200	CLA
	804364	ADD EXPTEM
10400	644364	MUL EXPTEM
	564427	DIV (1000.
	760200	CLA
	544364	MUL EXPTEM
10404	864427	DIV (1000.
	760200	CLA
	544364	MUL EXPTEM
	664427	DIV (1000.
10410	760200	CLA
	244364	DAC EXPTEM
10412	204447	LAC (10000.
	844427	MUL (1000.
10414	564364	DIV EXPTEM
	760200	CLA
	544363	MUL SIGTEM
	864447	DIV (10000.
10420	760200	CLA
	414362	JMP I EXPXX
	760200	CLA
	600421	JMP EXPX

/E RAISED TO THE MINUS X POWER COMPUTED WITH  
 /APPROXIMATION FORMULA FROM 'APPROXIMATIONS FOR  
 /DIGITAL COMPUTERS' BY HASTINGS  
 /THE FORMULA IS  $1 / (1 + A(1)X + A(2)X^2 + A(3)X^3 + A(4)X^4)$  TO THE 4TH  
 /WHERE A(1) = .2507,213, A(2) = .0292,732, A(3) = .0038,278  
 /WITH AN ERROR OF + OR - .0002 AND USUALLY BETTER

```

/*JDA SQRT* TO GET SQUART ROOT

10424 777777
244365
710024
245226
10430 200424
075001
254440
760200
10434 220424
067003
574440
760000
10440 077001
042000
404414
014440
10444 075001
434440
050100
000455
10450 014440
254440

SQR1  .-.
DAC *PCX /GETS VARIANCE
LAW I 20. /EXTENDED PROGRAM COUNTER
DAC MAC
LAC SQRT 7777
SAR 15 /DIVIDE BY TWO
OAC I (SIGMA /1ST ARBITRARY APPROXIMATION
CLA
CONI, L10 SQRT 7777
SCL 25 /TO CORRECT SIGN AND MUL. BY 2
DIV I (SIGMA
NGP
SCR 15
SPI /TEST IF NEED TO ROUND
ADD (I /YES INCREMENT ANSWER BY 1
ADD I (SIGMA /APPROX. SQ. RT. BY
SAR 15 /((Y/AIN) + AIN)/2
SUB (I (SIGMA
SZA I /TEST IF PREVIOUS APPROX IS SAME
JMP PC /YES - DONE
ADD I (SIGMA /NO-FIND BETTER APPROX.
DAC I (SIGMA /NEW AIN

REPLAY 1,2 /KEEP DISPLAY GOING
TSP MAC
JMP CONT
PC, JMP I PCX /LEAVE

/*JSP TABTEST* TO FIND THE NUMBER OF STEPS AND MAXIMUM Y VALUE

10456 244366
700622
10460 260461
200622
004452
040100
10464 000467
440461
000461

TABTEST DAC *DONES /EXTENDED PROGRAM COUNTER
LAW TABLE 7777
DAP .+1
TESTNEG, LAC TABLE 7777
ACD (0
SZA /TO FIND 1ST INDEXED VALUE
JMP TEST1
ICX TESTNEG
JMP TESTNEG

TEST1, REPLAY 1,2 /KEEP DISPLAY GOING
LAW ZLOC 7777+914.
OAP .+1

TESTPCS, LAC ZLOC 7777+914. /STARTING AT OTHER END
ADD (0
SZA /TABLE, DO THE SAME AS ABOVE
JMP COMP1
LAW I 1
ADD TESTPCS
OAC TESTPOS

```

10502	000472	JMP TESTPDS	
		CDMP1,	REPLAY 1,2 /KEEP DISPLAY GOING
10503	200461	COMPARE,	LAC TESTNEG
10504	024453		AND (7777
	024454		SUB (ZLOC 7777
	077001		SCR 15 /SINCE HAVE DOUBLE PRECISION
	052000		SPI 1
10510	024414		SUB (I
	040200		SPA
	761000		CMA
	254434		DAC ( (TEMP /ABSOLUTE VALUE
10514	200472	LAC TESTPDS	
	024453	AND (7777	
	024454	SUB (ZLOC 7777	
	077001	SCR 15	/SINCE HAVE DOUBLE PRECISION
10520	040200	SPA	
	761000	CMA	
	034434	SUB I (TEMP	
	040200	SPA	
10524	000527	JMP .+3	
	014404	ADD I (TEMP	
	254434	DAC I (TEMP	
	214434	LAC I (TEMP	
10530	024453	AND (7777	
	065001	SAL 15	
	004414	ADD (1	
	761000	CMA	
10534	254455	DAC I (CDUNTER	/NUMBER OF STEPS
		REPLAY 1,2	/KEEP DISPLAY GOING
10536	202445	LAC ZLDC 7777	/LDW ORDER PART
	254424	DAC I (MAXIMUM	/1ST ESTIMATE TO MAX. VALUE
10540	202446	LAC ZLOC 7777+1	/HIGH ORDER PART
	254456	DAC I (MAXIMUM+1	/BDTH DDUBLE PRECISION
10542	214434	LAC I (TEMP	
	024453	AND (7777	
10544	045001	SAL 15	/SINCE DOUBLE PRECISION
	761000	CMA	
	004454	ADD (ZLDC 7777	
	200552	DAP ADDRESS	
		REPLAY 1,2	/KEEP DISPLAY GOING
10550	214424	LAC I (MAXIMUM	
	020552	SUB ..	/DIFFERENCE OF LDW ORDER PARTS
	040400	SMA	/TEST IF NEED TO BORROW
10554	000560	JMP .+4	/NO, JUMP AHEAD
	710001	LAW I 1	/YES DO SO
	014456	ADD I (MAXIMUM+1	
	254456	DAC I (MAXIMUM+1	

10560	040552		ICX ADDRESS	
	214456		LAC 1 (MAXIMUM+1	
	720074		LEM	
	430552		SUB I ADDRESS	/DIFFERENCE OF HIGH ORDER PARTS
10564	724074		EEM	
	040200		SPA	/TEST WHICH IS LARGER
	000573		JMP CHANGE	/PUT Y INTO MAX. SINCE IS LARGER
10567	040552	BACK,	IDX ADDRESS	/MAX. LARGER, LEAVE AS IS
10570	074455		ISP 1 (COUNTER	/TEST IF HAVE DONE EACH REGISTER
	000550		JMP TTEST	/NO-CONTINUE TESTING
10572	014366	ONE,	JMP I DONEX	/YES-LEAVE
10573	720074	CHANGE,	LEM	
10574	210552		LAC 1 ADDRESS	/HIGH ORDER PART OF NEW Y MAX
	724074		EEM	
	254456		DAC 1 (MAXIMUM+1	
	710001		LAW 1 1	
10600	000552		ADD ADDRESS	
	260602		DAP .+1	
	200602		LAC ..	/LOW ORDER PART OF NEW Y MAX.
	254424		OAC 1 (MAX)MUM	
10604	000567		JMP BACK	/GO BACK AND FINISH TESTING
/CONSTANTS				
10605	777777	TTT,	---	
	777777	TT,	---	
	777777	TP1,	---	
10610	777777	TP2,	---	
	000001	CNE,	1	
	777777	SUMNEG,	---	
	777777		---	
10614	777777	SUMPOS,	---	
	777777		---	
	777777	CUMSUM,	---	
	777777		---	
10620	777777	HALF,	---	
	777777		---	
	777777	TABLE	---	
12445		TABLE+915./	---	
12445	777777	ZLOC	---	
14270		ZLOC+915./	---	
14270	777777	MAXIMUM	---	
	777777	MAXIMUM+1	---	
/LIGHT PEN FOLLOW ROUTINE				
	010000	MM1=10000		
	710000	LAM=LAW 1		
14272	244564	LPFOLL, OAC PFX1T		/SET EXIT

14273	344367	DZM *LPSWCH	/ZERO SWITCH FOR TEST
14274	204565	LAC INTEN	
	044566	IDR WRPRAM	/030110 - DISABLE L.P.
	244610	DAC LBUFF	/PAR PT
	204567	LAC WPY	/WRITING PDINT
14300	044601	ICR WPYWD	/PT PT
	244611	DAC LBUFF+1	
	204570	LAC WPX	/WRITING POINT
	044602	ICR WPXWD	/PT PT
14304	244612	DAC LBUFF+2	
	204571	LAC RPY	/REFERENCE PDINT
	044601	IDR WPYWD	/PT PT
	244613	DAC LBUFF+3	
14310	204572	LAC RPX	/REFERENCE PDINT
	044603	IDR CPXWD	/PT PAR.
	244614	DAC LBUFF+4	
	204565	LAC INTEN	
14314	044604	ICR PARAM	/ENABLE L.P.
	244615	DAC LBUFF+5	
	204571	LAC RPY	
	044657	ADD (-33)	
14320	024460	AND (1777)	
	244573	DAC YPT	/CENTER Y
	044601	IDR WPYWD	
	244616	DAC LBUFF+6	
14324	204572	LAC RPX	
	044601	ADD (33)	
	244574	DAC XPT	/CENTER X
	044603	IDR CPXWD	/PT PAR
14330	244617	DAC LBUFF+7	
	204462	LAC (3000)	
	244620	DAC LBUFF+10	/STDP
	204463	LAC (JMP I PFXIT)	
14334	244561	DAC STPCDC	
	204464	LAC (JMP TRACK)	
	244563	DAC LPHIT	
	224465	LID (MMI LBUFF)	
14340	624543	JSP RTRDLT	
	700400	HLT	
		/LIGHT PEN TRACK FDR PDP1	
14342	204565	LAC INTEN	
	044566	ICR WRPRAM	
14344	244612	DAC LBUFF+2	
	204573	LAC YPT	/CENTER Y
	044601	ICR WPYWD	
	244616	DAC LBUFF+6	
14350	204574	LAC XPT	/CENTER X
	044466	ADD (47)	/X + INCR.
	024600	SUR WRXR	
	040400	SMA	/IS IT OUT OF BDX
14354	004530	JMP RTX	/YES SET MAX.
	204574	LAC XPT	/NO
	044466	ADD (47)	

