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SKYNET APPLICATIONS SOFTWARE PACKAGE (SASP) PROGRAMMER'S HANDBO--ETC(U)
NOV 77 W J SCOTT, J R HILLER

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The objective of the Defense Nuclear Agency (DNA) sponsored SKYNET program is to develop a methodology for the assessment of satellite vulnerability to system generated electromagnetic pulse (SGEMP) effects from nuclear weapons. The approach includes a study of basic phenomenology and development of cost-effective simulation techniques, as well as improving SGEMP instrumentation and data acquisition and recording techniques. → over

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This report summarizes the software developed to acquire and reduce SGEMP data on satellite models for the SKYNET project. Included are comprehensive descriptions of the tasks, subroutines, and common areas. Accompanied by the source and task builder listings and the companion volume titled SKYNET Applications Software Package (SASP) Operator's and User's Handbook, this material provides the reader with a detailed explanation of the SGEMP Transportable Automated Recording System (STARS) operation.

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APPENDICES

1. INTRODUCTION

The objective of the Defense Nuclear Agency (DNA) sponsored SKYNET program is to develop a methodology for the assessment of satellite vulnerability to system generated electromagnetic pulse (SGEMP) effects from nuclear weapons. The approach includes a study of basic phenomenology and development of cost-effective simulation techniques, as well as improving SGEMP instrumentation and data acquisition and recording techniques.

This text presents detailed descriptions of the SKYNET Applications Software Package (SASP) main routines (tasks) and subroutines used in the SGEMP Transportable Automated Recording System (STARS). The SASP code controls the Digital Equipment Corp. (DEC) PDP 11/40 based instrumentation system and acquires, records, and reduces the data. Details concerning the STARS operation are given in the SASP Operator's and User's Handbook[1] and in several EG&G publications.[2,3]

References to the standard SASP digitizer and channel error codes and to the standard terminal input conventions contained in the documentation of several tasks and subroutines may be found in the SASP Operator's and User's Handbook.[1]

Although not mandatory, a reader knowledge of DEC MACRO-11 assembly language and related terminology will prove helpful in understanding certain portions of the SASP documentation.

2. INDIVIDUAL TASK DOCUMENTATION

The following standard entries have been used to document the SASP tasks:

Entry	Definition
Task name	Name of task
Language	DEC PDP 11 FORTRAN or MACRO-11

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[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

[2] *Data Acquisition and Processing System (DAPS), EG&G AL-1261, Albuquerque, NM (30 November 1976).*

[3] *Trigger Marker Generator EG&G Model ATX-6, EG&G AL-1238, Albuquerque, NM (13 August 1976).*

Entry (Cont'd)	Definition (Cont'd)
Date of documentation	Date that task was written
Subroutines called	Those subroutines called directly; entry points, if any, are in parentheses
Files	Disk files referenced by task
Input/output (I/O) devices	Devices used by task
Description	General narrative description
Algorithms	Description of any significant algorithms utilized
Common areas	Areas common to one or more tasks
Flowcharts	American National Standards Institute (ANSI) symbols
Typical output	Sample of typical output

Standard format entries are included only as needed. The Subroutine Cross-Reference List (app A), the Standardized Common Areas (app B), and the PLOT-10/Terminal Control System (TCS) subroutines used by SASP (app C) give more detailed information.

ATN

FORTRAN	Written May 1976
Subroutines called:	AINIT, ANEW, ANSWER, ARDENT, ARDNEX, ARESET, ASDCD, ATNREF, AWRADD, AWRENT, FLDCD, INPUT
File:	DK1:[100,100] ATNCAL.DAT
I/O devices:	TI:, LP0:
Description:	Task ATN generates and maintains the device calibration file, ATNCAL.DAT. Each mode of operation is selected by the proper command from the following list:

GN Start a new file

EN Enter new device information (including modifying an old entry)

PE Print selected device information

PA Print the file contents

HE[LP] List command codes in response to "A:" as a prompt; an immediate carriage return (CR) terminates the task

Modes that require additional information (specifically, EN and PE) request it. Standard SASP terminal input conventions apply. Both of these modes request a device identification (ID); an immediate CR causes an exit from the mode to the command interpreter.

See SASP Data Input Requirements, Operator's and User's Handbook.[1]

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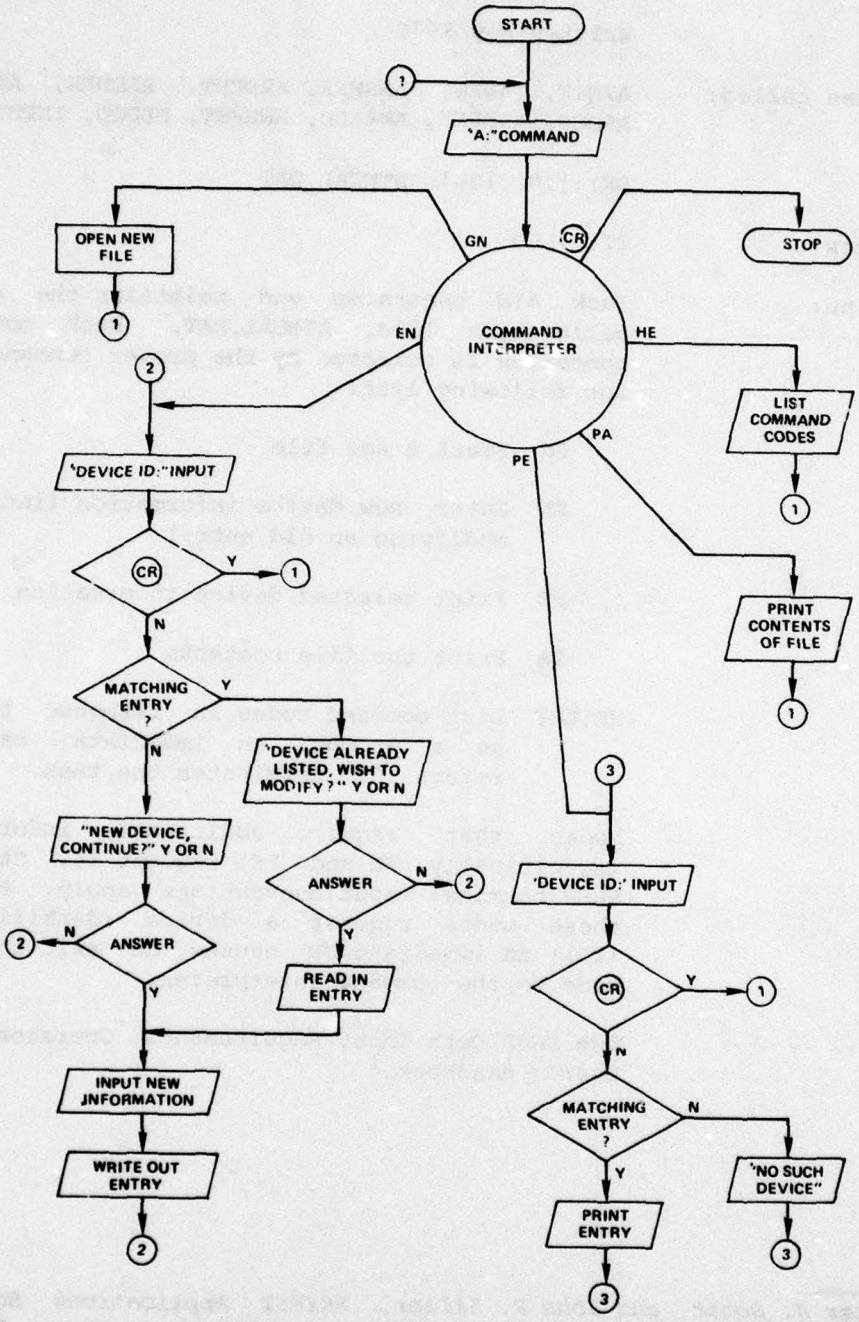
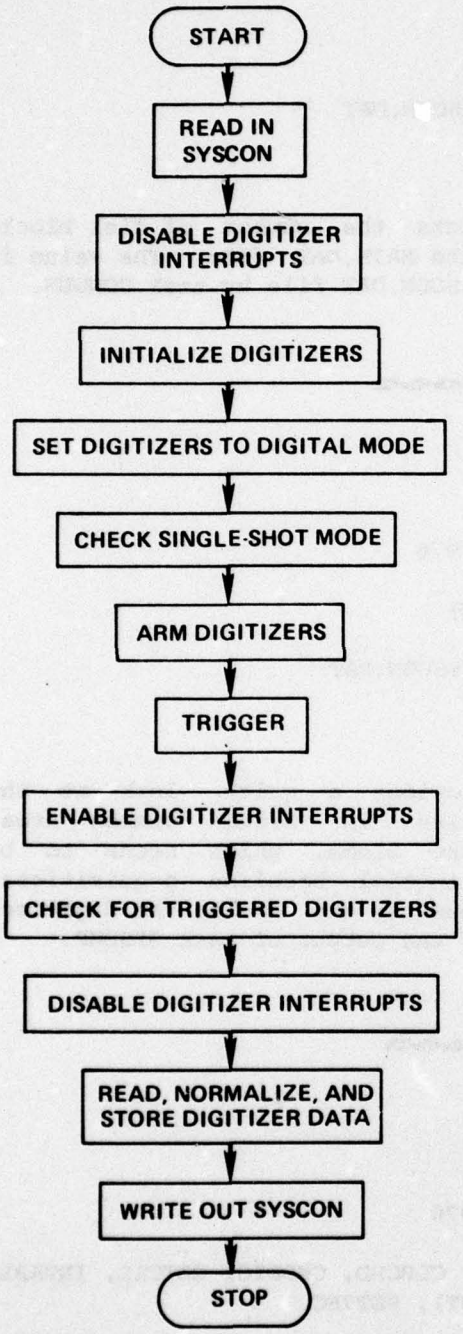
[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

Flowchart: ATN



Flowchart: BASE



BASE

MACRO-11	Written April 1976
Subroutines called:	ATTEN (TRIGB), CHKTRG, CLRCBD, CMDDIG, GETBAS, INTABL, SCIO (SCIN SCOUT)
Files:	DK0: [100,100] SYSCON.DAT, DK1: [100,100] MAIN.DAT
I/O devices:	TI:, digitizers, attenuator control unit
Description:	Task BASE acquires the baseline trace, reduces it, and stores it on enabled digitizers. Triggering is done automatically. The raw baseline trace is normalized, and the bloom is calculated. The digitizer knob readout is compared with the setting requested. Standard SASP digitizer and channel error codes apply. Any error condition, past or present, on either a digitizer or a channel also results in a NOB (no baseline) error on the associated digitizer. If the initial error occurs after normalization, a baseline trace is still actually stored.

BLKCNT

FORTRAN	**Written May 1976**
Subroutines called:	**SCIO (SCIN)**
File:	**DK0:[100,100] SYSCON.DAT**
I/O device:	**TI:**
Description:	**Task BLKCNT prints the number of disk blocks required for the MAIN.DAT file. The value is stored in the SYSCON.DAT file by task CONGEN.**

BLMCHK

FORTRAN	**Written August 1976**
Subroutines called:	**PAGE, SCIO (SCIN)**
File:	**DK0: [100,100] SYSCON.DAT**
I/O device	**TI:**
Description:	**Task BLMCHK provides a quick look at the digitizer entries in SYSCON common area, particularly the bloom, which needs to be checked after initial baseline acquisitions. The format is exactly the same as the digitizer entry section of the output of task SYSDMP.**

CAL

MACRO-11	**Written April 1976**
Subroutines called:	**CALIB, CHKTRG, CLRCBD, CMDDIG, GETCAL, INTABL, SCIO (SCIN, SCOUT), SETVEC**

Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O devices:	TI:, digitizers, attenuator control unit
Description:	Task CAL acquires the calibration trace, reduces it, and stores it for enabled digitizers. Triggering is done automatically. The raw calibration trace is normalized. The digitizer knob readout is compared with the setting requested. Standard SASP digitizer and channel error codes apply. A NOC (no calibration data) error is interpretted in the same manner as a NOB during task BASE. The transmitters are allowed time to warm up; the number of seconds is the value of CNTXMT in the SYMDEF Macro.[1] There is a 3-s pause between calibration triggering and turning off the transmitters.

CHKBAS

FORTRAN	Written July 1976
Subroutines called:	ANMODE, ANSWER, DATFIO (OPENS, READB, CLOSES), GRABAS, MOVABS, SCIO (SCIN)
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O device:	TI:
Description:	Task CHKBAS graphs baseline data on the Tektronix (TEK) R4010 graphic display console (TI:). The program queries the operator with "CONTINUE?" to which the operator types "Y." An "N" response (or CR) causes the question to be repeated. (The question is used as a dummy pause in the routine.)

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

Common areas: SYSCON, BASDAT

CHKCAL

FORTRAN — Written May 1976

Subroutines called: ANSWER, ASDCD, CHNERR, DATFIO (OPENS, CLOSES, READB, WRITER), MINMAX, SCIO (SCIN, SCOUT), XCHDRI

Files: DK0:[100,100] SYSCON.DAT, DK0:[100,100] XCHCAL.DAT, DK1: [100,100] Snnnnxx.DAT

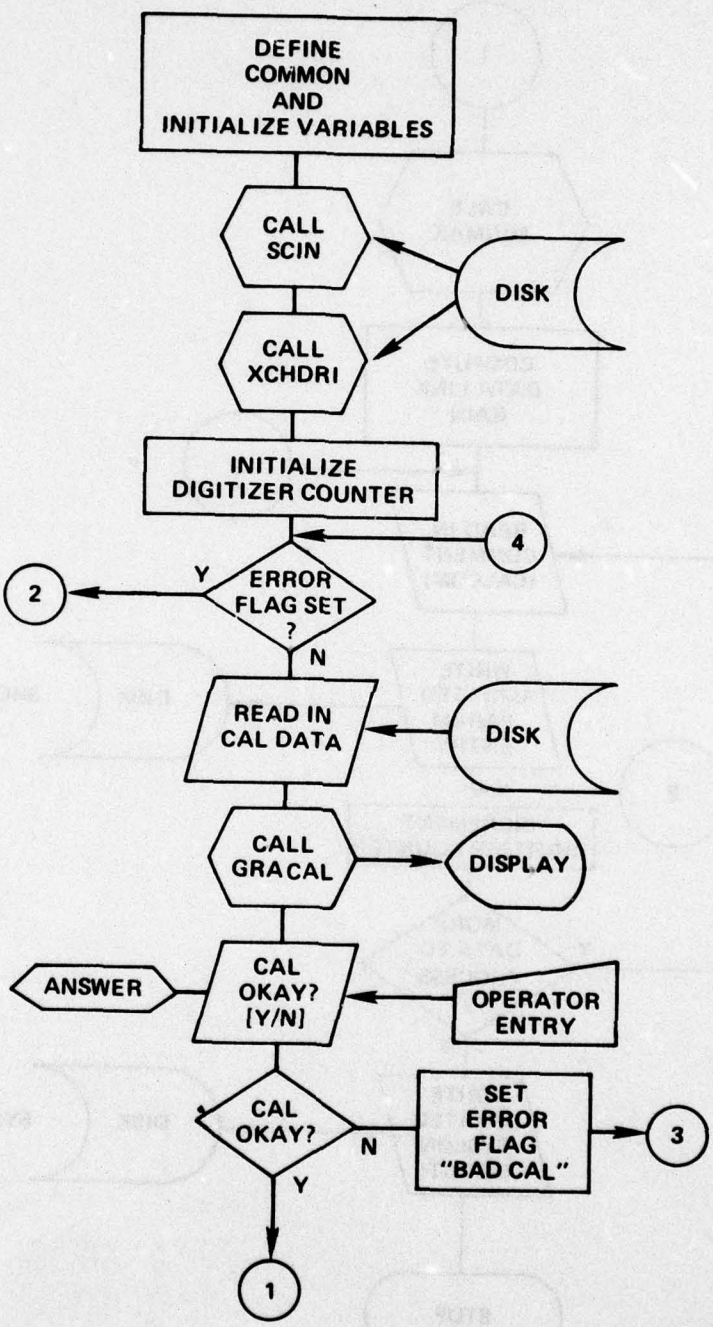
I/O devices: TI:, LP0:

Description: Task CHKCAL evaluates the calibration pulses emitted from the calibration pulse generators, one of which is in each optical data link transmitter. The calibration pulse is a bipolar signal whose amplitude as recorded by the TEK R7912 transient digitizer is a measure of subsystem gain. The subsystem is defined as the optical data link and any amplifiers or attenuators between the link receiver output and the TEK R7912 input.

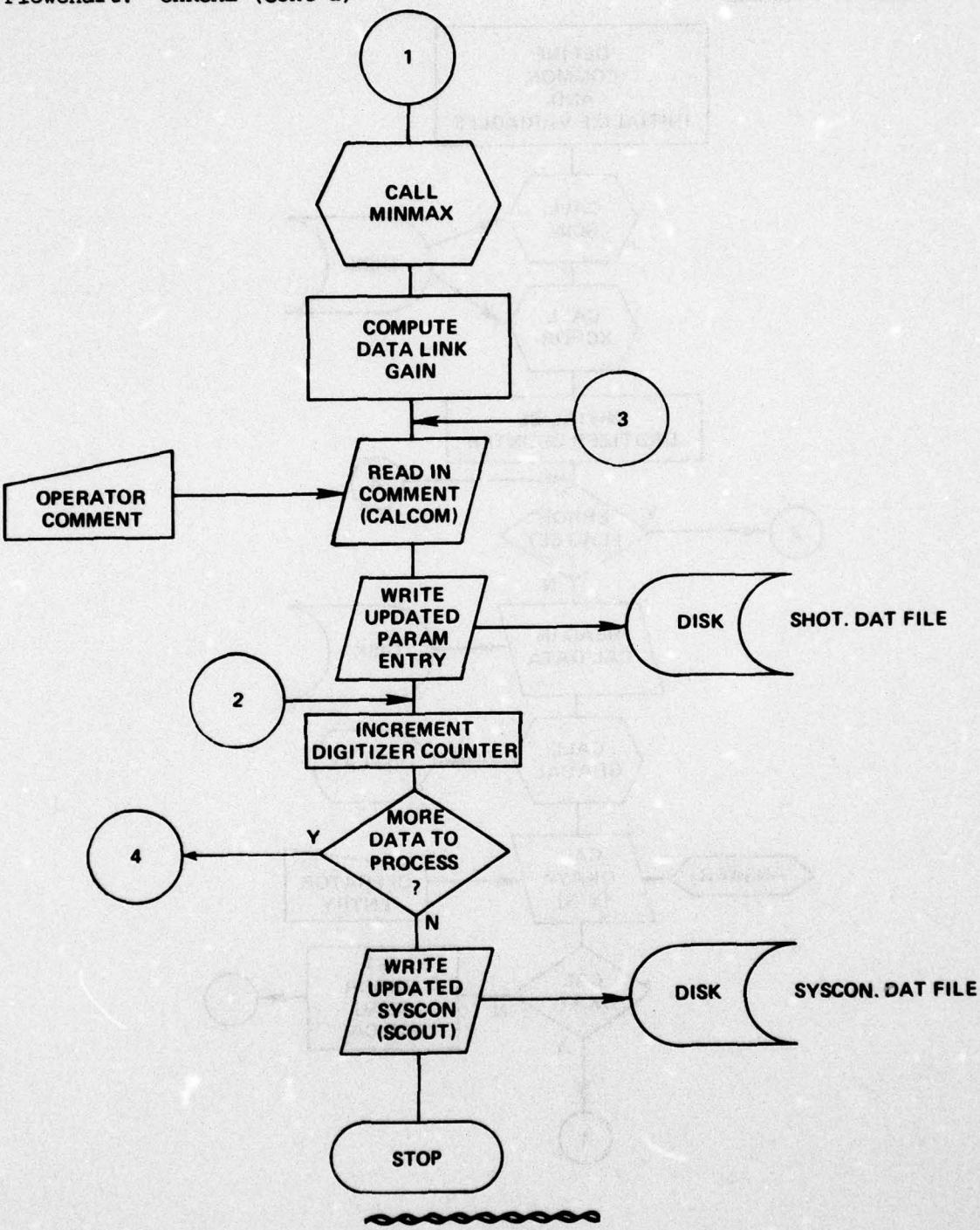
Task CHKCAL does not allow operator evaluation of calibration pulse data that have been flagged by the normalization routines as bad. Task CHKCAL automatically computes the absolute peak value and calculates subsystem gain, stored as data link gain in the SYSCON.DAT file "channel" entry. It also permits the operator to flag bad calibration pulses and input comments of up to 24 characters.

