

AN ABSTRACT OF THE THESIS OF

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CS 2

A cost reduction analysis is performed by coordinating the exchange of LANDSAT (formerly ERTS) data between a CDC 3300 and a PDP8/L minicomputer. The LANDSAT data is displayed on a 4002 Tektronix terminal by means of a grayscale output. Large amounts of data and number manipulation are processed in the PDP8/L in order to reduce the cost of production.

The combination of the PDP8L and the Tektronix terminal has stand alone computational power and appears as an intelligent terminal for the CDC 3300.

A SOFTWARE PACKAGE FOR AN INTELLIGENT
GRAPHIC DISPLAY TERMINAL

by

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DEDICATION

I would like to thank Dr. J. Herzog, Roy Rathja, and Gary Oliver for the help they gave me in the preparation and production of my thesis.

I would like to dedicate the thesis to my wife Anne, whose encouragement and patience lasted throughout the entire production of my thesis.

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A SOFTWARE PACKAGE FOR AN INTELLIGENT GRAPHIC DISPLAY TERMINAL

CHAPTER 1

PROBLEM DEFINITION

1.1 Background

The word ERTS is an acronym for Earth Resource Technology Satellite. The Satellite is a 1000 lb instrument which circles the earth in a near-polar orbit at an approximate velocity of 7.32×10^3 miles per hour. Solar radiation is reflected off the surface of the earth and imaged on an array of detectors by a rotating mirror and optics. The mirror oscillates in a west-to-east movement normally from -2.89° to $+2.89^\circ$ at an almost constant rate. The oscillating mirror scans a path of 185 km in width and has an 11.56° field of scan. Six scan lines are taken simultaneously per band to account for the distance covered between retrace cycles. There are four spectral bands being recorded which are shown in the table below.

Table 1

<u>Spectral Band Format</u>			
<u>BAND</u>	<u>COLOR</u>	<u>MICROMETERS</u>	<u>NASA REFERENCE NUMBER</u>
1	Green	0.5 to 0.6	4
2	Red	0.6 to 0.7	5
3	Infrared	0.7 to 0.8	6
4	Infrared	0.8 to 1.1	7

From the mirror 24 detectors receive the reflected radiation, 6 detectors per band, and transform the spectral

data into numerical values. The samples are transmitted to a ground-based-receiving site at Goddard Space Flight Center at Greenbelt, Maryland. The samples received from the detectors are callibrated and corrected, then formatted into useable information upon computer compatible magnetic tapes.

The magnetic tapes are formatted in the following manner. The first record of the tape consists of a 23-word identifier header generated by the computer center at Oregon State University. The information found in the 23-word header is shown in Table 2.

Each record corresponds to one scan line (185 km), where there are a maximum of 2340 records per tape. Thus one LANDSAT data tape covers an area of about 185 km by 185 km. Each scan line is composed of a maximum of 3480 PIXELS. The word PIXEL is an acronym for picture element. A PIXEL is one data point, which consists of an area of about 260 ft by 260 ft. Each data point is a vector that consists of six or seven binary bits per band. All of the vector values are rounded off to six bits for data packing convenience in a 24 bit computer word. Therefore, one data point equals one character, where four characters make one word. The tape files are further interwoven as shown in Table 3.

All information on the LANDSAT magnetic tape files can be accessed for manipulation by a FORTRAN BUFFER OUT statement.

Table 2

LANDSAT Header Format

<u>WORD</u>	<u>FORMAT</u>	<u>TYPE</u>	<u>CONTENTS DESCRIPTION</u>
1	I4	ID	day since launch
2	I2	ID	hour at observation time
3	I2	ID	minute at observation time
4	I2	ID	seconds/10 at observation time
5	I5	DV	CDC 3300 words/record
6	1A4	ID	strip number
7	I5	C	first character
8	I5	C	last character
9	I5	DV	orig. first scan line
10	I5	DV	orig. last scan line
11	I5	C	current starting scan line
12	I5	C	number of scan lines
13	I5	ID	adjusted line length
14	I5	AN	day of observation
15	R3	AN	month of observation
16	I2	AN	year of observation
17	R1	AN	center latitude direction
18	I2	AN	center latitude degrees
19	I2	AN	center latitude minutes
20	R1	AN	center longitude direction
21	I3	AN	center longitude degrees
22	I2	AN	center longitude minutes
23	1A4	DV	band or band combination

Table 3

LANDSAT File Format

<u>WORD</u>	<u>BAND</u>	<u>CHARACTERS</u>	<u>BAND</u>	<u>NASA</u>	<u>REFERENCE</u>	<u>NUMBER</u>
1		1-4	1			4
2		1-4	2			5
3		1-4	3			6
4		1-4	4			7
5		5-8	1			4
6		5-8	2			5
7		5-8	3			6
8		5-8	4			7
:		:	:			:
N		i-i+3	J			J+3
N+1		i-i+3	J+1			J+4
:		:	:			:

Where $i = \text{INTEGER } [(N-1)/4] * 4 + 1$ and $J = (\text{MOD}_4(N-1)) + 1$.

1.2 Problem Description

This document covers the software design of a distributed computation system for the display of LANDSAT data.

At the present time, in order to obtain a grayscale output of a LANDSAT data file, the program *PIXOUT is used. An explanation of *PIXOUT is found in reference [10]. When using *PIXOUT the grayscale output is oriented towards characters produced by a line printer. The characters produced are either one symbol or overstrikes.

As shown in Figure 1, the complete system consists of a PDP8/L minicomputer, which has a Tektronix Terminal 4002 as a peripheral device, and a CDC 3300 computer with its input processor. Using the graphics display terminal, a wider variety of symbols displayed are possible and some of the data and number manipulation can be done in the PDP8/L. This makes the graphics terminal appear as an intelligent terminal. To accomplish this task three phases of analysis are used.

Phase one, Chapter 2, does a modest amount of data and number manipulation in the PDP8/L and uses those parts of *PIXOUT that deal with a display of the grayscale. This initial phase is done to establish both a basic communication between the CDC 3300 and the PDP8/L, and an estimation of the cost of producing a full screen Tektronix Terminal output.

Phase two, Chapter 3, reduces the parts of *PIXOUT used by increasing the data and number manipulation in the PDP8/L. In addition, some of the *PIXOUT programming is replaced with COMPASS assembler language programming to use less C.P.U. time.

Phase three, Chapter 4, further reduces cost by using an interrupt scheme. Conceptually, the less amount of time taken for the display of LANDSAT data the less C.P.U. time used.

Finally in Chapter six is found a User's Guide for practical application of the analysis.

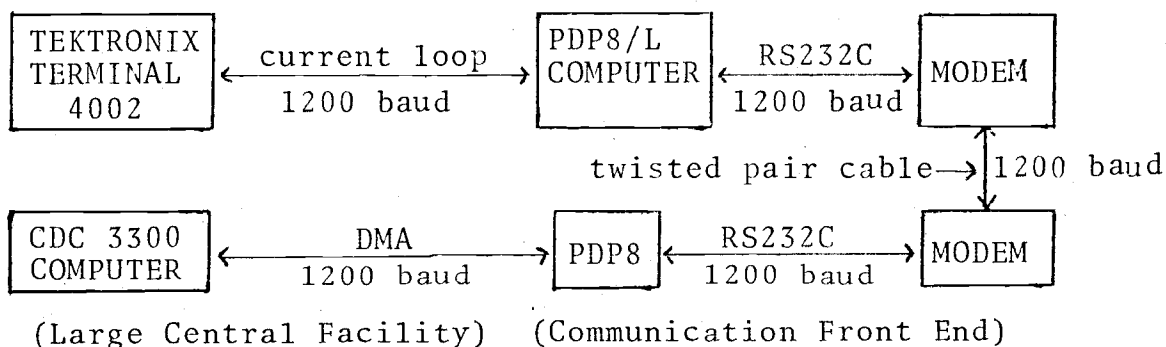


FIGURE 1. BLOCK DIAGRAM OF SYSTEM

CHAPTER 2

PHASE ONE: INITIAL ANALYSIS

2.1 Introduction

To establish a base for analysis, a procedure must be used which yields a valid comparison of the presently used programs to the newly developed programs. The following three headings were adopted for the analysis.

- 1) Basic Communication: between the CDC 3300 and the PDP8/L
- 2) Linkage Programs: between the CDC 3300 and the PDP8/L concerning LANDSAT data
- 3) Comparison Analysis: between the already existing programs and the linkage programs.

2.2 Basic Communication

The first step is to examine how the data are transferred between the CDC 3300 and the PDP8/L. The asynchronous communication system involves a high-speed modem and circuitry to convert the serial data to an eight bit form. This makes the PDP8/L appear as a high-speed receiving device. The information is transferred to the accumulator register (AC) from the interface upon program request. When information is received at the AC via the interface a bit pattern observed as shown in Table 4.

Table 4

<u>Interface Pattern Representation</u>													
	0	1	2	3	4	5	6	7	8	9	10	11	
AC													BITS
<u>BITS</u>	<u>REPRESENTATION</u>												
11-4	data												
3	set if overflow error occurs												
2	set if framing error occurs												
1	set if parity error occurs												
0	set if bits 1, 2, or 3 were set												

Information is transmitted at a 1200 baud rate, that is, 1200 bits per second. With each character there are associated 11 bits of information. Thus there are approximately 110 characters sent per second. The 4002 Tektronix terminal contains circuitry which can handle incoming information at a 1200 baud rate.

All I/O instructions for the PDP8/L are of the form 6XXY (octal), where XX is the device code and Y is the operation performed. The I/O operations which can be performed are explained in detail in reference [13]. The device codes that are available are shown in Table 5.

Table 5

<u>Device Code Reference and I/O Instruction Format</u>		
<u>DEVICE CODE</u>	<u>REFERENCE</u>	<u>SUBROUTINE MNEMONICS</u>
40	data to CDC 3300	SEND
41	data from CDC 3300	RECEIVE
03	data from keyboard	INPUT
04	data to CRT or TTY	OUTPUT
01	data from HSR	--

When establishing basic communication in the CDC 3300 the best programming language available is FORTRAN. Unique to the CDC FORTRAN at OSU library are two subroutines that are useful in exchanging data. They are explained in Table 6.

Table 6

Subroutines CHIN and CHOUT

<u>NAME</u>	<u>CALLING SEQUENCE</u>	<u>DESCRIPTION</u>
CHIN	CALL CHIN (NX)	Looks for one ASCII character and puts value in Variable NX
CHOUT	CALL CHOUT (NX)	Sends one ASCII character located in Variable NX

Where NX is the form N, NB, or NO, which corresponds to BCD, binary, or octal.

Initially a hand-shake type program between the two computers was developed. The CDC 3300 sends data to the PDP8/L and waits for the PDP8/L to acknowledge that it has received the data. Conversely, the PDP8/L waits for data from the CDC 3300 and then sends data back to acknowledge that the data was received. Two such programs that facilitate all of the above information can be found in appendix 7.1 with an associated resulting output.

A delay loop was necessary when sending values to the CDC 3300 to allow a settling time for the CHIN routine. This loop was augmented in the basic PDP8/L sending routine, with respect to the CDC 3300.

2.3 Linkage Program

To minimize the amount of data and number manipulation, only the grayscale output on the Tektronix terminal was used in the first PDP8/L linkage program. To output LANDSAT data the 0 to 63 PIXEL values are assigned to one of eight symbols. This is accomplished by seven threshold values.

Conceptually there are three modes of operation for number manipulation. The first CDC 3300 linkage program sends values from 0 to nine to indicate which mode of operation to perform. The first mode outputs a grayscale value when the values are sent, corresponding to the number of lines to be drawn 0, 1, 2, 3, 4, 5, 8, or 16. The second mode starts a new scan line when the value six is received. The third mode ends the program when the value seven is received. In the first PDP8/L linkage program there must be routines to facilitate each mode of operation and send back information to the first CDC 3300 linkage program when the operation is completed.

Four package routines are found in appendix 7.2 with an in depth explanation. Two of these routines used in the first PDP8/L linkage program are PACKAGE and INTENSITY. A brief explanation of these routines are shown in Table 7.

The Tektronix terminal 4002 has a 760 by 1024 point resolution. In the INTENSITY routine a 23 by 16 area was selected. The size of the grid area was picked both from

Table 7

Package Routines and General Description

<u>ROUTINES</u>	<u>DESCRIPTION</u>
PACKAGE	Graphic display routines for incremental mode, point plot mode, and vector mode. An output routine and register save and restore routines.
XYPLANE	Uses PACKAGE to output an X-Y axis. The routine expects parameters to give length of axis, center point, and the size of the tic marks.
PATTERN	Uses PACKAGE to output a triangle or square, with parameters to tell the size of the pattern and where to place the pattern.
INTENSITY	Uses PACKAGE to output grayscale value in a 23 by 16 point area. It expects parameters to tell if the point is positioned or where to position it and the number of lines to be drawn in the area.

programming ease and distinguishability. The INTENSITY routine uses the vector mode and draws lines in a north-south direction, maximum of 16. Because there are eight intensity levels the following number of lines drawn in the area are: 0, 1, 2, 3, 4, 5, 8, or 16. These values were picked for visual distinction due to the logarithmic response of the eye.

The first CDC 3300 linkage program was divided into three parts.

PART I: Exchange of information needed to calculate area of LANDSAT output.

PART II: Output points and scan lines on the Tektronix terminal

PART III: Exchange of the pixel values needed to output the grayscale on the Tektronix terminal.

A monitor, refer to [11], was used in exchanging information in PART I and II because all data and number manipulation was done in the CDC 3300. In PART III control is passed to the first PDP8/L linkage program for minimal data and number manipulation.

2.4 Comparison Analysis

Because on line time using the Tektronix terminal with the CDC 3300 is critical concerning cost, a routine was written to find the amount of time it took to output a full grayscale screen. The program was run entirely on the PDP8/L

and a variety of grayscale values were used to get an approximate average. The display time was 1:51 minutes and the program is found in appendix 7.3.

Some of the undesirable features found in the first linkage programs are as follows:

One: When exchanging information in PART I and II it may happen the information to be displayed will fall below the limits of the screen area. If this happens the information is lost. In Phase two this problem is avoided by a program line counter.

Two: If the file name used doesn't exist, the first CDC 3300 linkage program will abort and the user loses all that had been done at that point. In phase two a compass subroutine is used to find out if the file exists and exchange the proper information.

Three: Because typing "YES" or "NO" for response to questions asked in PART I and II is bothersome, in phase two "Y" or "N" is used.

Four: Some of the cost burden can be alleviated by removing the monitor, compiling the first CDC 3300 linkage program as an overlay, and loading the first PDP8/L linkage program on the high-speed reader. All of these things are done in phase two.

The files used for the analysis and the display information are shown in Table 8. The line printer results of

this information obtained from *PIXOUT, the present CDC 3300 FORTRAN program on file, can be found in appendix 7.4.

A comparison of cost, to output the file used, between the first linkage programs and the program *PIXOUT is shown in Table 9. The cost for the first linkage programs is based on the fact the first PDP8/L linkage is already loaded and OSU computer cost is 4.6875 dollars per minute. In appendix 7.5 are found pictures taken of the files output on the Tektronix terminal at different exposure times.

Table 8

Files Used and Display Information

<u>File name:</u> *CR20412	Band used: 5
Points on file 129-251	Points used 132-188
Scan lines on file 1925-2100	Scan lines used 1930-1963
Thresholds used: 14, 15, 16, 17, 19, 20, 23	
<u>File name:</u> *CR20413	Band used: 5
Points on file 257-384	Points used 257-314
Scan lines on file 1925-2100	Scan lines used 1925-1958
Thresholds used: 14, 15, 16, 17, 18, 19, 20	
<u>File name:</u> *PH1LO1	Band used: 5
Points on file 1-128	Points used 1-58
Scan lines on file 1090-1258	Scan lines used 1099-1132
Thresholds used: 11, 12, 13, 14, 15, 16, 18	
<u>File name:</u> *PH1LO2	Band used: 5
Points on file 129-256	Points used 129-186
Scan lines on file 1090-1258	Scan lines used 1090-1123
Thresholds used: 12, 13, 14, 15, 16, 18, 23	

Table 9
Cost Comparison Between *PIXOUT
and the First Linkage Programs

FILE NAME	(on line printer)	(on Tektronix terminal)
	*PIXOUT COST (\$)	FIRST LINKAGE PROGRAM (\$)
*CR20412	.28	1.22
*CR20413	.29	1.21
*PH1L01	.28	1.24
*PH1L02	.29	1.27

CHAPTER 3

PHASE TWO: INTERMEDIATE ANALYSIS3.1 Introduction

Since the initial analysis has been shown not to be cost effective, methods were investigated to further reduce the cost. With this in mind, the first linkage programs were revised and discussed under the following headings:

- 1) Second PDP8/L linkage program
- 2) Second CDC 3300 linkage program
- 3) Coordination problems
- 4) Comparison analysis

3.2 Second PDP8/L Linkage Program3.2.1 Subroutine Format

More of the date and number manipulation done in the CDC 3300 must be done in the PDP8/L to reduce cost. Therefore, the following subroutines were augmented in the revised PDP8/L linkage program, referred to as the second PDP8/L linkage program, and are described in the following format.

"Subroutine Name" (N.P.) or (PAR1, PAR2, ...) with an associated description of what the subroutine does. (N.P.) means no parameter and (PAR1, PAR2, ...) refers to the parameters expected.

Ordinarily when returning from a subroutine, one returns to the next sequential location in the main program after the parameters. In the description this is referred to as return one. If a return two is stated, it is two sequential locations later and so fourth.

3.2.2 Subroutines

REPLY (N.P.)- looks for inputs followed by a carriage return. All inputs are echoed and the carriage return terminates the subroutine. If the inputs are neither the single input N or Y the response is "WHAT?" and a return one is performed. An N causes a return two and a Y causes a return three.

WHAT (N.P.)- outputs the message "WHAT?" followed by a carriage return line feed.

INTWO (N.P.) -looks for just one input followed by a carriage return. Echoes all input and terminates on a carriage return. If just one input is received, a return two is performed, otherwise a return one is performed.

BNIN (N.P.) -looks for one input between four and seven followed by a carriage return. Echoes input, if valid does a return two, otherwise a return one.

FLIN (N.P.) -looks for input of a ERTS data file name up to eight characters, the rest are ignored. Echoes all data, stores name, and terminates on a carriage return.

FLOUT (N.P.) -sends ERTS data file name to CDC 3300.

CPRN1 (N.P.) -checks to see if the value in memory location COMH, COML is ≥ 0 . If not performs a return one, otherwise a return two.

THCK (N.P.) -checks to see if all inputted threshold values are positive and less than sixty-four. Also checks to see if each threshold is equal to or larger than the previous one. Performs a return two if values are good, otherwise a return one.

TABVAL (N.P.) -stores in a table, 64 locations long, each corresponding intensity value according to the input threshold values.

OUTOS3 (N.P.) -sends calculated values that are used in the FORTRAN linkage program for ERTS data output.

BDCON (BADR, DADR) -converts a binary value of two sequential locations starting at location BADR to a decimal value of four sequential locations starting at DABR.

REDN (N.P.) -used in BDCON to reduce the values found in the four decimal locations to a value of nine or less.

LIS (N.P.) -input routine from keyboard.

LIS40 (N.P.) -input routine from CDC 3300.

TYP41 (N.P.) -send ASCII values to CDC 3300, contains a delay loop for settling time.

ERASE (N.P.) -erase screen, puts pointer in home position and zeros out line counter for full page.

MESOUT ($M^1, M^2, \dots, 0$) -uses each M^i as a starting address of a message to be output. It looks for the value 0 to terminate the message and if a carriage return is output, the line counter is increased by one.

BOTCK (N.P.) -checks to see if line counter for full page has been reached. If not returns, otherwise the message "FULL PAGE" is output and waits for any input. When an input is received does an ERASE and then returns.

NUMIN (MAS, DADR) - looks for a number to be input up to a MAX of them, echoes them and deposits them at DADR. DADR takes four sequential locations, does an ADJUST and returns.

DATIN (DADR, NDP) -uses DADR as the starting location of where to deposit incoming information from the CDC 3300 and NDP as the number of values to be received.

DATOUT (DADR, NDP) -outputs data starting at location DADR, where NDP is the number of values to output.

NUMOUT (DLOC) -outputs four decimal numbers starting at location DLOC, suppresses leading zeros.

COMADI (N.P.) - adds one to location COMH, COML. Used for data calculations.

ROT (N.P.) -divides COMH, COML by two, used for data calculations.

ZEOUT (LOC, NUM) -zero outs NUM number of locations starting at location LOC.

BUFFIN (N.P.) -checks for buffer in error from the CDC 3300 linkage program.

ADJUST (N.P.) -takes the decimal number locations so the values are adjusted for correct decimal output.

THDIN (N.P.) -checks to see if the inputted threshold values follow the following form, where TH1 refers to the first threshold, TH2 to the second and so forth, and D refers to some deletemeter that is not a number.

TH1D TH2D TH3D TH4D TH5D TH6D TH7 carriage return.

PRINT1 (N.P.) -outputs decimal numbers followed by a line feed and backspace. Used to output top boundary values.

RIGHT (N.P.) -outputs the message "CORRECT?"

CKFL (N.P.) -checks to see if the file name sent to the CDC 3300 is a legal file name. If not does a return one, otherwise a return two.

FFIN (N.P.) -looks for a ">" from the CDC 3300, then one space and then returns.

DTOB (DADR, BADR) -converts the decimal number of four sequential locations starting at DADR to a binary number and puts the result in two sequential locations starting at BADR.

DUBADD (NUM1, NUM2) -adds a double precision number starting at location NUM1 to a second number starting at location NUM2 and puts the result at COMH, COML.

DUBSUB (NUM1, NUM2) -subtracts a double precision number starting at location NUM2 and puts the result at COMH, COML.

ERROS3 (N.P.) -deposits unneeded values that are sent from the CDC 3300.

3.3 Second CDC 3300 Linkage Program

Cost reduction in this linkage program is handled in two ways. First, two compass subroutines were written which take less machine language than the equivalent FORTRAN. Second, the FORTRAN Program called OS3P, and COMPASS routines were put in an overlay to eliminate compiling costs.

The two COMPASS subroutines are described as follows:

NEQUIP (XNAME) -called SUB1, takes the file name, stored at symbol address of XNAME, and finds out if it is a legal OS3 file. If it is not a legal file the subroutine does a false return, otherwise equips the file to logical unit 20 and does a true return.

BUFOUT (I, J, CID) -called SUB2, outputs characters from the character array CID, where I is the number of characters to be output and J is the starting character in the array.

The overlay file created is called *OUPIX, which the user types directly for use. The overlay was produced in the following manner, where underlined text refers to what was typed at teletype. The two COMPASS routines and the FORTRAN program, referred to as the second and third CDC 3300 linkage program, can be found in appendix 7.6.

```

# FORTTRAN, I=OS3P, X
    NO ERRORS FOR OS3PIX
    NO ERRORS FOR IDENT
# ASSEM, I=SUB1, X
    NO LINES OF ERROR FOR SUB1
# ASSEM, I=SUB2, X
    NO LINES OF ERROR FOR SUB2
# LOAD, 56, 0=*OVPIX
END

```

3.4 Coordination Problems

To find coordination problems examination of the data that is to be exchanged between the two linkage programs is done. The method is to look at what is input and output by the second CDC 3300 linkage program.

<u>I/O Performed</u>	<u>Input or Output Name: Description</u>	<u>Input Format</u>
Input	XNAME: LANDSAT data file name	A10
Output	NEQUIP: Checks for legal file name	---
Input	WS: Band number minus three	FFIN(60)
Output	BUFOUT: Sends header values ID(5), ID(7), ID(8), ID(11), and ID(12)	---
Input	REM: Starting character value = initial point - ID(7)	FFIN(60)
Input	M: Length of character array = [ID(5)/4]+1	FFIN(60)
Input	LP: Line to print	FFIN(60)

Input	PP: Points to Print	FFIN(60)
Output	BUFOUT: Sends one scan line from data file	---
Input	CHIN(N): Acknowledge that the scan line was gotten and has been displayed	READ(60)

When exchanging data some of the problems that arose and how they are handled are given below.

Problem 1. The format for XNAME was too large. Ordinarily the size expected for an input file name is eight characters maximum. With a format of A10 some of the first characters of the file name were lost, thus the file name appears to be an illegal file name. To eliminate this problem the format A10 was changed to A8.

Problem 2. When information is sent to the CDC 3300 followed by a carriage return, the CDC 3300 sends back a line feed. The PDP8/L linkage program must absorb this input by doing either a RECEIVE, a general input subroutine from CDC 3300, or a KRB40.

Problem 3. Sending data to the CDC 3300 using a FFIN(60) format, the CDC 3300 sends a space, <, space, >, and space. Because of timing sometimes the PDP8/L linkage program may miss part of the information sent. Therefore, a routine was written to look for the > and then the space.

Problem 4. Because of timing the SEND command didn't always work because of the delay augmented. Now the information to be sent is saved, the delay is run then the

information is sent.

3.5 Comparison Analysis

Now a comparison of the costs of the four LANDSAT data files between the FORTRAN program on file, called *PIXOUT and the second linkage programs is shown in Table 10. Also a display time duration between the first and second linkage programs is shown. At this point output cost is cheaper and display time is shorter, a result that has been sought after.

Table 10

Cost Comparison Between *PIXOUT and
the Second Linkage Program and
Display Time Comparison Between the First
and Second Linkage Programs
on the Tektronix Terminal

<u>FILE</u> <u>NAME</u>	<u>*PIXOUT</u> <u>PROGRAM</u> <u>COST</u> <u>(\$)</u>	<u>SECOND</u> <u>LINKAGE PROGRAM</u> <u>COST - DURATION</u> <u>(\$ - (MIN))</u>	<u>FIRST</u> <u>LINKAGE PROGRAM</u> <u>DURATION</u> <u>(MIN)</u>
*CR20412	.28	.19 - 1:20	9:20
*CR20413	.29	.20 - 1:35	11:50
*PH1L01	.28	.20 - 2:05	12:55
*PH1L02	.29	.19 - 1:52	12:06

The comparison values are based on several runs with 30 or less users on the system at once.