14357	044605				
14360	244617	TRACK1,		IDR CPWD	/PT VECTOR
	204467		OAC LBUFF+7		
	244620		LAC (600277)	/I VECTOR IN (-X)	
	204462		OAC LBUFF+10		
14364	244621		LAC (3000)		
	204470		DAC LBUFF+11		
	244563		LAC (JMP RTRXIT)		
	204367		OAC LPHIT	/SET EXIT	
14370	040100		LAC LPSWCH		
	004374		SZA	/HAS Y BEEN FOUND YET	
	204471		JMP +3	/YES	
	004375		LAC (JMP MODSW)	/NO	
14374	204472		JMP +2		
	244561		LAC (JMP LPFOLL+1)		
	244556		DAC STPCOD		
	224473		DAC EDGHIT		
14400	024543		LID (MM1 LBUFF+2)		
	720126		JSP RTROUT	/DISPLAY	
	003777		DKC	/X-Y I.O	
14404	003001		RCL 95		
	024474		RCL 15	/X 0-L6	
	244606		AND (1776)		
	204574		DAC X1	/X ONLY	
	404475		LAC XPT		
14410	024577		ADD (-50)		
	040200		SUB WRXL		
	004532		SPA	/IS IT OUT OF RDX	
	204574		JMP LFTX	/YES	
14414	404475		LAC XPT	/NO	
	044605	TRACK2,	ADD (-50)		
	244617		IOR CPWD		
	204476		DAC LBUFF+7		
14420	244620		LAC (600077)	/I VECTOR IN (+X)	
	224473		DAC LBUFF+10		
	024543		LIO (MM1 LBUFF+2)		
	720126		JSP RTROUT	/DISPLAY	
14424	003777		ORC	/X-Y I.O.	
	003001		RCL 95		
	024474		RCL 15		
	404606		AND (1776)	/X ONLY	
14430	075001		ADD X1		
	244574		SAR 15	/FINO MFAN	
	404457		DAC XPT		
	244572		ADD (-33)		
14434	204367		DAC RPX		
	040100		LAC LPSWCH		
	014964		SZA	/Y FOUND \$	
	204572		JMP I PFXIT	/YES	
14440	044603	GETY,	LAC RPX	/NEW REFERENCE IN X	
	244614		IOR CPXWO		
	204574		DAC LBUFF+4		
	044605		LAC XPT	/NEW CENTER X	
14444	244617		IOR CPWO		
			DAC LBUFF+7		

14445	204573		LAC YPT	/CENTER Y
	404466		ACD (47)	
	424576		SUB WRYT	
14450	804400		SMA	/IS IT OUT OF BOX
	804537		JMP UPY	/YES
	204573		LAC YPT	/NO
	404466		ADD (47)	
14454	844601	TRACK4,	1OR WPYWD	
	244616		DAC LBUFF+6	
	204477		LAC (737400)	/VECTOR IN (-Y)
	244620		OAC LBUFF+10	
14460	204472		LAC (JMP LPFOLL+1)	
	244561		OAC STPCOD	
	244556		DAC EDGHIT	/SET EXITS
	224473		L10 (MM1 LBUFF+2)	
14464	824543		JSP RTROUT	
	720126		DRC	/X - Y I.D.
	873777		RCR 95	
	873377		RCR 85	
14470	824474		AND (17761)	/Y IN 8 L6
	244607		DAC Y1	
	204573		LAC YPT	
	404475		ADD (-50)	
14474	424575		SUB WRYS	
	840200		SPA	/IS IT OUT OF BOX
	804541		JMP DOWNY	/YES
	204573		LAC YPT	/NO
14500	404475		ADD (-50)	
	844601	TRACK3,	1OR WPYWD	
	244616		DAC LBUFF+6	
	204500		LAC (637400)	/1 VECTOR IN + Y
14504	244620		OAC LBUFF+10	
	224473		L10 (MM1 LBUFF+2)	
	824543		JSP RTROUT	/DISPLAY
	720126		DRC	/X - Y I.D.
14510	873777		RCR 95	
	873377		RCR 85	
	824474		AND (17761)	/Y IN 8 - 16
	404607		ACD Y1	
14514	875001		SAR 15	/FIND MEAN
	244573		DAC YPT	/NEW CENTER Y
	404461		ADD (33)	
	244571		DAC RPY	
14520	844601		1DR WPYWD	
	244613		DAC LBUFF+3	
	204367		LAC LPSWCH	
	840400		SPA	/BOTH X + Y FOUND \$
14524	814564		JMP I PFXIT	/YES
	700001		LAW 1	/NO - LOOK FOR X
	244367		DAC LPSWCH	
	804342		JMP TRACK	
14530	204600	RTX,	LAC WRXR	/EDGE OF BOX - RIGHT
	804357		JMP TRACK1	
	204577	LFTX,	LAC WRXL	/EDGE OF BOX - LEFT

14533	004415	JMP TRACK2	
14534	710001	LAM 1	/CAN'T FIND X
	244367	OAC LPSWCH	
	004437	JMP CFTY	
	204576	LAC WRYT	/EDGE OF RCX - TOP
14540	004454	JMP TRACK4	
	204575	LAC WRYB	/EDGE OF BOX - BOTTOM
	004501	JMP TRACK3	
	264557	DAP RTRXIT	/SET EXIT
14544	720025	OLA	/START DISPLAY
	720227	OSS	/STOP \$
	004550	JMP .+2	/NO
	004560	JMP STPCOC-1	/YES
14550	720127	OSP	/L.P. HIT
	004553	JMP .+2	/NO
	004562	JMP LPHIT-1	/YES
	721427	DSE	/EDGE HIT
14554	004545	JMP .-7	/NO RECYCLE
	760000	NOP	
	000000	NOP	
	004557	NOP	
14560	760000	EOGHIT, 0	/EDGE EXIT
	000000	RTRXIT, JMP .	
	720125	NOP	
	000000	STPCOC, 0	/STOP EXIT
	000007	ORS	
14564	000000	LPHIT, 0	/L.P. EXIT
	000007	PFXIT, 0	
	030110	INTEN, 7	
	001033	WRPRAM, 030110	
14570	001033	WPY, 1033	
	001033	WPX, 1033	
	001033	RPY, 1033	
	001000	RPX, 1033	
14574	001000	YPT, 1000	
	001777	XPT, 1000	
	000000	WRYB, 0	
	001777	WRYT, 1777	
	000000	WRXL, 0	
14600	001777	WRXR, 1777	
	220000	WPYWD, 220000	
	022000	WPXWD, 022000	
	002000	CPXWD, 002000	
14604	034110	PARAM, 34110	
	102000	CPWD, 102000	
	000000	X1, 0	
	000000	Y1, 0	
14610	000000	LBUFF, 0	
14630		LBUFF+20*MODULE/	
		START	

/BASELINE 5

```
/DAD
/ LID TREG. NO.
/ LAC ADDRESS DF 2 REGISTER NUMBER ISX
/ JDA DAD /PUTS SUM IN ADDRESS IN AC
/
/JDA CADD'.
/ LID ADDRESS DF 2REG. NO.
/ LAC LDW ORDER ADDRESS DF 2 REG.
/ JDA DADD
/ ADDRESS
/RETURN
/
/JDA DDAD'.
/ LAC LDW ORDER ADDRESS DF 4 REG. NO.
/ LID LDW ORDER ADDRESS OF 4 REG. NO.
/ JDA DDAD
/ RETURN /ANSWER IN ADDRESS IN AC
/
/JDA DINDEX'.
/ LAC ADDRESS DF LDW ORDER PT. OF 2 REG. NO.
/ JDA DINDEX
/
/JDA DPCIV'.
/ LAC ADDRESS DF LDW ORDER PART DF NUM. (2R)
/ LID ADDRESS DF LDW ORDER PART DF DEN (2R)
/ JDA DPCIV
/ RETURN /ANSWER IN AC + I0, SIGN=BIT0 IN BDTH
/
/JDA DMUL'.
/ LAC ADDRESS DF LDW ORDER PART OF 2 REG. NUMBER
/ LID ADDRESS DF LDW ORDER PART DF 2 REG. NUMBER
/ JDA DMUL
/ ADDRESS DF 4 REG. NO. WHERE TO PUT ANSWER
/ RETURN
/
/JDA DPCIV4'.
/ LAC ADDRESS OF LDW ORDER PART OF 4 REG. NUMERATOR
/ LID ADDRESS DF LDW ORDER PART DF 2 REG. DENOMINATOR
/ JDA DPCIV4
/ ADDRESS DF 4 REG. NO. TO PUT ANSERE IN
/ RETURN
/
/JDA DPCIVF'.
/ LAC ADDRESS DF LDW ORDER PART DF 4 REG. NUMERATOR
/ LID ADDRESS DF LDW ORDER PART DF 4 REG. DENOMINATOR
/ JDA DPCIVF
/ RETURN /ANSWER IN AC - WILL BE ONLY I REG.
```

```
14620 777777
14624
14640 777777
777777
777777
00442
14643 244370
14644 324641
```

```
DMAC, .-.
DMAC+4+MDDULE/
DMZERO, REPEAT 4, 0
DMULAN, .-.
DMULI, .-.
DMUL, .-.
DMUL=DMUL 7777
DAC *DMULXX
DID DMULI
```