Common areas: SYSCON, PARAM, XCHCAL, CALDAT

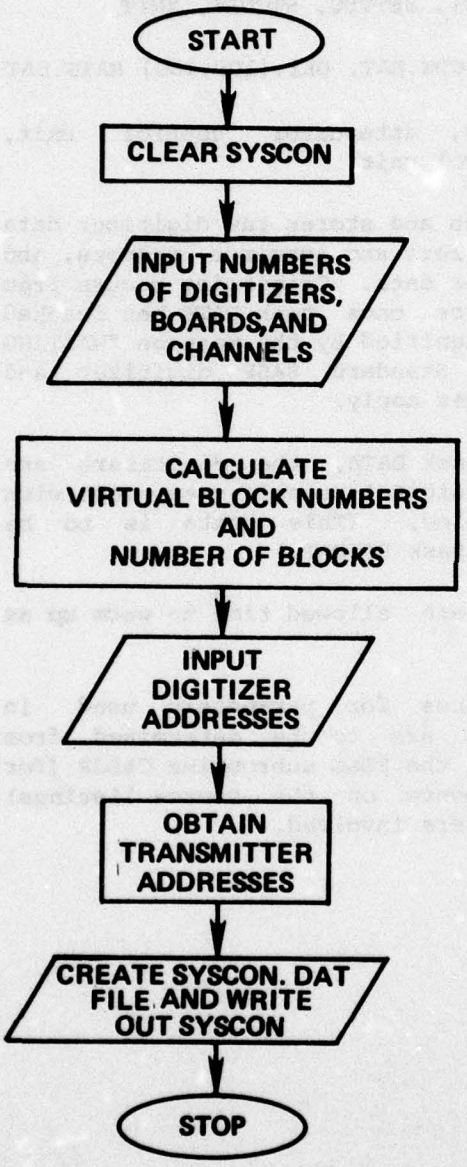
Flowchart: CHKCAL



Flowchart: CHKCAL (Cont'd)



Flowchart: CONGEN



CONGEN

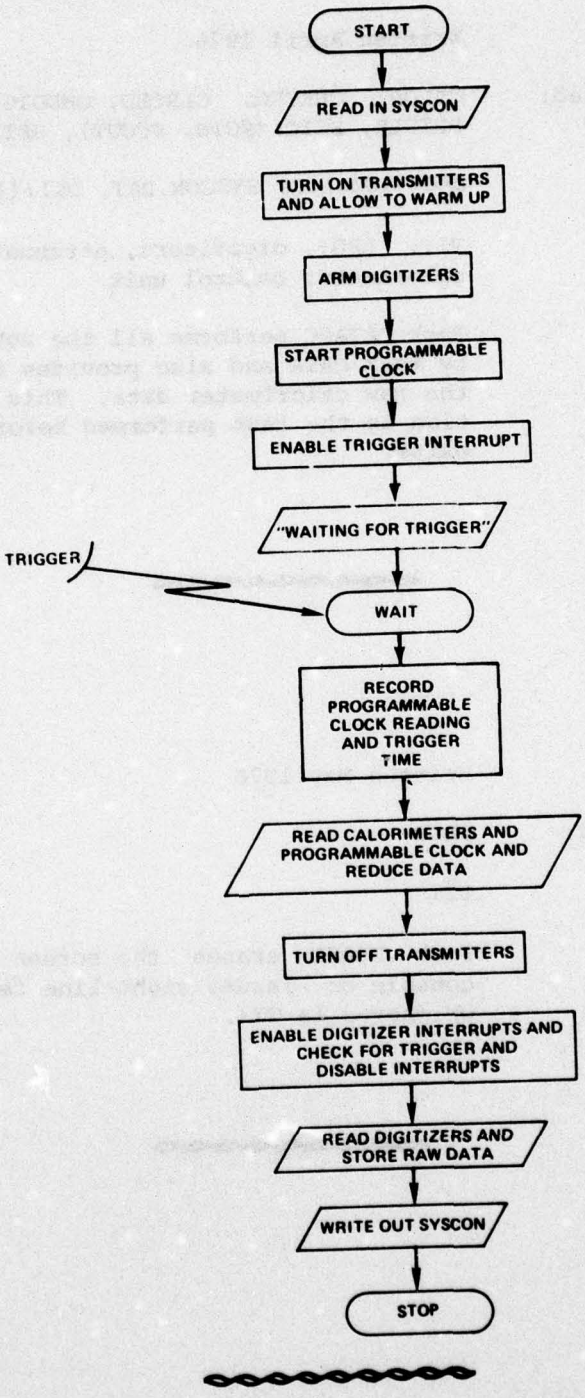
FORTRAN	Written May 1976
Subroutines called:	FXDCD, INPUT, SCGEN, XCHSCH
Files:	DKO: [100,100] SYSCON.DAT, DKO: [100,100] XCHCAL.DAT
I/O device:	TI:
Description:	Task CONGEN generates a new system configuration file, SYSCON.DAT, and initializes the following items: number of digitizers (operator input), number of digitizer controller boards (operator input), number of channels (operator input), virtual block numbers, number of blocks for a slot file, digitizer UNIBUS addresses (operator input), and transmitter addresses (from the XCHCAL.DAT file). The remainder of SYSCON is cleared.

DATA

MACRO-11	Written April 1976
Subroutines called:	CALOR,* CHKTRG, CLRCBD, CMDDIG, GETDAT, INTABL, SCIO (SCIN, SCOUT), SETVEC, STCDAT, XMIT
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O devices:	TI:, digitizers, attenuator control unit, calorimeter control unit
Description:	Task DATA acquires and stores raw digitizer data on enabled digitizers and acquires, reduces, and stores calorimeter data. Triggering occurs from an external source once task DATA has reached the wait mode signified by the message "WAITING FOR TRIGGER." Standard SASP digitizer and channel error codes apply. At the start of task DATA, the digitizers are assumed to be in digital, single-sweep mode with interrupts disabled. (This state is to be reached by using task PREDAT.) The transmitters are allowed time to warm up as in task CAL. The proper values for parameters used in subroutine CALOR are to be determined from documentation on the EG&G subroutine CALOR (for example, the comments on the source listings) and the calorimeters involved.

**Documentation for subroutine CALOR, written by EG&G, Inc., is not given in this report.*

Flowchart: DATA



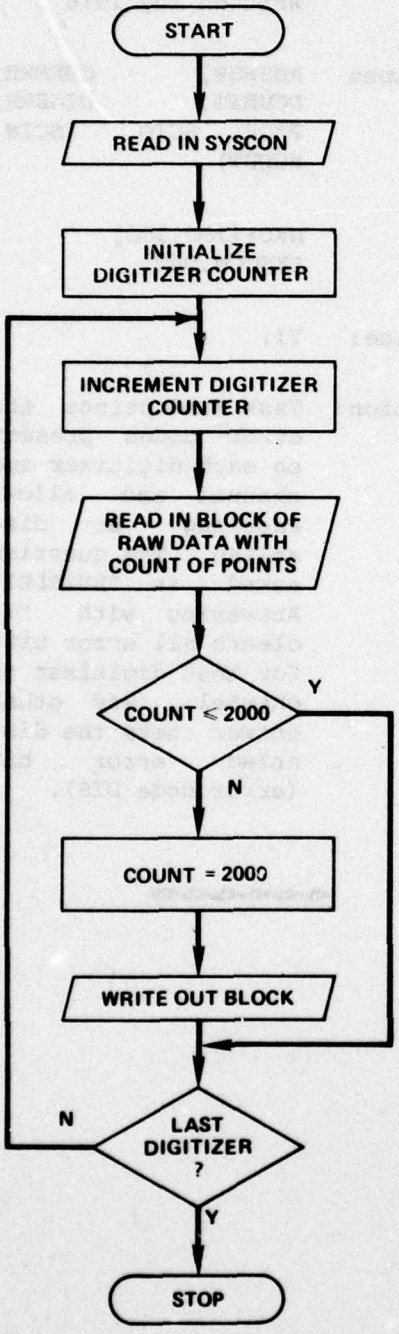
DATAPC

MACRO-11	**Written April 1976**
Subroutines called:	**CALOR, CHKTRG, CLRCBD, CMDDIG, GETDAT, INTABL, PRICLR, SCIO (SCIN, SCOUT), SETVEC, STCDAT, XMIT**
Files:	**DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT**
I/O devices:	**TI:, LP0:, digitizers, attenuator control unit, calorimeter control unit**
Description:	**Task DATAPC performs all the actions carried out by task DATA and also provides a quick dump of the raw calorimeter data. This additional function is the last performed before task DATAPC exits.**

ERASE

FORTRAN	**Written May 1976**
Subroutine called:	**PAGE**
I/O device:	**TI:**
Description:	**Task ERASE erases the screen of the TEK R4010 console or issues eight-line feeds to the LA36, whichever is TI:.**

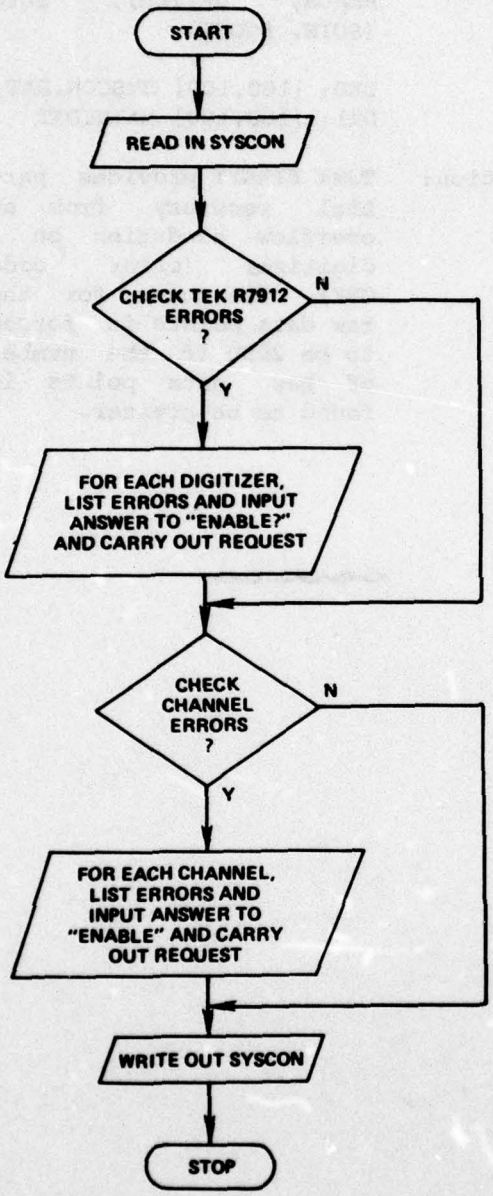
Flowchart: FIXNPT



FIXNPT

FORTRAN	Written August 1976
Subroutines called:	DATFIO (CLOSES, OPENS, READB, WRITER), SCIO (SCIN, SCOUT)
Files:	DK0: [100,100] SYSCON.DAT, DK1: [100,100] MAIN.DAT
Description:	Task FIXNPT provides partial recovery from an overflow condition on a digitizer (error code OVF). The count for the raw data points is forced to be 2000 if the number of raw data points is found to be greater.

Flowchart: FLAG



FLAG

FORTRAN — Written May 1976

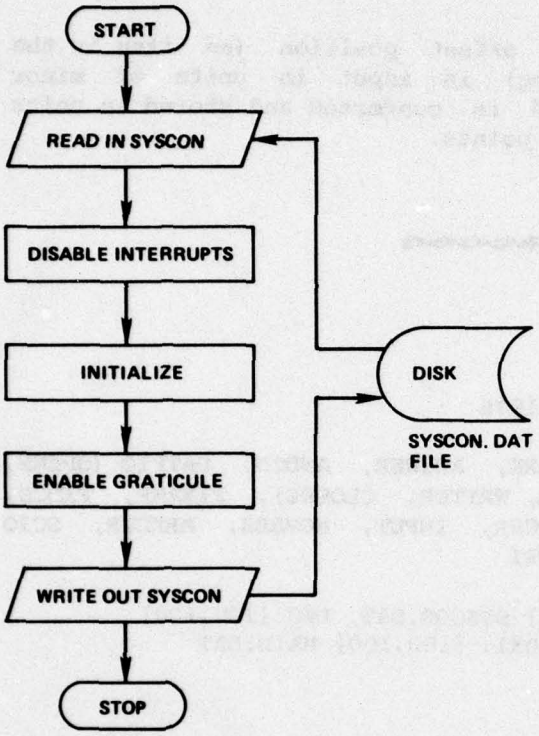
Subroutines called: ANSWER, CHNERR, DCDBIT, DIGERR, PAGE, SCIO (SCIN, SCOUT)

File: DKO:[100,100] SYSCON.DAT

I/O device: TI:

Description: Task FLAG prints the error codes present on each digitizer and channel and allows enabling or disabling. The question asked is "ENABLE?" Answering with "Y" clears all error bits for that digitizer or channel; any other answer sets the disabled error bit (error code DIS).

Flowchart: KNOB



KNOB

MACRO-11	Written April 1976
Subroutines called:	CLRCBD, CMDDIG, SCIO (SCIN, SCOUT)
File:	DKO:[100,100] SYSCON.DAT
I/O devices:	TI:, digitizers
Description:	Task KNOB places all enabled digitizers in the knob setting mode. Interrupts are disabled; digitizers initialized, switched to the TV mode, and their graticules are enabled. Standard SASP error codes apply.

LOG

FORTRAN	Written May 1976
Subroutines called:	ANSWER, ASDCD, FLDCD, FXDCD, INPUT, PAGE, SCIO (SCIN, SCOUT)
File:	DKO:[100,100] SYSCON.DAT
I/O device:	TI:
Description:	Task LOG inputs to SYSCON the information on the probe, transmitter, receiver, and digitizer logs. Choice of skipping one or more logs is provided. Standard SASP terminal input conventions apply. Items are not checked for validity.

For the content of the log forms, see Data Input Requirements, SASP Operator's and User's Handbook.[1]

The baseline offset position (an item in the digitizer log) is input in units of minor divisions and is converted and stored in units of digitizer points.

MARK

FORTRAN Written May 1976

Subroutines called: ANMODE, ANOMRK, ANSWER, ASDCD, DATFIO (OPENS, READB, READR, WRITER, CLOSES), FIXAMP, FXDCD, GRAATC, INPCSR, INPUT, MOVABS, MRKCUR, SCIO (SCIN), XCHDRI

Files: DK0:[100,100] SYSCON.DAT, DK0:[100,100] XCHCAL.DAT, DK1: [100,100] MAIN.DAT

I/O devices: TI:, LP0:

Description: Task MARK characterizes the unscaled data with timing marks to mark and store the time of peak of fiducial, time of start of data, and time of peak of interest. Scaled data are read from the MAIN.DAT file, unscaled, and plotted for each TEK R7912. The operator then marks the data with the characterization parameter times by setting the graphic y-cursor (which appears automatically at the proper point in the program; see subroutine INPCSR) to the point of interest and hitting any character followed by a CR. This process is repeated three times, once for each time point. The operator is then queried on the validity of the entries made with the cursor. If the cursor entries are judged by

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

the operator to be unsatisfactory, the plot is redisplayed, and the operator may again enter the timing parameters using the graphic cursor. This process is repeated until acceptable timing marks have been selected.

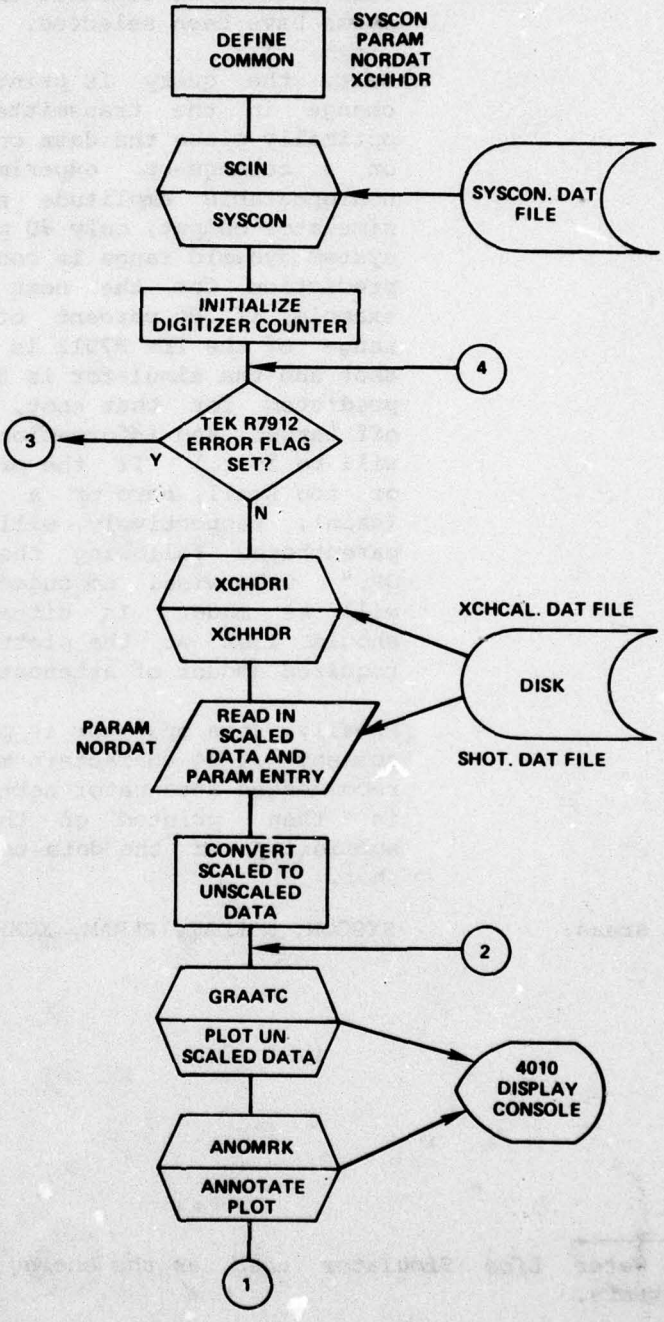
Next, the query is printed for the required change in the transmitter attenuator value to optimally place the data on the TEK R7912 target on a subsequent experiment. Due to the nonrepeatable amplitude nature of the OWL II* simulator output, only 70 percent of the usable system dynamic range is considered as an optimal prediction for the next simulator shot. (For example, if 90 percent of the maximum dynamic range of the TEK R7912 is chosen for the next shot and the simulator is 30 percent higher than predicted for that shot, then the data will be off target, and information concerning the peaks will be lost.) If the previous data were okay or too small, zero or a negative attenuation (gain), respectively, will be printed in the parentheses following the query "ADD ATTN (X) dB." Otherwise, no suggestion to the operator will be made. In either case, the operator should look at the plotted data and enter the required amount of attenuation or gain.

