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SUBROUTINES TO FACILITATE VISUAL DISPLAY AND MAN-MACHINE RELATIONSHIPS USING THE STANDARD OPERATING SYSTEM ON AN IBM 360 COMPUTER

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FOREWORD

The subroutines described herein were prepared in the Physical Sciences Branch of the Computer Programming Division in support of Computer Based Information Processing System. The work was authorized under Director of Naval Laboratory's Independent Exploratory Development Program, code R36100000/107-1/ZF0089801.

Mr. David Eliezer and Mr. Elijah Poole of NWL prepared most of the code for the original BPS version (See Reference (4)) with assistance from Mr. Arthur Herring, Mr. Richard Fausey, Mr. Robert Belsky, and Mr. James Robinson of NWL. Mr. David Eliezer and Mr. Hermon Thombs planned the content of the subroutines with some suggestions from Mr. Donald Sabot of IBM. The revisions necessary to put the package under the IBM standard operating system were carried out by Mr. Richard Fausey with some assistance from Mr. James Robinson.

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ABSTRACT

A group of subroutines is described which facilitates the utilization of the buffered IBM 2250 display terminal associated with an IBM System/360. The routines provide a means of displaying graphs and textual material and provide for efficient use of the light pen and other associated devices.

TABLE OF CONTENTS

I. INTRODUCTION

In November of 1965, the Naval Weapons Laboratory acquired two IBM 2250 CRT display consoles as part of an exploratory development program related to computer-based information processing systems. The two display consoles, each with a light-pen and alphameric keyboard, were connected to a previously installed IBM 360 (model 40) computer. IBM 2250 programmed function keyboards are planned for installation in the future to supplement the currently available 1092 function keyboards.

Previous experience with off-line graphics on the NORC and STRETCH computers had already demonstrated the desirability of having subroutines to accomplish a variety of graphic functions such as grid generation, labelling and plotting. It was therefore decided that subroutines be prepared to utilize the new equipment.

This memorandum describes a group of FORTRAN-callable subroutines which facilitate the utilization of the buffered IBM 2250 display units associated with an IBM System 360. The subroutines are currently designed to operate under OS and BPS FORTRAN [1] and are prepared to take advantage of the light-pen facility and to provide a means of communication which enhances man-machine relationships. Facilities for using the alphameric keyboard and/or the programmed function keyboard are also provided. This report indicates how the subroutines can be assembled into larger functional units and gives examples of how this has been done. It is assumed that the reader is familiar with FORTRAN IV and has a general knowledge of the IBM 360 and 2250.

It should be noted that the work reported here describes a tool for utilization of the terminal equipment and has been written to foster such utilization. Copies of the card decks may be obtained upon request.

[1] This report deals with the OS version. For details on the BPS version see Reference (4).

II. GENERAL SURVEY OF THE FUNCTION OF THE SUBROUTINES

A. The following eleven primary capabilities are provided:

1. draw grid lines,

2. label grid,

3. plot points or symbols or draw vectors at specified grid coordinates,

4. obtain a count of the number of points (or ends of vectors) that exceed the specified grid boundaries,

5. position the light beam in terms of raster units and display textual material,

6. position the light beam in terms of grid coordinates and display textual material,

7. delay computation while waiting for an interrupt from the light pen, from the programmed function keyboard, or from the end key or cancel key on the alphameric keyboard, and also determine which of these interrupts took place,

8. identify that portion of a set of displayed images (i.e. grid, labels, individual points or vectors or text) which has been touched by the light pen,

9. tag an image with a number 0 or 1 as desired and also have the ability to obtain that tag when desired,

10. allow alphameric data to be entered from the keyboard by inserting a cursor [1] where desired,

[1] The cursor is a special symbol displayed on the CRT display area to mark the position at which data from the keyboard is entered.

11. read the contents of any portion of the 2250 buffer (which may have been altered by the alphameric keyboard)into the System/360 memory.

B. The five groups of subroutines described in II. B. below outline the function of subroutines which are essentially declarative in nature. Taken by themselves, these subroutines may appear to serve no useful purpose. They are used,however, in providing those primary capabilities described in section II. A.

1. There is one subroutine which designates the device address of the 2250 to be used. That is, which of several 2250's is to be used. (See section III. A. which describes subroutine GUNIT.)

2. There is one subroutine which associates a set of four identifying numbers with any selected portion of the graphical or textual material. Even the grid lines or the labels can be identified. (See section III. B. which describes subroutine GUNAME.)

3. There are six subroutines which allocate storage and help determine the portions of this storage which are available for use. (See section III. C. which describes subroutines GUBUFF, GUMAP, GUCHAN, GUTTFY, GRBUF, GERASE.)

4. There are four subroutines which permit the programmer to declare grid specifications. The specifications that may be declared are as follows:

a. Grid type (i.e. rectangular Cartesian, polar, and various logarithmic plots [1]) (see section III. D. 2. which describes subroutine GUTYPE)

b. Area of display screen to be occupied by the grid in terms of raster units (See section III. D. 3. which describes subroutine GUSIZE.)

c. Grid scaling in terms of the maximum and minimum coordinate limits (See section III. D. 4. which describes subroutine GULIM.)

d. Distances between tick marks on the coordinate axis (See section III. D. 5. which describes subroutine GUGRID.)

5. There is one subroutine which designates the plotting mode in which the functional values are to be plotted i.e. as a succession of points, as a series of symbols or as vectors. See section III. F. which describes subroutine GUPLOT.

C. The subroutines required for each of the eleven primary capabilities are listed below in an acceptable order. Some of the routines require that they be preceded by others. The letters at the right indicate by referencing the letter at the left, those subroutines which must have been called at some prior time. For example, in the sequence in II. C. 1. below for drawing grid lines the subroutine, GDISPL uses information obtained from GUTTFY, GUCHAN, and GPGRID. Since

[1] At the time of this writing the routines are only implemented for linear rectangular Cartesian coordinates.

GPGRID uses six other subroutines, it may be considered that GDISPL requires nine subroutines. Throughout the entire package of subroutines no subroutine whose second letter is U (eg. GUNIT) requires other subroutines to be performed first.