	214370	LAC I DMULXX
	244640	DAC DMULAN
	444370	IDX DMULXX
14650	444634	DZM DMZERO
	444635	DZM DMZERO+1
	444636	DZM DMZERO+2
	444637	DZM DMZERO+3
14654	214642	LAC I QDMUL
	654641	MUL I DMUL1
	672001	RIR 1S
	244631	DAC DMAC+1
14660	324630	DID DMAC
	444632	DZM DMAC+2
	344633	DZM DMAC+3
		REPLAY 1,2 /KEEP DISPLAY GOING
14664	204501	LAC (DMAC+10000
	224502	LID (DMZERO+10000
		DPR DDAD
14670	214642	LAC I QDMLL
	244371	DAC 'XYZQ4 /SAVE
	444642	IDX QDMUL
	214642	LAC I QDMUL
14674	654641	MUL I DMUL1
	672001	RIR 1S
	244636	DAC DMZERO+2
	324635	DID DMZERO+1
14700	204501	LAC (DMAC 10000
	224502	LID (DMZERO+10000
		DPR DDAD
14704	444641	IDX DMUL1

14705	214641		LAC I DMUL1
	644371		MUL XYZQW
	672001		RTR IS
14710	244636		DAC DMZERD+2
	324635		DTD DMZERO+1
	204501		LAC (DMAC 10000
	224502		LID (DMZERO+10000
			DPR DDAC
			REPLAY 1,2 /KEEP DISPLAY GOING
14717	214642		LAC I QDMUL
14720	654641		MUL I DMUL1
	672001		RTR IS
	344635		DZM DMZERO+1
	244637		DAC DMZERD+3
14724	324636		DID DMZERO+2
	204501		LAC (DMAC+10000
	224502		LID (DMZERO+10000
			DPR DDAD
			IRP GG,0,1,2,3#
		CG,,	LAC DMAC+GG
			DAC I DMULAN
			ICX DMULAN
			ENDIRP
14731	204630	P,	LAC DMAC+0
	254640		DAC I DMULAN
	444640		ICX DMULAN
14734	204631		1, LAC DMAC+1
	254640		DAC I DMULAN
	444640		ICX DMULAN
	204632		2, LAC DMAC+2
14740	254640		DAC I DMULAN
	444640		ICX DMULAN
	204633		3, LAC DMAC+3
	254640		DAC I DMULAN
14744	444640		ICX DMULAN
	614370		DMULX, JMP I DMULXX
14746	777777	DDADL,	.-. /4 REGISTER ADDEND
	777777	DDAD	.-. /INPUT AND ANSWER 4 REGISTERS
	004747		QDDAD=CDAD 7777
14750	244372		DAC 'QDADXX
	324746		DID QDADL
	204747		LAC QDDAD
	244756		DAC .+3
			DPR DADD
14756	777777		.-.
	651000		SZ0 I
14760	404775		JMP DDADX
	040400		SMA
	404770		JMP .+6
	444747		ICX QDDAD
14764	204505		LAC (377777
	034747		AND I QDDAD
	254747		DAC I QDDAD
	005160		JMP DADDX+1
14770	444747		ICX QDDAD
	214747		LAC I QDDAD
	044506		ICR (400000
	254747		DAC I QDDAD
14774	005160		JMP DADDX+1

	044747	DDADX,	IDX QDDAD	
			REPLAY 1,2	/KEEP DISPLAY GOING
14777	044746		IDX DDADL	
15000	044746		IDX DDADL	
	224746		LID DDADL	
	044747		IDX QDDAD	
	245006		DAC .+3	
15000	777777		DPR DACC	
	014372		-*-	
			JMP I DDADXX	

15010	777777	DAX,	---	
	777777	DAD	---	
	005011		QDAD=DAD 7777	
15012	244373		DAC *DADXX	
	825010		DID DAX	
15014	215011		LAC 1 QDAD	
	051600		CLO	
	005010		ACD DAX	
	041000		SZD	
15020	005063		JMP DADx+1	
	255011		DAC 1 QDAD	
	244374		DAC DAD*MM	
	045011		IDX QDAD	
15024	204374		LAC DADMM	
	075011		XDR 1 QDAD	
	040400		SMA	
	005062		JMP DADx	
15030	215011		LAC 1 QDAD	
	004452		ADD (P	
	050100		SZA 1	
	005062		JMP DADx	
15034	040400		SMA	
	005050		JMP DADBB	
	004414		ACD (1	
	255011		DAC 1 QDAD	
15040	205011		LAC QDAD	
	024414		SUB (1	
	245011		DAC QDAD	
	215011		LAC 1 QDAD	
15044	004506		ADD (400000	
	024414		SUB (1	
	255011		DAC 1 QDAD	
	005062		JMP DADx	
15050	024414	DADBB,	SUB (1	
	255011		DAC 1 QDAD	
	205011		LAC QDAD	
	024414		SUB (1	
15054	245011		DAC QDAD	
	215011		LAC 1 QDAD	
	004505		ADD (377777	
	004414		ADD (1	
15060	255011		DAC 1 QDAD	
	005062		JMP DADx	
	014373	DADx,	JMP 1 DADXX	
	040200		SPA	
15064	005075		JMP DACJ	
	004506		IDR (400000	
	255011		DAC 1 QDAD	
	045011		IDX QDAD	
15071	710001		REPLAY 1,2	/KEEP DISPLAY GOING
	015011	LAW,	LAW 1 1	
	255011	DADx,	ADD 1 QDAD	
15074	005062		DAC 1 QDAD	
	024505	DADJ,	JMP DADx	
	255011		AND (377777	
	045011		DAC 1 QDAD	
15100	700001		IDX QDAD	
	005072		LAW 1	
			JMP DADM	

15102	777777	DINDEX	---	/LOCATION OF LOW ORDER PART
005102			QCINDEX=DINDEX 7777	
15103	244375		DAC 'DINDXX	
15104	051600		CLO	
	700001		LAW 1	
	015102		ACC 1 QDINDEX	/INDEX DOUBLE PRECISION
	024505		AND (377777	
15110	255102		DAC 1 QDINDEX	/REGISTER BY ONE
	445102		IDX QDINDEX	
	041000		SZO	
	055102		IDX 1 QDINDEX	
15114	014375	DINDEX,	JMP 1 DINDXX	
	777777	DADCL,	---	
	777777	DADDM,	---	
	777777	DAOC	---	/LOCATION OF LOW ORDER PART OF A
005117			QDADD=DADD 7777	
15120	244376		DAC 'QADPXX	/10 HAS LOCATION OF LOW ORDERS MOST OF 11
	204507		LAC (LAW 1	
	245150		DAC DADDP	
	214376		LAC 1 DADDXX	
15124	245115		DAC DADCL	/ANSWER PUT IN ARG FOLLOWING JDA
	051600		CLO	
	700006		CLF 6	
	044376		ICX DACCXX	
15130	325116		DID DADDM	
	215117		LAC 1 QOAO	
	415116		ADD 1 DADDM	
	051000		SZO 1	
15134	005141		JMP DADDW	
	700016		STF 6	
	040400		SMA	

15182	005160		JMP DADDB	
15180	024505		AND (377777	
	255115	DADDW,	DAC I DADDL	
	244377		DAC DAD'FWM	
	006115		IX DADDL	
15148	054421		IX I (DADD	
	045116		IX DADDM	
	700200		CLA	
	040006		SZF 6	
15150	700001	DADDP,	LAW I	
	015117		ADD I QDADD	
	015116		ADD I DADDM	
	255115		DAC I DADDL	
16154	064377		XDR DADFWM	
	040200		SPA	
	005166		JMP DADDWK	
	014376	DADDX,	JMP I DADDXX	
15100	044506	DADDB,	IDR (400000	
	255115		DAC I DADDL	
	244377		DAC DADFWM	
	200510		LAD (LAW I I	
15168	245150		DAC DACDP	
	005143		JMP DADDW+2	
16166	215115	DADDWK,	LAC I DADDL	
	004452		ADD (I	
15170	050100		SZA I	
	005157		JMP DADDX	
	040400		SMA	
	005207		JMP DADDWM	
15176	215115		LAC I DADDL	
	004414		ADD (I	
	255115		DAC I DADDL	
	205115		LAC DADDL	
15200	024414		SUB (I	
	246115		DAC DADDL	
	215115		LAC I DADDL	
	004506		ADD (400000	
15208	024414		SUB (I	
	255115		DAC I DADDL	
	005157		JMP DADDX	
15207	215115	DADDWM,	LAC I DADDL	
15210	424414		SUB (I	
	255115		DAC I DADDL	
	205115		LAC DADDL	
	024414		SUB (I	
16214	246115		DAC DADDL	
	215115		LAC I DADDL	
	004505		ADD (377777	
	004414		ADD (I	
16220	255115		DAC I DADDL	
	005157		JMP DADDX	
	777777	MADD,	REPEAT 4,2	
16243	777777	MAC,	-.-	/MAC=DIVISION, MAC+4=NUMERATOR, MAC+4=ANSWER
15243	777777	MAC+13.*MODULE/		/MAC + 8% = REMAINDER
16244	777777	DPDIVJ,	-.-	
		DPDIVF,	-.-	/R REG. NUMERATOR IN AC