CHAPTER 4

PHASE THREE: FINAL ANALYSIS4.1 Introduction

The primary difference between this phase and the second phase is the use of interrupts to handle display data. Using the technique of phase II, cost is at a near minimum but display time can be reduced. This phase divided into two basic headings:

- 1) Program Change
- 2) Comparison Analysis

4.2 Program Change

Using an interrupt scheme, there must exist a routine, referred to as a service routine, to facilitate all possible devices that may cause an interrupt. It is assumed that the reader is familiar with basic interrupt programming. If not, refer to [13] Chapter 6. The PDP8/L used has five possible interrupt devices: keyboard, printer, high-speed reader, output CDC 3300, and input CDC 3300. The service routine takes care of each device in the following manner: the keyboard, high-speed reader and output CDC 3300 have their flags cleared and their request is ignored; the printer has a program flag set and the device flag is cleared; and input CDC 3300 has the incoming information taken care of in a subroutine called DATIN, explained later

in this chapter.

The only subroutine no longer used is the DATOUT, but the original DATIN routine is still used to take care of receiving ID(5), ID(7), ID(8), ID(11), and ID(12). It is renamed DATTIN.

The following ten subroutines were augmented in this phase and are described in the same manner as the format of subroutine found in phase two. There is a counter called OUTDAT which is zero when no output location is ready, positive otherwise.

DATIN (N.P.) -deposits incoming values and stores the value at the correct location in the correct upper or lower six bits. Checks to see if all values for that line have been received, if so jumps to NEWLIN subroutine which takes the appropriate action. Checks to see if location pointer is at the end of the storage location, if so, resets location pointer to 4000, resets length counter to -1000, and resets side pointer to left side (lower six bits).

DATOUT (N.P.) -checks to see if any data is ready to be output. If so, outputs grayscale of that data point. Checks to see if the location pointer is at the end of the storage, if so, resets location pointer format as the subroutine found in Phase two.

TYP (N.P.) -used to output information to the Tektronix terminal depending upon a program flag called IFL. The routine waits for IFL to become negative before displaying,

then makes IFL positive.

INITIAL (N.P.) -,for the input routine, DATIN sets input counter equal to minus the number of points to print, used for BUFFER routine; sets side pointer for left side location deposit; sets depositing pointer to location 4000; and sets page length counter to -1000. (Length of area used for incoming information.) For the output routine, DATOUT, sets output counter equal to minus the number of points to print, used for starting next display line; sets side pointer for left side location usage; sets data use pointer to location 4000; sets page length counter to -1000; and sets IFL negative. It also sets BUFFL1, BUFFL2, and NUBFL to zero, which are used for BUFFER, resets length counter to -1000, and resets side pointer to left side (lower six bits).

NEWLIN (N.P.) -sets BUFFL2 flag if the BUFFER subroutine is used inside the service routine, or sets BUFFL2 flag if the BUFFER subroutine is used outside the service routine when storage is full, or sets NUBFL flag if BUFFER subroutine is ignored. It also resets input counter to minus the number of points to be printed.

INTON (N.P.) -obtains the JMS value for PAKTYP and puts that value in the accumulator which is used for INPUT.

INPUT (N.P.) -takes the value in the accumulator and deposits it in the appropriate places in the PAKMOV and PAKVEC routines depending on whether program control or

interrupt control is being executed.

ECHO (N.P.) -exchanges information between the Tektronix Terminal and the CDC 3300. A control sends a pound sign (#) and a control C starts the PDPPIX 3 program.

OUTBUF (N.P.) -does the BUFFER routine, and clears both the printer and CDC 3300 output internal flags.

In appendix 7.7 can be found both the CDC 3300 and the PDP8/L third linkage programs.

4.3 Comparison Analysis

Shown in Table 11 is a comparison analysis of both cost and display time duration between the second and third linkage programs. The conclusion from this table is the third linkage program is a slight improvement over the second linkage program, but not enough to warrant an interrupt scheme.

Table 11

Cost and Display Time Comparison
Between the Second and Third Linkage Programs
on the Tektronix Terminal

FILE NAME	SECOND LINKAGE PROGRAM		THIRD LINKAGE PROGRAM	
	COST - (\$)	DURATION (MIN)	COST - (\$)	DURATION (MIN)
*CR20412	.19	1:20	.18	1:15
*CR20413	.20	1:35	.19	1:29
*PH1L01	.20	2:05	.19	1:58
*PH1L02	.19	1:52	.18	1:47

CHAPTER 5

CONCLUSION5.1 Advantage

For a complete analysis of all the programs used a cost comparison for the four files between the three linkage programs and the FORTRAN program on file (called *PIXOUT) is shown in Table 11. Also found in this table is a comparison of the grayscale output display time between the three linkage programs. From the table it can be seen that from both a cost and a display time comparison the best program is the third linkage program. This points to the fact the main advantage of the third program is cost reduction.

5.2 Disadvantages

Looking at the other side of the coin there are three primary disadvantages of the third linkage program.

- 1) No hard copy
- 2) Limited amount of display time
- 3) The bleeding effect of the terminal

Both the second and third disadvantages point to the fact the Tektronix terminal 4002 is an inadequate device for the job at hand. A possible alternative is either a terminal that has a larger display area and a better resolution of that area or a terminal that outputs different colors, that

is, a minimum of three different colors for displaying eight different combinations. Also a hard copy can be added by expanding the third linkage program.

5.3 Improvements

Some of the possible improvements that can be made upon the third linkage program if the Tektronix terminal 4002 is still being used are:

- 1) Making any of the subroutines more efficient. This is usually done by decreasing the number of instructions through the use of more clever programming. The net result is less time spent in a particular subroutine.

- 2) Doing the third linkage program completely under interrupt control. At the present time only the grayscale output is done under interrupt control. When one is switching between program control and interrupt control, internal flag statuses are not known and unwanted problems arise. Programming should be consistent throughout and less time is lost waiting for flags to clear.

- 3) Changing the pixel output from a rectangular area to a character overstrike area. If this is done less calculation is needed to output the border numbers and the result can be output on the teletype, thus a hard copy can be created.

5.4 Future Work

Most additional work done in this area would have to do with the modification of the actual pixel value. For example doing a calculation which takes into consideration the effect the angle at which the satellite records the information. Or perhaps the effect the weather may have upon recording data. Possibly to adjust the data so it would fit into a longitude and latitude area instead of the skewed area obtained from the angle at which the satellite orbits. Another avenue of extension would be to display the data after it had been classified. There are of course numerable possibilities for the reader to investigate, but at this time only a few need be mentioned.

Table 12
Cost and Display Time Comparison
Between All Programs Used

<u>FILE NAME</u>	<u>*PIXOUT PROGRAM \$</u>	<u>FIRST LINKAGE PROGRAM \$</u>	<u>SECOND LINKAGE PROGRAM \$</u>	<u>THIRD LINKAGE PROGRAM \$</u>
*PH1L01	.28	1.24	.20	.19
*PH1L02	.29	1.27	.19	.18
*CR20412	.28	1.22	.19	.18
*CRO413	.29	1.21	.20	.19
		<u>DISPLAY TIME (MIN)</u>	<u>DISPLAY TIME (MIN)</u>	<u>DISPLAY TIME (MIN)</u>
*PH1L01		12:55	2:05	1:58
*PH1L02		12:06	1:52	1:47
*CR20412		9:20	1:20	1:15
*CR20413		11:50	1:35	1:29

CHAPTER 6

USER'S GUIDE6.1 Definitions

AC: Accumulator Register

Home Position: Upper northwest corner of the Tektronix
Terminal 4002

␣: Space Key

L: Link Register

SR: Switch Register

CRTL: Means to press the SHIFT key and the indicated
key at the same time.

6.2 Guide Lines

If a SR switch is up the value for that bit is one, if
down the value is zero.

All inputs must not contain leading or trailing spaces
and are terminated by a carriage return.

In response to the displayed statement "CORRECT" the
expected input is either a "Y" for yes or a "N" for no, any
other input is handled by the displayed statement "WHAT?"
and "CORRECT?".

The user should give time, after turning on the computer,
for the Tektronix terminal to warm up.

The Format for the threshold inputs are seven numbers
followed by a carriage return. Between each number is any

non-numbered key called a delimiter. All numbers must be less than 64 decimal and be equal to an increase in value to the previous number.

EXAMPLE: 11 11 15 19 30 48 63 (carriage return)

If the statement displayed is "PAGE FULL" this indicated the user is near the bottom of the screen. The program is waiting for any input from the keyboard, the screen is then erased and the display pointer is put in the home position. The reason for waiting is for the convenience of the user to observe any information displayed before it is destroyed.

If the PDPIX3 tape is not loaded, go to appendix 7.7, which explains how to load the tape. After the tape is loaded the status of the indicated keys is given below. The display light indicates the mode of the keys.

<u>KEY</u>	<u>STATUS</u>
ASCII	TTY
TTY	
ON LINE	ON LINE
LOCAL	
DIRECT	DIRECT
COMPOSE	

6.3 Program Example

The following is an example of the program where the user's answers are underlined, and helpful hints are found in parentheses. All alphabet letters found on the right margin are for reference only.

TO START

- (1) Load 1200 in SR
- (2) Press ADDR LOAD switch
- (3) Press RUN switch
- (4) CTRL A (^{CDI}_{SOH} key)

(If "#" is not displayed the terminal is probably not connected to the CDC 3300. Have the computer center patch in "terminal H3," information exchange begins here.)

#LOGIN (type user's code and validity code)

H #*OVPIX

START

CTRL C (^{CD3}_{ETX} key)

(Program begins here)

A WHAT IS THE INPUT FILE?

FILE NAME

(type name of LANDSAT file to be used)

CORRECT?

Y (if N is typed go to A)

(Wait for file name to be sent. If file name is not found go to A)

B WHAT ARE THE THRESHOLDS?

11 11 12 30 35 48 63

(If the threshold format is not correct the program will go to B)

C WHAT BAND?

4

(Band number must be between 4 and 7, if it is not the program will say so and go to C)

CORRECT?

Y (If N is typed the program will go to C)

(Wait for band number to be sent)

ON THIS FILE

POINTS 1-28

LINES 1090-53

(the second line value is the number of lines)

O WHAT IS THE INITIAL POINT?

1

CORRECT?

Y (If N is typed the program will go to D)

E NUMBER OF POINTS?

23

CORRECT?

Y (If N is typed the program will go to E)

F WHAT IS THE INITIAL LINE?

1090

CORRECT?

Y (If N is typed the program will go to F)

G NUMBER OF LINES?

33

CORRECT?

Y (If N is typed the program will go to G)

(If information falls beyond limit of the file on limit of the screen the program will state it and go back to the proper location to obtain new information. If all is correct wait for the exchange of information, then LANDSAT data is output with grayscale.)

PICTURE IS COMPLETE

(The program now waits for any input key, the screen is then erased.)

CRTL A (DC1
SOH key)

(If the user wants another picture go to I)

#LOGOFF

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APPENDICES

APPENDIX 7.1

Appendix 7.1 is divided into three sections.

Section 1: The HAND Routine

Section 2: The SHAKE Routine

Section 3: The Output Results From Both Routines

/PROGRAM HAND

TSF41=6411
 TLS41=6416
 KSF41=6411
 KCC41=6402
 KCB41=6406

*200

KCC41

/INITIALIZATION PART I

TLC

TLS+1

TAD 47

DCA CBT

TAD L001

DCA 10

TAD L002

DCA 11

TAD 0250

DCA 00T

ECHO,

TAD 08T

/SEND TO 083

DCA 1 11

TAD 08T

TSF41

JMP -1

TLS+1

DCA 1 11

/SAVE VALUE SENT

CLA 00L

TAD 00

DCA CBT3

OVR,

KSF41

/RECEIVE FROM 083

JMP -1

/GET THREE VALUES

KCB41

TSF

JMP -1

```

      TLS                      /PUT ON SCREEN
      CLA CLL
      ISZ CNTS
      JNP OVR
      ISZ OUT
      JNS LOOP                /DELAY BEFORE SENDING AGAIN
      ISZ CNT
      JNP EOC                /REPEAT ECHO
      TLS41                   /INITIALIZATION PART II
      TAB R7
      DCA CNT
      TAB L00
      DCA 10
      STORE, TAB OUT         /SEND MSG
      ISF41
      JNP .-1
      TLS41
      CLA CLL
      XSF41                   /RECEIVE MSG
      JNP .-1
      DCA 1
      ISZ OUT
      JNS LOOP                /DELAY
      ISZ CNT
      JNP STORE
      JNP 1 R01               /RETURN TO MONITOR
      LOOP,                   /DELAY CONTINUE
      TAB R1
      DCA R2
      ISZ R2
      JNP .-1
      JNP 1 LOOP
      P1,
      P2, 7600
      P3, 7775

```

OWT3, 5
H7, 7771
MON, 7400
CST, 0
EST, 0
H260, 25
LOC, LOC

LOC1, LOC1

LOC2, LOC2

1481

```

C   EQUIP LUN EQUAL TO 5 BEFORE STARTING PROGRAM
      PROGRAM SHAKE
      DIMENSION N(24)
      DO 10 I=1,21,3
        N(I)=I+2+26.75
        N(I+1)=212.5
        N(I+2)=215.5
10    CONTINUE
      WRITE(61,25)
20    FORMAT(' READY')
      CALL CHIN(L)
      DO 30 I=1,21,3
        CALL CHIN(L)
        L=440(L,3775)
        WRITE(61,43)L
        CALL CHOUT(N(I))
        CALL CHOUT(N(I+1))
        CALL CHOUT(N(I+2))
30    CONTINUE
40    FORMAT(24)
      CALL CHIN(L)
      J=2404
      DO 50 I=1,7
        J=J+3
        CALL CHIN(L)
        L=440(L,3775)
        WRITE(61,63)L
        CALL CHOUT(J)
50    CONTINUE
60    FORMAT(' L=',24)
      CALL CHIN(L)
      WRITE(61,73)
70    FORMAT(' END OF TEST')
      STOP
      END

```

7.1 SECTION 3

The Output Results From Both Routines

TEK. VALUES DISPLAYEDVALUES SENT FROM CDC3300

3	263
6	266
9	271
<	274
?	277
B	302
E	305

VALUE RECEIVED CDC3300VALUE SENT BY PDP8/L

FILE: 260	LOC1: 260
261	261
262	262
263	263
264	264
265	265
266	266

LOC 2 same as LOC 1

APPENDIX 7.2

Appendix 7.2 is divided into five sections.

Section 1: Introduction

Section 2: PACKAGE Explanation and Routines

Section 3: INTENSITY Explanation and Routines

Section 4: XYPLANE Explanation and Routines

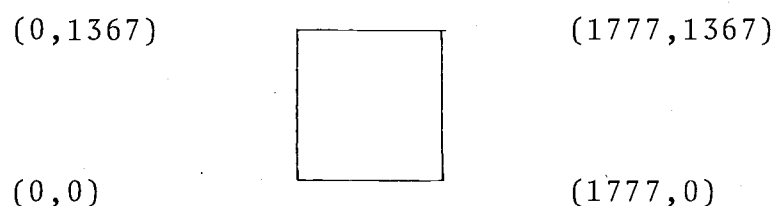
Section 5: PATTERN Explanation and Routines

7.2 Section 1 Introduction

The tek-terminal associated with the PDP-8 (t4002) is dimensioned in the following manner:

UNITS	SCREEN LENGTH	SCREEN WIDTH
Inches	8.18	6.08
Points Octal	1777	1367
Points Decimal	1024	760

Setting the screen up in the Octal x,y coordinate system depends upon the following corner values.



The approximate number of octal points per inch is 125. For ease of computation the ratio of octal points per inch used in the xyplane plot is 128. The error of three points out of 125 is within the realm of acceptability.

Subroutines in the four plot routines follow the general form:

Subroutine name(Para.1,...,Para.n) Location: xxxx

Therefore the calling sequence for a subroutine would be thus:

JMS I NAME	/Any label not used
Para.1	/The parameters that
	/are associated with
Para.n	/that substitute

NAME, xxxx /Location of subroutine

The program would preform the subroutine being called and return to the main program at one location passed the last parameter needed.

7.2 Section 2 Package Plot

LABELS

PAGE 24

Locations Used: 5000-5157

Label	Location	Usage
PAKACC	5021	/Accumulator storage location
PAKFS	5157	/Point plot mode control
PAKGS	5117	/Linear interpolation mode
<u>PAKINK</u>	5120	/Routine for incremental mode
PAKLNK	5022	/Link storage location
<u>PAKMOV</u>	5023	/Routine to position pointer
PAKMSK	5026	/Mask off part of data word
PAKORD	5057	/High order x or y bit
PAKORX	5060	/Low order x bit
PAKORY	5061	/Low order y bit
<u>PAKPPM</u>	5136	/Routine for point plot
PAKPX1	5150	/x value used in point plot
PAKPY1	5151	/Y value used in point plot
PAKRS	5134	/Incremental mode
<u>PAKRST</u>	5013	/Routine to restore registers
<u>PAKSAV</u>	5006	/Routine to save registers
PAKSVX	5063	/X storage in vector plot
PAKTYP	5000	/Routine to output data
PAKUS	5116	/Graphics mode
<u>PAKVEC</u>	5064	/Routine for vector plot

LABELS

PAGE 24 (con)

Locations Used: 5000-5157

Label	Location	Usage
PAKX1	5067	/First x value for vector mode
PAKX2	5107	/Second x value for vector mode
PAKY1	5077	/First y value for vector mode
PAKY2	5110	/Second y value for vector mode
PAK40	5135	/Value used in incremental mode
PRBF	=6046	/TLS value for PDP-8
PRFL	=6041	/TSF value for PDP-8

PAKTYP

Location: 5000

This is a general purpose output routine identical to the "type" routine found in most PDP-8 handbooks. Its primary use is associated with other subroutines found on this page, but may be used by a program located elsewhere in memory*.

PAKSAV

Location: 5006

This subroutine is used to store the value of the accumulator and link so that information is not destroyed while a subroutine from this page is being executed. It also may be used by a program elsewhere in memory. If it is used by a program elsewhere in memory the information must be restored before PAKSAV is used again or the information is lost. Routines on this page that don't use PAKSAV are PAKTYP, PAKSAV, PAKRST, and PAKMOV.*

PAKRST

Location: 5013

This subroutine is used to restore the values of the accumulator and link that were stored from a call to PAKSAV either from a program in memory or from a subroutine on this page.*

*Note calling sequence on next page.

Calling sequence for PAKTYP, PAKSAV, and PAKRST

MAIN PROGRAM

```

        JMS I NAME           /Any label not used
NAME,    xxxx               /Location value of sub-
                               /routine being called.

```

PAKMOV(X,Y) Location: 5023

The purpose of this subroutine is to place the pointer of a particular (X,Y) position on the screen. This routine is used by other routines on the page but may be used by a program elsewhere in memory as long as the status of the program is either point plot mode or linear interpolation mode. (vector mode)

Because the computer expects the output of the Y coordinate first, but most users think in terms of the X coordinated first the subroutine automatically takes care of the situation. That is, the X coordinate is stored, then the Y coordinate is manipulated in the following manner:

The maximum number of bits a coordinate can use is ten, thus the word is divided into a high order (upper five bits) and a low order (lower five bits). The Y coordinate is rotated five places to the right to obtain the high order and then 40_8 is added, or the sixth bit is set to indicate a high order output, the result is then output by a call to

PAKTYP. The Y coordinate is loaded again and the high order bits are masked off, 140_8 is added or the sixth and seventh bits are set and the result is output by a call to PAKTYP.

Next the X coordinate is output in a similar manner except when the low order bits are output just the seventh bit is set or 100_8 is added.

Graphically as seen in the display register.

L	0	1	2	3	4	5	6	7	8	9	10	11	
-	-	-	x_{10}	x_9	x_8	x_7	x_6	x_5	x_4	x_3	x_2	x_1	X or Y coord.
x_5	x_4	x_3	x_2	x_1	-	-	-	x_{10}	x_9	x_8	x_7	x_6	rotation
x_5	x_4	x_3	x_2	x_1	-	0	1	x_{10}	x_9	x_8	x_7	x_6	40_8 added

High order bits output

L	0	1	2	3	4	5	6	7	8	9	10	11	
-	-	-	x_{10}	x_9	x_8	x_7	x_6	x_5	x_4	x_3	x_2	x_1	X or Y coord.
-	0	0	0	0	0	0	0	x_5	x_4	x_3	x_2	x_1	mask (37_8)
-	0	0	0	0	0	1	1	x_5	x_4	x_3	x_2	x_1	140_8 Y/ 100_8 X added

Low order bits output

The status of the computer is not changed while using this subroutine.

PAKVEC (X1,Y1,X2,Y2)

Location: 5064

The subroutine draws a line between the two points (X1,Y1) and (X2,Y2) using the linear interpolation mode.

It may be entered by way of the alphanumeric or linear interpolation status. It stores the value of the

accumulator and link before execution and restores them after execution. After execution the terminal is set in Alphanumeric status, with the pointer at the (X2,Y2) position.

PAKPPM(X,Y)

Location: 5136

The subroutine draws a point at the (X,Y) position specified. It may be entered by way of the alphanumeric or point plot mode. Both the accumulator and link are stored before execution and restored after execution. The terminal is in alphanumeric status after execution.

PAKNK(DIR)

Location: 5120

The subroutine points the pointer in one of eight directions, as indicated by the picture found below, and executes one point in that direction. DIR expects one of sixteen values with each value associated with the indicated direction.

Pen down: $0 \leq \text{DIR} \leq 7$

Pen up: $10 \leq \text{DIR} \leq 17$

It may be entered by way of the alphanumeric or incremental mode. Both the accumulator and link are stored before execution and restored after execution. The status of the terminal after execution is alphanumeric.

```

#5340
PRFL=6741
PRBF=6046
PAKTYP,
    PFFL
    JMP .-1
    PRBF
    CLA CLL
    JMP I PAKTYP
PAKSAV,
    DCA PAKACC
    RAL
    DCA PAKLNK
    JMP I PAKSAV
PAKRST,
    CLA CLL
    TAC PAKLNK
    RAR
    TAC PAKACC
    JMP I PAKRST
PAKACC,
PAKLNK,
PAKMOV,
    TAD I PAKMOV
    DCA PAKSVX
    ISZ PAKMOV
    TAD I PAKMOV
    BTP
    BTR
    CAP
    AND PAKMSK
    TAD PAKORD
    JMS PAKTYP
    TAD I PAKMOV
    AND PAKMSK
    TAD PAKORD

```

```

/VALUE FOR PDP ILS
/VALUE FOR PDP
/RETURN ADDRESS
/IS PRINT FLAG SET
/WAIT FOR PRINT FLAG
/OUTPUT PRINT BUFFER
/CLEAR REGISTERS
/RETURN
/SAVE REGISTERS ROUTINE
/DEPOSIT ACC

/DEPOSIT LINK
/RETURN
/RESTORE REGISTERS ROUTINE
/CLEAR REGISTERS
/PUT IN LINK

/PUT IN ACC
/RETURN

/GET X VALUE
/SAVE X VALUE
/GET Y VALUE

/ROTATE TO GET HIGH Y VALUE

/REMOVE DATA TOO LARGE
/ADD HIGH Y VALUE
/OUTPUT HIGH Y COORD
/GET Y VALUE
/MASK OFF VALUE NOT NEEDED
/ADD LOW Y VALUE

```

JMS PAKTYP	/OUTPUT LOW Y COORD
TAD PAKSVX	/GET X VALUE
RTS	/ROTATE TO GET HIGH X VALUE
RTS	
RAD	
AND PAKMSK	/MASK OFF DATA TOO LARGE
TAD PAKORD	/GET HIGH X VALUE
JMS PAKTYP	/OUTPUT HIGH X COORD
TAD PAKSVX	/GET X VALUE
AND PAKMSK	/MASK OFF VALUE NOT NEEDED
TAD PAKORY	/ADD LOW X VALUE
JMS PAKTYP	/OUTPUT LOW X COORD
ISZ PAKNOV	/CORRECT RETURN ADDRESS
JMP I PAKNOV	/RETURN
PAKORD, 47	
PAKORY, 100	
PAKORY, 104	
PAKMSK, 37	
PAKSVX, 1	
PAKVEC, 1	
JMS PAKSAV	/SAVE REGISTERS
TAD I PAKVEC	/GET X VALUE
OCA PAKX1	/PUT IN X1 POS
ISZ PAKVEC	
TAD I PAKVEC	/GET Y VALUE
OCA PAKY1	/PUT IN Y1 POS
TAD PAKUS	/PUT IN VECTOR MODE
JMS PAKTYP	
JMS PAKNOV	/OUTPUT FIRST TWO VALUES
PAKX1, 1	
PAKY1, 1	
ISZ PAKVEC	
TAD I PAKVEC	/GET SECOND X VALUE
OCA PAKX2	/PUT IN X2 POS
ISZ PAKVEC	
TAD I PAKVEC	/GET Y2 VALUE

	DCA PAKY2	/PUT IN Y2 POS
	JMS PAKMOV	/OUTPUT SECOND TWO VALUES
PAKX2,	1	
PAKY2,	2	
	TAD PAKUS	/PUT IN ALPHA MODE
	JMS PAKTYP	
	ISZ PAKVEC	/GET CORRECT RETURN ADDRESS
	JMS PAKRST	/RESTORE REGISTERS
	JMP I PAKVEC	/RETURN
PAKUS,	237	
PAKGS,	235	
PAKINK,	7	
	JMS PAKSAV	/SAVE REGISTERS
	TAD PAKRS	/PUT IN INCR. MODE
	JMS PAKTYP	
	TAD I PAKINK	/GET DIR
	TAD PAK40	
	JMS PAKTYP	/PUT POINTER IN CORRECT POS
	ISZ PAKINK	/GET CORRECT RETURN ADDRESS
	TAD PAKGS	/PUT IN ALPHA MODE
	JMS PAKTYP	
	JMS PAKRST	/RESTORE REGISTERS
	JMP I PAKINK	/RETURN
PAKRS,	236	
PAK40,	11	
PAKPPH,		
	JMS PAKSAV	/SAVE REGISTERS
	TAD I PAKPPH	/GET X VALUE
	DCA PAKPX1	/PUT IN X POS
	ISZ PAKPPH	
	TAD I PAKPPH	/GET Y VALUE
	DCA PAKPY1	/PUT IN Y POS
	TAD PAKFS	/PUT IN PNT PLOT MODE
	JMS PAKTYP	
	JMS PAKMOV	/OUTPUT COORD
PAKPY1,	7	

PAKFX1,	0	
	ISZ PAKPPM	/SET CORRECT RETURN ADDRESS
	TAD PAKUS	/PUT IN ALPHA MODE
	JMS PAKTYP	
	JMS PAKRST	/RESTORE REGISTERS
	JMP I PAKPPM	/RETURN
PAKFS,	234	

7.2 Section 3 Intensity Plot

LABELS

PAGE 26

Locations Used: 5400-5561

Label	Location	Usage
INTDIF	5544	/Difference between lines produced
<u>INTEN</u>	5400	/Routine to produce lines
INTMO	5453	/No lines in the rectangle
INTM1	5460	/One line in the rectangle
INTM16	5522	/Sixteen lines in the rectangle
INTM2	5465	/Two lines in the rectangle
INTM23	5536	/Depth of rectangle
INTM3	5472	/Three lines in the rectangle
INTM4	5514	/Four lines in the rectangle
INTM5	5506	/Five lines in the rectangle
INTM8	5511	/Eight lines in the rectangle
INTN1	5542	/Used to subtract from x coord.
INTN2	5541	/Finding which lines to output
INTN3	5540	/Finding which lines to output
INTN7	5537	/No longer used in subroutine
INTOVR	5474	/Routine to draw lines
INTPLT	5561	/Location of PAKVEC routine
INTPO	5415	/Label entry for form B
INTP10	5531	/Used in one line output
INTP2	5535	/Used in eight lines output
INTP20	5530	/Value of next X coordinate

LABELS

PAGE 26 (con)

Locations Used: 5400-5561

Label	Location	Usage
INTP3	5534	/Used in five lines output
INTP4	5533	/Used in two and four lines output
INTP5	5532	/Used in three lines output
INTSAV	5543	/Storage for next X location
INTVEC	5545	/Routine to output lines
INTXL	5547	/First X value for line output
INTX2	5551	/Second X value for line output
INTY1	5550	/First Y value for line output
INTY2	5552	/Second Y value for line output
INXCAL	5554	/Routine to make INTX1=INTX2

<u>INTEN</u> (1,X,Y,NUMB)	:FORM A	LOCATION:5400
<u>INTEN</u> (0,NUMB)	:FORM B	LOCATION:5400

INTEN uses a sixteen by nineteen rectangle grid as it's working area. That is, there are a maximum of sixty-four rectangles across and thirty-nine rectangles down. In the working area the following number of lines can be drawn. Zero, one, two, three, four, five, eight, and sixteen. In order to draw that number of lines that exact number must be passed for NUMB or Zero lines are drawn. The X and Y parameters in FORM A refer to the upper left hand corner coordinate points.