1. Draw grid lines

a	GOPEN	
b	GUNIT	
c	GUTTFY	
d	GUMAP	
e	GUBUFF	
f	GUCHAN	
g	GUTYPE	
h	GUSIZE	
i	GUGRID	
j	GULIM	
k	GPGRID	d, e, g, h, i, j
l	GDISPL	c, f, k
m	GOPCP	b, l, a
n	GWAIT	a, m

2. Label grid

a through j same as in part 1 (draw grid)

k	GPLABL	d, e, g, h, i, j
l	GDISPL	c, f, k
m	GOPCP	b, l, a
n	GWAIT	a, m

3. Plot points or symbols or draw vectors at specified grid coordinates

a through h	same as in part 1 (draw grid)	
i	GULIM	
j	GUPLOT	
k	GPDATA	d, e, g, h, i, j
l	GDISPL	c, f, k
m	GOPCP	b, l, a
n	GWAIT	a, m

4. Obtain a count of the number of points (or ends of vectors) that exceed the specified grid boundaries

a through j	same as in part 3 above	
k	GPDATA	d, e, g, h, i, j
l	COUNT	k

5. Position the light beam in terms of raster units and display textual material.

a through f	same as in part 1 (draw grid)	
g	GPPOSN	d, e
h	GPTEXT [1]	d, e
i	GDISPL	c, f, g, h
j	GOPCP	b, i, a
k	GWAIT	a, j

[1] GPRINT may also be used for display of text

6. Position the light beam in terms of grid coordinates and display textual material.

a through h same as in part 1 (draw grid)

i GULIM

j GPBEAM d, e, g, h, i

k GPTEXT d, e

l GDISPL c, f, j, k

m GOPCP b, l, a

n GWAIT a, m

7. Delay computation while waiting for an interrupt from the light pen, from the programmed function keyboard, or from the end key or cancel key on the alphameric keyboard and also determine which of these interrupts took place.

a GOPEN

b GUNIT

c GWAIT (argument = 0) a, b

d GOPCP c, a

e GWAIT (argument = 1)[1] a, b, c, d

f GINKEY a, e

In the case of the light pen interrupt it was assumed that an image had been displayed as described in 1, 2, 3, 5, or 6.

[1] d and e are not required if it is desired to distinguish merely between a light pen interrupt and any other interrupt.

8. Identify that portion of a set of displayed images (i.e. grid, labels, individual points or vectors or text) which has been touched by the light pen.

Identification of the image (i.e. grid, labels, points and vectors or text) is made by preceding the subroutine GPGRID, GPLABL, GPDATA, or GPTEXT [1] respectively by GUNAME [2].

After the call to GDISPL as shown in 1, 2, 3, 5, 6 the following subroutines should be used to obtain the identification of touched image.

a GWAIT (argument = 0)

b GOPCP a

c GMGET b

9. Tag an image with a number 0 or 1 as desired. After tagging an image the tag for that image may be obtained.

An image may be tagged by following the subroutine GPGRID, GPLABL, GPDATA, or GPTEXT, GPRINT, GPPOSN, or GPBEAM with a call to GMPTAG. To retrieve a tag for an image the subroutine GMGTAG may be used at any time.

10. Allow alphameric data to be entered from the keyboard by inserting a cursor.

[1] GPRINT may also be used for display of text

[2] When GUNAME precedes GPBEAM or GPPOSN then the light beam portion also becomes identified.

To insert a cursor for any image follow the subroutine GPGRID, GPLABL, GPDATA, GPTEXT, GPRINT, GPPOSN, or GPBEAM (See section III. F. 1-8) with a call to subroutine GMCURS.

11. Read the contents of any identified portion of the 2250 buffer (which may have been entered by the alphameric keyboard) into the System 360 memory.

a GREAD

b GOPCP a

c GWAIT b, a

It is assumed that prior to the call for GREAD an identified image had been sent to the 2250. The identification was made through the use of the GUNAME subroutine. (See section III. B. 2.)

III. DETAILED DESCRIPTION

A. Identification of Device

1. General information

Since more than one 2250 may be connected to the IBM System 360, it is necessary to specify which of these display devices is to be employed. At the time of this writing only two 2250's are available at NWL. The one nearest the system 360 has the device address $2D1_{16}$. That is, it is on selector channel 2 subchannel D1. The other 2250 has the device address $2D0_{16}$. The subroutine GUNIT performs the function of declaring which 2250 device is to be used. It stores the device number (eg. 2D1 or 2D0) in the word GUNI of the communications region (See APPENDIX A).

2. Subroutine GUNIT

(Graphic - UNIT identification)

Call line:

CALL GUNIT (IDA)

where

IDA[1] is the address containing the decimal equivalent of the device address (That is IDA = 721 for $2D1_{16}$ and IDA = 720 for $2D0_{16}$).

[1] Fixed point and floating point variables in the call lines of all subroutines contained in the memorandum are distinguished by the usual FORTRAN notation (i.e. variables beginning with I, J, K, L, M, N are fixed point variables.)

B. Identification of Image

1. General information

The identification provides a convenient tool for referring to a grid, the grid labels and various portions of graphic or textual material which shall be called images. Each image may be identified by a set of four integers (N_1, N_2, N_3, N_4) each requiring no more than eight bits. N_1, which is the first number written in the set, is referred to as the 1st level name. N_2 is the 2nd level name etc. A programmer can refer to an image name by referring to that particular set of four numbers associated with the image. In addition a programmer can refer to all images whose first level name is a particular number or whose first and third level names are a particular pair of numbers or any other combination of this type. To illustrate the convenience of this naming technique the following example is presented:

Assume a square plotted on a labeled grid.

(See figure 1)

