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Specific Ion Mass Spectrometric Detection For Gas Chromatographic Pesticide Analysis



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SPECIFIC ION MASS SPECTROMETRIC
DETECTION FOR GAS CHROMATOGRAPHIC
PESTICIDE ANALYSIS

By

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ABSTRACT

Computer programs have been developed for a PDP8/e controlling a Finnigan 1015 quadrupole mass spectrometer to monitor selected ions from components in a gas chromatographic effluent. The program is designed to monitor only a few ions (1 to 8) to enhance the sensitivity for the selected ions. Signal-to-noise levels of 10:1-30:1 have been obtained for 0.2 ng or less of four pesticides^{173 211} employing chemical ionization mass spectrometry and a digital smoothing routine.

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Dr. Rodger Foltz of the Columbus Laboratory of Battelle Memorial Institute aided in the development of design parameters for the computer programs.

SECTION I

CONCLUSIONS

Two computer programs have been developed for selected ion monitoring of gas chromatographic effluent components with a Finnigan 1015 quadrupole mass spectrometer equipped with a System 150 data system. The programs are designed for a PDP8/e (or PDP-8/f or PDP8/m) computer equipped with the extended arithmetic element (EAE). With these programs, signal-to-noise ratios of 10:1 to 30:1 have been obtained for 0.2 ng or less of four pesticides employing chemical ionization mass spectrometry and a digital smoothing routine. Programs are also available with EAE simulator routines for computers without EAE. These programs have been debugged and are ready for general distribution.

SECTION II
RECOMMENDATIONS

The debugged Selected Ion Monitoring programs should be made available to users of Finnigan quadrupole mass spectrometers equipped with System 150 data systems.

SECTION III

INTRODUCTION

The goal of this project was the development of a practical system for application of "Selected Ion Monitoring" to gas chromatographic analysis of pesticides.

Selected Ion Monitoring (SIM) is the technique of monitoring one or only a few ions from a mass spectrum rather than acquiring complete mass spectra. The technique has been demonstrated magnetic deflection mass spectrometers.⁽¹⁻⁴⁾ However, magnetic deflection instruments have one serious drawback for development of this technique to its ultimate; it is difficult to change from one mass to another quickly by changing the magnetic field strength because of the hysteresis of magnet systems. The LKB mass spectrometer, for example, employs a change of the accelerating voltage to focus on different masses. This limits the masses that can be monitored to a range of about 10 percent of the mass. If a larger mass range is covered, there are significant differences in the sensitivity to the various masses.

The quadrupole mass spectrometer is well suited to the peak-monitoring technique because all that is needed to change from one mass to another is to change the voltage on the quadrupole rods. The Finnigan mass spectrometer in combination with a computer data system such as the System 150 provides an ideal system for development of a Selected Ion Monitoring mass spectrometric technique.

Chemical ionization mass spectrometry is also ideally suited to the SIM technique. It appears that chemical ionization gives higher sensitivity than electron impact ionization. In addition, most compounds produce

fewer ions with significant intensity under chemical ionization conditions than under electron impact ionization conditions. Thus, the simpler spectra give less chance for ambiguous identifications with chemical ionization mass spectrometry.

SECTION IV

The System 150 provides standard programs for data acquisition and display. These programs are ideal for gas chromatographic data; they provide output of real-time and reconstructed gas chromatograms as well as mass spectra plots. However, the standard programs are designed for discrete mass spectra. If the operator elects to monitor only one ion, an entire block of data is recorded for each point, so that a large amount of file storage room is required.

For electronic signals with random noise, the signal-to-noise ratio increases as the square root of the observation time,

$$S/N = k\sqrt{Vt}.$$

For example, consider the comparison of an ion in a standard mass spectrum (3 sec. scan, 300 amu) with monitoring of a single peak (100 msec integration periods) for a standard mass spectrum 10 msec is spent on each peak, but 2.3 msec is required for settling time between masses, so 7.7 msec is the actual integration time. For the SIM technique, the integration time is 97.7 percent of the total time. Hence the expected signal-to-noise ratio improvement is given by:

$$S/N = \sqrt{.977 \times 3 \times 1000 / 7.7} = 19.5$$

The standard System 150 routines are not well suited for the SIM technique. For disk systems, the large amount of storage space is not a major obstacle, although only a few runs can be made before a disk will be full. For a DECTape system however, it is a major problem. It is not unusual for a gas chromatographic run to last 30 minutes, and for 1 sec integration times, 1800 spectra would be acquired; a DECTape will only hold at most about 1200 spectra (1472 blocks, but about 250 are required for system programs).

Baseline noise due to column bleed is a significant problem in gas chromatography, particularly in programmed temperature operation. It is usually corrected by dual column operation, bucking one against the other (i.e. by baseline subtraction). For combined gc/ms, a single column technique, this solution is not feasible. The System 150 programs provide a background subtraction capability for display of individual spectra, but have no way of suppression or subtraction of the baseline in reconstructed gas chromatograms. Since baseline suppression is necessary for maximum sensitivity this is a serious shortcoming of the standard System 150 programs.

Further, the ions of interest in a gc/ms run change with the progress of the run. The standard System 150 programs provide the capability of monitoring only a few ions, but monitors the same set of ions during the entire run. Since all ions of interest must be monitored all the time, this reduces the percentage of the time that can be spent on each, thus reducing the theoretical signal-to-noise enhancement of the SIM technique.

SECTION V

COMPUTER PROGRAM DEVELOPMENT

This project was devoted to development and evaluation of computer programs for implementing compound specific mass spectrometric detection on a Finnigan mass spectrometer equipped with a System Industries System 150 mass spectrometer control system. This report describes the overall programs, flow charts for the overall program, and more detailed flow charts for the individual segments. Program assembly listings are given in the Appendices.

The programs will operate with either disk or tape-based systems. Of course, the disk system provides room for more data storage. However, two DECTapes provide ample storage for any normal run. Two programs have been written, one for data acquisition (including on-line presentation of the first mass specified, using the Houston digital plotter) and one to plot all data points to the same scale. These programs are discussed below. The programs are designed to operate on a 4K PDP8/e computer equipped with the KE8E extended arithmetic element (EAE). However, since the EAE is not required for the System 150, versions that do not require the EAE have been written for both programs. The non-EAE data acquisition program is not noticeably slower than the EAE version for most applications. However, the non-EAE off-line plotting program is noticeably slower.

Data Acquisition Program

The program provides for monitoring from one to eight different masses. The integration time for each mass can be specified separately to avoid saturation for strong peaks while providing required sensitivity for weak peaks. For improved signal-to-noise ratio on weak peaks without danger

of saturating strong peaks, a selectable number of consecutive points for each mass can be added together and stored as a double precision value. The value for the first specified mass is plotted to give a real-time chromatogram.

This program is designed to be called as a USER program on System 150, and uses standard System 150 mass-storage read, write, and file handling routines, standard teletype and plotter routines. These subroutines are the property of System Industries and therefore not discussed or listed in this report. The multiply and divide routines that are based on the EAE option are included in the program listing, but are not flow charted or discussed.

The program consists of five basic segments:

1. Initialization,
2. Mass Spectrometer Scan Control,
3. Data Recording,
4. On-Line Data Presentation, and
5. Keyboard Monitor.

A number of smaller subroutines are used to implement input, output and other functions. The overall flow of the program is shown in Figure 1. The individual program segments are described in the following sections.

Initialization. The initialization phase of the program sets all initial parameters for data acquisition. These are:

1. Calibration File Name. This program assumes the presence of a standard system calibration file.
2. Masses to be Monitored. From 1 to 8 can be specified, decimal fractions permitted.

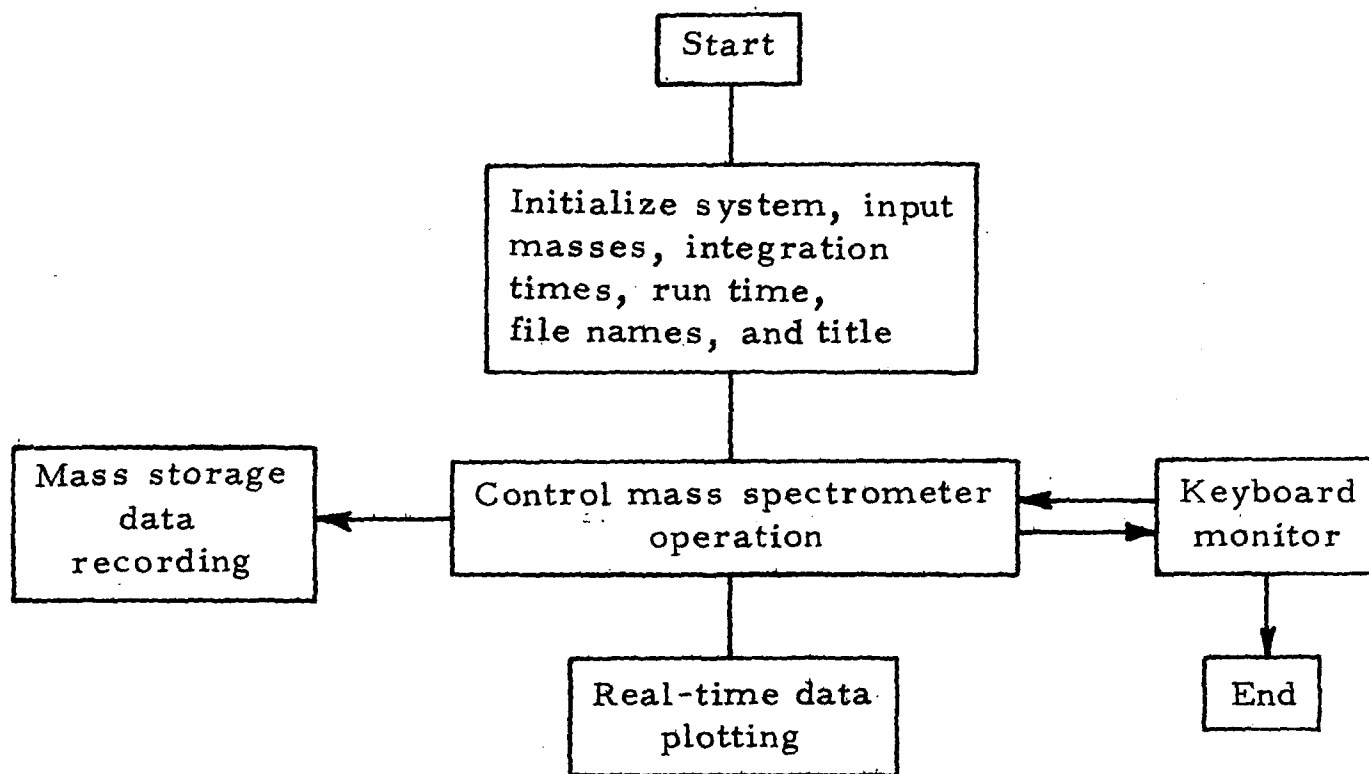


FIGURE 1. GENERAL PROGRAM FLOW CHART

3. Integration Time. The integration time is specified, in milliseconds (max of 4096). As many integration times can be entered as masses. However, if fewer integration times are entered than masses, the last time entered is used for the rest of the masses. (All masses can be monitored at the same integration time by entering only a single integration time).
4. Number of Sets of Masses. To permit rapid change of conditions, up to three sets of masses and integration times can be specified at the start of the run.
5. Number of Points to Scan For Each Mass. The specified number of values for each mass are summed and entered as a single value in the file of recorded data. This permits the equivalent of long integration times and frequent data sampling so that real data fluctuations are not missed.
6. Title of Run. Room exists in the record for a descriptive title of up to 40 alphanumeric characters.
7. Maximum Time of the Run in Minutes. When the specified time has elapsed, the run is terminated automatically. However, the run can be terminated earlier if desired by entering E(CR) on the teletype. Control-L (depressing both the control key and L) aborts the run, i.e., terminates it without entering the file in the system directory.
8. Data File Name. This is the name (six characters or less) by which the file is catalogued on the system device.

In the initialization program, the calibration file data are packed into the proper format to set rod voltages, and the rod voltage settings are calculated for each set of masses entered. A linear interpolation is used for the calculation: $V_c = V_1 + (M_c - M_1) \times (V_2 - V_1) / (M_2 - M_1)$ where c is the

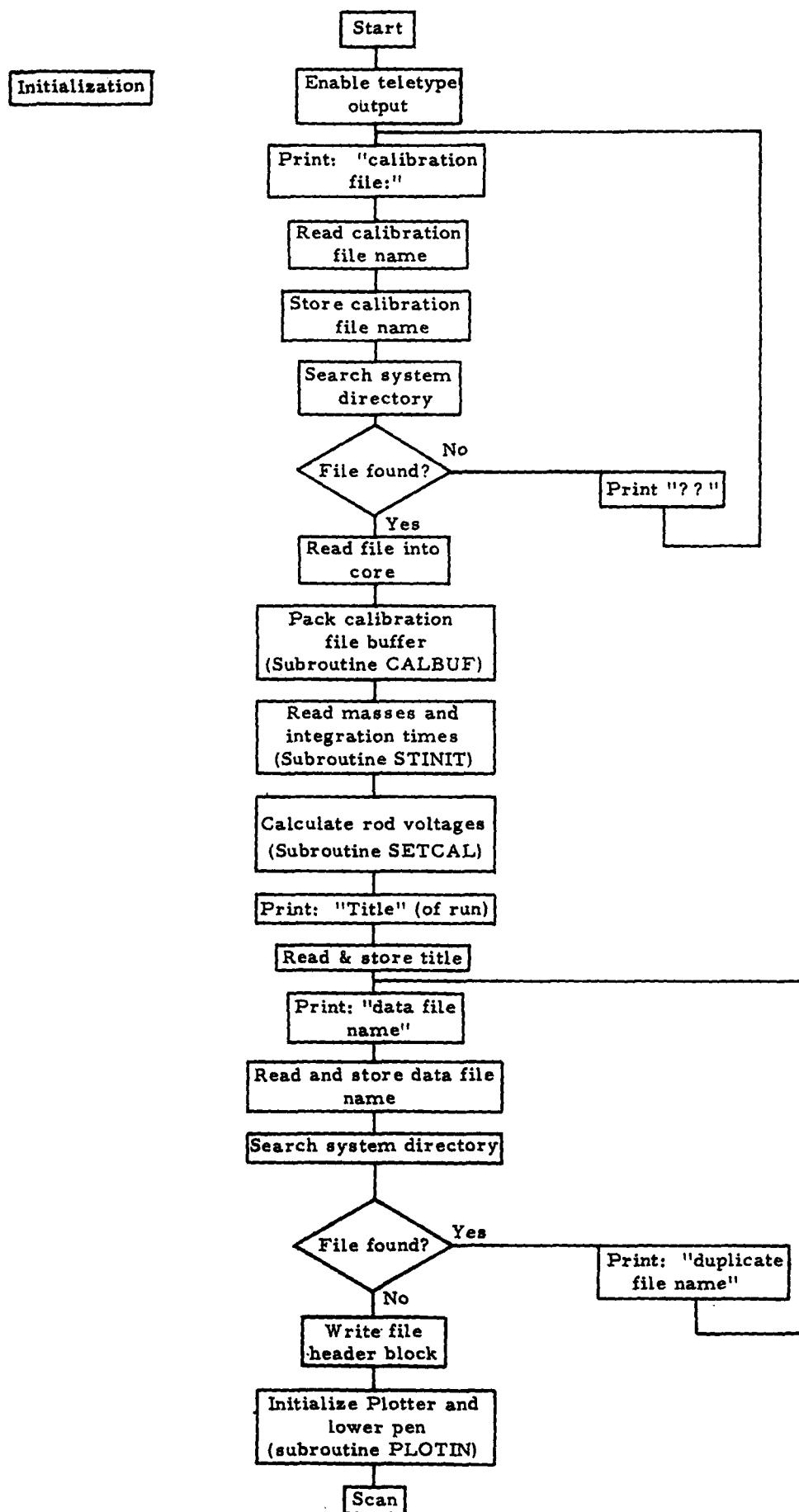


FIGURE 2. FLOW CHART FOR PROGRAM INITIALIZATION

CALBUF

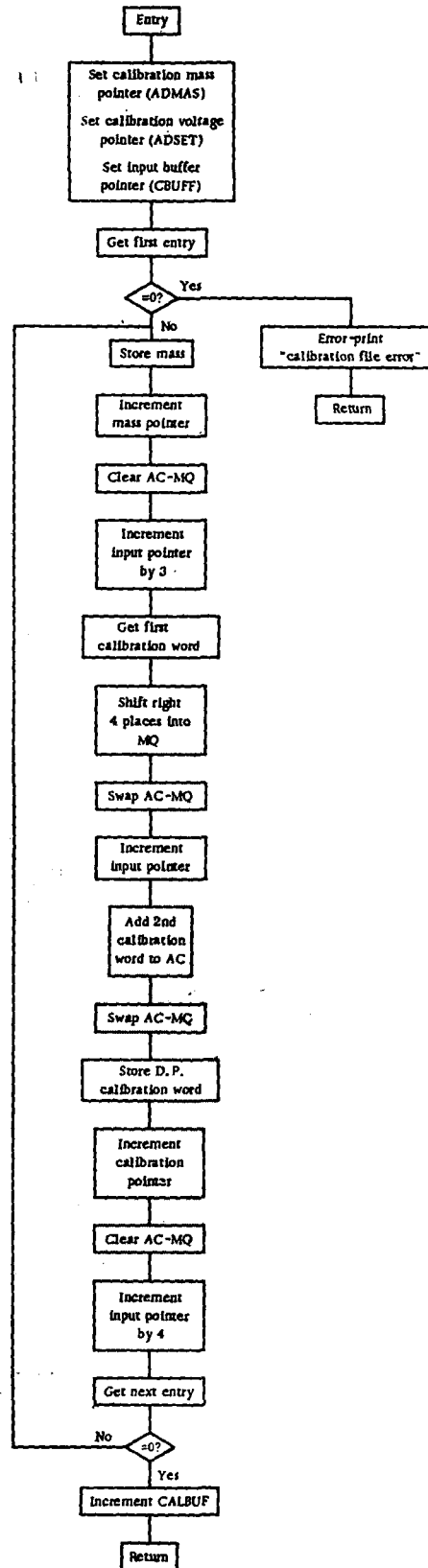


FIGURE 3. FLOW CHART FOR CALIBRATION-FILE-PACKING SUBROUTINE

STINIT

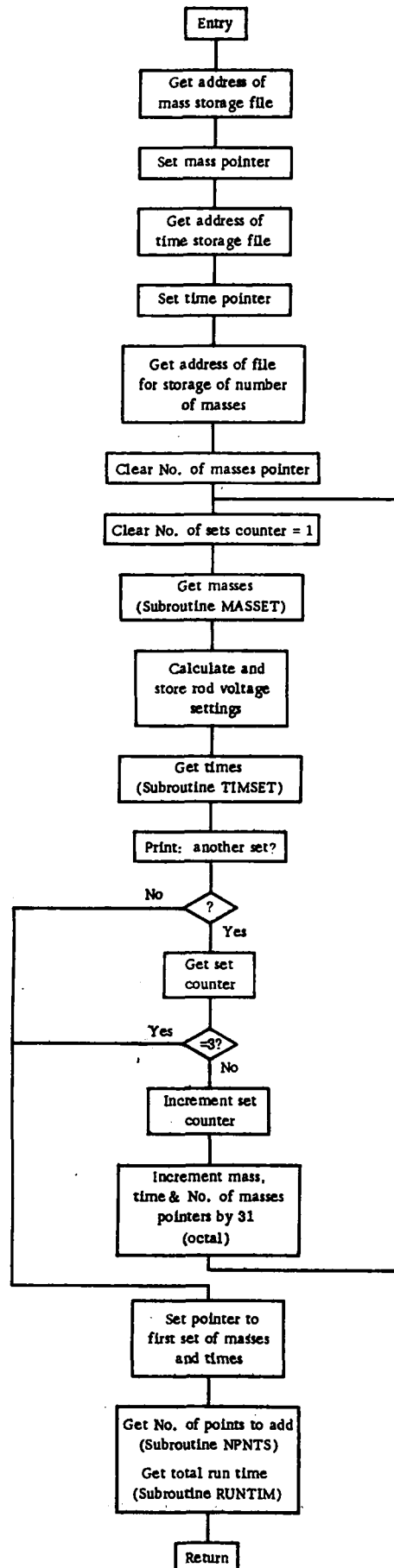


FIGURE 4. FLOW CHART OF SUBROUTINE FOR INPUTTING MASSES, INTEGRATION TIMES, TOTAL RUN TIME AND NUMBER OF POINTS TO SUM

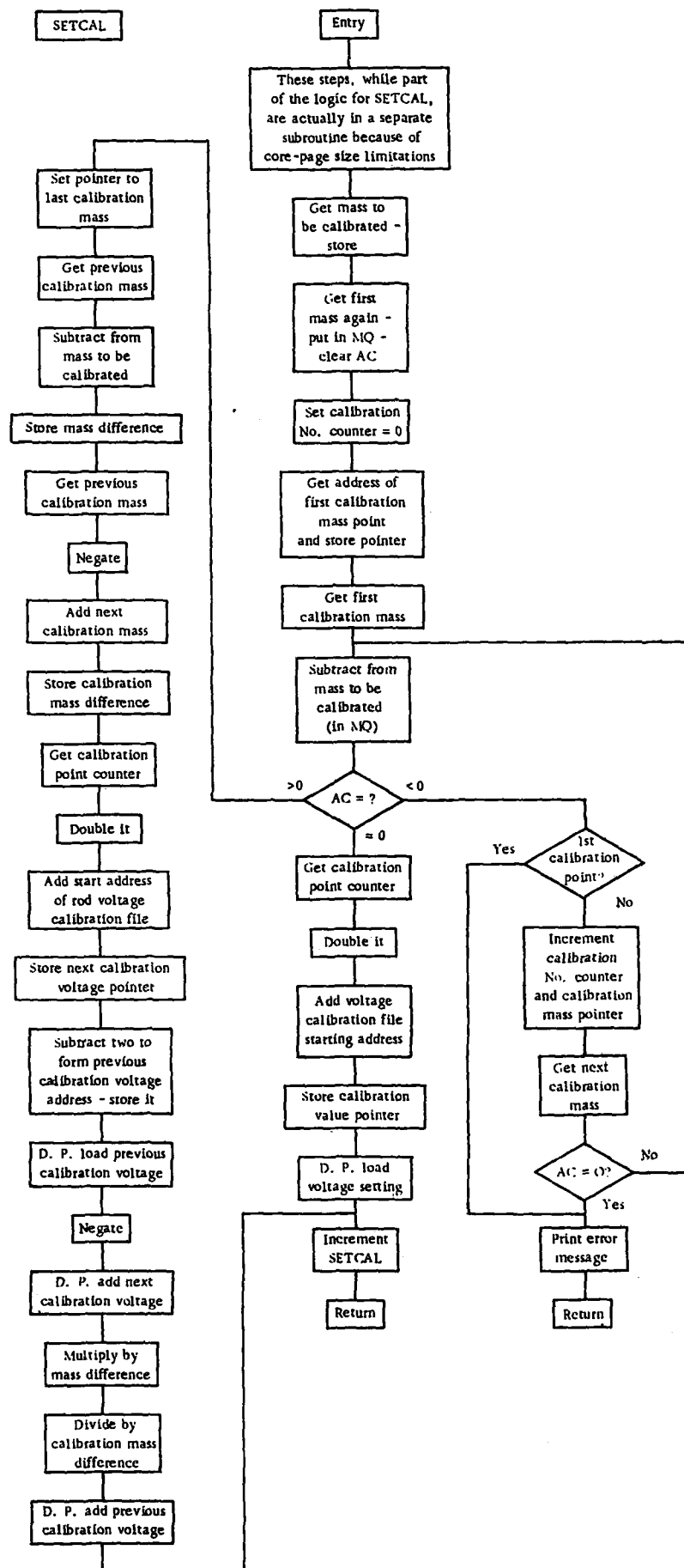


FIGURE 5. FLOW CHART FOR ROD-VOLTAGE-SETTING SUBROUTINE

point being calculated, and 1 and 2 are the mass/voltage points bracketing the point being calculated. If a mass that falls outside the range of the calibration file is entered, an error message is given, and the program waits for an acceptable set of masses.

A flow chart for the initialization program is given in Figure 2. Flow charts for subroutines used during initialization are given in Figures 3-5.

Mass Spectrometer Scan Control. The mass spectrometer scan is controlled by the computer using the normal mass spectrometer interface and controls. However, to optimize data handling and storage, the selected masses are monitored sequentially. The integration time for each peak must be selected such that the integrator does not saturate in the time selected. To avoid storing many small numbers, a number of sets of masses are scanned and the intensities for each summed using double precision addition.

A keyboard monitor allows the operator to change acquisition parameters during a run. If a change is requested, a marker is inserted in the mass storage record, and a new header block is written showing the new parameters before data recording is reinitiated. A flow chart for the scan control is shown in Figure 6.

On-Line Data Presentation. The data acquisition program provides for on-line plotting of the intensity of the first mass monitored. (Because the plotter is relatively slow, there is not time to plot all the peaks in real time without placing rather severe restrictions on the combination of parameters for data acquisition). The first mass in the list is the one that is plotted; however, the entries do not need to be in increasing mass order, so any mass can be plotted in real time. A flow chart for the on-line data presentation portion of the program is given in Figure 7.