INTEN has two forms that are used. Form A is basically used as an initialization of the X and Y coordinates. Form B is used if one know that the pointer is at the correct X and Y coordinated. Form B is used in conjunction with form A because after execution the pointer is placed to the right sixteen points. That is, one working area to the right. The two forms are easy to use when one is going across the screen, but to go down one either uses form A again or subtract nineteen (23_8) from INTY1 (5550) and INTY2 (5552).

One must enter in a graphics mode and after execution the terminal is in Alphanumeric mode.

#5433
INTEN.

TAD I INTEN
SNA CLA
JMP INTP1
ISZ INTEN
TAD I INTEN
OCA INTX1
ISZ INTEN
TAD I INTEN
OCA INTY1
TAD INTY1
TAD INTX2
OCA INTY2
TAD INTX1
TAD INTP20
OCA INTSAV
ISZ INTEN
TAD I INTEN
SNA
JMP INTP16
RAR
SNA
JMP INTX1
RAR
SNA
JMP INTX2
RAR
SNA
JMP INTX4
RAR
SNA
JMP INTX8
RAR
SNA CLA
JMP INTX16

INTP1.

/FORM A OR B
/FORM B
/GET NEXT INTEN LOC
/INITIAL X LOC

/GET NEXT INTEN LOC
/GET X LOC
/Y1 VALUE FOR VEC ROUTINE
/GET Y1 VALUE
/SUB. EIGHTEEN
/Y2 VALUE FOR VEC ROUTINE
/GET X COORD
/ADD SIXTEEN
/NEXT X LOC GOING NW
/NEXT INTEN LOC
/GET NUMBER OF LINES

/NO LINES

/ONE LINE

/TWO LINES

/FOUR LINES

/EIGHT LINES

/SIXTEEN LINES

	TAD I INTEN	/GET NUMBER OF LINES
	TAD INTN3	/MINUS THREE
	SNA	
	JMP INTN3	/THREE LINES
	TAD INTN2	/MINUS TWO
	SNA CLA	
	JMP INTN5	/FIVE LINES
INTN1,	TAD INTSAV	/GET NEXT X COORD
	JMS INXCAL	/X1 = X2
	CLA CLL	
	ISZ INTEN	/GET NEXT INTEN LOC
	JMP I INTEN	/RETURN
INTN1,	TAD INTX1	/GET X1 VALUE
	TAD INTPIA	/ADD EIGHT
	JMS INXCAL	/X1=X2
	JMS INTVEC	/OUTPUT LINE
	JMP INTN1	/RETURN
INTN2,	TAD INTX1	/GET X1 VALUE
	TAD INTPIA	/ADD FOUR
	JMS INXCAL	/X1=X2
	JMS INTVEC	/OUTPUT LINE
	JMP INTN1	/OUTPUT NEXT LINE
INTN3,	TAD INTPIB	/ADD FIVE
	LCA INTDIF	/PUT IN LINE LENGTH
INTDVR,	TAD INTX1	/GET X1 COORD
	TAD INTDIF	/ADD NEXT LINE COORD
	JMS INXCAL	/X1=X2
	TAD INTSAV	/GET NEXT X COORD
	CMA IAC	/MAKE NEG
	TAD INTX1	
	SNA CLA	/END OF LINES
	JMP INTN0	
	JMS INTVEC	/D, DRAW LINE
	JMP INTDVR	/COMPARE X1 VALUE
INTN5,	TAD INTPIB	/ADD THREE
	LCA INTDIF	/PUT IN LINE LENGTH

	JMP INTQVR	/OUTPUT LINES
INTN5,	TAD INTP2	/ADD TWO
	CCA INTDIF	/LINE LENGTH
	JMP INTQVR	/OUTPUT LINES
INTN4,	TAD INTX1	/GET X1
	TAD INTN1	/SUB. ONE
	JMS INXCAL	/PUT X1=X2
	TAD INTP4	/ADD FOUR
	CCA INTDIF	/PUT IN LINE LENGTH
	JMP INTQVR	/OUTPUT LINES
INTN16,	TAD INTX1	/GET X1
	TAD INTN1	/SUB. ONE
	JMS INXCAL	/PUT X1 =X2
	IAC	/ADD ONE
	CCA INTDIF	/PUT IN LINE LENGTH
	JMP INTQVR	/OUTPUT LINES
INTP22,	21	
INTP19,	12	
INTP5,	5	
INTP4,	4	
INTP3,	3	
INTP2,	2	
INTN22,	-22	
INTN7,	-7	
INTN3,	-3	
INTN2,	-2	
INTN1,	-1	
INTSAV,	-	
INTDIF,	-	
INTVEC,	0	
	JMS I INTP1	
INTX1,	0	
INTY1,	0	
INTX2,	0	
INTY2,	0	
	JMP I INTVEC	

```
INXCAL,  6  
        DCA INTX1  
        TAB INTX1  
        DCA INTX2  
        JMP I INXCAL  
INTPLT, 5264  
5
```

7.2 Section 4 XYPlane Plot

LABELS

PAGE 23

Locations Used: 4600-4776

Label	Location	Usage
IR10	-	/Autoindex 10
XY10	4776	/Amount added for tic marks
XY400	4761	/Axis length for no tic marks
XYAXIS	4625	/Outputs pos. or neg. (x and y)
XYCM1	4756	/Boundary comparison pos. axis
XYCM2	4757	/Boundary comparison neg. axis
XYCNT	4765	/Counter
XYCOM	4705	/Outside boundary
XYLNT	4766	/Distance between tic marks
XYLRG	4751	/Pos. boundary for x or y axis
XYM3	4763	/Para. input length for y axis
XYM5	4764	/Para. input length for x axis
XYM20	4775	/Amount sub. for tic marks
XYORG	4612	/Puts pointer at origin
XYPAN	4670	/Outputs axis section
XYPLAN	4600	/Subroutine to output x-y axis
XYPLOT	4740	/Output lines of axis
XYPLP	4677	/Loop indicator for links
XYPLST	4734	/Outputs last link of section
XYP2	4774	/0 for x axis, 1 for y axis
XYSQL	4752	/Neg. boundary for x and y axis

Label	Location	Usage
XYTAB	4750	/Table head for parameters
XYTICM	4753	/Length between tic marks
XYTLP	4646	/Loop indicator for tic length
XYTOT	4652	/Location jump for no tic marks
XYTWO	4762	/Used for finding locations
XYVEC	4760	/PAKVEC location
XYVV1	4771	/xyx1 or xyy1 for axis output
XYVV2	4772	/xyx2 or xyy2 for axis output
XYVV3	4773	/xyy1 or xyx2 for tic output
XYXOR	4754	/x origin value
XYXVL	4767	/xyx1 location for axis output
XYX1	4742	/x1 PAKVEC parameter
XYX2	4744	/x2 PAKVEC parameter
XYWOR	4755	/y origin value
XYVVL	4770	/xyy1 location for tic output
YYY1	4743	/y1 PAKVEC parameter
YYY2	4745	/y2 PAKVEC parameter

XYPLAN

Location: 4600

(XLRG,XSML,XTIC,XOR,YOR,YLRG,YSML,YTIC)

The purpose of this routine is to output an X-Y axis where XOR and YOR parameters are the origin of the axis. The XLRG and YLRG parameters are the positive axis boundaries, that is the positive end of the x and Y axis respectively. The XSML and YSML are the counter parts of XLRG and YLRG or the negative end of the X and Y axis. The following inequalities must be observed or the output results cannot be guaranteed.

(1) XOR XLRG 1777 (2) YOR YLRG 1367

(3) 0 XSML XOR (4) 0 YSML YOR

The parameters XTIC and YTIC of course deal with their indicated axis and use the following format:

VALUE INPUT	TIC MARK LENGTH (inches)
0	No tic marks
1	1/128
2	1/64
3	1/32
4	1/16
5	1/8
6	1/4
7	1/2
10	1

One must be careful to observe that with numbers larger than eight you will get one of the three following possibilities.

- (1) Larger than an inch
- (2) Larger than the axis length
- (3) One of the previously stated values

What happens is the value is made negative and decreased by one as a bit is rotated through the accumulator by one until the value becomes zero. As you can see a bit can rotate clear back around the accumulator.

One must enter by way of Alphanumeric status and after execution the terminal is in Alphanumeric status with the pointer at the origin of the axis. One must also have PACKAGE PLOT in memory.

*4628

XYPLAN,

CLA CLL
DCA XYP2
TAD XYM5
JMS XYAXIS
ISZ XYP2
TAD XYM3
JMS XYAXIS
JMS XYORG
JMP I XYPLAN

XYORG,

TAD XYXOR
DCA XYX1
TAD XYX1
DCA XYX2
TAD XYYOR
DCA XYY1
TAD XYY1
DCA XYY2
JMS XYPLT
JMP I XYORG

XYAXIS,

DCA XYCNT
TAD XYTAB
DCA IRL
TAD I XYPLAN
DCA I IRL
ISZ XYPLAN
ISZ XYCNT
JMP .-4
TAD XY40W
DCA XYLNT
TAD XYTICN
SNA

/X - Y AXIS OUTPUT
/CLEAR REGISTERS
/ 0 FOR X AXIS
/INITIALIZATION FOR X AXIS
/OUTPUT X AXIS
/ 1 FOR Y AXIS
/INITIALIZATION FOR Y AXIS
/OUTPUT Y AXIS
/PUT POINTER AT ORIGIN
/RETURN TO MAIN PROGRAM
/SUBROUTINE TO PUT POINTER
/AT ORIGIN
/X ORIGIN IN XYX1

/X ORIGIN IN XYX2

/Y ORIGIN IN XYY1

/Y ORIGIN IN XYY2
/POINTER TO ORIGIN
/RETURN FROM SUBROUTINE
/SUBROUTINE TO OUTPUT AXIS
/SECTION
/TABLE LENGTH COUNTER
/PARA. TABLE LOC.

/GET NEXT PARA.
/DEPOSIT NEXT PARA.

/ALL PARA. GOTTER
/NO, GET MORE
/MAKE LINK LENGTH 400
/STORE AT LINK LENGTH
/GET LENGTH PARA.
/IS IT EQUAL TO ZERO

	JMP XYTOT	/YES
	CIA	/NO MAKE NEG.
	DCA XYCNT	/MAKE COUNTER VALUE
	STL	/MAKE LINK ONE
XY TLP,	RAL	/ROTATE TILL ZERO
	ISZ XYCNT	/COUNTER ZERO
	JMP XYTLP	/NO
	DCA XYLNT	/YES, STORE AT LINK LEN
XY TOT,	TAD XYCM1	/BOUNDARY COMPARISON
	DCA XYCOM	
	JMS XYORG	/POINTER AT ORIGIN
	JMS XYPAN	/OUTPUT AXIS SECTION
	JMS XYORG	/PUT POINTER AT ORIGIN
	TAD XYLNT	/TIC LENGTH
	CIA	/MAKE NEG.
	DCA XYLNT	/STORE AT TIC LENGTH
	TAD XYCM2	/BOUNDARY COMPARISON
	DCA XYCOM	
	TAD XYSML	/EXCHANGE BOUNDARY
	DCA XYLR3	/VALUES
	JMS XYPAN	/OUTPUT AXIS SECTION
	JMS I XYAXIS	/RETURN FROM SUBROUTINE
XY PAN,		/SUBROUTINE TO OUTPUT AXIS
		/SECTIONS
	TAD XYP2	/X OR Y AXIS OUTPUT
	TAD XYXVL	/XXY1 LOCATION
	DCA XYVV1	/MAKE XXY1 OR XYY1 LOC.
	TAD XYVV1	
	TAD XYTW0	
	DCA XYVV2	/MAKE XXY2 OR XYY2 LOC.
XY PLP,	TAD I XYVV1	/XXY1 OR XYY1 LOC.
	TAD XYLNT	/ADD OR SUB. TIC LENGTH
	DCA I XYVV2	/PUT IN XXY2, XYY2 LOC
	TAD I XYVV2	
	CMA CLL	/MAKE XXY2 OR XYY2 NEG.
	TAD XYLR3	/BOUNDARY

XY X1 ,
XY Y1 ,
XY X2 ,
XY Y2 ,

/ RETURN FROM SUBROUTINE
/ SUBROUTINE TO OUTPUT LINES

```

      JNP I XYPLT
XYTAB, XYTAB
XYLRG, 0
XYSP, 0
XYTICK, 0
XYXOR, 0
XYXOF, 0
XYCH1, SPA CLA
XYCH2, SMA CLA
XYVEC, 3064
XY401, 400
XYTPO, 2
XY43, -3
XY45, -5
XYCNT, 0
XYLPT, 0
XYXVL, XYX1
XYXVL, XYY1
XYV1, 0
XYV2, 0
XYV3, 0
XYP2, 0
XYX2, -2
XY10, 10
IP10=10

```

```

/RETURN FROM SUBROUTINE
/ PARA. TABLE LOC.
/ LARGE X OR Y BOUNDARY
/ SMALL X OR Y BOUNDARY
/ LINK LENGTH SIZE
/ X ORIGIN
/ Y ORIGIN
/ BOUNDARY COMPARISON
/ BOUNDARY COMPARISON
/ PARVEC LOCATION

```

7.2 Section 5 Pattern Plot

LABELS

PAGE 25

Locations Used: 5200-5366

Label	Location	Usage
SQN10	5364	/Size of square counter
SQPLT	5366	/Location of PAKVEC routine
SQSAV	5363	/Size calculation storage
SQSIZ	5365	/Location for square size
<u>SQUARE</u>	5301	/Subroutine to output square
SQVEC	5354	/Line output subroutine
SQX1	5356	/First X value for line output
SQX2	5360	/Second X value for line output
SQY1	5357	/First Y value for line output
SQY2	5361	/Second Y value for line output
<u>TRIANG</u>	5200	/Subroutine to output triangle
TRICK	5274	/Leg of triangle counter
TRIFIX	5276	/X coord. length of triangle
TRIFIY	5277	/Y coord. length of triangle
TRIOVR	5206	/X or Y coordinate loop
TRIPLT	5234	/Location of PAKVEC routine
TRISIZ	5275	/Number of X and Y increases
TRIVEC	5300	/Leg output routine
TRIX1	5235	/First X value for leg output
TRIX2	5237	/Second X value for leg output
TRIY1	5236	/First Y value for leg output

LABELS

PAGE 25 (con)

Locations Used: 5200-5362

Label	Location	Usage
TRIY2	5240	/Second Y value for leg output
TRI2	5251	/Second leg of triangle output
TRI3	5260	/Third leg of triangle output
TRI4	5273	/One half base added per size
TRI7	5272	/Height added per size

TRIANG(SIZ,X,Y)

LOCATION: 5200

The pattern produced here is an almost equalateral triangle. The parameter SIZ indicates the size of the triangle that is to be produced. The triangle format is a $8^{\text{size}+1} \times 7^{\text{size}+1}$ that is, the width of the triangle is equal to $8^{\text{size}+1}$ and the height is equal to $7^{\text{size}+1}$. The X and Y parameters refer to the upper left hand coordinate values of the triangle. In order to use this routine the package plot routine must be in memory. The user must enter by way of a graphics status and after execution the terminal will be in Alphanumeric status mode.

SQUARE(SIZ,X,Y)

LOCATION: 5200

The pattern produced here is a square of an eight by eight multiple. The parameter SIZ indicates the size of the square to be produced. The square format is $8^{\text{size}+1} \times 8^{\text{size}+1}$. The X and Y parameters refer to the upper left hand coordinate values of the square. In order to use this routine the package plot routine must be in memory. The user must enter by way of a graphics status and after execution the terminal will be in Alphanumeric status mode.

*5200

TRIANG,

TRIOVR,

TRIPLT,

TRIX1,

TRIY1,

TRIX2,

TRIY2,

2
TAD I TRIANG
CMA
DCA TRISIZ
DCA TRIFIX
DCA TRIFIY
TAD TRIFIX
TAD TRI4
DCA TRIFIX
TAD TRIFIY
TAD TRI7
DCA TRIFIY
ISZ TRISIZ
JMP TRIOVR
ISZ TRIANG
TAD I TRIANG
DCA TRI X2
ISZ TRIANG
TAD I TRIANG
DCA TRI Y1
TAD TRI X2
TAD TRIFIX
DCA TRI X1
TAD TRIFIY
CMA IAC
TAD TRI Y1
DCA TRI Y2
DCA TRICK
JMS I TRIVEC
2
2
2
3
TAD TRICK
SNA

/RETURN ADDRESS
/PICK UP TRIANGLE SIZE
/MAKE NEG.
/USE FOR LENGTH SIZE
/MAKE X COORD ZERO
/MAKE Y COORD ZERO
/GET X COORD LENGTH
/ADD 4 TO X COORD LENGTH
/DEPOSIT IN X COORD LENGTH
/GET Y COORD LENGTH
/ADD 7 TO Y COORD LENGTH
/DEPOSIT IN Y COORD LENGTH
/ADDED TO COORD ENOUGH
/NO
/YES, GET X LOCATION
/GET X POSITION
/DEPOSIT X2 OF VEC ROUTINE
/GET Y LOCATION
/GET Y POSITION
/DEPOSIT Y1 OF VEC ROUTINE
/GET X2 VALUE
/ADD X COORD LENGTH
/DEPOSIT X1 OF VEC ROUTINE
/GET Y COORD LENGTH
/MAKE NEG.
/ADD X1 OF VEC ROUTINE
/DEPOSIT Y2 OF VEC ROUTINE
/MAKE LEG COUNTER ZERO
/OUTPUT FIRST LEG OF TRIANGLE
/FIRST X VALUE OF VEC OUTPUT
/FIRST Y VALUE OF VEC OUTPUT
/SECOND X VALUE OF VEC OUTPUT
/SECOND Y VALUE OF VEC OUTPUT
/GET LEG COUNTER
/IS IT ZERO

	JMP TRI2	/YES, OUTPUT SECOND LEG
	RAP	/NO
	SNA CLA CLL	/IS IT ONE
	JMP TRI3	/YES, OUTPUT THIRD LEG
	ISZ TRIANG	/NO, RETURN
	JMP I TRIANG	/RETURN
TRI2,	TAD TRIFIX	/ADD X COORD LENGTH
	TAD TRIFIX	/ADD X COORD LENGTH AGAIN
	TAD TRIK2	/ADD X2 OF VEC ROUTINE
	DCA TRIK2	/DEPOSIT X2 OF VEC ROUTINE
	IAC	/ADD ONE TO ACC.
	DCA TRICK	/DEPOSIT IN LEG COUNTER
	JMP TRIPLT	/OUTPUT SECOND LEG
TRI3,	TAD TRIFIX	/ADD XCOORD LENGTH
	CMA IAC	/MAKE NEG
	TAD TRIK1	/ADD X1 OF VEC ROUTINE
	DCA TRIK1	/DEPOSIT X1 OF VEC ROUTINE
	TAD TRIY2	/ADD Y2 OF VEC ROUTINE
	DCA TRIY1	/DEPOSIT Y2 OF VEC ROUTINE
	TAD TRICK	
	IAC	
	DCA TRICK	
	JMP TRIPLT	
TRI7,	7	
TRI4,	4	
TRICK,	0	
TRISIZ,	1	
TRIFIX,	1	
TRIFIY,	1	
TRIVED,	5064	
SQUARE,	0	
	TAD I SQUARE	/GET X COORD
	CMA	
	DCA SDS4V	
	ISZ SQUARE	
	TAD I SQUARE	

DCA SQX1	/PUT IN X1 FOR VEC ROUTINE
DCA SQSIZ	/ZERO SIZE OF SQUARE
ISZ SQUARE	/GET NEXT SQUARE LOC
TAD I SQUARE	/GET Y COORD
DCA SQY1	/PUT IN Y1 FOR VEC ROUTINE
TAD SQN14	/INITIAL SQUARE LENGTH
TAD SQSIZ	/ADD TO LENGTH OF SQUARE
DCA SQSIZ	/STORE IN LENGTH
ISZ SQSAV	/SQUARE LARGE ENOUGH
JMP .-4	/NO
TAD SQX1	/YES
TAD SQSIZ	/LENGTH OF SQUARE
DCA SQX2	/PUT IN X2 VALUE FOR VEC ROUTINE
TAD SQY1	/GET Y COORD
DCA SQY2	/PUT IN Y2 VALUE
JMS SQVEC	/FIRST LEG OF SQUARE
TAD SQX1	/GET X COORD
DCA SQX2	/X2 VALUE FOR VEC ROUTINE
TAD SQSIZ	/LENGTH OF SQUARE
CMA IAC	/MAKE NEG
TAD SQY1	/ADD Y1 COORD
DCA SQY2	/Y2 VALUE FOR VEC ROUTINE
JMS SQVEC	/LEG TWO
TAD SQY2	/GET Y2 COORD
DCA SQY1	/Y1 VALUE FOR LEG THREE
TAD SQX2	/GET X2 VALUE
TAD SQSIZ	/LENGTH OF SQUARE
DCA SQX1	/X1 VALUE FOR LEG THREE
JMS SQVEC	/LEG THREE
TAD SQX1	/GET X1 COORD
DCA SQX2	/X2 VALUE FOR LEG 4
TAD SQY1	/GET Y1 COORD
TAD SQSIZ	/LENGTH OF SQUARE
DCA SQY2	/Y2 VALUE FOR LEG 4
JMS SQVEC	/LEG FOUR
ISZ SQUARE	/GET NEXT SQUARE LOC

```

SQVEC,    JMP I SQUARE
           0
           JMP I SCPLT
SQX1,     0
SQY1,     0
SQX2,     0
SQY2,     0
           JMP I SQVEC
SQSAV,    0
SQN13,    10
SQSI2,    0
SQPLT,    5064
$

```

```

/RETURN
/LEG OUTPUT
/VECTOR SUBROUTINE

```

APPENDIX 7.3

Appendix 7.3 deals with a full screen output. The program outputs a variety of possible grayscale values in the largest area used, that is 58 by 34 points.

/OUTPUTS FULL SCREEN USING INTENSITY ROUTINE

```

*244
CLA CLL
TLE          /CLEAR FLAG
TAB          /INTEN TALLE HEAD
DOA          10
TAB          42          /LENGTH OF TAYLE
DOA          TABCNT
TAB          460          /MAX NUMB. OF ROWS
DOA          ROWCNT
TAB          442          /MAX NUMB. OF LINES
DOA          LINCNT
TAB          P1230
DOA          FAX1          /INITIAL Y LOC.
TAB          P117
DOA          FAX1          /INITIAL X LOC.
DOA          IAC
DOA          FA1          /OPTION 1 FOR INTEN
TAB          P8
DOA          FA2          /LEFT EDGE OUTPUT
START, J 5 I    TESVEC
FA1,           /OPTION 1
FAX1, 0
FAX1,
FA2, 1
AGAIN, TAB I    10          /NEXT TABLE VALUE
DOA          FA2
JMS          TABLP          /RESTART TABLE?
JMS I        TESVEC          /OUTPUTS NEXT ROW VALUE
FA1,
FA2,
JMS          LINLP          /NEXT LINE CHECK
JMP          AGAIN          /CONTINUE

TABLP, 0          /END OF TABLE?

```

```

      ISZ      TABCNT
      JNP I    TABLP      /NO, RETURN
      TAD      M20        /YES, RESTART COUNTER
      DCA      TABCNT
      TAD      TAB        /RESTART TABLE HEAD
      DCA      13
      JNP I    TABLP      /RETURN

```

```

LINEP, 1      /END OF LINE CHECK

```

```

      ISZ      ROWCNT
      JNP I    LINEP      /NO, RETURN
      TAD      FAY1       /NEW Y LOC.
      TAD      M22
      DCA      FAY1
      TAD      P110       /NEW X LOC.
      DCA      FAX1
      TAD      M66        /RESTART COUNTER
      DCA      ROWCNT
      ISZ      LINECNT    /LAST LINE+
      JNP      START     /NO, CONTINUE
      LIT      /YES, STOP

```

```

ROWCNT,
TARCNT,
LINECNT,
P8, 10
P110, 110
P125, 125
TESVEC, 0
M20, -20
M22, -20
M42, -42
M66, -66
TAP, TAB
20
20
10

```

5
4
3
2
1
0
0
0
0
4
5
1
1
2
2

APPENDIX 7.4

Appendix 7.4 is divided into four sections.

Section 1: *PHILO1 Line Printer Output.

Section 2: *PHILO2 Line Printer Output.

Section 3: *CR20412 Line Printer Output.

Section 4: *CR20413 Line Printer Output.

APPENDIX 7.5

Appendix 7.5 is divided into four sections.