Finally, the operator is prompted to enter a comment of 24 characters maximum. A table of recommended attenuator settings for each channel is then printed on the line printer for submission to the data user prior to the next shot.

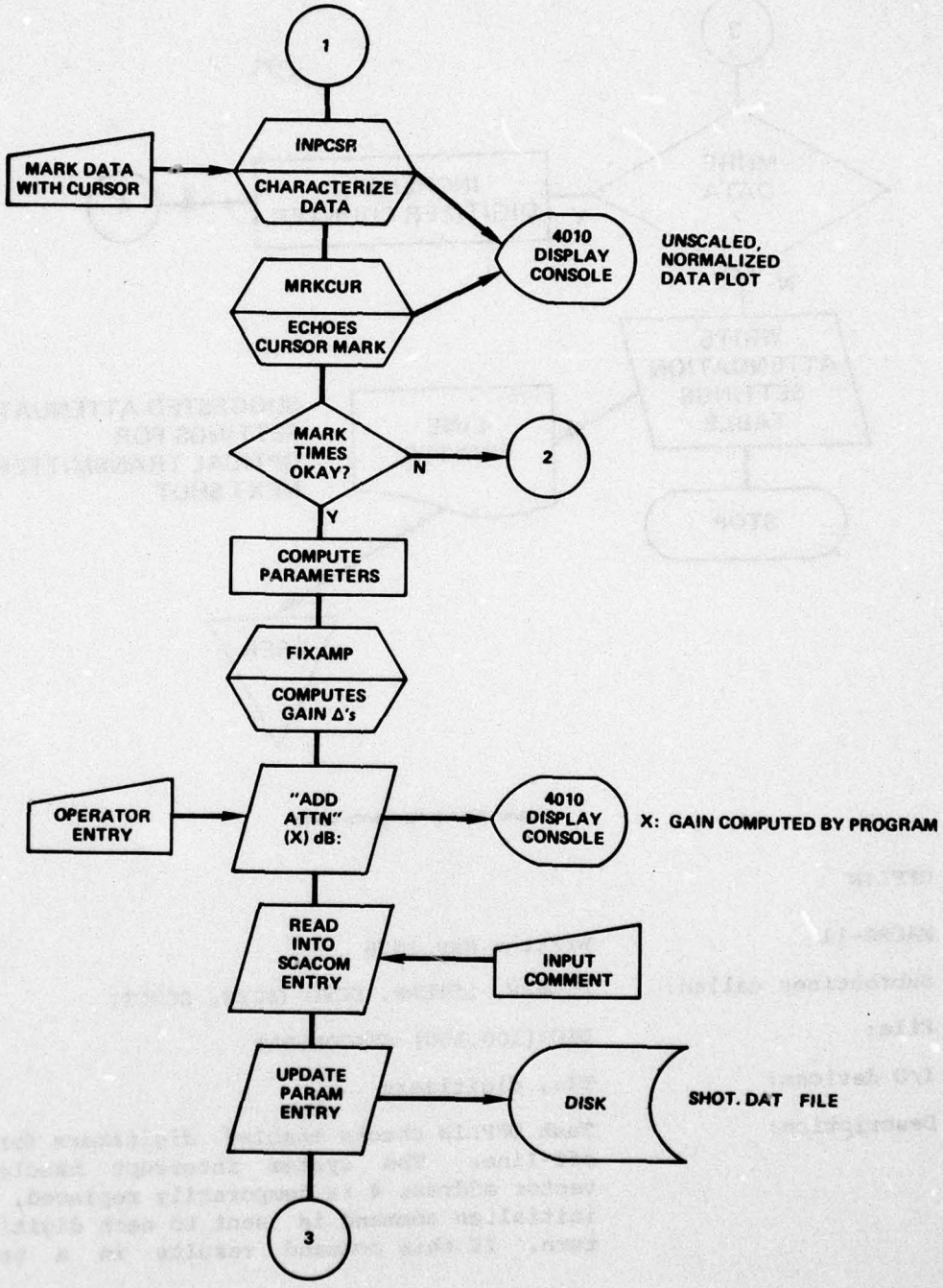
Common areas: SYSCON, NORDAT, PARAM, XCHHDR.

Oil Water Line Simulator used as the energy source for the SKYNET experiments.

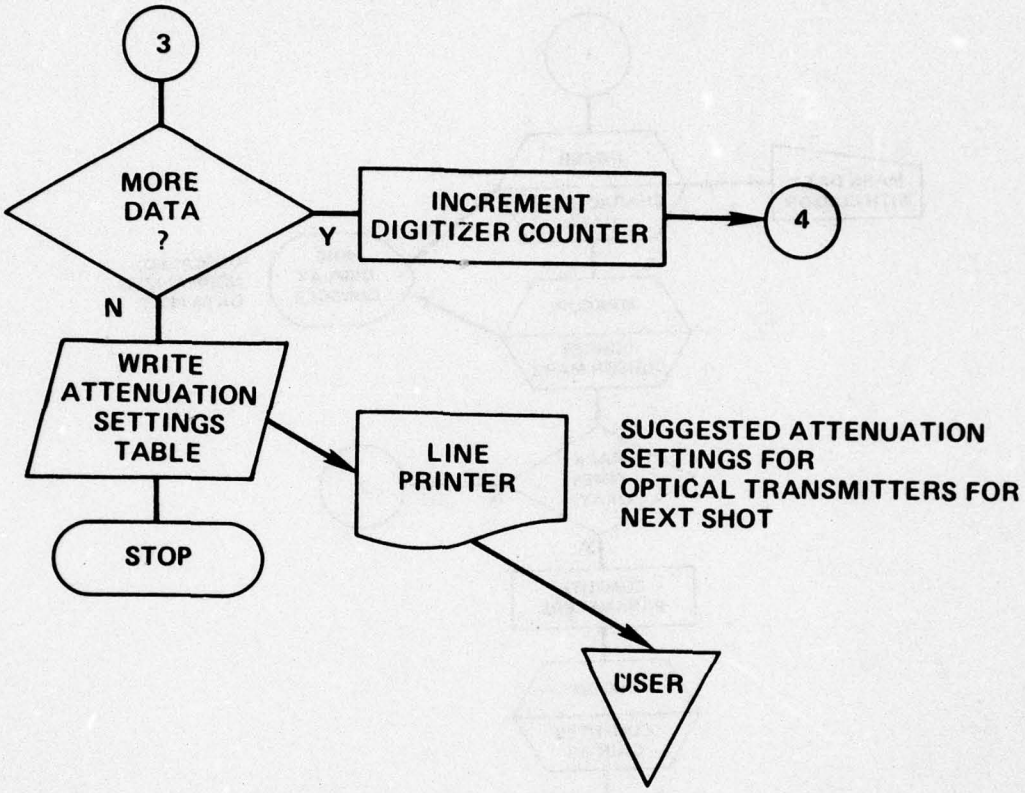
Flowchart: MARK



Flowchart: MARK (Cont'd)



Flowchart: MARK (Cont'd)



OFFLIN

MACRO-11	Written May 1976
Subroutines called:	DIGERR, LSTERR, SCIO (SCIN, SCOUT)
File:	DK0:[100,100] SYSCON.DAT
I/O devices:	TI:, digitizers
Description:	Task OFFLIN checks enabled digitizers for being off-line. The system interrupt handler for vector address 4 is temporarily replaced, and an initialize command is sent to each digitizer in turn. If this command results in a trap to

vector 4, an OFF error condition is flagged and listed for the digitizer.

OUTFIL

MACRO-11	Written April 1976
Subroutine called:	SCIO (SCIN)
Files:	DK0: [100,100] SYSCON.DAT, DK1: [100,100] MAIN.DAT
Description:	Task OUTFIL creates a zero-filled noncontiguous MAIN.DAT file. The size is as specified by the "number of blocks" item in the SYSCON header.

PRB

FORTRAN	Written May 1976
Subroutines called:	ANSWER, ASDCD, FLDCD, FXDCD, INPUT, PRBREF (PINIT, PNEW, PRDENT, PRDNEX, PRESET, PWRADD, PWRENT)
File:	DK0:[100,100] PRBCAL.DAT
I/O devices:	TI:, LP0:
Description:	Task PRB performs the same functions toward the probe calibration file, PRBCAL.DAT, as task ATN does toward the device calibration file. The reader should reference the task documentation for ATN, replacing the device with the probe. The input of the balun number is checked to be sure that it is from 1 to 3. (See the SASP Operator's and User's Handbook,[1] sect. 3.2.)

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

PREDAT

MACRO-11	Written April 1976
Subroutines called:	CLRCBD,CMDDIG, SCIO (SCIN, SCOUT)
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O devices:	TI:, digitizers
Description:	Task PREDAT prepares the enabled digitizers for acquiring a data trace (with task DATA or DATAPC). Interrupts are disabled; the digitizers are initialized, switched to the digital mode, and checked for a single-shot mode. Standard SASP error codes apply.

PRTNAM

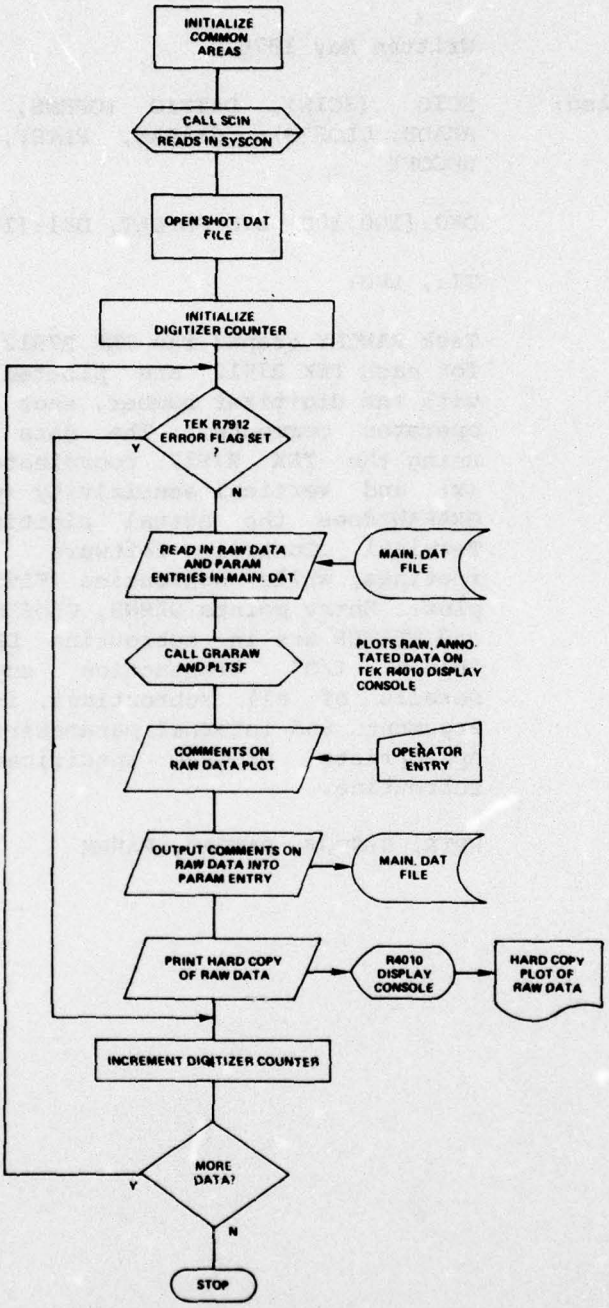
FORTRAN	Written May 1976
Subroutine called:	SCIO (SCIN)
File:	DK0:[100,100] SYSCON.DAT
I/O device:	TI:
Description:	Task PRTNAM prints the name of the shot file to which SYSCON points. (See SASP Data File documentation.[1])

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

RAWCPY

FORTRAN	Written May 1976
Subroutines called:	SCIO (SCIN), DATFIO (OPENS, READR, WRITER, READB, CLOSES), GRARAW, PLTSF, INPUT, ASDCD, HDCOPY
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O devices:	TI:, LP0:
Description:	Task RAWCPY graphs raw TEK R7912 data. The data for each TEK R7912 are plotted and annotated with the digitizer number, shot number, and any operator comments. The data are plotted by using the TEK R7912 coordinates, sweep speed (x) and vertical sensitivity (y). Subroutine GRARAW does the actual plotting using the TEK Terminal Control Software (TCS) graphics routines, while subroutine PLTSF annotates the plot. Entry points OPENS, CLOSES, READB, READR, and WRITER are in subroutine DATFIO, the disk "block I/O" transaction support program. Details of all subroutines, including calling arguments and internal parameters, are under the appropriate program specification for that subroutine.
Common areas:	HPTR, SYSCON, RAWDAT, PARAM

Flowchart: RAWCPY



SCACPY

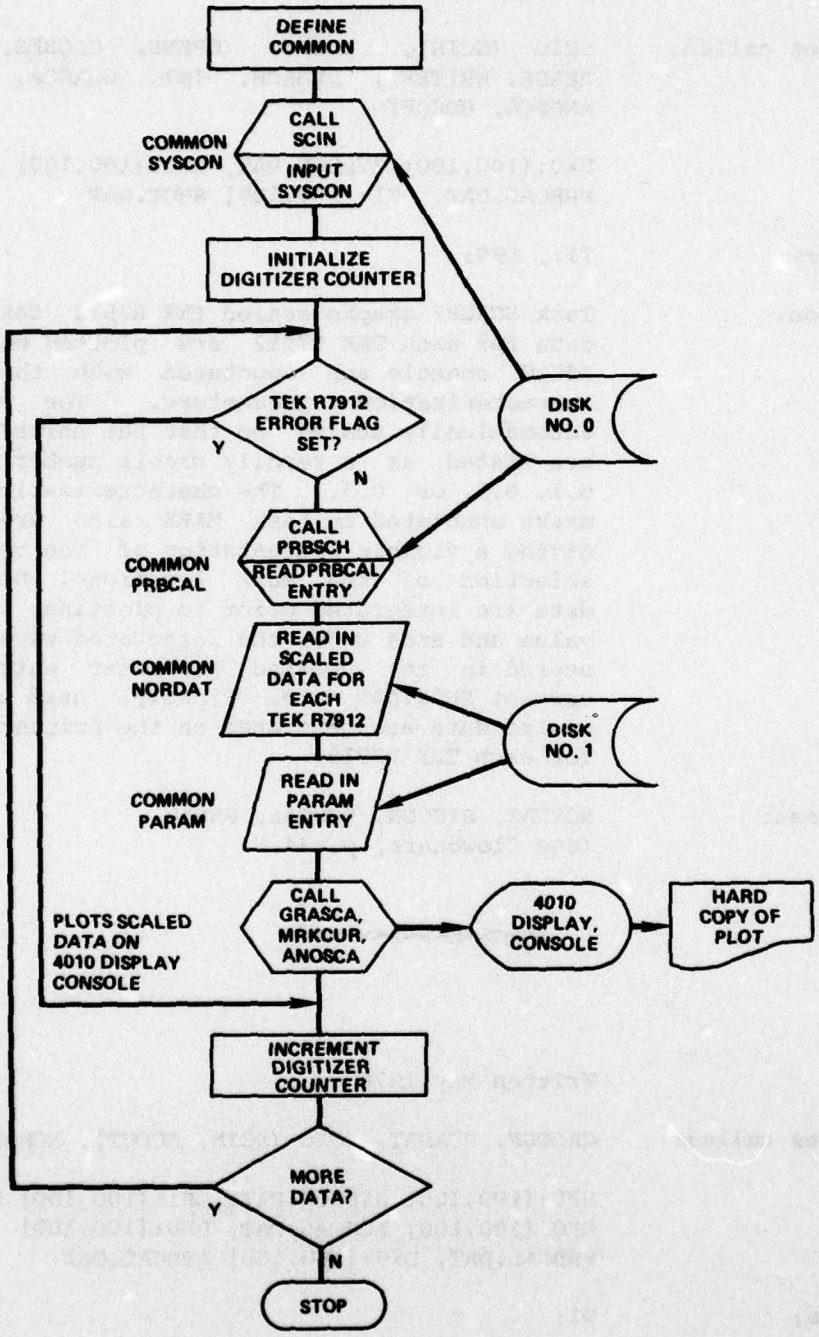
FORTRAN	Written May 1976
Subroutines called:	SCIO (SCIN), DATFIO (OPENS, CLOSES, READB, READR, WRITER), PRBSCH, INT, GRASCA, MRKCUR, ANOSCA, HDCOPY
Files:	DK0:[100,100] SYSCON.DAT, DK0:[100,100] PRBCAL.DAT, DK1:[100,100] SHOT.DAT
I/O devices:	TI:, LP0:
Description:	Task SCACPY graphs scaled TEK R7912 data. The data for each TEK R7912 are plotted on the TEK R4010 console and annotated with the proper characterization parameters. The plot is automatically scaled so that the units/division are listed as a readily usable number, such as 0.1, 0.2, or 0.5. The characterization timing marks annotated in task MARK also are plotted giving a visible presentation of the operator's selection of the mark locations. Derivative data are integrated prior to plotting. The peak value and area under the integrated waveform are stored in the updated parameter entry in the current SHOT.DAT file. Finally, hard copies of scaled data are generated on the printer/plotter for each TEK R7912.
Common areas:	NORDAT, SYSCON, PRBCAL, PARAM

(See flowchart, p. 34.)

SCALE

FORTRAN	Written May 1976
Subroutines called:	CALCSF, SCADAT, SCIO (SCIN, SCOUT), XCHDRI
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT DK0:[100,100] XCHCAL.DAT, DK0:[100,100] PRBCAL.DAT, DK0:[100,100] ATNCAL.DAT
I/O device:	TI:

Flowchart: SCACPY



Description:

Task SCALE calculates the overall scale factor and data link delay (Δt_{data}). The raw data trace is normalized and scaled, and the result is stored in the MAIN.DAT file. The delay and scale factor are stored in SYSCON. The calibration information required is obtained from the calibration files.

Task SCALE checks the knob readout stored in the raw data. The check is done after all the calculations, and an error does not prevent the storage of scaled data. However, such an error does prevent the digitizer and its data from being referenced until the flag is cleared.

Running task SCALE for a channel with a bad data link gain (particularly zero) results in FORTRAN execution errors. To recover from such errors, the operator generates a proper data link gain by running task CAL followed by task CHKCAL, or he disables the channel using task FLAG. He continues processing the other data by rerunning task SCALE.

Algorithms:

The contributions to the overall system gain in decibels are found in the following equation:

$$G_{sys} = G_A + G_P + G_D + G_B + G_{TA} + G_{DL} ,$$

where

G_A = gain of attenuator,

G_P = gain of probe,

G_D = gain of device,

G_B = gain of transmitter balun,

G_{TA} = gain of transmitter attenuator,

G_{DL} = gain of transmission channel.