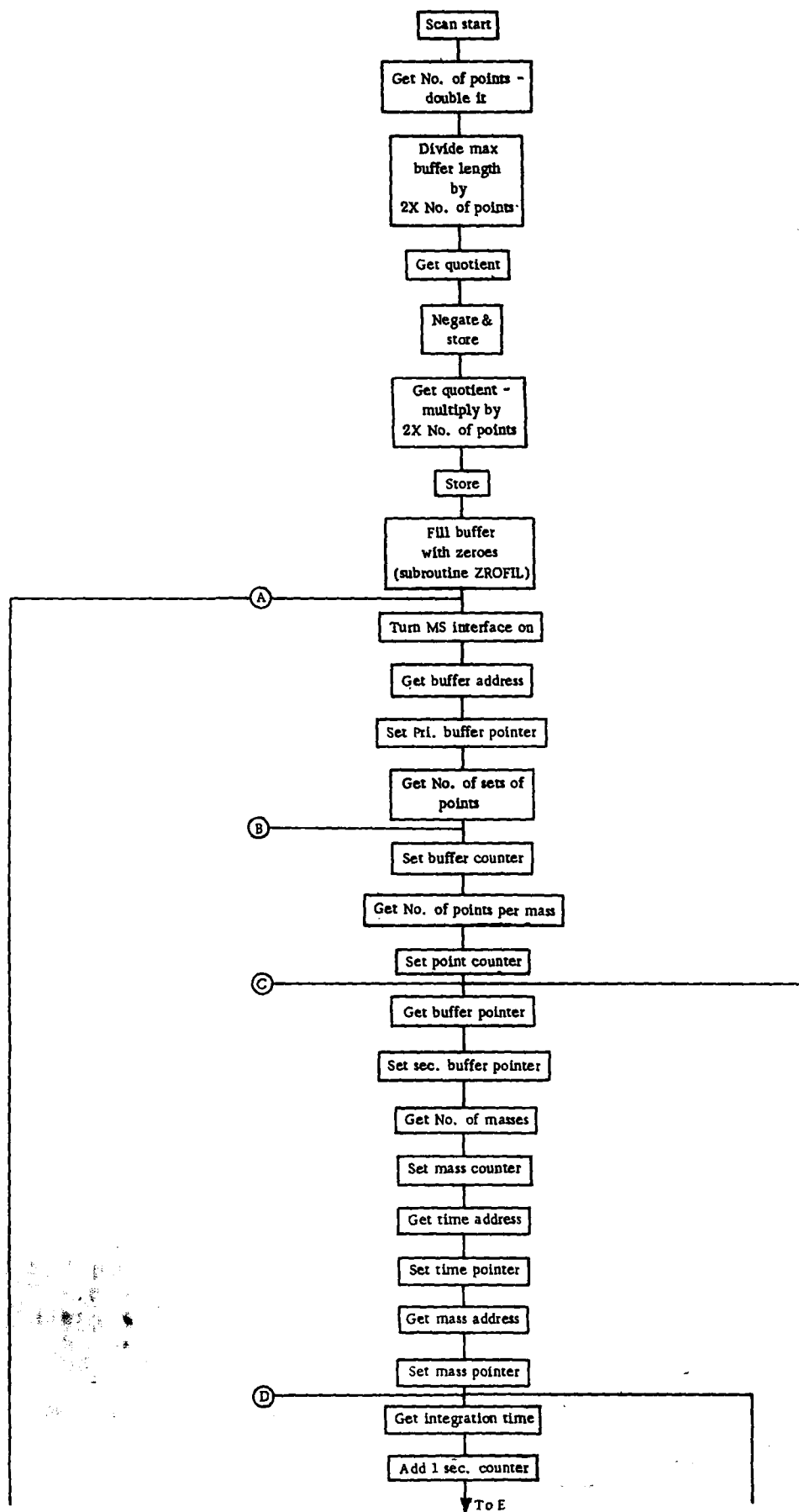


FIGURE 6. FLOW CHART FOR MASS-SPECTROMETER-SCAN ROUTINE

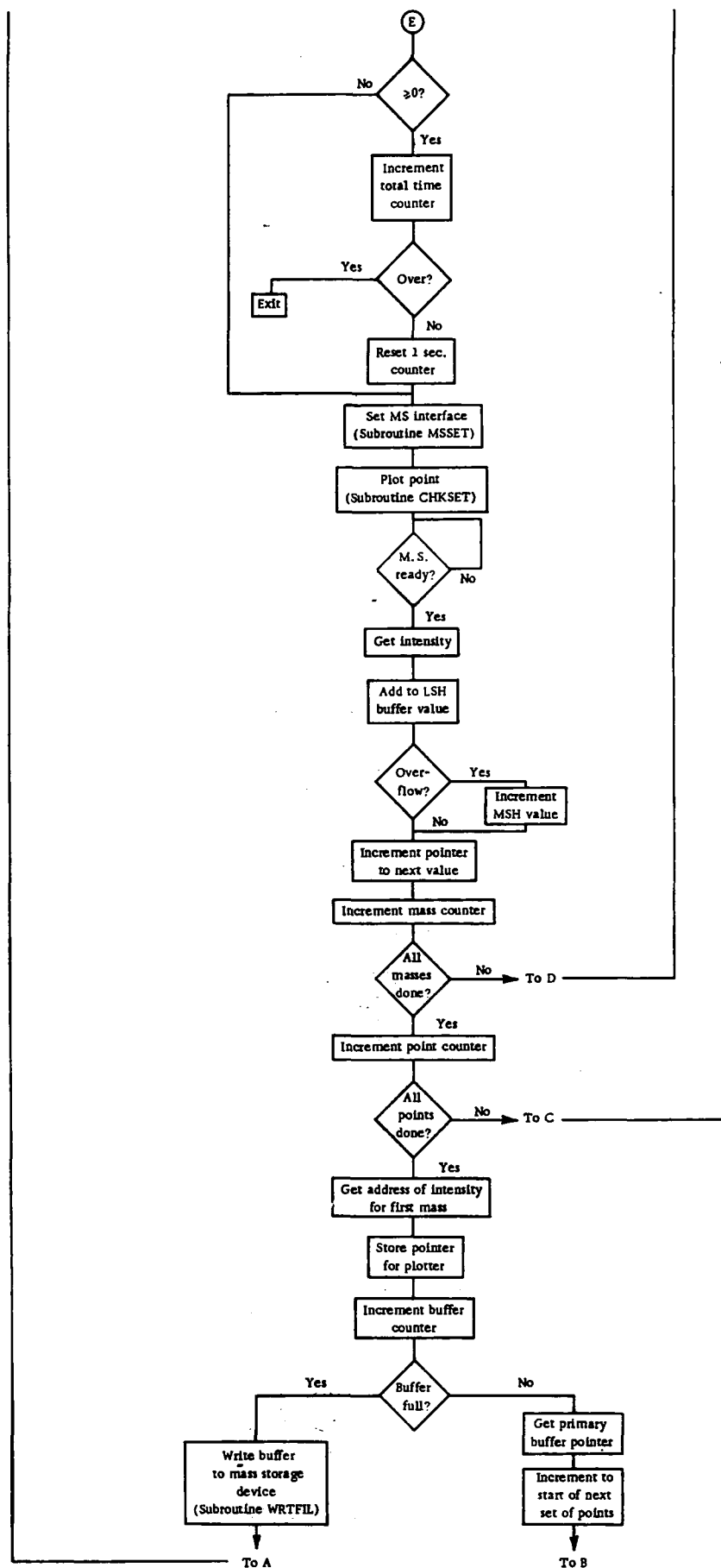


FIGURE 6. (continued) FLOW CHART FOR MASS-SPECTROMETER-SCAN ROUTINE

CHKSET
On-line data
plotting routine

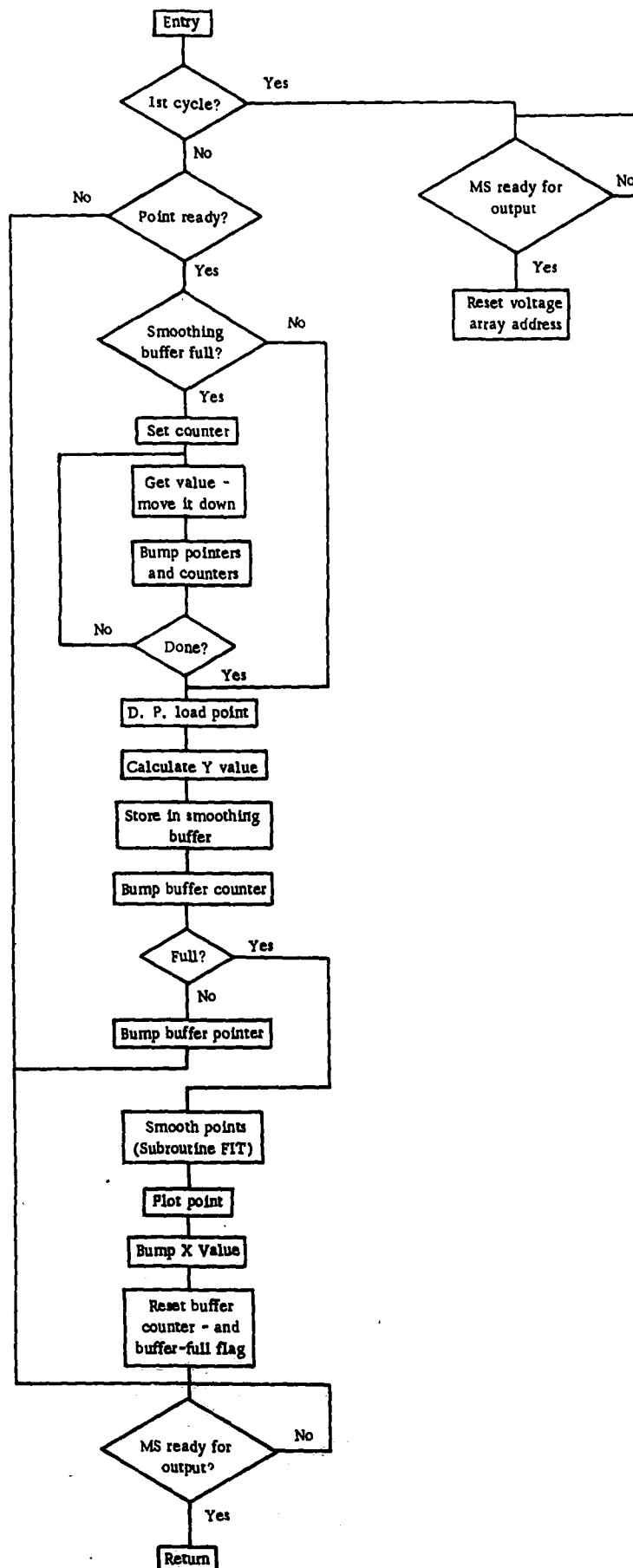


FIGURE 7. FLOW CHART FOR ON-LINE DATA PLOTTING ROUTINE

The initial program version plotted data on line as discrete points. Data thus presented was quite noisy. To decrease the noise level, a least-squares smoothing routine was added to the program. This routine uses the technique of Savitzky and Golay,⁽⁵⁾ in which smoothing is obtained by multiplying successive values by a set of smoothing factors, and dividing the sum of the products by a normalizing factor. A flow chart for this smoothing routine is shown in Figure 8.

Data Processing and Recording. The program uses one core page to record the title of the run and the data acquisition parameters. At the start of the run, this page is written onto the mass storage device as a header block. Five core pages of memory are used as a buffer for recording data. When the buffer is full, the data are written on the mass storage device, the buffer is filled with zeros, and data are then entered starting over at the beginning of the buffer. A flow chart for the data processing and recording routine is shown in Figure 9. (The program is independent of the mass storage device and will work on either disk or tape systems). The program checks to see that there is room at the end of the buffer for an inter-buffer flag. If there is enough room when a change of data recording parameters is signalled by the keyboard interrupt routine, a two-word inter-buffer record mark (7070 0000) is entered in the buffer. The buffer is then written on the mass storage device, and a new header block is recorded to indicate data acquisition parameters. If there is not enough room, the inter-buffer record is started at the beginning of the next block, so that the end-of-record flag will always be at the location for the start of a data set. When the run is terminated, a two-word end-of-file record mark (7171 0000) is entered in the buffer, the buffer is written out on the mass storage device, and the file is closed and catalogued in the system directory.

Subroutine
FIT

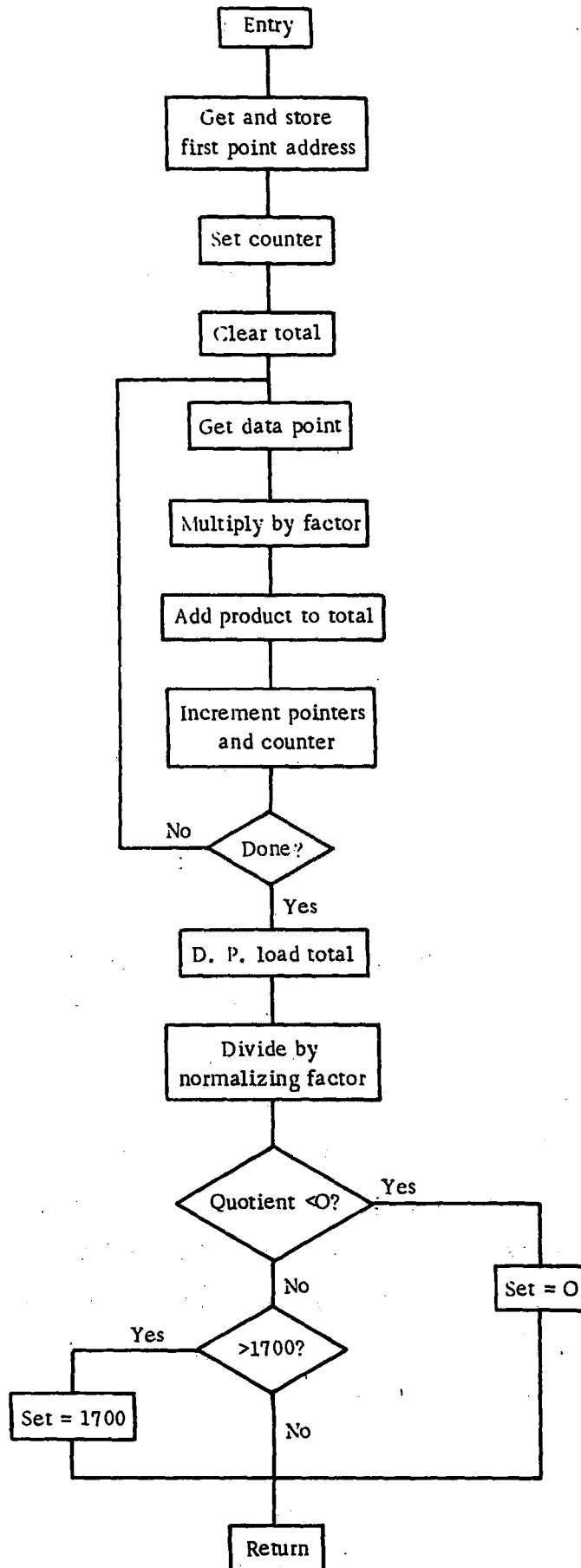


FIGURE 8. FLOW CHART FOR SMOOTHING ROUTINE

Flow charts for these routines are shown in Figure 9 and 10.

Keyboard Monitor. A keyboard monitor allows the operator to change parameters during data acquisition. The allowed commands are:

1. E(CR): End run, insert E-0-F and catalog file
2. Sn(CR): Change to set of masses n where $n = 1, 2, \text{ or } 3$
3. Nn(CR): Change number of points to n
4. Fn(CR): Change scale factor to n
5. Tn₁,n₂,---ni(CR): Change integration times to n₁,n₂---n₁
6. Control-L: Abort, do not catalog file

A flow chart for the keyboard monitor is shown in Figure 11.

Plotting Program

Since the on-line data acquisition program can plot only one mass from each set, an off-line program plots all data points. This program scans the entire data file prepared by the data acquisition program and determines the proper scale factor to keep the entire plot on scale. The minimum value is considered to be baseline and subtracted from all values for baseline suppression. It then makes a second pass through the data and plots each mass sequentially in the order data were acquired. Two output options are provided to the operator. After each mass is plotted, the prompt "CHANGE PEN." is printed by the teletype. If the operator wishes to overlay the plots using different ink colors, he should change the plotter pen and press the RETURN key. If he does not wish to overlay the plots, depressing any key other than RETURN advances the plotter chart about three inches and plot the next point. A flow chart of the program is shown in Figure 12.

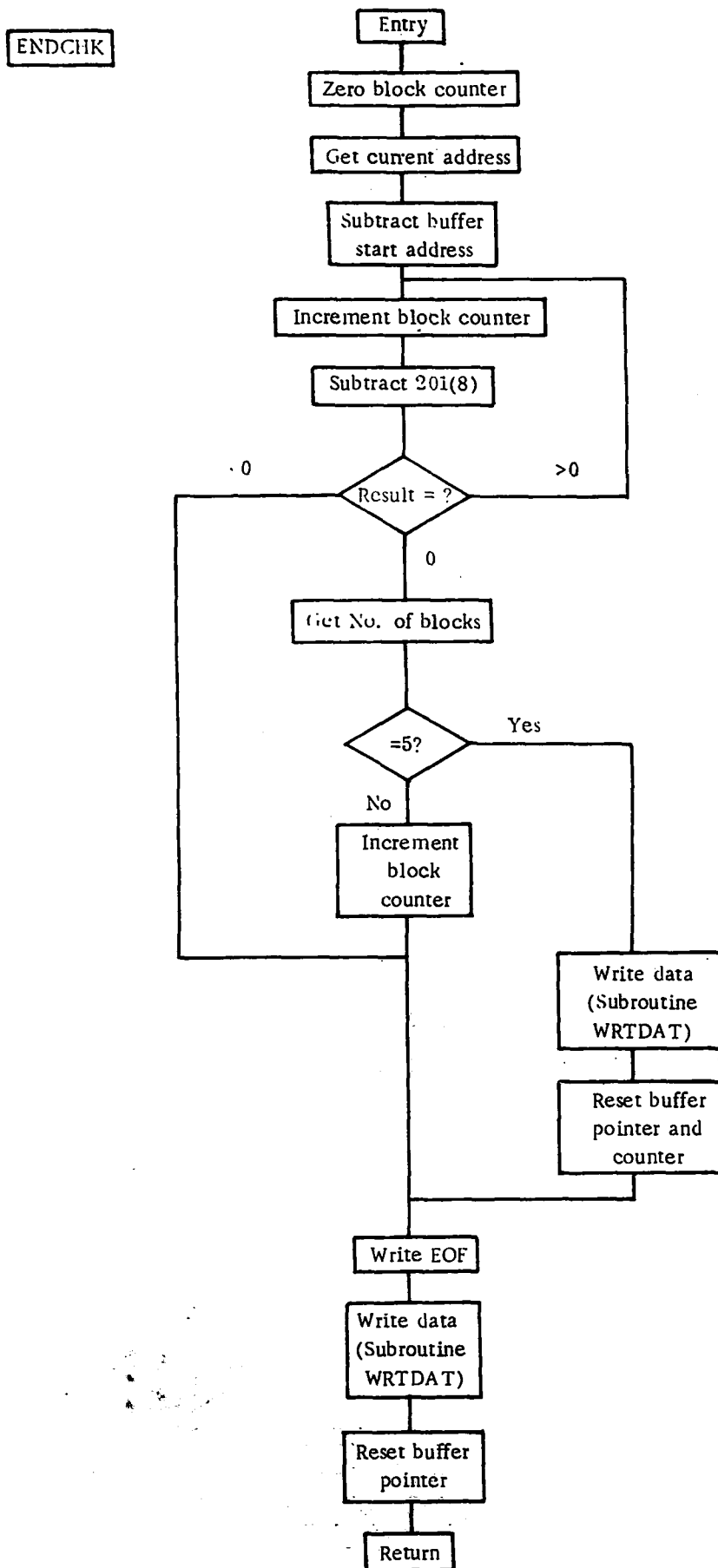


FIGURE 9. FLOW CHART FOR DATA-BUFFER-PROCESSING ROUTINE

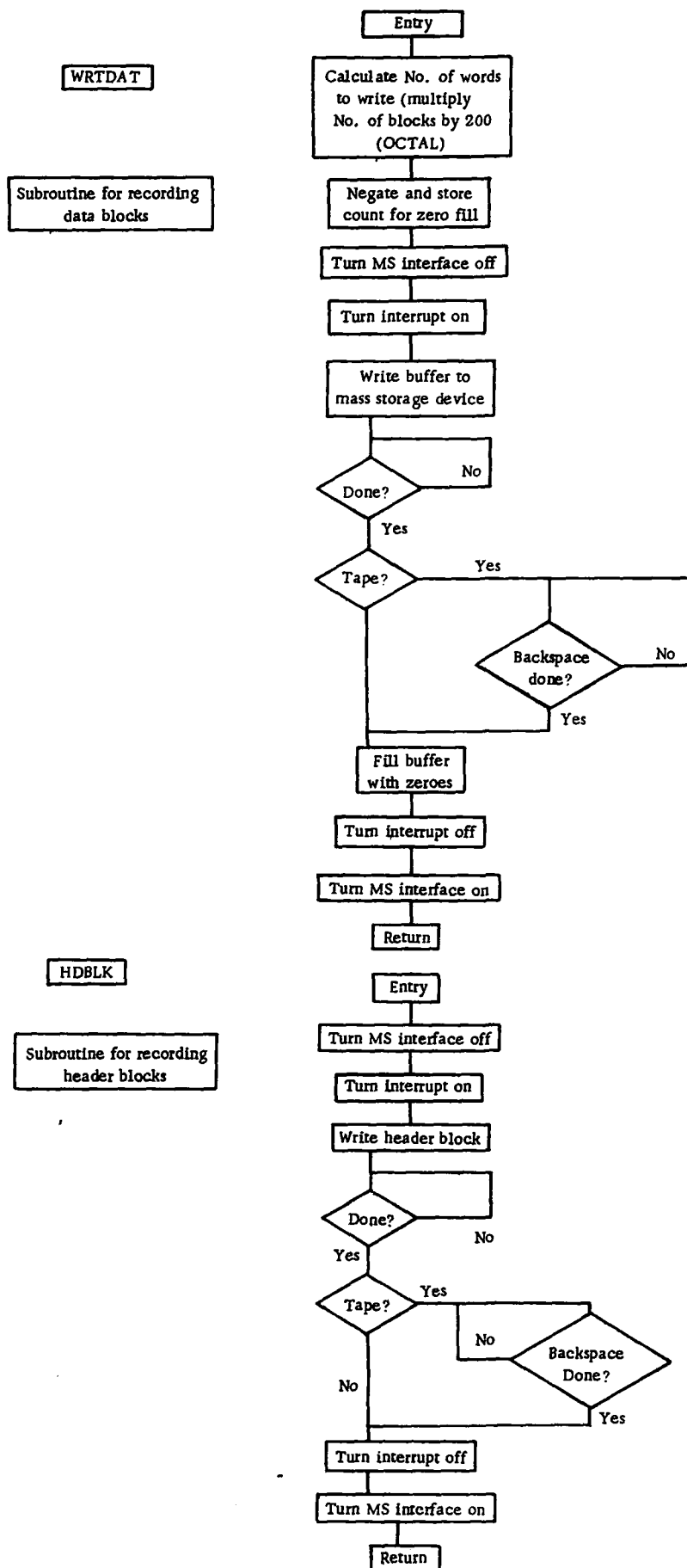


FIGURE 10. FLOW CHART FOR MASS-STORAGE-DATA-RECORDING ROUTINE

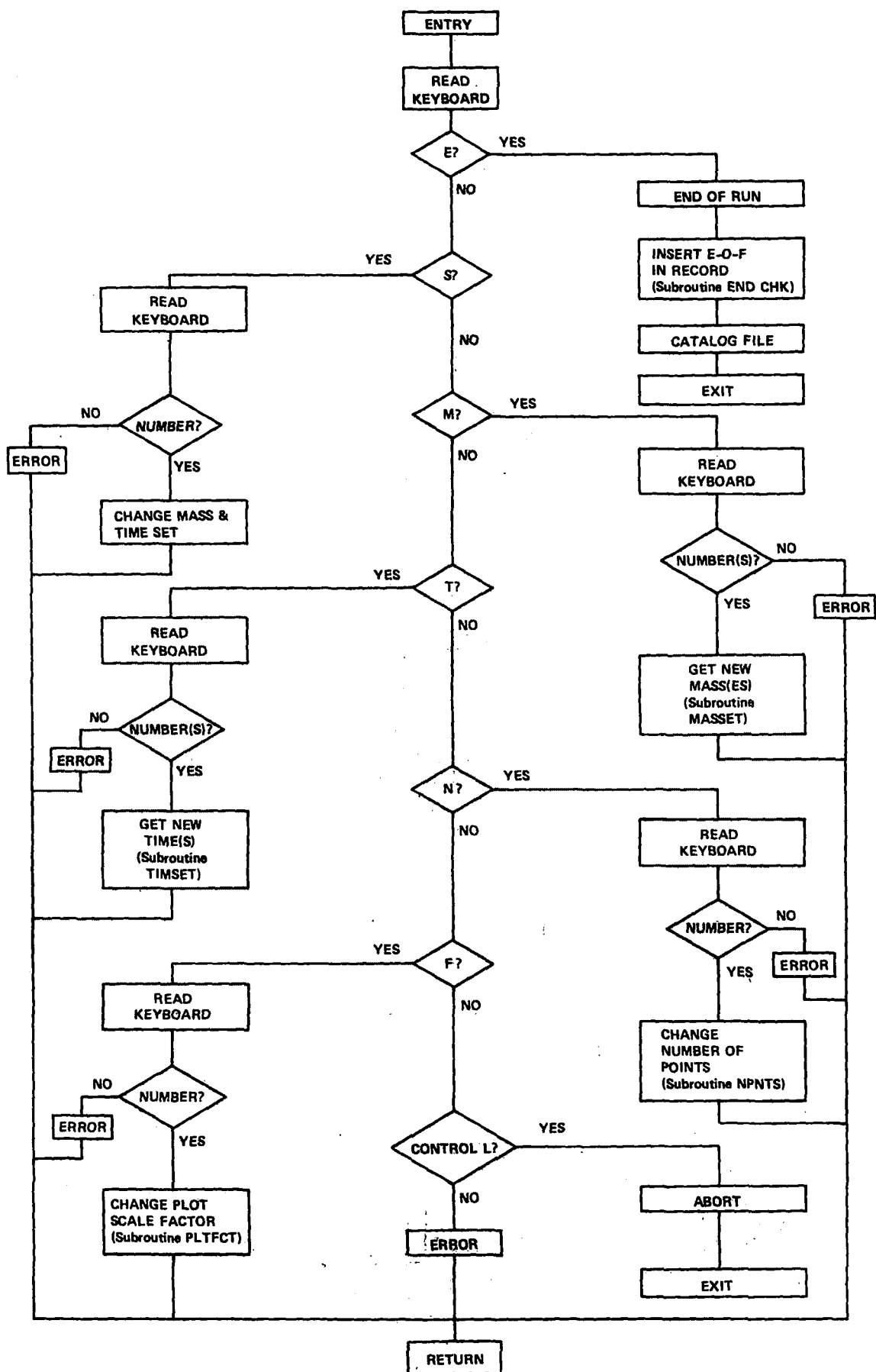


FIGURE 11. FLOW CHART FOR KEYBOARD MONITOR

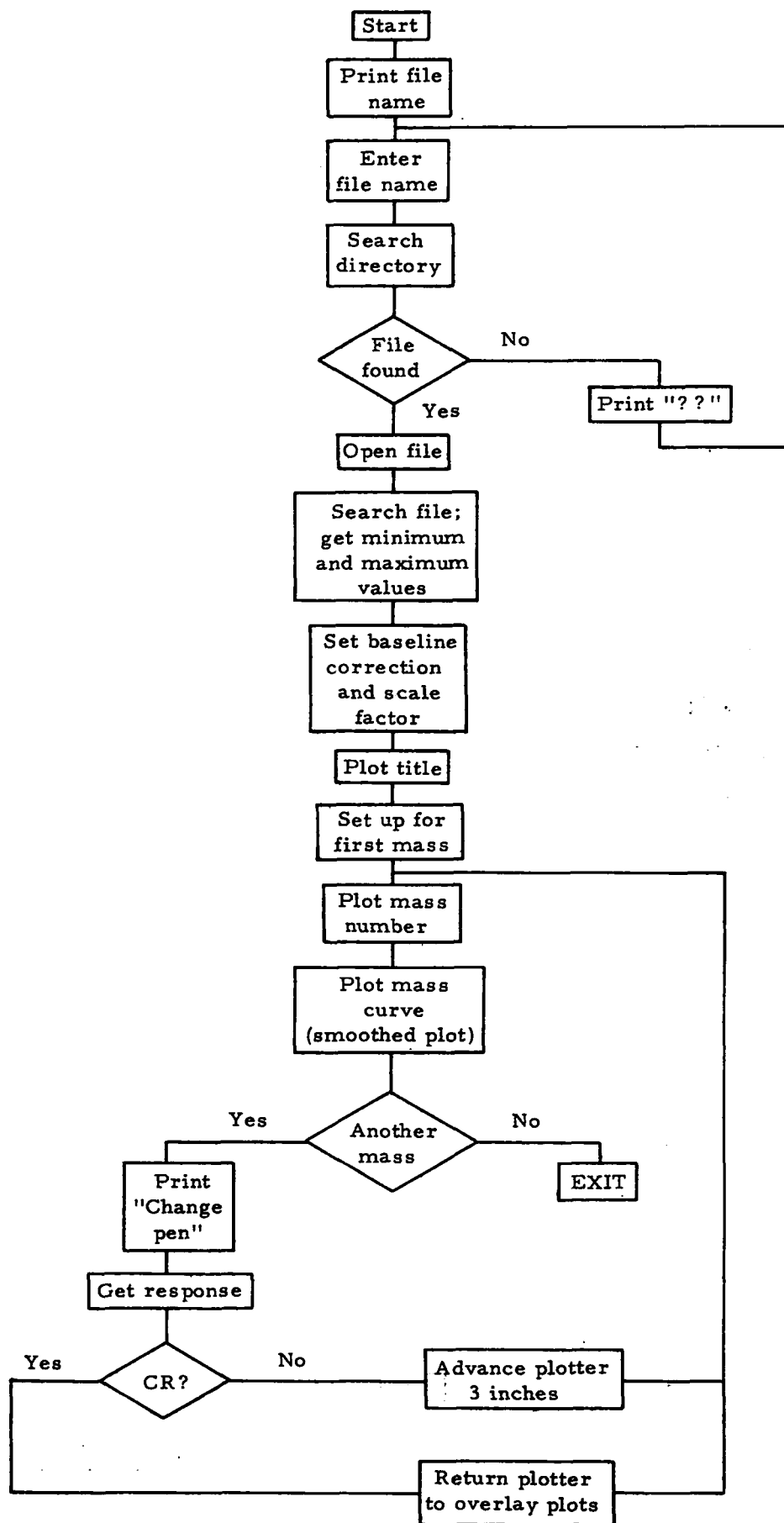


FIGURE 12. FLOW CHART FOR OFF-LINE PLOTTING PROGRAM

SECTION VI

SYSTEM PERFORMANCE

This section describes system operation and presents results obtained in this laboratory.