Section 1: *PHIL01 and Shutter time

Section 2: *PHIL02 and Shutter time

Section 3: *CR20412 and Shutter time

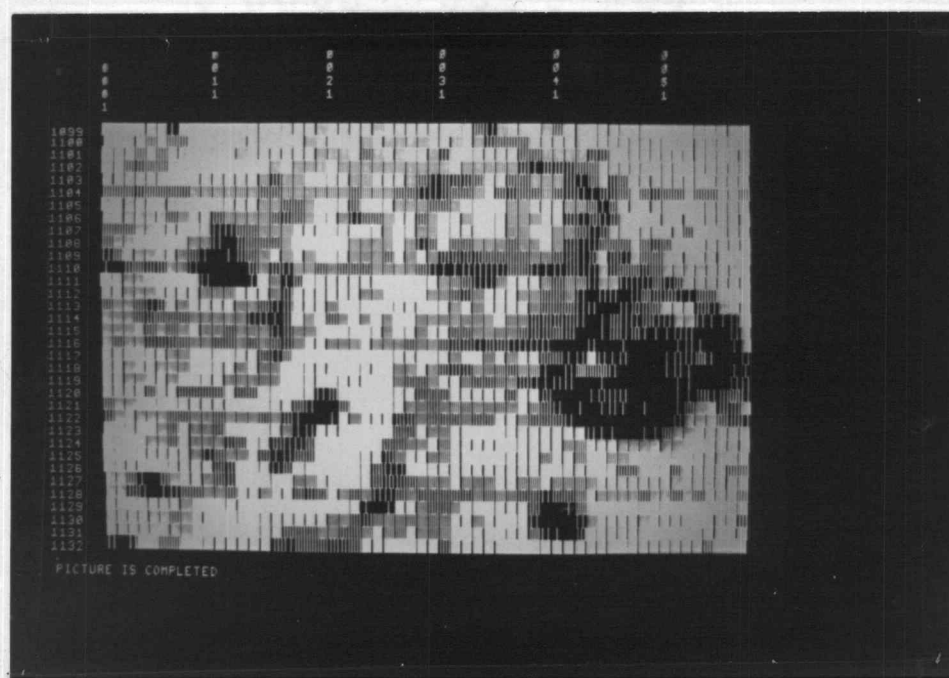
Section 4: *CR20413 and Shutter time

7.5 Section 1 *PHILO1

Shutter speed: 1/30

F stop: 1.8

ASA 125

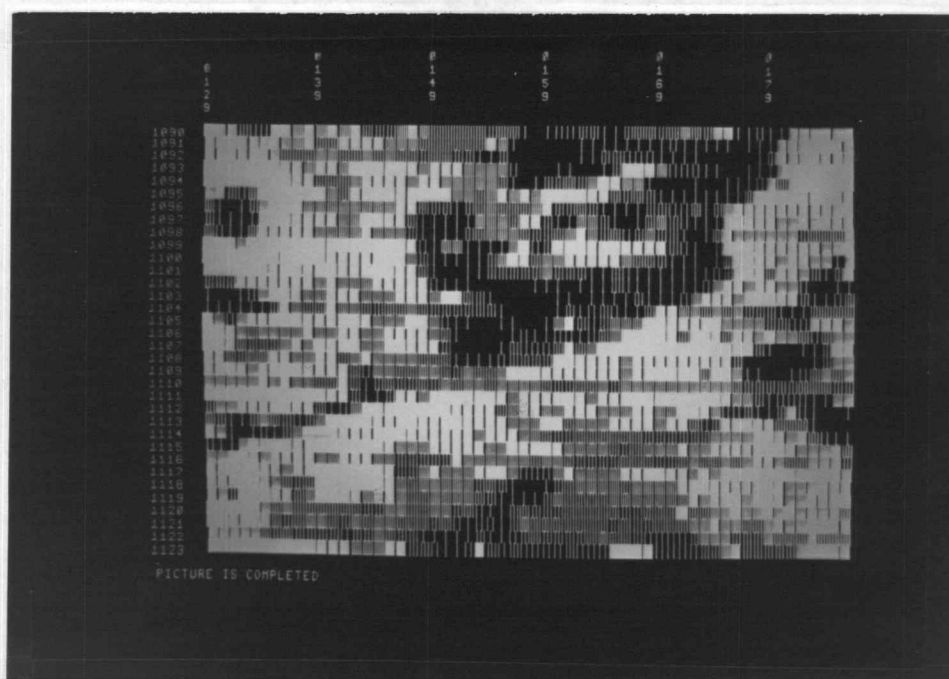


7.5 Section 2 *PHILO2

Shutter speed: 1/30

F stop: 1.8

ASA 125

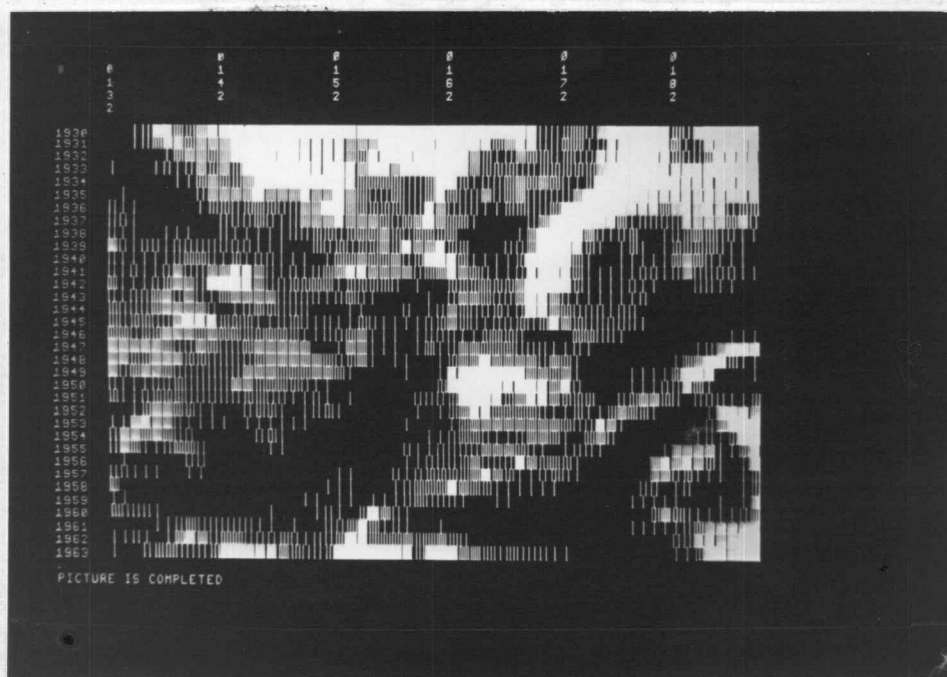


7.5 Section 3 *CR20412

Shutter speed: 1/15

F stop: 1.8

ASA 125

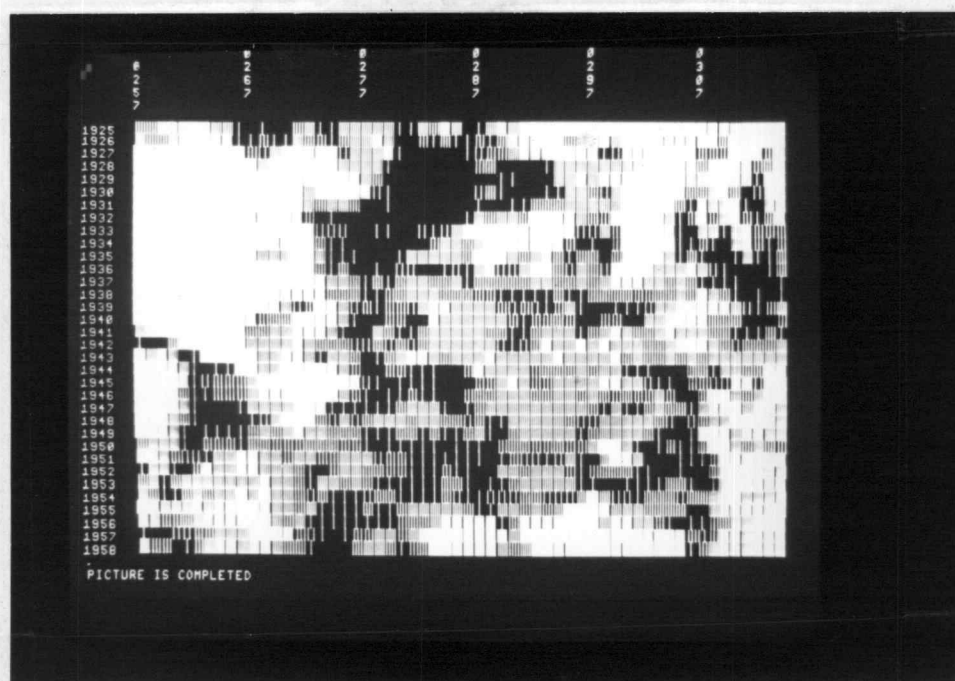


7.5 Section 4 *CR20413

Shutter speed: 1/15

F stop: 1.8

ASA 125



APPENDIX 7.6

Appendix 7.6 is divided into four sections.

Section 1: The third CDC 3300 Linkage Program

Section 2: The BUFOUT Subroutine

Section 3: The NEQUIP Subroutine

Section 4: The third PDP8/L Linkage Program

```

PROGRAM OS3PIX3
C *****
C *
C *      OS3PIX IS A COMMUNICATION PROGRAM BETWEEN *
C * OS3 AND THE PDP8-L USING THE ORIGINAL ERTS *
C * BINARY FILE.  LUN 20 IS THE INPUT FILE. *
C *****
DIMENSION ID(23),INPUT(870),IWORK(218)
INTEGER PP,REM,WS,WSS
CHARACTER CWORK(872),CID(92)
EQUIVALENCE(IWORK,CWORK),(CID,ID)
WRITE(61,100)
100 FORMAT(' START')
110 CALL CHIN(N)
120 CALL UNEQUIP(20)
READ(60,130)XNAME
130 FORMAT(A6)
IF(NEQUIP(20,XNAME)) 150,140
140 CALL CHIN(N)
CALL CHOUT(5B)
GO TO 120
150 CALL CHIN(N)
CALL CHOUT(4B)
CALL IDENT(ID,10,LD)
IF (LD .EQ. 2) GO TO 120
WS=FFIN(60)

C SEND ID(5)& ID(7),ID(8)& ID(11),ID(12)
C
      I=4
      J=16
      CALL BUFOUT(I,J,CID)
      I=I+4
      J=J+8
      CALL BUFOUT(I,J,CID)
      J=J+16

```

```

      CALL BUFOUT(1,J,CID)
      RE=FFIN(60)
      N=FFIN(64)
      LE=FFIN(68)
      LS=FFIN(62)
      PR=FFIN(54)
      LENGTH=10(5)

C
C   BUFFER OVER TO STARTING BLOCK
C
      DO 17 I=1,LS
        BUFFER=IN(24,1)(INPUT(1),INPUT(LENGTH))
16      GO TO (164,174,224,224),UNITSTF(23)
17      CONTINUE
        CALL CHIN(4)
        CALL CHOUT(44)
        CALL CHIN(4)

C
C   BUFFER IN THAT PART OF BLOCK TO OUTPUT
C
      DO 21A I=1,LE
        BUFFER=IN(28,1)(INPUT(1),INPUT(LENGTH))
18      GO TO (184,194,224,224),UNITSTF(24)
19      ASS=75
        CALL CHIN(4)
        CALL CHOUT(15)
        DO 20 J=1,N
          IWORK(J)=INPUT(ASS)
          ASS=ASS+4
20      CONTINUE
        CALL REPORT(PR,RE,IWORK)
21      CONTINUE
      STOP
22      CALL CHIN(4)
        CALL CHOUT(55)
      GO TO 11

```

```

END
SUBROUTINE IDENT(ID,LIN,LP)
DIMENSION ID(23)
CALL CHIN(0)
DOFFER ID(23,1) (ID(1),ID(23))
10 GO TO (1,24,34,34),UNITSTF(23)
20 LP=1
CALL CHIN(0)
CALL CROUT(40)
RETURN
30 LP=2
CALL CHIN(0)
CALL CROUT(40)
RETURN
END

```

	IDENT	BUFOUT	
	ENTRY	BUFOUT	
BUFOUT	UJP	**	
	LDI	BUFOUT,3	GET ADR OF PARM.
	LDA,I	1,3	GET # OF FIRST CHAR
	SHAQ	24	STORE IN Q
	LDA	2,3	GET CHAR ADR OF ARRAY
	LPA	MASK	MASK OFF 77
	AQA		ADD OFF SET AND CHAR ADR
	SCHA	STCHA	STORE CHAR ADR
	LDA,I	0,3	GET # OF CHARS TO OUTPUT
	ENI	0,1	PUT 0 IN IR1
	UJP	EOL	GET CHAR OUTPUT LOOP
STCHA	LACH	**,1	GET CHAR VALUE
EOL	IJD	STCHA,2	ALL CHAR OUTPUTTED ?
	CTO		OUTPUT CHAR
	INI	1,1	NEXT CHAR
	TAI	2	STORE IN IR2
	UJP	3,3	
MASK	OCT	00777777B	
	END		

	IDENT	NEQUIP
	ENTRY	NEQUIP
NEQUIP	UJP	**
	LDI	NEQUIP,3
	LDA,I	0,3
	STA	LUN
	LDAC,I	1,3
	SDI	3,1
	XREQ,I	LUN
	ENA	1
	ISG	1,1
	UJP	2,3
	ENA	0
LUN	RSS	1
	END	

PUTS LUN ADR IN 3
 GET LUN VALUE
 STORE LUN VALUE AT LUN
 PUTS NAME IN A0
 PUTS 3 IN 1 (EQUIP)
 EQUIP LUN WITH A0
 TRUE RETURN
 SKIP NEXT LINE IF NO ERROR
 RETURN
 FALSE RETURN
 LUN STORAGE