G_{DL} is calculated by task CHKCAL by using the equation

$$G_{DL} = 20 \log_{10} \frac{\text{cal trace peak at digitizer (mV)}}{\text{cal trace peak at generator (mV)}}$$

which includes any attenuation between the receiver and the digitizer.

The scale factor is the overall system gain in units of oscilloscope volts over the selected units of the probe:

$$A_{sys} = \log_{10}^{-1} \frac{G_{sys}}{20} .$$

Since normalized data are in units of digitizer points of which there are 64/vertical division, scaled data are given by the following equation:

$$\text{scaled (selected units)} = \frac{\text{normalized (points)} \times \text{vertical sensitivity (V/div)}}{64 \text{ (points/div)} \times A_{sys} \text{ (V/selected units)}} .$$

With integrated data for which are introduced an additional factor of a change in time (in seconds), the units of G_P are assumed to be V-s/selected units, and those of A_{sys} become V-s/selected units. Integrated scaled data then have units of selected units.

The contributions to the overall system delay (in nanoseconds) make up the following equation:

$$D_{sys} = D_A + D_P + D_{TC} + D_D + D_{DL} + D_{RC} ,$$

where

D_A = delay of attenuator,

D_P = delay of probe,

D_{TC} = delay of pretransmitter cables,

D_D = delay of device,

D_{DL} = delay of transmission channel,

D_{RC} = delay of postreceiver cables.

SHOTNO

FORTRAN	Written April 1976
Subroutines called:	ASDCD, FXDCD, IASCII, INPUT, SCIO (SCIN, SCOUT)
File:	DK0:[100,100] SYSCON.DAT
I/O device:	TI:
Description:	Task SHOTNO is the means by which the simulator code and the shot number are set in SYSCON. Standard SASP terminal input conventions apply. No input for the simulator code is permissible if a valid simulator code is already present in SYSCON (from a previous run of task SHOTNO). A one- to four-digit number must be given for shot number. Through the use of task SHOTNO, the shot file name is established.

SUMERR

FORTRAN	Written June 1976
Subroutines called:	SCIO (SCIN), DCDBIT
File:	DK0:[100,100] SYSCON.DAT
I/O device:	LP0:
Description:	Task SUMERR prints the error codes present for each digitizer and channel.

SYSCHK

FORTRAN	Written May 1976
Subroutines called:	ATNSCH, PRBSCH, SCIO (SCIN)
Files:	DK0:[100,100] SYSCON.DAT, DK0:[100,100] PRBCAL.DAT, DK0:[100,100] ATNCAL. DAT

I/O device: LP0:

Description: Task SYSCHK checks the validity of certain entries in SYSCON. These are attenuator ID, probe ID, device ID, transmitter attenuation, sweep rate, vertical sensitivity, and baseline trace offset. The last is reconverted from points to minor divisions for printing. Any item found to be wrong is printed; a blank implies a valid entry.

The first page of output includes the first four items, those associated with a channel; the remainder are on the second page.

SYSDMP

FORTRAN: Written June 1976

Subroutine called: SCIO (SCIN)

File: DK0:[100,100] SYSCON.DAT

I/O device: LP0:

Description: Task SYSDMP provides a quick dump of the meaningful contents of SYSCON. The output does not presume to be a polished product, but is to be used as a system "diagnostic." Digitizer UNIBUS addresses and digitizer and channel error flags are printed as octal numbers. All other numbers are decimal. To interpret the error flags, see the documentation of standard error codes.[1]

TABIN

FORTRAN: Written April 1976

Subroutines called: ASDCD, FXDCD, IASCII, INPUT, SCIO (SCIN, SCOUT), SCMAIN

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

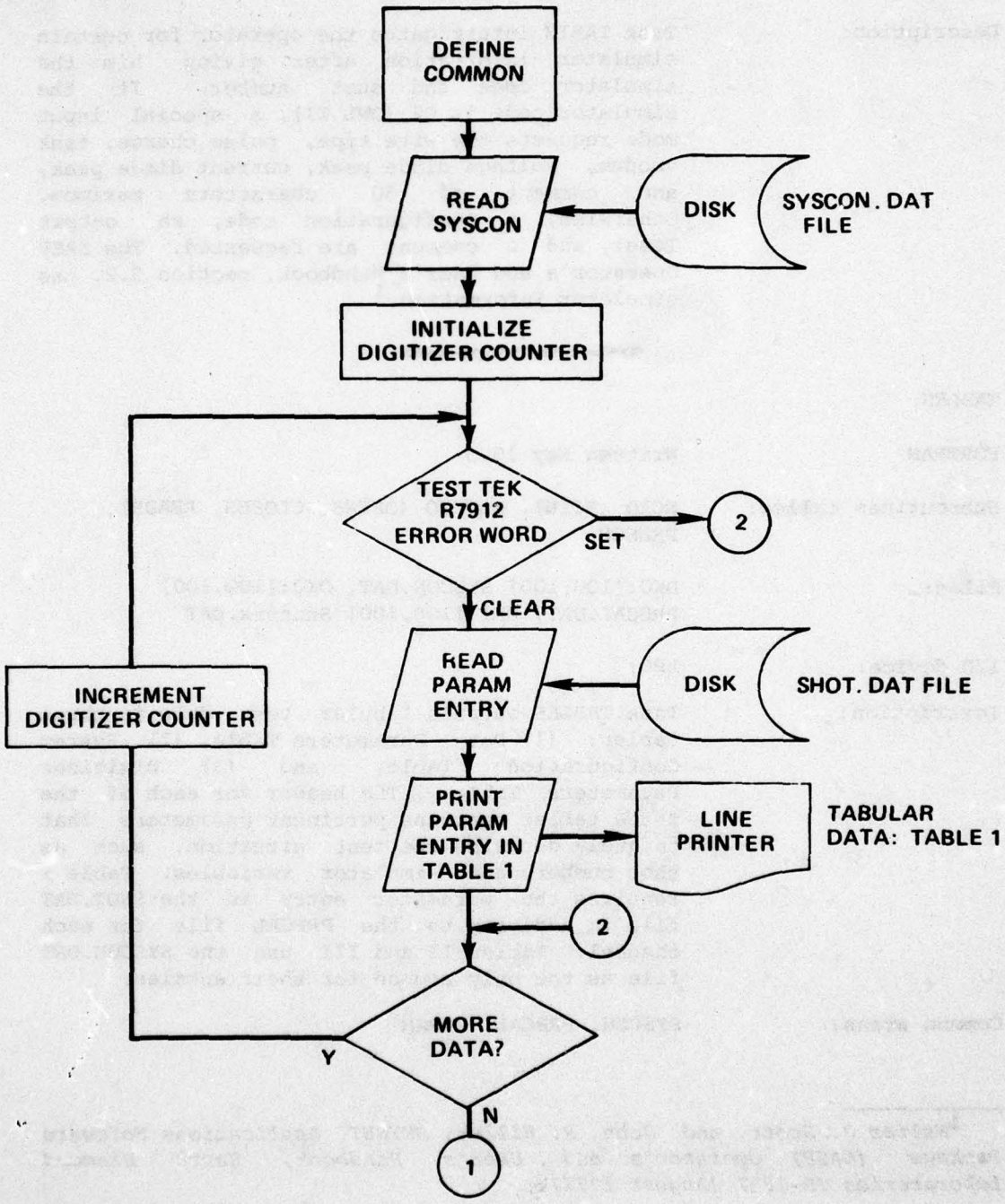
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT
I/O device:	TI:
Description:	Task TABIN interrogates the operator for certain simulator information after giving him the simulator code and shot number. If the simulator code is 02 (OWL II), a special input mode requests the wire type, pulse charge, tank vacuum, voltage diode peak, current diode peak, and comment of 30 characters maximum. Otherwise, a configuration code, an output level, and a comment are requested. The SASP Operator's and User's Handbook, section 3.2, has simulator information.[1]

TABLES

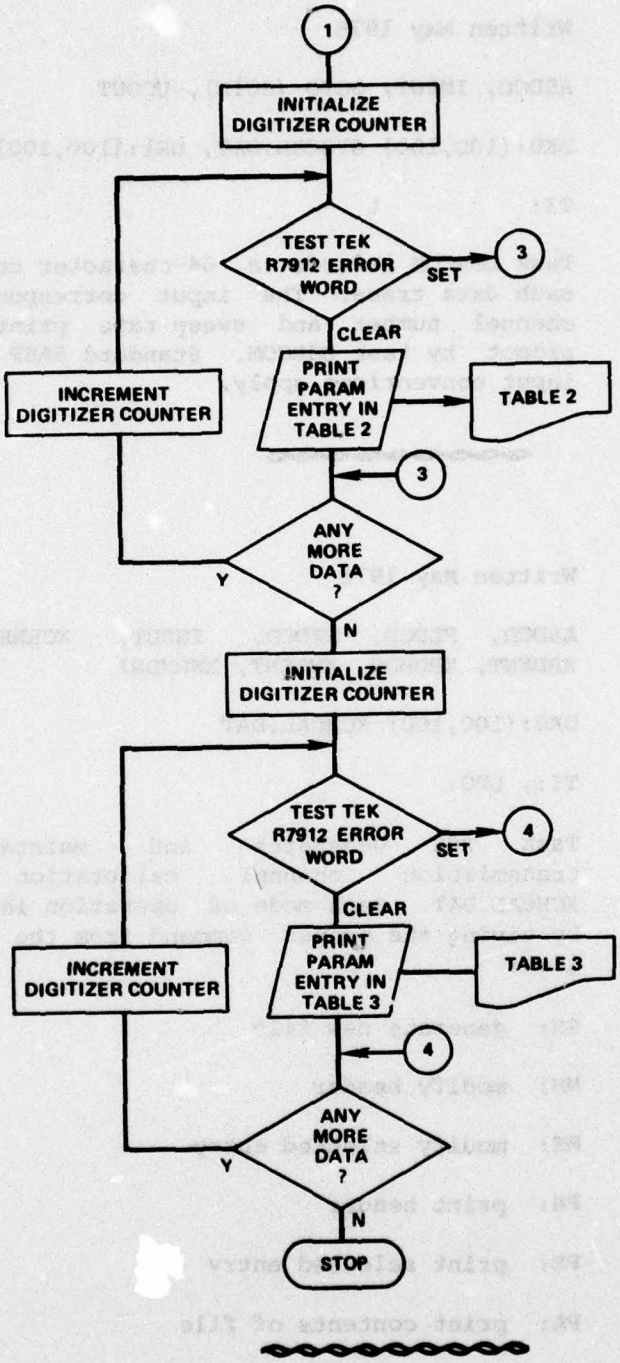
FORTRAN	Written May 1976
Subroutines called:	SCIO (SCIN), DATFIO (OPENS, CLOSES, READR), PRBSCH
Files:	DK0:[100,100] SYSCON.DAT, DK0:[100,100] PRBCAL.DAT, DK1:[100,100] Snnnnxx.DAT
I/O device:	LP0:
Description:	Task TABLES outputs tabular test data in three tables: (1) Data Parameters Table, (2) System Configuration Table, and (3) Digitizer Parameters Table. The header for each of the three tables contains pertinent parameters that uniquely describe the test situation, such as shot number and simulator variables. Table I requires the parameter entry in the SHOT.DAT file in addition to the PRBCAL file for each channel. Tables II and III use the SYSCON.DAT file as the only source for their entries.
Common areas:	SYSCON, PRBCAL, PARAM

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

Flowchart: TABLES



Flowchart: TABLES (Cont'd)



USRCOM

FORTRAN	Written May 1976
Subroutines called:	ASDCD, INPUT, SCIO (SCIN), UCOUT
Files:	DK0:[100,100] SYSCON.DAT, DK1:[100,100] SHOT.DAT
I/O device:	TI:
Description:	Task USRCOM records a 64-character comment for each data trace. The input corresponds to the channel number and sweep rate printed as a prompt by task USRCOM. Standard SASP terminal input conventions apply.

XCH

FORTRAN	Written May 1976
Subroutines called:	ASDCD, FLDCD, FXDCD, INPUT, XCHREF (XNEW, XRDENT, XRDHDR, XWRENT, XWRHDR)
File:	DK0:[100,100] XCHCAL.DAT
I/O devices:	TI:, LP0:
Description:	Task XCH generates and maintains the transmission channel calibration file, XCHCAL.DAT. Each mode of operation is selected by giving the proper command from the following list:

GN: generate new file

MH: modify header

ME: modify selected entry

PH: print header

PE: print selected entry

PA: print contents of file

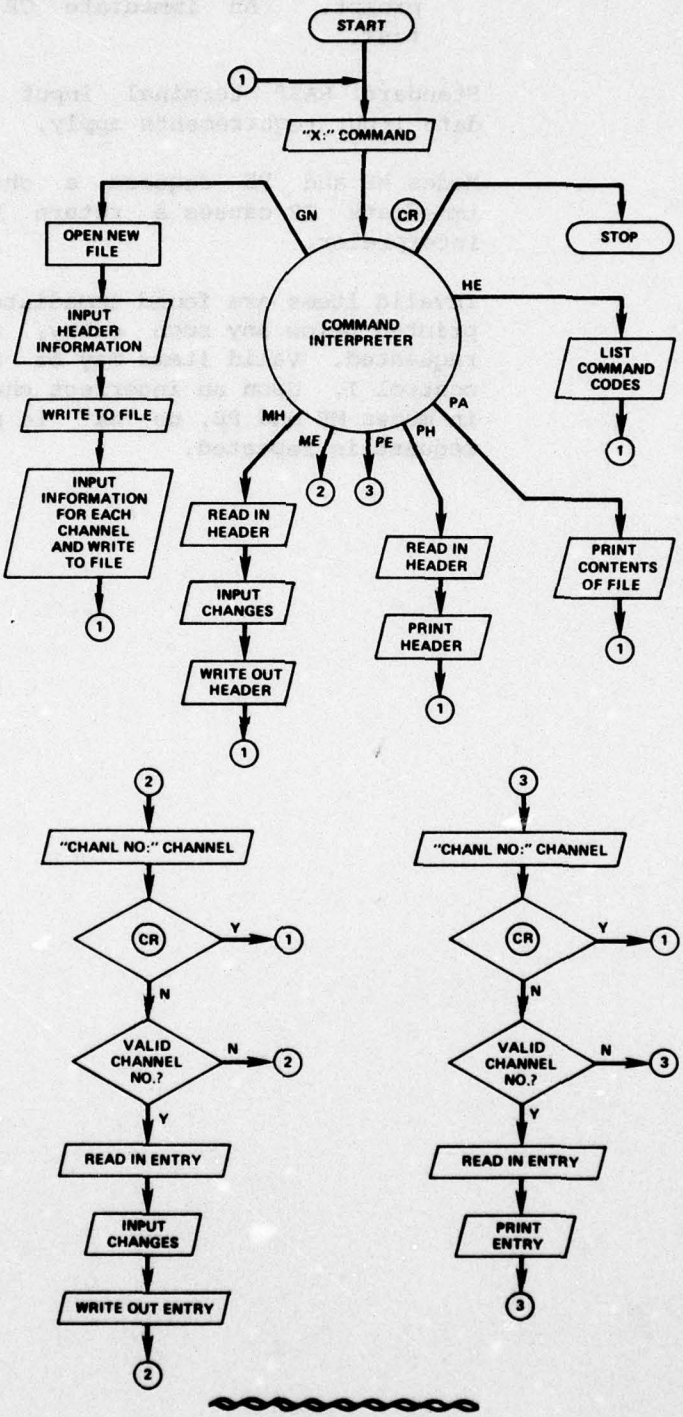
HE[LP]: list command codes in response to "X:" as a prompt. An immediate CR terminates the task.

Standard SASP terminal input conventions and data input requirements apply.

Modes ME and PE request a channel number; an immediate CR causes a return to the command interpreter.

Invalid items are found immediately. An "XX" is printed below any such entry, and reinput is requested. Valid items may be skipped with a control I. Upon an incorrect channel selection in modes ME and PE, no "XX" is printed, but the request is repeated.

Flowchart: XCH



3. INDIVIDUAL SUBROUTINE DOCUMENTATION

The following standard entries have been used to document the SASP subroutines.

Entry	Definition
Subroutine name	Name of subroutine
Language	DEC PDP 11 FORTRAN or MACRO-11
Date written	Date that subroutine was written
Files	Disk files referenced by subroutine
I/O devices	I/O devices utilized
Arguments	List with description of arguments in order called
Description	General narrative description
Algorithms	Description of any signficant algorithms used
Common areas	Areas common within task
Flowchart	ANSI symbols
Typical output	Sample of typical output

Standard format entries are included only as needed. The Subroutine Cross-Reference List (app A) and the Standardized Common Areas (app B) give more detailed information.

ABSPKV

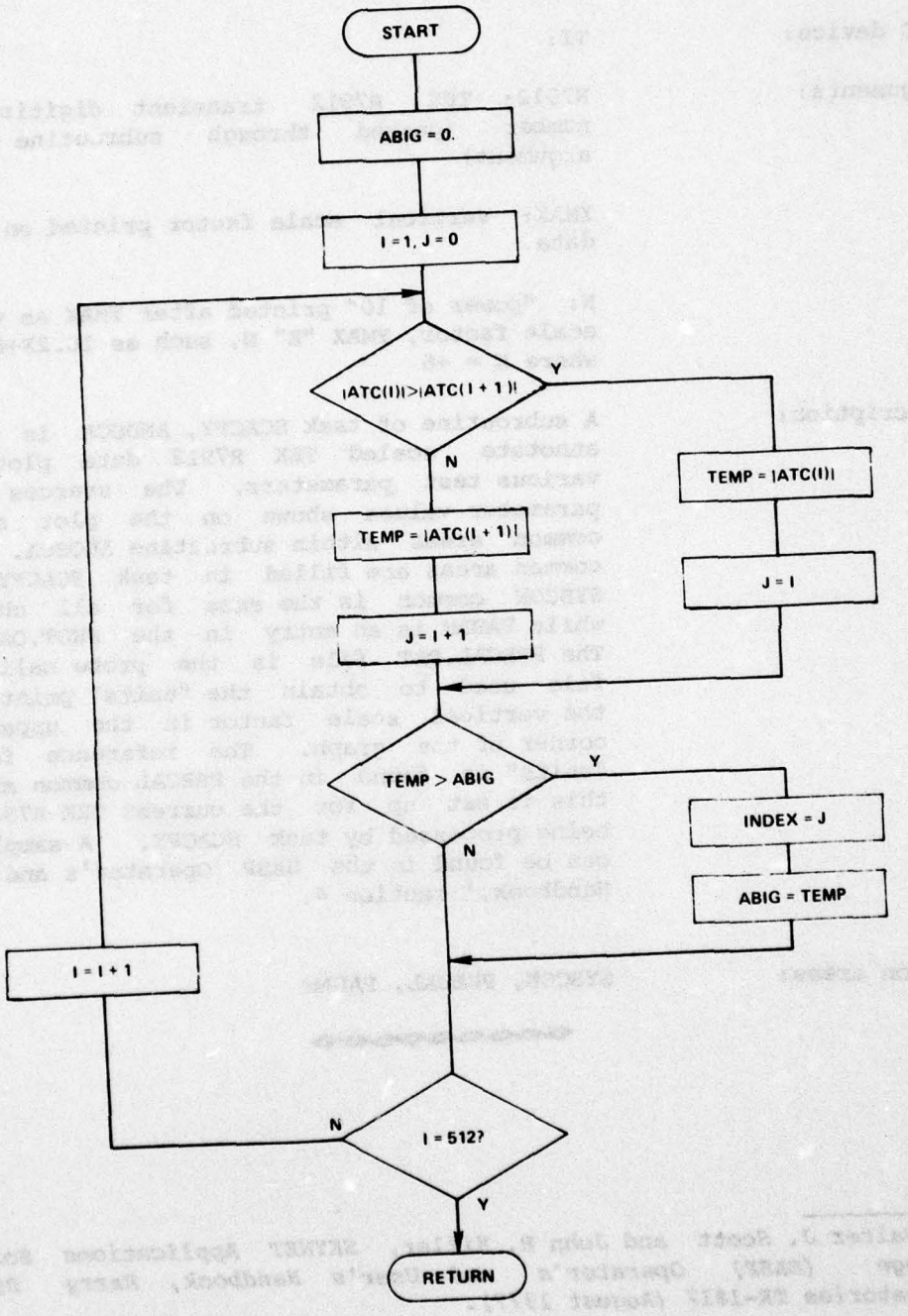
FORTRAN	Written May 1976
Arguments:	**ABIG:** returns magnitude of peak element of array ATC(512)
	INDEX: returns array index at which ABIG occurred
Description:	A subroutine of subroutines FIXAMP and GRASCA, ABSPKV is used to compute the absolute peak value of the array ATC. Its arguments ABIG and INDEX return the absolute peak value of ATC and its INDEX, respectively, to the calling routine.
Common area:	NORDAT

(See flowchart, p. 47.)