The SIM programs are called as USER programs on the System 150. A typical dialogue for a SIM data acquisition follows with operator responses underlined: (Each response is followed by a carriage return).

```
SYSTEM 150 IS ON SELECT MODE: USER
LOAD FILE: SIMSCN
CALIBRATION FILE: CAL-H
MASS(ES): 243,209,279,292
INTEGRA. TIME: 100
ANOTHER SET?N
NO. POINTS: 5
RUN TIME: 30
TITLE: GC-MS(CI-CH4) OF PESTICIDE MIXTURE
SCALE FACTOR: 50
DATA FILE NAME: N-1
DATA
```

A sample of the plotting program dialogue is given below:

```
SYSTEM 150 IS ON SELECT MODE: USER
LOAD FILE: SIMPLT
FILE? N-1
CHANGE PEN (CR)
CHANGE PEN (CR)
CHANGE PEN (CR)
CHANGE PEN (CR)
```

The SIM technique is especially well-suited to analysis of very small quantities of known materials. Since the analysis is based on only a few ions, sensitivity is gained at the expense of the specificity of a complete mass spectrum. However, since it is generally intended for use in gc/ms, retention times provide additional confirmation of identity. Chemical ionization (CI) mass spectrometry is especially suitable for SIM because it is generally more sensitive than electron impact (EI) mass spectrometry and because CI spectra usually show less fragmentation than EI spectra. Accordingly, the development work on this project has been done with CI mass spectrometry. Four pesticides have been studied in the evaluation of SIM.

The EI and CI (CH_4) base peaks for these pesticides are tabulated below:

<u>Pesticide</u>	<u>M/E</u>	
	EI	CI
DDT	235	243
DDD	235	209
Dieldrin	79	279 (243 is 50% of 279)
Parathion	292	292

The spectra of the chlorinated pesticides show significant fragmentation under CI conditions, but better sensitivity is obtained with CI than EI conditions. EI and CI spectra for p,p'-DDT are shown in Figure 13. Figure 14 shows SIM plots for CI gc/ms of the four pesticides, 0.04 ng of DDT, 0.1 ng of parathion, 0.2 ng of dieldrin, and 0.2 ng of DDD. Signal-to-noise levels for these chromatograms have not been determined accurately but are approximately:

<u>Pesticide</u>	<u>S/N</u>
DDT	15:1
Dieldrin	10:1
DDD	12:1
Parathion	30:1

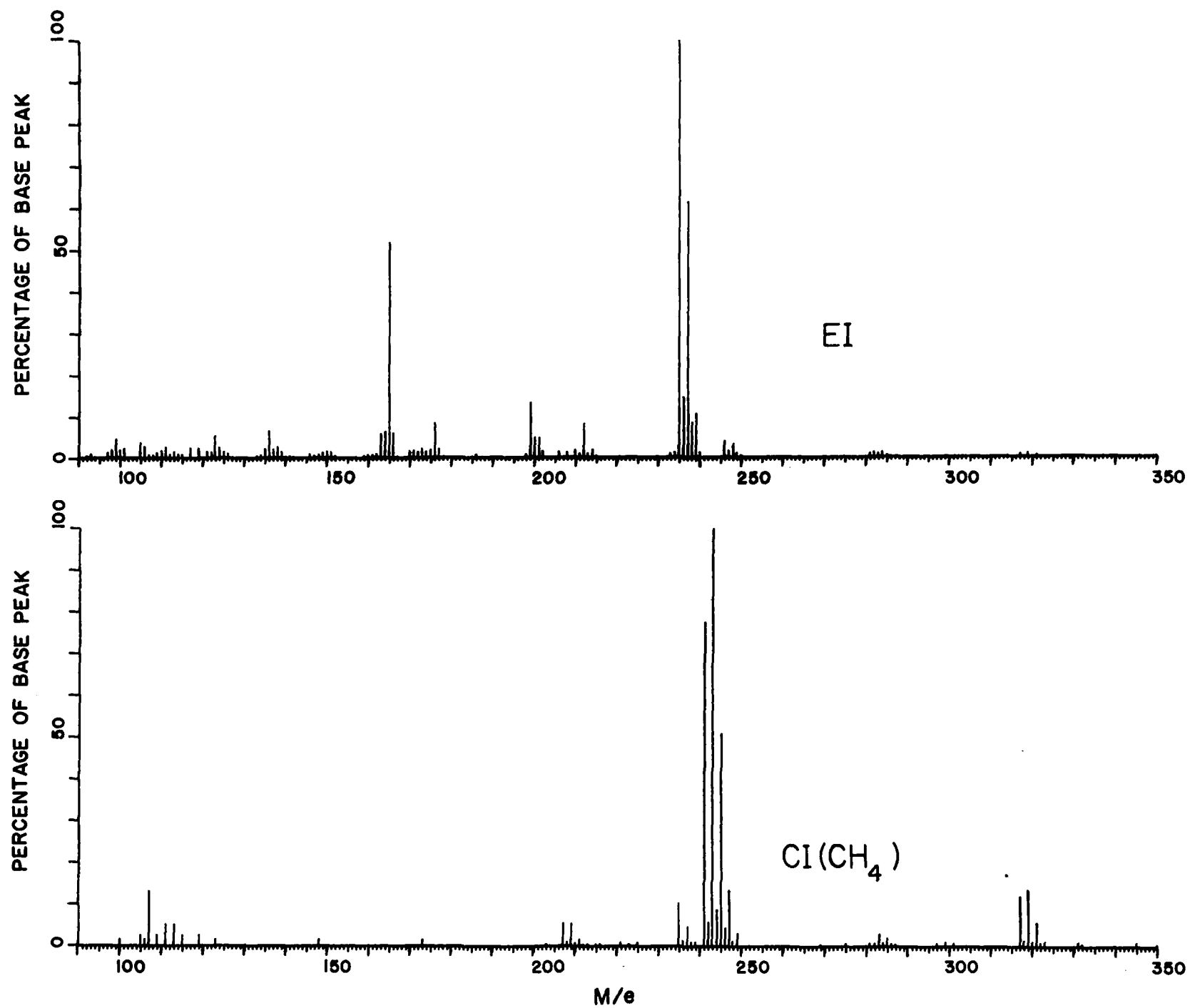


FIGURE 13. ELECTRON IMPACT AND CHEMICAL IONIZATION
MASS SPECTRA OF DDT

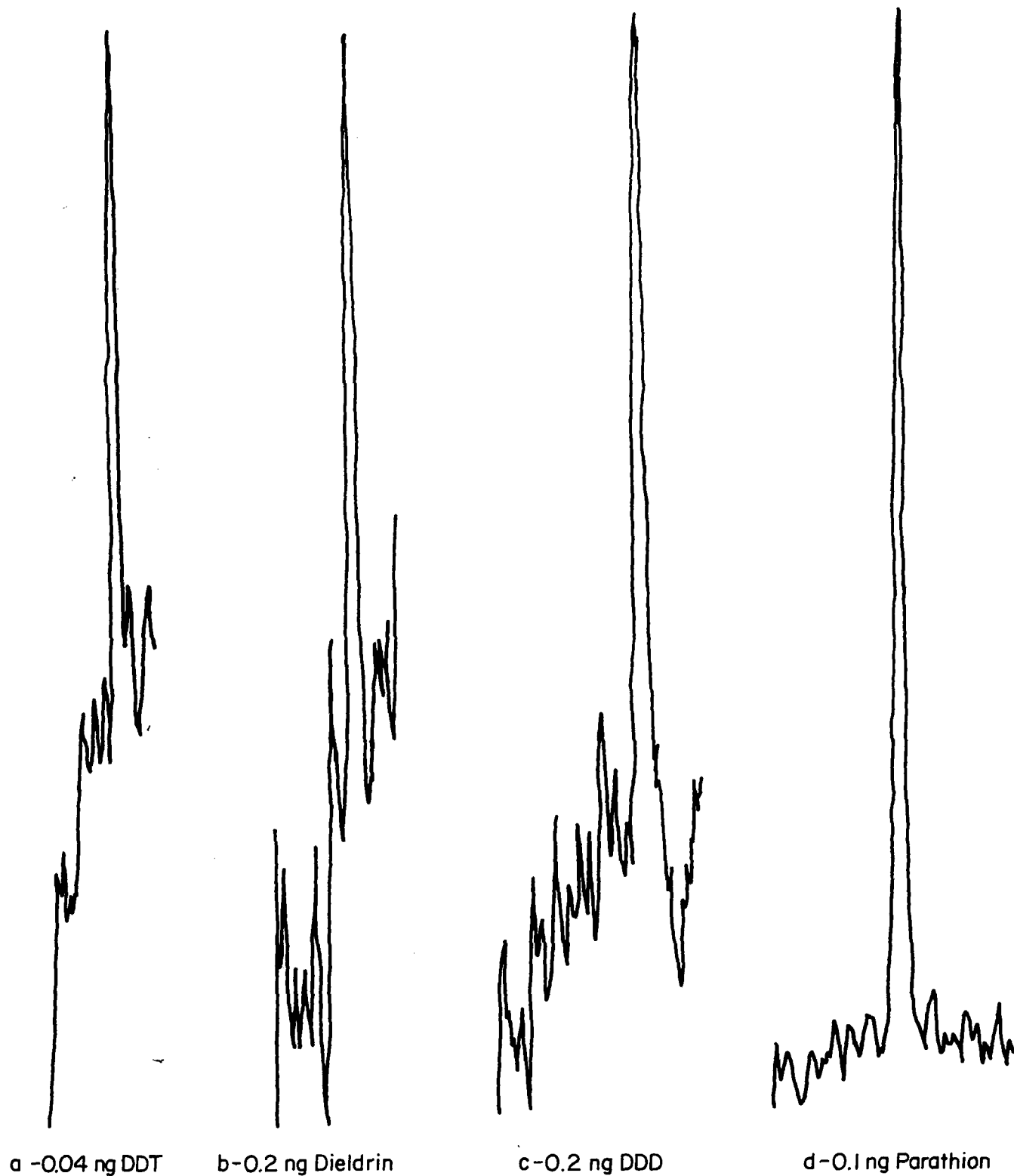


FIGURE 14. SIM PLOTS FOR CI GC/MS OF PESTICIDES

Carrier Gas: Methane 30 ml/min

Column Temperature: 175-250° C @ 10° C/min

Column: 6 ft. x 2 mm glass, 3 percent

OV-17 on Gas-Chrom. Q

Using methane CI gc/ms the best results so far have been obtained with Parathion and DDT. The limit of detectability for DDT is about .01 ng (10 pico grams) and about 0.002 ng (2 picograms) for Parathion. Precise limits of detectability have not been determined for either. For electron impact gc/ms the detectability limits are higher.

Figure 15 shows a CI gc/ms SIM plot for a mixture of 1 ng each of DDT, DDD, Parathion, and Dieldrin. The real time plot of m/e 243 shows two peaks. The first peak is for Dieldrin and is about 30 percent of the second peak (DDT). The reconstructed plot shows the relative retention of the four pesticides. The plot also indicates that DDD gives the highest response and Dieldrin, the lowest.

The SIM technique has also been applied to drug analyses using methane CI. Clarke and Foltz⁽⁶⁾ have used the technique for analysis of morphine using a reverse isotope technique in which d₃ morphine is used as a carrier. In a comparison study of SIM with some of the commonly used morphine quantitation procedures, TLC, GLC, spectrofluorimetry, radioimmunoassay, hemagglutination, inhibition, and Auto Analyzer), SIM was found to be at least as sensitive as the radioimmunoassay (RIA) technique but more specific. The RIA technique will detect other opiates as well as morphine, whereas the SIM technique is specific for morphine. Detectability limits have been set at 25 ng/ml⁽⁷⁾ for RIA. The SIM technique detected 5 ng/ml without special attention to the instrumentation. The lower limit of detection was not determined, but is well below 1 ng/ml.

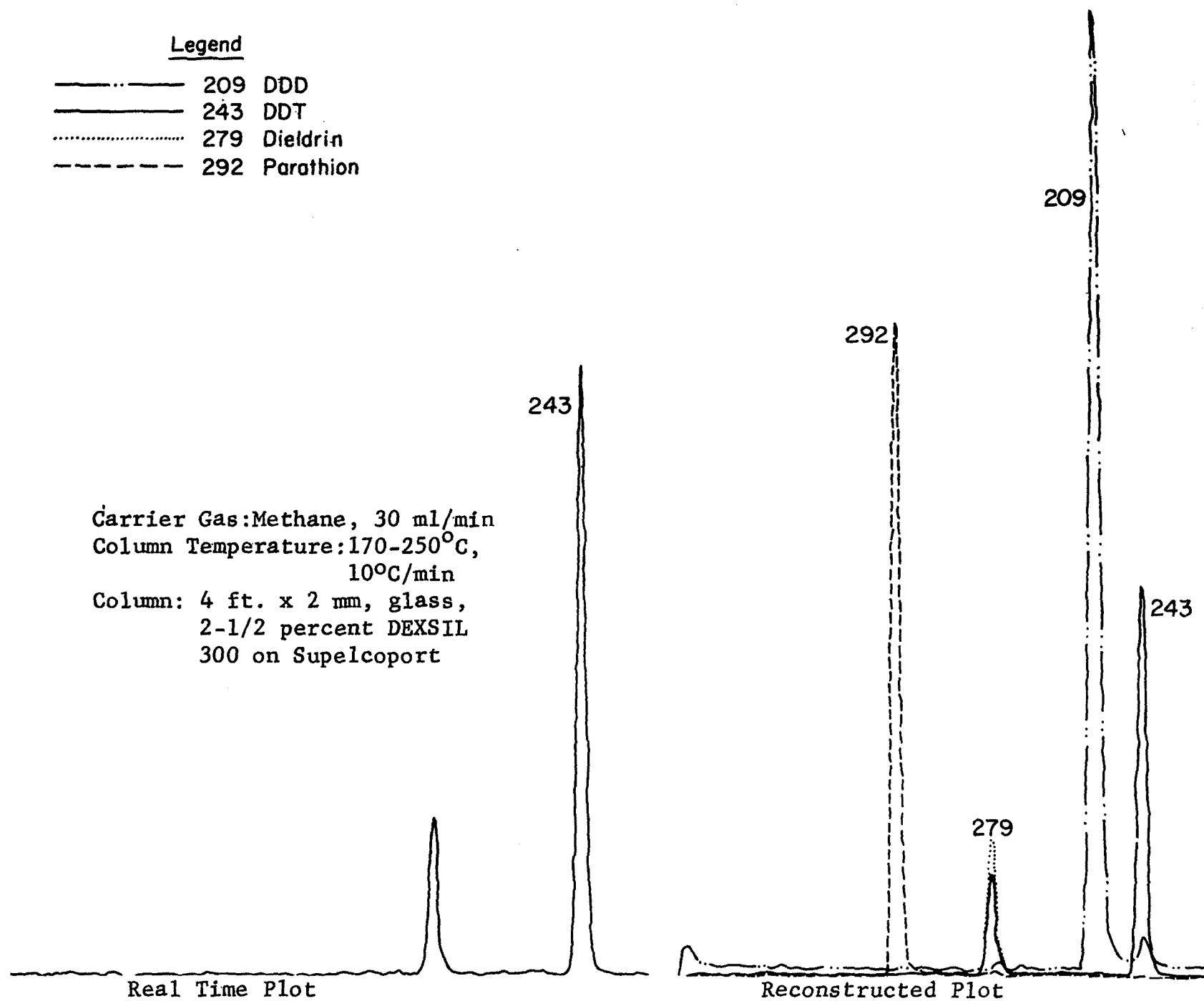


FIGURE 15. SIM PLOTS OF CI GC/MS OF PESTICIDE MIXTURE, 1 ng EACH

SECTION VII

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SECTION VIII

APPENDICES

- A. Listing of Data Acquisition Program
- B. Listing of EAE Program

/EAE DEFINITION.

PAL8-V7

PAGE 1

/EAE DEFINITION.

/

0001 EAE=1

```
/SYMSCN
/
/THIS PROGRAM IS WRITTEN FOR A PDP 8/E
/COMPUTER, FINNIGAN 1015 MASS SPECTROMETER
/AND A SYSTEM 150 INTERFACE. THE
/PROGRAM CONTROLS THE MASS SPECTROMETER
/TO PROVIDE MONITORING OF FROM 1 TO 8
/PEAKS FOR SELECTABLE INTEGRATION TIMES,
/WITH FRACTIONAL MASSES PERMITTED. FOR SYSTEMS
/WITH THE KES-E EXTENDED ARITHMETIC ELEMENT, EAE,
/DEFINING EAE=1 DIRECTS ASSEMBLY OF A PROGRAM USING
/THE EAE INSTRUCTIONS. IF EAE IS NOT DEFINED ( OR
/DEFINED EAE=0 ) SIMULATOR ROUTINES WILL BE ASSEMBLED
/THAT DO NOT NEED THE EAE.
/
/WRITTEN BY:
/      MAYNARD B. NEHER
/      BATTELLE COLUMBUS
/      505 KING AVENUE
/      COLUMBUS, OHIO 43201
/      614-299-3151 EXT 1693
/
/PLIST CONTROLS LISTING OF THE S. I. PLOTTER
/ROUTINES. IF NOT DEFINED ( OR DEFINED EQUAL
/TO ZERO ) THESE ROUTINES ARE NOT LISTED. IF DEFINED
/NONZERO, THE PLOTTER ROUTINES ARE LISTED.
/
IFDEF PLIST <PLIST=0>
/
/DEFINITIONS FOR 150 INTERFACE IOTS
/
6362 MSIC=6362          /CLEAR IBR
6364 MSI=6364          /INPUT TO IBR
6361 SKMI=6361         /SKIP IF NOT READY FOR INPUT
6371 SKMO=6371         /SKIP IF NOT READY FOR OUTPUT
6372 MSO=6372          /OUTPUT OBR
/
/MISCELLANEOUS DEFINITIONS
/
7301 NL0001=7301       /AC=1
7305 NL0002=7305       /AC=2
7325 NL0003=7325       /AC=3
7307 NL0004=7307       /AC=4
7340 NL7777=7340       /AC=-1
7344 NL7776=7344       /AC=-2
7346 NL7775=7346
/
/EAE DEFINITIONS:
/
7521 SWP=7521
7721 MQAC=7721
7701 MQAR=7701
7421 ACMC=7421
7621 CAM=7621
```

0020 *20

IFNDEF EAE < EAE=0 >

IFZERO EAE <

DPIC=JMS I

DPICSM

DST=JMS I

DSTSM

DLD=JMS I

DLDSM

DCM=JMS I

DCMSM

DAD=JMS I

DADSM

SAM=JMS I

SAMSM

ASR=JMS I

ASRSM

MUY=JMS I

MUYSM

DVI=JMS I

DVISM

LSR=JMS I

LSRSM >

IFNZRO EAE <

7573 DPIC=7573

7445 DST=7445

7665 DLD=7665

7575 DCM=7575

7443 DAD=7443

7457 SAM=7457

7415 ASR=7415

7405 MUY=7405

7407 DVI=7407

7417 LSR=7417 >

/

/SYSTEM 150 DEFINITIONS:

/

5600 LINE=5600

0200 RAD=200

0400 MON=400

0412 READ=MON+12

0601 OPENR=MON+201

0613 OPENW=MON+213

1000 WAIT=MON+400

1400 TTYIN=MON+1000

1401 TTYOUT=MON+1001

0606 CLOSE=MON+206

0404 WRITE=MON+4

1200 EXEC=MON+600

1402 PLOTR=MON+1002
 4600 INPL=4600
 5000 PL=INPL+200
 5101 PLR=INPL+301
 5110 QUES=INPL+310
 5122 TTYT=INPL+322
 5125 TTPRI=INPL+325
 5132 TTYCR=INPL+332
 5200 DEO=INPL+400
 5300 DEO4=INPL+500
 5323 GAC=INPL+523
 5532 TRANS=INPL+732
 5541 R1=INPL+741
 5543 TTRDI=INPL+743
 1600 LOAD=MON+1200

/

/STORAGE DEFINITIONS:

/

0243	PNUM=243	/NUMBER OF POINTS PER MASS.
0244	BSET=244	/NUMBER OF SETS OF MASSES.
0245	NUMMAS=245	/NUMBER OF MASSES.
0246	MASS=0246	/MASSES TO BE MONITORED.
0266	TIME=0266	/INTEGRATION TIMES.
	/BUF0	/1205 WORD BUFFER, STARTING CA. 6000.
7300	RODVL=7300	/SETTINGS FOR MONITORED MASSES
7360	PLTBUF=7360	/SMOOTHING BUFFER.
7400	CMAS=7400	/PACKED CALIBRATION FILE POINTS -M
7500	CALSET=7500	/ROD SETTINGS

00020 6000 ABUF0, BUF0
 00021 5200 ADEO, DEO
 00022 5300 ADEO4, DEO4
 00023 0246 ADMAS, MASS
 00024 0000 ADMAS1, 0
 00025 0000 ADSTOR, 0
 00026 0266 ADTIME, TIME
 00027 4600 AINPL, INPL
 00030 2400 AINTOF, INTOF
 00031 2410 AINTON, INTON
 00032 5600 ALINE, LINE
 00033 0245 AMASS1, NUMMAS
 00034 6000 AMPPTR, 6000
 00035 5724 ASTCAL, SETCAL
 00036 3400 ANPNTS, NPNTS
 00037 5000 APL, PL
 00040 5101 APLR, PLR
 00041 0243 APNUM, PNUM
 00042 5110 AQUES, QUES
 00043 4356 ARGCHR, RCGCHR
 00044 0000 ASETT, 0
 00045 3014 ASTINT, STINIT
 00046 0000 ATIME, 0
 00047 5125 ATTPRI, TTPRI
 00050 5543 ATTRDI, TTRDI
 00051 5532 ATRANS, TRANS
 00052 0000 BUFLOC, 0

00053	0000	CBUFF,	0
00054	0606	CLOSEX,	CLOSE
00055	3617	DIVIDI,	DIVIDE
00056	0000	DIVNUM,	0
00057	3472	DSPF,	SPF
00060	3075	ENDCKI,	ENDCHK
00061	1200	EXECK,	EXEC
00062	0000	FACTOR,	0
00063	5640	FRCNVI,	FRCNVT
00064	3565	HDRBLK,	HDBLOK
00065	0000	LMASS,	0
00066	0000	LOCMAS,	0
00067	0000	LOCTIM,	0
00070	7722	M56,	-56
00071	0000	MASCTR,	0
00072	0000	MLEN,	0
00073	0000	MNMASS,	0
00074	0000	MNUM,	0
00075	3662	MULTI,	MULT
00076	0000	NMASS,	0
00077	0244	NSET,	BSET
00100	0000	NTIME,	0
00101	6573	NWORDS,	-1205
00102	0601	OPENRX,	OPENR
00103	0613	OPENWX,	OPENW
00104	0031	P31,	31
00105	0000	PTCTR,	0
00106	0000	PNTLEN,	0
00107	4000	PLOTT,	PLOTX
00110	7360	PTBUF,	PLTBUF
00111	0412	READX,	READ
00112	7300	RODLOC,	RODVL
00113	0000	RODSTT,	0
00114	0000	SETFLG,	0
00115	0000	SFACT,	0
00116	0000	SMASS,	0
00117	0000	TADMAS,	0
00120	0000	TADTIM,	0
00121	3151	TCHCKI,	TCHECK
00122	0000	TEMP1,	0
00123	0000	TMASS,	0
00124	0000	TOTIME,	0
00125	0000	TOTSET,	0
00126	0000	TRTIME,	0
00127	1400	TTRD,	TTYIN
00130	1401	TTWI,	TTYOUT
00131	6000	WAITL,	-2000
00132	1000	WAITX,	WAIT
00133	0404	WRITEX,	WRITE
00134	3512	WRTFIL,	WRTDAT
00135	0000	WTFLAG,	0
00136	3067	ZROFLI,	ZROFIL
		/PLOTTER COMMANDS.	
00137	4214	APENUP,	PENUP
00140	4230	APENDN,	PENDN

00141	4237	ACRDN,	CRDN
00142	4246	ACRUP,	CRUP
00143	4255	ACHTLF,	CHTLFT
00144	4264	ACHTRT,	CHTRT
00145	4273	ACHLCD,	CHLCDN
00146	4302	ACHLCU,	CHLCUP
00147	4311	ACHRCD,	CHRCDN
00150	7360	SPTBUF,	PLTBUF
00151	0000	EAETP1,	0
00152	0000	EAETP2,	0

```

      2000  *2000
02000  7200  START,  CLA
02001  4430      JMS I  AINTOF  /TURN MS INTERFACE OFF
02002  1047      TAD      ATTRDI
02003  3530      DCA I  TTWI      /ARM TTY FOR OUTPUT.
02004  4437      JMS I  APL      /PRINT "CALIBRATION FILE:"
02005  3200      TEXT1
02006  0011      11
02007  1050      TAD      ATTRDI
02010  3527      DCA I  TTRD      /ARM TTY FOR INPUT.
02011  4457      JMS I  DSPF
02012  4427      JMS I  AINPL      /READ FILE NAME
02013  4451      JMS I  ATRANS      /MOVE FILE NAME.
02014  0240      RAD+40
02015  0003      3
02016  4442      JMS I  AQUES
02017  5206      JMP      START+6
02020  4502      JMS I  OPENRX      /SEARCH DIRECTORY
02021  5600      LINE
02022  6000      BUF0
02023  5216      JMP      .-5
02024  4511      JMS I  READX      /READ FILE
02025  0000      0
02026  0200      200      /WORDS TO READ
02027  6000      BUF0      /STORAGE AREA
02030  0000      0      /DONE FLAG
02031  4532      JMS I  WAITX
02032  4760      JMS I  ACLBUF
02033  5203      JMP      START+3
02034  4445      JMS I  ASTINT      /READ MASSES AND INTEGRATIO
02035  4436      JMS I  ANPNTS      /GET NO. POINTS PER PASS.
02036  4771      JMS I  ARNTIM      /GET MAX. RUN TIME.
02037  4437      JMS I  APL      /PRINT "TITLE:"
02040  3221      TEXT3
02041  0003      3
02042  1050      TAD      ATTRDI
02043  3527      DCA I  TTRD      /ENABLE TTY READ
02044  4457      JMS I  DSPF
02045  4427      JMS I  AINPL      /READ TITLE
02046  4451      JMS I  ATRANS
02047  0200      RAD
02050  0040      40
02051  4442      JMS I  AQUES      /PRINT "??
02052  5245      JMP      .-5
02053  4770      JMS I  PLTFCI      /SET PLOT FACTOR.
02054  3527      DCA I  TTRD      /DISABLE TTY READ
02055  4761      JMS I  ARDFIL
02056  1374      TAD      M1750
02057  3126      DCA      TRTIME      /SET RUN TIME COUNTER.
02060  1050      TAD      ATTRDI
02061  3527      DCA I  TTRD      /ENABLE TTY READ
02062  4767      JMS I  PLOTNI      /INITIALIZE PLOTTER.
02063  4765      JMS I  WTDATI
02064  6002      IOF
02065  4431      JMS I  AINTON      /TURN MS INTERFACE ON.