	244400		DAC *98XX	/4 REGISTER DIVISOR IN ID
	025243		DID OPCIVJ	/CIVISION DDNE BY SHIFTING
	710104		LAW I 68.	/SHIFT CDUNT
15250	244401		DAC *SC	
	044402		DZM *SIGNN	/SIGN DF RESULT
		GG,,	IRP GG,,0,I,2,3*	
			LIO I DPDIJ	
			LAC I DPDIJ	
			DAC MAC+GG+4	
			DIO MAC+GG	
			DZM MAC+GG+8.	
			IDX DPDIJ	
			IDX DPDIJ	
			ENDIRP	
15252	235243	0,	LIO I DPDIJ	
	215244		LAC I DPDIJ	
15254	245232		DAC MAC+0+4	
	025226		DIO MAC+0	
	045236		DZM MAC+0+8.	
	445243		IDX DPDIJ	
15260	445244		IDX DPDIJ	
	235243		I,	LID I DPDIJ
	215244		LAC I DPDIJ	
	245233		DAC MAC+1+4	
15264	025227		DIO MAC+1	
	045237		DZM MAC+1+8.	
	445243		IDX DPDIJ	
	445244		IDX DPDIJ	
15270	235243		2,	LID I DPDIJ
	215244		LAC I DPDIJ	
	245234		DAC MAC+2+4	
	025230		DIO MAC+2	
15274	045240		DZM MAC+2+8.	
	445243		IDX DPDIJ	
	445244		IDX DPDIJ	
	235243		3	LID I DPDIJ
15300	215244		LAC I DPDIJ	
	245235		DAC MAC+3+4	
	025231		DIO MAC+3	
	045241		DZM MAC+3+8.	
15304	445243		IDX DPDIJ	
	445244		IDX DPDIJ	
			REPLAY I,2	/KEEP DISPLAY GOING
15307	205226		LAC MAC	
15310	640400		SMA	
	605335		JMP KANKS	
	700001		LAW 1	
	064402		XDR SIGNN	
15314	244402		DAC SIGNN	
		GG,,	IRP GG,,0,I,2,3*	
			LAC MAC+GG	
			SPA	
			CMA	
			DAC MAC+GG	

15319	205226	0,	ENDIRP	
	640200		LAC MAC+0	
	761000		SPA	
15320	245226		CMA	
			DAC MAC+0	
15321	205227		1,	LAC MAC+1
	640200		SPA	
	761000		CMA	
15324	245227		DAC MAC+1	
15329	205230		2,	LAC MAC+2
	640200		SPA	
	761000		CMA	
15330	245230		DAC MAC+2	
15331	205231		3	LAC MAC+3
	640200		SPA	
	761000		CMA	
15334	245231		DAC MAC+3	

16338	105232		KANKS,	LAC MAC+4
	040400		SMA	
	005363		JMP DPDIVX	
15340	000001		LAW 1	
	004402		XDR SIGNN	
	244402		DAC SIGNN	
		GG,,	1RP GG,,0,1,2,3*	
			LAC MAC+4+GG	
			SPA	
			CMA	
			DAC MAC+4+GG	
			ENDIRP	
15343	205232	0,	LAC MAC+4+0	
15344	040200		SPA	
	061000		CMA	
	245232		DAC MAC+4+0	
	205233		1,	LAC MAC+4+1
15350	040200		SPA	
	061000		CMA	
	245233		DAC MAC+4+1	
	205234		2,	LAC MAC+4+2
15354	040200		SPA	
	061000		CMA	
	245234		DAC MAC+4+2	
	205235		3	LAC MAC+4+3
15360	040200		SPA	
	061000		CMA	
	245235		DAC MAC+4+3	
	025500		DPDIVX,	JSP XCDMP
15364	005605		JMP 98X	/MAC MAC+B, DIVISION ERRDR
	025423		JSP XSHIFT	/MAC+MAC+B
			REPLAY 1,2	
15367	025500		JSP XCDMP	
15370	005372		JMP .+2	
	005376		JMP .+5	
	025401		JSP XSLBT	
	000001		LAW 1	
15374	045232		IDR MAC+4	
	245232		DAC MAC+4	
	004401		ISP SC	
	005365		JMP DPDIVX+2	
15400	005560		JMP 97X	/ALL DDNE, SD INSERT SIGN
	265422	XSUBT,	DAP XSUBTX	
		GG,,	1RP GG,,0,1,2,3*	
			LAC MAC+GG	
			CMA	
			DAC MACC+GG	
			ENDIRP	
15402	205226	0,	LAC MAC+0	
	061000		CMA	
15404	245222		DAC MACC+0	
	205227		1,	LAC MAC+1
	061000		CMA	
	245223		DAC MACC+1	
15410	205230		2,	LAC MAC+2
	061000		CMA	
	245224		DAC MACC+2	
	205231		3	LAC MAC+3
15414	061000		CMA	
	245225		DAC MACC+3	
	224511			LIO (MACC+10000

	204512		LAC (MAC+E.+1000
			DPR DDAD
15422	005422	XSUBIX,	JMP .
	244403	XSHIFT,	DAC X'SH4X
15424	044404		DZM 'TEMXL
	044405		DZM 'TEMXH
			REPLAY 1,2 /KEEP DISPLAY GOING
			IRP GG,,4,5,6,7,8.,9.,10.,11.*
		GG,,	LID MAC+GG
			JSP GG4LK
			DAC MAC+GG
			LAC TEMXL
			DAC TEMXH
			ENDIRP
15427	225232	4,	LID MAC+4
15430	025706		JSP GG4LK
	245232		DAC MAC+4
	204404		LAC TEMXL
	244405		DAC TEMXH
15434	225233		5,
	025706		JSP GG4LK LID MAC+5
	245233		DAC MAC+5
	204404		LAC TEMXL
	244405		DAC TEMXH
15440	225234		6,
	025706		JSP GG4LK LID MAC+6
	245234		DAC MAC+6
15444	204404		LAC TEMXL
	244405		DAC TEMXH
	225235		7,
	025706		JSP GG4LK LID MAC+7
15450	245235		DAC MAC+7
	204404		LAC TEMXL
	244405		DAC TEMXH
	225236		8.,
15454	025706		JSP GG4LK LID MAC+8.
	245236		DAC MAC+8.
	204404		LAC TEMXL
	244405		DAC TEMXH
15460	225237		9.,
	025706		JSP GG4LK LID MAC+9.
	245237		DAC MAC+9.
	204404		LAC TEMXL
	244405		DAC TEMXH
15464	225240		10.,
	025706		JSP GG4LK LID MAC+10.
	245240		DAC MAC+10.
	204404		LAC TEMXL
	244405		DAC TEMXH
15470	225241		11.
	025706		JSP GG4LK LID MAC+11.
	245241		DAC MAC+11.
	204404		LAC TEMXL
	244405		DAC TEMXH
	014403		XSHIFT,
15500	244406	XCDMP,	JMP I XSH4X
			DAC 'XCM4X
		GG,,	IRP GG,,3,2,1,0*
			LAC MAC+GG
			SUB MAC+GG+8.
			ADD I0 /ELIMINATE -0
			SZA I
			JMP .+4
			SMA
			IDX XCM4X
			JMP XCDMPX
			LAC MAC+GG

			SZA	
			JMP -3	
15501	205231	3,	ENDIRP	
	425241		LAC MAC+3	
	444452		SUB MAC+3+R.	
15504	650100		ACD (0	/ELIMINATE -0
	605511		SZA I	
	640400		JMP +4	
	444406		SMA	
15510	605557		IDX XCM4X	
	205231		JMP XCOMPX	
	640100		LAC MAC+3	
	605510		SZA	
15514	205230		JMP -3	LAC MAC+2
	425240		2,	
	404452		SUB MAC+2+R.	
	650100		ACD (0	/ELIMINATE -0
15520	605524		SZA I	
	640400		JMP +4	
	444406		SMA	
	605557		IDX XCM4X	
15524	205230		JMP XCOMPX	
	640100		LAC MAC+2	
	605523		SZA	
	205227		JMP -3	LAC MAC+1
15530	425237		1,	
	404452		SUB MAC+1+R.	
	650100		ADD (0	/ELIMINATE -0
	605537		SZA I	
15534	640400		JMP +4	
	444406		SMA	
	605557		IDX XCM4X	
	205227		JMP XCOMPX	
15540	640100		LAC MAC+1	
	605536		SZA	
	205226		JMP -3	LAC MAC+0
	425236		0	
15544	404452		SUB MAC+0+R.	
	650100		ADD (0	/ELIMINATE -0
	605552		SZA I	
	640400		JMP +4	
15550	444406		SMA	
	605557		IDX XCM4X	
	205226		JMP XCOMPX	
	640100		LAC MAC+0	
15554	605551		SZA	
	605554		JMP -3	JMP -1
15557	614406	XCOMPX,	REPLAY 1,2	
15560	204402	97X,	JMP I XCM4X	
	650100		LAC SIGNN	
	605604		SZA I	
			JMP 9HX-1	
		GG,,	IRP GG,,0,1,2,3*	
			LAC MAC+4.+GG	
			CMA	
			ADD (0	
			DAC MAC+4.+GG	
15563	205232	0,	ENDIRP	
15564	761000		LAC MAC+4.+0	
	404452		CMA	
	245232		ADD (0	
	205233		DAC MAC+4.+0	
15570	761000		1,	LAC MAC+4.+1
	404452		CMA	
			ADD (0	

	245233		DAC MAC+4.+1	
	205234		2,	LAC MAC+4.+2
15574	701000		CMA	
	004452		ADD 10	
	245234		DAC MAC+4.+2	
	205235		3	LAC MAC+4.+3
15600	701000		CMA	
	004452		ADD 10	
	245235		DAC MAC+4.+3	
				REPLAY 1,2
15604	205232		LAC MAC+4.	
	014400	98X,	JMP I 98XX	
		CP4X,	REPEAT 4,0	
		DP4N,	*--	
		DPDIV4	*--	
	777777		DAC 'DP41X	
	777777		DID DP4N	
15614	244407		LAC I DP4N	
	025612		DAC DP4X	
	215612		IDX DP4N	
15620	245606		LAC I DP4N	
	040612		DAC DP4X+1	
	215612		DZM DP4X+2	
	245607		DZM DP4K+3	
15624	045611		REPLAY 1,2	/XEEP DISPLAY GDING
15626	224513		LAC I IDPDIV4	
	224514		LIO (DP4K+10000)	
15630	175244		JDA DPDIVF	
	214407		LAC I DP41X	
	245606		DAC DP4K	
			IRP GG,,0,I,2,3*	
		GG,,	LAC MAC+4+GG	
			DAC I DP4K	
			IDX DP4X	
			ENDIRP	
15633	205232	0,	LAC MAC+4+0	
15634	255606		DAC I DP4K	
	045606		IDX DP4X	
	205233		I,	LAC MAC+4+1
	255606		DAC I DP4K	
15640	045606		IDX DP4K	
	205234		2,	LAC MAC+4+2
	255606		DAC I DP4X	
	045606		IDX DP4K	
15644	205235		3	LAC MAC+4+3
	255606		DAC I DP4K	
	045606		IDX DP4K	
	044407			IDX DP41X
15650	014407	CP41,	JMP I CP41X	
		DBX,	REPEAT 0,,0	
	777777	DBXM,	*--	
	777777	DPDIV	*--	
	005662		QDPDIV=DPDIV 7777	
15663	244410		DAC 'DBXDIX	
15664	025661		DID DBXM	
			IRP GG,,0,I*	
		GG,,	LAC I QDPDIV	
			DAC DBX+GG	
			LAC I DBXM	
			DAC DBX+4.+GG	
			IDX DPDIV 7777	
			IDX DBXM	
			ENDIRP	
15665	215662	0,	LAC I QDPDIV	
	245651		DAC DBX+0	
	215661		LAC I DBXM	