7.6 Section 4 PDP8/L Linkage Routine

3300 PAL/OS3 VER 3.1 12/04/75 23142

PAGE 1

```

      6402      1 KSC40 =6402
      6401      2 KSF40 =6401
      6406      3 KOR40 =6406
      6411      4 TSF41 =6411
      6412      5 TCF41 =6412
      6416      6 TLS41 =6416

      1000      7
      1001      8
      1002      9
      1003     10
      1004     11
      1005     12
      1006     13
      1007     14
      1008     15
      1009     16
      1010     17
      1011     18
      1012     19
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      2008    1015
      2009    1016
      2010    1017
      2011    1018
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0117 0000 81 COM1, 0
0120 0000 82 NUMR1, 0 /1000#S
0121 0000 83 NUMR2, 0 /100#S
0122 0000 84 NUMR3, 0 /10#S
0123 0000 85 NUMR4, 0 /UNITS
0124 4554 86
0125 1347 87 OS3IN, JMS I DATPUT
0126 7850 88 TAD NUBFL /SKIP BUFFER FLAG SETA
0127 1344 89 SNA CLA /YES, SKTE BUFFER
0130 7840 90 TAD RUFFL1 /BUFFER FLAG SETA
0131 4457 91 S7A CLA
0132 3344 92 BUFFER /YES, BUFFER
0133 4537 93 OCA RUFFL1 /NO
0134 6301 94 RETT, JMS I REGRES /RESTORE REGISTERS
0135 5400 95 ION
0136 5306 96 JMP I 0
0137 5013 97 SAVREG, PAKSAV
0138 5013 98 REGRES, PAKRST
0139 5013 99
0140 0000 100 TYP, 0
0141 3155 101 OCA KEYP /SAVE VALLE
0142 1343 102 TAD IFL /OUTPUT FLAG SET
0143 7700 103 SNA CLA /YES, CONTINUE
0144 5142 104 JMP --2 /NO, WAIT
0145 1155 105 TAD KEYP /GET VALUE
0146 6302 106 IOP /TURN INTERRUPT OFF, CLEAR FLAG
0147 6340 107 TIS
0148 7300 108 CLA CLL
0149 3143 109 OCA IFL
0150 6301 110 ION /TURN ON INTERRUPT
0151 5540 111 JMP I TYP /RETURN
0152 5540 112
0153 3000 113 DATPUT, DATIN
0154 0000 114 KEYP, 0
0155 4451 115 INPUT =JMS I LIS1
0156 4452 116 OUTPUT =JMS I TYP1
0157 4453 117 RECEIVE =JMS I LIS2
0158 4454 118 SEND =JMS I TYP2
0159 4455 119 SCREEN =JMS I SCFULL
0160 4456 120 MESSAGE =JMS I MESS
0161 4457 121 BUFFER =JMS I BUF
0162 4457 122
0163 4457 123 /SET UP FOR BUFFER IN ERROR
0164 4457 124
0165 4457 125
0166 4457 126
0177 0177 *J177
0178 4451 126 NEW, INPUT

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128
129
130
131 /THE EXCHANGE OF ERT'S DATA FROM THE 3300 TO FORA/L
132 /BY CECIL L NELSON
133 /NOV.. 1975
134
135
136
137 *200
138 REGIN. CLA CLL /CLEAR ALL FLAGS
139 TLS
140 TLS41 /FRASE SCREEN
141 ME0. JMS I WIPE /WHAT
142 MESSAGE /IS THE
143 MESSA /INPUT FILE
144 MESSC /A
145 MESSD
146 C
147 JMS I FLSTR /STORE THE FILE NAME
148 ME1. MESSAGE /IS THE
149 MESSC /INPUT FILE
150 MESSD /CORRECT
151 MESSB /A
152 C
153 JMS I ANS /REPLY ROUTINE
154 JMS ME1 /ERROR RETURN
155 JMS ME0 /NO RETURN
156 JMS I INFIL /YES RETURN: SEND FILE
157 JMS I FLOCK /FILE EXISTA
158 JMS ME0 /NO
159 SEND /BUFFER IN ERROPA
160 BUFFER
161 ME2. MESSAGE /WHAT
162 MESSA /ARE THE THRESHOLDS
163 MESSC /A
164 MESSD
165 C
166 JMS I THOVAL /STORE THRESHOLDS
167 ME2. MESSAGE /INPUT ERROR
168 MESSC /CORRECT (THRESHOLDS)
169 MESSB /A
170 C
171 JMS I ANS /REPLY ROUTINE
172 JMS ME4 /ERROR RETURN
173 JMS ME2 /NO RETURN
174 JMS I THCHCK /YES RETURN:LEGAL VALLESA
175 JMS ME2 /NOT LEGAL
176 JMS I VALTAB /SETS UP TABLE VALUE
177 ME5. MESSAGE /WHAT
178 MESSA /BAND NUMBER
179 MESSC /A
180 MESSD
181 C
182 JMS I BNDCK /BAND 2: BETWEEN (4-7)A
183 ME7. MESSAGE /NO
184 MESSC /CORRECT
185 MESSB /A
186 C
187 JMS I ANS /REPLY ROUTINE
188 JMS ME6 /ERROR RETURN
189 JMS ME5 /NO RETURN
190 JMS RANO /YES RETURN
191 JMS MIN3
192 SEND
193 JMS P215 /SEND WITHOUT DELAY
194 SEND /GET LINE FEED
195 RECEIVE /CLAP ACC
196 CLA /INPUT ID(5,7,8,11,12)
197 JMS I IDAT
198 JMS I INFF /CHECK FOR < >
199 MESSAGE /ON THIS FILE
200 MESSC /POINT
201 MESSH /S
202 MESSI
203
204
205
206
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0307 0000 228 0
0310 4771 229 JMS I BIDEK /CONVERTS ID(7) TO DECIMAL
0311 4775 230 ID7H /ID(7) BINARY
0312 3304 231 IDN7 /ID(7) DECIMAL
0313 4772 232 JMS I IDOUT /DECIMAL OUTPUT ID(7)
0314 3307 233 IDN8-1 /SPACE-SPACE
0315 4456 234 MESSAGE
0316 6150 235 MESSAGE
0317 0377 236 MESSAGE
0318 0377 237 JMS I BIDEK /CONVERT ID(8) TO DECIMAL
0319 3310 238 ID8H /ID (8) BINARY
0320 4772 239 IDN8 /ID (8) DECIMAL
0321 3313 240 JMS I IDOUT /
0322 4456 241 IDN11-1 /DECIMAL OUTPUT ID(8)
0323 6150 242 MESSAGE
0324 5760 243 MESSAGE
0325 5727 244 MESSAGE
0326 5711 245 MESSAGE
0327 0377 246 MESSAGE
0328 0377 247 JMS I BIDEK /CONVERT ID(11) TO DECIMAL
0329 0101 248 ID11H /ID(11) BINARY
0330 3314 249 IDN11 /ID(11) DECIMAL
0331 4772 250 JMS I IDOUT /DECIMAL OUTPUT ID(11)
0332 3317 251 IDN12-1 /SPACE-SPACE
0333 4456 252 MESSAGE
0334 6150 253 MESSAGE
0335 0377 254 JMS I BIDEK /CONVERT ID(12) TO DECIMAL
0336 3318 255 ID12H /ID (12) BINARY
0337 4772 256 IDN12 /ID (12) DECIMAL
0338 3323 257 JMS I IDOUT /DECIMAL OUTPUT ID(12)
0339 4456 258 IDN12+3 /SPACE-SPACE
0340 5760 259 MESSAGE
0341 0377 260 MESSAGE
0342 0377 261 JMS I BIDEK /CONVERT ID(13) TO DECIMAL
0343 3319 262 ID13H /ID (13) BINARY
0344 4772 263 IDN13 /ID (13) DECIMAL
0345 3323 264 JMS I IDOUT /DECIMAL OUTPUT ID(13)
0346 4456 265 IDN13+3 /SPACE-SPACE
0347 5760 266 MESSAGE
0348 0377 267 MESSAGE
0349 0377 268 JMS I BIDEK /CONVERT ID(14) TO DECIMAL
0350 3320 269 ID14H /ID (14) BINARY
0351 4772 270 IDN14 /ID (14) DECIMAL
0352 3323 271 JMS I IDOUT /DECIMAL OUTPUT ID(14)
0353 4456 272 IDN14+3 /SPACE-SPACE
0354 5760 273 MESSAGE
0355 0377 274 MESSAGE
0356 0377 275 JMS I BIDEK /CONVERT ID(15) TO DECIMAL
0357 3321 276 ID15H /ID (15) BINARY
0358 4772 277 IDN15 /ID (15) DECIMAL
0359 3323 278 JMS I IDOUT /DECIMAL OUTPUT ID(15)
0360 4456 279 IDN15+3 /SPACE-SPACE
0361 5760 280 MESSAGE
0362 0377 281 MESSAGE
0363 0377 282 JMS I BIDEK /CONVERT ID(16) TO DECIMAL
0364 3322 283 ID16H /ID (16) BINARY
0365 4772 284 IDN16 /ID (16) DECIMAL
0366 3323 285 JMS I IDOUT /DECIMAL OUTPUT ID(16)
0367 4456 286 IDN16+3 /SPACE-SPACE
0368 5760 287 MESSAGE
0369 0377 288 MESSAGE
0370 0377 289 JMS I BIDEK /CONVERT ID(17) TO DECIMAL
0371 3323 290 ID17H /ID (17) BINARY
0372 4772 291 IDN17 /ID (17) DECIMAL
0373 3323 292 JMS I IDOUT /DECIMAL OUTPUT ID(17)
0374 4456 293 IDN17+3 /SPACE-SPACE
0375 5760 294 MESSAGE
0376 0377 295 MESSAGE
0377 0377 296 MESSAGE

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0424 4770 244 JMS I COMP /RESULTS<=0A
0425 4353 249 JMS ME12 /NO
0426 9200 250 JMD ME8
0427 4456 251 ME9, MESSAGE
0428 5714 252 MESSAGE /NUMBER OF
0429 5703 253 MESSAGE /POINT
0430 5711 254 MESSAGE /S
0431 5606 255 MESSAGE /A
0432 0000 256 C
0433 4763 257 JMS I GET /INPUT POINTS TO PRINT
0434 7775 258 /-(MAY > INPUTS) +1
0435 0573 259 ST1 /STORAGE LCC.
0436 5227 260 JMD ME9 /ERROR INPUT
0437 4765 301 JMS I CORCT /REPLY ROUTINE
0438 5241 302 JMD *-1 /ERROR RETURN
0439 5227 303 JMD ME9 /NO RETURN
0440 4764 304 JMS I DECB /YES RETURN: CHANGE TO PINARY
0441 0573 305 ST1 /DECIMAL ACP
0442 0110 306 PPH /BINARY ACP
0443 307
0444 308 /CHECK TO SEE IF INITIAL POINT AND POINTS TO PRINT LEGAL
0445 309
0446 4765 310 JMS I OPADD /POINT PRINT + INITIAL POINT
0447 0106 311 IDH
0448 0110 312 PPH
0449 4767 313 JMS I DPSUB /RESULTS - ID(A)
0450 0077 314 IDHH
0451 0116 315 COMH
0452 4766 316 JMS I OPADD /RESULTS -1
0453 0063 317 MLH
0454 0116 318 COMH
0455 4770 319 JMS I COMP /RESULTS<=0A
0456 4353 320 JMS ME12 /NO
0457 5200 321 JMD ME8
0458 4767 322 JMS I DPSUB /YES:POINTS TO PRINT -58
0459 0571 323 NRRH
0460 0110 324 PCH
0461 4770 325 JMS I COMP /RESULTS<=0A
0462 4353 326 JMS ME12 /NO
0463 5227 327 JMD ME9
0464 4766 328 ME10, MESSAGE
0465 5600 329 MESSAGE /WHAT
0466 5601 330 MESSAGE /IS THE
0467 5602 331 MESSAGE /INITIAL
0468 5603 332 MESSAGE /LINE
0469 5604 333 MESSAGE /A
0470 0 334 C
0471 4773 335 JMS I GET /INPUT INITIAL LINE
0472 7773 336 /-(MAY > INPUTS) +1
0473 0573 337 ST1 /STORAGE LCC.
0474 5227 338 JMD ME10 /ERROR INPUT
0475 4765 339 JMS I CORCT /REPLY ROUTINE
0476 5241 340 JMD *-1 /ERROR RETURN
0477 5227 341 JMD ME10 /NO RETURN
0478 4764 342 JMS I DECB /YES RETURN: CHANGE TO PINARY
0479 0573 343 ST1 /DECIMAL ACP
0480 0110 344 LSH /BINARY ACP
0481 4766 345 ME11, MESSAGE
0482 5600 346 MESSAGE /NUMBER OF
0483 5601 347 MESSAGE /LINE
0484 5602 348 MESSAGE /S
0485 5603 349 MESSAGE /A
0486 0 350 C
0487 4773 351 JMS I GET /INITIAL LINE INPUT
0488 7773 352 /-(MAY > INPUTS) +1
0489 0573 353 ST1 /STORAGE LCC.
0490 5227 354 JMD ME11 /ERROR INPUT
0491 4765 355 JMS I CORCT /REPLY ROUTINE
0492 5241 356 JMD *-1 /ERROR RETURN
0493 5227 357 JMD ME11 /NO RETURN
0494 4764 358 JMS I DECB /YES RETURN: CHANGE TO PINARY
0495 0573 359 ST1 /DECIMAL ACP
0496 0110 360 LPH /BINARY ACP
0497 4762 361 JMS I ONINT /SET TYPE ROUTINE
0498 362
0499 363 /CHECK TO SEE IF INITIAL LINE AND LINES TO PRINT OK
0500 364
0501 4767 365 JMS I DPSUB /ID(11) - START LINE
0502 0112 366 LSH
0503 0101 367 ID11H

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0536 4770 369 JMS I COMP /RESULT<=CA
0537 4771 370 JMS ME12 /NO
0540 5271 371 JMS ME10
0541 4766 372 JMS I OPADD /RESULTS + IO(12)
0542 0116 373 COMH
0543 0113 374 IO12H
0544 4767 375 JMS I OPSUB /RESULTS - 2 OF LINES
0545 0116 376 COMH
0546 0114 377 LPH
0547 4770 378 JMS I COMP /RESULTS<=0A
0550 4353 379 JMS ME12 /NO
0551 5271 380 JMS ME10
0552 5761 381 JMS I PAGE /YES, NEXT PAGE
0553 0113 382
0554 4456 383 MESSAGE
0555 6120 384 MESSAGE /EXCEED SCREEN . . .
0556 6120 385 MESSAGE /ENTER NUMBER . . .
0557 0113 386
0558 5761 387 JMS I ME12
0559 0500 388
0560 1247 389 INTOFF
0561 0500 390 ONINT,
0562 1247 391 GET,
0563 2733 392 NUMIN
0564 3500 393 DECR,
0565 3540 394 RIGHT
0566 3575 395 OPAND,
0567 3724 396 OPOR,
0570 2162 397 OPSUB,
0571 0500 398 COMH,
0572 0572 399 COMP,
0573 0600 400 ST1,

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/ SEND REM, M, LP, AND PP TO CCG3300

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0500 *600
0600 4742 401 JMS I DPMIN /LINES TO PRINT -34
0601 0764 402 N14H
0602 0114 403 LPH
0603 4761 404 JMS I CMPR /RESULTS<=0A
0604 4762 405 JMS I RF12 /NO
0605 5763 406 JMS I BF11
0606 4762 407 JMS I DPMIN /INITIAL FCINT- IO(7)
0607 0579 408 IO7H
0610 0106 409 IPH
0611 4757 410 JMS I OS3OUT /REF= IP - IO(7)
0612 4766 411 JMS I FINE /CHECK FOR < >
0613 1073 412 TAD
0614 3116 413 DCA IO5H
0615 1074 414 TAD COMH
0616 3117 415 DCA IO5L
0617 7105 416 COML
0618 4744 417 GLL
0619 4744 418 JMS I ROT1
0620 4744 419 JMS I ROT1 /IO(5)/4 INTO COM
0621 4743 420 JMS I DPLUS /RESULTS +1
0622 0116 421 PLH
0623 0117 422 COMH
0624 4766 423 JMS I OS3OUT /M= (IO(5)/4) + 1
0625 4766 424 JMS I FINE /CHECK FOR < >
0626 1114 425 TAD LPH
0627 3116 426 DCA COMH
0628 3117 427 TAD LPL
0629 4767 428 DCA COML
0630 4766 429 JMS I OS3OUT /LP= LP
0631 4766 430 JMS I FINE /CHECK FOR < >
0632 4766 431 JMS I DPMIN /LINE START-IO(11)
0633 0101 432 IO11H
0634 0112 433 LSH
0635 4767 434 JMS I OS3OUT /LS= LS - IO(11)
0636 4766 435 JMS I FINE /CHECK FOR < >
0637 1110 436 TAD RPH
0638 3116 437 DCA COMH
0639 1111 438 TAD RPL
0640 3117 439 DCA COML
0641 4767 440 JMS I OS3OUT /PP= PP
0642 4453 441 RECFIVE /EXPECT LINE FEED
0643 4457 442 BUFFER
0644 4454 443 SFNO
0645 4745 444 JMS I CLEAN /CLEAN SCREEN
0652 4745 445

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/OUTPUT ROWS AND LINES OF FRTXS DATA

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0653 1346 449 TAO MIN6
0654 1356 450 DCA COUT1
0655 1347 451 TAO SPAC
0656 4652 452 OUTPUT
0657 4653 453 IS7
0658 4654 454 COUT1
0659 4655 455 JMS I BCNVD /POINTS TO PRINT TO DECIMAL
0660 4656 456 PSH /BINARY ACP
0661 4657 457 NUMR1 /DECIMAL ACP
0662 01120 458 CLA
0663 01200 459 TAO NUMR2
0664 72200 460 CMA
0665 1121 461 DCA COUT1
0666 7340 462 TAO NR110 /SET X PAGA. FOR MOVE
0667 3351 463 DCA X1
0668 1351 464 TAO X1
0669 3335 465 DCA X2
0670 1335 466 JMS I BCNVD /INITIAL POINT TO DECIMAL
0671 3337 467 IPH /BINARY ACP
0672 4760 468 NUMR1 /DECIMAL ACP
0673 0106 469 ROWOUT, TAO NUMR4 /OUTPUTS ROW
0674 01200 470 JMS I PRINT
0675 1123 471 TAO NUMR3
0676 4752 472 JMS I PRINT
0677 1121 473 TAO NUMR2
0678 4752 474 JMS I PRINT
0679 1120 475 TAO NUMR1
0680 4752 476 JMS I PRINT
0681 2350 477 IS7 COUT1 /DONEA
0682 5312 478 JMP .+2 /NO,CONTINUE
0683 5756 479 JMP I PAGN /YES,NEXT PAGE
0684 2121 480 IS7 NUMR2
0685 1121 481 TAO NUMR2 /DIGIT>=10A
0686 1355 482 TAO MN10
0687 7540 483 S7A CLA /YES
0688 5327 484 JMP NEXROW /NO
0689 3121 485 DCA NUMR2
0690 2122 486 IS7 NUMR3
0691 1122 487 TAO NUMR3 /DIGIT >=10A
0692 1355 488 TAO MN10 /YES
0693 7640 489 S7A CLA /NO
0694 5327 490 JMP NEXROW
0695 3122 491 DCA NUMR3
0696 2123 492 IS7 NUMR4
0697 1354 493 TAO N240 /CALCULATE NEXT ROW
0698 1335 494 TAO X1
0699 3335 495 DCA X1
0700 1335 496 TAO X1
0701 3337 497 DCA X2
0702 4755 498 JMS I MOV
0703 0000 499 X1, 0
0704 1367 500 Y1, 1367
0705 0000 501 X2, 0
0706 1367 502 Y2, 1367
0707 5277 503 ROWOUT
0708 3724 504 DPMIN, DURSUD
0709 3575 505 DPLUS, DURADD
0710 1411 506 ROT1, ROT
0711 2525 507 CLFAN, EPASE
0712 7772 508 MIN6, -6
0713 0240 509 SPAC, 240
0714 0000 510 COUT1, 0
0715 0110 511 NR110, 110
0716 3527 512 PRINT1, PRINT1
0717 7765 513 MN10, -12
0718 0240 514 N240, 240
0719 5064 515 MOV, PAKVEC
0720 1367 516 PAGN, 1367
0721 2345 517 OS3OUT, OUTOS3
0722 2400 518 BCNVD, BCNVD
0723 0000 519 CPMR, CPMR1
0724 0512 520 RE12, RE12
0725 0511 521 RE11, RE11
0726 0000 522 N34H, 0
0727 0042 523 N34L, 42
0728 3565 524 FINF, FFIN
0729 1000 525 *1000
0730 526
0731 527

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1000 1065 524    TAQ    P215    /PLACE PCTINTER DOWN 6 SPACES
1001 4452 529    OUTPUT
1002 1166 530    TAQ    P212
1003 4452 531    OUTPUT
1004 1166 532    TAQ    P212
1005 4452 533    OUTPUT
1006 1115 534    TAQ    LPL
1007 7041 535    CIA
1008 3357 536    OCA    LINCT    /-> LINES TO PRINT
1009 1157 537    TAQ    LINCT
1010 3160 538    OCA    LSAV
1011 1356 539    TAQ    M154
1012 3325 540    OCA    LY1
1013 1325 541    TAQ    LY1
1014 3327 542    OCA    LY2
1015 4761 543    JMS    I    LPDEC    /LINES START DEC
1016 0112 544    LSH
1017 0120 545    NUMR1    /BINARY ADD
1018 4771 546    LINOUT, JMS    I    OUTNR4    /DECIMAL ADD
1019 2123 547    NUMR4    /OUTPUTS LINES
1020 2357 548    ISZ
1021 5227 549    JMS    LINCT
1022 5254 550    JMS    .+2
1023 2120 551    JMS    DATA
1024 1120 552    ISZ    NUMR1    /DONE, YETA
1025 1362 553    TAQ    NUMR1    /INCREASE UNITS
1026 7640 554    TAQ    NUMR1    /DIGIT>=10A
1027 5252 555    SZA    CLA
1028 3120 556    JMS    NEXLN
1029 2121 557    OCA    NUMR1    /YES
1030 1121 558    ISZ    NUMR2    /NO, CONTINUE
1031 1362 559    TAQ    NUMR2    /DIGIT>=10A
1032 7640 560    TAQ    NEG10
1033 5252 561    SZA    CLA
1034 3120 562    JMS    NEXLN
1035 2122 563    OCA    NUMR2    /YES
1036 1122 564    ISZ    NUMR3    /NO, CONTINUE
1037 1362 565    TAQ    NUMR3    /AND SO FURTH
1038 7640 566    TAQ    NEG10
1039 5252 567    SZA    CLA
1040 3123 568    JMS    NEXLN
1041 2123 569    OCA    NUMR3
1042 4322 570    ISZ    NUMR4
1043 5222 571    JMS    OWNLIN    /NEXT LINE
1044 1351 572    DATA, JMS    LINOUT    /CONTINUE WITH LINES
1045 3754 573    TAQ    P1230    /SETS UP POINTER FOR GRAY SCALE
1046 1351 574    OCA    I    YVAL
1047 1370 575    TAQ    P1230
1048 3755 576    OCA    I    M422
1049 1352 577    TAQ    YVAL2
1050 3753 578    OCA    I    P110
1051 1360 579    TAQ    XVAL
1052 3357 580    OCA    LSAV
1053 4776 581    OCA    LINCT
1054 4775 582    JMS    I    INITL    /RESETTING ROUTINE
1055 4773 583    JMS    I    BUFOUT    /SEND BUFFER
1056 6001 584    JMS    I    TRNTON    /CHANGE TO INTERRUPT TYPE
1057 1111 585    DATLN, TAQ    PPL
1058 7041 586    CIA
1059 3721 587    OCA    I    DAPR2
1060 4766 588    JMS    I    OUTDAT    /YES, GET NEXT POINT
1061 4336 589    JMS    NEXLN    /NEXT DATA LINE
1062 6002 590    IOF
1063 1147 591    TAQ    NUBFL
1064 7653 592    SZA    CLA
1065 1045 593    TAQ    BUFL2
1066 7540 594    SZA    CLA
1067 4775 595    JMS    I    BUFOUT    /SKIP BUFFER FLAG SETA
1068 3345 596    OCA    I    BUFL2    /YES, SKIP
1069 2357 597    ISZ    LINCT    /BUFFER FLAG 2 SETA
1070 5270 598    JMS    DATLN    /NO
1071 4774 599    JMS    I    TRNTON    /YES, SEND BUFFER
1072 4322 600    JMS    OWNLIN    /CLEAR FLAG 2
1073 1066 601    TAQ    P212    /DONE
1074 4452 602    OUTPUT
1075 4456 603    MESSAGE
1076 5734 604    MESSL
1077 0000 605    /PICTURE IS COMPLETE
1078 4451 606    INPUT
1079 5720 607    JMS    I    ECHO

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1120 1200 658 ECHO, EXCHNG
1121 3115 659 DAP02, DATCT
1122 0000 610 OWNLIN, 0
1123 4767 611 JMS I MOVER
1124 0000 612 LY1, 0
1125 0000 613 LY1, 0
1126 0000 614 LY2, 0
1127 0000 615 LY2, 0
1128 1325 616 TAO LY1
1129 1370 617 TAO M422
1130 3425 618 DCA LY1
1131 1325 619 TAO LY1
1132 3427 620 DCA LY2
1133 5722 621 JMS I OWNLIN
1134 0000 622 NEXLIN, 0
1135 1754 623 CLA
1136 1754 624 TAO I YVAL
1137 1754 625 TAO I M422
1138 1754 626 DCA I YVAL
1139 1754 627 TAO I YVAL2
1140 1754 628 TAO I M422
1141 1754 629 DCA I YVAL2
1142 1754 630 TAO P110
1143 1754 631 DCA I XVAL
1144 5736 632 JMS I NEXLIN
1145 1230 633 P1230, 1230
1146 1110 634 P110, 1110
1147 5547 635 XVAL, INTX1
1148 5550 636 YVAL, INTY1
1149 5552 637 YVAL2, INTY2
1150 1165 638 M154, 1165
1151 0000 639 LINCT, 0
1152 0000 640 LSAV, 0
1153 2400 641 LDDEC, RDCON
1154 7766 642 NFG10, -12
1155 7772 643 LSE, -6
1156 0000 644 PNT, 0
1157 3240 645 SPC, 240
1158 3246 646 OLTDAT, DATOUT
1159 5064 647 MOVER, PAKVEC
1160 7756 648 M422, -72
1161 1303 649 OUTNUR, NUMOUT
1162 7774 650 LS4, -4
1163 1241 651 TRNION, INTON
1164 1247 652 TRNIOF, INTOFF
1165 1471 653 BUFOUT, OUTPUT
1166 1423 654 INITL, INITIAL
1167 655
1168 656 /ECHO INPUT-OUTPUT
1169 657
1170 1200 658 *1200
1171 7300 659 EXCHNG, CLA CLL /CLEAR FLAGS
1172 6546 660 TLS
1173 6416 661 TLS41
1174 6031 662 AGAIN, KSF /IS IT THE KEYBOARD
1175 7410 663 SKP /NO
1176 5215 664 JMP OS3 /YES SEND
1177 6401 665 KSF40 /IS IT OS3
1178 5203 666 JMP AGAIN /NO TRY AGAIN
1179 6406 667 KSF40 /RECEIVE
1180 6041 668 TSE /TEK OUTPUT
1181 5211 669 JMP -1
1182 6046 670 TLS
1183 5203 671 JMP AGAIN /NEXT
1184 6031 672 KSF /BUFFER CLT
1185 1235 673 TAO M203 /IS IT C2A
1186 7450 674 SNA
1187 5534 675 JMP I GO /BEGIN PROGRAM
1188 1236 676 TAO P203 /ADD VALUE PACK
1189 6411 677 TSE41 /SEND OS3
1190 5222 678 JMP -1
1191 6416 679 TLS41
1192 1237 680 TAO M201 /IS IT A 2A
1193 7450 681 SNA
1194 5232 682 JMP -1 /YES DON'T SEND
1195 1230 683 TAO P201 /ECHO
1196 6046 684 TLS
1197 7300 685 CLA CLL
1198 5203 686 JMP AGAIN /NEXT
1199 0200 687 GO, ZCU

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1235 7575 644 M203, -203
1236 0203 649 P203, 203
1237 7577 690 M201, -201
1240 0201 691 P201, 201
692
693 / ION-IOF ROUTINES FOR USING PAKVEC OUTPUT
694
1241 4140 695 TYPIO= JMS TYP
1242 0200 696 INTON, 0 /INTERRUPT TYPE ROUTINE
1243 7510 697 TAO .+2
1244 7510 698 SKP
1245 4140 699 TYPIO
1246 4254 700 JMS INTPUT /PLACES IN PAKMOV ROUTINE
1247 5441 701 JMP I INTON /RETURN
702
1247 0000 703 INTOFF, 0 /GENERAL TYPE ROUTINE
1248 0002 704 IOF /TURN OFF INTERRUPT
1249 7510 705 TAO
1250 4254 706 JMS N4203 /PLACES IN PAKVEC ROUTINE
1251 5447 707 JMP I INTOFF /RETURN
708
1254 0000 709 INPUT, 0 /PLACES CORRECT TYPE ROUTINE
1255 3773 710 OCA INTVAL /SAVE TYPE LOC.
1256 7510 711 TAO INTVAL
1257 7510 712 OCA I CH1 /FIRST REPLACE LOC
1258 7510 713 TAO INTVAL
1259 7510 714 OCA I CH2 /SECOND REPLACE LOC
1260 7510 715 TAO INTVAL
1261 7510 716 OCA I CH3 /THIRD REPLACE LOC
1262 7510 717 TAO INTVAL
1263 7510 718 OCA I CH4 /FOURTH REPLACE LOC
1264 7510 719 TAO INTVAL
1265 7510 720 OCA I CH5 /FIFTH REPLACE LOC
1266 7510 721 TAO INTVAL
1267 7510 722 OCA I CH6 /SIXTH REPLACE LOC
1268 7510 723 JMP I INPUT /RETURN
724
1269 0000 724 INTVAL, 0
1270 3773 725 CH1, PAKT1
1271 7510 726 CH2, PAKT2
1272 7510 727 CH3, PAKT3
1273 7510 728 CH4, PAKT4
1274 7510 729 CH5, PAKT5
1275 7510 730 CH6, PAKT6
1276 7510 731 N4200, 4200
1277 7510 732
1278 7510 733
734 /OUTPUT DECIMAL NUMBERS
735
1279 0000 735 NUMOUT, 0
1280 1072 736 TAO M4 /MAX > OF NUMDEPS
1281 3341 737 OCA NRCNT /COLATED
1282 3341 738 OCA OUTCK /ZERO CHECK
1283 1703 739 TAO I NUMOUT /UNIT'S ADDRESS
1284 3341 740 OCA NUMPT /POINTS
1285 3341 741 ISZ NUMOUT /PROPER RETURN
1286 7510 742 TAO I NUMPT /GET NUMBER
1287 7510 743 SNA ZEROCK /IS IT A 0
1288 7510 744 JMP ZEROCK /YES, SO PRINT 0
1289 7510 745 JMP NUMPT
746
1290 7510 746 NOPRI, CLA CMA /GET NEXT NUMBER
1291 7510 747 TAO NUMPT
1292 7510 748 OCA NUMPT
1293 7510 749 ISZ NRCNT /LOOPED 4 TIMES
1294 7510 750 JMP NUMNEX /NO, CONTINUE
1295 7510 751 TAO OUTCK /YES, ANY OUTPUT
1296 7510 752 SNA CLA
1297 7510 753 JMS .+2 /NO, PRINT 0
1298 7510 754 JMP I NUMOUT /YES RETURN
1299 7510 755 NUMPRI, 0 /OUTPUTS NUMBER
1300 7510 756 TAO P260
1301 7510 757 OUTPUT
1302 7510 758 ISZ OUTCK /INDICATE NUMBER PRINTED
1303 7510 759 JMP I NUMPRI /RETURN
1304 7510 760 ZEROCK, TAO OUTCK
1305 7510 761 SZA CLA
1306 7510 762 JMS NUMPRI
1307 7510 763 JMP NOPRI
764
1308 0000 764 NRCNT, 0
1309 0000 765 OUTCK, 0
1310 0000 766 NUMPT, 0
1311 0000 767

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1343 0000 768 DATTIN, 0
1344 1743 769 TAD I DATTIN /PARAM. 1
1345 3373 770 DCA DATTPT /STARTING ADDR.
1346 2343 771 ISZ DATTIN /PARAM. 2
1347 1743 772 TAD I DATTIN /,(NUMBER OF CHAR.)
1348 3374 773 DCA DATTCT /COUNTER
1349 2343 774 ISZ DATTIN /PROPER RETURN
1350 4453 775 DATTOV, RECEIVE DATT77 /GET CHAR.
1351 3375 776 AND DATT77 /JUST UPPER 6 BITS
1352 7306 777 RTL
1353 7306 778 RTL
1354 3373 779 DCA I DATTPT /STORE RESULTS
1355 2374 780 ISZ DATTCT /DOAEA
1356 5743 781 JMP I DATTIN /NO
1357 4453 782 RECEIVE /YES, RETURN
1358 3375 783 AND DATT77 /GET CHAR.
1359 1773 784 TAD I DATTPT /JUST UPPER 6 BITS
1360 3373 785 DCA I DATTPT /ADD LOWER 6 BITS
1361 2373 786 ISZ DATTPT /STORE
1362 2374 787 ISZ DATTCT /NEXT STORE
1363 5743 788 JMP DATTOV /DOAEA
1364 3373 789 JMP I DATTIN /INC. CONTINUE
1365 3373 790 DATTPT, 0
1366 3373 791 DATTCT, 0
1367 3373 792 DATT77, 77
1368 0000 793
1369 0000 794
1370 0000 795
1371 0000 796
1372 0000 797
1373 0000 798
1374 0000 799
1375 0000 800
1400 1400 801 COMAD1, 0
1401 0000 802 CLL /ADD ONE TO COMH, COML