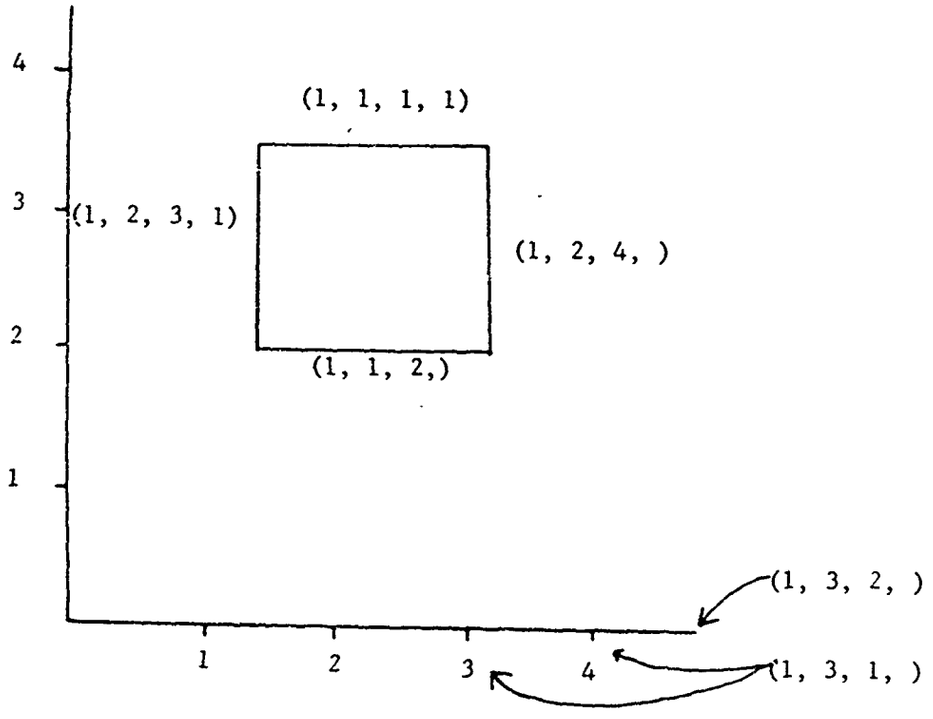


FIGURE 1

In figure 1 the numbers in parentheses are the identification. In those cases where only 3 numbers are specified they represent the first 3 levels. (The fourth level exists but is unspecified. Missing levels are assumed to be zero until a number has been assigned to that level). In figure 1 the labels are assigned the first three level identification numbers (1, 3, 1); the grid with the tick marks are identified by the first three levels with numbers (1, 3, 2); the upper edge of the square is identified by four levels with the numbers (1, 1, 1, 1) the right side of the square is identified by three levels with the numbers (1, 2, 4); the bottom side is identified by the first three levels with numbers (1, 1, 2); the left side is identified by 4 levels with the numbers (1, 2, 3, 1).

In order to refer to this entire figure, it is only necessary to specify all those images whose first level is 1. In order to refer to just the top and bottom sides of the square it is only necessary to specify those images whose second level is 1. In order to refer to the grid, the labels, the top and left hand side of the square it would be permissible to specify those images whose second level is 3 and also to specify those images whose fourth level is 1.

The manner of specifying the desired images to be operated on by subroutines GERASE, GDISPL, GREAD, GMPTAG, and GMGTAG is described in sections III. C. 11., III.G., III.H.2., and III. H. 3.

In order to associate an identification with an image, a new entry[1] is made into a region called the map (See APPENDIX B). This entry is made each time a set of orders and associated data bytes[2] are composed which when sent to the 2250 will position the light beam or generate a desired image. (The routines which compose these orders and data bytes are known as the buffer preparation subroutines. See section III. F.) The map entry is in effect a correspondance table between the location of these orders and data bytes in the 360 storage composed by the buffer preparation subroutines and the name associated with the image generated by those orders and data bytes. At the time of the composition of the orders and data bytes for generating images, the name is obtained from the communications region into which the name has been placed by subroutine GUNAME prior to a call to the buffer preparation subroutine. Putting the number in the communications region does not in itself identify a portion of the image. A name is entered in the map only by a call to one of the buffer preparation routines which consists of the following sets of seven subroutines[3]:

1. GPPØSN
2. GPBEAM

[1] If the identifying name is already in the map a completely new entry is not always made. This is described in an ensuing paragraph.

[2] See reference 1.

[3] It is easy to recognize these subroutines since they are the only ones whose first two letters are GP.

3. GPDATA

4. GPTEXT

5. GPGRID

6. GPRINT

7. GPLABL

Each of these subroutines and only these compose the orders which are to be sent to the 2250 for positioning the beam or displaying images.

When a new entry is made in the map the 360 location of the orders that were composed and the number of consecutive bytes occupied by these orders are stored in the map along with the 4 level identification. In addition a phony value (of $7FFF_{16}$) is made up for the 1st location at which these orders have been placed in the 2250 buffer. The value is phony because the orders have not yet been sent to the 2250 buffer. (The tag bit of the map is set to zero.)

If the same 4 level identification had previously been entered in the map and if the latest set of composed orders are contiguous in storage with those already indicated by the map for that same 4 level name then a completely new entry is not made in the map; it is necessary to increase the number of bytes occupied by the orders. A phony value of $7FFF_{16}$ is again made up for the 1st location at which these orders have been placed in the 2250 buffer (and the tag bit is left unaltered).

2. Subroutine GUNAME

(Graphic User NAME)

Call line:

CALL GUNAME (N1, N2, N3, N4)

where

N1, N2, N3, N4 are the addresses containing the 4 identifying names corresponding to levels 1 through 4. The following calls are also permitted:

CALL GUNAME (N1, N2, N3)

CALL GUNAME (N1, N2)

CALL GUNAME (N1)

When any of these last 3 calls are employed the missing levels are assumed to be the previous number assigned to that level (originally set to zero).

C. Storage Allocation Subroutines

1. General information

In addition to the communication region, there are 3 other types of storage areas in the IBM 360 used by the graphic routines. They will be known as:

a. the 360 buffer

b. the map

c. the channel command program storage

2. The 360 buffer

As mentioned in section III.B.1., mode orders (graphic, character and control) and data bytes must be stored in the IBM

System 360 prior to being sent to the IBM 2250 buffer. These mode orders and data bytes are generated and stored in "the 360 buffer" by the 7 subroutines whose first two letters are GP. See section III. F. Not all of the orders and data bytes stored in the 360 buffer need be sent to the 2250 for display; only those corresponding to images which are specified through appropriate identification are sent (See subroutine GDISPL). The location of the start of the storage to be used for this buffer is placed in the communication region by subroutine GUBUFF. The maximum amount of storage (in bytes) available for this buffer is also supplied by GUBUFF. The last address available for the buffer is computed and placed in the communication region by subroutine GUBUFF. This subroutine also initializes the current address in which the next set of orders and data bytes are to be placed. As data is generated and entered into the buffer, a running account of the next location available for storage is kept in the communication region. Thus if the subroutines GPPØSN and GPTEXT are called successively, the mode orders and data bytes for these two routines will appear as contiguous groups of bytes within the buffer area.

3. Subroutine GUBUFF

(Graphic User BUFFer)

Call line:

CALL GUBUFF (AB, NB)

where

AB is the first address of the array to be used for the 360 buffer.

NB is the address containing the maximum number of bytes allocated for use by the buffer.

The following approximate rules will aid in deciding the number of bytes which will be required for each of the subroutines that employ the 360 buffer:

GPPOSN requires 6 bytes,

GPBEAM requires 6 bytes,

GPDATA requires a maximum of 4 bytes + 4 bytes per data point + 6 bytes per character other than the null character (the null character requires no additional bytes),

GPTEXT requires 2 bytes + 2 bytes for every pair of characters,

GPGRID requires a maximum of 30 bytes + 8 bytes for each horizontal tick mark or grid line + 8 bytes for each vertical tick mark or grid line,

GPRINT requires a maximum of 6 bytes + the number of bytes equal to the size of the field widths, i.e. if the format is (4HTEST, I5,F10.4) then 19 bytes are required,

GPLABL requires a maximum of 8 bytes for each label + the number of bytes equal to the size of the field width for each label.

i.e. if there are 5 labels on the horizontal axis and 3 labels on the vertical axis whose field widths are 4 and 6 respectively then a total of 102 bytes are required.