```

02066	4762	RESCAN,	JMS I	DCONTI	/SET STORAGE POINTERS.
02067	1020		TAD	ABUF0	/BUFFER START ADDRESS.
02070	3034		DCA	AMPPTR	
02071	1375		TAD	M1205	/BUFFER LENGTH.
02072	3101		DCA	NWORDS	/COUNTER FOR ZEROFIL
02073	4536		JMS I	ZROFLI	/ZERO-FILL BUFFER.
02074	1020	BUFSET,	TAD	ABUF0	
02075	3025		DCA	ADSTOR	/SET BUFFER POINTER.
02076	1072		TAD	MLEN	
02077	3372		DCA	BUFEND	
02100	4431		JMS I	AINTON	/TURN MS INTERFACE ON.
02101	1074	CYCLE1,	TAD	MNUM	/NO. POINTS PER MASS.
02102	3364		DCA	LPOINT	
02103	1025	CYCLE2,	TAD	ADSTOR	/SET BUFFER
02104	3034		DCA	AMPPTR	/POINTER.
02105	1523		TAD I	TMASS	/NUMBER OF MASSES
02106	7041		CIA		/NEGATE
02107	3071		DCA	MASCTR	/STORE
02110	1120		TAD	TADTIM	/GET AND STORE
02111	3046		DCA	ATIME	/TIME ADDRESS.
02112	1113		TAD	RODSTT	/GET AND STORE
02113	3044		DCA	ASETT	/SETTING ADDRESS.
02114	1446	MSLOOP,	TAD I	ATIME	/GET INTEGRATION TIME
02115	1126		TAD	TRTIME	/ADD 1 SEC. COUNTER.
02116	3126		DCA	TRTIME	
02117	1126		TAD	TRTIME	
02120	7510		SPA		/GE. 0?
02121	5327		JMP	MSET	/NO. CONTINUE.
02122	2124		ISZ	TOTIME	/YES. INCREMENT RUN TIME CO
02123	7410		SKP		/TIME LIMIT EXCEEDED?
02124	5443		JMP I	ARGCHR	/YES. EXIT.
02125	1374		TAD	M1750	/NO. RESET 1 SEC. COUNTER.
02126	3126		DCA	TRTIME	
02127	4763	MSET,	JMS I	MSSETI	/SET INTERFACE
02130	4773		JMS I	CHKSTI	
02131	1434		TAD I	AMPPTR	/ADD TO STORED VALUE
02132	3434		DCA I	AMPPTR	/AND STORE.
02133	2034		ISZ	AMPPTR	/INCREMENT POINTER TO MSH.
02134	7430		SZL		/OVERFLOW?
02135	2434		ISZ I	AMPPTR	/YES.
02136	7100		CLL		
02137	2034		ISZ	AMPPTR	/INCREMENT POINTER TO NEXT
02140	2046		ISZ	ATIME	/INCREMENT TIME POINTER.
02141	2071		ISZ	MASCTR	/SET OF MASSES DONE?
02142	5314		JMP	MSLOOP	/NO. DO NEXT ONE.
02143	2364		ISZ	LPOINT	/ALL POINTS DONE?
02144	5303		JMP	CYCLE2	/NO. DO ANOTHER POINT.
02145	1025		TAD	ADSTOR	
02146	3766		DCA I	PLOTP1	
02147	2372		ISZ	BUFEND	/BUFFER FULL?
02150	5354		JMP	RESET	/NO. GET MORE DATA
02151	4534		JMS I	WRTFIL	/YES. WRITE IT OUT.
02152	0005		5		
02153	5274		JMP	BUFSET	/START NEXT BUFFER.
02154	1025	RESET,	TAD	ADSTOR	/RESET FOR NEXT SET OF POIN

02155	1106	TAD	PNTLEN	/NO. LOCATIONS PER SET.
02156	3025	DCA	ADSTOR	/NEXT BUFFER LOCATION.
02157	5301	JMP	CYCLE1	
02160	2200	ACLBUF,	CALBUF	
02161	4322	ARDFIL,	RDFILE	
02162	3600	DCONT1,	DCONST	
02163	2430	MSSET1,	MSSET	
02164	0000	LPOINT,	0	
02165	3143	WTDAT1,	WTDATA	
02166	4435	PLOTP1,	PLOTPT	
02167	3323	PLOTN1,	PLOTIN	
02170	3457	PLTFCT,	PLTFCT	
02171	3417	ARNTIM,	RUNTIM	
02172	0000	BUFEND,	0	
02173	4400	CHKST1,	CHKSET	
02174	6030	M1750,	-1750	
02175	6573	M1205,	-1205	
		///		
	2200	PAGE		

```

2200 *2200
/CALIBRATION FILE PACKING SUBROUTINE.
02200 0000 CALBUF, 0
02201 7200 CLA
02202 1356 TAD ADCMAS /GET CALIBRATION MASS
02203 3024 DCA ADMAS1 /ADDRESS AND STORE.
02204 1357 TAD ACALST /GET VOLTAGE SETTING
02205 3233 DCA ADSET /ADDRESS AND STORE.
02206 1020 TAD ABUF0 /GET BUFFER ADDRESS.
02207 3053 DCA CBUF /AND STORE.
02210 2053 ISZ CBUF /INCREMENT POINTER.
02211 1453 TAD I CBUF /GET FIRST MASS.
02212 7440 SZA /ZERO?
02213 5215 JMP CBUF1 /NO. CONTINUE.
02214 5600 JMP I CALBUF /ERROR RETURN.
02215 3424 CBUF1, DCA I ADMAS1 /STORE.
02216 2024 ISZ ADMAS1 /INCREMENT MASS POINTER.
02217 7621 CAM /CLEAR AC AND MQ.
02220 1250 TAD P3 /BUMP POINTER
02221 1053 TAD CBUF /BY 3 AND
02222 3053 DCA CBUF /STORE.
02223 1453 TAD I CBUF /PUT FIRST CAL. WORD
02224 7415 ASR /IN AC. SHIFT RIGHT
02225 0004 4 /4 BITS.
02226 7521 SWP /SWAP AC AND MQ.
02227 2053 ISZ CBUF /INCREMENT POINTER.
02230 1453 TAD I CBUF /ADD 2ND CAL. WORD.
02231 7521 SWP /PUT BACK IN ORDER.
02232 7445 DST
02233 0000 ADSET, 0 /STORE.
02234 2233 ISZ ADSET
02235 2233 ISZ ADSET /BUMP POINTER BY 2.
02236 7621 CAM /CLEAR AC AND MQ.
02237 1251 TAD P4 /BUMP POINTER
02240 1053 TAD CBUF /BY 4
02241 3053 DCA CBUF /AND STORE.
02242 1453 TAD I CBUF /GET NEXT MASS
02243 7440 SZA /VALUE=0?
02244 5215 JMP CBUF1 /NO. PROCESS
02245 3424 DCA I ADMAS1 /YES. ZERO MASS
02246 2200 ISZ CALBUF /UPDATE RETURN
02247 5600 JMP I CALBUF /RETURN
02250 0003 P3, 3
02251 0004 P4, 4
/SUBROUTINE TO DETERMINE ROD VOLTAGE SETTINGS.
02252 0000 CALIB, 0
02253 3116 DCA SMAS /STORE MASS
02254 1116 TAD SMAS
02255 7421 ACMC /PUT MASS IN MQ
02256 3351 DCA NPOINT /ZERO POINTER
02257 1356 TAD ADCMAS /GET CALIBRATED MASS STORAGE
02260 3360 DCA ADMAS2 /ADDRESS AND STORE.
02261 1760 TAD I ADMAS2 /GET FIRST CALIBRATION MASS
02262 7457 SETCA1, SAM /SUBTRACT FROM STORED MASS
02263 7450 SNA /AC=0? (MASS=CALIBRATION MA

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02264	5344	JMP	DONE	/YES. DONE WITH SEARCH.
02265	7710	SPA	CLA	/AC>0? (MASS) CALIBRATION MA
02266	5300	JMP	SINTRP	/NO. INTERPOLATE.
02267	2351	ISZ	NPOINT	/YES. CHECK NEXT POINT.
02270	2360	ISZ	ADMAS2	/INCREMENT POINTER
02271	1760	TAD	I	ADMAS2
02272	7440	SZA		/GET NEXT CALIBRATION PEAK.
02273	5262	JMP	SETCA1	/ZERO?
02274	4440	SETCA2,	JMS I	/NO. PROCEED.
02275	3240	TEXT7	APLR	/PRINT "MASS OUTSIDE
02276	0020	20		/CALIBRATION RANGE. "
02277	5652	JMP	I	
02300	1351	SINTRP,	TAD	CALIB
02301	7650	SNA	CLA	NPOINT
02302	5274	JMP	SETCA2	/FIRST POINT?
02303	7340	NL7777		/YES. ERROR.
02304	1351	TAD	NPOINT	/AC=-1
02305	1356	TAD	ADCMAS	
02306	3065	DCA	LMASS	/POINTER TO PREVIOUS POINT.
02307	1465	TAD	I	LMASS
02310	7457	SAM		/PREVIOUS CALIBRATION MASS
02311	3354	DCA	INTDIF	/SUBTRACT FROM MASS TO
02312	1465	TAD	I	LMASS
02313	7041	CIA		/BE CALIBRATED AND STORE
02314	1760	TAD	I	LMASS
02315	3355	DCA	MASDIF	/PREVIOUS CALIBRATION MASS.
02316	1351	TAD	NPOINT	/NEGATE
02317	1351	TAD	NPOINT	/ADD LAST CALIBRATION MASS
02320	1357	TAD	ACALST	/LAST POINT COUNTER
02321	3333	DCA	HISSET	/START OF ROD CALIBRATION F
02322	7344	NL7776		/ADDRESS OF PREVIOUS SETTING
02323	1333	TAD	HISSET	/AC=-2
02324	3330	DCA	LOWSET	/PREVIOUS ROD SETTING ADDR.
02325	1330	TAD	LOWSET	
02326	3342	DCA	LOSETI	/STORE FOR USE LATER.
02327	7665	DLD		/D. P. LOAD
02330	0000	LOWSET,	0	/PREVIOUS ROD SETTING
02331	7575	DCM		/D. P. COMPLEMENT
02332	7443	DAD		/D. P. ADD LAST
02333	0000	HISSET,	0	/ROD SETTING
02334	4475	JMS I	MULTI	/MULTIPLY BY
02335	2354	INTDIF		/INTERPOLATION DIFFERENCE
02336	7402	HLT		/MULTIPLY OVERFLOW.
02337	4455	JMS I	DIVIDI	/DIVIDE BY DIFFERENCE
02340	2355	MASDIF		/IN MASSES.
02341	7443	DAD		/ADD PREVIOUS SETTING.
02342	0000	LOSETI,	0	/CALIBRATION VALUE IN AC-MQ
02343	5352	JMP	.+7	
02344	1351	DONE,	TAD	NPOINT
02345	1351	TAD	NPOINT	/GET LAST VALUE POINTER.
02346	1357	TAD	ACALST	/ADDRESS OF VALUE.
02347	3351	DCA	NPOINT	/STORE.
02350	7665	DLD		/D. P. LOAD LAST VALUE.
02351	0000	NPOINT,	0	/CALIBRATION VALUE NOW IN
02352	2252	ISZ	CALIB	/INC. FOR NORMAL RETURN.

```
02353 5652          JMP I    CALIB
02354 0000  INTDIF, 0
02355 0000  MASDIF, 0
02356 7400  ADCMAS, CMAS
02357 7500  ACALST, CALSET
02360 0000  ADMAS2, 0
          /SUBROUTINE TO SET POINTERS BEFORE CALLING SETCAL.
02361 0000  PRESET, 0
02362 1117          TAD      TADMAS  /SET MASS POINTER.
02363 3024          DCA      ADMAS1
02364 1523          TAD I    TMASS
02365 7041          CIA
02366 3073          DCA      MNMASS
02367 1113          TAD      RODSTT
02370 3772          DCA I    RODADI
02371 5761          JMP I    PRESET
02372 5762  RODADI, RODADD
          ///
          2400  PAGE
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2400 *2400

/INTERFACE CONTROL FOR SYSTEM 50/150/250 MASS
 /SPECTROMETER INTERFACE.
 /THESE ROUTINES TURN THE INTERFACE
 /FIXED SAMPLING PERIOD ON AND OFF, ALLOW THE
 /TIME REGISTER TO BE LOADED AND ALLOW A DOUBLE
 /PRECISION NUMBER TO BE SENT TO THE MASS SET
 /REGISTER.

/THIS SET OF ROUTINES WAS WRITTEN BY:

/ W. J. FIES
 / FINNIGAN CORP.
 / 595 N PASTORIA AVE
 / SUNNYVALE, CALIF.
 / 408-732-0940

/THIS VERSION DATE:12-2-71

/ADAPTED FOR MASS MONITORING PROGRAM BY:

/ M. B. NEHER
 / BATTELLE MEMORIAL INSTITUTE
 / 505 KING AVENUE
 / COLUMBUS, OHIO 43201

/TURN INTERFACE INTERRUPT AND FLAG OFF

/CALLING SEQUENCE:

/ JMS INTOF

/RETURN IS TO JMS+1

02400	0000	INTOF, 0	
02401	7300	CLA CLL	
02402	6364	MSI	/SEND ZERO TO LOWER IBR
02403	7200	CLA	
02404	1300	TAD K340	
02405	6364	MSI	/SEND COMMAND CODE TO UPPER B
02406	7200	CLA	
02407	5600	JMP I INTOF	/YES. NOW RETURN.

/TURN INTERFACE INTERRUPT AND FLAG ON

/CALLING SEQUENCE:

/ JMS INTON

/RETURN IS TO JMS+1

02410	0000	INTON, 0	
02411	7201	CLA IAC	
02412	6364	MSI	/SEND 1 TO LOWER IBR
02413	7200	CLA	
02414	1300	TAD K340	
02415	6364	MSI	/SEND COMMAND CODE TO UPPER B
02416	7340	NL7777	/AC=-1
02417	3135	DCA WFLAG	/SET WAIT FLAG
02420	3626	DCA I INTON1	
02421	1131	TAD WAITL	/SET UP DELAY.
02422	3227	DCA WCOUNT	
02423	2227	ISZ WCOUNT	/DONE?
02424	5223	JMP -1	/NO. WAIT LONGER.
02425	5610	JMP I INTON	
02426	4435	INTON1, PLOTPT	
02427	0000	WCOUNT, 0	

/SEND INTEGRATION TIME

/CALLING SEQUENCE :

```

/      C(AC)=TIME-1
/      JMS      ITIME
/RETURN IS TO JMS+1
/TIME CAN BE BETWEEN 0000 AND 7777
02430 0000 MSSET, 0
02431 7200 CLA
02432 6031 KSF      /CHAR. IN KEYBOARD?
02433 7410 SKP      /NO.
02434 4701 JMS I    RDTTY /YES. PROCESS IT.
02435 1446 TAD I    ATIME /SET LOWER 8 BITS OF TIME.
02436 6361 SKMI     /SKIP IF MS IS NOT READY
02437 7410 SKP      /FOR INPUT.
02440 5236 JMP      -2
02441 6366 MSIC MSI  /CLEAR IBR AND SEND LOWER 8
02442 7104 CLL RAL   /ROTATE UPPER BITS OF
02443 7006 RTL      /TIME INTO LOWER AC
02444 7006 RTL
02445 0276 AND      K17  /MASK OFF UPPER PART OF AC
02446 1277 TAD      K240 /ADD CONTROL CODE
02447 6364 MSI      /SEND TO UPPER IBR
/SEND MASS NO. TO INTERFACE AND GET AMPLITUDE BACK
/NUMBER IS STORED IN LOCATION SPECIFIED BY ASETT.
/AMPLTD WILL CONTAIN NEW AMPLITUDE AFTER RETURN.
/IF (ASETT) EXCEEDS 0007 7777 OR IS NEGATIVE AN ERROR
/WILL RESULT IN THE VALUE SENT TO THE IBR.
02450 7300 CLA CLL
02451 1444 TAD I    ASETT
02452 6361 SKMI     /WAIT FOR IBR FLAG
02453 7410 SKP
02454 5252 JMP      -2
02455 6366 MSIC MSI  /CLEAR IBR. SEND LOWER 8 BI
02456 2044 ISZ      ASETT
02457 7006 RTL
02460 7006 RTL
02461 7004 RAL
02462 0276 AND      K17  /MASK
02463 3122 DCA      TEMP1
02464 1444 TAD I    ASETT /GET UPPER HALF.
02465 2044 ISZ      ASETT
02466 0275 AND      K7   /MASK
02467 7106 CLL RTL   /ROTATE INTO POSITION
02470 7006 RTL
02471 1122 TAD      TEMP1 /ADD TO OTHER PART
02472 6364 MSI      /SEND TO UPPER IBR
02473 7200 CLA
02474 5630 JMP I    MSSET /JUMP TO BACKGROUND ROUTINE.
02475 0007 K7,      0007
02476 0017 K17,     0017
02477 0240 K240,    240
02500 0340 K340,    340
02501 2600 RDTTY,   RDKYBD
/SUBROUTINE TO READ MASSES
02502 0000 MASSET, 0
02503 3076 DCA      NMASS /ZERO COUNTER.
02504 1117 TAD      TADMAS /GET AND STORE START

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02505 3066      DCA      LOCMAS  /OF MASS TABLE.
02506 4437      JMS I    APL      /PRINT "MASS(ES):"
02507 3224      TEXT4
02510 0005      5
02511 1050      TAD      ATTRDI
02512 3527      DCA I    TTRD
02513 4457      JMS I    DSPF
02514 4427      JMS I    AINPL    /INPUT MASS(ES)
02515 3527      DCA I    TTRD    /DISABLE TTY READ
02516 4421      NXTMAS, JMS I    ADEO  /RETURN OCTAL NUMBER
02517 5335      JMP      LSTMAS  /END OF LINE.
02520 7000      NOP
02521 3466      DCA I    LOCMAS  /STORE NUMBER
02522 2066      ISZ      LOCMAS  /INCREMENT POINTER
02523 1422      TAD I    ADEO4   /TERMINATOR.
02524 1070      TAD      M56
02525 7640      SZR CLA      /DECIMAL POINT?
02526 5331      JMP      .+3     /NO. ASSUME INTEGER.
02527 4463      JMS I    FRCNVI  /GET OCTAL FRACTION.
02530 5340      JMP      MERROR  /ERROR RETURN.
02531 3466      DCA I    LOCMAS  /STORE FRACTION.
02532 2066      ISZ      LOCMAS  /INCREMENT POINTER.
02533 2076      ISZ      NMASS   /INCREMENT COUNTER.
02534 5316      JMP      NXTMAS
02535 1076      LSTMAS, TAD      NMASS
02536 3523      DCA I    TMASS
02537 5702      JMP I    MASSET  /NORMAL RETURN.
02540 2302      MERROR, ISZ      MASSET
02541 2302      ISZ      MASSET
02542 5702      JMP I    MASSET
/SUBROUTINE TO READ INTEGRATION TIMES.
02543 0000      TIMSET, 0
02544 4437      JMS I    APL      /PRINT "INTEG. TIME:"
02545 3231      TEXT5
02546 0007      7
02547 7340      TIMST1, NL7777  /AC=-1
02550 1120      TAD      TADTIM
02551 3067      DCA      LOCTIM
02552 1523      TAD I    TMASS
02553 7041      CIA      /NEGATE
02554 3100      DCA      NTIME
02555 1050      TAD      ATTRDI
02556 3527      DCA I    TTRD    /ENABLE TTY READ
02557 4457      JMS I    DSPF
02560 4427      JMS I    AINPL    /READ INTEGRATION TIME
02561 3527      DCA I    TTRD    /DISABLE TTY READ
02562 4421      NXTIME, JMS I    ADEO  /GET INTEGRATION TIMES
02563 7000      NOP
02564 5372      JMP      SET2
02565 2067      ISZ      LOCTIM  /INCREMENT POINTER
02566 3467      DCA I    LOCTIM  /STORE INTEGRATION TIME
02567 2100      ISZ      NTIME   /INCREMENT COUNTER
02570 5362      JMP      NXTIME  /GET NEXT TIME
02571 5743      JMP I    TIMSET  /FINISHED
02572 1467      SET2,  TAD I    LOCTIM /GET TIME

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02573	2067	ISZ	LOCTIM	/INCREMENT POINTER
02574	3467	DCA I	LOCTIM	/REPEAT FOR NEXT MASS
02575	2100	ISZ	NTIME	/INCREMENT COUNTER
02576	5372	JMP	SET2	/DO NEXT ONE
02577	5743	JMP I	TIMSET	

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2600 PAGE

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2600 *2600
/SUBROUTINE TO INTERPRET TELETYPE
/COMMANDS DURING OPERATION.
02600 0000 RDKYBD, 0
02601 6036 KRB /READ TTY KEYBOARD.
02602 3372 DCA STORE
02603 4430 JMS I AINTOF /TURN MS INTERFACE OFF.
02604 1372 TAD STORE
02605 6001 ION
02606 4773 JMS I ATTYT /ECHO.
02607 1050 TAD ATTRDI
02610 3527 DCA I TTRD /ENABLE TTY READ.
02611 1372 TAD STORE
02612 1362 TAD MEE /MINUS E.
02613 7640 SZA CLA /IS CHARACTER E?
02614 5225 JMP CHANGE /NO.
02615 5222 JMP STOP /YES. TERMINATE RUN.
02616 4756 RDK1, JMS I CRLF /PUT OUT CRLF.
02617 6002 END, IOF
02620 4431 JMS I AINTON /TURN MS INTERFACE ON.
02621 5600 JMP I RDKYBD

/ROUTINE TO TERMINATE DATA ACQUISITION
/AND START PLOTTING.
02622 4427 STOP, JMS I AINPL /WAIT FOR CR.
02623 6002 IOF
02624 5443 JMP I ARGCHR
02625 1372 CHANGE, TAD STORE
02626 1363 TAD MCNTRL /MINUS CONTROL-L.
02627 7450 SNA /IS IT CONTROL-L?
02630 5251 JMP ABORT /YES. ABORT.
02631 1364 TAD MESS /MINUS S.
02632 7450 SNA /IS CHARACTER S.
02633 5300 JMP SCHANG /YES.
02634 1365 TAD MTEE /MINUS T.
02635 7450 SNA /IS CHARACTER T?
02636 5351 JMP TCHANG /YES.
02637 1366 TAD MEN /MINUS N.
02640 7450 SNA /IS CHARACTER N?
02641 5255 JMP NCHANG /YES.
02642 1367 TAD MEM /MINUS M.
02643 7450 SNA /IS CHARACTER M?
02644 5265 JMP MCHANG /YES.
02645 1370 TAD MEFF /MINUS F.
02646 7650 SNA CLA /IS CHARACTER F?
02647 5261 JMP FCHANG /YES.
02650 5216 JMP RDK1 /NO. IGNORE.
02651 6002 ABORT, IOF
02652 4537 JMS I APENUP /RAISE PLOTTER PEN
02653 6001 ION
02654 5461 JMP I EXECX / AND RETURN TO EXEC.

/CHANGE NUMBER OF POINTS USED IN
/COMPUTING RUNNING AVERAGE.
02655 1260 NCHANG, TAD NCHRET /RETURN ADDRESS.
02656 3436 DCA I ANPNTS
02657 5757 JMP I ANPNT1 /CHANGE NO. POINTS.

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02660 2666 NCHRET, MCHA1
        /CHANGE PLOT SCALE FACTOR.
02661 1264 FCHANG, TAD      FCHRET /RETURN ADDRESS.
02662 3761          DCA I    APLTFC
02663 5760          JMP I    APLTF1 /CHANGE PLOT FACTOR.
02664 2617 FCHRET, END
        /CHANGE MASSES TO MONITOR.
        /ENTRY OF NEW SETS OF MASSES DURING OPERATION IS NOT
        /POSSIBLE WITH THE NON EAE VERSION UNLESS THE PROGRAM
        /IS ALTERED TO CALL FRONVT AS AN OVERLAY.
MCHANG,
IFZERO EAE <
        JMP END >
IFNZRO EAE <
02665 4445          JMS I    ASTINT >/REINITIALIZE POINTERS.
02666 4460 MCHA1,   JMS I    ENDCKI
02667 7070          7070
02670 6001          ION
02671 4464          JMS I    HDRBLK /WRITE NEW HEADER BLOCK.
02672 6002          IOF
02673 4431          JMS I    AINTON /TURN MS INTERFACE ON.
02674 1050          TAD      ATTRDI
02675 3527          DCA I    TTRD   /ENABLE TTY READ,
02676 5677          JMP I    .+1
02677 2066          RESCAN
        2700 SCHANG=.
02700 4427 MCHA3,   JMS I    AINPL  /READ SET NO.
02701 4421          JMS I    ADEO
02702 4442          JMS I    AQUES
02703 5300          JMP      MCHA3  /TRY AGAIN.
02704 3477          DCA I    NSET
02705 1477          TAD I    NSET
02706 7041          CIA
02707 1125          TAD      TOTSET
02710 7700          SMA CLA      /NUMBER TOO LARGE?
02711 5314          JMP      MCHA4  /NO. NUMBER OK.
02712 4442          JMS I    AQUES  /PRINT "??"
02713 5300          JMP      MCHA3  /TRY AGAIN.
02714 3527 MCHA4,   DCA I    TTRD   /DISABLE TTY READ.
02715 7340          NL7777 /AC=-1
02716 1477          TAD I    NSET   /GET SET NO.
02717 3371          DCA      SDIFF
02720 1371          TAD      SDIFF
02721 7450          SNA              /NO. >1?
02722 5327          JMP      MCHA5  /NO. ! USE FIRST SET.
02723 7421          ACMC           /PUT IN MQ
02724 7405          MUY
02725 3065          P20
02726 7521          SWP
02727 1112 MCHA5,   TAD      RODLOC /PUT ANSWER IN AC
02730 3113          DCA      RODSTT /START OF VOLTAGE ARRAY
02731 1371          TAD      SDIFF  /START OF THIS SET
02732 7450          SNA              /SET NO. >1?
02733 5340          JMP      MCHA6  /NO. USE FIRST SET.
02734 7421          ACMC           /PUT IN MQ

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02735 7405      MUY
02736 0104      P31
02737 7701      MQAR      /PUT ANSWER IN AC.
02740 1026      MCHA6,   TAD      ADTIME  /START OF 1ST TIME ARRAY.
02741 3120      DCA      TADTIM  /START OF THIS SET OF TIMES.
02742 1371      TAD      SDIFF
02743 7450      SNA      /SET NO. >1?
02744 5346      JMP      MCHA7  /NO.
02745 7721      MQAC      /GET OFFSET FROM MQ.
02746 1033      MCHA7,   TAD      AMASS1  /START OF MASS TABLE.
02747 3123      DCA      TMASS  /LOC. OF NO. MASSES.
02750 5266      JMP      MCHA1
          /CHANGE INTEGRATION TIMES.
02751 1260      TCHANG,  TAD      NCHRET
02752 3755      DCA I    TIMSTI  /CHANGE RETURN ADD.
02753 5754      JMP I    ATIMS1
02754 2547      ATIMS1,  TIMST1
02755 2543      TIMST1,  TIMSET
02756 5132      CRLF,    TTYCR
02757 3405      ANPNT1,  NPNTS1
02760 3464      APLTF1,  PLTFC1
02761 3457      APLTFC,  PLTFCT
02762 7473      MEE,     -305
02763 7564      MCNTRL,  -214
02764 7671      MESS,    -107      /214-323
02765 7777      MTEE,    -1        /323-324
02766 0006      MEN,     6          /324-316
02767 0001      MEM,     1          /316-315
02770 0007      MEFF,    7          /315-307
02771 0000      SDIFF,   0
02772 0000      STORE,   0
02773 5122      ATTYT,   TTYT
02774 5541      TELRD,   R1

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      3000  *3000
      /SUBROUTINE FOR INITIALIZING POINTERS PRIOR TO CALL
      /MASSET AND TIMSET.
03000  0000  PTRS,  0
03001  1023      TAD      ADMASS
03002  3117      DCA      TADMAS  /1ST MASS STORAGE LOC.
03003  1026      TAD      AOTIME
03004  3120      DCA      TADTIM  /1ST TIME STORAGE LOC.
03005  1033      TAD      AMASS1
03006  3123      DCA      TMASS   /LOC. FOR NO. MASSES.
03007  1112      TAD      RODLOC
03010  3113      DCA      RODSTT
03011  7301      NL0001      /AC=1
03012  3477      DCA I      NSET   /FIRST SET OF MASSES.
03013  5600      JMP I      PTRS
03014  0000  STINIT, 0
03015  4200      JMS      PTRS
03016  4662  SET,  JMS I      AMSSET
03017  4664      JMS I      ATMSET
03020  4435      JMS I      ASTCAL
03021  4442      JMS I      AQUES
03022  5216      JMP      SET
03023  1477      TAD I      NSET
03024  1266      TAD      M3ST    /MINUS 3
03025  7700      SMA CLA      /NSET=3?
03026  5253      JMP      SETDON  /YES.
03027  4437      JMS I      APL    /PRINT "ANOTHER SET?"
03030  3305      TEXT12
03031  0006      6
03032  4663      JMS I      AQUERY
03033  5235      JMP      .+2      /CHANGE POINTERS FOR NEXT S
03034  5253      JMP      SETDON
03035  2477      ISZ I      NSET   /INCREMENT NO OF SETS.
03036  1117      TAD      TADMAS  /INCREMENT
03037  1104      TAD      P31     /MASS AND
03040  3117      DCA      TADMAS  /TIME
03041  1120      TAD      TADTIM  /POINTERS
03042  1104      TAD      P31     /BY
03043  3120      DCA      TADTIM  /31
03044  1123      TAD      TMASS
03045  1104      TAD      P31
03046  3123      DCA      TMASS
03047  1113      TAD      RODSTT
03050  1265      TAD      P20
03051  3113      DCA      RODSTT
03052  5216      JMP      SET
03053  7200  SETDON, CLA      /NO MORE SETS.
03054  1477      TAD I      NSET
03055  3125      DCA      TOTSET  /NO. OF SETS OF MASSES.
03056  4200      JMS      PTRS
03057  1050      TAD      ATTRDI  /ARM TTY
03060  3527      DCA I      TTRD  /FOR INPUT.
03061  5614      JMP I      STINIT
03062  2502  AMSSET, MASSET
03063  3547  AQUERY, QUERY

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03064 2543 ATMSET, TIMSET
03065 0020 P20, 20
03066 7775 M3ST, -3
      /SUBROUTINE TO WRITE E-O-R FLAG ON DISK OR TAPE.
      /SUBROUTINE TO ZERO-FILL BUFFER.
03067 0000 ZROFIL, 0
03070 3434 ZR1, DCA I AMPPTR
03071 2034 ISZ AMPPTR
03072 2101 ISZ NWORDS /DONE?
03073 5270 JMP ZR1 /NO.
03074 5667 JMP I ZROFIL
      /SUBROUTINE TO END RECORDS.
03075 0000 ENDCHK, 0
03076 3333 DCA NBLOCK /ZERO BLOCK COUNTER.
03077 1025 TAD ADSTOR /RESET BUFFER ADDRESS TO
03100 3034 DCA AMPPTR /START OF CURRENT SET
03101 1034 TAD AMPPTR /OF MASSES.
03102 1342 TAD M6000 /AMPLITUDE BUFFER START.
03103 1341 ENDC1, TAD M201
03104 2333 ISZ NBLOCK /INCREMENT BLOCK COUNTER.
03105 7540 SMA SZA /DONE?
03106 5303 JMP ENDC1 /NO. DO MORE.
03107 7540 SZA CLA /YES. ANY ROOM LEFT IN BLOC
03110 5327 JMP ENDC2 /YES.
03111 1333 TAD NBLOCK /NO.
03112 1340 TAD M5
03113 7450 SNA /5 BLOCKS?
03114 5317 JMP .+3 /YES.
03115 2333 ISZ NBLOCK /NO. BUMP BLOCK COUNTER
03116 5327 JMP ENDC2
03117 4534 JMS I WRTFIL /WRITE OUT FILE
03120 0005 5
03121 1020 TAD ABUF0 /RESET POINTER
03122 3034 DCA AMPPTR
03123 7301 NL0001 /AC=1
03124 3333 DCA NBLOCK /SET BLOCK COUNTER FOR WRITE
03125 7344 NL7776 /AC=-2
03126 3101 DCA NWORDS /ONLY 2 WORDS TO ZERO OUT.
03127 2034 ENDC2, ISZ AMPPTR
03130 1675 TAD I ENDCHK /GET E-O-R CHARACTER.
03131 3434 DCA I AMPPTR /STORE E-O-R CHAR.
03132 4534 JMS I WRTFIL
03133 0000 NBLOCK, 0
03134 1020 TAD ABUF0
03135 3034 DCA AMPPTR /RESET BUFFER LOCATION
03136 2275 ISZ ENDCHK
03137 5675 JMP I ENDCHK
03140 7773 M5, -5
03141 7577 M201, -201
03142 2000 M6000, -6000
      /
03143 0000 WTDATA, 0
03144 4437 JMS I APL /PRINT "DATA"
03145 3211 TEXT2
03146 0002 2

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03147 4427 JMS I AINPL /WAIT FOR RESPONSE
03150 5743 JMP I WTDATA

/
/SUBROUTINE TO CHECK TAPE STATUS.
03151 0000 TCHECK, 0
03152 1764 TAD I CONFIG /CONFIGURATION WORD.
03153 0362 AND P4IN /MASK OFF DISK-TAPE BIT.
03154 7640 SZA CLA /TAPE?
03155 5751 JMP I TCHECK /NO. DISK. RETURN.
03156 1763 TAD I BFLAG /YES. GET BACKSPACE FLAG.
03157 7640 SZA CLA /DONE?
03160 5356 JMP .-2 /NO. WAIT.
03161 5751 JMP I TCHECK /YES. RETURN.
03162 0004 P4IN, 4
03163 0402 BFLAG, 402
03164 0170 CONFIG, 170

03165 0314 TEXT16, TEXT /CLOSE ERROR!/
03166 1723
03167 0540
03170 0522
03171 2217
03172 2241
03173 0000
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3200 *3200
03200 0301 TEXT1, TEXT /CALIBRATION FILE: /
03201 1411
03202 0222
03203 0124
03204 1117
03205 1640
03206 0611
03207 1405
03210 7240
03211 0000
3211 *. -1
03211 0401 TEXT2, TEXT /DATA FILE NAME: /
03212 2401
03213 4006
03214 1114
03215 0540
03216 1601
03217 1505
03220 7240
03221 0000
3221 *. -1
03221 2411 TEXT3, TEXT /TITLE:/
03222 2414
03223 0572
03224 0000
3224 *. -1
03224 1501 TEXT4, TEXT /MASS(ES): /
03225 2323
03226 5005
03227 2351
03230 7240
03231 0000
3231 *. -1
03231 1116 TEXT5, TEXT /INTEGRA. TIME: /
03232 2405
03233 0722
03234 0156
03235 4024
03236 1115
03237 0572
03240 4000
3240 *. -1
03240 1501 TEXT7, TEXT /MASS OUTSIDE CALIBRATION RANGE. /
03241 2323
03242 4017
03243 2524
03244 2311
03245 0405
03246 4003
03247 0114
03250 1102
03251 2201
03252 2411
03253 1716
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03254 4022
03255 0116
03256 0705
03257 5640
03260 0000
      3260 *. -1
03260 0425 TEXT8, TEXT /DUPLICATE FILE NAME!/
03261 2014
03262 1103
03263 0124
03264 0540
03265 0611
03266 1405
03267 4016
03270 0115
03271 0541
03272 0000
      3272 *. -1
03272 1617 TEXT9, TEXT /NO. POINTS: /
03273 5640
03274 2017
03275 1116
03276 2423
03277 7240
03300 0000
      3300 *. -1
03300 2225 TEXT10, TEXT /RUN TIME: /
03301 1640
03302 2411
03303 1505
03304 7240
03305 0000
      3305 *. -1
03305 0116 TEXT12, TEXT /ANOTHER SET?/
03306 1724
03307 1005
03310 2240
03311 2305
03312 2477
03313 0000
      3313 *. -1
03313 2303 TEXT15, TEXT /SCALE FACTOR: /
03314 0114
03315 0540
03316 0601
03317 0324
03320 1722
03321 7240
03322 0000

      /SUBROUTINE TO SET POINTERS FOR SETCAL.
      /SUBROUTINE TO INITIALIZE PLOTTER.
03323 0000 PLOTIN, 0
03324 6002 IOF
03325 7340 NL7777 /AC=-1
03326 4507 JMS I PLOTT /SET NEW ORIGIN

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03327	7301	NL0001	/SET AC=1
03330	4507	JMS I PLOTT	/DRIVE PLOTTER PEN DOWN TO
03331	0000	0	/X AXIS
03332	6030	-1750	
03333	7340	NL7777	/AC=-1
03334	4507	JMS I PLOTT	/SET NEW ORIGIN
03335	7301	NL0001	/SET AC=1
03336	4507	JMS I PLOTT	/RAISE PEN 1" ABOVE
03337	0000	0	/X AXIS.
03340	0100	100	
03341	7340	NL7777	/AC=-1
03342	4507	JMS I PLOTT	/SET NEW ORIGIN.
03343	4540	JMS I APENDN	/LOWER PEN.
03344	1753	TAD I NSMOTI	/POINTS TO SMOOTH
03345	7041	CIA	/NEGATE
03346	3105	DCA PTCTR	/SET POINT COUNTER.
03347	1110	TAD PTBUF	/SET PLOT BUFFER
03350	3052	DCA BUFLOC	/ POINTER.
03351	6001	ION	
03352	5723	JMP I PLOTIN	
03353	4571	NSMOTI, NSMOOT	
		/	
03354	0000	TOTAL, 0	
03355	0000	0	
03356	7734	SVTGLY, -44	
03357	0011	11	
03360	0054	54	
03361	0105	105	
03362	0124	124	
03363	0131	131	
03364	0124	124	
03365	0105	105	
03366	0054	54	
03367	0011	11	
03370	7734	-44	
03371	0655	655	

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      3400 *3400
      /SUBROUTINE TO SET NUMBER OF POINTS FOR AVERAGING.
03400 0000 NPNTS, 0
03401 4437 JMS I APL /PRINT "NO. POINTS:"
03402 3272 TEXT9
03403 0006 6
03404 4457 JMS I DSPF
03405 4427 NPNTS1, JMS I AINFL /READ NUMBER OF POINTS.
03406 4421 JMS I ADEQ
03407 4442 JMS I AQUES /PRINT "??
03410 5200 JMP NPNTS /TRY AGAIN.
03411 3441 DCA I APNUM
03412 4241 JMS DIVSET
03413 7410 SKP
03414 5600 JMP I NPNTS
03415 4442 JMS I AQUES /PRINT "??
03416 5201 JMP NPNTS+1

      /SUBROUTINE TO SET MAXIMUM RUN TIME
03417 0000 RUNTIM, 0
03420 4437 JMS I APL /PRINT "RUN TIME:"
03421 3300 TEXT10
03422 0005 5
03423 4457 RUNTM1, JMS I DSPF
03424 4427 JMS I AINFL /READ RUN TIME.
03425 4421 JMS I ADEQ
03426 4442 JMS I AQUES
03427 5223 JMP RUNTM1 /TRY AGAIN.
03430 7521 SWP
03431 7200 CLA
03432 7405 MUY
03433 3440 P74
03434 7521 SWP /PUT PRODUCT IN AC
03435 7041 CIA /NEGATE
03436 3124 DCA TOTIME /AND STORE
03437 5617 JMP I RUNTIM
03440 0074 P74, 74 /MULTIPLIER TO CONVERT TIME
      /TO SECONDS.

      /SUBROUTINE TO CALCULATE DIVISOR FOR AMPLITUDE SCA
03441 0000 DIVSET, 0
03442 1441 TAD I APNUM
03443 7041 CIA
03444 3074 DCA MNUM
03445 1441 TAD I APNUM
03446 7421 ACMC
03447 7405 MUY
03450 2251 P4
03451 7440 SZR
03452 5641 JMP I DIVSET /OVERFLOW. NUMBER TOO LARGE
03453 7521 SWP
03454 3056 DCA DIVNUM
03455 2241 ISZ DIVSET /SET PROPER RETURN
03456 5641 JMP I DIVSET

      /SUBROUTINE TO SET PLOT SCALING FACTOR
03457 0000 PLTFCT, 0
03460 4437 JMS I APL /PRINT "SCALE FACTOR:"

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03461 3313 TEXT15
03462 0007 7
03463 4457 JMS I DSPF
03464 4427 PLTFC1, JMS I AINPL /READ SCALE FACTOR
03465 4421 JMS I ADEO /DECIMAL-OCTAL CONVERT
03466 4442 JMS I AQUES /ERROR
03467 5264 JMP PLTFC1 /TRY AGAIN
03470 3062 DCA FACTOR
03471 5657 JMP I PLTFCT
/SUBROUTINE TO WRITE DATA RECORDS.
03472 0000 SPF, 0
03473 7200 CLA
03474 1306 TAD SPF1 /RPT COUNT
03475 3311 DCA SPF5 /TEMP STORAGE
03476 1032 TAD ALINE
03477 3307 DCA SPF2 /STORAGE ADDR
03500 1310 SPF3, TAD SPF4 /SPACE FILL
03501 3707 DCA I SPF2 /STORE
03502 2307 ISZ SPF2 /UPDATE STR ADDR
03503 2311 ISZ SPF5 /FINISHED?
03504 5300 JMP SPF3 /NO
03505 5672 JMP I SPF /YES-RETURN
03506 7760 SPF1, 7760 /-20 OCTAL
03507 0000 SPF2, 0
03510 4040 SPF4, 4040
03511 0000 SPF5, 0
/SUBROUTINE TO WRITE DATA RECORDS.
03512 0000 WRTDAT, 0
03513 1712 TAD I WRTDAT /GET NO. BLOCKS.
03514 2312 ISZ WRTDAT
03515 7421 ACMC /PUT IN MQ
03516 7405 MUY /MULTIPLY BY 201.
03517 3546 P201
03520 7430 SZL /ERROR?
03521 7402 HLT
03522 7521 SWP /PRODUCT TO AC
03523 3335 DCA WRTNUM
03524 1335 TAD WRTNUM
03525 7041 CIA
03526 3101 DCA NWORDS /COUNT F00P PZER FILL.
03527 1020 TAD ABUF0 /SET POINTER FOR
03530 3034 DCA AMPPTR /FOR ZROFIL.
03531 4430 JMS I AINTOF
03532 6001 ION
03533 4533 JMS I WRITEX
03534 0000 0
03535 0000 WRTNUM, 0 /NO. WORDS TO WRITE
03536 6000 BUF0 /ADDRESS.
03537 0000 0 /DONE FLAG
03540 4532 JMS I WAITX
03541 7200 CLA
03542 4521 JMS I TCHCKI
03543 6002 IOF
03544 4536 JMS I ZROFLI /ZERO-FILL BUFFER
03545 5712 JMP I WRTDAT

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03546 0201 P201, 201
03547 0000 QUERY, 0 /QUESTION SUBROUTINE.
03550 1050 TAD ATTRDI
03551 3527 DCA I TTRD /ENABLE TTY READ.
03552 4427 JMS I AINPL /READ ANSWER.
03553 3527 DCA I TTRD /DISABLE TTY INPUT
03554 1432 TAD I ALINE /GET ANSWER
03555 0364 AND P7700 /MASK OFF FIRST 6 BITS
03556 1363 TAD YNEG /SUBTRACT "Y"
03557 7650 SNA CLA
03560 5747 JMP I QUERY /POSITIVE RETURN.
03561 2347 ISZ QUERY
03562 5747 JMP I QUERY /NEGATIVE RETURN.
03563 4700 YNEG, 4700
03564 7700 P7700, 7700
/SUBROUTINE TO WRITE HEADER BLOCK.
03565 0000 HDBLOK, 0
03566 4533 JMS I WRITEX /WRITE TAPE HEADER BLOCK.
03567 0000 0
03570 0200 200 /NO. WORDS.
03571 0200 RAD /WRITE START ADDRESS.
03572 0000 0 /DONE FLAG
03573 4532 JMS I WAITX
03574 7200 CLA
03575 4521 JMS I TCHCKI
03576 5765 JMP I HDBLOK