1402 1117 803 TAD COML /ADD ONE TO COML
1403 7306 804 IAC COML
1404 3117 805 DCA COML
1405 7306 806 RAL /IF OVERFLOW ADD TO COMH
1406 1116 807 TAD COMH
1407 3116 808 DCA COMH
1408 5600 809 JMP I COMAD1 /RETURN
1411 0000 810 ROT, 0
1412 7100 811 CLL /DIVIDES COMH, COML BY TWO
1413 1116 812 TAD COMH /GET COMH ROTATE
1414 7112 813 RAR
1415 3116 814 DCA COMH
1416 1117 815 TAD COML /ADD LINK IF SET
1417 7110 816 RAR
1418 7100 817 CLL
1419 3117 818 DCA COML
1420 5611 819 JMP I ROT /RETURN
1421 5611 820
1422 5611 821
1423 0000 822 /INITIAL DATA INPUT-OUTPUT ROUTINE
1424 1111 823 INITIAL, 0
1425 7141 824 TAD PPL
1426 3556 825 CIA /PPL
1427 1111 826 DCA I OUTCT /SET INPUT POINT COUNTER
1428 7141 827 TAD PPL
1429 3557 828 CIA CLL
1430 7141 829 DCA I OUTDAT /SET OUTPUT POINT COUNTER
1431 3556 830 DCA I SIDE1 /SET INPUT LEFT SIDE POINTER
1432 3556 831 DCA I SIDE2 /SET OUTPUT LEFT SIDE POINTER
1433 1267 832 TAD N4J00
1434 3556 833 DCA I DATTPT3 /SET INPUT VALUE LOC. POINTER
1435 1267 834 TAD N4J00
1436 3556 835 DCA I DATTPT4 /SET OUTPUT VALUE LOC. POINTER
1437 1270 836 TAD M1030
1438 3556 837 DCA I DATT11 /SET PAGE LENGTH INPUT
1439 1270 838 TAD M1030
1440 3556 839 DCA I DATT12 /SET PAGE LENGTH OUTPUT
1441 1115 840 TAD LPL
1442 7141 841 CIA
1443 3146 842 DCA NUGBUF
1444 7040 843 DCA
1445 3043 844 DCA IFL /SET OUTPUT INTERRUPT FLAG
1446 3044 845 DCA RUFFL1 /ZERO RUFFED FLAG 1
1447 3045 846 DCA RUFFL2 /ZERO RUFFED FLAG 2
1448 3147 847 DCA NURFL /ZERO OUT LINE RUFFED FLAG
1449 3556 848 DCA I PNTDAT /ZERO I/O FLAG
1450 5623 849 JMP I INITIAL /RETURN
1451 3162 850 OUTCT, OUTCNT

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1457 3115 848 CNTDAT, DATCT
1460 3144 849 SIOF1, SIOCNT
1461 3117 850 SIOF3, SIOFCT
1462 3143 851 DATPT3, DATPT1
1463 3113 852 DATPT4, DATPT2
1464 3141 853 DAT11, DATCNT
1465 3116 854 DAT12, PGEND
1466 3114 855 PNTDAT, DATPNT
1467 4500 856 N4000, 4000
1470 7000 857 M1000, -1000
1471 0000 858 OUTBUF, 0
1472 6002 859 IOF
1473 4457 860 BUFFER
1474 6411 861 TSF41 /CLEAR FLAGS
1475 5274 862 JMP --1
1476 6412 863 TCF41
1477 6341 864 TSF
1500 5277 865 JMP --1
1501 6342 866 TCF
1502 7443 867 CMA
1503 3143 868 DCA IFL /MAKE OUTPUT FLAG NEG.
1504 5671 869 JMP I OUTBUF /RETURN
870
871
872 /ZERO OUT LOCATIONS
873 /PARM. 1 LCC ADDRESS
874 /PARM. 2 -(2 OF LOC)
875
1505 0000 876 ZECUT, 0
1506 1705 877 TAD I ZFOUT /GET PARM. 1
1507 3121 878 DCA ZFAOR
1510 2375 879 ISZ ZFOUT
1511 1705 880 TAD I ZFOUT /GET PARM. 2
1512 3122 881 DCA ZECNT
1513 3121 882 ZENEX, DCA I ZFAOR /ZERO LCC
1514 2321 883 ISZ ZFAOR /NEXT LOC
1515 2322 884 ISZ ZECNT /NOEA
1516 5713 885 JMP ZENEX /NO, CONTINUE
1517 2305 886 ISZ ZFOUT /PROPER RETURN
1520 5705 887 JMP I ZECUT /RETURN
1521 0100 888 ZFAOR, 0
1522 0000 889 ZECNT, 0
890
891 /BASIC SUBROUTINES, REPLY, INTWO, BNIN, ETC
892
893 /REPLY
894 /RETURN 1 ERROR INPUT
895 /RETURN 2 N INPUT (NO)
896 /RETURN 3 Y INPUT (YES)
897
2000 2000 898 *2000
2001 0000 899 REPLY, 0
2002 4300 900 JMS INTWO /CHECKS FOR ONE LETTER INPUT
2003 5600 901 JMP I REPLY /ERROR RETURN
2004 1227 902 TAD KEEP /WHICH LETTER?
2005 1225 903 TAD M316 /IS IT AN NA
2006 7455 904 SNA /NO
2007 5215 905 JMP NOUT /YES
2008 1226 906 TAD M13 /IS IT A Y
2009 7456 907 SNA CLA /NO
2010 5214 908 JMP YOUT /YES
2011 4317 909 JMS WHAT /ERROR RETURN
2012 5600 910 JMP I REPLY /RETURN
2013 3370 911 YOUT, ISZ REPLY /PROPER Y RETURN
2014 2370 912 NOUT, ISZ REPLY /PROPER N RETURN
2015 5600 913 JMP I REPLY /RETURN
914
915 /OUTPUTS WHAT
916
2017 0000 917 WHAT, 0
2020 4456 918 MESSAGE
2021 5600 919 MESSA /WHAT
2022 5606 920 MESS9 /A
2023 0000 921 0
2024 5617 922 JMP I WHAT /RETURN
2025 7462 923 M316, -316
2026 7765 924 M13, -13
2027 0000 925 KFEF, 0
926
927 /CHECKS FOR JUST ONE INPUT RESPONSE

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2137 0000 1009 0
2140 0000 1009 0
2141 0000 1010 0
2142 0000 1011 0
2143 0000 1012 0
2144 0000 1013 0
1014
1015 /OUTPUTS FILE
1016
2145 0000 1017 FLOUT, 0
2146 1331 1018 TAD FLST /GET FILE HEAD
2147 3010 1019 DCA 10
2150 1410 1020 FILOVR, TAD I 10 /GET NEXT CHAR.
2151 1071 1021 TAD M215 /IS IT A CPA
2152 7455 1022 SVA
2153 5357 1023 JMP FLON /YES
2154 1365 1024 TAD P215 /ADD PACK
2155 4454 1025 SEND /TO OS3
2156 5350 1026 JMP FILOVR /REPEAT
2157 1365 1027 FLOUT, TAD P215 /SEND TO CS3
2161 4454 1028 SEND
2161 5745 1029 JMP I FLOUT /RETURN
1030
1031 /ARE RESULTS < OR = TO CA
1032
2162 0000 1033 CPRN1, 0
2163 1116 1034 TAD CONH /GET RESULTS HIGH
2164 7510 1035 SPA /POSA
2165 5374 1036 JMP *+7 /NO GOOD RETURN
2166 7640 1037 SVA CLA /RESULTS = CA
2167 5762 1038 JMP I CPRN1 /ERROR RETURN
2170 1117 1039 TAD CONL /GET RESULTS LOW
2171 7650 1040 SVA CLA /RESULTS = CA
2172 5374 1041 JMP *+2 /YES
2173 5762 1042 JMP I CPRN1 /ERROR RETURN
2174 2362 1043 ISZ CPRN1
2175 2362 1044 ISZ CPRN1
2176 5762 1045 JMP I CPRN1 /GOOD RETURN
1046
1047 /CHECKS FOR LEGAL THRESHOLD INPUT VALUES
1048
2200 *2200
2200 0000 THCK, 0
2201 1307 TAD TARM6
2202 3341 DCA TABCNT /> OF CHECKS
2203 1227 TAD TABL /TH(1) ADDRESS -1
2204 3010 DCA 10
2205 1230 TAD TABL1 /TH(2) ADDRESS -1
2206 3010 DCA 11
2207 1630 TAD I TABL1 /IS FIRST ENTRY POSITIVE?
2208 7710 JMP I THCK /NO
2209 5680 TAD I 10 /TH(1)
2210 1410 TAD I 11 /NEGATE
2211 7710 TAD I 11 /TH(1+1)
2212 5680 JMP I THCK /NEGATIVE RESULT?
2213 7710 ISZ TABCNT /NO, ERROR RETURN
2214 1410 JMP *+6 /CHECK ALL VALUES
2215 5680 TAD I M65 /NO, CONTINUE
2216 5680 TAD I M65 /YES, FINAL VALUE LESS 64?
2217 2341 ISZ TABCNT
2218 5212 JMP I THCK
2219 1410 TAD I M65
2220 1227 TAD TABL1
2221 7710 SPA CLA
2222 2200 ISZ THCK /PROPER RETURN
2223 5680 JMP I THCK /RETURN
2224 7677 M65, -101
2225 3312 TABL, THHO
2226 3513 TABL1, THHO+1
2227 7700 M100, -100
1076
1077 /STORES CORRECT GRAY SCAL VALUE IN TABLE
1078
2232 0100 TARVAL, 0
2233 1310 TAD TABL2 /STARTING ADDRESS OF TAB.
2234 3341 DCA TABCNT
2235 1231 TAD M100 /0 ALL OF TABLE
2236 3341 DCA TABCNT /COUNTER
2237 3341 DCA TABVL /VALUE OF DEPOSITS
2240 4322 JMS TARIN /DOES DEPOSITING
2241 4316 JMS PTNEG /1'S UP TO TH(7)
2242 3341 DCA TABCNT /2 OF DEPOSITS

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2243 4311 1134 JMS TABINC /VALUE OF DEPOSIT
2244 4312 1135 JMS TABIN /DOES DEPOSITING
2245 4313 1136 JMS TABDEC /DECREASE POINTER
2246 4314 1137 JMS PTNEG /2'S UP TO TH(6)
2247 4315 1138 JMS TABCNT /SO FOURTH
2248 4316 1139 JMS TABINC
2249 4317 1140 JMS TABDEC
2250 4318 1141 JMS PTNEG /3'S UP TO TH(5)
2251 4319 1142 JMS TABCNT
2252 4320 1143 JMS TABINC
2253 4321 1144 JMS TABIN
2254 4322 1145 JMS TABDEC
2255 4323 1146 JMS PTNEG /4'S UP TO TH(4)
2256 4324 1147 JMS TABCNT
2257 4325 1148 JMS TABINC
2258 4326 1149 JMS TABIN
2259 4327 1150 JMS TABDEC
2260 4328 1151 JMS PTNEG /5'S UP TO TH(3)
2261 4329 1152 JMS TABCNT
2262 4330 1153 JMS TABINC
2263 4331 1154 JMS TABIN
2264 4332 1155 JMS TABDEC
2265 4333 1156 JMS PTNEG /8'S UP TO TH(2)
2266 4334 1157 JMS TABCNT
2267 4335 1158 JMS TABINC
2268 4336 1159 JMS TABIN
2269 4337 1160 JMS TABDEC
2270 4338 1161 JMS PTNEG /16'S UP TO TH(1)
2271 4339 1162 JMS TABCNT
2272 4340 1163 JMS TABVL
2273 4341 1164 JMS RAL CLL
2274 4342 1165 JMS TABINC
2275 4343 1166 JMS TABIN
2276 4344 1167 JMS TABDEC
2277 4345 1168 JMS PTNEG
2278 4346 1169 JMS TABCNT
2279 4347 1170 JMS TABVL
2280 4348 1171 JMS RAL CLL
2281 4349 1172 JMS TABVL
2282 4350 1173 JMS TABIN
2283 4351 1174 JMS TABVAL
2284 4352 1175 JMS I
2285 4353 1176 JMS THWD+7
2286 4354 1177 JMS TABINC
2287 4355 1178 JMS IAC
2288 4356 1179 JMS TABVL
2289 4357 1180 JMS DCA
2290 4358 1181 JMS TABVL
2291 4359 1182 JMS JMP I
2292 4360 1183 JMS TABINC
2293 4361 1184 JMS PTNEG
2294 4362 1185 JMS TABPT
2295 4363 1186 JMS TAB I
2296 4364 1187 JMS PTNEG
2297 4365 1188 JMS TABIN
2298 4366 1189 JMS /ACTUALL DEPOSITING OF VALUES
2299 4367 1190 JMS TABH
2300 4368 1191 JMS TABP
2301 4369 1192 JMS TABVL
2302 4370 1193 JMS DCA I
2303 4371 1194 JMS TABP
2304 4372 1195 JMS ISZ
2305 4373 1196 JMS TABCNT
2306 4374 1197 JMS JMP I
2307 4375 1198 JMS TABIN
2308 4376 1199 JMS TABDEC
2309 4377 1200 JMS CLA CHA /DECREASES THRS ADDRESS
2310 4378 1201 JMS TABPT
2311 4379 1202 JMS TABPT
2312 4380 1203 JMS JMP I
2313 4381 1204 JMS TABDEC /RETURN
2314 4382 1205 JMS TABPT
2315 4383 1206 JMS TABCNT
2316 4384 1207 JMS TABVL
2317 4385 1208 JMS TABH
2318 4386 1209 JMS TABP
2319 4387 1210 JMS TABVL
2320 4388 1211 JMS DCA I
2321 4389 1212 JMS TABP
2322 4390 1213 JMS ISZ
2323 4391 1214 JMS TABCNT
2324 4392 1215 JMS JMP I
2325 4393 1216 JMS TABIN
2326 4394 1217 JMS TABDEC
2327 4395 1218 JMS CLA CHA /DECREASES THRS ADDRESS
2328 4396 1219 JMS TABPT
2329 4397 1220 JMS TABPT
2330 4398 1221 JMS JMP I
2331 4399 1222 JMS TABDEC /RETURN
2332 4400 1223 JMS TABPT
2333 4401 1224 JMS TABCNT
2334 4402 1225 JMS TABVL
2335 4403 1226 JMS TABH
2336 4404 1227 JMS TABP
2337 4405 1228 JMS TABVL
2338 4406 1229 JMS DCA I
2339 4407 1230 JMS TABP
2340 4408 1231 JMS ISZ
2341 4409 1232 JMS TABCNT
2342 4410 1233 JMS JMP I
2343 4411 1234 JMS TABIN
2344 4412 1235 JMS TABDEC
2345 4413 1236 JMS CLA CHA /DECREASES THRS ADDRESS
2346 4414 1237 JMS TABPT
2347 4415 1238 JMS TABPT
2348 4416 1239 JMS JMP I
2349 4417 1240 JMS TABDEC /RETURN
2350 4418 1241 JMS TABPT
2351 4419 1242 JMS TABCNT
2352 4420 1243 JMS TABVL
2353 4421 1244 JMS TABH
2354 4422 1245 JMS TABP
2355 4423 1246 JMS TABVL
2356 4424 1247 JMS DCA I
2357 4425 1248 JMS TABP
2358 4426 1249 JMS ISZ
2359 4427 1250 JMS TABCNT
2360 4428 1251 JMS JMP I
2361 4429 1252 JMS TABIN
2362 4430 1253 JMS TABDEC
2363 4431 1254 JMS CLA CHA /DECREASES THRS ADDRESS
2364 4432 1255 JMS TABPT
2365 4433 1256 JMS TABPT
2366 4434 1257 JMS JMP I
2367 4435 1258 JMS TABDEC /RETURN
2368 4436 1259 JMS TABPT
2369 4437 1260 JMS TABCNT
2370 4438 1261 JMS TABVL
2371 4439 1262 JMS TABH
2372 4440 1263 JMS TABP
2373 4441 1264 JMS TABVL
2374 4442 1265 JMS DCA I
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2376 4444 1267 JMS ISZ
2377 4445 1268 JMS TABCNT
2378 4446 1269 JMS JMP I
2379 4447 1270 JMS TABIN
2380 4448 1271 JMS TABDEC
2381 4449 1272 JMS CLA CHA /DECREASES THRS ADDRESS
2382 4450 1273 JMS TABPT
2383 4451 1274 JMS TABPT
2384 4452 1275 JMS JMP I
2385 4453 1276 JMS TABDEC /RETURN
2386 4454 1277 JMS TABPT
2387 4455 1278 JMS TABCNT
2388 4456 1279 JMS TABVL
2389 4457 1280 JMS TABH
2390 4458 1281 JMS TABP
2391 4459 1282 JMS TABVL
2392 4460 1283 JMS DCA I
2393 4461 1284 JMS TABP
2394 4462 1285 JMS ISZ
2395 4463 1286 JMS TABCNT
2396 4464 1287 JMS JMP I
2397 4465 1288 JMS TABIN
2398 4466 1289 JMS TABDEC
2399 4467 1290 JMS CLA CHA /DECREASES THRS ADDRESS
2400 4468 1291 JMS TABPT
2401 4469 1292 JMS TABPT
2402 4470 1293 JMS JMP I
2403 4471 1294 JMS TABDEC /RETURN
2404 4472 1295 JMS TABPT
2405 4473 1296 JMS TABCNT
2406 4474 1297 JMS TABVL
2407 4475 1298 JMS TABH
2408 4476 1299 JMS TABP
2409 4477 1300 JMS TABVL
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2413 4481 1304 JMS TABCNT
2414 4482 1305 JMS JMP I
2415 4483 1306 JMS TABIN
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2417 4485 1308 JMS CLA CHA /DECREASES THRS ADDRESS
2418 4486 1309 JMS TABPT
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2420 4488 1311 JMS JMP I
2421 4489 1312 JMS TABDEC /RETURN
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2423 4491 1314 JMS TABCNT
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2425 4493 1316 JMS TABH
2426 4494 1317 JMS TABP
2427 4495 1318 JMS TABVL
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2444 4512 1335 JMS TABP
2445 4513 1336 JMS TABVL
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2450 4518 1341 JMS JMP I
2451 4519 1342 JMS TABIN
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2455 4523 1346 JMS TABPT
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2462 4530 1353 JMS TABP
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2465 4533 1356 JMS TABP
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2467 4535 1358 JMS TABCNT
2468 4536 1359 JMS JMP I
2469 4537 1360 JMS TABIN
2470 4538 1361 JMS TABDEC
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2522 4590 1413 JMS JMP I
2523 4591 1414 JMS TABIN
2524 4592 1415 JMS TABDEC
2525 4593 1416 JMS CLA CHA /DECREASES THRS ADDRESS
2526 4594 1417 JMS TABPT
2527 4595 1418 JMS TABPT
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2529 4597 1420 JMS TABDEC /RETURN
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2532 4600 1423 JMS TABVL
2533 4601 1424 JMS TABH
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2539 4607 1430 JMS TABCNT
2540 4608 1431 JMS JMP I
2541 4609 1432 JMS TABIN
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2544 4612 1435 JMS TABPT
2545 4613 1436 JMS TABPT
2546 4614 1437 JMS JMP I
2547 4615 1438 JMS TABDEC /RETURN
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2549 4617 1440 JMS TABCNT
2550 4618 1441 JMS TABVL
2551 4619 1442 JMS TABH
2552 4620 1443 JMS TABP
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2557 4625 1448 JMS TABCNT
2558 4626 1449 JMS JMP I
2559 4627 1450 JMS TABIN
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2622 4690 1513 JMS TABVL
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2629 4697 1520 JMS TABCNT
2630 4698 1521 JMS JMP I
2631 4699 1522 JMS TABIN
2632 4700 1523 JMS TABDEC
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2635 4703 1526 JMS TABPT
2636 4704 1527 JMS JMP I
2637 4705 1528 JMS TABDEC /RETURN
2638 4706 1529 JMS TABPT
2639 4707 1530 JMS TABCNT
2640 4708 1531 JMS TABVL
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2647 4715 1538 JMS TABCNT
2648 4716 1539 JMS JMP I
2649 4717 1540 JMS TABIN
2650 4718 1541 JMS TABDEC
2651 4719 1542 JMS CLA CHA /DECREASES THRS ADDRESS
2652 4720 1543 JMS TABPT
2653 4721 1544 JMS TABPT
2654 4722 1545 JMS JMP I
2655 4723 1546 JMS TABDEC /RETURN
2656 4724 1547 JMS TABPT
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2658 4726 1549 JMS TABVL
2659 4727 1550 JMS TABH
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2666 4734 1557 JMS JMP I
2667 4735 1558 JMS TABIN
2668 4736 1559 JMS TABDEC
2669 4737 1560 JMS CLA CHA /DECREASES THRS ADDRESS
2670 4738 1561 JMS TABPT
2671 4739 1562 JMS TABPT
2672 4740 1563 JMS JMP I
2673 4741 1564 JMS TABDEC /RETURN
2674 4742 1565 JMS TABPT
2675 4743 1566 JMS TABCNT
2676 4744 1567 JMS TABVL
2677 4745 1568 JMS TABH
2678 4746 1569 JMS TABP
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2684 4752 1575 JMS JMP I
2685 4753 1576 JMS TABIN
2686 4754 1577 JMS TABDEC
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2688 4756 1579 JMS TABPT
2689 4757 1580 JMS TABPT
2690 4758 1581 JMS JMP I
2691 4759 1582 JMS TABDEC /RETURN
2692 4760 1583 JMS TABPT
2693 4761 1584 JMS TABCNT
2694 4762 1585 JMS TABVL
2695 4763 1586 JMS TABH
2696 4764 1587 JMS TABP
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2702 4770 1593 JMS JMP I
2703 4771 1594 JMS TABIN
2704 4772 1595 JMS TABDEC
2705 4773 1596 JMS CLA CHA /DECREASES THRS ADDRESS
2706 4774 1597 JMS TABPT
2707 4775 1598 JMS TABPT
2708 4776 1599 JMS JMP I
2709 4777 1600 JMS TABDEC /RETURN
2710 4778 1601 JMS TABPT
2711 4779 1602 JMS TABCNT
2712 4780 1603 JMS TABVL
2713 4781 1604 JMS TABH
2714 4782 1605 JMS TABP
2715 4783 1606 JMS TABVL
2716 4784 1607 JMS DCA I
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2719 4787 1610 JMS TABCNT
2720 4788 1611 JMS JMP I
2721 4789 1612 JMS TABIN
2722 4790 1613 JMS TABDEC
2723 4791 1614 JMS CLA CHA /DECREASES THRS ADDRESS
2724 4792 1615 JMS TABPT
2725 4793 1616 JMS TABPT
2726 4794 1617 JMS JMP I
2727 4795 1618 JMS TABDEC /RETURN
2728 4796 1619 JMS TABPT
2729 4797 1620 JMS TABCNT
2730 4798 1621 JMS TABVL
2731 4799 1622 JMS TABH
2732 4800 1623 JMS TABP
2733 4801 1624 JMS TABVL
2734 4802 1625 JMS DCA I
2735 4803 1626 JMS TABP
2736 4804 1627 JMS ISZ
2737 4805 1628 JMS TABCNT
2738 4806 1629 JMS JMP I
2739 4807 1630 JMS TABIN
2740 4808 1631 JMS TABDEC
2741 4809 1632 JMS CLA CHA /DECREASES THRS ADDRESS
2742 4810 1633 JMS TABPT
2743 4811 1634 JMS TABPT
2744 4812 1635 JMS JMP I
2745 4813 1636 JMS TABDEC /RETURN
2746 4814 1637 JMS TABPT
2747 4815 1638 JMS TABCNT
2748 4816 1639 JMS TABVL
2749 4817 1640 JMS TABH
2750 4818 1641 JMS TABP
2751 4819 1642 JMS TABVL
2752 4820 1643 JMS DCA I
2753 4821 1644 JMS TABP
2754 4822 1645 JMS ISZ
2755 4823 1646 JMS TABCNT
2756 4824 1647 JMS JMP I
2757 4825 1648 JMS TABIN
2758 4826 1649 JMS TABDEC
2759 4827 1650 JMS CLA CHA /DECREASES THRS ADDRESS
2760 4828 1651 JMS TABPT
2761 4829 1652 JMS TABPT
2762 4830 1653 JMS JMP I
2763 4831 1654 JMS TABDEC /RETURN
2764 4832 1655 JMS TABPT
2765 4833 1656 JMS TABCNT
2766 4834 1657 JMS TABVL
2767 4835 1658 JMS TABH
2768 4836 1659 JMS TABP
2769 4837 1660 JMS TABVL
2770 4838 1661 JMS DCA I
2771 4839 1662 JMS TABP
2772 4840 1663 JMS ISZ
2773 4841 1664 JMS TABCNT
2774 4842 1665 JMS JMP I
2775 4843 1666 JMS TABIN
2776 4844 1667 JMS TABDEC
2777 4845 1668 JMS CLA CHA /DECREASES THRS ADDRESS
2778 4846 1669 JMS TABPT
2779 4847 1670 JMS TABPT
2780 4848 1671 JMS JMP I
2781 4849 1672 JMS TABDEC /RETURN
2782 4850 1673 JMS TABPT
2783 4851 1674 JMS TABCNT
2784 4852 1675 JMS TABVL
2785 4853 1676 JMS TABH
2786 4854 1677 JMS TABP
2787 4855 1678 JMS TABVL
2788 4856 1679 JMS DCA I
2789 4857 1680 JMS TABP
2790 4858 1681 JMS ISZ
2791 4859 1682 JMS TABCNT
2792 4860 1683 JMS JMP I
2793 4861 1684 JMS TABIN
2794 4862 1685 JMS TABDEC
2795 4863 1686 JMS CLA CHA /DECREASES THRS ADDRESS
2796 4864 1687 JMS TABPT
2797 4865 1688 JMS TABPT
2798 4866 1689 JMS JMP I
2799 4867 1690 JMS TABDEC /RETURN
2800 4868 1691 JMS TABPT
2801 4869 1692 JMS TABCNT
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2803 4871 1694 JMS TABH
2804 4872 1695 JMS TABP
2805 4873 1696 JMS TABVL
2806 4874 1697 JMS DCA I
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2809 4877 1700 JMS TABCNT
2810 4878 1701 JMS JMP I
2811 4879 1702 JMS TABIN
2812 4880 1703 JMS TABDEC
2813 4881 1704 JMS CLA CHA /DECREASES THRS ADDRESS
2814 4882 1705 JMS TABPT
2815 4883 1706 JMS TABPT
2816 4884 1707 JMS JMP I
2817 4885 1708 JMS TABDEC /RETURN
2818 4886 1709 JMS TABPT
2819 4887 1710 JMS TABCNT
2820 4888 1711 JMS TABVL
2821 4889 1712 JMS TABH
2822 4890 1713 JMS TABP
2823 4891 1714 JMS TABVL
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2827 4895 1718 JMS TABCNT
2828 4896 1719 JMS JMP I
2829 4897 1720 JMS TABIN
2830 4898 1721 JMS TABDEC
2831 4899 1722 JMS CLA CHA /DECREASES THRS ADDRESS
2832 4900 1723 JMS TABPT
2833 4901 1724 JMS TABPT
2834 4902 1725 JMS JMP I
2835 4903 1726 JMS TABDEC /RETURN
2836 4904 1727 JMS TABPT
2837 4905 1728 JMS TABCNT
2838 4906 1729 JMS TABVL
2839 4907 1730 JMS TABH
2840 4908 1731 JMS TABP
2841 4909 1732 JMS TABVL
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2844 4912 1735 JMS ISZ
2845 4913 1736 JMS TABCNT
2846 4914 1737 JMS JMP I
2847 4915 1738 JMS TABIN
2848 4916 1739 JMS TABDEC
2849 4917 1740 JMS CLA CHA /DECREASES THRS ADDRESS
2850 4918 1741 JMS TABPT
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2852 4920 1743 JMS JMP I
2853 4921 1744 JMS TABDEC /RETURN
2854 4922 1745 JMS TABPT
2855 4923 1746 JMS TABCNT
2856 4924 1747 JMS TABVL
2857 4925 1748 JMS TABH
2858 4926 1749 JMS TABP
2859 4927 1750 JMS TABVL
2860 4928 1751 JMS DCA
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2357 1072 1163 TAD M4
2360 3375 1169 OCA OS3CNT
2361 1756 1170 TAD I NUMST
2362 3376 1171 OCA OS3SND
2363 2356 1172 ISZ NUMST
2364 1776 1173 OS3OVR, TAD I OS3SND
2365 1067 1174 TAD P265
2366 4454 1175 SEND
2367 7240 1176 OCA CLA
2368 1376 1177 TAD OS3SND
2369 3376 1178 OCA OS3SND
2370 2375 1179 ISZ OS3CNT
2371 5364 1180 JMP OS3OVR
2372 5756 1181 JMP I NUMST
2373 0000 1182 OS3CNT, 0
2374 0000 1183 OS3SND, 0
2375 2400 1184 9COND, BDCON
2376 2400 1185
2377 2400 1186
1187 /BINARY TO DECIMAL CONVERSION
1188 /TWO PARAM. (1)=BINARY NUMBER ADDRESS
1189 / (2)=DECIMAL NUMBER ADDRESS
1190
2400 1191 *2400
1192
2400 0000 1193 BDCON, 0
2401 1600 1194 TAD I BDCON /ADDRESS OF NUMBER
2402 3350 1195 OCA B0PT1
2403 2200 1196 ISZ BDCON /NEXT PARAMETER
2404 1600 1197 TAD I BDCON /ADDRESS OF RESULTS
2405 3242 1198 OCA B0PT2 /STORE
2406 1600 1199 TAD I BDCON /KEEP INITIAL ADDRESS
2407 3351 1200 OCA B0PT3
2408 2200 1201 ISZ BDCON /DEPOSIT RETURN
2409 0000 1202 JMS I CLEAR /ZERO OUT SCRATCH AREA
2410 7774 1203 B0PT2, 0 /ADDRESS BAFAM.
2411 7774 1204 B0M4, 7774 /NUMBER OF LOCATION TO ZERO
2412 7774 1205 TAD I B0PT1 /ANY 4096 BITS*
2413 5235 1206 JMS B0512
2414 5235 1207 JMP B0512 /NO
2415 1067 1208 TAD B00CT /YES, FIND AMOUNT TO ADD
2416 1067 1209 RAL CLL
2417 7240 1210 TAD H0409 /ADDRESS*4
2418 7240 1211 RAL /ADD 4096 ADDRESS HEAD
2419 1067 1212 IAC RTL
2420 5235 1213 JMS B0CNT /DEPOSIT NUMBERS
2421 5235 1214 B0512, ISZ B0PT1 /GET BEST OF COTAL NUMB.
2422 1750 1215 TAD I B0PT1 /GET FIRST TRIPLE
2423 1750 1216 RTL CLL
2424 5235 1217 RTL
2425 5235 1218 JMS B064 /ANY 512 BITS*
2426 5235 1219 JMP B064 /NO
2427 1067 1220 TAD B00CT /YES, FIND AMOUNT TO ADD
2428 1067 1221 RAL CLL
2429 7240 1222 TAD H0512 /ADDRESS*4
2430 7240 1223 RAL /ADD 512 ADDRESS HEAD
2431 1067 1224 OCA B0PT /STORE, DEPOSITING
2432 5235 1225 JMS B0CNT /DEPOSIT
2433 5235 1226 B064, TAD I B0PT1 /GET SECOND TRIPLE
2434 1750 1227 RTL CLL
2435 1750 1228 RTL
2436 5235 1229 JMS B01 /ANY 64 BITS*
2437 5235 1230 JMP B01 /AND SO FOURTH
2438 5235 1231
2439 5235 1232 TAD B00CT
2440 5235 1233 OCA B00CT
2441 5235 1234 TAD B00CT
2442 7240 1235 RAL CLL
2443 7240 1236 TAD B00CT /AMOUNT TO ADD * 3
2444 7240 1237 TAD H064
2445 7240 1238 OCA B0PT
2446 7240 1239 STL
2447 7240 1240 IAC RAL
2448 7240 1241 JMS B0CNT
2449 1750 1242 B0A, TAD I B0PT1 /GET THIRD TRIPLE
2450 7240 1243 RTL CLL
2451 4422 1244 OAR
2452 5275 1245 JMS B01 /ANY 8TH BITS*
2453 5275 1246 JMP
2454 5275 1247

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2467 1332 1244 TAD BDOCT
2473 7104 1249 RAL CLL
2474 1356 1250 TAD HDA
2475 3362 1251 OCA BDOPT
2476 7105 1252 TAD RAL CLL
2477 4333 1253 JMS BDOCT
2478 1750 1254 BDI, TAD I BDOPT1 /ANY FOURTH TRIPLEA
2479 3361 1255 AND MSK7
2480 1751 1256 TAD I BDOPT3
2481 3751 1257 OCA BDOPT3
2482 1213 1258 CONVER, TAD BDM4 /CONVERT TO 9 OR LESS