15670 245655  
445662  
445661  
215662  
15674 245652  
215661  
245656  
445662  
15700 445661  
204515  
224516  
175244  
15704 225233

DAC DBX+4.+0  
IDX OPDIV 7777  
IDX DBXM  
1 LAC I QDPDIV  
DAC DBX+1  
LAC I DBXM  
DAC DBX+4.+1  
IDX OPDIV 7777  
IDX DBXM LAC (DBX+10000  
LID (DBX+4+10000  
JOA OPDIV  
LID MAC+5

15705	614410	Q8XD,	JMP I DRXD
15706	265720	GG4LK,	OAP .+12
	760200		CLA
15710	667003		SCL 25
	024414		AND (1
	244404		OAC TFMXL
	077003		SCR 25
15714	663777		RCL 95
	663777		RCL 95
	665001		SAL 15
	044405		IOR TFMXH
15720	605720		JMP .

722046  
726046

/BASELINE TAPE ROUTINES FOR IBM EQUIPMENT -- 2/26/65  
SW1=722046  
SW0=726046

DEFINE SWAP  
RCL 95  
RCL 95

TERMINATE

15721 015721

QQ0REG QQ0REG

REPEAT 0IF VP QQ0REG-100,PRINTX (

LOCATION OF TAPE PACKAGE MAY INTERFERE WITH SEQUENCE BREAK SYSTEM.

(\*

15722	000000	QQ0DEN,	0	/DENSITY, 0 FOR 200 CPI, 1 FOR 556, 2 FOR 800
	000001	QQ0UNT,	1	/UNIT, 0 THRU 7
15724	000000	QQ0PAR,	0	/PARITY, 0 ODD, 1 EVEN
	000000	QQ0RW1,	0	/REWIND INDICATOR, 0 FOR NO REWIND, 1 FOR REWIND
	000000	QQ0SOF,	0	/POSITIVE MEANS START OF FUNCTION, NEGATIVE OTHERWISE
	000000	QQ0CRP,	0	/RECORD POINTER
15730	000000	QQ0JS,	0	/LOC(JSP) TO TAPE PACKAGE
	000000	QQ0DU,	0	/DUR
15732	176257	QQ0WR,	JDA QQ0INT	/INITIALIZE
15733	710003	QQ0WR2,	LAW I 3	
15734	246566		DAC QQ0RTC	/INITIALIZE BLANK TAPE COUNTER
	710003	QQ0WR3,	LAW I 3	
	246567		OAC QQ0RWC	/INITIALIZE REWRITE COUNTER
15740	026037	QQ0WR1,	REPLAY 1,2	
	731071		JSP QQ0TCZ	/GO TO TCU-UNIT FREE SR, SETTING 50F TO 00
			731071	
15742	626127	QQ0WR6,	JSP QQ0PDC	/PROCESS CALLING SEQUENCE FOR DATA CHANNEL
15743	720346		SIA	
15744	226560		LIC QQ0WC	
	726046		SW0	/SWC OUT
15746	026215	JSP QQ0EXF		/EXECUTE FUNCTION, TEST FOR ACCEPTANCE AND COMPLETION.
	000001	1		/INCREMENT RECORD COUNT

15750	005754 700005 405730 000313	JMP 000WR7 LAW 5 000WR7, ADD 000J5 JMP 000OUT	/ERROR RETURN /NO ERROR--GO TO NORMAL RETURN /GO BACK TO MAIN PROGRAM
15750	026024	000WR7, JSP 000EPE	/GO TO SEE IF ANY ERRORS BESIDE END PT
15750	005761	JMP 000WR8	/NON-END-PT ERRORS
15756	764000 700004	CL1 000W12, LAW 4	/INDICATES END PT NOT DURING WRITE BLANK TAPE
15760	005752	JMP 000WR7	/GO TO END PT RETURN IN MAIN PROGRAM
15761	026037 730471	000WR8, JSP 000TCZ 730471	/BASIC BACKSPACE FUNCTION
16763	026214	JSP 000EXF-1	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION
15760	777776 006005 006567 005737	-1 JMP 000REW 000WR9, ISP 000RWC JMP 000WR1	/DECREMENT RECORD COUNT /ERROR RETURN FROM BACKSPACE AFTER WRITE /NORMAL RETURN /REWRITE
15770	710010 246552	LAW I 10 OAC 000CTI	/SET COUNTER TO WRITE BLANK TAPE 8 TIMES FOR A TOTAL 0
15772	026037 731071	000W10, JSP 000TCZ 731071	/BASIC WRITE MTF
15774	026214 777777 006011 006552 005772	JSP 000EXF-1 -0 JMP 000RTE 000W11, ISP 000CT1 JMP 000W10	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION /DO NOT CHANGE RECORD COUNT. /ERROR RETURN FROM WRITE BLANK TAPE /NORMAL RETURN
16000	006566 005735	ISP 000BTC JMP 000WR3	/6 INCHES BLANK TAPE WRITTEN. /INIT. REWRITE COUNTER
16000	700003 005752	000W13, LAW 3 JMP 000WR7	/GO TO UNSUCCESSFUL RETURN IN MAIN PROGRAM
16000	026336 226536 026241	000REW, JSP 000SST L10 000C9 JSP 000EY7	/SAVE STR AND ILC.
16010	005766	JMP 000WR9	/GO TO NORMAL RETURN
16011	026024 006015 226554	000RTE, JSP 000EPE JMP 000RTE L10 000OU2 JMP 000W12	/BLANK TAPE ERROR /THERE ARE NON-END-PT ERRORS /MAKE IO NEGATIVE IMPLIES END PT DURING WRITE BLANK TA
16014	005757	JMP 000W12	/GO TO END PT RETURN IN MAIN PROGRAM
16015	026336 226537 026241	000RTE, JSP 000SST L10 000C10 JSP 000EY7	/SAVE STATE
16020	001177 040200 006013	RAL 75 SPA JMP 000RTE 2	/END POINT

16023	005777		JMP QQQW11	/CONTINUE WRITE OPERATIONS
16024	266032	QQQPE,	DAP QQQEPX	/ROUTINE TO DETERMINE IF OTHER ERRORS BESIDE END PT
16027	026562		SWAP	/BRING ROTATED STATE REGISTER INTO AC
16030	050100		AND QQQMK1	/MASK OUT TIME BIT AND ALL NON-ERROR BITS
	446032		SZA 1	
	006032	QQQEPX,	IDX QQQEPX	/NO OTHER ERRORS BESIDE END PT
			JMP .	
16033	226554			/TCU-UNIT FREE SR
16034	025726	QQQTC,	L10 QQQDU0	
	266103		D10 QQQSOF	/SET QQQSOF NEG MEANS NOT START OF FUNCTION
	006060		DAP QQQTCX	
			JMP QQQTC3-2	
16037	045726	QQQTCZ,	D7M QQQSOF	/SET QQQSOF POSITIVE MEANS START OF FUNCTION
16040	266103	QQQTC1,	DAP QQQTCX	/SET TO 1+LOC(JSP QQQTCZ)
	266045		DAP QQQTCZ	
			REPLAY 1,2	
16043	205724		LAC QQQPAR	
16044	065177		SAL 75	/MOVE PARITY INDICATOR INTO BIT 10
	046045	QQQTC2,	1OR .	/CONSTRUCT FUNCTION WITH CORRECT PARITY
	246220		DAC QQQEX1 1	/STORE INTO EXECUTION ROUTINE
	046103		IDX QQQTCX	/SET TO 2+LOC(JSP QQQTCZ)
16050	700001		LAW 1	
	005722		ADD QQQDEN	
	065007		SAL 35	
	045723		1OR QQQUNT	
16054	065077		SAL 65	
	045725		1OR QQQRW1	
	046554		1OR QQQDU0	
	245731		DAC QQQDU	/STORE SELECT INSTRUCTION
16060	206527		LAC QQQC1	
	246553		DAC QQQCT	/SET COUNTER TO -66666 DECIMAL
	720072	QQQTC3,	SFC	
	006065		JMP QQQTC4	
16064	006101		JMP QQQTD1	
	026336	QQQTC4,	JSP QQQSST	
			REPLAY 1,2	
16067	066553		1SP QQQCT	
16070	006062		JMP QQQTC3	
	720073		CGO	/TCU NOT FREE WITHIN 5 SECS
16072	226530		L10 QQQC2	
	205726		LAC QQQSOF	
16074	040200		SPA	
	226531		L10 QQQC3	
			REPLAY 1,2	
16077	026241		JSP QQQEY1	/GO TO ERROR TYPEOUT SPECIFYING CH1 OR CH2
16100	006253		JMP QQQET1	/GO TO HALT AGAIN
16101	205726	QQQTD1,	LAC QQQSOF	/TCU FREE--IS THIS START OF FUNCTION
	040200		SPA	
	006103	QQQTCX,	JMP .	/NORMAL EXIT
16104	205731	QQQTC2,	XCT QQQDU	/SELECT TAPE
			REPLAY 1,2	
16106	720172		RSR	
	072001		RIR 15	
16110	042000		SPI	