```

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3600 *3600
/SUBROUTINE TO CALCULATE CONSTANTS FOR DATA ACQUI
DCONST, 0
03600 0000
03601 1523 TAD I TMASS /GET NO. OF MASSES.
03602 7104 CLL RAL /MULTIPLY BY 2.
03603 3106 DCA PNTLEN
03604 1216 TAD P1205 /MAX. BUFFER LENGTH
03605 7421 APMC /PUT IN MQ
03606 7407 DVI
03607 0106 PNTLEN
03610 7430 SZL
03611 7402 HLT /DIVIDE ERROR.
03612 7521 SWP /QUOTIENT TO AC.
03613 7041 CIA /NEGATE
03614 3072 DCA MLEN /NUMBER OF SETS OF POINTS.
03615 5600 JMP I DCONST /RETURN.
03616 1205 P1205, 1205
/EAE ROUTINE TO DIVIDE UNSIGNED DOUBLE PRECISION
/DIVIDEND BY UNSIGNED SINGLE PRECISION DIVISOR
/CALLING SEQUENCE:
/ AC CONTAINS HIGH ORDER DIVIDEND.
/ MQ CONTAINS LOW ORDER DIVIDEND.
/ JMS I (DIVIDE)
/ DIVISOR ADDRESS
03617 0000 DIVIDE, 0
03620 4320 JMS SIGN1
03621 7521 SWP /PUT MSH DIVIDEND IN MQ.
03622 3260 DCA DIVI1 /STORE LSH DIVIDEND
03623 1617 TAD I DIVIDE /GET ADDRESS OF
03624 3261 DCA DIVI2 /DIVISOR AND STORE.
03625 1661 TAD I DIVI2 /GET DIVISOR
03626 4336 JMS SIGN2
03627 3261 DCA DIVI2 /AND STORE.
03630 7407 DVI
03631 3661 DIVI2
03632 7430 SZL
03633 7402 HLT /DIVIDE ERROR
03634 7521 SWP /MSH TO AC, REM TO MQ.
03635 3262 DCA DIVI3 /STORE MSH QUOTIENT
03636 1260 TAD DIVI1 /GET LSH DIVIDEND
03637 7521 SWP /PUT IN PROPER ORDER.
03640 7407 DVI
03641 3661 DIVI2
03642 7430 SZL
03643 7402 HLT /DIVIDE ERROR
03644 7104 CLL RAL /MULTIPLY REMAINDER BY 2
03645 7041 CIA / AND NEGATE.
03646 1261 TAD DIVI2 /ADD DIVISOR.
03647 7750 SPA SNA CLA /DIVISOR GE. REMAINDER?
03650 5253 JMP .+3 /NO.
03651 1262 TAD DIVI3 /YES. GET MSH QUOTIENT.
03652 5255 JMP .+3
03653 1262 TAD DIVI3
03654 7573 DPIC /INCREMENT QUOTIENT.
03655 2217 ISZ DIVIDE

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```

03656 4344      JMS      SIGN3
03657 5617      JMP I    DIVIDE
          /QUOTIENT IN AC-MQ ON RETURN, MSH IN AC.
03660 0000      DIVI1, 0
03661 0000      DIVI2, 0
03662 0000      DIVI3, 0
          /EAE MULTIPLY ROUTINE.
          /MULTIPLIES DOUBLE PRECISION MULTIPLICAND IN MQ-AC
          /BY SINGLE PRECISION MULTIPLIER. RETURNS DOUBLE
          /PRECISION PRODUCT IN AC-MQ. HALTS ON MULTIPLY OVE
          /CALLING SEQUENCE:
          /      JMS      (MULT)
          /      JMULIPLIER ADDRESS
03663 0000      MULT, 0
03664 4320      JMS      SIGN1
03665 3260      DCA      MULT1 /STORE MSH.
03666 1663      TAD I    MULT /GET MULTIPLIER
03667 3261      DCA      MULT2 /ADDRESS.
03670 1661      TAD I    MULT2 /NOW GET MULTIPLIER
03671 4336      JMS      SIGN2
03672 3261      DCA      MULT2 / AND STORE IT.
03673 1260      TAD      MULT1 /GET BACK MSH
03674 7450      SNA      /D.P. ?
03675 5307      JMP      MULT0 /NO.
03676 7521      SWP      /MSH TO MQ.
03677 3260      DCA      MULT1 /STORE LSH
03700 7405      MUY      /MULTIPLY MSH.
03701 3661      MULT2
03702 7440      SZR
03703 7402      HLT      /MULTIPLY OVERFLOW.
03704 1260      TAD      MULT1 /GET LSH MULTIPLICAND AND
03705 7521      SWP      /PUT IN MQ, PRODUCT TO AC.
03706 3260      DCA      MULT1 /STORE MSH PRODUCT.
03707 7405      MULT0, MUY /MULTIPLY LSH.
03710 3661      MULT2
03711 7430      SZL
03712 5315      JMP      +3 /OVERFLOW ERROR.
03713 1260      TAD      MULT1 /NOW ADD MSH PRODUCT
03714 2263      ISZ      MULT /SET UP NORMAL RETURN.
03715 2263      ISZ      MULT /ERROR RETURN.
03716 4344      JMS      SIGN3
03717 5663      JMP I    MULT
          3660      MULT1=DIVI1
          3661      MULT2=DIVI2
          /
03720 0000      SIGN1, 0
03721 7500      SMA      /NEGATIVE?
03722 5331      JMP      SIGNCL /NO.
03723 7575      DCM      /YES. COMPLEMENT.
03724 3260      DCA      DIVI1
03725 7340      NL7777 /AC=-1
03726 3335      DCA      SIGN /SET SIGN SWITCH=-1
03727 1260      TAD      DIVI1
03730 5720      JMP I    SIGN1
03731 3260      SIGNCL, DCA DIVI1 /STORE OPERAND.

```

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03732 3335      DCA      SIGN      /CLEAR SIGN SWITCH.
03733 1260      TAD      DIVI1     /GET BACK OPERAND.
03734 5720      JMP I    SIGN1     /RETURN.
03735 0000      SIGN,    0
          //
03736 0000      SIGN2,   0
03737 7500      SMA                      /NEGATIVE?
03740 5736      JMP I    SIGN2     /NO.
03741 7041      CIA                      /YES. NEGATE.
03742 2335      ISZ      SIGN      /INCREMENT SIGN SWITCH.
03743 5736      JMP I    SIGN2
          //
03744 0000      SIGN3,   0
03745 3260      DCA      DIVI1     /STORE MSH ANSWER.
03746 1335      TAD      SIGN      /CHECK SIGN.
03747 7640      SZA CLA                      /ZERO.
03750 5353      JMP      .+3        /NO.
03751 1260      TAD      DIVI1     /GET BACK MSH ANSWER.
03752 5744      JMP I    SIGN3
03753 1260      TAD      DIVI1
03754 7575      DCM                      /COMPLEMENT ANSWER.
03755 5744      JMP I    SIGN3

```

/

/ ONE OF THE EAE SIMULATOR ROUTINES.

IFZERO EAE <

```

LSRSM, 0
      DCA      EAETP1  /SAVE AC
      TAD I    LSRSM   /GET NUMBER OF SHIFTS
      ISZ      LSRSM
      SZA                      /NO SHIFTS?
      JMP      .+3
      TAD      EAETP1  /RESTORE AC
      JMP I    LSRSM
      CIA                      /COMPLIMENT
      DCA      EAETP2
      TAD      EAETP1  /RESTORE AC
LSRLP, CLL RAR      /ROTATE MSH 1 BIT
      SWP
      RAR                      /ROTATE
      SWP
      ISZ      EAETP2  /DONE?
      JMP      LSRLP  /NO
      JMP I    LSRSM >

```

IFZERO PLIST <XLIST> /RESET IF NOT LISTING PLOTTER ROUTINES.
 /SUBROUTINE TO GET DATA FILE NAME AND
 /DETERMINE WHETHER THERE IS ALREADY A FILE
 /BY THAT NAME ON THE SYSTEM DEVICE.

```

04322 0000 RDFFILE, 0
04323 4437 JMS I APL /PRINT "DATA FILE NAME:"
04324 3211 TEXT2
04325 0010 10
04326 1050 RDF1, TAD ATTRDI
04327 3527 DCA I TTRD /ENABLE TTY READ.
04330 4457 JMS I DSPF
04331 4427 JMS I AINPL /READ FILE NAME.
04332 3527 DCA I TTRD /DISABLE TTY READ.
04333 4503 JMS I OPENWX /DOES FILE EXIST>
04334 5600 LINE /FILE NAME ADDRESS.
04335 6000 BUF0
04336 5344 JMP .+6
04337 4440 JMS I APLR /PRINT "DUPLICATE FILE NAME
04340 3260 TEXT8
04341 0012 12
04342 4442 JMS I AQUES /PRINT "??
04343 5326 JMP RDF1 /TRY AGAIN.
04344 4451 JMS I ATRANS /MOVE FILE NAME
04345 4353 RDF2
04346 0003 3
04347 5342 JMP .-5 /ERROR RETURN.
04350 7000 NOP
04351 4464 JMS I HDRBLK
04352 5722 JMP I RDFFILE
04353 0000 RDF2, 0
04354 0000 0
04355 0000 0
/
04356 0000 RCGCHR, 0
04357 4460 JMS I ENDCKI /INSERT RECORD END.
04360 7171 7171 /EOF FLAG.
04361 4430 JMS I AINTOF /TURN OFF MS INTERFACE.
04362 4537 JMS I APENUP /RAISE PLOTTER PEN.
04363 6001 ION
04364 4454 JMS I CLOSEX /CLOSE FILE
04365 4353 RDF2
04366 5600 LINE
04367 0000 0
04370 7410 SKP /ERROR RETURN
04371 5376 JMP TERMIN
04372 4521 JMS I TCHCKI
04373 4440 JMS I APLR /PRINT "CLOSE ERROR!"
04374 3165 TEXT16
04375 0006 6
04376 4521 TERMIN, JMS I TCHCKI
04377 5461 JMP I EXECX