2483 3350 1259 OCA BDOPT1 /COUNT
2484 1351 1260 TAD BDOPT3 /INITIAL ADDRESS
2485 3312 1261 OCA BDOPT3 /MOVABLE ADDRESS
2486 3357 1262 CONNEX, OCA BDOPT2 /ZERO OUT CARRY
2487 1612 1263 TAD I BDOPT2 /SECURE NUMBER
2488 7450 1264 SNA CONOUT /IS IT ZEROA
2489 5313 1265 JMS REBT /YES, GET NEXT NUMBER
2490 4333 1266 JMS BDOPT2 /ACTUALLY REDUCES
2491 3612 1267 CONOUT, ISZ BDOPT2 /STORE RESULTS
2492 1512 1268 TAD I BDOPT2 /GET NEXT ADDRESS
2493 1357 1269 TAD BDOPT2
2494 3512 1270 OCA I BDOPT2 /ADD CARRY
2495 2356 1271 ISZ BDOPT1 /STORE RESULTS
2496 5305 1272 JMS CONNEX /DOXA
2497 5600 1273 JMS BDOCON /NO, CONTINUE
2498 3350 1274 MAKOFF, BDOCON /RETURN
2499 3350 1275 AND MSK7 /MASK OFF UNWANTED BITS
2500 7450 1276 SNA /RESULTS=CA
2501 5722 1277 JMS I MAKOFF /YES, RETURN
2502 3333 1278 OCA BDOCT /STORE FOR COUNTED
2503 1357 1279 TAD MLH
2504 3322 1280 ISZ MAKOFF
2505 5722 1281 JMS I MAKOFF /RETURN
2506 3333 1282 JMS BDOCT /DOES ACTUAL STORING
2507 3333 1283 BOCNT, BOCNT
2508 3333 1284 OCA BDOPT2
2509 1750 1285 BDI, TAD I BDOPT2 /? CF DEPOSIT
2510 1512 1286 TAD I BDOPT2 /LOC. OF DEPOSIT
2511 3350 1287 OCA I BDOPT2 /AND VALUE OF DEPOSIT
2512 3350 1288 ISZ BDOPT2 /STORE
2513 3350 1289 ISZ BDOPT2 /NEXT DEPOSIT LOC
2514 3350 1290 ISZ BDOPT2 /NEXT VALUE TO DEPOSIT
2515 1357 1291 JMS BDI, /NO, CONTINUE
2516 3350 1292 TAD BDOPT3 /YES, INITIAL ADDRESS
2517 3350 1293 JMS BDOCT /RETURN
2518 3350 1294 BOCNT, BOCNT
2519 3350 1295 JMS BDI,
2520 3350 1296 BOCNT, BOCNT
2521 3350 1297 CLEAR,
2522 3350 1298 HDA,
2523 3350 1299 HDA,
2524 3350 1300 HDA,
2525 3350 1301 HDA,
2526 3350 1302 HDA,
2527 3350 1303 BDOCT,
2528 3350 1304 BDOCT,
2529 3350 1305 MSK7,
2530 3350 1306 BDI,
2531 3350 1307 REON,
2532 3350 1308 TAD RDM12 /REDUCE NUMBER TO 9 OR LESS
2533 3350 1309 SNA /-10
2534 3350 1310 JMS /NEGATIVE YFTA
2535 3350 1311 JMS /YES
2536 3350 1312 ISZ BDOCT /NO, ADD TO CARRY
2537 3350 1313 JMS /CONTINUE REDUCTION
2538 3350 1314 TAD RDM12 /ADD BACK
2539 3350 1315 JMS I REON /RETURN
2540 3350 1316 RDM12, -12
2541 3350 1317 RDM12, 12
2542 3350 1318 / I/O ROUTINES
2543 3350 1319 LIS,
2544 3350 1320 *2600 /FROM POPA
2545 3350 1321 KSF
2546 3350 1322 SKP
2547 3350 1323 JMS I
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2606 6136 132A KX8
2607 5600 1329 JMP I LIS
1330
2610 0100 1331 LIS40, 0 /FROM CS3
2611 6401 1332 KX840
2612 5211 1333 JMP --1
2613 6406 1334 KX840
2614 5610 1335 JMP I LIS40
1336
2615 0100 1337 TYP41, 0 /TO OS3
2616 3200 1338 OCA LIS /SAVE FOR OUTPUT
2617 4240 1339 JMS DELAY
2620 1200 1340 TAO LIS /OUTPUT VALUE
2621 641A 1341 TIS41
2622 7100 1342 CLA CLL
2623 5615 1343 JMP I TYP41
2624 3754 1344 ERRIN, ERPOS3
1345
/ SCREEN PUTS POINTER AT HOME
1346
2625 0000 1349 ERASE, 0
2626 7200 1349 CLA
2627 1237 1350 TAO CAN /ERASE SCREEN
2630 4727 1351 JMS I TYP /TYP
2631 4240 1352 JMS DELAY /WAIT
2632 1350 1353 TAO HOME /PUT POINTER AT HOME
2633 4727 1354 JMS I TYP
2634 3236 1355 OCA LNCNT /ZERO LINE COUNTER
2635 5625 1356 JMP I ERASE
1357
LNCNT, 0
2636 0100 1357 CAN, 230
2637 0230 1358 DELAY, 0 /DELAY ROUTINE
2640 0300 1359
2641 1251 1360 TAO P1
2642 3252 1361 OCA P2
2643 3377 1362 OCA ADST
2644 2377 1363 ISZ ADST
2645 5244 1364 JMS --1
2646 2252 1365 ISZ P2
2647 5244 1366 JMS --3
2650 5640 1367 JMP I DELAY
2651 7747 1368 P1, 7747
2652 0000 1369 P2, 0
1370
/OUTPUTS MESSAGE CHECKS END OF MESSAGE
/INCREMENTS LINE COUNTER IF 312 RECEIVED
1371
1372
1373
2653 0100 1374 MESOUT, 0
2654 7300 1375 CLA CLL
2655 1553 1376 TAO I MESOUT /END OF MESSAGE A
2656 7440 1377 SZA
2657 5262 1378 JMS --3 /NO
2658 2253 1379 ISZ MESOUT /YES, PROPER RETURN
2659 5653 1380 JMP I MESOUT /RETURN
2662 3277 1381 OCA MESPT /SAVE WORD ADDRESS
2663 1677 1382 TAO I MESPT
2664 7440 1383 SZA /END OF WORDS OUTPUTA
2665 5270 1384 JMS --3 /NO
2666 2253 1385 ISZ MESOUT /YES, NEXT SET OF WORDS
2667 5254 1386 JMS MESOUT+1 /START OVER
2670 4727 1387 JMS I TYP /OUTPUT LETTER OF WORDS
2671 1677 1388 TAO I MESPT /IS LETTER A CR
2672 1371 1389 TAO M215 /BOTTOM CHECK
2673 7650 1390 SNA CLA /NO
2674 4300 1391 JMS BOTCK /YES, CHECK
2675 2277 1392 ISZ MESPT /GET NEXT LETTER ADDRESS
2676 5263 1393 JMP --13 /GET NEXT LETTER
2677 0000 1394 MESPT, 0
1395
/IS POINTER AT BOTTOM OF THE SCREEN
1396
1397
2700 0100 1398 BOTCK, 0
2701 1253 1399 TAO MESOUT /SAVE RETURN ADR
2702 3330 1400 OCA BSAV1
2703 1277 1401 TAO MESPT /SAVE WORD ADR
2704 3371 1402 OCA BSAV2
2705 2236 1403 ISZ LNCNT /INCREASE LINE COUNTER
2706 1236 1404 TAO LNCNT /GET COUNTER
2707 1326 1405 TAO M36 /36 LINES YFTA
2710 7640 1406 SZA CLA /RESULT=0A
2711 5317 1407 JMP --6

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2712 4456 1408 MESSAGE
2713 6154 1409 MESSAGE
2714 0800 1410 0 /PAGE FULL
2715 4451 1411 INPUT
2716 4325 1412 JMS ERASE /YES, NEW SCREEN
2717 1326 1413 TAD P212 /DOWN ONE LINE
2720 4727 1414 JMS I TYP
2721 1330 1415 TAD R5AV1 /RETURN SAVED ADR
2722 3253 1416 DCA MESOUT
2723 1331 1417 TAD R5AV2
2724 3277 1418 DCA MESPT
2725 5700 1419 JMP I BOTCK /RETURN
2726 7742 1420 M36, -36
2727 5000 1421 TYP, PAKTYP
2730 0300 1422 BSAV1, 0
2731 0300 1423 BSAV2, 0
2732 0000 1424
2733 1722 1425 /PARAMETER (1) - (MAX. 2 OF INPUTS +1)
2734 3373 1426 /PARAMETER (2) ADDRESS OF DEPOSIT
2735 3340 1427
2736 2332 1428 NUMIN, 0
2737 1722 1429 TAD I NUMIN /FIRST PARAM.
2738 3373 1430 DCA NUMCNT /MAX > INPUTS +1
2739 3340 1431 DCA NUMCNT
2740 2332 1432 ISZ NUMIN
2741 1722 1433 TAD I NUMIN /SECOND PARAM.
2742 3373 1434 DCA NUMIT /ADR OF DEPOSIT
2743 2332 1435 TAD I NUMIN
2744 4200 1436 DCA ADST
2745 6346 1437 NUMIN /PROPER RETURN
2746 1371 1438 LIS /GET INPUT
2747 7450 1439 TAD M215 /ECHO
2748 5366 1440 JMP M215 /IS IT A CRA
2749 1365 1441 SNA
2750 3373 1442 NUMOUT1 /YES, RETURN ONE
2751 2060 1443 TAD P215 /ADD BACK
2752 3373 1444 AND MS17 /JUST NUMBER VALUE
2753 3373 1445 DCA I NUMIT /STORE
2754 2060 1446 ISZ NUMCNT
2755 3373 1447 NUMIT /NEXT ADR
2756 2332 1448 ISZ NUMCNT /DOWNA
2757 5344 1449 JMP NUMEX1 /NO, CONTINUE
2758 4200 1450 NUMEX2, LIS /ECHO
2759 6346 1451 TAD M215
2760 1371 1452 SNA CLA /IS IT A CRA
2761 7450 1453 TAD M215
2762 5366 1454 JMP NUMOUT2 /YES, RETURN ONE
2763 1377 1455 NUMEX2 /NO, CONTINUE
2764 4777 1456 NUMOUT1, TAD ADST
2765 2332 1457 JMS I PUSOWN
2766 4300 1458 ISZ NUMIN
2767 5732 1459 NUMOUT2, JMS BOTCK /BOTTOM OF SCREENA
2768 0300 1460 JMP I NUMIN /RETURN
2769 0300 1461 NUMCNT, 0
2770 0300 1462 NUMIT, 0
2771 3217 1463 MS17, 17
2772 3340 1464 PUSOWN, ADJUST
2773 0300 1465 ADST, 0
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3023 0245 1488 AND DAT77 /JUST 6 BITS
3024 1643 1449 TAD I DATPT1
3025 3543 1490 OCA I DATPT1 /PUT IN RIGHT LOC SIDE
3026 2244 1491 ISZ DATPT1 /NEXT DATA LOC
3027 3244 1492 OCA SIOCNT /SET FOR LEFT DEPOSIT
3030 2314 1493 ISZ DATPNT /INCREASE LOC POINTER
3031 2241 1494 ISZ DATCNT /END OF PAGE
3032 5237 1495 JMP *+5 /NO
3033 1320 1496 TAD M7000 /YES
3034 3241 1497 OCA DATCNT /RESET COUNTER
3035 1242 1498 TAD P4000
3036 3243 1499 OCA DATPT1 /RESET POINTER
3037 5500 1500 JMP I DATIN /RETURN
3040 0300 1501 DATVAL, 0
3041 0300 1502 DATCNT, 0
3042 4000 1503 P4000, 4000
3043 0300 1504 DATPT1, 0
3044 0300 1505 SIOCNT, 0
3045 0377 1506 DAT77, 77

3045 0000 1507 DATOUT, 0
3046 1314 1508 TAD DATPNT /ANY OUTPUT VALUES
3047 7540 1509 SZA CLA
3048 5253 1510 JMP *+2 /YES, CONTINUE
3049 5247 1511 JMP *-3 /ASK AGAIN
3050 1317 1512 TAD SIOCNT /LEFT OR RIGHT SIDE
3051 7540 1513 SZA CLA
3052 5271 1514 JMP RTGOUT /RIGHT SIDE
3053 1713 1515 LFTOUT, TAD I DATPT2 /GET LEFT CHAR.
3054 7112 1516 RTR
3055 7112 1517 RTR
3056 7112 1518 RTR
3057 7112 1519 RTR
3058 0345 1520 AND DAT77 /JUST 6 BITS
3059 4321 1521 JMS GRAY /OUTPUT GRAY SCALE
3060 2315 1522 ISZ DATCT /LINE DONE
3061 5267 1523 JMP *+2 /NO
3062 5646 1524 JMP I DATOUT /YES
3063 7240 1525 CMA CLA
3064 3317 1526 DCA SIOCNT /SET FOR RIGHT SIDE
3065 1713 1527 RTGOUT, TAD I DATPT2 /GET RIGHT CHAR.
3066 0245 1528 AND DAT77 /JUST 6 BITS
3067 4321 1529 JMS GRAY /OUTPUT GRAY SCALE
3068 2313 1530 ISZ DATPT2 /NEXT ADDR.
3069 7240 1531 CLA CMA /GET NEXT OUTPUT LOC
3070 1314 1532 TAD DATPNT
3071 3314 1533 OCA DATPNT
3072 3317 1534 DCA SIOCNT
3073 2315 1535 ISZ PGEND /SET FOR LEFT SIDE
3074 5327 1536 JMP *+5 /END OF PAGE
3075 1314 1537 TAD M7000 /NO
3076 3314 1538 OCA PGEND /YES
3077 1242 1539 TAD P4000 /RESET COUNTER
3078 3317 1540 DCA DATPT2 /RESET POINTER
3079 2315 1541 ISZ DATCT /LINE DONE
3080 5312 1542 JMP *+2 /NO
3081 5546 1543 JMP I DATOUT /YES, RETURN
3082 5247 1544 JMP DATOUT+1 /CONTINUE
3083 0300 1545 DATCT2, 0
3084 0300 1546 DATPNT, 0
3085 0300 1547 DATCT, 0
3086 0300 1548 PGEND, 0
3087 0300 1549 SIOCNT, 0
3088 7300 1550 M7000, -1000

3089 0300 1551 GRAY, 0
3090 1314 1552 TAD THVAL /OUTPUTS GRAY SCALE
3091 3314 1553 OCA GRYVAL /ADD TABLE VALUE ADD.
3092 1734 1554 TAD I GRYVAL /ADD INTEN VALUE
3093 3314 1555 OCA PAR2 /GET INTEN VALUE
3094 4733 1556 JMS I INTROU /DEPOSIT IN PAR2. OF
3095 0300 1557 INTROU /INTEN POLTIME
3096 0300 1558 PAR2, 0
3097 0300 1559 JMP I GRAY /INTEN VALUE
3098 3700 1560 TAD THVAL /RETURN
3099 3700 1561 INTROU, INTROU
3100 5400 1562 GRYVAL, 0
3101 0300 1563 NEWLIN, 0
3102 2046 1564 ISZ NUBBUF /ANY MORE LINES

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3137 5341 1568 JMP .+2 /YES
3140 5357 1569 JMP NONBUF /NO
3141 1114 1570 TAD DATPNT /OVER FLOW INPUTS
3142 1111 1571 TAD PPL /SET FLAG 1 OR 2
3143 1320 1572 SPA CLA M7000
3144 7710 1573 IAC
3145 7201 1574 DCA
3146 3344 1575 DCA BUFL1 /SET BUFFER FLAG 1
3147 1444 1576 TAD BUFL1 /IS FLAG 1 SET
3148 7650 1577 SNA CLA /YES
3149 7340 1578 CMA
3150 3345 1579 DCA BUFL2 /SET BUFFER FLAG 2
3151 1111 1580 TAD PPL
3152 7341 1581 CIA
3153 3362 1582 SETPPR, TAD
3154 7341 1583 CIA
3155 3362 1584 DCA OUTCNT /RESET BUFFER LINE COUNTER
3156 5735 1585 JMP NEWLIN /RETURN
3157 7340 1586 NONBUF, CMA
3158 3347 1587 DCA NUBFL /SET NO BUFFER FLAG
3159 5353 1588 JMP SETPPR /RETURN
3160 0000 1589 OUTCNT, 0
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3355 1374 1644 TAO AOSAV3
3356 7001 1650 TAC
3357 3375 1651 DCA AOSAV4 /UNITS ADR
3358 1774 1652 PUSOVR, TAO I AOSAV3 /GET 10'S ADR
3359 3375 1653 DCA I AOSAV4 /PUT IN UNITS
3360 1773 1654 TAO I AOSAV2 /GET 100'S ADR
3361 3374 1655 DCA I AOSAV3 /PUT IN 10'S ADR
3362 1772 1656 TAO I AOSAV1 /GET 1000'S ADR
3363 3373 1657 DCA I AOSAV2 /PUT IN 1000'S ADR
3364 3372 1658 DCA I AOSAV1 /IN 100'S
3365 2376 1659 ISZ RNDCNT /DONE
3366 5360 1660 JMP PUSOVR /NO, CONTINUE
3367 5740 1661 JMP I ADJUST /YES, RETURN
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3372 0000 1666 RNDCNT, 0
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3471 1326 1734 TAD RADIX /ADD 12 FIRST 2 TIMES
3472 2324 1735 ISZ THST1
3473 5221 1736 JMP *-2
3474 1225 1737 TAD THST2 /ADD SECOND NUMBER
3475 3224 1738 OCA THST1 /STORE RESULTS
3476 5223 1739 JMP THIN2
3477 7220 1740 THOEL, CLA
3500 1224 1741 TAD THST1
3501 3711 1742 OCA I THPT /STORE
3502 2223 1743 ISZ THCNT /7 TIMES
3503 7100 1744 NOP
3504 1223 1745 TAD THCNT /0
3505 7420 1746 SNA
3506 5226 1747 JMP THRET1 /NO, ECHO
3507 2311 1748 ISZ THPT /NEXT ADDRESS
3510 5226 1749 JMP THIN1 /CONTINUE
3511 0000 1750 THPT, 0
3512 3512 1751 THHO, THHO
3513 0000 1752 C
3514 0000 1753 0
3515 0000 1754 0
3516 0000 1755 0
3517 0000 1756 0
3520 0000 1757 0
3521 0000 1758 0
3522 2220 1759 THPT2, ISZ THOIN
3523 5223 1760 JMP I THOIN /PROPER RETURN
3524 0017 1761 MSK17, 17
3525 0000 1762 THSTJ, 0
3526 0212 1763 RADIX, 12
3527 0100 1764 PRINT1, 0
3530 1227 1765 TAD P260 /BACK AND LF
3531 4422 1766 OUTPUT /ADD 2 VALUE
3532 1026 1767 TAD P212 /LF
3533 4422 1768 OUTPUT
3534 1337 1769 TAD BS /BACK SPACE
3535 4422 1770 OUTPUT
3536 5727 1771 JMP I PRINT1
3537 0210 1772 BS, 210
3540 0000 1773 /IS THE INPUT CORRECT
3541 4426 1774 RIGHT, 0
3542 5535 1775 MESSAGE
3543 5536 1776 /CORRECT
3544 0000 1777 0
3545 4723 1778 JMS I RETORT
3546 5532 1779 JMP *-4 /ERROR RETURN
3547 5351 1780 JMP *-2 /NO RETURN
3550 2340 1781 ISZ RIGHT /YES RETURN
3551 2340 1782 ISZ RIGHT
3552 5740 1783 JMP I RIGHT /RETURN...
3553 2000 1784 RETORT, REPLY
3554 0000 1785 CKFL, 0
3555 4423 1786 RECEIVE /GET LINE FEED
3556 4424 1787 SEND
3557 4423 1788 RECEIVE /CHECK IF OS3 FILE
3560 1072 1789 TAD M4
3561 7540 1790 SZA CLA
3562 5724 1791 JMP I CKFL /NOT A OS3 FILE RETURN
3563 2354 1792 ISZ CKFL /IS A OS3 FILE RETURN
3564 5322 1793 JMP *-2
3565 0000 1794 /CHECK FOR FF(60) OUTPUT
3566 4423 1795 FF(, 0
3567 0377 1796 RECEIVE
3570 1376 1797 AND HK377 /MASK OFF UNWANTED BITS
3571 7640 1798 TAD M276 /IS IT A >A
3572 5326 1799 SZA CLA
3573 4423 1800 JMP *-4 /NO, KEEP LOOKING
3574 7220 1801 RECEIVE /YES, TAKE IN SPACE
3575 5725 1802 CLA
3576 7502 1803 JMP I FF( /RETURN
3577 0377 1804 M276, -276
1805 HK377, 377
1806
1807 /DECIMAL TO BINARY CONVERSION

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1308 /PARAM. (1)= DECIMAL NUMBER ADDRESS
1309 /PARAM. (2)= BINARY NUMBER ADDRESS
1310
1311 *3600
1312 OTOR, 0
1313 TAO I DT00 /DECIMAL ADDRESS
1314 OCA DBPT1
1315 ISZ DT00
1316 TAO I DT00 /BINARY ADDRESS
1317 OCA DBPT2
1318 JMS I CLR1 /CLEAR BINARY LOC.
1319
1320 DBPT2, 0
1321 7776 /Z CF LOC. TO CLEAR
1322 TAO DBHD /TABLE HEADS
1323 OCA 10
1324 TAO I DBPT1 /GET NUMBER VALUE
1325 TAO I 10 /ADD ADDRESS
1326 OCA DBPT4
1327 ISZ DBPT2 /GET LOW ADDRESS
1328 TAO I DBPT4 /GET BINARY VALUE
1329 OCA I DBPT2 /STORE AT LOW
1330 OCA DBLNK /ZERO CARRY
1331 TAO I DBPT1 /IS 1000'S <4A
1332 TAO M4
1333 SPA SNA /YES
1334 JMP +6 /NO
1335 ISZ DBLNK /ADD TO LINK CARRY
1336 TAO M4 /IS 1000'S <8A
1337 SPA SNA /YES
1338 JMP +2 /NO
1339 ISZ DBLNK /ADD TO CARRY
1340 CLA CLL
1341 TAO DBM3 /3 TIMES THROUGH
1342 OCA DBCNT /COUNTER
1343 ISZ DBPT1 /NEXT DECIMAL UNIT
1344 TAO I DBPT1 /GET NUMBER VALUE
1345 TAO I 10 /ADD ADDRESS
1346 OCA DBPT4
1347 TAO I DBPT4 /GET VALUE
1348 TAO I DBPT2 /ADD LOW VALUE
1349 OCA I DBPT2
1350 SZL /OVERFLOWA
1351 ISZ DBLNK /YES ADD TO CARRY
1352 CLA CLL
1353 ISZ DBCNT /DONEA
1354 JMP DBAGA /NO, CONTINUE
1355 CLA CMA /YES
1356 TAO DBPT2 /GET HIGH ADDRESS
1357 OCA DBPT2
1358 TAO DBLNK /GET CARRY
1359 TAO I DBPT2
1360 OCA I DBPT2 /STORE RESULTS
1361 ISZ DT00 /PROPER RETURN
1362 JMP I DT00 /RETURN
1363
1364 DBPT1, 0
1365 DBPT4, 0
1366 DBLNK, 0
1367 DBCNT, 0
1368 DBM3, -3
1369 CLP1, ZECUT
1370 DBHD, DBHD
1371 DB1000, THS /THS
1372 DB100, HUND /HUND
1373 DB10, TEN /TEN
1374 DB1, UNITS /UNITS
1375
1376 /DOUBLE PRECISION ADD AND SUB.
1377 /PARAM. (1) ADDRESS OF NUMR. 1
1378 /PARAM. (2) ADDRESS OF NUMR. 2
1379
1380 DURADD, 0
1381 CLA CLL
1382 TAO I DURADD /PARAM. 1
1383 OCA DBAP1
1384 ISZ DURADD
1385 TAO I DURADD /PARAM. 2
1386 OCA DBAP2
1387 ISZ DURADD
1388 TAO I DBAP1 /PROPER RETURN
1389 /NUMR. 1 HIGH

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3706 1723 1844 TAD I DBAP2 /NUMB. 2 HIGH
3707 3116 1849 DCA COMH /STORE HIGH RESULTS
3710 7100 1850 CLL
3711 2322 1851 ISZ DBAP1 /LOW ADDRESSES
3712 2323 1852 ISZ DBAP2
3713 1723 1853 TAD I DBAP1 /NUMB. 1 LOW
3714 1723 1854 TAD I DBAP2 /NUMB. 2 LOW
3715 3117 1855 DCA COMH /STORE RESULTS
3716 7104 1856 RAL /GET CARRY IF ANY
3717 1116 1857 TAD COMH
3720 3116 1858 DCA COMH /STORE RESULTS
3721 5675 1859 JMP I DBRADD /RETURN
3722 0000 1900 DBAP1, 0
3723 0100 1901 DBAP2, 0
1902
1903 /DOUBLE PRECISION SUB.
1904
3724 0100 1905 DUBSUB, 0
3725 7300 1906 CLA CLL
3726 1724 1907 TAD I DUBSUB /PARAM. 1
3727 3222 1908 DCA DBPT1
3730 2324 1909 ISZ DUBSUB
3731 1724 1910 TAD I DUBSUB /PARAM. 2
3732 3227 1911 DCA DBPT2
3733 2324 1912 ISZ DUBSUB /PROPER RETURN
3734 1662 1913 TAD I DBPT1 /NUMB. 1 HIGH
3735 7040 1914 CMA /NEGATE
3736 1667 1915 TAD I DBPT2 /ADD NUMB. 2 HIGH
3737 3116 1916 DCA COMH /STORE RESULTS
3740 7100 1917 CLL
3741 2322 1918 ISZ DBPT1 /GET LOW ADDRESSES
3742 2327 1919 ISZ DBPT2
3743 1662 1920 TAD I DBPT1 /SUB LOW
3744 7041 1921 CIA /NEGATE
3745 1667 1922 TAD I DBPT2
3746 3117 1923 DCA COMH /STORE RESULTS
3747 7044 1924 RAL /ADD CARRY
3750 1116 1925 TAD COMH
3751 3116 1926 DCA COMH /STORE RESULTS
3752 7100 1927 CLL
3753 5724 1928 JMP I DUBSUB /RETURN
1929
1930 /CHECKS FOR UNWANTED VALUES SENT FROM OS3
1931
3754 0000 1932 ERROS3, 0
3755 6401 1933 KSF40
3756 5754 1934 JMP I ERROS3 /FLAG SET
3757 6406 1935 FRRNEX, KRB40 /NO RETURN
3760 3362 1936 DCA FRRLOC /GET VALUE
3761 5754 1937 JMP I ERROS3 /CLEAR BUFFER
3762 0000 1938 ERRLOC, 0 /RETURN
1939
1940 /STORAGE FOR ERTS DATA INPUT
1941 /MAX. OF FOUR PAGES
1942
4000 *4000
1943
*5000
5000 0000 1944 PAKTYP, 0 /RETURN ADDRESS
5001 6041 1945 PRFL /IS PRINT FLAG SET
5002 5201 1946 JMP --1
5003 6146 1947 PRRF
5004 7300 1948 CLA CLL /OUTPUT PRINT BUFFER
5005 5500 1949 JMP I PAKTYP /CLEAR REGISTERS
1950
1951 PRFL=5041
1952 PRRF=6046
5006 0000 1953 PAKSAV, 0 /VALUE FOR PDP
5007 3221 1954 DCA PAKACC /SAVE REGISTERS ROUTINE
5008 7104 1955 RAL /DEPOSIT ACC
5009 3222 1956 DCA PAKLNK /DEPOSIT LINK
5010 5506 1957 JMP I PAKSAV /RETURN
5011 0000 1958 PAKRST, 0 /POSTORE REGISTERS ROUTINE
5012 7300 1959 CLA CLL /CLEAR REGISTERS
5013 1222 1960 TAD PAKLNK /PUT IN LINK
5014 7040 1961 RAL
5015 1221 1962 TAD PAKACC
5016 5613 1963 JMP I PAKRST /PUT IN ACC
5017 0000 1964 PAKACC, 0 /RETURN
5020 0000 1965 PAKLNK, 0
5021 0000 1966 PAKMOV, 0
5022 0000
5023 0000

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50224 1623 1959 TAD I PAKMOV
50225 1623 1959 OCA PAKSVX
50226 2223 1970 ISZ PAKMOV
50227 1623 1971 TAD I PAKMOV
50330 7012 1972 RTR
50331 7012 1973 RTR
50332 7012 1974 RAR
50333 0262 1975 AND PAKMSK
50334 1257 1976 TAD PAKORD
50335 4200 1977 JMS PAKTYP
50336 1623 1978 TAD I PAKMOV
50337 0262 1979 AND PAKMSK
50440 1257 1980 TAD PAKORD
50441 4200 1981 JMS PAKTYP
50442 1263 1982 TAD PAKSVX
50443 7012 1983 RTR
50444 7012 1984 RTR
50445 7012 1985 RAR
50446 0262 1986 AND PAKMSK
50447 1257 1987 TAD PAKORD
50550 4200 1988 JMS PAKTYP
50551 1263 1989 TAD PAKSVX
50552 0262 1990 AND PAKMSK
50553 1260 1991 TAD PAKORD
50554 4200 1992 JMS PAKTYP
50555 3223 1993 ISZ PAKMOV
50556 5623 1994 JMS I PAKMOV
50557 0040 1995 PAKORD,
50558 0100 1996 PAKORD,
50559 0140 1997 PAKORD,
50560 0137 1998 PAKMSK,
50561 0100 1999 PAKSVX,
50562 0000 2000 PAKVEC,
50563 1664 2001 TAD I PAKVEC
50564 2264 2002 OCA PAKY1
50565 2264 2003 ISZ PAKVEC
50566 2264 2004 TAD I PAKVEC
50567 2264 2005 OCA PAKY1
50568 1315 2006 TAD PAKGS
50569 4200 2007 JMS PAKTYP
50570 4223 2008 JMS PAKMOV
50571 0000 2009 PAKX1,
50572 0000 2010 PAKY1,
50573 2264 2011 ISZ PAKVEC
50574 2264 2012 TAD I PAKVEC
50575 2264 2013 OCA PAKX2
50576 2264 2014 ISZ PAKVEC
50577 2264 2015 TAD I PAKVEC
50578 2264 2016 OCA PAKY2
50579 4200 2017 JMS PAKMOV
50580 0000 2018 PAKY2,
50581 0000 2019 PAKY2,
50582 1314 2020 TAD PAKUS
50583 4200 2021 JMS PAKTYP
50584 2264 2022 ISZ PAKVEC
50585 2264 2023 TAD I PAKVEC
50586 2264 2024 JMS I PAKVEC
50587 2264 2025 PAKUS,
50588 2264 2026 PAKGS,
50589 2264 2027 PAKINK,
50590 4200 2028 JMS PAKSAV
50591 4200 2029 TAD PAKOS
50592 4200 2030 JMS PAKTYP
50593 4200 2031 TAD I PAKINK
50594 4200 2032 TAD PAK40
50595 4200 2033 JMS PAKTYP
50596 4200 2034 ISZ PAKINK
50597 4200 2035 TAD PAKUS
50598 4200 2036 JMS PAKTYP
50599 4200 2037 JMS I PAKINK
50600 236 2038 PAKOS,
50601 4200 2039 PAK40,
50602 4200 2040 PAKPPM,
50603 4200 2041 JMS PAKSAV
50604 4200 2042 TAD I PAKPPM
50605 4200 2043 OCA PAKPY1
50606 4200 2044 ISZ PAKPPM
50607 4200 2045 TAD I PAKPPM
50608 4200 2046 OCA PAKPY1
50609 4200 2047 TAD PAKFS
50610 4200 2048 JMS PAKTYP

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/GET X VALUE
/SAVE X VALUE
/GET Y VALUE
/ROTATE TO GET HIGH Y VALUE
/REMOVE DATA TOO LARGE
/ADD HIGH Y VALUE
/OUTPUT HIGH Y COORD
/GET Y VALUE
/MASK OFF VALUE NOT NEEDED
/ADD LOW Y VALUE
/OUTPUT LOW Y COORD
/GET X VALUE
/ROTATE TO GET HIGH X VALUE

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/MASK OFF DATA TOO LARGE
/GET HIGH X VALUE
/OUTPUT HIGH X COORD
/GET Y VALUE
/MASK OFF VALUE NOT NEEDED
/ADD LOW X VALUE
/OUTPUT LOW X COORD
/CORRECT RETURN ADDRESS
/RETURN

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/GET X VALUE
/PUT IN X1 POS
/GET Y VALUE
/PUT IN Y1 POS
/PUT IN VECTOR MODE
/OUTPUT FIRST TWO VALUES

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/GET SECOND X VALUE
/PUT IN X2 POS
/GET Y2 VALUE
/PUT IN Y2 POS
/OUTPUT SECOND TWO VALUES

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/PUT IN ALPHA MODE
/GET CORRECT RETURN ADDRESS
/RETURN

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/SAVE REGISTERS
/PUT IN INCRF. MODE
/GET DTP

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/PUT ECOUNTER IN CORRECT POS
/GET CORRECT RETURN ADDRESS
/PUT IN ALPHA MODE
/RETURN

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/SAVE REGISTERS
/GET X VALUE
/PUT IN X POS
/GET Y VALUE
/PUT IN Y POS
/PUT IN PNT PLOT MODE

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5144 4223 2048 JMS PAKMOV
5145 0000 2049 /OUTPUT C00PD
5146 0000 2050 PAKPY1,
5147 2333 2051 PAKPX1,
5150 1314 2052 TS7 PAKPPM
5151 4200 2053 TAD PAKUS
5152 4213 2054 JMS PAKTYP
5153 5733 2055 JMS PAKRST
5154 0234 2056 JMP I PAKPPM
2057 PAKFS, 234
2058 /DECIMAL AND BINARY TABLES
2059
5200 *5200
2060 /BINARY TABLE
2061
2062 001, 10 /TWO TABLE ENTRIES
2063 002, 0
2064 003, 1
2065 004, 4
2066 005, 2
2067 006, 2
2068 007, 3
2069 008, 0
2070 009, 0
2071 010, 4
2072 011, 4
2073 012, 10
2074 013, 4
2075 014, 6
2076 015, 5
2077 016, 4 /THREE TABLE ENTRIES
2078 017, 6
2079 018, 0
2080 019, 10
2081 020, 1
2082 021, 1
2083 022, 2
2084 023, 3
2085 024, 4
2086 025, 11
2087 026, 1
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2099 038, 3
2100 039, 2
2101 040, 11
2102 041, 3
2103 042, 4
2104 043, 0
2105 044, 6
2106 045, 3
2107 046, 5
2108 047, 10
2109 048, 4
2110 049, 10
2111 050, 11
2112 051, 11
2113 052, 3
2114 053, 4
2115 054, 10
2116 055, 0
2117 056, 6
2118 057, 7
2119 058, 3
2120 059, 3
2121 060, 4
2122 061, 10
2123 062, 3
2124 063, 5
2125 064, 3
2126 065, 6
2127 066, 11 /FOUR TABLE ENTRIES
5300 0011 2127

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5301 0000 2138 0
5302 0001 2139 4
5303 0002 2140 2
5304 0003 2141 11
5305 0004 2142 10
5306 0005 2143 10