	606104		JMP QQQTD2	/TAPE IS REWINDING
16112	206527		LAC QQQC1	
	246553		DAC QQCT	/SET COUNTER TO -66666 DECIMAL
16118	920172	QQQTD3,	RSR	
	652000		SPI I	
	606103		JMP QQCTCX	/NDRMAL EXIT
	026336		JSP QQCSST	/SAVE STR AND ILC
16120	066553		ISP QQCT	
	606114		JMP QQQTD4	
	720073		CGD	/UNIT NDT FREE WITHIN 5 SECS
	226532		LIO QQCC4	
			REPLAY 1,2	
16125	626241		JSP QQCTY	
	606104		JMP QQCTD?	/TRY AGAIN
				/SR TO LOAD DATA CONTROL
16127	266154	QQCPDC,	DAP QQCPDX	/SET UP RETURN
16130	206306		LAC QQQIN1	/RC(I)ST ADDRESS OF OUTPUT OR INPUT BLOCK1
	246557		DAC QQCIA	
	640200		SMA	
	606210		JMP QQCPDJ	/ILLEGAL CALLING SEQUENCE
16134	026534		SUB QQCT	/1ST ADDRESS - 040000
	640400		SMA	
	606210		JMP QQCPDJ	/ILLEGAL CALLING SEQUENCE
16137	206307		LAC QQQIN2	/RC(I)+LAST ADDRESS OF OUTPUT OR INPUT BLOCK1
16140	426557		SUB QQCIA	
	246560		DAC QQCW	/STORE TENTATIVE WORD COUNT
	050500		SPC	
	606210		JMP QQCPDJ	/ILLEGAL CALLING SEQUENCE
16144	206307		LAC QQQIN2	
	026534		SUB QQCT	/((I)+LAST ADDRESS) - 040000
	640500		SZM	
	606210		JMP QQCPDJ	/ILLEGAL CALLING SEQUENCE
16150	206154		LAC QQCPDX	
	526546		SAS QQCT17	
	606155		JMP QQCPDE	/SETTING UP EDR A READ OR READ COMPARE
16153	226557	QQCPDC,	LID QQCIA	
16154	606154	QQCPDX,	JMP .	
				/SETTING UP FOR A READ OR READ COMPARE. MORE CHECKING
16155	206550	QQCPDE,	LAC QQRC1	
	640100		SZA	
	606177		JMP QQCPDF	/READ COMPARE
16160	206306		LAC QQQIN1	
	025721		SUB QQQDEN-1	/ACTUALLY SUBTRACTING VALUE OF QQQBEG
	640400		SMA	
	606172		JMP QQCPDI	
16164	710001		LAW I 1	
	406307		ADD QQQIN2	
	026570		SUB QQQRWC 1	/ACTUALLY SUBTRACTING VALUE OF QQQEND
	640400		SMA	
16170	606210		JMP QQCPDJ	/READ-IN REGION OVERLAPS TAPE PACKAGE. ILLEGAL.
	606153		JMP QQCPDC	/READ-IN REGION DOESNT OVERLAP TAPE PACKAGE. LEGAL.
16172	206306	QQCPD1,	LAC QQQIN1	
16174	026570		SUB QQQRWC 1	/ACTUALLY SUBTRACTING VALUE OF QQQEND
	050500		SPQ	
	606210		JMP QQCPDJ	/READ-IN REGION OVERLAPS TAPE PACKAGE. ILLEGAL.

	006153		JMP QQQPO0	/READ-IN REGION DOESNT OVERLAP TAPE PACKAGE. LEGAL.
16177	206306	QQQPDF,	LAC QQQIN1	
16200	026547		SUB QQQRCB	
	040400		SMA	
	006210		JMP QQQPQJ	/REFERENCE REGION OVERLAPS READ-COMPARE BUFFER. ILLEGAL.
	205721		LAC QQQOEN-1	
16204	026547		SUB QQQRCB	
	040400		SMA	
	006210		JMP QQQPQJ	/TAPE PACKAGE OVERLAPS READ-COMPARE BUFFER. ILLEGAL.
	006153		JMP QQQPO0	/LEGAL.
16210	226535	QQQPQJ,	L1Q QQCCB	
			REPLAY 1,2	
16212	026241		JSP QQQETY	/TYPE OUT ERROR MESSAGE FOR ILLEGAL CALLING SEQUENCE.
	006003		JMP QQQW13	/GO TO UNSUCCESSFUL RETURN
				/ROUTINE TO EXECUTE FUNCTION AND WAIT FOR COMPLETION
16214	720146		SDF	
	266240	QQQEXF,	OAP QQQEXX	/SET UP RETURN
	266230		OAP QQQEX2 1	
16220	205731	QQQEX1,	XCT QQCDU	/SELECT TAPE CLEARING INDICATORS IN STATE REGISTER.
	000000		Ø	/FUNCTION TO BE EXECUTED IS PRESTORED HERE.
	720072		SFC	
	006227		JMP QQQEX2	/FUNCTION ACCEPTED
	226533		L1Q QQCC5	
			REPLAY 1,2	
16223	026241		JSP QQQETY	/FUNCTION NOT ACCEPTED--TYPE ERROR MESSAGE
	006217		JMP QQQEX1	/TRY AGAIN
16227	026033	QQQEX2,	JSP QQQTCØ	/FUNCTION ACCEPTED--IS TCU FREE IN LESS THAN 5 SECS.
16230	206230		LAC .	/PICK UP RECQRD NUMBER INCREMENT OR DECREMENT
	005727		ADQ QQCRP	
	245727		OAC QQCRP	
	046240		IDX QQQEXX	
16234	720172		RSR	
	062001		R1L 15	
	052000		SPI 1	
	046240		IDX QQQEXX	
16240	006240	QQQEXX,	JMP .	
				/ERROR TYPEOUT ROUTINE
16241	266256	QQQETY,	DAP QQQETX	/SET UP RETURN
16250	226961		REPEAT 3,R1L 65	
	730003		L1Q QQCMK2	
			TYO	/PUT CQCE FOR CARRIAGE RETURN IN RIGHT 6 BITS
			TYO	
			REPLAY 1,2	
16253	206555	QQQET1,	LAC QQCSTR	
16254	226556		L1Q QQCILC	
	760000	QQQET2,	HLT	
	006256	QQQETX,	JMP .	/RETURN TO PROGRAM WHICH CALLED.
				/INITIALIZATION ROUTINE
16257	000000	QQQINT,	Ø	
16260	720033		CKS	
	720054		LSM	
	266305		O1O QQQINØ	
	266304		OAP QQQINX	
16264	005725		OZM QQQRW1	
16265	770001		LAW I 1	

	406257 245730		ACC QCCINT QAC QCCJS	
16270	724074 706306 266276 710005		EEM LAW QCCIN1 OAP QCCIN7 LAW 1 5	
16274	246552 216257 246306 446257	QQQIN6, QQQIN7,	OAC QCCCT1 LAC I QCCINT OAC QCCIN1 ICX QCCINT ICX QCCIN7	
16300	446276		REPLAY 1,2 ISP QCCCT1 JMP QCCIN6	
16302	466552 406275		JMP .	
16304	406304	QQQINX,	JMP .	
16309	000000 000000 000000	QQQIN0, QQQIN1, QQQIN2,	0 0 0	/STATUS INFO /1ST WORD FOLLOWING JSP /2ND WORD FOLLOWING JSP
16310	000000 000000 000000	QQQIN3, QQQIN4, QQQIN5,	0 0 0	/3RD WORD FOLLOWING JSP /4TH WORD FOLLOWING JSP /5TH WORD FOLLOWING JSP
16313	246335	QQQOUT,	OAC QCCQUX	/EXITING ROUTINE
16314	026551 246312 760300 026551		AND QCCQUP OAC QCCINS LAP AND QCCQUM	/MASK WITH 030000 TO EXTRACT MODULE NUMBER
16320	626312 006324 760200 006335		SAS QCCIN5 JMP QCCQU1 CLA OIP QCCQUX	/RETURN IS IN SAME MODULE AS TAPE PACKAGE.  /CLEAR BITS 0-5
16324	206257 661001 640400 720074	QQQU1,	LAC QCCINT RAL 15 SMA LEM	/LEAVE EXTEND MODE IF APPROPRIATE
16330	206305 461077 640200 720055		LAC QCCIN0 RAL 65 SPA ESM	/BRING BACK STATUS INFO TO CHECK INITIAL STATE OF SEQ.
16334	616335 000000	QQQUX,	JMP I QCCQUX 0	/EXIT
16336	266344 720336	QQQSS1,	OAP QCCSSX RLC	
16340	026556 720172 026555		OIO QCCILC RSR OIO QCCSTR REPLAY 1,2	
16344	006344	QQQSSX,	JMP .	