The program will call a diagnostic subroutine if insufficient storage is allocated for the 360 buffer.

4. The Map

Each time an image with a different identification number set or each time an image with the same identification as another already in the 360 buffer but not contiguous with its namesake, is generated and stored in the 360 buffer, a new entry is made into the map region. (See APPENDIX B.) This 12 byte entry serves as a correspondence table between image name and that area of the 360 buffer and 2250 buffer containing the code which generates that image. [The map is also used to store a tag which may be associated with the image. (See subroutines GMPTAG and GMGTAG section III. H.) In addition, the map stores the 2250 buffer location (relative to the 1st position in the 2250 for that image) into which the cursor is to be placed for those images requiring a cursor. For those images not requiring a cursor, the number of bytes from the 1st position for that image is set to $7FFF_{16}$ in the map. (The information regarding the cursor is placed into the map by subroutine GMCURS [1].)]

The location of the start of the map and the maximum

[1] See section III. F. 5.

number of entries to be made in the map are placed into the communications region by subroutine GUMAP. This subroutine also initializes to zero the current number of entries in the map. As each additional entry is made, the current number of entries is increased by one.

The number of bytes which must be reserved for use by the map is equal to 12 times the maximum number of entries. The program will call a diagnostic subroutine if insufficient storage is allocated for the map.

5. Subroutine GUMAP

(Graphic User MAP)

Call lines:

CALL GUMAP (AM, M)

where

AM is the first address of the array to be used by the map

M is the address containing the maximum number of 12 byte entries permitted in the map at any one time. The contents of M must be less than 2^{16}.

6. The Channel Command Program Storage

In order to communicate with the IBM 2250, a channel program must be operated. This channel program can direct the reading of data from the 360 storage into the 2250 buffer or from the 2250 buffer into the 360 storage; this channel program is created by subroutine GDISPL or GREAD respectively. The subroutine GWAIT(0) also

creates a channel program to read out the 2250 sense bytes [1] or the manual input bytes [2]. The location of the start of the storage for the channel program is placed in the communications region by the subroutine GUCHAN. The maximum amount of storage (in bytes) available for this channel program is also supplied by GUCHAN. The last address available for the channel program is computed and placed in the communications region by subroutine GUCHAN. This subroutine also initializes the current address in which the next set of channel control words are to be placed. This current address is reinitialized to the first address available when each new channel program is created by calls to GDISPL, GREAD, or GWAIT. This current address is only used for bookkeeping within those subroutines.

When using GDISPL, the maximum amount of storage required by the channel program is given by the formula:

# of bytes = 40 + 8 bytes for each image in map to be displayed + 16 for cursor if there is one.

When using GREAD, the maximum amount of storage required by the channel program is given by the formula:

# of bytes = 32

When using GWAIT(0) the maximum amount of storage required by the channel program is given approximately by the formula:

[1] See reference 1.

[2] See section III. G.

# of bytes = 24

The program will call a diagnostic subroutine if insufficient storage is allocated for the channel program.

7. Subroutine GUCHAN

(Graphic User's CHANnel program storage)

Call lines:

CALL GUCHAN (AC, NC)

where

AC is the first address of the array to be used for the channel program. This address is increased to the next double word boundary before being placed into GUCH of the communications region since all channel programs must begin at a double word.

NC is the address containing the maximum number of bytes allocated for use by the channel program.

8. The 2250 Buffer

The IBM 2250 buffer may be shared between more than one display unit. Therefore more than one set of order codes may occupy the buffer simultaneously. It is a requirement that the buffer storage to be used by each set of orders be specified. The absolute location of the start of each set and the maximum number of bytes of the buffer allocated to this set is placed into the communications region by the subroutine GUTTFY. If the number of bytes sent to the buffer by the channel program exceeds the amount allocated, the program will call a diagnostic subroutine.

9. Subroutine GUTTFY

(Graphic User's Two Fifty buffer)

Call lines:

CALL GUTTFY (MT, NT)

where

MT is address containing the absolute location of the first address available in the 2250 for this set of orders. If the contents of MT is odd, then "MT" + 1 is placed into GUTT of the communications region and "NT" -1 is placed into GUTT + 2 bytes[1].

NT is the address containing maximum number of bytes available in the 2250 buffer for this set of orders.

10. Subroutine GRBUF

(Graphic - Read the number of bytes currently used in the 360 BUFfer)

By obtaining the difference between the current address in which the next buffer preparation subroutine will place its output and the first address of the array to be used for the 360 buffer, the program can compute how much of the 360 buffer has been already filled. This difference is obtained by using subroutine GRBUF.

Call line:

CALL GRBUF (IBUF)

where

IBUF is address to be set to the difference in bytes between the current address in which to start storing the output of

[1] The notation "MT" signifies the contents of the address MT.

the buffer preparation subroutine to be operated next and the first address of the array to be used for the 360 buffer. (Both of these quantities are found in the communication region.)

11. Subroutine GERASE

(Graphic - ERASE entries in map)

In order to eliminate entries in the map, the subroutine GERASE may be used. A major use for this subroutine would be to conserve map storage by eliminating map entries no longer needed. The entries following those eliminated are pushed up to consolidate the entries in the map and the count of current number of entries in the map located in the communication region is altered to reflect the new number of current entries.[1]

Call Lines:

option 1:

CALL GERASE (I_1, I_2, I_3 ...)

where I_1, I_2, I_3 etc. are the addresses containing first level identification numbers of those images whose associated map entries are to be eliminated. All images created thus far whose first level identification number is given in I_1, I_2, I_3 etc. are effectively eliminated from further use. The storage thus saved in the map will then be reused as additional entries are made.

[1] In eliminating the entries in the map the subroutine does not currently eliminate the corresponding entries in the 360 buffer. Areas in the 360 buffer can be reused by reinitializing the buffer by means of a call to the GUBUFF subroutine. The area of the buffer used by any particular image may be determined by appropriate use of the GRBUF subroutine.

option 2:

CALL GERASE (M_1, J_{11}, J_{12}, J_{13}, ... , $J_{1\ell_1}$, M_2, J_{21}, J_{22}, J_{23}, ... , $J_{2\ell_2}$, ... ,M_n, J_{n1}, J_{n2}, ... , $J_{n\ell_n}$)

where

M_1, M_2, ..., M_k, ..., M_n are the addresses containing masks which indicate which levels of identification are to be considered. The masks are distinguishable from any of the values contained in $J_{k\ell}$ in that $10000 \leq$ "M_k" ≤ 11111 where as "$J_{k\ell}$" must be identification numbers (i.e. "$J_{k\ell}$" < 256). "M_k" can take on the following integer values (base 10) 10000, 10001, 10010, 10011, 10100, 10101, 10110, 10111, 11000, 11001, 11010, 11011, 11100, 11101, 11110, 11111.