```

```

      4400  *4400
      /SUBROUTINE TO HANDLE DATA DURING M. S.
      /INTERFACE INTEGRATION.
04400  0000  CHKSET, 0
04401  1135      TAD      WTFLAG  /GET WAIT FLAG
04402  7510      SPA      /USE THIS POINT?
04403  5273      JMP      WAIT2   /NO.
04404  1235      TAD      PLOTPT
04405  7650      SNA CLA      /POINT TO PLOT?
04406  5265      JMP      WAIT1   /NO.
04407  1114      TAD      SETFLG
04410  7650      SNA CLA      /TIME TO MOVE POINTS?
04411  5234      JMP      PLOTPT-1 /NO. CALCULATE POINT.
04412  3114      DCA      SETFLG  /CLEAR FLAG.
04413  1371      TAD      NSMOOT  /GET NO POINTS TO SMOOTH9
04414  7041      CIA
04415  7001      IAC
04416  3372      DCA      CTR      /SET COUNTER (-NSMOOT+1)
04417  1150      TAD      SFTBUF
04420  3306      DCA      PTBUF0
04421  1150      TAD      SFTBUF
04422  7001      IAC
04423  3307      DCA      PTBUF1
04424  1707      RLOOP,  TAD I    PTBUF1  /GET VALUE.
04425  3706      DCA I    PTBUF0  /MOVE IT DOWN.
04426  2372      ISZ      CTR      /DONE?
04427  7410      SKP      /NO.
04430  5234      JMP      PLOTPT-1
04431  2306      ISZ      PTBUF0
04432  2307      ISZ      PTBUF1
04433  5224      JMP      RLOOP
04434  7665      DLD
04435  0000      PLOTPT, 0
04436  4475      JMS I     MULTI
04437  0062      FACTOR
04440  7402      HLT      /MULTIPLY OVERFLOW.
04441  4455      JMS I     DIVIDI
04442  0056      DIVNUM
04443  7721      MQAC
04444  3452      DCA I     BUFLOC  /STORE IT.
04445  3235      DCA      PLOTPT  /ZERO PLOT POINT ADD.
04446  2105      ISZ      PTCTR   /ENOUGH POINTS TO SMOOTH?
04447  7410      SKP      /NO.
04450  5253      JMP      SMOOTH  /YES.
04451  2052      ISZ      BUFLOC  /BUMP STORAGE POINTER.
04452  5265      JMP      WAIT1
04453  4310      SMOOTH, JMS     FIT  /CALL SMOOTH ROUTINE.
04454  7360      PLTBUF  /ARRAY ADD.
04455  3260      DCA      PLOTPY
04456  4507      JMS I     PLOTT   /PLOT POINT.
04457  0000      PLOTPX, 0
04460  0000      PLOTPY, 0
04461  2257      ISZ      PLOTPX
04462  7340      NL7777  /AC=-1
04463  3105      DCA      PTCTR   /RESET COUNTER.

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04464 2114      ISZ      SETFLG  /SET FLAG.
04465 6371 WAIT1, SKMO      /M. S. READY FOR OUTPUT?
04466 7410      SKP      /YES.
04467 5265      JMP      .-2   /NO. WAIT LONGER.
04470 7100      CLL      /LINK MUST BE CLEARED.
04471 6372      MSO      /OUTPUT OBR.
04472 5600      JMP I    CHKSET /RETURN.
04473 6371 WAIT2, SKMO      /MS READY FOR OUTPUT?
04474 7410      SKP      /YES.
04475 5273      JMP      .-2   /NO WAIT LONGER.
04476 6372      MSO      /OUTPUT OBR.
04477 7344      NL7776     /AC=-2
04500 1044      TAD      ASETT  /RESET VOLTAGE ARRAY
04501 3044      DCA      ASETT  /ADDRESS.
04502 2135      ISZ      WTFLAG /BUMP FLAG
04503 7000      NOP
04504 5705      JMP I    .+1
04505 2114      MSLOOP
04506 0000 PTBUF0, 0
04507 0000 PTBUF1, 0
          /SAVITZKY-GOLAY SMOOTHING ROUTINE.
          /THIS VERSION SMOOTHS 11 POINTS.
          /FIRST POINT TO SMOOTH IN CALL+1.
          /SMOOTHED POINT RETURNED IN AC, SINGLE PRECISION.
04510 0000 FIT, 0
04511 1710      TAD I    FIT
04512 3373      DCA      SMADD  /STARTING ADDRESS.
04513 2310      ISZ      FIT
04514 1371      TAD      NSMOOT
04515 7041      CIA
04516 3372      DCA      CTR    /SET UP POINT COUNTER.
04517 1375      TAD      AFACT
04520 3374      DCA      FACT
04521 7621      CAM
04522 7445      DST
04523 3354      TOTAL
04524 1773 SML0OP, TAD I    SMADD
04525 7421      ACMC      /INTENSITY TO MQ.
04526 1374      TAD      FACT
04527 3331      DCA      SML1
04530 4475      JMS I    MULTI  /CALL MULTIPLY ROUTINE.
04531 0000 SML1, 0
04532 7402      HLT
04533 7443      DAD
04534 3354      TOTAL
04535 7445      DST
04536 3354      TOTAL
04537 7621      CAM
04540 2373      ISZ      SMADD  /INCREMENT ADDRESSES.
04541 2374      ISZ      FACT
04542 2372      ISZ      CTR    /DONE?
04543 5324      JMP      SML0OP /NO.
04544 1374      TAD      FACT
04545 3351      DCA      SML2
04546 7665      DLD      /YES. GET TOTAL

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04547	3354		TOTAL		
04550	4455		JMS I	DIVIDI	/CALL DIVIDE ROUTINE.
04551	0000	SML2,	0		
04552	7500		SMA		/AC. GE. 0?
04553	5356		JMP	. +3	/YES.
04554	7621		CAM		/NO. SET=0!
04555	5710		JMP I	FIT	/EXIT
04556	7440		SZA		/AC=0?
04557	7402		HLT		/NO. OVERFLOW ERROR.
04560	1370		TAD	P1700	
04561	7457		SAM		
04562	7710		SPA CLA		/TOO LARGE?
04563	5366		JMP	. +3	/NO.
04564	1370		TAD	P1700	/YES.
04565	5710		JMP I	FIT	
04566	7721		MQAC		/YES. GET QUOTIENT
04567	5710		JMP I	FIT	/ AND RETURN.
04570	1700	P1700,	1700		
04571	0013	NSMOOT,	13		
04572	0000	CTR,	0		
04573	0000	SMADD,	0		
04574	0000	FACT,	0		
04575	3356	AFACT,	SVTGLY		

/THE REST OF THE EAE SIMULATOR ROUTINES

IFZERO EAE <

*5645

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MUYSM, 0
      CLA CLL           /SINGLE PRECISION UNSIGNED MULP
      SWP              /GET MULTIPLIER
      DCA      EAETP1  /STORE
      TAD I    MUYSM  /GET ADDRESS OF MULT.
      DCA      EAETP2
      TAD I    EAETP2 /MULTIPLICAND
      DCA      EAETP2
      ISZ      MUYSM  /UPDATE REURN
      DCA      MP5
      TAD      THIR
      DCA      MP3
MP4,   TAD      EAETP1
      RAR
      DCA      EAETP1
      TAD      MP5
      SNL
      JMP      . +3
      CLL
      TAD      EAETP2
      RAR
      DCA      MP5
      ISZ      MP3
      JMP      MP4
      TAD      EAETP1
      RAR              /LOW ORDER PRODUCT
      SWP              /TO MQ
      TAD      MP5      /HIGH ORDER PRODUCT
      JMP I    MUYSM
MP3,   0
MP5,   0
THIR,  7764
DVISM, 0
      DCA      EAETP1  /UNSIGNED S. P. DIVIDE
      SWP      /STORE MSH
      DCA      EAETP2  /GET LSH
      TAD I    DVISM  /STORE
      DCA      DIVSOR  /GET DIVISOR ADDRESS
      TAD I    DIVSOR  /ACTUAL DIVISOR
      CIA      /COMPLIMENT
      DCA      DIVSOR  /STORE
      CLL
      TAD      DIVSOR
      TAD      EAETP1
      ISZ      DVISM  /CHECK FOR OVERFLOW
      SZL CLA
      JMP I    DVISM  /OVERFLOW
      TAD      MDV13
      DCA      DIVCNT
      JMP      DV2
DV3,   TAD      EAETP1

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      RAL
      DCA      EAETP1
      TAD      EAETP1
      TAD      DIVSOR
      SZL
      DCA      EAETP1
      CLA
DV2,  TAD      EAETP2
      RAL
      DCA      EAETP2
      ISZ      DIVCNT
      JMP      DV3
      TAD      EAETP2  /QUOTIENT
      SWP      /TO MQ
      TAD      EAETP1
      CLL
      JMP I    DVISM
DIVSOR, 0
DIVCNT, 0
MDV13, -15
DCMSM, 0
      DCA      EAETP1  /STORE MSH
      SWP      /GET LSH TO AC
      CMA CLL CML IAC /COMPLIMENT AC SET LINK TO ZERO
      SWP      /IF AC WAS ZERO
      GLK      /GET LINK BIT
      TAD      EAETP1  /ADD TO MSH
      CIA      /COMPLIMENT
      JMP I    DCMSM
DLDSM, 0
      CAM      /CLEAR AA, MQ
      TAD I    DLDSM  /GET ADDRESS
      DCA      .+3
      ISZ      DLDSM  /UPDATE RETURN
      DAD      /DOUBLE ADD TO A CLEAR AC, MQ
      0
      JMP I    DLDSM
BUF0=.
*BUF0+1205
DADSM, 0
      DCA      EAETP1  /STORE AC
      TAD I    DADSM  /GET ADDRESS OF LSH
      DCA      EAETP2  /STORE
      ISZ      DADSM  /UPDATE RETURN
      CLL
      SWP      /SWAP MQ, AC
      TAD I    EAETP2  /LSH(1)+LSH(2)
      SWP      /PUT IN MQ
      GLK      /GET CARRY BIT
      ISZ      EAETP2  /MSH ADDRESS
      TAD I    EAETP2
      TAD      EAETP1  /MSH(1)+MSH(2)
      JMP I    DADSM  /DONE.
ASRSM, 0
      DCA      EAETP1  /STORE MSH

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TAD      EATP1
AND      ASRSM1  /GET SIGN BIT
DCA      ASRSM2
TAD I    ASRSM   /NUMBER OF SHIFTS
DCA      . +5
ISZ      ASRSM   /UPDATE RETURN
TAD      EAETP1
AND      ASRSM3

LSR
0
DCA      EAETP1
TAD      ASRSM2  /GET SIGN
CLL RAL   /INTO LINK
TAD      EAETP1
TAD      ASRSM2  /RESTORE SIGN
JMP I    ASRSM

ASRSM1, 4000
ASRSM2, 0
ASRSM3, 3777
DSTSM, 0

DCA      EAETP1  /STORE MSH IN TEMPORARY
TAD I    DSTSM   /GET LSH STORAGE ADDRESS

DCA      EAETP2
MQAR      /MQ TO AC, MQ UNCHANGED.
DCA I    EAETP2
ISZ      EAETP2
ISZ      DSTSM   /UPDATE RETURN
TAD      EAETP1  /MSH
DCA I    EAETP2  /STORE
TAD      EAETP1  /RESTOR AC
JMP I    DSTSM   /DONE

SAMSM, 0
CIA      /COMPLIMENST AC
DCA      EAETP1  /STORE
CLL
MQAR      /MQ TO AC, MQ UNCHANGED.
TAD      EAETP1  /ADD COMPLIMENT
JMP I    SAMSM   /DONE

DPICSM, 0
SWP      /LSH TO AC.
CLL      /BE SURE L IS CLEAR.
IAC      /INC. LSH.
SWP      /PUT BACK IN ORDER.
SZL      /OVERFLOW OF LSH INC. ?
IAC      /YES. INC. MSH.
JMP I    DPICSM >

```

IFZERO EAE < *6400 >

5640 IFNZRO EAE < *5640

6000 BUF0=6000 >

/DECIMAL TO OCTAL FRACTION CONVERSION ROUTINE.
/THIS ROUTINE IS OVERLAID BY THE DATA BUFFER
/IN THE NON EAE VERSION. THEREFORE, NEW SETS OF
/MASSES CANNOT BE ENTERED DURING A RUN UNLESS
/THE PROGRAM IS CHANGED TO CALL FRCNVT AS
/AN OVERLAY WHEN NEEDED.

05640	0000	FRCNVT,	0		
05641	3313		DCA	FRNCTR	
05642	3314		DCA	FRTEMP	
05643	4723	FRCN1,	JMS I	AGAC	/GET A CHARACTER.
05644	5301		JMP	FREXIT	/NO MORE CHARACTERS.
05645	1315		TAD	M71	
05646	7540		SMA SZA		/GT. 71(9)?
05647	5305		JMP	FREXT1	/NO.
05650	1316		TAD	N11	
05651	7510		SPA		/GE. 60(0)?
05652	5305		JMP	FREXT1	/NO.
05653	3312		DCA	FRCFCT	
05654	1313		TAD	FRNCTR	
05655	1322		TAD	FRNJMP	
05656	3257		DCA	. +1	
05657	7402	FRCN2,	HLT		/CHANGED TO JUMP.
05660	1317		TAD	TENS	
05661	1320		TAD	HUNDRS	
05662	1321		TAD	THOUS	
05663	7421		ACMC		/PUT IN MQ.
05664	7405		MUY		
05665	5712		FRCFCT		
05666	7721		MQAC		/GET ANSWER.
05667	1314		TAD	FRTEMP	/PREV. TOTAL.
05670	3314		DCA	FRTEMP	/NEW. TOTAL.
05671	2313		ISZ	FRNCTR	
05672	7346		NL7775		/AC=-3
05673	1313		TAD	FRNCTR	
05674	7750		SPA SNA CLA		/1ST OR 2ND CHAR?
05675	5243		JMP	FRCN1	/YES. TRY ANOTHER.
05676	4421		JMS I	ADE0	/NO. GET REST, IF ANY.
05677	5305		JMP	. +6	/END OF LINE.
05700	7000		NOP		
05701	7200	FREXIT,	CLA		
05702	2240		ISZ	FRCNVT	/INCREMENT RETURN.
05703	1314		TAD	FRTEMP	/GET NUMBER.
05704	5640		JMP I	FRCNVT	/NORMAL RETURN.
05705	7200	FREXT1,	CLA		
05706	1313		TAD	FRNCTR	
05707	7640		SZA CLA		/ANY CONVERSION?
05710	5301		JMP	FREXIT	/YES.

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05711 5640      JMP I   FRCNVT  /ERROR RETURN.
05712 0000      FRCFCT, 0
05713 0000      FRNCTR, 0
05714 0000      FRTEMP, 0
05715 7707      M71,    -71
05716 0011      N11,    11
05717 0554      TENS,    554      /0632-0056
05720 0052      HUNDRS, 52      /0056-0004
05721 0004      THOUS,   0004
05722 5260      FRNJMP, JMP      FRCN2+1
05723 5323      AGAC,    GAC
      /SUBROUTINE TO CALCULATE ROD VOLTAGE SETTINGS
      /FOR NON-INTEGERS MASSES.
05724 0000      SETCAL, 0
05725 4777      JMS I    PRSETI  /SET POINTERS.
05726 1424      TAD I    ADMAS1  /GET INTEGER MASS.
05727 4776      JMS I    ACALIB  /CALCULATE SETTING.
05730 5375      JMP SETERR
05731 7445      DST
05732 3354      TOTAL
05733 2024      ISZ      ADMAS1  /INCREMENT POINTER.
05734 7621      CAM
05735 1424      TAD I    ADMAS1  /GET FRACTIONAL MASS.
05736 7440      SZA      /FRACTIONAL MASS?
05737 5343      JMP      SETC1   /YES.
05740 7665      DLD      /NO.
05741 3354      TOTAL
05742 5361      JMP      SETC2
05743 3115      SETC1, DCA      SFACT
05744 1116      TAD      SMASS   /GET INTEGER MASS AND
05745 7001      IAC      /INCREMENT.
05746 4776      JMS I    ACALIB  /CALCULATE M+1 SETTING.
05747 5375      JMP      SETERR
05750 7575      DCM      /NEGATE.
05751 7443      DAD      /SUBTRACT PREVIOUS
05752 3354      TOTAL      / VALUE.
05753 7575      DCM      /NEGATE TO MAKE POSITIVE.
05754 7405      MUY      /MULTIPLY BY FRACTIONAL
05755 0115      SFACT     / MASS.
05756 7421      ACMC      /PUT RESULT IN MQ.
05757 7443      DAD      /ADD IN LOWER MASS
05760 3354      TOTAL      / VALUE.
05761 7445      SETC2, DST      /D. P. STORE
05762 0000      RODADD, 0
05763 7621      CAM
05764 2073      ISZ      MNMASS  /DONE?
05765 7410      SKP
05766 5373      JMP      NORRET
05767 2362      ISZ      RODADD  /INCREMENT POINTER.
05770 2362      ISZ      RODADD
05771 2024      ISZ      ADMAS1
05772 5326      JMP      SETCAL+2
05773 2324      NORRET, ISZ      SETCAL  /NORMAL RETURN
05774 2324      ISZ      SETCAL
05775 5724      SETERR, JMP I    SETCAL

```

05776	2252	ACALIB,	CALIB
05777	2361	PRSET1,	PRESET
		\$	

ABORT	2651	ATTRDI	0050	DPIC	7573	MASS	0246
ABUF0	0020	ATTYT	2773	DSPF	0057	MASSET	2502
ACALIB	5776	BFLAG	3163	DST	7445	MCHANG	2665
ACALST	2357	BSET	0244	DVI	7407	MCHA1	2666
ACHLCD	0145	BUFEND	2172	EAE	0001	MCHA3	2700
ACHLCU	0146	BUFLOC	0052	EAETP1	0151	MCHA4	2714
ACHRCD	0147	BUFSET	2074	EAETP2	0152	MCHA5	2727
ACHTLF	0143	BUF0	6000	END	2617	MCHA6	2740
ACHTRT	0144	CALBUF	2200	ENDCHK	3075	MCHA7	2746
ACLBUF	2160	CALIB	2252	ENDCKI	0060	MCNTRL	2763
ACMC	7421	CALSET	7500	ENDC1	3103	MEE	2762
ACRDN	0141	CAM	7621	ENDC2	3127	MEFF	2770
ACRUP	0142	CBUFF	0053	EXEC	1200	MEM	2767
ADCMAS	2356	CBUFF1	2215	EXECX	0061	MEN	2766
ADEO	0021	CHANGE	2625	FACT	4574	MERROR	2540
ADEO4	0022	CHKSET	4400	FACTOR	0062	MESS	2764
ADMASS	0023	CHKSTI	2173	FCHANG	2661	MLEN	0072
ADMAS1	0024	CHLCDN	4273	FCHRET	2664	MNMASS	0073
ADMAS2	2360	CHLCF1	4310	FIT	4510	MNUM	0074
ADPLTW	4175	CHLCUP	4302	FRCFCT	5712	MON	0400
ADSET	2233	CHLC1	4301	FRCNVI	0063	MOAC	7721
ADSTOR	0025	CHRCDN	4311	FRCNVT	5640	MOAR	7701
ADTIME	0026	CHRC1	4317	FRCN1	5643	MSET	2127
AFACT	4575	CHTLFT	4255	FRCN2	5657	MSI	6364
AGAC	5723	CHTL1	4263	FREXIT	5701	MSIC	6362
AINPL	0027	CHTRT	4264	FREXT1	5705	MSLOOP	2114
AINTOF	0030	CHTR1	4272	FRNCTR	5713	MSO	6372
AINTON	0031	CLOSE	0606	FRNJMP	5722	MSSET	2430
ALINE	0032	CLOSEX	0054	FRTEMP	5714	MSSETI	2163
AMASS1	0033	CMASS	7400	GAC	5323	MTEE	2765
AMPPTR	0034	COMPAR	4147	HDBLOK	3565	MULT	3662
AMSSET	3062	CONFIG	3164	HDRBLK	0064	MULTI	0075
ANPNTS	0036	CRDN	4237	HISSET	2333	MULT0	3706
ANPNT1	2757	CRDN1	4245	HUNDRS	5720	MULT1	3657
APENDN	0140	CRLF	2756	INFL	4600	MULT2	3660
APENUP	0137	CRUP	4246	INTDIF	2354	MUY	7405
APL	0037	CRUP1	4254	INTOF	2400	M1205	2175
APLR	0040	CTR	4572	INTON	2410	M1750	2174
APLTFC	2761	CYCLE1	2101	INTON1	2426	M201	3141
APLTF1	2760	CYCLE2	2103	K17	2476	M3ST	3066
APNUM	0041	DAD	7443	K240	2477	M5	3140
AQUERY	3063	DCM	7575	K340	2500	M56	0070
AQUES	0042	DCONST	3600	K7	2475	M6000	3142
ARDFIL	2161	DCONTI	2162	LINE	5600	M71	5715
ARGCHR	0043	DEO	5200	LMASS	0065	NBLOCK	3133
ARNTIM	2171	DEO4	5300	LOAD	1600	NCHANG	2655
ASETT	0044	DIVIDE	3617	LOCMAS	0066	NCHRET	2660
ASR	7415	DIVIDI	0055	LOCTIM	0067	NL0001	7301
ASTCAL	0035	DIVI1	3657	LOSETI	2342	NL0002	7305
ASTINT	0045	DIVI2	3660	LOWSET	2330	NL0003	7325
ATIME	0046	DIVI3	3661	LPOINT	2164	NL0004	7307
ATIMS1	2754	DIVNUM	0056	LSR	7417	NL7775	7346
ATMSET	3064	DIVSET	3441	LSTMAS	2535	NL7776	7344
ATRANS	0051	DLD	7665	MASCTR	0071	NL7777	7340
ATTPRI	0047	DONE	2344	MASDIF	2355	NMASS	0076

NORRET	5773	PLTFC1	3464	SETERR	5775	TIMSET	2543
NPNTS	3400	PLTWT1	4206	SETFLG	0114	TIMSTI	2755
NPNTS1	3405	PNTLEN	0106	SET2	2572	TIMST1	2547
NPOINT	2351	PNUM	0243	SFACT	0115	TMASS	0123
NSET	0077	PRESET	2361	SIGN	3734	TOTAL	3354
NSMOOT	4571	PRSET1	5777	SIGNCL	3730	TOTIME	0124
NSMOT1	3353	PTBUF	0110	SIGN1	3717	TOTSET	0125
NTIME	0100	PTBUF0	4506	SIGN2	3735	TRANS	5532
NUMMAS	0245	PTBUF1	4507	SIGN3	3743	TRTIME	0126
NWORDS	0101	PTCTR	0105	SINTRP	2300	TTPRI	5125
NXTIME	2562	PTRS	3000	SKMI	6361	TTRD	0127
NXTMAS	2516	P1205	3616	SKMO	6371	TTRDI	5543
N11	5716	P1700	4570	SMADD	4573	TTWI	0130
OPENR	0601	P20	3065	SMASS	0116	TTYCR	5132
OPENRX	0102	P201	3546	SML00P	4524	TTYIN	1400
OPENW	0613	P3	2250	SML1	4531	TTYOUT	1401
OPENWX	0103	P31	0104	SML2	4551	TTYT	5122
PENDN	4230	P4	2251	SMOOTH	4453	WAIT	1000
PENUP	4214	P4IN	3162	SPF	3472	WAITL	0131
PEN1	4222	P74	3440	SPF1	3506	WAITX	0132
PEN2	4223	P7700	3564	SPF2	3507	WAIT1	4465
PEN3	4236	QUERY	3547	SPF3	3500	WAIT2	4473
PL	5000	QUES	5110	SPF4	3510	WCOUNT	2427
PLIST	0000	RAD	0200	SPF5	3511	WRITE	0404
PLOTA	4020	RCGCHR	4356	SPLTBY	6301	WRITEX	0133
PLOTDB	4117	RDFILE	4322	SPTBUF	0150	WRTDAT	3512
PLOTDX	4172	RDF1	4326	START	2000	WRTFIL	0134
PLOTDY	4173	RDF2	4353	STINIT	3014	WRTNUM	3535
PLOTIN	3323	RDKYBD	2600	STOP	2622	WTDATA	3143
PLOTMY	4176	RDK1	2616	STORE	2772	WTDATI	2165
PLOTNA	4174	RDTTY	2501	SVTGLY	3356	WTFLAG	0135
PLOTNI	2167	READ	0412	SWP	7521	YNEG	3563
PLOTNX	4170	READX	0111	TADMAS	0117	ZROFIL	3067
PLOTNY	4171	RESCAN	2066	TADTIM	0120	ZROFLI	0136
PLOTPN	4167	RESET	2154	TCHANG	2751	ZR1	3070
PLOTPT	4435	RLOOP	4424	TCHKI	0121		
PLOTPX	4457	RODADD	5762	TCHECK	3151		
PLOTPY	4460	RODADI	2372	TELRD	2774		
PLOTP1	2166	RODLOC	0112	TEMP1	0122		
PLOTT	0107	RODSTT	0113	TENS	5717		
PLOTTT	1402	RODVL	7300	TERMIN	4376		
PLOTT1	4130	RSTAC	4224	TEXT1	3200		
PLOTT2	4133	RUNTIM	3417	TEXT10	3300		
PLOTT3	4136	RUNTM1	3423	TEXT12	3305		
PLOTWT	4200	R1	5541	TEXT15	3313		
PLOTX	4000	SAM	7457	TEXT16	3165		
PLOTZ	4320	SCHANG	2700	TEXT2	3211		
PLOT1	4027	SDIFF	2771	TEXT3	3221		
PLOT2	4063	SET	3016	TEXT4	3224		
PLOT3	4104	SETCAL	5724	TEXT5	3231		
PLOT4	4126	SETCA1	2262	TEXT7	3240		
PLR	5101	SETCA2	2274	TEXT8	3260		
PLTBUF	7360	SETC1	5743	TEXT9	3272		
PLTFC1	2170	SETC2	5761	THOUS	5721		
PLTFCT	3457	SETDON	3053	TIME	0266		

/EAE DEFINITION.

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PAGE 1

/EAE DEFINITION.

/

0001 EAE=1

/SIMPLT.

/

/THIS PROGRAM PREPARES NORMALIZED PLOTS FROM DATA FILES
 /CREATED BY THE "SIM" SCAN PROGRAM. IT USES THE STANDARD
 /SYSTEM 150 PROGRAMS. THIS VERSION REQUIRES A PDP8/E OR
 /8/M BUT INCORPORATES EAE SIMULATOR ROUTINES FOR
 /SYSTEMS WITHOUT THE KES-E EXTENDED ARITHMETIC
 /ELEMENT, EAE. FOR SYSTEMS WITH EAE, DEFINE EAE=1 TO
 /ASSEMBLE A PROGRAM USING THE EAE.

/

/PLIST CONTROLS LISTING OF THE S.I. PLOTTER ROUTINES.
 /IF NOT DEFINED (OR SET EQUAL TO ZERO) THE PLOTTER ROUTINES
 /ARE NOT LISTED. IF SET NONZERO, THE PLOTTER ROUTINES ARE LISTED.

/

IFNDEF PLIST <PLIST=0>

/

```

7701 MQR=7701
6221 LINE=6221
7521 SWP=7521
7621 CAM=7621
0171 RADD=171
7421 MQL=7421
0020 *20
00020 6221 ALINE, LINE
00021 3517 APL, PL
00022 3400 AINPL, INPL
00023 7770 M10, -10
00024 0000 TMP1, 0
00025 0000 TMP2, 0
00026 0000 TMP3, 0
00027 0000 TMP4, 0
00030 4040 BLBL, 4040
00031 0040 P40, 40
00032 3111 ASTORG, SETORG
00033 0601 OPENRX, 601
00034 0000 ORGNUM, 0
00035 0000 TRADD, 0
00036 0000 0
00037 0000 ABSYRG, 0
00040 3277 AHDRPL, HDRPLT
00041 3027 ARTORG, RTNORG
00042 7510 AMSADD, 7510
00043 0000 PASS, 0
00044 0000 FRSFLG, 0
00045 0000 HYMASS, 0
00046 0000 MSMTCH, 0
00047 0000 INTRVL, 0
00050 0000 MASNUM, 0
00051 0000 CRTMAS, 0
00052 6300 P6300, 6300
00053 3075 RDINTX, INTRD
00054 0000 NPTS, 0
00055 0000 BGINT, 0
00056 0000 0
00057 7777 LWINT, 7777

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```
00060 3777      3777
00061 0000 SPCADD, 0
00062 0000 RESET, 0
00063 3010 AYPLT, YRGC
00064 3007 AXPLT, XRG
00065 0000 PENUD, 0
00066 2357 ATRNON, TRNON
      0100 *100
      /GENERALIZED PLOTTING PROGRAM, ALL MEASUREMENTS IN TERMS
      /OF PLOTTING INCREMENTS (.01'S). NO SCALING DONE BY PLOTTING
      /PROGRAM

      /VARIABLES
00100 0000 X, 0
00101 0000 Y, 0
00102 0000 FACT, 0
      NUMB,
      LL,
00103 0000 SADDR, 0
      LJ,
00104 0000 THETA, 0
      LXADDR,
00105 0000 S, 0
      LYADDR,
00106 0000 DX, 0
      LK,
00107 0000 XMIN, 0
      DTIC,
00110 0000 LN, 0
00111 0000 IX, 0
00112 0000 IY, 0
00113 0000 AX, 0
00114 0000 AY, 0
00115 0000 BX, 0
00116 0000 BY, 0

      /LINKS AND POINTERS
00117 4200 ADPLOT, PLOTX
00120 4406 ADPFETCH, PFETCH
00121 4542 ADSBAL, SUBALF
00122 4510 ADMULT, MULT
00123 4446 ADNEWB, NEWB
00124 4607 ADLTR, LETTER
00125 4720 ADRTAT, ROTATE
00126 4607 OUTPUT, LETTER

      /CONSTANTS
00127 0077 N77, 77
00130 7701 M77, -77
00131 0005 N5, 5
00132 0011 N11, 11
00133 0144 N144, 144
00134 7774 M4, -4
00135 7776 M2, -2
00136 7775 M3, -3
```

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00067 0067 *67
00067 6042 APENUP,  PENUP
00070 6056 APENDN,  PENDN
00071 6065 ACRDN,   CRDN
00072 6074 ACRUP,   CRUP
00073 6103 ACHTLF,  CHTLFT
00074 6112 ACHTRT,  CHTRT
00075 6200 ACHLCU,  CHLCUP
00076 6207 ACHRCD,  CHRCDN
00077 5646 ADIMOVE, IMOVE
0137 *137
00137 0412 READX,   412
00140 1000 WAITX,   1000
00141 2351 ASTMSP,  SETMSP
00142 2676 PTMASC,  PLTMAS
00143 6032 APLOTW,  PLOTWT
00144 0000 CDMASS,   0
00145 0000          0
00146 0237 P237,    237
00147 3740 MBLBL,   -4040
00150 7763 NSMOOT,  -15
00151 5400 SMTHX,   SMOOTH

```

```
IFNDEF EAE <EAE=0 >
```

```
IFZERO EAE <
```

```

SWAB=7000
EAETP1, 0
EAETP2, 0
DST=JMS I
        DSTSM
DLD=JMS I
        DLDSM
DAD=JMS I
        DADSM
DVI=JMS I
        DVISM
DCM=JMS I
        DCMSM
MUY=JMS I
        MUYSM
LSR=JMS I
        LSRSM
SHL=JMS I
        SHLSM
DPSZ=JMS I
        DPSZSM >

```

```
IFNZRO EAE <
```

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7431 SWAB=7431
7445 DST=7445
7663 DLD=7663
7443 DAD=7443