16345	176257	QQQWF,	JDA QQINT	/WRITE END OF FILE SECTION
	626037	QQWF1,	JSP QQCTCZ	
	733271		733271	/WRITE EOF FUNCTION
16350	626214		JSP QQEXF-1	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION.
	000001		1	/INCREMENT RECORD COUNT
	006355		JMP QQWF2	/ERROR RETURN
	700002	QQWF4,	LAW 2	
16354	005752		JMP QQWRY	/RETURN TO NORMAL RETURN IN MAIN PROGRAM
16355	626024	QQWF2,	JSP QQCEPE	
	006361		JMP QQWF3	/THERE ARE NON-END-PT ERRORS
	700001	QQWF5,	LAW 1	/ONLY END POINT
16360	005752		JMP QQWRY	/GO TO END POINT RETURN OF MAIN PROGRAM.
	626336	QQWF3,	JSP QQSST	/SAVE STATE
	226542		LIO QQCT3	
	626241		JSP QQETY	
16364	001177		RAL 75	
	040200		SPA	
	000357		JMP QQWF2 2	/GO TO END POINT RETURN OF MAIN PROGRAM
	006353		JMP QQWF1 5	/GO TO NORMAL RETURN OF MAIN PROGRAM
				/SECTION FOR READ AND READ COMPARE
16370	346550	QQRD,	DYM QQRC1	/SET READ COMPARE INDICATOR TO STRAIGHT READ
	176257		JDA QQINT	
16372	710003	QQRD2,	LAW 1 3	
	246565		DAC QQPRD	
16374	626037	QQRD1,	JSP QQCTCZ	
	731471		731471	
16376	626127	QQRD3,	JSP QQCPDC	/PROCESS THE CALLING SEQUENCE.
16377	720346	QQRD8,	SIA	
16400	226560		LIO QQWC	
	722046		SWI	/SWC IN
16402	626215		JSP QQEXF	/EXECUTE FUNCTION, TEST FOR ACCEPTANCE AND COMPLETION.
	000001	QQRD6,	1	/INCREMENT RECORD COUNT
16404	006412		JMP QQRD4	/ERROR RETURN
	672037		RIX 55	/NO ERROR--MOVE EOF BIT INTO SIGN.
	042000		SPI	
	005757		JMP QQW12	/END OF FILE RETURN.
16410	226550		LIO QQRC1	
	605751		JMP QQWRY-1	/NORMAL RETURN
16412	626037	QQRD4,	JSP QQCTCZ	

16413	730471		730471	/BASIC BACKSPACE FUNCTION
16414	826214 777776 806422		JSP QQCEXF-1 -1 JMP QQCBER	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION /DECREMENT RECORD COUNT /ERROR RETURN FROM BACKSPACE AFTER READ
16418	806565	QQQRD5,	ISP QQQRD JMP QQQR01	/NORMAL RETURN FROM BACKSPACE /RE-READ
16421	806003		JMP QQCW13	/GO TO UNSUCCESSFUL RETURN IN MAIN PROGRAM.
16422	826336 226540	QQCBER,	JSP QQCSST LIO QQCC11	/SAVE STATE
16424	826241 806417		JSP QQGETY JMP QQQRD5	/NORMAL RETURN  /SECTION FOR SPACE FUNCTION
16426	776257	QQQSP,	JOA QQQINT LIO QQQR04 1	/BASIC BACKSPACE FUNCTION
16430	206306 840400 226375 826447		LAC QQCINI SMA LIO QQQR01 1 DIO QQQSP4	/PICK UP PLUS OR MINUS THE NUMBER OF RECORDS TO BE SPA  /BASIC FORWARD FUNCTION
16434	226415 840400 226403 826461		LIO QQQRD4 3 SMA LIO QQQRD6 DIO QQQSP5	/-1  /+1
16440	840400 761000 805775 805757		SMA CMA SAD QQCW10 3 JMP QQCN12 OAC QQCT1	/-0 /ZERO SPACING REQUIRED!--GO TO NORMAL RETURN /COUNTER CONTAINS -(NO. RECORDS TO SPACE)
16444	246552		REPLAY 1,2	
16446	826037 800000	QQQSP3, QQQSP4,	JSP QQQTC7 0	/BASIC FUNCTION IS PRESET /PICK UP RECORD POINTER
16450	205727 840100 800460 206306		LAC QQQRP SZA JMP QQCSPS-1 LAC QQCINI	/RECORD POINTER NOT 0---PERFORM SPACING FUNCTION /PICK UP '+ NUMBER OF RECORDS TO SPACF
16454	840400 800460 226552 800353	QQQSP8,	SMA JMP QQCSPS-1 LIO QQCT1 JMP QQQWF4	/PERFORM FORWARD SPACING FUNCTION  /GO TO RECORD 0 RETURN IN MAIN PROGRAM
16460	826214 777776 806473 720172	QQQSP5, QQQSP6,	JSP QQCEXF-1 -1 JMP QQCESP RSR	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION. /-1 OR +1 /ERROR RETURN /NO ERROR--BRING STATE INTO IO
16464	872017 842000 806477		RIR 45 SPI JMP QQQSP7 REPLAY 1,2	/ROTATE EOF BIT INTO SIGN  /EOF FOUND.

16470	446552 406446 405757		ISP QQCCT1 JMP QQCSP3 JMP QQQW12	/SPACE SOME MORE. /GO TO NORMAL RETURN.
16473 16474	426336 226541 426241 406463	QQGESP,	JSP QGQSS L10 QQC12 JSP QQCETY JMP QQCSP6	/ERROR FROM SPACING--SAVE STATE /ERROR TYPEOUT /NORMAL RETURN
16477 16500	446552 226552 406003	QQQSP7,	IDX QQCCT1 L10 QQCCT1 JMP QQQW13	/GO TO END OF FILE RETURN.
16502 16504	376257 704000 245725	QQOREW,	JDA QQQINT LAW 4000 OAC QQQRW1	/SECTION FOR REWIND /SET REWIND INDICATOR TO REWIND
16505 16510	626037 730471 472077 442000 606515		JSP QQCCTZ 730471 RIR 65 SPI JMP QQQRW1	/BASIC BACKSPACE FUNCTION /AT LOAD POINT
16512 16514	426214 400000 406517 345727		JSP QQCXFF-1 JMP QQQRW2 O2M QQCRRP	/DISCONNECT DATA CONTROL AND EXECUTE FUNCTION. /ERROR RETURN /NO ERROR--RESET RECORD POINTER
16516	406357		JMP QQCWF5	/GO TO NORMAL RETURN IN MAIN PROGRAM
16517 16520	426336 226543 710700 426555 526545 426241	QQQRW2,	JSP QGQSS L10 QQC14 LAW 1 700 AND QGQSTR SAS QQC16 JSP QQCETY REPLAY 1,2	/SAVE STATE /MASK TO REMOVE PARITY AND DENSITY FROM STATE INDICATED
16524	426241			
16526	406515		JMP QQQRW1	
16527 16530	575625 436201	QQQC1, QQQC2,	-66666. TEXT (CB1	/CONSTANTS, TEMP STORAGE, MASKS, MESSAGES AND COUNTERS
16531	636202	QQQC3,	TEXT (CB2	{
16532	246200	QQQC4,	TEXT (UB	{
16533	444561	QQQC5,	TEXT (FNA	{
16534	440000 716322	QQQC7, QQQC8,	040000 TEXT (ICS	{
16536	456226	QQQC9,	TEXT (EBW	{

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16537 056223      QQQC10,          TEXT (EBT
16540 056251      QQQC11, TEXT (EBR
16541 052247      QQQC12, TEXT (ESP
16542 052666      QQQC13, TEXT (EWF
16543 055126      QQQC14, TEXT (ERW
16544 002000      QQQC15, 2000
      000001      QQQC16, 600001
      000377      QQQC17, JMP QQRD3 1
16550 036000      QQRCEB, 036000 /START OF READ COMPARE BUFFER
      000000      QQRCL, 0 /READ COMPARE INDICATOR, 0 FOR STRAIGHT READ, - FOR RE
      030000      QQQCUM, 030000
16552 000000      QQQCT1, 0
      000000      QQQCT, 0
16554 720070      QQQU0, 720070
      000000      QQQSTR, 0
      000000      QQQ1LC, 0
      000000      QQQ1A, 0
16560 000000      QQQWC, 0
16561 177777      QQQMK2, 177777
      370001      QQQMK1, 370001
16563 000000      QQQTEM, 0
16564 000000      QQQTM1, 0
16565 000000      QQQRRC, 0 /REREAD COUNTER
      000000      QQQBTC, 0 /BLANK TAPE COUNTER
      000000      QQQRWC, 0 /REWRITE COUNTER
16570 016570      QQQEND QQQEND

```

```

REPEAT 01F VZ QQQEND 770000-QQBEG 770000,PRINTX (
TAPE PACKAGE OVERLAPS CORE MODULES AND WILL NOT OPERATE PROPERLY.
(†

```

START

```

/MODULE 2 SCOPE DISPLAY
20000/
20000 020137
      221761
      060066
      130000
20070 003000
      034137
      221673
      060064
20074 037061
      454565
      432200
      000100
20100 000200
      000300
      000400
20103 730000

20000/
TEXTLINES 20137
          221761
          060066
          REPEAT 52., TEXTLINES
          130000 /ESCAPE
          3000 /STOP
CHANNELS 34137
          221673
          060066
          TEXT /CHA
          NNE
          LS
          1
          2
          3
          4/
          130000 /ESCAPE