If "M_k" has a value of 1 in the thousands position and zeroes elsewhere then "J_{k1}", "J_{k2}", "J_{k3}", etc. are the first level identification of all those images which are designated to be operated upon by the subroutine irrespective of what is in the other levels.

If "M_k" has a value of 1 in the hundreds position and zeroes elsewhere, then "J_{k1}", "J_{k2}", "J_{k3}" etc. are the second level identification of all those images which are designated to be operated upon by the subroutine irrespective of what is in the other levels. Similarly the tens position and unit position refer to the third and fourth level names respectively. If "M_k" has a 1 in the thousands position and hundreds position and zeroes elsewhere then each of the pairs of values

"J_{k1}", "J_{k2}" and "J_{k3}", "J_{k4}", and "J_{k5}", "J_{k6}" etc. are the first and second level identification of all those images which are designated to be operated upon by the subroutine irrespective of what is in the other levels.

In like manner any level, pair of levels, triple of levels or the entire four level identification may be designated.

The zero digit appearing in the mask indicates that any value appearing in that corresponding level of identification is acceptable.

Option 2 of the GERASE subroutine is similar to option 1 in that all images which are designated by the parameters are effectively eliminated from further use. The storage thus saved in the map is made available for further use. Option 1 of GERASE is a special case of option 2 when there is a single mask "M_1" = 11000.

A special case of option 2 is

CALL GERASE (10000)

where

10000 implies that all images in the map are to be affected.

D. Grid Specification Routines

1. General information

The 4 subroutines GUTYPE, GULIM, GUSIZE, and GUGRID are declarative in nature. They merely store information in the communications region. This information is later used by those subroutines

which prepare the data for the 360 buffer. (See section III. F.). The entire set of routines have only been implemented for the linear cartesian coordinate system. Wit' the exception of subroutine GUTYPE it has not yet been determined what call lines will be employed for systems other than the linear cartesian coordinates. In discussing GULIM, GUSIZE, and GUGRID only linear cartesian coordinates will be considered in this memorandum.

2. Subroutine GUTYPE

(Graphic User's TYPE of grid)

Call line:

CALL GUTYPE (ITYPE)

where

ITYPE is the address of a control which determines the coordinate system to be used as follows:

"ITYPE" = 1 means linear in X, linear in Y

"ITYPE" = 2 means logarithmic in X, linear in Y

"ITYPE" = 3 means logarithmic in X, logarithmic in Y

"ITYPE" = 4 means linear in X, logarithmic in Y

"ITYPE" = 5 means polar

Note: implemented only for I = 1 at the time of this writing

3. Subroutine GULIM

(Graphic User's LIMits)

Call line:

CALL GULIM (U1, V1, U2, V2)

where

"U1" = lower limit of abscissa values to be plotted

"V1" = lower limit of ordinate values to be plotted

"U2" = upper limit of abscissa values to be plotted

"V2" = upper limit of ordinate values to be plotted

4. Subroutine GUSIZE

(Graphic User's SIZE of image on 2250 screen)

Call line:

CALL GUSIZE (IU1, IV1, IU2, IV2)

where

IU1 and IV1 are the addresses containing the coordinates in raster units of the lower left hand corner and IU2 and IV2 are the addresses containing the coordinates in raster units of the upper right hand corner of the portion of the 2250 screen to be used. The point ("U1", "V1") is made to correspond to the CRT coordinates given by ("IU1", "IV1"). The point("U2", "V2") is made to correspond to the CRT coordinates given by ("IU2", "IV2"). U1, V1, U2, V2 are given by subroutine GULIM. All other points ("U_k", "V_k") to be plotted are transformed by the buffer preparation routines according to the linear transformation

$$IU_k = \text{"IU1"} + \frac{\text{"IU2"} - \text{"IU1"}}{\text{"U2"} - \text{"U1"}} \cdot \frac{\text{"}U_k\text{"} - \text{"U1"}}{1}$$

$$IV_k = \text{"IV1"} + \frac{\text{"IV2"} - \text{"IV1"}}{\text{"V2"} - \text{"V1"}} \cdot \frac{\text{"}V_k\text{"} - \text{"V1"}}{1}$$

where

IU_k , IV_k are the raster units corresponding to the points (U_k , V_k).

$0 \leq$ "IU1" ≤ 1023

$0 \leq$ "IV1" ≤ 1023

$0 \leq$ "IU2" ≤ 1023

$0 \leq$ "IV2" ≤ 1023

If grids or labels are used, enough room must be left around the edges of the grid to permit the tick marks or labels to be displayed.

5. Subroutine GUGRID

(Graphic User axis and tick mark information for GRID system)

Call line:

CALL GUGRID (XO, YO, DX, DY, NX, NY, IG)

where

XO, YO represents addresses containing the coordinates of the point of origin (in problem units, not raster units) for which grid lines will be prepared in the 360 buffer if subroutine GPGRID is called subsequently. (See section III. F. 6.)

DX represents the address containing the horizontal interval from "XO" to "U2" and from "XO" to "U1" at which additional grid lines or large tick marks will be placed and axis labels can be written. (See section II. F. 8. for description of axis labeling). U1 and U2 are specified by subroutine GULIM. Additional vertical grid lines are specified at this interval if "IG" = 2 or 3; tick marks are specified if "IG" = 0 or 1.

DY represents the address containing the vertical interval from "YO" to "V2" and from "YO" to "V1" at which points additional

grid lines or large tick marks will be placed and axis labels can be written. V1 and V2 are specified by subroutine GULIM. Additional horizontal grid lines are specified at these intervals if "IG" = 1 or 3; tick marks are specified if "IG" = 0 or 2.

NX represents the address containing the number of small tick marks to be inserted equally spaced within each "DX" interval. NX ≥ 0.

NY represents the address containing the number of small tick marks to be inserted equally spaced within each "DY" interval. NY ≥0.

IG is the address containing a control such that when GUGRID is used in conjunction with GUSIZE, GULIM, and GPGRID, the GPGRID routine will cause graphic mode orders to be placed in the 360 buffer which when sent to the 2250 buffer will draw the lines segments as follows:

when "IG" = 0 see figure (2)

a. line segments ("IU1", "IV1") to ("IU2", "IV1") and ("IU1", "IV1") to ("IU1", "IV2", will be generated.

b. horizontal and vertical line segments through the origin "XO", "YO" which will extend from 20 raster units below "IV1" to "IV2" and 20 raster units from the left of "IU1" to "IU2" will be generated.

c. tick marks will be placed at intervals of "DX" and "DY" from "XO", "YO" along the horizontal and vertical axis respectively.