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7407 DVI=7407
7575 DCM=7575
7405 MUY=7405
7417 LSR=7417
7413 SHL=7413
7451 DPSZ=7451 >

```

2000      2000      *2000
02000      6002      IOF
02001      7621      CAM
02002      4432      JMS I   ASTORG  /SET ORIGIN
02003      4541      JMS I   ASTMSP
02004      4421      JMS I   APL
02005      2340      MES1
02006      0003      3          /FILE
02007      4422      JMS I   AINPL
02010      6304      6304      /TURN PLOTTER OFF
02011      6001      ION
02012      4433      JMS I   OPENRX
02013      6221      LINE
02014      6300      6300      /OPEN FILE
02015      7402      HLT          /NO FILE
02016      7201      CLA IAC
02017      3034      DCA      ORGNUM
02020      1171      TAD      RADD
02021      3035      DCA      TRADD
02022      1172      TAD      RADD+1
02023      3036      DCA      TRADD+1 /SAVE STARTING BLOCK
02024      3037      DCA      ABSYRG /ABSOLUTE Y ORIGIN
02025      4771      JMS I   RDHDRX
02026      1370      TAD      M40
02027      3024      DCA      TMP1
02030      1146      TAD      P237
02031      3025      DCA      TMP2      /FIND END OF TITLE
02032      1425      TAD I   TMP2
02033      1147      TAD      MELBL
02034      7640      SZR CLA
02035      5243      JMP      .+6
02036      2024      ISZ      TMP1
02037      7240      CLA CMA
02040      1025      TAD      TMP2
02041      3025      DCA      TMP2
02042      5232      JMP      .-10
02043      4440      JMS I   AHDRPL /PLOT TITLE
02044      1042      TAD      AMSADD
02045      3365      DCA      P20T1
02046      4441      JMS I   ARTORG
02047      3043      DCA      PASS
02050      3044      DCA      FRSFLG /SET IN SEARCH MODE - FIRST TIME DLAG
02051      7240      CLA CMA
02052      3045      DCA      HYMASS /SET NO MASS FLAG
02053      3463      DCA I   AYPLT
02054      7001      IAC
02055      3464      DCA I   AXPLT
02056      5260      JMP      .+2
02057      4771      FNDPLT, JMS I   RDHDRX /READ HEADER BLOCK
02060      1776      TAD I   A244
02061      1372      TAD      MSDTNX
02062      3027      DCA      TMP4
02063      3046      DCA      MSMTCH
02064      1427      TAD I   TMP4
02065      3027      DCA      TMP4

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02066	1427	TAD I	TMP4	/# OF POINTS IN SET
02067	3366	DCA	P20T2	
02070	1366	TAD	P20T2	
02071	7104	CLL RAL		
02072	3047	DCA	INTRVL	
02073	1366	TAD	P20T2	
02074	7041	CIA		
02075	3026	DCA	TMP3	
02076	3050	DCA	MASNUM	
02077	2027	ISZ	TMP4	
02100	1045	TAD	HVMAS	/GET FLAG
02101	7640	SZA CLA		
02102	5317	JMP	NOMSCR	/NO CURRENT MASS
02103	4777	JMS I	(DPMAS	
02104	7041	CIA		
02105	2050	ISZ	MASNUM	
02106	1051	TAD	CRTMAS	/ADD CURRENT MASS
02107	7650	SNA CLA		
02110	5357	JMP	SETFLG	/MASS=CURRETN MASS?
02111	2027	ISZ	TMP4	
02112	2026	ISZ	TMP3	
02113	5303	JMP	.-10	
02114	7240	CLA CMA		/SET NO MATCH FLAG
02115	3046	DCA	MSMTCH	
02116	5357	JMP	SETFLG	
02117	4777	NOMSCR, JMS I	(DPMAS	
02120	3025	DCA	TMP2	
02121	2050	ISZ	MASNUM	
02122	1042	TAD	AMSADD	
02123	3024	DCA	TMP1	/PREPARE TO TEST IF ALREADY DONE
02124	1370	TAD	M40	
02125	3051	DCA	CRTMAS	
02126	1424	NOMSC1, TAD I	TMP1	
02127	7041	CIA		
02130	1025	TAD	TMP2	
02131	7640	SZA CLA		
02132	5337	JMP	.-+5	
02133	2027	ISZ	TMP4	
02134	2026	ISZ	TMP3	/ALREADY BEEN DONE
02135	5317	JMP	NOMSCR	
02136	5767	JMP I	AMNMXP	/NO MASS NOT DONE
02137	2024	ISZ	TMP1	
02140	2051	ISZ	CRTMAS	
02141	5326	JMP	NOMSC1	/LOOK AT NEXT ONE
02142	1025	TAD	TMP2	
02143	3051	DCA	CRTMAS	
02144	3046	DCA	MSMTCH	/STORE MASS AND FIX FLAG
02145	3045	DCA	HVMAS	
02146	7201	CLA IAC		
02147	0043	AND	PASS	
02150	7650	SNA CLA		
02151	5354	JMP	.-+3	
02152	1051	TAD	CRTMAS	
02153	4542	JMS I	PTMAS	
02154	1051	TAD	CRTMAS	

02155	3765		DCA I	P20T1	
02156	2365		ISZ	P20T1	/SECOND PASS
02157	7240	SETFLG,	CLA	CMA	
02160	1050		TAD		MASNUM
02161	7104		CLL	RAL	
02162	1052		TAD		P6300
02163	3061		DCA		SPCADD
02164	5767		JMP I		AMNMXP
02165	0000	P20T1,	0		
02166	0000	P20T2,	0		
02167	2200	AMNMXP,	2200		
02170	7740	M40,	-40		
02171	3060	RDHDRX,	RDHEDR		
02172	2172	MSDTNX,	.		
02173	0245		245		
02174	0276		276		
02175	0327		327		
02176	0244	A244,	244		
		//			
02177	3566				
	2200	PAGE			

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      2200  *2200
02200  4453      JMS I    RDINTX
02201  7201      CLA IAC
02202  0043      AND      PASS
02203  3043      DCA      PASS      /PASS=0 OR 1
02204  7621      CAM
02205  7431      SWAB
02206  1350      TAD      P1205
02207  7521      SWP
02210  7407      DVI
02211  0047      INTRVL
02212  7521      SWP
02213  7041      CIA
02214  3054      DCA      NPTS
02215  7621      CAM
02216  1045      TAD      HYMASS
02217  1046      TAD      MSMTCH
02220  7640      SZR CLA
02221  5734      JMP I    ASRER1  /NOT AN OPERATIVE PASS
02222  1150      TAD      NSMOOT
02223  3106      DCA      DX
02224  1043      TAD      PASS
02225  7640      SZR CLA
02226  5733      JMP I    APLTIT  /PASS=1 - PLOT
02227  7621  FRSNZR, CAM
02230  1061      TAD      SPCADD
02231  3062      DCA      RESET
02232  1054      TAD      NPTS
02233  3336      DCA      NPTS1
02234  4765      JMS I    APRSC1
02235  1061  SURVEY, TAD      SPCADD
02236  3246      DCA      BGCHK
02237  1061      TAD      SPCADD
02240  3267      DCA      LOCHK
02241  4551      JMS I    SMTHX
02242  1107      TAD      XMIN
02243  7640      SZR CLA
02244  5301      JMP      DONECK
02245  7663      DLD
02246  0000  BGCHK, 0
02247  7575      DCM
02250  7443      DAD
02251  0055      BGINT
02252  7500      SMA      /TEST
02253  5263      JMP      LOWCHC  /NO GOOD
02254  7621      CAM
02255  1061      TAD      SPCADD
02256  3260      DCA      . +2
02257  7663      DLD
02260  0000      0
02261  7445      DST
02262  0055      BGINT
02263  7663  LOWCHC, DLD
02264  0057      LWINT
02265  7575      DCM

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02266	7443		DAD	
02267	0000	LOCHK,	0	
02270	7500		SMA	
02271	5301		JMP	DONECK /NO GOOD
02272	7621		CAM	
02273	1061		TAD	SPCADD
02274	3276		DCA	.+2
02275	7663		DLD	
02276	0000		0	
02277	7445		DST	
02300	0057		LWINT	
02301	7621	DONECK,	CAM	
02302	2336		ISZ	NPTS1
02303	5311		JMP	.+6
02304	4732		JMS I	AEBLK1 /EOB
02305	4453		JMS I	RDINTX
02306	1062		TAD	RESET
02307	3061		DCA	SPCADD
02310	5232		JMP	SURVEY-3
02311	1735		TAD I	AP20T2
02312	7041		CIA	
02313	3337		DCA	P22T1
02314	7621	INCRLP,	CAM	
02315	2061		ISZ	SPCADD
02316	2061		ISZ	SPCADD
02317	2337		ISZ	P22T1
02320	7410		SKP	
02321	5235		JMP	SURVEY
02322	1061		TAD	SPCADD
02323	3325		DCA	+2
02324	7663		DLD	
02325	0000		0	
02326	7500		SMA	
02327	5314		JMP	INCRLP
02330	5731		JMP I	EREFX1 /EOR OR EOF
02331	2430	EREFX1,	EOREOF	
02332	2551	AEBLK1,	EOBLOK	
02333	2600	APLTIT,	2600	
02334	2400	ASRER1,	2400	
02335	2166	AP20T2,	P20T2	
02336	0000	NPTS1,	0	
02337	0000	P22T1,	0	
02340	0611	MES1,	0611	
02341	1405		1405	/FILE
02342	7740		7740	
02343	0310	MES2,	0310	
02344	0116		0116	
02345	0705		0705	/CHANGE PEN
02346	4020		4020	
02347	0516		0516	
02350	1205	P1205,	1205	
02351	0000	SETMSP,	0	
02352	1355		TAD	22000
02353	3756		DCA I	AXMSCL

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02354 5751      JMP I   SETMSP
02355 2000  Z2000,  2000
02356 2732  AXMSCL, YMSCLR
02357 0000  TRNON,  0
02360 1364      TAD      PLOTON
02361 4543      JMS I   APLOTW
02362 7200      CLA
02363 5757      JMP I   TRNON
02364 6302  PLOTON, 6302
02365 3146  APRSC1, PRESRC
      //
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2400 *2400
02400 7201 SRVEY1, CLA IAC
02401 1052 TAD P6300
02402 3061 DCA SPCADD
02403 1054 TAD NPTS /# OF SETS/BLOCK
02404 3226 DCA NPTS2
02405 1461 SRVEY2, TAD I SPCADD
02406 7510 SPA
02407 5230 JMP EOREOF /FOUND EOR OR EOF
02410 7200 CLA
02411 1043 TAD PASS
02412 7650 SMA CLA
02413 5217 JMP .+4
02414 7001 IAC /SET PEN UP
02415 4627 JMS I ARG01
02416 0000 0 /SET Y=0 1 MOVEMENT X PEN UP
02417 1061 TAD SPCADD
02420 1047 TAD INTRVL
02421 3061 DCA SPCADD
02422 2226 ISZ NPTS2
02423 5205 JMP SRVEY2
02424 4453 JMS I RDINTX /NEED NEW BLOCK
02425 5200 JMP SRVEY1
02426 0000 NPTS2, 0
02427 3000 ARG01, RG0PLT
02430 1366 EOREOF, TAD P707
02431 7700 SMA CLA
02432 5261 JMP ENDFIL
02433 1367 TAD M5 /EOR
02434 3226 DCA NPTS2 /SET RETREAT TO 5 BLOCKS
02435 1061 TAD SPCADD
02436 1371 TAD M6300
02437 2226 ISZ NPTS2
02440 7000 NOP
02441 1372 TAD M201 /COMPUTE # TO RETREAT
02442 7500 SMA
02443 5237 JMP .-4
02444 7300 CLA CLL
02445 1226 TAD NPTS2
02446 7700 SMA CLA
02447 5660 JMP I ABK2TH
02450 1172 TAD RADD+1
02451 1226 TAD NPTS2
02452 3172 DCA RADD+1
02453 7420 SNL
02454 7240 CLA CMA
02455 1171 TAD RADD
02456 3171 DCA RADD
02457 5660 JMP I ABK2TH
02460 2057 ABK2TH, FNDPLT
02461 1045 ENDFIL, TAD HYMASS
02462 7650 SMA CLA
02463 5313 JMP STLDOT
02464 1043 TAD PASS
02465 7650 SMA CLA /NO MASS - CHECK PASS

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02466 5272      JMP      ENDP51  /END OF PASS 1
02467 6304      6304
02470 6001      ION          /END OF RUN ROUTINE
02471 5773      JMP I      EXECX
02472 2043      ENDP51, ISZ    PASS  /SET TO PASS 2
02473 4750      JMS I      FLSHIT /FLUSH MASSES DONE BUFFER
02474 7663      DLD
02475 0057      LWINT
02476 7575      DCM
02477 7445      DST
02500 0057      LWINT
02501 7663      DLD
02502 0055      BGINT
02503 7443      DAD
02504 0057      LWINT
02505 4777      JMS I      (SHFTIT
02506 3055      DCA      BGINT
02507 7621      CAM
02510 1042      TAD      AMSADD
02511 3774      DCA I      AP20T1
02512 5333      JMP      RSTFLG
02513 1043      STLDOT, TAD    PASS
02514 7650      SNA CLA
02515 5333      JMP      RSTFLG
02516 4775      JMS I      ALFTPN
02517 4421      JMS I      APL
02520 2343      MES2
02521 0005      5
02522 4422      JMS I      AINPL
02523 7200      CLA
02524 1147      TAD      MBLEBL
02525 1420      TAD I      ALINE
02526 7650      SNA CLA
02527 5332      JMP      +3
02530 4432      JMS I      ASTORG
02531 7410      SKP
02532 4441      JMS I      ARTORG
02533 1035      RSTFLG, TAD    TRADD
02534 3171      DCA      RADD    /RESET ALL POINTERS AND FLAGS
02535 1036      TAD      TRADD+1
02536 3172      DCA      RADD+1
02537 7040      CMA
02540 3045      DCA      HVMASS
02541 3463      DCA I      AYPLT
02542 7001      IAC
02543 3464      DCA I      AXPLT
02544 7001      IAC
02545 3034      DCA      ORGNUM
02546 3037      DCA      ABSYRG
02547 5660      JMP I      ABK2TH
02550 3133      FLSHIT, FLUSH
02551 0000      EOBLK, 0
02552 7621      CAM
02553 2061      EOBLK1, ISZ    SPCADD
02554 1061      TAD      SPCADD

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02555	1370	TAD	P273	/CHECK OF END OF BLOCK
02556	7700	SMA CLA		
02557	5751	JMP I	EOBLQK	
02560	1461	TAD I	SPCADD	
02561	7510	SPA		
02562	5230	JMP	EOREOF	/FOUND EOR OR EOF
02563	7200	CLA		
02564	2061	ISZ	SPCADD	
02565	5353	JMP	EOBLK1	
02566	0707	P707,	707	
02567	7773	M5,	-5	
02570	0273	P273,	273	
02571	1500	M6300,	1500	
02572	7577	M201,	-201	
02573	1200	EXECX,	1200	
02574	2165	AP20T1,	P20T1	
02575	3167	ALFTPN,	LIFTPN	
		//		
02577	3600			
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	2600	*2600		
02600	7621	PLTSTP,	CAM	
02601	3044		DCA	FRSFLG
02602	7431		SWAB	
02603	1061		TAD	SPCADD
02604	3062		DCA	RESET
02605	1054		TAD	NPTS /#OF PTS/BLOCK
02606	3266		DCA	NPTS3
02607	4742		JMS I	APRSC2
02610	1061	PLTST1,	TAD	SPCADD
02611	3217		DCA	PLCHQ
02612	4551		JMS I	SMTHX
02613	1107		TAD	XMIN
02614	7640		SZA CLA	
02615	5234		JMP	YTOBPL-2
02616	7663		DLD	
02617	0000	PLCHQ,	0	
02620	7443		DAD	
02621	0057		LWINT	/SUBTRACT MINIMUM
02622	4777		JMS I	<INORM
02623	3236		DCA	YTOBPL
02624	1037		TAD	ABSYRG
02625	7041		CIA	
02626	1236		TAD	YTOBPL
02627	3236		DCA	YTOBPL /Y VALUE RELATIVE TO CURRENT ORIGIN
02630	1044		TAD	FRSFLG /FIRST TIME?
02631	7640		SZA CLA	
02632	5235		JMP	. +3
02633	2044		ISZ	FRSFLG
02634	7201		CLA IAC	
02635	4672		JMS I	ARGC2 /PLOT IT
02636	0000	YTOBPL,	0	
02637	2266		ISZ	NPTS3
02640	5246		JMP	. +6
02641	4673		JMS I	AEBLK2
02642	4453		JMS I	RDINTX
02643	1062		TAD	RESET
02644	3061		DCA	SPCADD
02645	5205		JMP	PLTSTP+5
02646	1674		TAD I	BP20T2
02647	7041		CIA	
02650	3275		DCA	P26T1
02651	7621	INCLP2,	CAM	
02652	2061		ISZ	SPCADD
02653	2061		ISZ	SPCADD
02654	2275		ISZ	P26T1
02655	7410		SKP	
02656	5210		JMP	PLTST1
02657	1061		TAD	SPCADD
02660	3262		DCA	. +2
02661	7663		DLD	
02662	0000		0	
02663	7500		SMA	
02664	5251		JMP	INCLP2
02665	5667		JMP I	EREFX2

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02666 0000 NPTS3, 0
02667 2430 EREFX2, EOREOF
02670 0000 INTCRT, 0
02671 0000 0
02672 3000 ARGC2, RGCPLT
02673 2551 AEBLK2, EOBLOK
02674 2166 BP20T2, P20T2
02675 0000 P26T1, 0
02676 0000 PLTMAS, 0
02677 7200 CLA
02700 1051 TAD CRTMAS
02701 4744 JMS I ASPTCD
02702 0144 CDMASS
02703 1341 TAD M46
02704 3331 DCA XMSCLR
02705 1332 TAD YMSCLR
02706 1340 TAD MHUN
02707 3332 DCA YMSCLR
02710 1144 TAD CDMASS
02711 0127 AND N77
02712 4323 JMS PLTNUM
02713 1145 TAD CDMASS+1
02714 7002 7002 /BYTE SWAP
02715 0127 AND N77
02716 4323 JMS PLTNUM
02717 1145 TAD CDMASS+1
02720 0127 AND N77
02721 4323 JMS PLTNUM
02722 5676 JMP I PLTMAS
02723 0000 PLTNUM, 0
02724 3334 DCA LTSTOR
02725 1331 TAD XMSCLR
02726 1337 TAD P5
02727 3331 DCA XMSCLR
02730 4743 JMS I ADDLTR
02731 0000 XMSCLR, 0
02732 0000 YMSCLR, 0
02733 0002 2
02734 0000 LTSTOR, 0
02735 0000 0
02736 5723 JMP I PLTNUM
02737 0012 P5, 12
02740 7700 MHUN, -100
02741 7722 M46, -56
02742 3146 APRSC2, PRESRC
02743 4600 ADDLTR, DLTR
02744 3200 ASPTCD, SPOCTD
//
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      3000      *3000
03000      0000      RGCPLT, 0
03001      3065      DCA      PENUD
03002      1600      TAD I      RGCPLT
03003      3210      DCA      YRGC      /Y VALUE
03004      2200      ISZ      RGCPLT
03005      1065      TAD      PENUD
03006      4517      JMS I      ADPLOT
03007      0000      XRGC, 0
03010      0000      YRGC, 0
03011      2207      ISZ      XRGC
03012      1207      TAD      XRGC
03013      7700      SMA CLA
03014      5600      JMP I      RGCPLT
03015      7240      CLA CMA
03016      4517      JMS I      ADPLOT      /NEW ORIGIN
03017      2034      ISZ      ORGNUM
03020      1037      TAD      ABSYRG
03021      1210      TAD      YRGC
03022      3037      DCA      ABSYRG
03023      3210      DCA      YRGC
03024      7001      IAC
03025      3207      DCA      XRGC
03026      5600      JMP I      RGCPLT
03027      0000      RTNORG, 0
03030      7621      CAM
03031      1034      TAD      ORGNUM
03032      7041      CIA
03033      3065      DCA      PENUD
03034      1037      TAD      ABSYRG
03035      7041      CIA
03036      3242      DCA      +4
03037      7001      IAC
03040      4517      JMS I      ADPLOT
03041      0000      0
03042      0000      0
03043      7240      CLA CMA
03044      4517      JMS I      ADPLOT      /NEW ORIGIN
03045      7621      RTNRG1, CAM
03046      2065      ISZ      PENUD
03047      7410      SKP
03050      5627      JMP I      RTNORG
03051      7201      CLA IAC
03052      4517      JMS I      ADPLOT
03053      4000      4000
03054      0000      0
03055      7240      CLA CMA
03056      4517      JMS I      ADPLOT
03057      5245      JMP      RTNRG1
03060      0000      RDHEDR, 0
03061      6304      6304
03062      6001      ION
03063      4537      JMS I      READX
03064      0000      0
03065      0200      200

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03066	0200	200	
03067	0000	0	
03070	4540	JMS I	WAITX
03071	7200	CLA	
03072	6002	IOF	
03073	4466	JMS I	ATRNON
03074	5660	JMP I	RDHEDR
03075	0000	INTRD,	0
03076	6304	6304	
03077	6001	ION	
03100	4537	JMS I	READX
03101	0000	0	
03102	1205	1205	
03103	6300	6300	
03104	0000	0	
03105	4540	JMS I	WAITX
03106	6002	IOF	
03107	4466	JMS I	ATRNON
03110	5675	JMP I	INTRD
03111	0000	SETORG,	0
03112	4466	JMS I	ATRNON
03113	7240	CLA CMA	
03114	4517	JMS I	ADPLOT
03115	7201	CLA IAC	
03116	4517	JMS I	ADPLOT
03117	0200	200	
03120	6000	-2000	
03121	7240	CLA CMA	
03122	4517	JMS I	ADPLOT
03123	7201	CLA IAC	
03124	4517	JMS I	ADPLOT
03125	0000	00	
03126	0020	20	
03127	7240	CLA CMA	
03130	4517	JMS I	ADPLOT
03131	7200	CLA	
03132	5711	JMP I	SETORG
03133	0000	FLUSH,	0
03134	1042	TAD	AMSADD
03135	3024	DCA	TMP1
03136	1345	TAD	M40P30
03137	3025	DCA	TMP2
03140	3424	DCA I	TMP1
03141	2024	ISZ	TMP1
03142	2025	ISZ	TMP2
03143	5340	JMP	.-3
03144	5733	JMP I	FLUSH
03145	7740	M40P30,	-40
03146	0000	PRESRC,	0
03147	7001	IAC	
03150	1052	TAD	P6300
03151	3311	DCA	SETORG
03152	1711	SRCIT,	TAD I SETORG
03153	7510	SPA	
03154	5766	JMP I	EREFX4

03155	7200	CLA	
03156	2311	ISZ	SETORG
03157	2311	ISZ	SETORG
03160	1311	TAD	SETORG
03161	7041	CIA	
03162	1061	TAD	SFCADD
03163	7710	SPA CLA	
03164	5746	JMP I	PRESRC
03165	5352	JMP	SRCIT
03166	2430	EREFX4,	EOREOF
03167	0000	LIFTPN,	0
03170	1210	TAD	YRGC
03171	3374	DCA	+3
03172	7001	IAC	
03173	4200	JMS	RGCPLT
03174	0000	0	
03175	5767	JMP I	LIFTPN

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	3200	*3200			
03200	0000	SPOCTD,	0		
03201	3261	DCA	OCTNUM	/STORE NUMBER	
03202	1600	TAD I	SPOCTD		
03203	3262	DCA	ADDSSP	/ADDRESS FOR RESULT	
03204	2200	ISZ	SPOCTD		
03205	3267	DCA	ICHPOT		
03206	3270	DCA	GOTONE	/0 CHAR. POS. AND PREV. CHR. FLG.	
03207	1272	TAD	AMTHOU	/ADD. OF -1000	
03210	3273	DCA	CURNT		
03211	1134	TAD	M4	/-4	
03212	3274	DCA	KPTRAC		
03213	3271	LOOPSD,	DCA	DECCAR	
03214	1261	INLPSD,	TAD	OCTNUM	
03215	1673		TAD I	CURNT	
03216	7510		SPA		
03217	5224		JMP	+5	
03220	2271		ISZ	DECCAR	
03221	2270		ISZ	GOTONE	
03222	3261		DCA	OCTNUM	
03223	5214		JMP	INLPSD	
03224	7200		CLA	/DONE WITH CURRENT POWER OF TEN	
03225	1271		TAD	DECCAR	
03226	7440		SZA	/0?	
03227	5236		JMP	NONZRO	
03230	1270		TAD	GOTONE	
03231	7640		SZA CLA	/PREV. NON-ZERO?	
03232	5236		JMP	NONZRO	
03233	1275		TAD	PSOC40	/BLANK
03234	3271		DCA	DECCAR	
03235	5240		JMP	STORIT	
03236	1276	NONZRO,	TAD	P60	
03237	3271		DCA	DECCAR	
03240	1267	STORIT,	TAD	ICHPOT	
03241	7740		SZA CLA	CLL	
03242	5250		JMP	SECNDC	
03243	2267		ISZ	ICHPOT	
03244	1271		TAD	DECCAR	
03245	7002		7002	/BYTE SWAP	
03246	3662		DCA I	ADDSSP	
03247	5255		JMP	INCRSP	
03250	1662	SECNDC,	TAD I	ADDSSP	
03251	1271		TAD	DECCAR	
03252	3662		DCA I	ADDSSP	
03253	3267		DCA	ICHPOT	
03254	2262		ISZ	ADDSSP	
03255	2273	INCRSP,	ISZ	CURNT	
03256	2274		ISZ	KPTRAC	
03257	5213		JMP	LOOPSD	
03260	5600		JMP I	SPOCTD	
03261	0000	OCTNUM,	0		
03262	0000	ADDSSP,	0		
03263	6030	MTHOU,	-1750		
03264	7634		-144		
03265	7766		-12		

03266	7777	-1	
03267	0000	ICHPOT,	0
03270	0000	GOTONE,	0
03271	0000	DECCAR,	0
03272	3263	AMTHOU,	MTHOU
03273	0000	CURNT,	0
03274	0000	KPTRAC,	0
03275	0040	PSOC40,	40
03276	0060	P60,	60
03277	0000	HDRPLT,	0
03300	1332	TAD	P200
03301	3025	DCA	TMP2
03302	1135	TAD	M2
03303	3333	DCA	HDRT1
03304	1334	TAD	P2066
03305	3345	DCA	YHD
03306	1335	TAD	P20
03307	3344	DCA	XHD
03310	4466	JMS I	ATRNON
03311	1031	TAD	P40
03312	4336	JMS	PLOTHD /BLANK
03313	1425	PROTHD, TAD I	TMP2
03314	2333	ISZ	HDRT1
03315	5326	JMP	UPHBYT
03316	0127	AND	N77
03317	4336	JMS	PLOTHD
03320	2025	ISZ	TMP2
03321	1135	TAD	M2
03322	3333	DCA	HDRT1
03323	2024	ISZ	TMP1
03324	5313	JMP	PROTHD
03325	5677	JMP I	HDRPLT
03326	7002	UPHBYT, 7002	
03327	0127	AND	N77
03330	4336	JMS	PLOTHD
03331	5313	JMP	PROTHD
03332	0200	P200,	200
03333	0000	HDRT1,	0
03334	2044	P2066,	2044
03335	0020	P20,	20
03336	0000	PLOTHD,	0
03337	3347	DCA	HDRT2
03340	1353	TAD	P6
03341	1344	TAD	XHD
03342	3344	DCA	XHD
03343	4754	JMS I	DLTRX
03344	0000	XHD,	0
03345	0000	YHD,	0
03346	0002		2
03347	0000	HDRT2,	0
03350	0000		0
03351	7200	CLA	
03352	5736	JMP I	PLOTHD
03353	0012	P6,	12
03354	4600	DLTRX,	DLTR

/SIMPLT.

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	3400	*3400			
03400	0000	INFL,	0		
03401	7200		CLA		
03402	1023		TAD	M10	
03403	3024		DCA	TMP1	
03404	1020		TAD	ALINE	
03405	3025		DCA	TMP2	
03406	1030	BLNKFL,	TAD	BLBL	
03407	3425		DCA	I	TMP2
03410	2025		ISZ	TMP2	
03411	2024		ISZ	TMP1	
03412	5206		JMP	BLNKFL	/FILL BUFFER WITH BLANKS
03413	1020		TAD	ALINE	
03414	3024		DCA	TMP1	
03415	1135		TAD	M2	
03416	3025		DCA	TMP2	
03417	6031	PCKLN,	KSF		/WAIT FOR CHARACTER
03420	5217		JMP	. -1	
03421	6036		KRB		/GET CHARACTER
03422	3026		DCA	TMP3	
03423	1026		TAD	TMP3	
03424	4310		JMS	PRN1CH	/ECHO
03425	1026		TAD	TMP3	
03426	1357		TAD	MRBOUT	/RUBOUT?
03427	7450		SNA		
03430	5201		JMP	INPL+1	
03431	1360		TAD	P106	/L?
03432	7640		SZA	CLA	
03433	5255		JMP		CRTCHK
03434	7001		IAC		
03435	1025		TAD	TMP2	/POSITION OF LST CHARACTER
03436	7640		SZA	CLA	
03437	5245		JMP	. +6	
03440	1135		TAD	M2	
03441	3025		DCA	TMP2	/FLAG WAS -1 - RESET TO -2
03442	1030		TAD	BLBL	
03443	3424		DCA	I	TMP1
03444	5255		JMP		CRTCHK
03445	7040		CMA		
03446	1024		TAD	TMP1	/FLAG WAS -2 - MAKE -1
03447	3024		DCA	TMP1	
03450	2025		ISZ	TMP2	
03451	1424		TAD	I	TMP1
03452	0361		AND		MASK2
03453	1031		TAD		P40
03454	3424		DCA	I	TMP1
03455	1026	CRTCHK,	TAD		TMP3
03456	1362		TAD		MCRTRN
03457	7640		SZA	CLA	/CARRIAGE RETURN?
03460	5266		JMP	. +6	
03461	1026		TAD		TMP3
03462	4310		JMS		PRN1CH
03463	1363		TAD		LINEFD
03464	4310		JMS		PRN1CH
03465	5600		JMP	I	INPL

00466	1026		TAD	TMP3	
00467	0127		AND	N77	
00470	3026		DCA	TMP3	/STRIP AND RESTORE
00471	2025		ISZ	TMP2	/UPPER OR LOWER BYTE
00472	5303		JMP	UPPRIN	
00473	1424		TAD I	TMP1	
00474	0361		AND	MASK2	
00475	1026		TAD	TMP3	
00476	3424		DCA I	TMP1	
00477	1135		TAD	M2	
00500	3025		DCA	TMP2	
00501	2024		ISZ	TMP1	
00502	5217		JMP	PCKLN	
00503	1026	UPPRIN.	TAD	TMP3	
00504	7002		7002		
00505	1031		TAD	P40	
00506	3424		DCA I	TMP1	
00507	5217		JMP	PCKLN	
00510	0000	PRN1CH.	0		
00511	6046		TLS		/PRINT
00512	6041		T5F		/WAIT FOR COMPLETION FLAG
00513	5312		JMP	-1	
00514	7200		CLA		
00515	6042		TCF		
00516	5710		JMP I	PRN1CH	
00517	0000	PL.	0		
00520	1717		TAD I	PL	
00521	3024		DCA	TMP1	
00522	2317		ISZ	PL	
00523	1717		TAD I	PL	
00524	7041		CIA		
00525	3025		DCA	TMP2	
00526	2317		ISZ	PL	
00527	1135		TAD	M2	
00530	3026		DCA	TMP3	
00531	1424	PRTOUT.	TAD I	TMP1	
00532	2026		ISZ	TMP3	
00533	5345		JMP	UPOUT	
00534	0127		AND	N77	
00535	4351		JMS	CONVT	
00536	2025		ISZ	TMP2	
00537	7410		SKP		
00540	5717		JMP I	PL	/DONE
00541	2024		ISZ	TMP1	
00542	1135		TAD	M2	
00543	3026		DCA	TMP3	
00544	5331		JMP	PRTOUT	
00545	7002	UPOUT.	7002		
00546	0127		AND	N77	
00547	4351		JMS	CONVT	
00550	5331		JMP	PRTOUT	
00551	0000	CONVT.	0		
00552	1364		TAD	P240	
00553	0365		AND	P277	
00554	1031		TAD	P40	