ANOMRK

FORTRAN	Written May 1976
I/O device:	TI:
Argument:	N7912: TEK R7912 unit number
Description:	A subroutine of task MARK, ANOMRK is used to annotate information onto the plots generated by task MARK. The TCS graphics routines are used to position the start point for all WRITE statements except the last one.
Common area:	SYSCON

Flowchart: ABSPKV



ANOSCA

FORTRAN	Written May 1976
I/O device:	TI:
Arguments:	N7912: TEK R7912 transient digitizer unit number (passed through subroutine GRASCA argument)
	YMAX: vertical scale factor printed on scaled data
	N: "power of 10" printed after YMAX as vertical scale factor, YMAX "E" N, such as 10.2E+6MA/DIV, where N = +6
Description:	A subroutine of task SCACPY, ANOSCA is used to annotate scaled TEK R7912 data plots with various test parameters. The sources for all parameter values shown on the plot are the common areas within subroutine ANOSCA. These common areas are filled in task SCACPY. The SYSCON common is the same for all channels, while PARAM is an entry in the SHOT.DAT file. The PRBCAL.DAT file is the probe calibration file used to obtain the "units" printed with the vertical scale factor in the upper left corner of the graph. The reference for the "units" is found in the PRBCAL common area and this is set up for the current TEK R7912 unit being processed by task SCACPY. A sample plot can be found in the SASP Operator's and User's Handbook,[1] section 4.
Common areas:	SYSCON, PRBCAL, PARAM

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

ANSWER

MACRO-11	Written May 1976
I/O device:	TI:
Argument:	ANSWER: 0 = NO, 1 = YES
Description:	Subroutine ANSWER inputs a single character from the terminal. If the input is null or a character other than "Y," a "0" is returned. A "1" is returned only if the character is a "Y." Standard SASP terminal input conventions apply.

ASDCD

MACRO-11	Written May 1976
Arguments:	Null flag: 1 = first character a blank 0 = input received -1 = field empty -2 = no such field
	Field number
	Output character string
	Number of characters desired for output string
Description:	Subroutine ASDCD parses an ASCII field from the terminal input buffer. There are three possible courses of action as a function of the null flag:
	Null flag of 0: The output string is blank filled, and characters are transferred from the field until the field is exhausted or the number desired is reached, whichever comes first.
	Null flag of 1: The first word of the output string is zeroed out.
	Null flag of -1 or -2: No action is taken. The output string is untouched.

ATNREF

MACRO-11	**Written May 1976**
File:	**DK0:[100,100] ATNCAL.DAT**
Argument:	**Entry point ARDENT: device ID**
Description:	**Multiple entry point subroutine ATNREF is centered about a common file descriptor block (FDB) for the ATNCAL.DAT file. The subroutine meets the file referencing needs of task ATN. The ATNCAL.DAT file is opened and closed with each call. The function of each entry point is as follows:**

AINIT: initialize last record pointer; clear current record pointer

ANEW: create new file with only end-of-file record

ARDENT: search file for entry matching given ID; returning entry with -1's implies "no such entry"

ARDNEX: read next entry (record)

ARESET: clear current record pointer

AWRADD: add record to end of file

AWRENT: rewrite current record

ATNSCH

MACRO-11	**Written May 1976**
File:	**DK0:[100,100] ATNCAL.DAT**
Argument:	**Device ID**
Description:	**Subroutine ATNSCH reads in the ATNCAL.DAT file entry for the given device ID. An entry of -1's indicates that there is no such entry. The ATNCAL.DAT file is opened and closed with each call.**

BASATC

MACRO-11	**Written April 1976**
Arguments:	**Bloom parameter**
	Error word
Description:	**Subroutine BASATC performs the ATC step of the normalization process for the baseline trace. The bloom parameter also is calculated as the average separation in points between dual verticals in the baseline data. An error code of 0009 is generated if the bloom is not from BLMMIN to BLMMAX or the number of dual verticals (only two) is less than NPTMIN. Those three variables are established in the SYMDEF Macro.[1]**

BUSY

MACRO-11	**Written April 1976**
Arguments:	**R1: digitizer UNIBUS address**
	R2: error word
Description:	**Subroutine BUSY allows the digitizer referenced at address R1 (register 1) CNTBZY seconds (see SYMDEF Macro[1]) to leave a busy status. If it does not, error code 0004 is generated (that is, BZYERR is placed in R2).**

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

CALATC

MACRO-11 — Written April 1976

Argument: — Bloom parameter

Description: — Subroutine CALATC performs the ATC step of the normalization process for the calibration trace. The bloom parameter is obtained from the digitizer entry in the SYSCON.DAT file by the calling routine. The parameter should be the number generated by a call to subroutine BASATC for a baseline trace after which the digitizer intensity was not changed.

CALCSF

MACRO-11 — Written May 1976

Files: — DK0:[100,100] SYSCON.DAT, DK0:[100,100] ATNCAL.DAT, DK0:[100,100] PRBCAL.DAT, DK0:[100,100] XCHCAL.DAT

Arguments: — Channel number

System gain in decibels

Description: — Subroutine CALCSF calculates the overall system delay in nanoseconds and gain in decibels. The delay is stored directly in SYSCON; the gain is returned to the calling routine for further processing.

Algorithms: — The individual task documentation for task SCALE is used for subroutine CALCSF.

CALIB

MACRO-11	Written July 1976
File:	DK0:[100,100] SYSCON.DAT
I/O devices:	TI:, attenuator control unit
Argument:	MODE: 0 = ON 1 = OFF 2 = calibration pulse
Description:	Subroutine CALIB controls the transmitters for task CAL. Commands are sent to the transmitters for all channels defined in SYSCON without considering the error flag. An error resulting from a command is listed and flagged only for an enabled channel.

CHKTRG

MACRO-11	Written March 1976
File:	DK0:[100,100] SYSCON.DAT
I/O devices:	TI:, digitizers
Description:	Subroutine CHKTRG checks each enabled digitizer for a trigger interrupt. An error code of 0006 is flagged and listed for digitizers without a trigger interrupt after a time of CNTCMD seconds. (See SYMDEF Macro.[1]) Since the interrupt handler, subroutine INTDIG, locks the memory of an interrupting digitizer, subroutine CHKTRG uses a locked memory status as the indication of interrupt.

[1]*Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

CHNERR

MACRO-11	Written April 1976
File:	DK0:[100,100] SYSCON.DAT
Arguments:	Error word
	Dummy argument
	Channel number
Description	Subroutine CHNERR flags a channel's error and disables the associated digitizers. A bit set (BIS) instruction is used so that no previous error flags are lost.

CLRCBD

MACRO-11	Written March 1976
I/O devices:	Digitizers
Argument:	Number of digitizer controller boards
Description:	Subroutine CLRCBD clears the digitizer controller boards, thereby disabling the interrupts. The addresses used are

$$ADRCB1 + n*1000_8,\ n = 0, 1, \ldots, m - 1,$$

where m is the argument passed and ADRCB1 is established by the SYMDEF Macro.[1]

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

CMDDIG

MACRO-11	Written July 1976
File:	DK0:[100,100] SYSCON.DAT
I/O devices:	TI:, digitizers
Arguments:	Set/clear mode (1/0)
	Command word
	Status word

Description: Subroutine CMDDIG sends commands to the enabled digitizers and confirms their execution. The subroutine can handle any command except "READ DATA." The status word sent to subroutine CMDDIG is the word that should be compared to the digitizer status word (with a BIT instruction) to confirm execution. If the status bits are set by the command, the mode should be "SET"; if they are cleared, the mode should be "CLEAR." For example, if the digital mode is desired,

```
CALL CMDDIG (1, "2015, "200) ,
```

since bit 7 is set for the digital mode. Command and status words are defined in the SYMDEF Macro.[1]

If a digitizer remains busy for CNTCMD seconds, it is flagged with an error code of 0004. If a command does not execute, repeated attempts are made until CNTCMD seconds have passed. After CNTCMD seconds, the digitizer is flagged with an error code of 0005.

The command is sent once to each digitizer before any is checked. The check/retry process involves one digitizer at a time. The manner of

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[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

the initial command was instituted to save time in switching to the digital mode for which each digitizer requires a few seconds. These times pass in parallel rather than adding together.

See Digitizer Commands and Status[1] for a description of arguments 2 and 3.

DATATC

MACRO-11 Written April 1976

Argument: Bloom parameter

Description: Subroutine DATATC performs the floating point equivalent of subroutine CALATC.

DATFIO

MACRO-11 Written July 1976

File: DK1:[100,100] file name

Argument: Entry points:

CLOSES	NONE
OPENS	1 = fnam, 2 = flen
READB	1 = arr, 2 = nblk, 3 = iblk
READR	1 = arr, 2 = len, 3 = recno
WRITEB	1 = arr, 2 = nblk, 3 = iblk
WRITER	1 = arr, 2 = len, 3 = recno

[1]*Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

where

fnam = array containing file name from byte 14 to byte flen

flen = position of last byte of file name in fnam

arr = start address for data transfer

nblk = number of blocks (256 words/block) for data transfer

iblk = initial block for data transfer

len = number of words for data transfer; must be even divisor of 256

recno = record number in file, assuming records of length len

Description: Subroutine DATFIO accesses the SASP data files. This subroutine performs block I/O at all times, but permits the user to simulate record I/O. Record transfers do not necessarily result in disk readouts or writeouts.

The functions of the entry points are as follows:

CLOSES: write out last block from a record transfer and close file

OPENS: open file and initialize flags and pointers

READB: read in blocks after writing out last block if record write transfer took place

READR: calculate block required and read it in if different from last block used in write transfer

WRITEB: write out blocks, reverse of READB

WRITER: write out block required, reverse of READR

DCDBIT

MACRO-11 — Written May 1976

Arguments: — Selection word

Table of 16 four-character codes

Output string

Description: — Subroutine DCDBIT selects entries from the table and places them in the output string. Each bit in the selection word corresponds to a table entry, bit 15 to the first and bit 0 to the last. Each set bit selects an entry in the table for placement in the output string. The length of the output string (in bytes) is four times the number of bits set in the selection word. The selection word is scanned from bit 15 to bit 0; the entries selected for output are placed in the output string in reverse numerical order.

DIGERR

MACRO-11 — Written April 1976

File: — DK0:[100,100] SYSCON.DAT

Arguments: — Error word

Digitizer number

Dummy argument

Description: — Subroutine DIGERR flags a digitizer's error and disables the associated channel (unless an enabled digitizer also is connected with the channel). A BIS instruction is used so that no previous error flags are lost.

DISABL

MACRO-11	**Written May 1976**
File:	**DK0:[100,100] SYSCON.DAT**
Arguments:	**For entry point DISCHN: channel number**
	For entry point DISDIG: digitizer number
Description:	**The function of each entry point is as follows:**
	DISCHN: sets disable bit of channel error word if all associated digitizers are in error
	DISDIG: sets disable bit of digitizer error word

ELIMPT

MACRO-11	**Written April 1976**
Argument:	**Array of 512 points**
Description:	**Subroutine ELIMPT carries out the noise point elimination step of the normalization process with floating point arithmetic for the data trace.**

ERRNUM

MACRO-11	**Written March 1976**
Arguments:	**Error word**
	Number of bit set
Description:	**Subroutine ERRNUM returns the number of the left-most bit set in the error word.**

EXTRAP

MACRO-11 Written April 1976

Description: Subroutine EXTRAP completes the normalization process for a baseline trace. The ends are extrapolated to provide a complete trace, and "256" is subtracted to place zero at the target center line.

FIELD

MACRO-11 Written April 1976

Arguments: Null flag: 1 = first character blank

0 = input received

-1 = field empty

-2 = no such field

Field number

Description: Subroutine FIELD searches and counts the characters in the selected field of the terminal input buffer. All fields but the first start with control I, and all but the last end with control I; the last ends with zero (NUL), since the buffer is zero filled before input.

Subroutine FIELD was designed to be used by ASDCD, FLDCD, and FXDCD, the terminal input buffer decoding subroutines.

Subroutine FIELD also determines the null flag.

FIXAMP

FORTRAN — Written May 1976

Arguments:

LARGE: 1 = amplitude too large, off TEK R7912 target

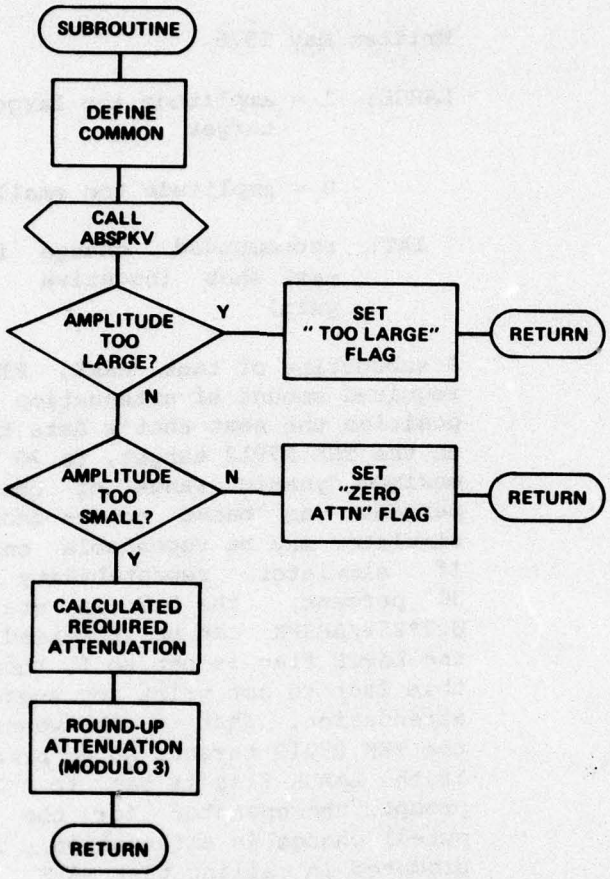
0 = amplitude too small or okay

IAT: recommended change in attenuator for next shot (negative value indicates gain)

Description: A subroutine of task MARK, FIXAMP computes the required amount of attenuation or gain needed to position the next shot's data trace, as recorded on the TEK R7912 target, to 70 percent of the maximum dynamic range of the system. Seventy percent was based on the fact that the OWL II simulator may be repeatable only to 30 percent. If simulator repeatability is better than 30 percent, the 0.7 in statement XATTN = 0.7*255/ABSPK can be increased accordingly. If the LARGE flag is set to 1, then task MARK uses this fact to *not* print any suggested change in attenuation. That is, the waveform peak is off the TEK R7912 target, so no prediction is made. If the LARGE flag is set to 0, argument IAT prompts the operator for the suggested (computed) change in attenuation. This change is prompted in calling task MARK.

Common area: NORDAT

Flowchart: FIXAMP



FLDCD

MACRO-11 Written April 1976

Arguments: Null flag: 1 = first character blank

0 = input received

-1 = field empty

-2 = no such field

Field number

Floating point variable

Description: Subroutine FLDCD decodes a floating point number from the selected field. The standard SASP terminal input conventions apply, particularly for the null flag.

There are two subfields separated by an "E" to the left of a floating point number. To the right is an integer exponent of no more than two digits. In each subfield, an odd number of minus signs gives a negative result. All other noninteger characters are ignored. The exponent is limited to keep the result within the limits of FORTRAN conventions. The subfield to the left is limited to seven digits. The exponent is then applied by multiplying or dividing by 10, depending on its sign. This step also includes the proper positioning of the decimal point in the original floating point number which was recorded with a counter incremented each time that an integer character to the right of the decimal point is introduced to the present intermediate result.

The field is searched from left to right.

FLGPTS

MACRO-11 March 1976

Description: Subroutine FLGPTS searches the raw digitizer data and flags points known to be bad. These points are the repeated horizontals, the last horizontal read, and the last horizontal on the target. Subroutine FLGPTS is used immediately after reading the raw data. The flag is the setting of bit 12 or using BADBIT from the SYMDEF Macro.[1] Any routines referencing raw data should check for this bit.

[1]*Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

FLOTE

MACRO-11

Written April 1976

Arguments:

Using general register four (R4) as a floating point stack pointer, subroutine FLOTE removes an integer from the stack and places the floating point equivalent on the stack.

Description:

Subroutine FLOTE converts an integer to a floating point. The subroutine is used with a stack pointed to by R4. This use minimizes the code for executing floating point operations that require the floating of an integer argument.

FXDCD

MACRO-11

Written April 1976

Arguments:

Null flag: 1 = first character blank

0 = input received

-1 = field empty

-2 = no such field

Field number

Integer variable

Description:

Subroutine FXDCD decodes an integer from the selected field. The standard SASP terminal input conventions apply, particularly for the null flag.

An odd number of minus signs gives a negative result. All other characters except integers are ignored, including the decimal point (for example, 2.4 is decoded to 24).

The field is searched from left to right.

GETBAS

MACRO-11	**Written April 1976**
Files:	**DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT**
I/O devices:	**TI:, digitizers**
Description:	**Subroutine GETBAS reads digitizers, normalizes baseline traces, and stores the results in the MAIN.DAT file for all enabled digitizers. Error conditions are flagged and listed.**
	The normalized baseline trace is checked for proper positioning. The bloom parameter is calculated, checked, and stored, and the knob readout is checked.
	The baseline traces are written into the MAIN.DAT file beginning at the block pointed to by the first virtual block number (VBN) in SYSCON. Anything stored there previously (particularly another baseline) is overwritten.

GETCAL

MACRO-11	**Written April 1976**
Files:	**DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT**
I/O devices:	**TI:, digitizers**
Description:	**Subroutine GETCAL reads digitizers, normalizes calibration traces, and stores the results in the MAIN.DAT file. This reading includes the previously stored baseline traces for use in subroutine ISBASE and provides the bloom factor stored in SYSCON to subroutine CALATC. The KR0 is checked. All these functions are done for each enabled digitizer. Error conditions are flagged and listed.**

The traces are written into the MAIN.DAT file beginning at the block pointed to by the second VBN in SYSCON. Anything stored there previously is overwritten.