The ticks will be 20 raster units in length and will be placed between the horizontal lines "IV1" - 20 and "IV1" and the vertical lines "IU1" - 20 and "IU1" and also along the horizontal and vertical lines which pass through the origin.

d. Additional tick marks will be inserted as specified by "NX" and "NY". These additional ticks will be 12 raster units in length.

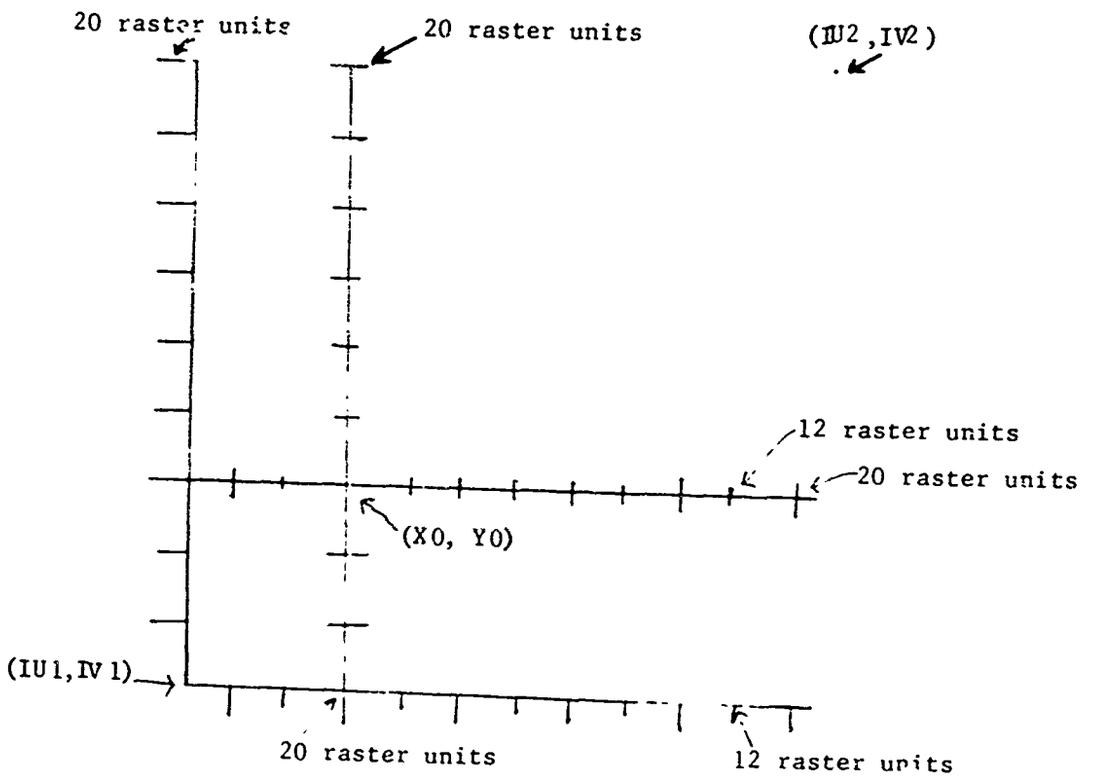


Figure 2

If "XO" or "YO" lie outside of the upper and lower limits given by GULIM then a new axis origin is assumed to be at the point corresponding to "IU1", "IV1".

If "NX" or "NY" is zero no additional tick marks are inserted in the "DX" or "DY" interval respectively.

When "IG" = 1

all the segments specified by "IG" = 0 are obtained but the tick marks positioned at the intervals of "DY" are extended to the vertical at "IX2". This gives horizontal grid lines.

When "IG" = 2

all the segments specified by "IG" = 0 are obtained but the tick marks positioned at the interval of "DX" are extended to the horizontal line at "IY2". This gives vertical grid lines.

When "IG" = 3

all the line segments specified by "IG" = 1 and "IG = 2 are obtained.

E. Plotting Mode

1. General information

There is 1 subroutine GUPLØT which specifies to the GPDATA subroutine (See section F) whether:

a. vectors are to be drawn consecutively from point to point of a set of points whose coordinates are specified. That is, the first point is connected to the second; the secord point is connected to the third, etc.

b. pairs of coordinates are to be plotted as points.

c. the beam is to be positioned at each pair of points without intensification of the beam. (This is for the purpose of permitting symbols to be plotted without vectors or point plotting.

This subroutine is declarative in nature and merely stores its argument in the communication region.

The determination of values of the coordinates is given by the arguments to subroutine GPDATA. See section F.

2. Subroutine GUPLOT

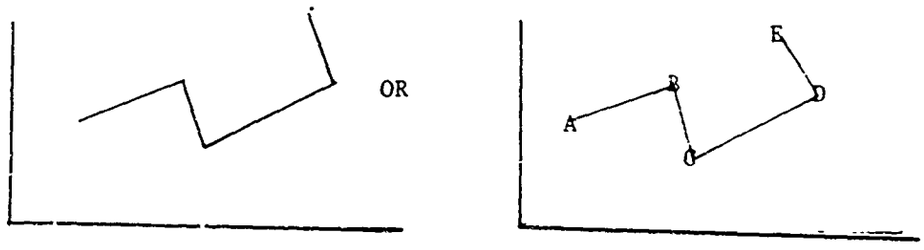
(Graphic Users information on how to PLOT coordinates)

Call line:

CALL GUPLOT (I)

where

"I" = 0 means vector plotting (as in III. E. 1. a. above) and is typically used in drawing images as shown below

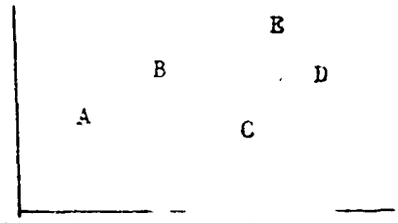


where

"I" = 1 means point plotting (as in III. E. 1.c. above) and is typically used in drawing images as shown below

where

"I" = 2 means beam positioning without intensification (as in II. E. 1. c. above) and is typically used in drawing images as shown below



F. Buffer Preparation Subroutines

1. General information

There are 7 subroutines[1] GPPOSN, GPBEAM, GPDATA, GPTEXT, GPGRID, GPRINT, GPLABL which place data into the 360 buffer. This data consists of the mode orders (graphs, character and control) and data bytes which when sent to the IBM 2250 (by the combination of subroutines GDISPL and GOPCP) operate the display. Each time one of the 7 buffer preparation routines is called, another entry is made in the map as noted in section III. B. 1. In addition to the arguments supplied in the call lines to these subroutines, the communications region supplies additional information as specified by other subroutines as follows:

[1] The buffer preparation subroutines are easy to recognize since they are the only ones where the first two letters are GP.