```

/DECIMAL TABLE

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5307 0000 2144 0
5308 0001 2145 1
5309 0002 2146 2
5310 0003 2147 3
5311 0004 2148 4
5312 0005 2149 5
5313 0006 2150 6
5314 0007 2151 7
5315 0008 2152 8
5316 0009 2153 9
5317 0010 2154 10
5318 0011 2155 11
5319 0012 2156 12
5320 0013 2157 13
5321 0014 2158 14
5322 0015 2159 15
5323 0016 2160 16
5324 0017 2161 17
5325 0018 2162 18
5326 0019 2163 19
5327 0020 2164 20
5328 0021 2165 21
5329 0022 2166 22
5330 0023 2167 23
5331 0024 2168 24
5332 0025 2169 25
5333 0026 2170 26
5334 0027 2171 27
5335 0028 2172 28
5336 0029 2173 29
5337 0030 2174 30
5338 0031 2175 31
5339 0032 2176 32
5340 0033 2177 33
5341 0034 2178 34
5342 0035 2179 35
5343 0036 2180 36
5344 0037 2181 37
5345 0038 2182 38
5346 0039 2183 39
5347 0040 2184 40
5348 0041 2185 41
5349 0042 2186 42
5350 0043 2187 43
5351 0044 2188 44
5352 0045 2189 45
5353 0046 2190 46
5354 0047 2191 47
5355 0048 2192 48
5356 0049 2193 49

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UNITS, 0

1

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*5400
INTEN.

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F
TAD I INTEN
SNA CLA
JMP INTPO
ISZ INTEN
TAD I INTEN
DCA INTX1
ISZ INTEN
TAD I INTEN
DCA INTY1
TAD INTX2
DCA INTY2
TAD INTX1
TAD INTX2
DCA INTSAV
ISZ INTEN
CLA CLL
TAD I INTEN
SNA
JMP INTM0
BAP
SNA
JMP INTM1
BAP
SNA
JMP INTM2
BAP
SNA

```

INTPO,

```

/FCPM 1 CR 8
/FCPM 3
/GET NEXT INTEN LOC
/INITIAL X LOC
/GET NEXT INTEN LOC
/GET X LOC
/GET Y1 VALUE FOR VEC ROUTINE
/GET Y2 VALUE
/SET Y1 EIGHTTEEN
/GET Y2 VALUE FOR VEC ROUTINE
/GET X CC000
/ADD SIXTEEN
/NEXT X LOC GOING NW
/NEXT INTEN LOC
/GET NUMBER OF LINES
/NO LINES
/ONE LINE
/TWO LINES

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5435 5314 2208 JMP INTH4 /FOUR LINES
5436 7040 2209 SNA /EIGHT LINES
5437 7040 2210 JMP INTH8 /EIGHT LINES
5440 5311 2211 SNA CLA /SIXTEEN LINES
5441 7040 2212 JMP INTH16 /GET NUMBER OF LINES
5443 7040 2213 SNA CLA /MINUS THREE
5444 1532 2214 TAO I INTEN
5445 1346 2215 TAO INTN3
5446 7040 2216 SNA CLA /THREE LINES
5447 5272 2217 JMP INTH3 /MINUS TWO
5450 1341 2218 TAO INTN2
5451 7040 2219 SNA CLA /FIVE LINES
5453 5315 2220 JMP INTH5 /GET NEXT X COORD
5454 1344 2221 TAO INTSAV /X1 = X2
5455 4354 2222 JMS INXCAL
5456 7040 2223 CLA CLL
5457 2200 2224 ISZ INTEN /GET NEXT INTEN LOC
5460 1347 2225 JMP I INTEN /RETURN
5461 1331 2226 TAO INTX1 /GET X1 VALUE
5462 4354 2227 TAO INTP10 /ADD EIGHT
5463 4354 2228 JMS INXCAL /X1=X2
5464 5253 2229 JMS INTVEC /OUTPUT LINE
5465 1347 2230 JMP INTH2 /RETURN
5466 1333 2231 TAO INTX1 /GET X1 VALUE
5467 4354 2232 TAO INTP4 /ADD 4
5470 4354 2233 JMS INXCAL /X1=X2
5471 5250 2234 JMS INTVEC /OUTPUT LINE
5472 1332 2235 JMP INTH1 /OUTPUT NEXT LINE
5473 3344 2236 TAO INTDIF /ADD FIVE
5474 1347 2237 TAO INTX1 /PUT IN LINE LENGTH
5475 1344 2238 TAO INTDIF /GET X1 COORD
5476 4354 2239 JMS INXCAL /ADD NEXT LINE COORD
5477 1343 2240 TAO INTSAV /X1=X2
5480 7041 2241 CMA IAC /GET NEXT X COORD
5481 1347 2242 TAO INTX1 /MAKE NEG
5482 7700 2243 SNA CLA /END OF LINES
5483 5353 2244 JMP INTH2
5484 4354 2245 JMS INTVEC /NO. OF LINE
5485 5274 2246 JMP INTOVR /COMPARE X1 VALUE
5486 1344 2247 TAO INTP3 /ADD 1-SEE
5487 3344 2248 DCA INTDIF /PUT IN LINE LENGTH
5490 5274 2249 JMP INTOVR /OUTPUT LINES
5491 1335 2250 TAO INTP2 /ADD 1-2
5492 3344 2251 DCA INTDIF /LINE LENGTH
5493 5274 2252 JMP INTOVR /OUTPUT LINES
5494 1347 2253 TAO INTX1 /GET X1
5495 1342 2254 TAO INTN1 /SUB. ONE
5496 4354 2255 JMS INXCAL /PUT X1=X2
5497 1333 2256 TAO INTP4 /ADD FIVE
5498 3344 2257 DCA INTDIF /PUT IN LINE LENGTH
5499 5274 2258 JMP INTOVR /OUTPUT LINES
5500 1347 2259 TAO INTX1 /GET X1
5501 1342 2260 TAO INTN1 /SUB. ONE
5502 4354 2261 JMS INXCAL /PUT X1=X2
5503 7001 2262 IAC /ADD ONE
5504 3344 2263 DCA INTDIF /PUT IN LINE LENGTH
5505 5274 2264 JMP INTOVR /OUTPUT LINES
5506 2220 2265 INTP20. 20
5507 0010 2266 INTP10. 10
5508 0005 2267 INTP5. 5
5509 0004 2268 INTP4. 4
5510 0003 2269 INTP3. 3
5511 0002 2270 INTP2. 2
5512 7756 2271 INT422. -22
5513 7771 2272 INT47. -7
5514 7775 2273 INT43. -3
5515 7776 2274 INT42. -2
5516 7777 2275 INT41. -1
5517 0000 2276 INTSAV. 0
5518 0000 2277 INTDIF. 0
5519 0000 2278 INTVEC. 0
5520 4761 2279 JMS I INTPLT
5521 0000 2280 INTX1. 0
5522 0000 2281 INTY1. 0
5523 0000 2282 INTX2. 0
5524 0000 2283 INTY2. 0
5525 5745 2284 JMP I INTVEC.
5526 0000 2285 INXCAL. 0

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5555 3347 2388 DCA INTX1
5556 1347 2389 TAD INTX1
5557 3351 2390 DCA INTX2
5560 5754 2391 CMP INTXCAL
5561 5064 2392 INTPLT, PAKVEC.

/ WORD TABLE FOR MESSAGE OUTPUT

MESSA, *5600
3377 /W
3378 /H
3379 /A
3380 /T
3381 /SPACE
MESS9, 00077 /A
0015 /CR
MESSC, 00011 /I
00011 /S
00011 /T
00011 /H
00011 /E
00011 /SPACE
MESSD, 00011 /I
00011 /N
00011 /P
00011 /U
00011 /T
00011 /SPACE
00011 /I
00011 /L
00011 /E
00011 /SPACE
MESSE, 00033 /C
00033 /O
00033 /R
00033 /E
00033 /G
00033 /T
00033 /SPACE
MESSF, 00011 /A
00011 /R
00011 /E
00011 /SPACE
00011 /T
00011 /H
00011 /F
00011 /SPACE
00011 /T
00011 /H
00011 /R
00011 /E
00011 /S
00011 /H
00011 /O
00011 /L
00011 /J
00011 /S
00011 /SPACE
MESSG, 00011 /I
00011 /N
00011 /I
00011 /T
00011 /I
00011 /A
00011 /L
00011 /SPACE
MESSH, 00020 /P
00017 /O
00011 /I
00011 /N

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5707	0324	2368	324	/T
5710	0300	2369		
5711	0323	2370	MESSI,	/S
5712	0324	2371	40	/SPACE
5713	0300	2372		
5714	0316	2373	MESSJ,	/N
5715	0316	2374		/U
5716	0311	2375		/M
5717	0311	2376		/R
5720	0306	2377		/E
5721	0323	2378		/R
5722	0324	2379		/SPACE
5723	0311	2380		/D
5724	0300	2381		/T
5725	0324	2382		/SPACE
5726	0311	2383		
5727	0314	2384	MESSK,	/L
5730	0311	2385		/T
5731	0311	2386		/F
5732	0305	2387		/F
5733	0300	2388		
5734	0300	2389	MESSL,	/P
5735	0311	2390		/T
5736	0311	2391		/C
5737	0300	2392		/T
5740	0300	2393		/U
5741	0300	2394		/R
5742	0305	2395		/E
5743	0322	2396		/SPACE
5744	0311	2397		/T
5745	0300	2398		/SPACE
5746	0300	2399		/SPACE
5747	0300	2400		/C
5750	0306	2401		/O
5751	0311	2402		/M
5752	0300	2403		/P
5753	0311	2404		/L
5754	0300	2405		/E
5755	0300	2406		/T
5756	0305	2407		/E
5757	0306	2408		/D
5760	0300	2409	MESSM,	/CR
5761	0300	2410		
5762	0300	2411	MESS1,	/B
5763	0300	2412		/A
5764	0300	2413		/N
5765	0300	2414		/D
5766	0300	2415		/SPACE
5767	0311	2416		/N
5770	0300	2417		/U
5771	0311	2418		/M
5772	0300	2419		/B
5773	0300	2420		/R
5774	0300	2421		/SPACE
5775	0300	2422		
5776	0300	2423	MESS2,	/R
5777	0300	2424		/E
6000	0300	2425		/T
6001	0300	2426		/W
6002	0300	2427		/E
6003	0300	2428		/E
6004	0300	2429		/N
6005	0300	2430		/SPACE
6006	0300	2431		/L
6007	0300	2432		/SPACE
6010	0300	2433		/SPACE
6011	0300	2434		/A
6012	0300	2435		/N
6013	0300	2436		/D
6014	0300	2437		/SPACE
6015	0300	2438		/T
6016	0300	2439		/CR
6017	0300	2440		
6020	0305	2441	MESSN,	/F
6021	0316	2442		/N
6022	0324	2443		/T
6023	0305	2444		/E
6024	0322	2445		/R
6025	0324	2446		/SPACE
6026	0316	2447		/N

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6027	0335	2448	325	/U
6031	0335	2449	15	/M
6031	0335	2450	15	/R
6032	0335	2451	15	/E
6033	0335	2452	15	/R
6034	0335	2453	15	/SPACE
6035	0335	2454	15	/A
6036	0335	2455	15	/C
6037	0335	2456	15	/A
6040	0335	2457	15	/T
6041	0335	2458	15	/N
6042	0335	2459	15	/CR
6043	0335	2460	15	
6044	0335	2461	15	
6045	0335	2462	15	MESSO.
6046	0335	2463	15	/O
6047	0335	2464	15	/N
6048	0335	2465	15	/SPACE
6049	0335	2466	15	/T
6050	0335	2467	15	/H
6051	0335	2468	15	/I
6052	0335	2469	15	/G
6053	0335	2470	15	/SPACE
6054	0335	2471	15	/E
6055	0335	2472	15	/I
6056	0335	2473	15	/L
6057	0335	2474	15	/E
6058	0335	2475	15	/SPACE
6059	0335	2476	15	
6060	0335	2477	15	MESS4.
6061	0335	2478	15	/F
6062	0335	2479	15	/X
6063	0335	2480	15	/C
6064	0335	2481	15	/E
6065	0335	2482	15	/E
6066	0335	2483	15	/SPACE
6067	0335	2484	15	/C
6068	0335	2485	15	/C
6069	0335	2486	15	/E
6070	0335	2487	15	/N
6071	0335	2488	15	/SPACE
6072	0335	2489	15	/O
6073	0335	2490	15	/SPACE
6074	0335	2491	15	/I
6075	0335	2492	15	/L
6076	0335	2493	15	/E
6077	0335	2494	15	/SPACE
6078	0335	2495	15	/T
6079	0335	2496	15	/H
6080	0335	2497	15	/I
6081	0335	2498	15	/T
6082	0335	2499	15	/CR
6083	0335	2500	15	
6084	0335	2501	15	MESSQ.
6085	0335	2502	15	/B
6086	0335	2503	15	/U
6087	0335	2504	15	/E
6088	0335	2505	15	/E
6089	0335	2506	15	/SPACE
6090	0335	2507	15	/E
6091	0335	2508	15	/R
6092	0335	2509	15	/R
6093	0335	2510	15	/O
6094	0335	2511	15	/R
6095	0335	2512	15	/SPACE
6096	0335	2513	15	/S
6097	0335	2514	15	/T
6098	0335	2515	15	/A
6099	0335	2516	15	/R
6100	0335	2517	15	/T
6101	0335	2518	15	/SPACE
6102	0335	2519	15	/O
6103	0335	2520	15	/V
6104	0335	2521	15	/E
6105	0335	2522	15	/R
6106	0335	2523	15	/CR

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6147	0000	2529		0	
6150	0240	2529	MESSR,	240	/SPACE
6151	0255	2530		255	/-
6152	0240	2531		243	/SPACE
6153	0000	2532		0	
6154	0212	2533	MESSV,	212	/LF
6155	0320	2534		323	/P
6156	0301	2535		301	/A
6157	0307	2536		307	/G
6160	0305	2537		305	/E
6161	0240	2538		240	/SPACE
6162	0306	2539		306	/F
6163	0325	2540		325	/U
6164	0314	2541		314	/L
6165	0314	2542		314	/L
6166	0000	2543		0	
6167	0000	2544		\$\$\$	
		2545			

NO DIAGNOSTICS

APPENDIX 7.7

Appendix 7.7 is divided into three sections.

Section 1: To load High-Speed Reader Tape

Section 2: To load RIM

Section 3: To load BIN

7.7 Section 1 Load High-Speed Tape

F-1: To Load High-Speed Reader Tape

There are three switches on the High-Speed Reader

S1: the on-off switch

S2: back-center-forward moving switch

S3: load-ready switch

Loading Procedure

1. S1 in off position
S2 in center position
S3 in load position
2. Place tape in high-speed reader, punched leader should be near user.
3. S1 in on position
S3 in ready position
4. Load 7777 (actual) in SR
Press ADDR LOAD switch
5. Make bit 0 of SR zero (push down)
6. Press Run switch

If tape stalls before entirely fed apply small amount of tension on tape being fed, then let go. If tape doesn't continue go to 1.

7. If tape is loaded properly
AC=0 ; L=1 return to user guide

8. If tape didn't load properly the first time go to 1, if it doesn't load properly the second time go to F-2.

If user continues to have trouble loading tape, tape may be bad, user needs new tape.

7.7 Section 2 Load Rim

F-2: To Load RIM

First make sure RIM is not in memory by going to the examine section.

I Load Section

1. Load 7756 (octal) in SR
Press ADPR LOAD switch
2. Load 6014 in SR
Press deposit switch (this places 6014 in memory location 7756)
3. Load 6011 in SR
Press deposit switch (this places 6011 in memory location 7757)
4. Continue pattern found in Rim loader table (high-speed). Now go to F-3.

II Examine Section

1. Load 7756 (octal) in SR
Press ADDR load switch
Contents of memory locator 7756 found in AC
2. Press examine switch twice for next location (7757)
3. To get next sequential memory location press examine switch once. Continue until all locations are all right or until a location is bad. If location is bad go to Load Section. If all right go to F-3.

7.7 Section 3 Load BIN

F-3: To Load BIN

To load BIN follow the same instructions as F1 except for a few changes. At introduction 4 user loads 7756 (octal) in SR, skip instruction 5,7, and 8. Assume BIN got loaded properly when tape done and press stop switch. Now go to F-1.