GETDAT

MACRO-11 — Written April 1976

Files: — DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT

I/O devices: — TI:, digitizers

Description: — Subroutine GETDAT reads the digitizers and stores the raw data for all digitizers that are enabled. The only error condition is 0015, which is caused by having a previous error. It is flagged and listed.

The raw data are stored in the MAIN.DAT file by using the third VBN in SYSCON as a pointer. Previous entries are overwritten.

GRAATC

FORTRAN — Written July 1976

I/O device: — TI:

Arguments:

ISIZE: graph size parameter--one, largest; three, smallest; takes on value 1, 2, or 3

ITYPE: takes on value 1 for ATC, 2 for CAL, 3 for BASE, or 4 for RAW data waveforms

N7912: TEK R7912 transient digitizer unit number

Description: Subroutine GRAATC graphs normalized, floating point data waveforms on the TEK R4010 console. Parameters ISIZE, ITYPE, and N7912 are not used internally; they are passed onto subroutine GRAT.

Common area: NORDAT

GRABAS

FORTRAN Written July 1976

I/O device: TI:

Arguments:

ISIZE: graph size parameter--one, largest; three, smallest; takes on value 1, 2, or 3

ITYPE: takes on value 1 for ATC, 2 for CAL, 3 for BASE, or 4 for RAW data waveforms

N7912: TEK R7912 transient digitizer unit number

Description: Subroutine GRABAS graphs normalized, integer baseline data on the TEK R4010 console. By acquiring baseline sweeps prior to each shot, the STARS console operator can determine if the bloom (intensity) on each TEK R7912 is set properly. Under normal circumstances, a printout of the bloom parameter is sufficient, and running subroutine GRABAS is not required.

Common area: BASDAT

GRACAL

FORTRAN Written July 1976

I/O device: TI:

Arguments:

ISIZE: graph size parameter--one, largest; three, smallest; takes on value 1, 2, or 3

ITYPE: takes on value 1 for ATC, 2 for CAL, 3 for BASE, or 4 for RAW data waveforms

N7912: TEK R7912 transient digitizer unit number

Description; Subroutine GRACAL graphs normalized, integer calibration (CAL) data waveforms on the TEK R4010 console

Common area: CALDAT

GRARAW

FORTRAN Written May 1976

I/O device: TI:

Arguments: ISIZE: graph size parameter--one, largest; three, smallest; takes on value 1, 2, or 3

N7912: TEK R7912 transient digitizer unit number

Description: A subroutine of task RAWCPY, GRARAW plots raw (unnormalized) data waveforms on the TEK R4010 console. The arguments are not used internally, but are passed to other subroutines.

GRASCA

FORTRAN Written May 1976

I/O device: TI:

Arguments: N7912: passed through to subroutine ANOSCA, current TEK R7912 transient digitizer

YMAX: passed through to subroutine ANOSCA, vertical scale factor is printed on scaled data

N: passed through to subroutine ANOSCA; power of 10 is printed after YMAX as vertical scale factor in YMAX"E" N UNITS/DIV; for example 0.1E-5 GAUSS/DIV; power of 10 of scaled data in ATC array; N = -5

Description: A subroutine of task SCACPY, GRASCA automatically rescales the normalized, scaled data so that the vertical units/division factor is adjusted to a readily interpretable value. For example, 1.0, 0.5, and 0.25 V/division aid the operator when he mentally interpolates points of interest on a graph, whereas 0.333 is not readily interpretable. Next, subroutine GRASCA calls subroutine GRAT, which defines the virtual graph window y-coordinates in terms of the easily interpretable Y (units/division) values computed in subroutine GRASCA--vertical range coordinates YMAX and YMIN.

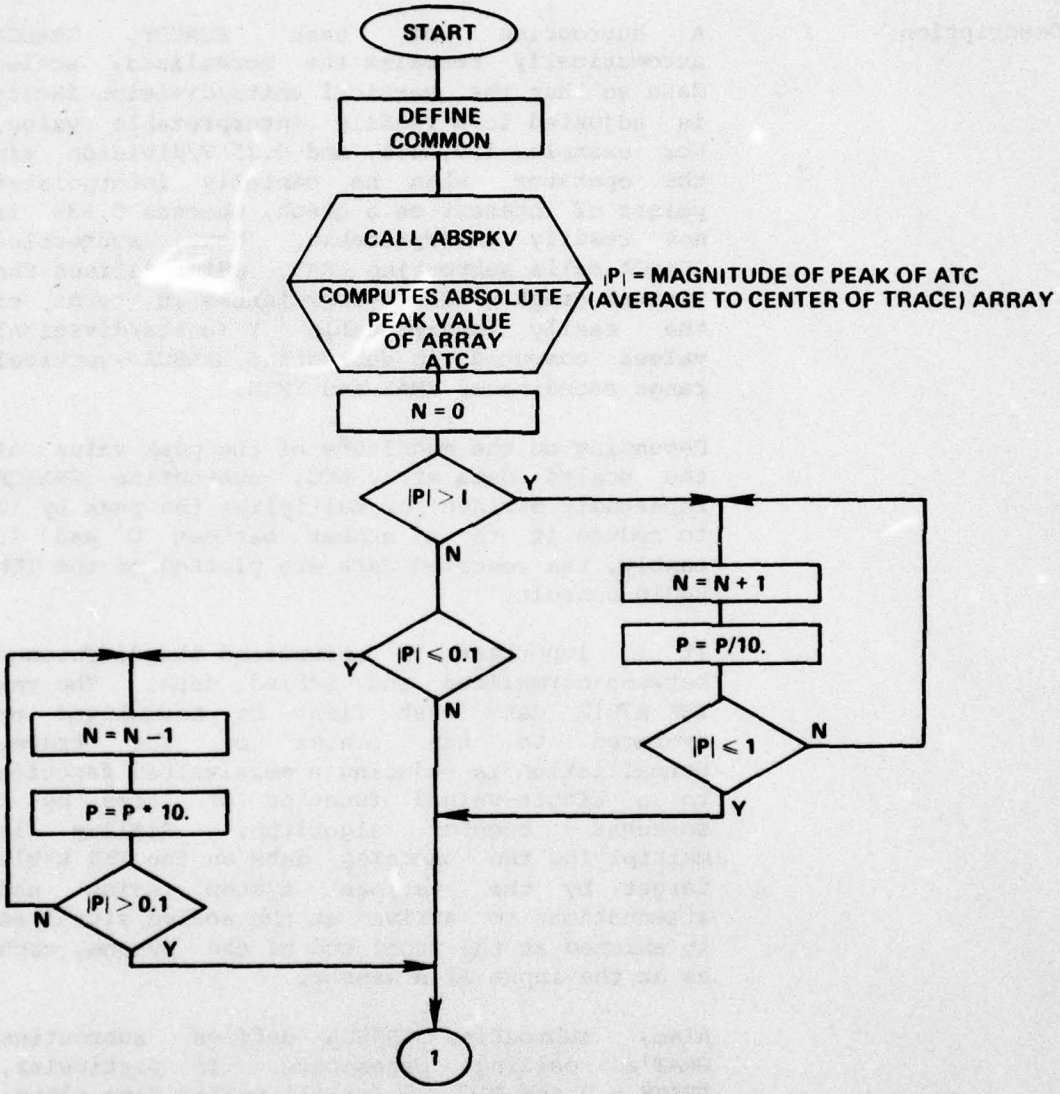
Depending on the magnitude of the peak value of the scaled data array ATC, subroutine GRASCA repeatedly divides or multiplies the peak by 10 to reduce it to a number between 0 and 1. Lastly, the rescaled data are plotted on the TEK R4010 console.

It is important to understand the difference between normalized and scaled data. The raw TEK R7912 data must first be normalized or averaged to the center of the trace. Normalization is reducing a multivalued function to a single-valued function of time by a somewhat complex algorithm. Scaling is multiplying the unscaled data on the TEK R7912 target by the various system gains and attenuations to arrive at the scaled signal as it existed at the front end of the system, such as at the input of a sensor.

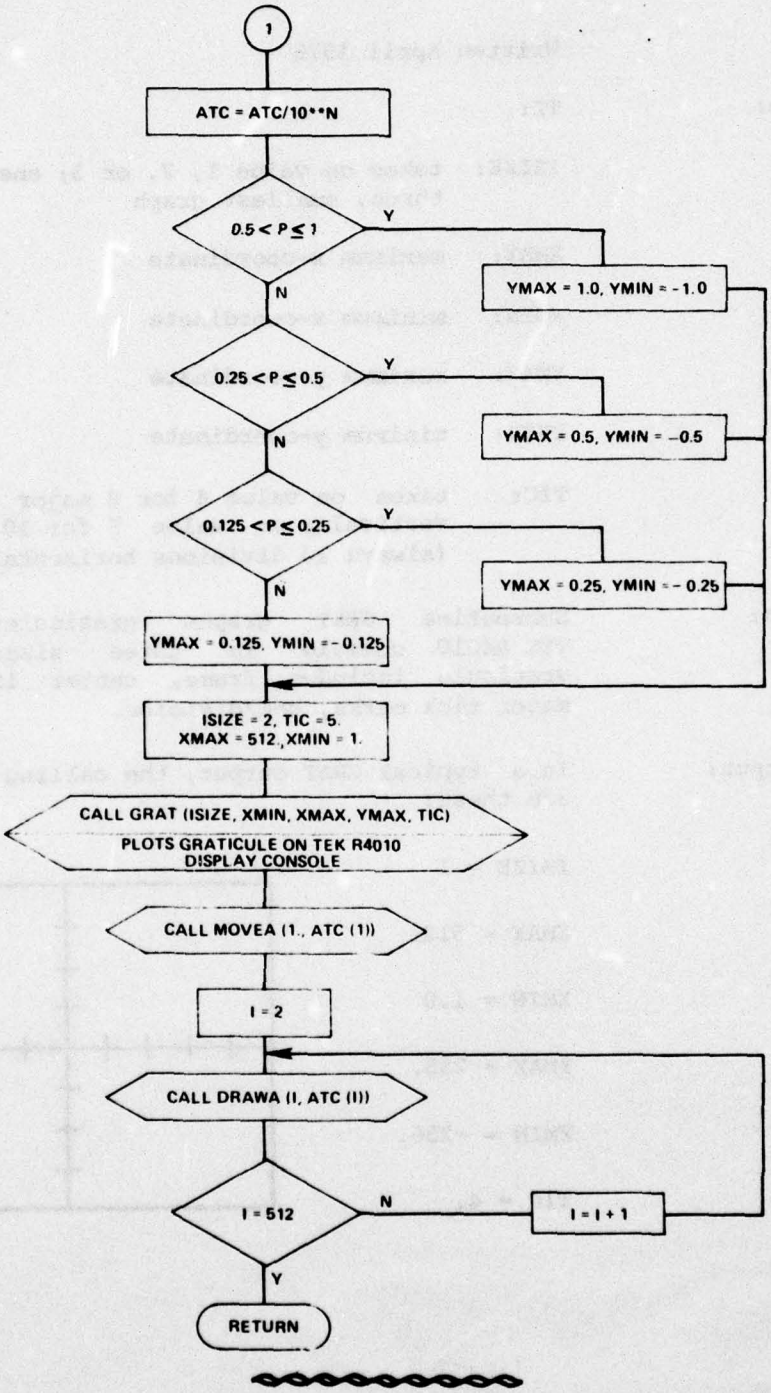
Also, subroutine GRASCA defines subroutine GRAT's calling parameters. In particular, ISIZE = 2 and TIC = 5 for all scaled data plots.

Common areas: SYSCON, NORDAT, PRBCAL, PARAM

Flowchart: GRASCA



Flowchart: GRASCA (Cont'd)



GRAT

FORTRAN — Written April 1976

I/O device: TI:

Arguments:

ISIZE: takes on value 1, 2, or 3; one, largest; three, smallest graph

XMAX: maximum x-coordinate

XMIN: minimum x-coordinate

YMAX: maximum y-coordinate

YMIN: minimum y-coordinate

TIC: takes on value 4 for 8 major divisions vertically or value 5 for 10 divisions (always 10 divisions horizontally)

Description: Subroutine GRAT graphs graticules on the TEK R4010 console in three sizes. Each graticule includes frame, center lines, and major tick marks, one/division.

Typical output: In a typical GRAT output, the calling arguments are these:

ISIZE = 1

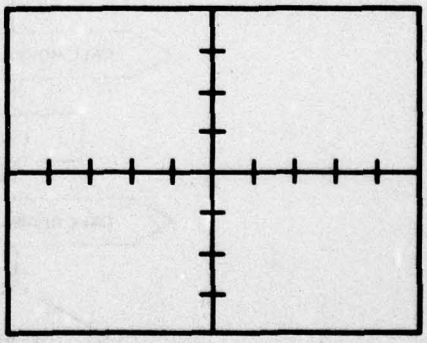
XMAX = 512.

XMIN = 1.0

YMAX = 255.

YMIN = -256.

TIC = 4.



The coordinates discussed are virtual and do not determine the actual graticule size displayed on the TEK R4010 console. See the TEK TCS manual for details.[4]

IASCII

MACRO-11 Written April 1976

Arguments: One- to four-digit integer

Left half of ASCII equivalent

Right half of ASCII equivalent

Description: Subroutine IASCII converts the integer into four ASCII digits by dividing by successively smaller powers of 10, adding 60_8 to the quotient, and using the remainder in the next step.

IFICKS

MACRO-11 Written April 1976

Arguments: Using R4 as a floating point stack pointer, subroutine IFICKS removes a floating point number from the stack and places the truncated integer equivalent on the stack.

Description: Subroutine IFICKS is the inverse of subroutine FLOTE. It converts a floating point number to an integer in a manner structured for use with a stack pointer of R4.

[4] *PLOT-10/Terminal Control System User's Manual, Tektronix, Inc., Document No. 062-1474-00 (1974).*

INPCSR

FORTRAN — Written May 1976

I/O device: TI:

Description: A subroutine of task MARK, INPCSR graphically inputs the time (x) coordinate of certain points on the graphic representation of the TEK R7912 data as plotted on the TEK R4010 console. In particular, three x-coordinates are input by using the graphic input cursor feature of the TEK TCS graphics software. The subroutine prints a message to prompt the operator to begin marking the data. The operator then positions the displayed y-coordinate cursor (the x-coordinate cursor is displayed but not required) to the point of interest on the displayed data plot and hits any key followed by a RETURN. This process is repeated three times to input the following parameters: (1) time of peak of fiducial, (2) time of start of data, and (3) time of peak of interest. Subroutine INPCSR then transfers these parameters to common area PARAM. The PARAM entry in the SHOT.DAT file is then updated in task MARK.

Common area: PARAM

INPUT

MACRO-11 — Written May 1976

I/O device: TI:

Argument: Null flag: -2 = immediate CR

0 = not immediate CR

Description: Subroutine INPUT inputs up to 80 characters from logical unit number (LUN) 5 to the terminal input buffer. The character count is checked for being zero to set the null flag properly.

The buffer is zero filled to begin. Those bytes not filled by subroutine INPUT remain zero.

The SASP terminal input conventions apply.[1]

INT

MACRO-11 — Written May 1976

Arguments: Start point as FORTRAN subscript

Sweep rate in nanoseconds

Description: Subroutine INT carries out trapezoidal integration of a floating point data trace. The time increment (Δt) is calculated in seconds, based on the sweep rate and the fixed spacing of horizontal digitizer points. The integration begins at the selected start point with a value of zero. The data before the start point are multiplied by Δt so they are of the same magnitude as the integrated portion to facilitate graphing the result. The data before the start point do not contribute to the integral.

Algorithm:

$$y'_n \begin{cases} y_n \times \Delta t , & n = 1, 2, \ldots, m - 1, \\ 0 , & n = m , \\ \dfrac{y_n + y_{n-1}}{2} \Delta t , & n = m + 1, m + 2, \ldots, 512, \end{cases}$$

$$\Delta t = \frac{1 \text{ point} \times S_{ns} \text{ (ns/div)}}{(51.2 \text{ points/div})(10^9 \text{ ns/s})} ,$$

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

where

y'_n = resulting vertical (selected units),

y_n = initial vertical (selected units/S),

m = start point subscript,

S_{ns} = sweep rate in nanoseconds.

The formula for Δt is based on a change in the x-coordinate of 1 point (512 points in 10 divisions).

INTABL

MACRO-11 — Written March 1976

I/O devices: — Digitizers

Argument: — Number of digitizer controller boards

Description: — Subroutine INTABL enables digitizer interrupts by setting the enable bit of the controller status word. The addresses used are

$$\text{ADRCB1} + n \times 1000_8 \ , \quad n = 0, 1, \ldots, m - 1 \ ,$$

where m is the argument passed and ADRCB1 is established by the SYMDEF Macro.[1]

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

INTDIG

MACRO-11 Written April 1976

I/O devices: Digitizers

Description: Subroutine INTDIG is an interrupt routine for handling digitizer interrupts. The only action taken is to lock the memory.

There is a separate entry point for each digitizer controller board:

INSCB1: board No. 1
INSCB2: board No. 2
INSCB3: board No. 3
INSCB4: board No. 4

Each path is reentrant. The address of the interrupting unit is calculated from the address of the controller board and the device number is placed in the controller status word.

INTRP

MACRO-11 Written April 1976

Argument: Array address

Description: Subroutine INTRP fulfills the interpolation step in the normalization for the data trace. Floating point arithmetic is used.

ISBASE

MACRO-11 Written April 1976

Description: Subroutine ISBASE performs baseline subtraction for the calibration trace. It also subtracts

"256." Both are steps in the normalization. Integer arithmetic is used.

LSTERR

MACRO-11 Written May 1976

I/O device: TI:

Arguments: Error word

Digitizer number or zero

Zero or channel number

Description: Subroutine LSTERR lists either a digitizer error or a channel error. If the second argument is nonzero, the digitizer is listed. Otherwise, the channel is listed; the message is printed with a QIO$ to LUN 5 and includes ringing the terminal bell.

MINMAX

MACRO-11 Written April 1976

Arguments: Integer array

Array size

Maximum

FORTRAN subscript of maximum

Minimum

FORTRAN subscript of minimum

Description: Subroutine MINMAX scans the input array, picks the maximum and minimum (signed) values, and records their positions within the array. These positions are then converted to FORTRAN subscripts.