GPPOSN uses information declared by
- GUNAME
- GUBUFF
- GUMAP

GPBEAM uses information declared by
- GUNAME
- GUBUFF
- GUMAP
- GUTYPE
- GULIM
- GUSIZE

GPDATA uses information declared by
- GUNAME
- GUBUFF
- GUMAP
- GUTYPE
- GULIM
- GUSIZE
- GUPLOT

GPTEXT uses information declared by
- GUNAME
- GUBUFF
- GUMAP

GPGRID uses information declared by
- GUNAME
- GUBUFF
- GUMAP
- GUTYPE

	GULIM
	GUSIZE
	GUGRID

GPRINT requires information declared by	GUNAME
	GUBUFF
	GUMAP

GPLABL requires information declared by	GUNAME
	GUBUFF
	GUMAP
	GUTYPE
	GULIM
	GUSIZE
	GUGRID

It is necessary that those subroutines providing information to the buffer preparation subroutines be called prior to the call to the buffer preparation subroutine.

Section III. C. 3. describes the amount of 360 buffer storage required by each of the buffer preparation subroutines.

2. Subroutine GPPOSN

(Graphic - Place data in 360 buffer to POSitioN beam)

This subroutine generates the 2250 mode order and data

bytes necessary to position the beam to any designated raster position.

Call line:

CALL GPPOSN (I, J)

where

I and J are the addresses containing the position in raster units to which the beam will be positioned.

$$0 \leq \text{"I"} \leq 1023$$

$$0 \leq \text{"J"} \leq 1023$$

3. Subroutine GPBEAM

(Graphic - Place data in 360 buffer to position BEAM)

This subroutine generates the 2250 mode orders and data bytes necessary to position the beam. This subroutine is similar to GPPOSN except that the arguments are in user coordinates instead of raster units. For linear cartesian coordinates the raster units, $\tilde{I}_x$, $\tilde{I}_y$ are obtained by the following linear transformation formulas

$$\tilde{I}_x = \text{"IU1"} + \frac{\text{"IU2"} - \text{"IU1"}}{\text{"U2"} - \text{"U1"}} \quad (\text{"C"} - \text{"U}_1\text{"})$$

$$\tilde{I}_y = \text{"IV1"} + \frac{\text{"IV2"} - \text{"IV1"}}{\text{"V2"} - \text{"V1"}} \quad (\text{"D"} - \text{"V}_1\text{"})$$

where

IU1, IV1, IU2, IV2, U1 V1, U2, V2 are obtained from the communications region and C and D are the addresses containing the coordinates of the desired position of the light beam in terms of user coordinates (not raster units). C and D are arguments of the GPBEAM subroutine.

Call line:

CALL GPBEAM (C, D)

where

C and D are the addresses containing the desired position of the light beam as desired in users coordinates (not raster units).

4. Subroutine GPDATA and Subroutine GCOUNT

a. Subroutine GPDATA

(Graphic - Place bytes in 360 buffer to plot DATA point or symbols)

This subroutine generates the 2250 mode orders and data bytes necessary to cause the plotting of a dependent variable as a function of an independent variable. The plotting may be made with either points, vectors, or symbols as described in GUPLOT (See section III. E.).

Call line:

option (0):

CALL GPDATA (IK, R, IDR, S, IDS, ISYM, IDSYM, NP, IS)

where

IK is the address containing the option number "IK" = 0 for option 0.

R is the address of the independent variable of the first point to be plotted.

IDR is the address containing the increment in words [1] to the address of the independent variable to obtain succeeding addresses of the independent variables.

[1] One word is equal to 4 bytes. If successive addresses of the independent variable are R(1), R(3), R(5) etc. then IDR = 2.

S is the address of the dependent variable of the first point to be plotted.

IDS is the address containing the increment in words to the address of the dependent variable to obtain succeeding addresses of the dependent variable.

ISYM is the address of the first symbol to be plotted. Since a symbol only requires 8 bits, the address is that of the first of the 8 bits. A zero in this byte produces the null character which will produce no order code and therefore no symbol; however, if GUPL is 0 or 1, the vector or point will be displayed. The bit configuration of each symbol is given in reference 1.

IDSYM is the address containing the increment in bytes to the address of the symbol to obtain succeeding symbol addresses. When "IDSYM" is zero, the symbol obtained from the address ISYM will be used throughout.

NP is the address containing the number of points to be plotted.

IS is an address containing 0 or 1 depending respectively on whether a basic size or large size symbol is desired.

option (1):

CALL GPDATA (IK, R, DR, S, IDS, ISYM, IDSYM, NP, IS)

Option 1 is the same as option 0 except that DR which replaces the fixed point variable IDR represents the address containing the increment to be added to the independent variable (rather than to

the address of the independent variable) to form successive values of the independent variable.

"IK" = 1 for option 1

option (2):

CALL GPDATA (IK, R, IDR, S, DS, ISYM, IDSYM, NP, IS)

Option 2 is the same as option 0 except that DS which replaces the fixed point variable IDS represents the address containing the increment to be added to the dependent variable (rather then to the address of the dependent variable) to form successive values of the dependent variable.

"IK" = 2 for option 2.

option (3):

CALL GPDATA (IK, R, DR, S, DS, ISYM, IDSYM, NP, IS)

Option 3 is the same as option 0 except that DR and DS replace the fixed point variables IDR and IDS. DR and DS have the same meaning as in option 2 and 3.

"IK" = 3 for option 3.

b. Subroutine GCOUNT

(Graphic - points outside the limit COUNT)

During the operation of GPDATA, if any of the values of the independent variables lies outside the range "U1" to "U2" or if any of the values of the dependent variable lies outside the range "V1" to "V2" the corresponding points, vectors, or symbols are not plotted.[1]

[1] U_1, U_2, V_1, V_2 are specified by subroutine GUIDM.

For each point which is not plotted, a counter, GCOU, in the communications region is increased by 1. GCOU is not automatically reset to zero by a call to GPDATA. It can be reset by subroutine GCOUNT in order to make the count meaningful. GCOUNT can also be used to place the result of the count, GCOU, into a specified address. Since it is possible that all points to be plotted lie outside the prescribed range the buffer area occupied by such an image would be zero. An entry will still be made in the map even if the size of the 360 buffer representing that image is zero.

Call lines:

CALL GCOUNT (IT, IE)

where

IT is the address containing a 0 or 1 depending respectively on whether a value is to be read into GCOU from the address given by IE or out of GCOU into the address given by IE.

5. Subroutine GPTEXT and Subroutine GMCURS

a. Subroutine GPTEXT

(Graphic - Place bytes in 360 buffer to generate TEXTual material)

This subroutine is used to generate the appropriate 2250 mode orders and data bytes which when sent to the 2250 will cause alphameric characters to be displayed. This routine may be used in making headings or writing sentences etc.