DEFINE BTEXT A,B,C
A 24137
  220000+B
  060000+C
TERMINATE

BTEXT CONTINUE,33,711
TEXT /CON
      TIN
      UE/

130000 /ESCAPE
3000 /STOP
BTEXT NEXTFILE,66,66
TEXT /NEX
      T F
      ILE
      /

130000 /ESCAPE
BTEXT TYP0UT,66,1535
TEXT /TYP
      E 0
      UT/

130000 /ESCAPE
BTEXT TYPIN,66,1205
TEXT /TYP
      F I
      N/

130000 /ESCAPE
BTEXT THISFILE,66,416
TEXT /THI
      S F
      ILE
      /

130000 /ESCAPE
3000 /STOP
20107 034646
20110 237145
      246500
20112 130000
      003000
20117 456527
20120 230066
      714365
20122 130000
20126 233047
      050046
20130 242300
20131 730000
20135 233047
      050071
      450000
20140 130000
20144 237071
      220066
      714365
20147 130000
20150 003000

```

20154	044663 204465 452300	BTEXT DOCUMENT,33,242 TEXT /DOC LIME NT/
20157	130000	130000 /ESCAPE
20160	003000	3000 /STOP
20164	665161 446500	BTEXT FRAME,66,66 TEXT /FRA MF/
20166	130000	130000 /ESCAPE
20172	224346 260000	BTEXT SLOW,66,416 TEXT /SLO W/
20174	130000	130000 /ESCAPE
20200	444664 655161 236500	BTEXT MODERATE,66,1205 TEXT /MOD ERA TE/
20203	130000	130000 /ESCAPE
20207	666122	BTEXT FAST,66,1535
20210	230000	TEXT /FAS T/
20211	130000 003000	130000 /ESCAPE 3000 /STOP

20216	227167		RTEXT INFO,1673,1170
	446100		227167 /SIGMA =
20220	320000		446100
	000000	INFC1	320000
	000000		000000
	000000		000000 /SIGMA
	000000		000000
20224	000013		000013 /ESCAPE
	034037		034037
	221640		221640
	001100		001100
20230	452444		452444
	626551		626551
	004666		004666
	002351		002351
20234	616365		616365
	220032	INFC2	220032
	000000		000000
	000000		000000 /NUMBER OF TRACES
	000000		000000
20240	000013		000013 /ESCAPE
	034037		034037
	221605		221605
20244	001100		001100
	446127		446127
	001600		001600
	271600		271600
20250	003200		003200
	000000	INFC3	000000
	000000		000000
	000000		000000 /MAX X
20254	130000		130000
	034037		034037
	221552		221552
	061100		061100
20260	237144		TEXT /TIM
	050026		E W
	065164		ORO
20263	003200		/
20264	000000	TAPINF	000000
	000000		000000
	000000		000000
	130000		130000
20270	034037		034037
	221517		221517
	061100		061100
	235161		TEXT /TRA
20274	636502		CE
	454673		NO.
20276	003200		/
	000000	TAPINK	000000
20300	000000		000000
	000000		000000
	130000		130000
	003000		0000
	034157	SORRY	34157
20304	221000		221000
	060070		060070
	074365		TEXT /PLE

20310 412265  
002324  
514600  
222346  
20310 470062  
242323  
404500  
406666

ASE  
TU  
RN  
STO  
P B  
UTT  
ON  
OFF /

20320	130000	130000	/ESCAPE
	003000	3000	/STOP
	001540	SOTOSC=1540	
20322	034117	034117	
	221540	220000+SOTOSC	
20324	100777	100777	
	003000	REPEAT 400.,	TRACE /TRACE DISPLAY BUFFER AREA
	034117	3000	
	220207	THYTB	34117
21150	100066	220207	100066
23431	003000	.+20000+1200./	3000
23431	003000	DEFINE	UPXW
			24117 /UPPER LIMIT
			220000
			100000
			200226
			200054
			200226
			313626
			213426
		TERMINATE	
		DEFINE	LOXW /LOWER LIMIT
			24117
			220000
			100000
			200226
			200054
			200226
			213626
			313426
			013426
		TERMINATE	/STOP
		LIMITS	REPEAT 8., UPXW LOXW
			BTEXT TMCTFR,115,122
23665	360000	360000	
	130000	130000	/ESCAPE
	003000	3000	/STOP
	023062	T1MCR=TMCTFR	
		BTEXT TMCTSL,115,452	
23673	360000	360000	
23674	130000	130000	/ESCAPE
	003000	3000	/STOP
		BTEXT TMCTMO,115,1275	
23701	360000	360000	
	130000	130000	/ESCAPE
	003000	3000	/STOP
		BTEXT TMCTFA,115,1571	
23707	360000	360000	
23710	130000	130000	/ESCAPE
	003000	3000	/STOP

```

DEFINE NAME1
34137
222000 /ALLOWS FOR 6
062000 /CHARACTER NAME
000000
000000
130000
3000 /STOP
TERMINATE NAME REPEAT 8., NAME1
DEFINE KAROTE A,B,C
A BTEXT A,B,C
360013
3000 /STOP
TERMINATE
KAROTE NAMCRT,0,0
KAROTE CRTCON,60,777
KAROTE CRTNF,115,141
KAROTE CRTT0,115,1616
KAROTE CRTT1,115,1246
KAROTE CRTTF,115,472
KAROTE CRTDOC,60,310
KAROTE DATAX,0,0
24052 020117 BASELN 020117
220207 220207
24054 102066 102066
200177 200177
200177 200177
200177 200177
24060 200177 200177
200177 200177
200177 200177
200177 200177
200177 200177
200177 200177
200177 200177
24064 600032 600032 /STOP
003000 003000
034137 34137
220207 220207
24070 062000 062000
050013 350013
034137 34137
220172 220172
24074 060000 060000
360013 360013
003000 003000 /STOP
24077 034157 CHNMES 34157
24100 221000 221000
060070 060070
174365 TEXT /PLE
112265 ASE
24104 002265 SE
036563 LEC
230061 T A
004365 LE
676143 GAL
002361 TA
176500 PE
037061 CHA

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24114 454565  
430000

NNE  
L/

24116 000013  
003000

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3000

24120 034157  
221000  
060070

LSDNC 34157  
221000  
060070  
TEXT /LIM

24124 437144  
112300  
226523

IT

24130 006465  
007145  
112371

SET

24134 064500  
112200  
454623

DE

24140 000047  
436561  
226500

FIN

24144 232451  
450046  
450043

ITI

24160 114471  
232200  
022423

ON

24154 234645  
006145  
440066

IS

24156 000013  
003000

NOT

24164 034157  
221000  
060070

CO

24170 002324  
014600  
406666

MPL

24174 430022  
246243  
114471

ETE

24177 000013  
003000

SH.

24200 000013  
003000

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24204 144572  
244462  
055100

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24208 406600  
046123  
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24210 232200  
 743372  
 24212 744472  
 456145  
 24214 887433  
 720000  
 24216 744772  
 614662  
 24220 416271  
 437123  
 300046  
 440044  
 24224 456145  
 887433  
 720000  
 24227 747172  
 452365  
 24230 475161  
 430047  
 514662  
 24234 416271  
 437123  
 300066  
 465100  
 24240 010022  
 716744  
 410074  
 837200  
 24244 742272  
 716744  
 410074  
 837200  
 24250 747172  
 452365  
 475161  
 430047  
 24254 614662  
 416271  
 437123  
 300066  
 24260 465100  
 020022  
 716744  
 410074  
 24264 837200  
 24268 747172  
 452365  
 475161  
 24270 430047  
 514662  
 416271  
 437123  
 300066  
 465100  
 030022  
 716744  
 24300 410074  
 837200  
 24302 746772

TS = /  
 8C2 TEXT /M  
 EAN = /  
 8C3 TEXT /P  
 ROB ABI LIT Y O F M EAN = /  
 8C4 TEXT /I  
 NTE GRA L P ROB ABI LIT Y F OR 1 S IGM A = /  
 8C3A TEXT /S  
 IGM A = /  
 8C5 TEXT /I  
 NTE GRA L P ROB ABI LIT Y F OR 2 S IGM A = /  
 8C6 TEXT /I  
 NTE GRA L P ROB ABI LIT Y F OR 3 S IGM A = /  
 8C7+ TEXT /G

24304 516145  
 244361  
 517123  
 100000  
 743372  
  
 24310 744472  
 412771  
 442444  
 002700  
 743372  
  
 24315 744472  
 714571  
 442444  
 002700  
 743372  
  
 24322 744472  
 712247  
 436163  
 054465  
 452300  
 106600  
 24330 226543  
 056323  
 056400  
 270074  
 743372  
  
 24335 747172  
 452365  
 475161  
 24340 430047  
 114662  
 416271  
 437123  
 100046  
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 054365  
 032365  
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 014564  
 267164  
 237000  
 24354 743372

031000

24411

24412 000124  
 000777  
 475000  
 24414 000001  
 012445  
 000002  
 000004

RAN  
 ULA  
 RIT  
 Y  
 = /  
  
 8C8 TEXT /M  
 AXI  
 MUM  
 X  
 = /  
  
 8C9 TEXT /M  
 INI  
 MUM  
 X  
 = /  
  
 8C10 TEXT /D  
 ISP  
 LAC  
 EME  
 NT  
 OF  
 SEL  
 ECT  
 ED  
 X  
 = /  
  
 8C11 TEXT /I  
 NTF  
 GRA  
 L  
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 ROB  
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 S  
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 R  
 AND  
 WID  
 TH  
 = /

DATA=31000

EQUALS NAME1,NULL  
 EQUALS LOXW,NULL  
 EQUALS UPXW,NULL  
 EQUALS @TEXT,NULL  
 EQUALS KAROTE,NULL

VARIABLES

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 020622  
 24424 014270  
 001336  
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 001750  
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 000117  
 24434 001534  
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 010620  
 010614  
 24440 000121  
 115726  
 233654  
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 24444 003240  
 000014  
 004713  
 023420  
 24450 005557  
 000577  
 000000  
 007777  
 24454 002445  
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 014271  
 777744  
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 000033  
 003000  
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 000047  
 000277  
 24470 004557  
 004534  
 004273  
 014612  
 24474 001776  
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 300077  
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 24500 637400  
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 014747  
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 700001  
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 015286  
 015613  
 24514 015606  
 015651  
 015655  
 24570  
 24574 760400  
 004576

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13. ABSTRACT  BASELINE was designed to perform a statistical analysis of radar pulse data previously read by the Laboratory's high precision computer controlled film reader. A computer controlled display oscilloscope, a light pen and a set of function coded sense switches provide a real time interface between an analyst and the data reduction program in the computer. The computer performs all necessary display, computation and outputting functions. All operations are under direct control of the analyst. He sets the operating criteria, exercises the required judgments and steers the program through the required analysis.  Analytical results are quickly available and rapidly documented. Output consists of a statistical distribution of the input data displayed on a large oscilloscope. This display may easily be documented photographically. Key parameters describing the statistical distribution may be output on the type-writer at the command of the analyst. A very large saving in the data reduction time results since the necessity of repeated test runs through a large computer and subsequent study of the numerical printouts is eliminated.		
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