MRKCUR

FORTRAN Written May 1976

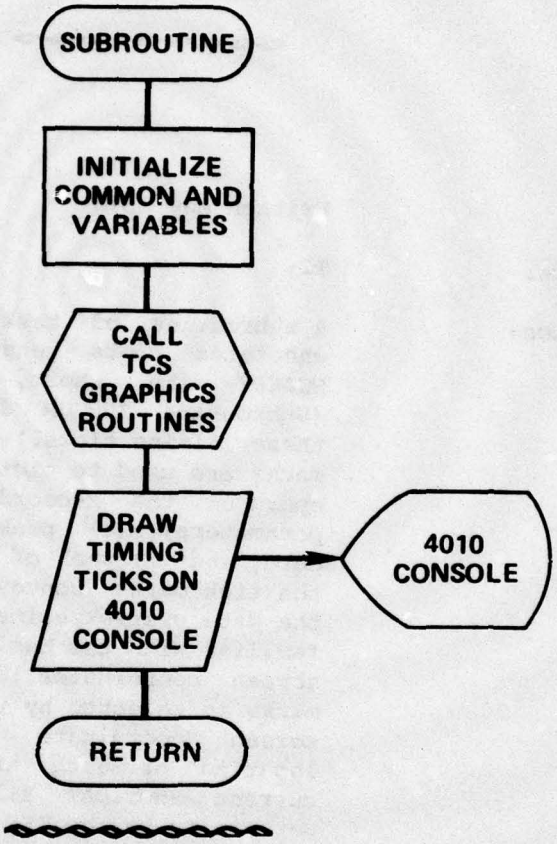
I/O device: TI:

Description: A subroutine of tasks MARK and SCACPY, MRKCUR annotates plots generated in tasks MARK and SCACPY with short, vertical timing ticks. (Subroutine INPCUR details the selection of these timing ticks.) In task MARK, the tick marks are used to picture for the data terminal operator the x-coordinates for three timing parameters: (1) peak of fiducial, (2) start of data, and (3) peak of interest. In task SCALE, the tick marks convey identical information to the data user/experimenter. (The reader must be familiar with the basic concepts of virtual and screen coordinates.) The position of the tick marks is selected by using the TEK TCS graphics screen coordinate system. Actually, the location of each tick mark is stored in the current SHOT.DAT file in the PARAM entry pertaining to the TEK R7912 whose data are being plotted. Since these data are stored as 512 vertical values, the corresponding horizontal values are numbered 1 to 512. Therefore, the locations of the timing marks are numbers between 1 and 512. To draw the timing marks on the scaled data (task SCACPY), it was necessary to convert the mark position in TEK TCS virtual coordinates to screen coordinates and add the distance from the left edge of the screen to the left edge of the graph to this value. Doing so avoided the problem of having to locate the ticks vertically in virtual coordinates, the solution of which locating would have

unnecessarily lengthened and complicated the routine.

Common area: PARAM

Flowchart: MRKCUR



PAGE

FORTRAN Written June 1976

I/O device: TI:

Description: Subroutine PAGE erases the screen of the TEK R4010 console or issues eight-line feeds on the LA36 teletype. It determines the terminal being used by a GETLUN (get logical unit number) executive call and checks the terminal buffer size. If the size is 132, the terminal is the

LA36, and a FORTRAN WRITE statement with a "1" FORMAT is issued. If the size is not 132, a TEK TCS ERASE statement is used to erase the screen.

PLTSF

FORTRAN — Written April 1976

I/O device: TI:

Description: A subroutine of subroutine GRARAW, PLTSF annotates the TEK R7912 vertical and horizontal scale factors onto one of three different-size plots. In addition, the TEK R7912 unit number and the type of data being plotted are annotated beneath the plot.

Common area: SYSCON

PRBREF

MACRO-11 — Written May 1976

File: *DK0:[100,100] PRBCAL.DAT*

Argument: Entry point PRDENT: probe identification

Description: A *multiple* entry point subroutine, PRBREF is centered at a common FDB for the PRBCAL.DAT file. The subroutine meets the file referencing needs of task PRB. The file is opened and closed with each call. The function of each entry point is as follows:

PINIT: initialize last record pointer; clear current record pointer

PNEW: create new file with only end-of-file record

PRDENT: search file for entry matching given identification; returning entry with -1's implies "no such entry"

PRDNEX: read next entry (record)

PRESET: clear current record pointer

PWRADD: add record to end of file

PWRENT: rewrite current record

PRBSCH

MACRO-11 — Written May 1976

File: — DK0:[100,100] PRBCAL.DAT

Argument: — Probe ID

Description: — Subroutine PRBSCH reads the PRBCAL.DAT file entry for the given probe ID. An entry of -1's indicates that there is no such entry. The file is opened and closed with each call.

PRICLR

MACRO-11 — Written July 1976

I/O device: — LP0:

Arguments: — τ_o clock count at trigger

Sample count on calorimeter channel A

Sample count on calorimeter channel B

Description: — Subroutine PRICLR quickly dumps the raw calorimeter data. They are printed in five columns of 20 time-amplitude pairs with the time first. The units are 10 μs for the time and 1.95 μV for the amplitude. Such a data set is printed for each calorimeter channel and contained on one page. Channel A is in the top half and labeled "TP3"; Channel B is in the bottom half and labeled "2B."

The integers stored in the PSECT (program section) CLRDAT by the EG&G routine INITLZ are converted to ASCII by dividing by successively smaller powers of 10. Before they are, however,

the entries beyond the sample count are cleared, and the τ_o time is subtracted from the time values.

QKELIM

MACRO-11 — Written April 1976

Argument: — 512 integer array

Description: — Subroutine QKELIM carries out the noise point elimination step of the normalization for baseline and calibration traces. Integer arithmetic is used.

QKLNTP

MACRO-11 — Written April 1976

Argument: — 512 integer array

Description: — Subroutine QKLNTP carries out the interpolation step of the normalization for baseline and calibration traces. Integer arithmetic is used.

RAWPLT

MACRO-11 — Written May 1976

Description: — A subroutine of subroutine GRARAW, RAWPLOT conditions the raw data array and pointers for plotting. The raw data are passed through IRAW, a 2046-element array in which each word corresponds to a horizontal, vertical, or missing horizontal address on the TEK R7912 diode matrix target. Subroutine RAWPLT counts the number of vertical lines associated with each horizontal setting and stores that value in the corresponding element of IHPTR (the horizontal pointer array). Also, the horizontal addresses are reordered to the range 1 to 512 (from 1023 to 512, originally).

Common areas: — HPTR, RAWDAT

RDIG

MACRO-11 Written April 1976

Arguments: Digitizer UNIBUS address

Error word

Description: Subroutine RDIG reads and verifies the raw data from the digitizer specified. During the first reading, the number of data points is counted, and a pointer to the first horizontal on the target is set. A second reading compares words with the first. More than MISMAX errors causes a complete repetition. More than TRYMAX repetitions causes the generation of error code 0007. (TRYMAX and MISMAX are parameters defined by the SYMDEF Macro.[1])

At each data word read, the digitizer is checked for a busy status with the subroutine BUSY. Such a status generates error code 0004.

No more than RAWMAX points are stored (plus knob readout). After that number, the reading is completed, but the remaining words are not stored, and an error code 0002 is generated. If after the reading and verification fewer than RAWMIN points are found, error code 0003 is generated. The RAWMAX and RAWMIN parameters are defined by the SYMDEF Macro.[1] Their values should be based on the consideration that two vertical addresses per horizontal point are ideal and gives a total number of raw data points 512 + 2×512 or 1536. Any raw data trace with a number of points significantly different from 1536 proves difficult to normalize.

The data points and knob readout data are stored in the order read from the digitizer. Since the read gun begins in an arbitrary location and wraps around, the first horizontal point read is rarely the first horizontal point on the target.

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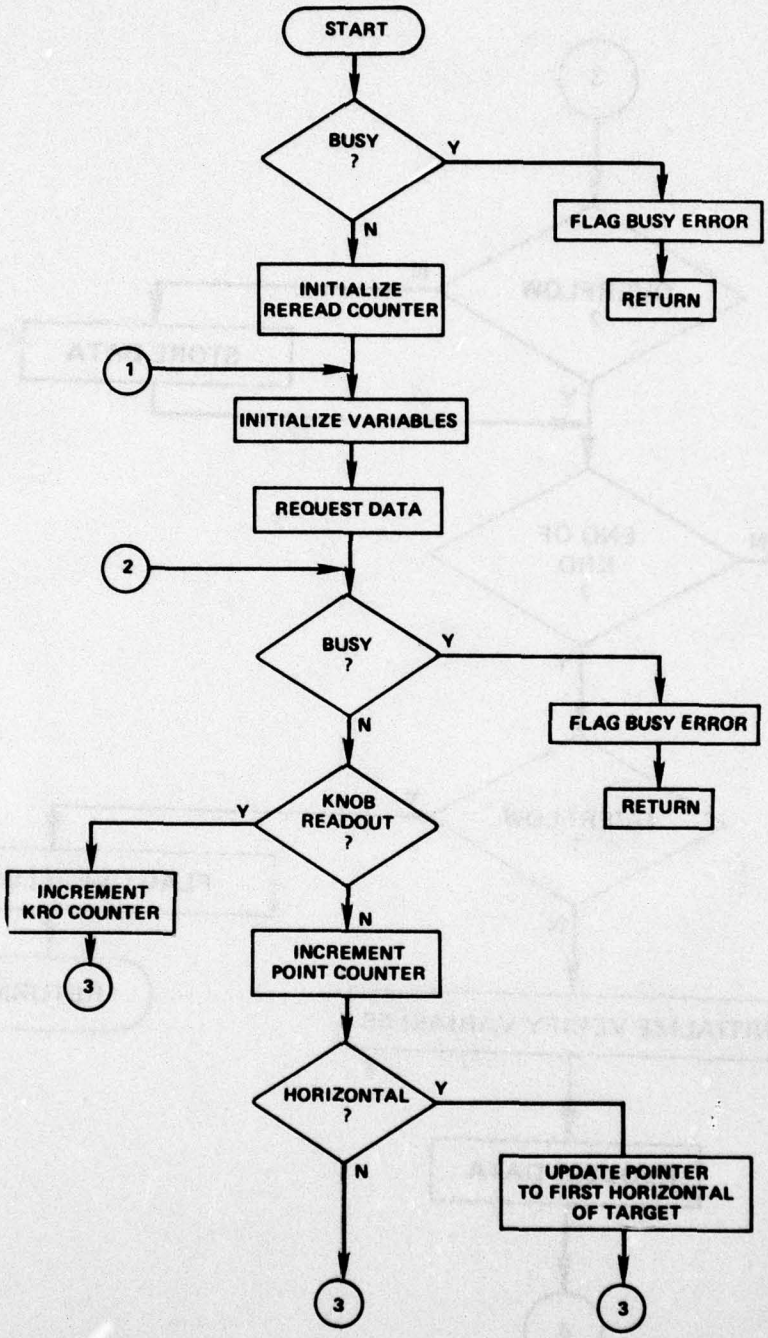
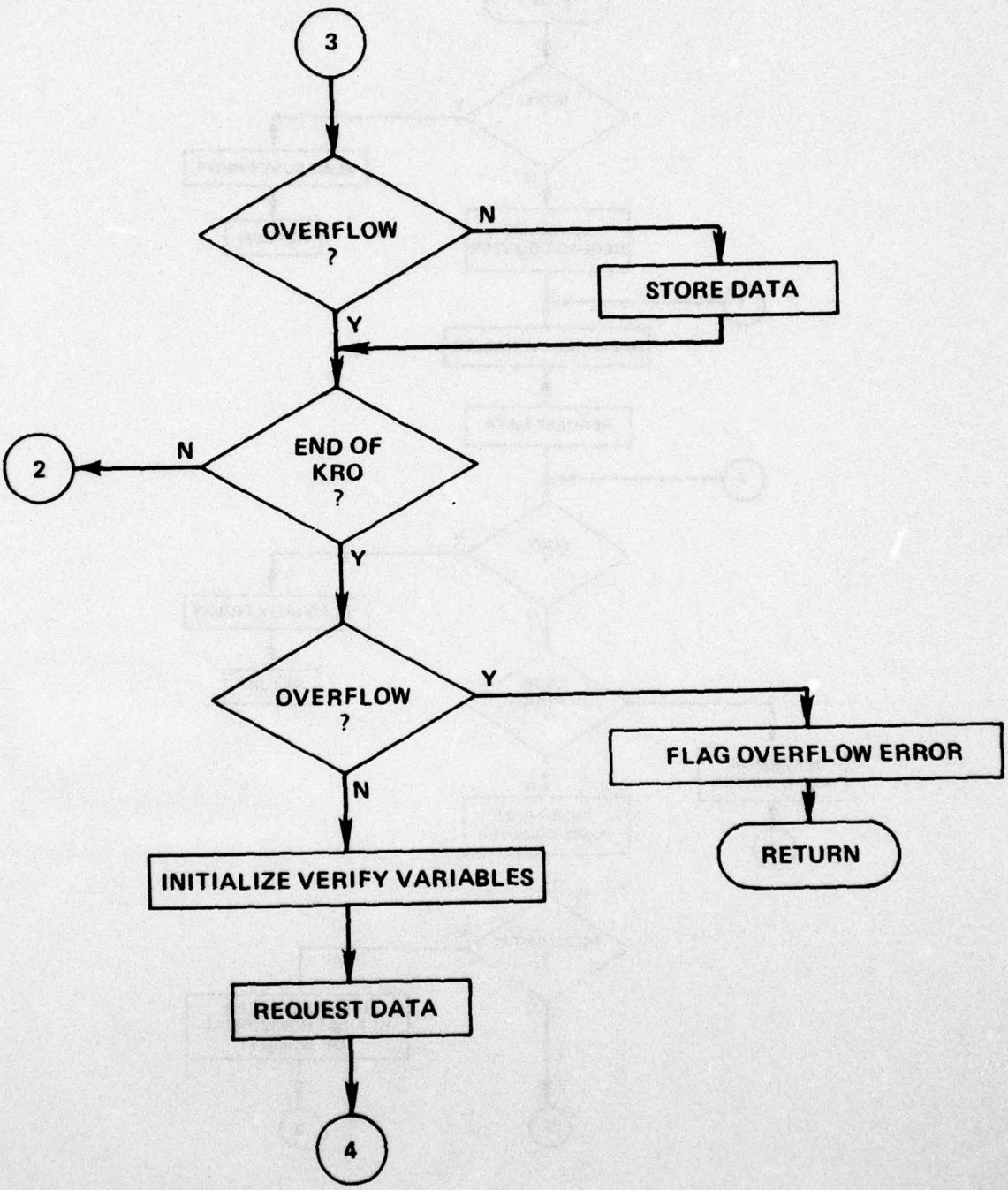
[1]*Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

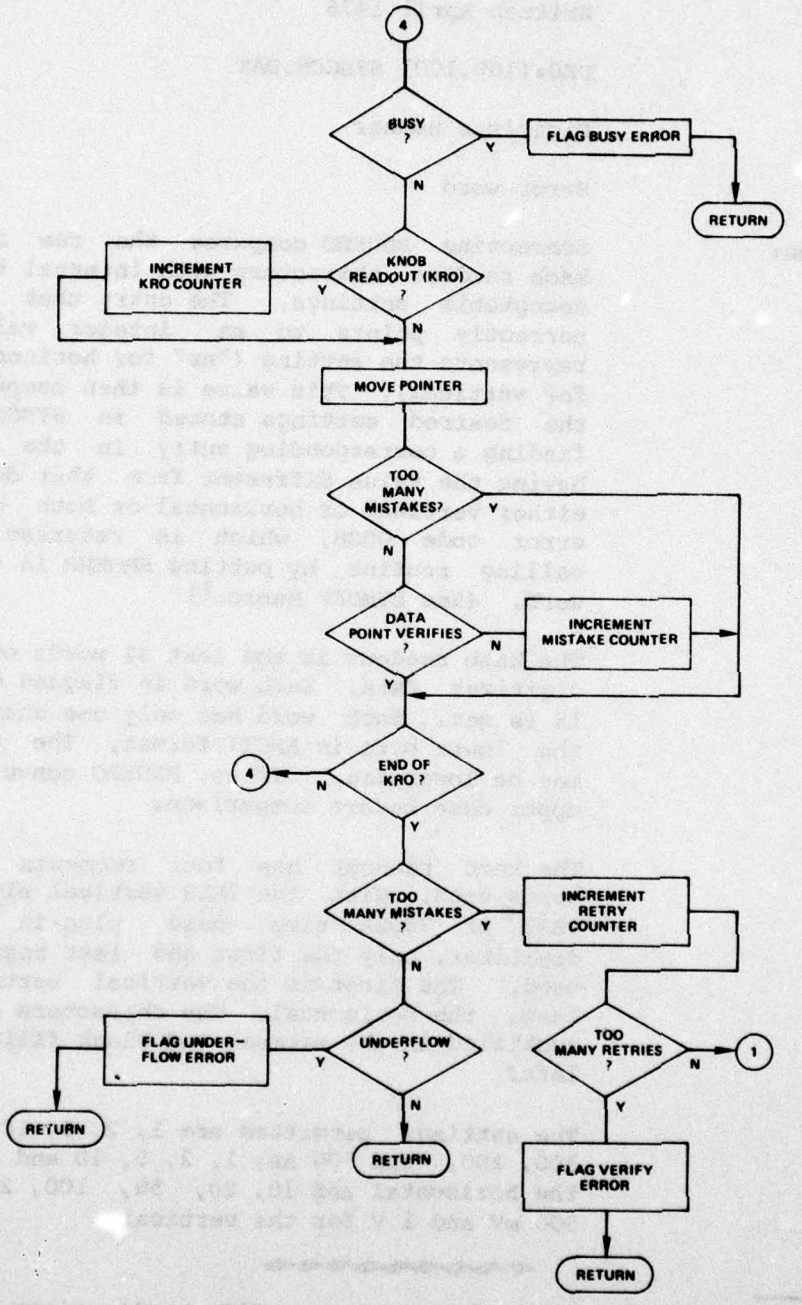
Flowchart: RDIG



Flowchart: RDIG (Cont'd)



Flowchart: RDIG (Cont'd)



RDUKRO

MACRO-11	Written April 1976
File:	DK0:[100,100] SYSCON.DAT
Arguments:	Digitizer number
	Error word

Description:

Subroutine RDUKRO compares the raw digitizer knob readout characters with internal tables of acceptable settings. The entry that compares correctly points to an integer value that represents the setting ("ns" for horizontal, "V" for vertical). This value is then compared with the desired settings stored in SYSCON. Not finding a corresponding entry in the table or having the value different from that desired on either vertical or horizontal or both generates error code 0008, which is returned to the calling routine by putting KROERR in the error word. (See SYMDEF Macro.[1])

The knob readout is the last 32 words of the raw digitizer data. Each word is flagged when bit 15 is set. Each word has only one character in the lower byte in ASCII format. The character may be lowercase. If so, RDUKRO converts it to upper case before comparison.

The knob readout has four segments of eight words each. With the 7A19 vertical plug-in and 7B92 or 7B92A time base plug-in in the digitizer, only the first and last segments are used. The first is the vertical setting; the last, the horizontal. The characters are right justified in the segment and blank filled to the left.

The settings permitted are 1, 2, 5, 10, 20, 50, 100, 200, and 500 ns; 1, 2, 5, 10 and 20 µs for the horizontal and 10, 20, 50, 100, 200, and 500 mV and 1 V for the vertical.