```
03555 4310      JMS      PRN1CH
03556 5751      JMP I    CONVY
03557 7401      MRBOUT, -377
03560 0040      P106,    40
03561 7700      MASK2,   7700
03562 7563      MCRTRN, -215
03563 0212      LINEFD,  212
03564 0240      P240,    240
03565 0277      P277,    277
03566 0000      DPMASS,  0
03567 1427      TAD I    TMP4
03570 3377      DCA      DPMT
03571 2027      ISZ      TMP4
03572 1427      TAD I    TMP4
03573 7710      SPA CLA
03574 2377      ISZ      DPMT
03575 1377      TAD      DPMT
03576 5766      JMP I    DPMASS
03577 0000      DPMT,    0
              //
              3600      PAGE
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      3600 *3600
03600 0000 SHFTIT, 0
03601 3246 DCA TM361
03602 3247 DCA SHFCNT
03603 1246 TAD TM361
03604 7510 SPA
03605 5600 JMP I SHFTIT
03606 7413 SHL
03607 0001 1
03610 2247 ISZ SHFCNT
03611 5204 JMP -5
03612 0000 INORM, 0
03613 3246 DCA TM361
03614 3250 DCA SHFCN2
03615 1246 TAD TM361
03616 7451 DPSZ
03617 7410 SKP
03620 5612 JMP I INORM
03621 7510 SPA
03622 5227 JMP INORM1
03623 7413 SHL
03624 0001 1
03625 2250 ISZ SHFCN2
03626 5221 JMP -5
03627 7417 INORM1, LSR
03630 0001 1
03631 7407 DVI
03632 0055 BGINT
03633 7200 CLA
03634 1250 TAD SHFCN2
03635 7041 CIA
03636 1247 TAD SHFCNT
03637 1251 TAD T3612
03640 7510 SPA
03641 7200 CLA
03642 3244 DCA +2
03643 7413 SHL
03644 0000 0
03645 5612 JMP I INORM
03646 0000 TM361, 0
03647 0000 SHFCNT, 0
03650 0000 SHFCN2, 0
03651 0013 T3612, 13

```

IFZERO EAE <

```

      DSTSM, 0
      DCA EAETP1 /STORE MSH IN TEMPORARY
      TAD I DSTSM /GET LSH STORAGE ADDRESS
      DCA EAETP2
      MQA /MQTO AC, MQ UNCHANGED
      DCA I EAETP2
      ISZ EAETP2
      ISZ DSTSM /UPDATE RETURN
      TAD EAETP1 /MSH

```

```

DCA I   EAETP2  /STORE
TAD     EAETP1  /RESTOR AC
JMP I   DSTSM   /DONE
DCMSM,  0
DCA     EAETP1  /STORE MSH
SWP     /GET LSH TO AC
CMA CLL CML IAC /COMPLIMENT AC SET LINK TO ZERO
SWP     /IF AC WAS ZERO
GLK     /GET LINK BIT
TAD     EAETP1  /ADD TO MSH
CIA     /COMPLIMENT
JMP I   DCMSM
DLDSM,  0
CAM     /CLEAR AC, MQ
TAD I   DLDSM   /GET ADDRESS
DCA     .+3
ISZ     DLDSM   /UPDATE RETURN
DAD     /DOUBLE ADD TO A CLEAR AC, MQ
0
JMP I   DLDSM
DADSM,  0
DCA     EAETP1  /STORE AC
TAD I   DADSM   /GET ADDRESS OF LSH
DCA     EAETP2  /STORE
ISZ     DADSM   /UPDATE RETURN
CLL
SWP     /SWAP MQ, AC
TAD I   EAETP2  /LSH(1)+LSH(2)
SWP     /PUT IN MQ
GLK     /GET CARRY BIT
ISZ     EAETP2  /MSH ADDRESS
TAD I   EAETP2
TAD     EAETP1  /MSH(1)+MSH(2)
JMP I   DADSM   /DONE
DPSZSM, 0
SZA     /AC=0?
JMP I   DPSZSM  /NO - NORMAL RETURN
SWP     /YES - CHECK MQ
SNA     /MQ=0?
ISZ     DPSZSM  /YES - UPDATE RETURN FOR SKIP
SWP     /RESTORE
JMP I   DPSZSM

```

*4000

MUYSM,

0

CLA CLL

/SINGLE PRECISION UNSIGNED MULP.

SWP

/GET MULTIPLIER

DCA

EAETP1

/STORE

TAD I

MUYSM

/GET ADDRESS OF MULT.

DCA

EAETP2

TAD I

EAETP2

/MULTIPLICAND

DCA

EAETP2

ISZ

MUYSM

/UPDATE REURN

DCA

MP5

TAD

THIR

DCA

MP3

MP4,

TAD

EAETP1

RAR

DCA

EAETP1

TAD

MP5

SNL

JMP

. +3

CLL

TAD

EAETP2

RAR

DCA

MP5

ISZ

MP3

JMP

MP4

TAD

EAETP1

RAR

/LOW ORDER PRODUCT

SWP

/TO MQ

TAD

MP5

/HIGH ORDER PRODUCT

JMP I

MUYSM

MP3,

0

MP5,

0

THIR,

7764

DVISM,

0

/UNSIGNED S. P. DIVIDE

DCA

EAETP1

/STORE MSH

SWP

/GET LSH

DCA

EAETP2

/STORE

TAD I

DVISM

/GET DIVISOR ADDRESS

DCA

DIVSOR

TAD I

DIVSOR

/ACTUAL DIVISOR

CIA

/COMPLIMENT

DCA

DIVSOR

/STORE

CLL

TAD

DIVSOR

TAD

EAETP1

ISZ

DVISM

/CHECK FOR OVERLOW

SZL CLA

JMP I

DVISM

/OVERFLOW

TAD

MDV13

DCA

DIVCNT

JMP

DV2

DV3,

TAD

EAETP1

RAL

DCA

EAETP1

TAD

EAETP1

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      TAD      DIVSOR
      SZL
      DCA      EAETP1
      CLA
DV2,  TAD      EAETP2
      RAL
      DCA      EAETP2
      ISZ      DIVCNT
      JMP      DV3
      TAD      EAETP2  /QUOTIENT
      SWP      /TO MQ
      TAD      EAETP1
      CLL
      JMP I    DVISM
DIVSOR, 0
DIVCNT, 0
MDV13, -15
SHLSM, 0
      DCA      EAETP1
      TAD I    SHLSM  /# 00 SHIFTS
      ISZ      SHLSM  /UPDATE RETURN
      SZA      /NO SHIFTS?
      JMP      .+3
      TAD      EAETP1  /RESTOR AC
      JMP I    SHLSM
      CIA
      DCA      EAETP2
      TAD      EAETP1
SHLLP,  SWP      /GET LSH
      CLL RAL    /ROTATE 1 BIT LEFT
      SWP      /GET MSH
      RAL      /ROTATE 1 BIT LEFT
      ISZ      EAETP2  /DONE?
      JMP      SHLLP
      JMP I    SHLSM  /YES - RETURN
LSRSM,  0
      DCA      EAETP1  /SAVE AC
      TAD I    LSRSM  /GET NUMBER OF SHIFTS
      ISZ      LSRSM
      SZA      /NO SHIFTS?
      JMP      .+3
      TAD      EAETP1  /RESTORE AC
      JMP I    LSRSM
      CIA      /COMPLIMENT
      DCA      EAETP2
      TAD      EAETP1  /RESTORE AC
LSRLP,  CLL RAR    /ROTATE MSH 1 BIT
      SWP      /GET LSH
      RAR      /ROTATE
      SWP
      ISZ      EAETP2  /DONE?
      JMP      LSRLP  /NO
      JMP I    LSRSM  >

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/SIMPLT.

PAL8-V7

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IFZERO PLIST <XLIST>

/RESET IF SKIPPING PLOTTER LISTING.

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5400  *5400
05400 0000 SMOOTH, 0
05401 7201 CLA IAC
05402 3107 DCA XMIN /SET FOR NO SMOOTHING
05403 1106 TAD DX
05404 7041 CIA
05405 1150 TAD NSMOOT /FIRST TIME IN?
05406 7640 SZA CLA
05407 5212 JMP NOTINT /NO
05410 1354 TAD SMTHBX
05411 3351 DCA ASMTH
05412 1106 NOTINT, TAD DX /BUFFER FULL ALREADY?
05413 7650 SNA CLA
05414 5223 JMP FLSMTH /YES
05415 2351 ISZ ASMTH /NO
05416 2351 ISZ ASMTH /UPDATE ADDRESS
05417 4340 JMS CVLSMT
05420 2106 ISZ DX /NOW IS IT FULL?
05421 5600 JMP I SMOOTH /NO
05422 5247 JMP SMTHIT /YES
05423 7305 FLSMTH, CLA CLL IAC RAL /BEGIN PUSH UP ROUTINE
05424 1354 TAD SMTHBX
05425 3237 DCA UPRSM
05426 7305 CLA CLL IAC RAL
05427 1237 TAD UPRSM
05430 3235 DCA LOWRSM
05431 7001 IAC
05432 1150 TAD NSMOOT /NUMBER TO MOVE
05433 3355 DCA P54T1
05434 7663 PUSHUP, DLD
05435 0000 LOWRSM, 0
05436 7445 DST
05437 0000 UPRSM, 0
05440 2235 ISZ LOWRSM
05441 2235 ISZ LOWRSM
05442 2237 ISZ UPRSM /UPDATE ADDRESS
05443 2237 ISZ UPRSM
05444 2355 ISZ P54T1 /DONE?
05445 5234 JMP PUSHUP /NO
05446 4340 JMS CVLSMT /YES - INSERT CURRENT VALUE
05447 1150 SMTHIT, TAD NSMOOT
05450 3355 DCA P54T1
05451 1360 TAD COEFX /START ADDRESS OF COEFFICIENTS
05452 3361 DCA COEFSM
05453 7621 CAM
05454 7445 DST
05455 5563 TOTAL /SET TOTAL TO 0
05456 7305 CLA CLL IAC RAL
05457 1354 TAD SMTHBX
05460 3275 DCA P54T2
05461 3107 DCA XMIN /SET SMOOTHING DONE FLAG
05462 7240 SMTHLP, CLA CMA
05463 3356 DCA SIGN /SET FOR + COEF.
05464 3357 DCA ROTAT
05465 1761 TAD I COEFSM /CHECK FOR - COEF.

```

05466	7500	SMA		
05467	5273	JMP	. +4	
05470	7041	CIA		
05471	3356	DCA	SIGN	
05472	1356	TAD	SIGN	
05473	3366	DCA	MLPLR	
05474	7663	DLD		
05475	0000	P54T2, 0		/GET POINT
05476	7450	SNA		/DOUBLE PRECISION?
05477	5304	JMP	. +5	
05500	7417	LSR		/YES - SHIFT RIGHT
05501	0001	1		
05502	2357	ISZ	ROTAT	
05503	5276	JMP	. -5	
05504	1357	TAD	ROTAT	
05505	3311	DCA	. +4	
05506	7405	MUY		
05507	5566	MLPLR		
05510	7413	SHL		/MULTIPLY AND SHIFT LEFT
05511	0000	0		
05512	2356	ISZ	SIGN	
05513	7575	DCM		/COMPLIMENT
05514	7443	DAD		
05515	5563	TOTAL		/ADD TO TOTAL
05516	7445	DST		
05517	5563	TOTAL		/STORE TOTAL
05520	2361	ISZ	COEFSM	/UPDATE
05521	2275	ISZ	P54T2	/ADDRESSES
05522	2275	ISZ	P54T2	
05523	2355	ISZ	P54T1	/DONE?
05524	5262	JMP	SMTHLP	/NO
05525	7621	CAM		
05526	1061	TAD	SPCADD	
05527	3335	DCA	. +6	
05530	7663	DLD		
05531	5563	TOTAL		
05532	4762	JMS I	NORMLX	
05533	5561	COEFSM		/COEFSM CONTAINS ADDRESS
05534	7445	DST		
05535	0000	0		
05536	7621	CAM		
05537	5600	JMP I	SMOOTH	
05540	0000	CVLSMT, 0		
05541	7621	CAM		
05542	1061	TAD	SPCADD	
05543	3345	DCA	. +2	
05544	7663	DLD		
05545	0000	0		
05546	7510	SPA		
05547	5765	JMP I	EREFX3	
05550	7445	DST		
05551	0000	ASMTH, 0		
05552	7621	CAM		
05553	5740	JMP I	CVLSMT	
05554	5776	SMTHBX, 5776		

05555	0000	P54T1,	0
05556	0000	SIGN,	0
05557	0000	ROTAT,	0
05560	6221	COEFX,	SVTGLY
05561	0000	COEFM,	0
05562	5600	NORMLX,	NORMLZ
05563	0000	TOTAL,	0
05564	0000		0
05565	2430	EREFX3,	EOREOF
05566	0000	MLPLR,	0
		//	
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      5600  *5600
05600 0000 NORMLZ, 0
05601 7500 SMA
05602 5206 JMP +4
05603 7621 DCA
05604 2200 ISZ NORMLZ
05605 5600 JMP I NORMLZ
05606 3243 DCA P56T1
05607 3245 DCA RTAT2 /STORE MEH AND SET 0 ROTATION
05610 1600 TAD I NORMLZ /ADD. OF ADD. OF DIVISOR
05611 3236 DCA DVSOR
05612 2200 ISZ NORMLZ /RETURN ADDRESS
05613 1636 TAD I DVSOR
05614 3236 DCA DVSOR
05615 1636 TAD I DVSOR
05616 7041 CIA
05617 3244 DCA P56T2 /COMPLIMENT
05620 1243 TAD P56T1 /MSH
05621 1244 TAD P56T2 /OVERFLOW?
05622 7710 SPA CLA
05623 5232 JMP .+7 /NO
05624 1243 TAD P56T1 /YES
05625 7417 LSK /ROTATE RIGHT
05626 0001 1
05627 2245 ISZ RTAT2
05630 3243 DCA P56T1
05631 5220 JMP .-11
05632 1245 TAD RTAT2
05633 3241 DCA .+6 /SET FOR RE-ROTATION
05634 1243 TAD P56T1
05635 7407 DVI
05636 0000 DVSOR, 0
05637 7200 CLA
05640 7413 SHL
05641 0000 0
05642 5600 JMP I NORMLZ
05643 0000 P56T1, 0
05644 0000 P56T2, 0
05645 0000 RTAT2, 0
      IFZERO PLIST <XLIST> /RESET IF SKIPPING PLOTTER LISTING.

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	6240	*6240	
06240	7765	SVTGLY,	-13
06241	0000		0
06242	0011		11
06243	0020		20
06244	0025		25
06245	0030		30
06246	0031		31
06247	0030		30
06250	0025		25
06251	0020		20
06252	0011		11
06253	0000		0
06254	7765		-13
06255	0217		217
	7510	*7510	
07510	0000	ZBLOCK	41
		\$\$\$	

ABK2TH	2460	A244	2176	DVI	7407	LC3	4624
ABSYRG	0037	BGCHK	2246	DVSOR	5636	LC4	4706
ACHLCD	4377	BGINT	0055	DX	0106	LETTER	4607
ACHLCU	0075	BLBL	0030	EAE	0001	LIFTPN	3167
ACHRCD	0076	BLNKFL	3406	ENDFIL	2461	LINE	6221
ACHTLF	0073	BP20T2	2674	ENDPS1	2472	LINEFD	3563
ACHTRT	0074	BUMP	4467	EOBLK1	2553	LJ	0104
ACRDN	0071	BX	0115	EOBLOK	2551	LK	0107
ACRUP	0072	BY	0116	EOREOF	2430	LL	0103
ADDLTR	2743	CAM	7621	EREFX1	2331	LN	0110
ADDSSP	3262	CCMA	4646	EREFX2	2667	LOCHK	2267
ADFDAD	4767	CDMASS	0144	EREFX3	5565	LOOPSD	3213
ADIMOV	0077	CHLCDN	6121	EREFX4	3166	LOWCHC	2263
ADLTR	0124	CHLCP1	6206	EXECX	2573	LOWRSM	5435
ADMULT	0122	CHLCUP	6200	FACT	0102	LSR	7417
ADNEWB	0123	CHLC1	6127	FLSHIT	2550	LTADR	4707
ADPFTC	0120	CHRCDN	6207	FLSMTH	5423	LTHLD	4717
ADPLOT	0117	CHRC1	6215	FLUSH	3133	LTSTOR	2734
ADPLTW	4375	CHTLFT	6103	FNDADR	4455	LTSWT1	4710
ADRTAT	0125	CHTL1	6111	FNDPLT	2057	LTSWT2	4713
ADSBAL	0121	CHTRT	6112	FRSFLG	0044	LT0	4622
ADTBL	4505	CHTR1	6120	FRSNZR	2227	LT1	4626
AEBLK1	2332	CIAC	4541	GCMND	4534	LT2	4637
AEBLK2	2673	CMND	4423	GMOVE	4523	LT3	4671
AHDRPL	0040	CNT	4522	GOTONE	3270	LT4	4677
AINPL	0022	CNTR	4507	HAX	5670	LWINT	0057
ALFTPN	2575	COEF5M	5561	HAY	5671	LXADDR	0105
ALINE	0020	COEFX	5560	HBX	4536	LYADDR	0106
ALPHA	4400	COMPAR	4347	HBV	4537	MASK2	3561
AMNMXP	2167	CONVT	3551	HDRPLT	3277	MASNUM	0050
AMSADD	0042	CPEN1	6217	HDRT1	3333	MBLBL	0147
AMTHOU	3272	CRDN	6065	HDRT2	3347	MCRTRN	3562
APENDN	0070	CRDN1	6073	HLD	4434	MES1	2340
APENUP	0067	CRSTAC	6220	HVMAS5	0045	MES2	2343
APL	0021	CRTCHK	3455	ICHPOT	3267	MHUN	2740
APLOTW	0143	CRTMAS	0051	IMCMND	5666	MLPLR	5566
APLTIT	2333	CRUP	6074	IMOVE	5646	MOVE2	4716
APRSC1	2365	CRUP1	6102	INCLP2	2651	MQA	7701
APRSC2	2742	CURNT	3273	INCRLP	2314	MQL	7421
AP20T1	2574	CVLSMT	5540	INCRSP	3255	MRBOUT	3557
AP20T2	2335	CYCL	4473	INIB	4440	MSDTNX	2172
ARGC1	2427	DAD	7443	INLPSD	3214	MSMTCH	0046
ARGC2	2672	DCAX	4436	INORM	3612	MTHOU	3263
ARTORG	0041	DCM	7575	INORM1	3627	MULT	4510
ASMTN	5551	DECCAR	3271	INPL	3400	MUY	7405
ASPTCD	2744	DLD	7663	INTCRT	2670	M1	4765
ASRER1	2334	DLTA	4521	INTRD	3075	M10	0023
ASTMSP	0141	DLTR	4600	INTRVL	0047	M2	0135
ASTORG	0032	DLTRX	3354	IX	0111	M201	2572
ATRNON	0066	DONECK	2301	IY	0112	M3	0136
AX	0113	DPMAS5	3566	JMPLT4	4712	M4	0134
AXMSCL	2356	DPMT	3577	JMSAM	4711	M40	2170
AXPLT	0064	DPSZ	7451	KPTRAC	3274	M40P30	3145
AY	0114	DST	7445	LC1	4670	M40Q	4502
AYFLT	0063	DTIC	0110	LC2	4642	M46	2741

M5	2567	PLOTT2	4333	RSTFLG	2533	SPRD	5240
M5Q	4503	PLOTT3	4336	RTAT2	5645	SQ	5104
M6300	2571	PLOTWT	6032	RTNORG	3027	SR	5112
M77	0130	PLOTX	4200	RTNRG1	3045	SRCIT	3152
NCNT	4437	PLOTZ	4561	R180	4740	SRPR	5216
NEWB	4446	PLOT1	4227	R270	4752	SRVEY1	2400
NIAC	5673	PLOT2	4263	R90	4730	SRVEY2	2405
NOMSCR	2117	PLOT3	4304	S	0105	SS	5120
NOMSC1	2126	PLOT4	4326	SADDR	0103	SSCL	5343
NONZRO	3236	PLTMAS	2676	SAPS	5214	SSPC	5156
NORMLX	5562	PLTNUM	2723	SB	5005	ST	5127
NORMLZ	5600	PLTSTP	2600	SC	5014	STLDDOT	2513
NOTINT	5412	PLTST1	2610	SCBX	5157	STORIT	3240
NPTS	0054	PLTWT	6130	SCDM	5210	SU	5132
NPTS1	2336	PLTWTB	6216	SCOX	5204	SUBALF	4542
NPTS2	2426	PRESRC	3146	SCOC	5164	SUB1	4544
NPTS3	2666	PRN1CH	3510	SCOL	5335	SURVEY	2235
NSMOOT	0150	PROTHD	3313	SCOM	5232	SV	5136
NUMB	0103	PRTOUT	3531	SCPL	5177	SVTGLY	6240
N11	0132	P50C40	3275	SCTR	5173	SW	5140
N144	0133	PTMASC	0142	SD	5021	SWAB	7431
N40	4504	PUSHUP	5434	SOSH	5236	SWP	7521
N5	0131	P106	3560	SE	5025	SX	5143
N7	4714	P1205	2350	SECNDC	3250	SY	5146
N70	4715	P20	3335	SEQU	5354	SZ	5151
N77	0127	P20T1	2165	SETFLG	2157	S0	5244
OCTNUM	3261	P20T2	2166	SETMSP	2351	S1	5252
OPENRX	0033	P200	3332	SETORG	3111	S2	5255
ORGNUM	0034	P2066	3334	SF	5031	S3	5262
OUTPUT	0126	P22T1	2337	SG	5035	S4	5271
PADDR	4435	P237	0146	SGRT	5357	S5	5274
PASS	0043	P240	3564	SH	5043	S6	5302
PCKLN	3417	P26T1	2675	SHFCNT	3647	S7	5311
PENDN	6056	P273	2570	SHFCN2	3650	S8	5315
PENUD	0065	P277	3565	SHFTIT	3600	S9	5326
PENUP	6042	P40	0031	SHL	7413	TABLE	5000
PEN1	6050	P5	2737	SI	5047	TADDR	4506
PEN2	6051	P54T1	5555	SIGN	5556	THETA	0104
PEN3	6064	P54T2	5475	SJ	5053	TMP	4766
PFETCH	4406	P56T1	5643	SK	5057	TMP1	0024
PL	3517	P56T2	5644	SL	5063	TMP2	0025
PLCHQ	2617	P6	3353	SLPR	5222	TMP3	0026
PLIST	0000	P60	3276	SLST	5352	TMP4	0027
PLOTA	4220	P6300	0052	SM	5065	TM361	3646
PLOTDB	4317	P707	2566	SMOOTH	5400	TOTAL	5563
PLOTDX	4372	RADD	0171	SMTHBX	5554	TRADD	0035
PLOTDY	4373	RDHDRX	2171	SMTHIT	5447	TRNON	2357
PLOTHD	3336	RDHEDR	3060	SMTHLP	5462	T3612	3651
PLOTMY	4376	RDINTX	0053	SMTHX	0151	UPHBYT	3326
PLOTNA	4374	READX	0137	SN	5070	UPOUT	3545
PLOTNX	4370	RESET	0062	SO	5073	UPPRIN	3503
PLOTNY	4371	RGCPLT	3000	SP	5100	UPPRSM	5437
PLOTON	2364	ROTAT	5557	SPCADD	0061	WAITX	0140
PLOTPN	4367	ROTATE	4720	SPLS	5227	X	0100
PLOTT1	4330	RSTAC	6052	SPOCTD	3200	XHD	3344

/SIMPLT.

PALS-V7

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XMIN 0107
XMSCLR 2731
XRG0 3007
Y 0101
YHD 3345
YMSCLR 2732
YRG0 3010
YTOBPL 2636
Z2000 2355

SELECTED WATER RESOURCES ABSTRACTS INPUT TRANSACTION FORM		W	
Specific Ion Mass Spectrometric Detection for Gas Chromatographic Pesticide Analysis		6. Report Date: November 1973 8. Performing Organization Report No.:	
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Battelle-Columbus Laboratories		R-800909	
12. Sponsoring Organization: U.S. Environmental Research Laboratory		13. Type of Period and Period Covered: Final July 1, 1971 thru June 30, 1973	
Environmental Protection Agency, report number, EPA-660/2-74-004, January 1974.			
Computer programs have been developed for a PDP8/e controlling a Finnigan 1015 quadrupole mass spectrometer to monitor selected ions from components in a gas chromatographic effluent. The program is designed to monitor only a few ions (1 to 8) to enhance the sensitivity for the selected ions. Signal-to-noise levels of 10:1-30:1 have been obtained for 0.2 ng or less of four pesticides employing chemical ionization mass spectrometry and a digital smoothing routine. This report was submitted in fulfillment of Project Number 16ADN 28, Grant Number R-800909, by Battelle Memorial Institute under the sponsorship of the Environmental Protection Agency. Work was completed as of June 30, 1973			
17a. Descriptors Mass Spectrometry* Gas Chromatography* Pollutant Identification* Organic Compounds* Computers* Data Processing* Organic Pesticides*			
17b. Identifiers Specific Ion Monitoring* GC/MS* Computer Control* Pesticide Mixture			
17c. NCRPK Field & Group: 05A			
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