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

SCADAT

MACRO-11	**Written May 1976**
Files:	**DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT**
I/O device:	**TI:**
Description:	**Subroutine SCADAT normalizes and scales the raw data and stores the result in the MAIN.DAT file at the location pointed to by the fourth VBN in SYSCON. The subroutine functions thus only for enabled digitizers.**
	The standard normalization for data traces is followed. Baseline and raw data are read in from the MAIN.DAT file. The scale factor is obtained from SYSCON (which is already in core). The knob readout is checked. This check produces the only standard error of 0008 and does not prevent properly scaled data from being placed in the MAIN.DAT file. However, that digitizer is now disabled and must be reenabled before the data can be accessed.
Algorithms:	**See documentation for task SCALE in section 2.**

SCGEN

MACRO-11	**Written May 1976**
File:	**DK0:[100,100] SYSCON.DAT**
Description:	**Subroutine SCGEN creates a new SYSCON.DAT file and writes into it the contents of the SYSCON common area. The number of blocks allocated and written is NSCBLK. (See SYMDEF Macro.[1])**

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

SCIO

MACRO-11 Written April 1976

File: DK0:[100,100] SYSCON.DAT

Description: Dual entry point subroutine SCIO is centered at a common FDB for the SYSCON.DAT file. The entry point functions are as follows:

SCIN: read in SYSCON

SCOUT: write out SYSCON

The number of blocks read or written is defined by NSCBLK in the SYMDEF Macro.[1]

SCMAIN

MACRO-11 Written April 1976

Files: DK0:[100,100] SYSCON.DAT, DK1:[100,100] MAIN.DAT

Description: Subroutine SCMAIN writes the contents of the SYSCON common area into the first NSCBLK's of the MAIN.DAT file and renames the MAIN.DAT file to correspond to the standard shot file name as described in the SASP data file documentation.[1] The variable NSCBLK is defined in the SYMDEF Macro.[1]

SETVEC

MACRO-11 Written March 1976

I/O devices: Digitizers

Description: Subroutine SETVEC sets up the digitizer interrupt vectors and priorities. The addresses for the vectors are the entry points of subrou-

[1]*Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

tine INTDIG. The priority is PRIDIG ((digitizer priority) as defined by the SYMDEF Macro.[1]

STCDAT

MACRO-11 — Written May 1976

File: — DK0:[100,100] SYSCON.DAT

Description: — Subroutine STCDAT transfers the six most significant words of the eight returned by a GTIM (get time) executive directive at trigger time into the date and time storage locations in the SYSCON common area. The words are transferred from the TIME PSECT. It is assumed that the date and time storage locations in SYSCON are contiguous and in that order. These locations are in the header of SYSCON.

SUBASE

MACRO-11 — Written April 1976

Description: — Subroutine SUBASE subtracts the baseline and "256" from a data trace. End gaps in the data are set to zero. These are the final three steps of the normalization. Floating point arithmetic is used.

UCOUT

MACRO-11 — Written May 1976

Files: — DK0:[100,100] SYSCON.DAT, DK1:[100,100] shot file

Description: — Subroutine UCOUT writes the user comments to the shot file at the location pointed to by the sixth VBN in SYSCON. The shot number and simulator code for the shot file name are obtained from the SYSCON header. The comments

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

are assumed to have been stored in the channel entry section of the SYSCON PSECT. (The original channel information is to have been overwritten only in core by the calling task.)

The number of blocks written is calculated from the sixth VBN and the total number of blocks for the shot file.

XCHDRI

MACRO-11 Written May 1976

File: DK0:[100,100] XCHCAL.DAT

Description: Subroutine XCHDRI opens the XCHCAL.DAT file, reads in the header section (the first three records), and closes the file. The header is then present in the XCHADR common area.

XCHREF

MACRO-11 Written May 1976

File: DK0:[100,100] XCHCAL.DAT

Argument: Entry point: XNEW: number of channels
XRDENT: channel number
XWRENT: channel number

Description: Multiple entry point subroutine XCHREF is centered at a common FDB for the XCHCAL.DAT file. The subroutine meets the file referencing needs of task XCH. The XCHCAL.DAT file is opened and closed with each call. The function of each entry point is as follows:

XNEW: create new file large enough to hold number of channels given

XRDENT: read in entry for channel number given (goes to XCHCAL PSECT)

XRDHDR: read in three records of header information (goes into XCHHDR PSECT)

XWRENT: write out entry for channel number given from XCHCAL PSECT

XWRHDR: write out header information from XCHHDR PSECT

XCHSCH

MACRO-11 Written May 1976

File: DK0:[100,100] XCHCAL.DAT

Argument: Channel number

Description: Subroutine XCHSCH reads in the entry in the XCHCAL.DAT file for the channel number given. The entry is placed in the XCHCAL PSECT.

XMIT

MACRO-11 Written April 1976

File: DK0:[100,100] SYSCON.DAT

I/O devices: TI:, attenuator control unit

Argument: Mode 0 = on
1 = off

Description: Subroutine XMIT controls the transmitters for tasks DATA and DATAPC. Commands are sent to enabled channels. A verification error is flagged and listed as code 0002, and the unit is turned off. An off-line error is flagged and listed as code 0000. Associated digitizers are disabled for channels in error.

This subroutine is not to be used for executing the calibration trace acquisition sequence.

.RSTR

MACRO-11 **Written July 1976**

Description: **Subroutine .RSTR restores registers R0 to R5 from the stack. It is the inverse of subroutine .SAVE.**

.SAVE

MACRO-11 **Written July 1976**

Description: **Subroutine .SAVE saves registers R0 to R5 in the stack. It is the inverse of subroutine .RSTR.**

ABBREVIATIONS

ASCII	American Standard Code for Information Interchange
ATC	Average to center of trace
CAL	Calibration
CR	Carriage return
DEC	Digital Equipment Corporation
DK0:	Disk unit No. 0, DEC product
DK1:	Disk unit No. 1, DEC product
FDB	File descriptor block
LA36	Teletype terminal, DEC product
LP0:	Versatek printer/plotter
R4010	Tektronix graphic display terminal (system console device)
R7912	Tektronix transient digitizer
TCS	Tektronix Plot-10/Terminal Control System (software used to drive R4010)
TEK	Tektronix, Inc.
TI:	R4010 display console
VBN	Virtual block number
XRD	X-ray detector

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APPENDIX A.--SUBROUTINE CROSS-REFERENCE LIST

This appendix is a cross-reference listing of SKYNET Applications Software Package (SASP) subroutines.[1] For each subroutine, the following entries are given (table A-I):

a. "Library" refers to one of four subroutine libraries to group subroutines that perform similar functions: INPUT, NORMAL, HANDLR, and ERROR. INPUT contains subroutines used to convert or input data from the Tektronix (TEK) R4010 console. NORMAL's subroutines perform the steps in the normalization of TEK R7912 transient digitizer raw data. Subroutines in HANDLR are needed to pass commands and data between the TEK R7912 and the central processor. ERROR contains subroutines that process digitizer and channel errors.

b. "Subroutine called" lists all subroutines called by this subroutine, including any entry points used.

c. "Calling routine" lists all calling subroutines or tasks, except for certain subroutines that are called by a large number of routines. (All entry points are in parentheses.)

TABLE A-I. CROSS REFERENCES

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
ABSPKV	None	None	FIXAMP GRASCA
ANOMRK	None	MOVABS* ANMODE*	MARK
ANOSCA	None	MOVABS* ANMODE*	SCACPY
ANSWER	INPUT	ASDCD INPUT	Many

*See footnote at end of table, p. 104.

[1] *Walter J. Scott and John R. Hiller, SKYNET Applications Software Package (SASP) Operator's and User's Handbook, Harry Diamond Laboratories TR-1817 (August 1977).*

APPENDIX A

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
ASDCD	INPUT	FIELD	Many
ATNREF (AINIT) (ANEW) (ARDENT) (ARDNEX) (ARESET) (AWRADD) (AWRENT)	None	None	ATN
ATNSCH	None	None	Many
BASATC	NORMAL	None	GETBAS
BUSY	HANDLR	None	RDIG
CALATC	NORMAL	None	GETCAL
CALCSF	None	ATNSCH FLOTE PRBSCH XCHSCH	SCALE
CALIB	None	ATTEN (ATTEN) CHNERR LSTERR .RSTR .SAVE	CAL
CHKTRG	HANDLR	DIGERR LSTERR .RSTR .SAVE	BASE CAL DATA DATAPC
CHNERR	ERROR	DISABL (DISDIG)	Many
CLRCBD	HANDLR	None	Many
CMDDIG	HANDLR	DIGERR LSTERR	Many

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
		.RSTR .SAVE	
DATATC	NORMAL	FLOTE	SCADAT
DATFIO (CLOSES) (OPENS) (READB) (READR) (WRITEB) (WRITER)	None	None	Many
DCDBIT	ERROR	None	FLAG SUMERR
DIGERR	ERROR	DISABL (DISCHN)	Many
DISABL (DISCHN) (DISDIG)	ERROR	None	CHNERR DIGERR
ELIMPT	NORMAL	IFICKS	SCADAT
ERRNUM	ERROR	None	LSTERR
EXTRAP	NORMAL	None	GETBAS
FIELD	INPUT	None	ASDCD FLDCD FXDCD
FIXAMP	None	ABSPKV	MARK
FLDCD	INPUT	FIELD FLOTE	Many
FLGPTS	HANDLR	None	GETBAS GETCAL GETDAT
FLOTE	INPUT	None	Many

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
FXDCD	INPUT	FIELD	Many
GETBAS	None	BASATC	BASE
		DIGERR	
		EXTRAP	
		FLGPTS	
		LSTERR	
		MINMAX	
		QKELIM	
		QKLNTP	
		RDIG	
		RDUKRO	
GETCAL	None	CALATC	CAL
		DIGERR	
		FLGPTS	
		ISBASE	
		LSTERR	
		QKELIM	
		QKLNTP	
		RDIG	
		RDUKRO	
GETDAT	None	DIGERR	DATA
		FLGPTS	DATAPC
		LSTERR	
		RDIG	
GRAATC	None	GRAT	MARK
		MOVEA*	
		DRAWA*	
GRABAS	None	GRAT	CHKBAS
		MOVEA*	
		DRAWA*	
GRACAL	None	GRAT	CHKCAL
		MOVEA*	
		DRAWA*	

*See footnote at end of table, p. 104.

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
GRARAW	None	RAWPLT GRAT POINTA*	RAWCPY
GRASCA	None	GRAT MOVEA* DRAWA* ABSPKV	SCACPY
GRAT	None	TWINDO* DWINDO* MOVEA* DRAWA* MOVER* DRAWR* INITT*	GRAATC GRABAS GRACAL GRARAW GRASCA
IASCII	ERROR	None	LSTERR SHOTNO
IFICKS	INPUT	None	Many
INPCSR	None	SETBUF* VCURSR*	MARK
INPUT	INPUT	None	Many
INT	None	FLOTE	SCACPY
INTABL	HANDLR	None	BASE CAL DATA DATAPC
INTDIG (INSCB1) (INSCB2) (INSCB3) (INSCB4)	HANDLR	None	SETVEC TEK R7912 interrupt

*See footnote at end of table, p. 104.

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
INTRP	NORMAL	FLOTE	SCADAT
ISBASE	NORMAL	None	GETCAL
LSTERR	ERROR	ERRNUM IASCII	Many
MINMAX	None	None	GETBAS CHKCAL
MRKCUR	None	MOVABS* DRWREL*	MARK SCACPY
PAGE	None	ANMODE* INITT*	BLMCHK ERASE FLAG LOG
PLTSF	None	MOVABS* ANMODE*	RAWCPY
PRBREF (PINIT) (PNEW) (PRDENT) (PRDNEX) (PRESET) (PWRADD) (PWRENT)	None	None	PRB
PRBSCH	None	None	Many
PRICLR	None	None	DATAPC
QKELIM	NORMAL	None	GETBAS GETCAL
QKLNTP	NORMAL	None	GETBAS GETCAL

*See footnote at end of table, p. 104.

TABLE A-I. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called		Calling routine
RDIG	HANDLR	BUSY		GETBAS GETCAL GETDAT
RDUKRO	None	None		GETBAS GETCAL SCADAT
SCADAT	None	DATATC DIGERR ELIMPT FLOTE LSTERR INTRP RDUKRO SUBASE		SCALE
SCGEN	None	None		CONGEN
SCIO	None	None		Many
SCMAIN	None	None		TABIN
SETVEC	HANDLR	INTDIG	(INSCB1) (INSCB2) (INSCB3) (INSCB4)	BASE CAL DATA DATAPC
STCDAT	None	None		DATA DATAPC
SUBASE	NORMAL	FLOTE		SCADAT
UCOUT	None	None		USRCOM
XCHDRI	None	None		Many
XCHREF (XNEW) (XRDENT) (XRDHDR)	None	None		XCH

TABLE A-1. CROSS REFERENCES (Cont'd)

Name (entry point)	Library	Subroutine (entry point) called	Calling routine
(XWRENT) (XWRHDR)			
XCHSCH	None	None	Many
XMIT	None	ATTEN (ATTEN) CHNERR LSTERR .RSTR .SAVE	DATA DATAPC
.RSTR	ERROR	None	Many
.SAVE	ERROR	None	Many

**These subroutines are contained in the terminal control system (TCS) library. The TCS is a software product marketed by Tektronix, Inc., to perform plotting and character input and output on the TEK R4010 console. See appendix C for details.*

APPENDIX B.--STANDARDIZED COMMON AREAS

Appendix B defines the structure and contents of the standardized common areas used in the SKYNET Applications Software Package source code.

Area	Definition
ATNCAL	ATNCAL.DAT entry
BASDAT	Baseline trace
CALDAT	Calibration trace
LINE	Terminal input buffer
NORDAT	Scaled data trace
PARAM	Parameter entry of shot file
PRBCAL	PRBCAL.DAT entry
RAWDAT	Raw digitizer data
SYSCON	Copy of SYSCON.DAT
TIME	Time and date of trigger
XCHCAL	XCHCAL.DAT entry
XCHHDR	XCHCAL.DAT header

Area	Variable
ATNCAL	IDA(2), GAIN, DLAY, MODL(4), IMFR(4), ISP3(2)
BASDAT	IBASE (512)
CALDAT	ICAL (512)
LINE	INBUF (40)
NORDAT	ATC (512)
PARAM	IEFLG, ITFIDU, ITSDTA, ITPEAK, ITEND, ITCAL, TFST, PEAK, TPEAK, AREA, CALCOM (6), RAWCOM (6), SCACOM (6), ISPRE (14)

APPENDIX B

Area	Variable
PRBCAL	ID(2), TF, DLY, IUNIT(4), IFLG, IBLN, MT, ISP1, MDL(4), IMFG(4), ICON(4), PAR, ISP2(4)
RAWDAT	IHPT, NPTS, IRAW(2046)
SYSCON (short form)	IHDR(64), IDIG(8, 20), ICHAN(32,33)
SYSCON (long form)	IDAT(3), ITEM(3), IASC(2), ISHN, NDIG, NCB, NCHAN, IVBN(6) ISIM, IWIRE, CHARGE, TVAC, VDPV, CDPV, ICOM(15), NBLKS, CALOR1, CALOR2, NSAMP1, NSAMP2, ICLERR, ISPARE(13), IDIG(8, 20), ICHAN(32,33)
TIME	ITM(8)
XCHAL	IXMT, IFBR, IREC, ISP4, DELAY, CALLEV
XCHHDR	NCHN, ISP6, DT1, DTR1, DTR2, DTF, DTV, BLN(3), ISP7(6)

Area	Variable	Definition
ATNCAL	DLAY	Device delay (nanoseconds)
	GAIN	Device gain (decibels)
	IDA	Device ID
	IMFR	Manufacturer's serial number
	ISP3	Spare
	MODL	Model
BASDAT	IBASE	Baseline trace
CALDAT	ICAL	Calibration trace
LINE	INBUF	Terminal input buffer
NORDAT	ATC	Scaled data trace
PARAM	AREA	Area under data trace
	CALCOM	Comment on calibration trace
	IEFLG	Flag
	ITCAL	FORTRAN subscript for peak of calibration trace
	ITEND	FORTRAN subscript for end of data trace
	ITFIDU	FORTRAN subscript for peak of fiducial in data trace

Area	Variable	Definition
	ITPEAK	FORTRAN subscript for peak of interest in data trace
	ITSDTA	FORTRAN subscript for start of data in data trace
	ISPRE	Spare
	PEAK	Peak of interest in data trace
	RAWCOM	Comment on raw data trace
	SCACOM	Comment on scaled data trace
	TFST	Time from source to start of data
	TPEAK	Time from start of data to peak of interest
PRBCAL	DLY	Probe delay (nanoseconds)
	MDL	Model
	MT	Measurement type
	IBLN	Balun number
	ICON	Connector
	ID	Probe ID
	IFLG	Flag
	IMFG	Manufacturer's serial number
	ISP1	Spare
	ISP2	Spare
	IUNIT	Units for scaled data
	PAR	Parameter
	TF	Transfer function (decibels)
RAWDAT	IHPT	FORTRAN subscript for first horizontal in raw data trace
	IRAW	Raw data trace followed by knob readout characters
	NPTS	Number of data points in raw data trace
SYSCON (short form)	ICHAN	Channel entries
	IDIG	Digitizer entries
	IHDR	Header
SYSCON (long form)	CALOR1	Result for calorimeter channel A
	CALOR2	Result for calorimeter channel B
	CDPV	Current diode peak value
	CHARGE	Simulator charge level or pulser output level
	IASC	American Standard Code for Information Interchange (ASCII) shot number
	ICHAN	Channel entries
	ICLERR	Calorimeter error flag
	ICOM	Simulator comment
	IDAT	Trigger date
	IDIG	Digitizer entries
	ISHN	Integer shot number

APPENDIX B

Area	Variable	Definition
	ISIM	Simulator or pulser code
	ISPARE	Spare
	ITIM	Trigger time
	IVBN	Virtual block numbers for segments of shot file
	IWIRE	Wire type or configuration code
	NBLKS	Number of blocks in shot file
	NCB	Number of digitizer controller cards
	NCHAN	Number of channels
	NDIG	Number of digitizers
	NSAMP1	Number of samples taken on calorimeter channel A
	NSAMP2	Number of samples taken on calorimeter channel B
	TVAC	Tank vacuum
	VDPV	Voltage diode peak value
TIME	ITM	Trigger time and date
XCHCAL	CALLEV	Calibration pulse reference level
	DELAY	Transmission channel delay
	IFBR	Fiber number
	IREC	Receiver number
	ISP4	Spare
	IXMT	Transmitter address (number)
XCHHDR	BLN	Balun insertion gain (decibels)
	DTF	Fiducial path delay (Δt_{fidu}) (nanoseconds)
	DTR1	First part of trigger path delay ($\Delta t_{trig\ 1}$) (nanoseconds)
	DTR2	Second part of trigger path delay ($\Delta t_{trig\ 2}$) (nanoseconds)
	DTV	Vertical plug-in delay
	DT1	Source to x-ray detector (XRD) transit time (nanoseconds)
	ISP6	Spare
	ISP7	Spare
	NCHN	Number of channels

APPENDIX C.--PLOT-10/TERMINAL CONTROL SYSTEM SUBROUTINES USED BY THE SKYNET APPLICATIONS SOFTWARE PACKAGE

The Terminal Control System (TCS) software, a product of Tektronix, Inc. (TEK), is used to perform plotting on the TEK R4010 graphic display terminal. The TCS contains approximately 100 routines with some subroutines nested to several levels. Only those TCS subroutines called directly by the SKYNET Applications Software Package (SASP) tasks or subroutines are listed here:

ANMODE

DRAWA

DRAWR

DRWREL

DWINDO

ERASE

HDCOPY

INITT

MOVABS

MOVEA

MOVER

POINTA

SETBUF

TWINDO

VCURSR

All TCS subroutines required to run the SASP are in the TCS library. These TCS subroutines were translated from FORTRAN to MACRO-11 assembly language to minimize core usage and execution time. A complete description of all TCS routines is given in the TCS User's Manual.[1]

---

[1]*PLOT-10/Terminal Control System User's Manual, Tektronix, Inc., 062-1474-00 Release No. 3 (September 1975).*

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