Call line:

CALL GPTEXT (ITX, ATX, NTX)

where

"ITX" = 0, 1, 4, or 5 to select the enter character mode order[1] as follows:

If "ITX" = 0, enter character mode fixed, basic size (unprotected).

If "ITX" = 1 enter character mode fixed, large size (unprotected).

If "ITX" = 4 enter character mode protected, basic size.

If "ITX" = 5 enter character mode protected, large size.

ATX is the address of the first 8 bit byte (left adjusted in a FORTRAN word) representing an alphameric character to be displayed.

NTX is the address containing the total number of characters to be displayed. Thus if "NTX" = 7 the 4 bytes representing characters in the FORTRAN word starting with A and the next 3 bytes in the next FORTRAN word would be used as the group of data bytes following the mode order. The eight bit bytes must be in the character code described in reference 1. When NTX is odd an even number of bytes is generaced by adding a final space.

b. Subroutine GMCURS

(Graphic Make CURSor position in image)

The cursor (see reference 1) may be associated with any data byte for any image in the 360 buffer by specifying to subroutine GMCURS which byte of the specified image stored in the 360 buffer

[1] The numbers 0, 1, 4, and 5 are the units digits of the mode control (MC) when operation in the character mode. See reference 1.

by GPTEXT or GPRINT is to be associated with the cursor.

Example: Suppose the image X=7 is to be positioned by subroutine GPPOSN and then a cursor is to be placed under the 7. Then the 11th byte should be specified as an argument to the GMCURS subroutine because the character 7 would occupy the 11th byte. The reason for this is as follows.

Positioning requires 6 bytes

Entering the character mode requires 2 bytes

X=7 requires 3 bytes (i.e. 1 for each character)

6 + 2 + 3 yields a total of 11 bytes.

Call line

option (1):

CALL GMCURS (IG, I_1, I_2, I_3, ..., I_n)

option (2):

CALL GMCURS (IG, M_1, J_{11}, J_{12}, J_{13},...$J_{1\ell_1}$, M_2, J_{21}, J_{22}, J_{23},... $J_{2\ell_2}$, ..., M_n, J_{n_2}, ... , $J_{n\ell_n}$)

where

IG is the address containing the byte number of the image stored in the 360 buffer at which the cursor is to be inserted. "IG" > 0

I_1 through I_n or M_1 through $J_{n\ell_n}$ specify the image in which the cursor is to be inserted. The manner of image specification is identical with that subroutine GERASE. See section III. C. 11.

Subroutine GMCURS enters the byte number "IG", into the map associated with the specified image. When GDISPL is called, the

The cursor will probably be more widely used in conjunction with either the GPTEXT or GPRINT subroutines than with the other buffer generation subroutines.

channel program is prepared in such a manner that the cursor will be inserted. Although several images may be displayed at one time on the 2250 only one of these may have a cursor.

As stated previously (section III. C. 4.), for those images not requiring a cursor, the number of bytes from the 1st position of the 360 buffer for those images is set to $7FFF_{16}$ in map.

6. Subroutine GPGRID

(Graphic - Place bytes in 360 buffer to generate a GRID)

This subroutine is used to generate the appropriate 2250 mode orders and data bytes which when sent to the 2250 will cause a grid to be displayed. The grid thus generated will conform to the criteria prescribed by the grid specification routines. See section III. D. and figure 2.

Call line:

CALL GPGRID

7. Subroutine GPRINT

(Graphic - Place data in 360 buffer to obtain hollerith characters, integer values, fixed point values etc. according to a format which is similar to that associated with a FORTRAN IV PRINT statement)

This subroutine is used to generate the appropriate 2250 mode orders and data bytes which when sent to the 2250 will cause textual material to be displayed with variables according to a format described by reference 2. The GPRINT subroutine calls to IOUT, FSCAN, and WITEM which are described in reference 2.

Generally the beam should be positioned before using this subroutine.

Call line:

CALL GPRINT (ITX, FMT, A1, A2...AN)

where

ITX has the same meaning as in GPTEXT (See section III. F. 5.)

FMT is the address of the first byte in a series of bytes (4 bytes per FORTRAN word) which make up a format statement describing the data. For example the contents of FMT may be:

(11HbbJOEbSMITH) or

(2HY=,3E5.3,I2)

The first byte must contain a left parenthesis. A1 through AN form a series of variable names (not arrays) which may be indexed (i.e. A(1), A(I), I = 1, J)). They specify the storage addresses of the items to be written in the format given by FMT.

8. Subroutine GPLABL

(Graphic Place data in 360 buffer to LABeL the grid)

This subroutine is used to generate the 2250 mode orders and data bytes which when sent to the 2250 will cause the grid produced by GPGRID to be labeled with appropriate coordinates centered 7 raster units below the large tick marks on the X axis and 7 raster units to the left of the large tick marks on the Y axis [1]. Basic size characters are used in the labeling. Either E, F, or I type formats is permitted to be used for each of the axes independ ly.

[1] If GPGRID has not been called prior to the GPLABL call, the labels will still be generated for the appropriate position.

Call line:

CALL GPLABL (FMTX, FMTY)

where

FMTX is the address containing the format to be used for the labels along the abscissa and FMTY is the format to be used for the labels along the ordinate. Example: In the location of FMTX we may have (I5) or (E7.2) or (F6.4). The first byte must represent a left parenthesis. If FMTX or FMTY=0 (integer style) then the x or y axis is not labeled.

The maximum amount of space in raster units needed for labels is as follows:

(1) to the left of the Y-axis - maximum {14 x (the largest number of characters used to label the Y axis) + 27, 7 x (number of characters in the first label on the X axis + 1)}

(2) below the X axis - 47

(3) for the rightmost label on the X-axis - 7 x (number of characters in the label + 1)

(4) above the grid for the uppermost label on the Y-axis - 7

G. Channel Program and Interrupt Handling Subroutines

1. General information

There are 3 subroutines which create channel programs: GDISPL, GREAD, and GWAIT. Closely associated with these subroutines are 4 others which are related to the handling of interrupts: GOPEN GOPCP, GINKEY, and GMGET.

2. Subroutine GDISPL

(Graphic - Create channel program to DISPLay images)

This subroutine creates the channel program which, when operated after a call to GØPCP will send to the 2250 buffer, data created by those buffer preparation subroutines whose identification corresponds to those specified as arguments to GDISPL.

This subroutine also places in the map, the first 2250 buffer address into which the data corresponding to each image will be placed. It also places an impossible 2250 address number into the map for those images which will not be displayed. If the image size is zero[1] no entry will be made in the channel program for that image.

Call line:

option 1:

CALL GDISPL (I_1, I_2, I_3, ... I_n)

option 2:

CALL GDISPL (M_1, J_{11}, J_{12}, J_{13} ... J_{12_1}, M_2, J_{21}, J_{22}, J_{23}, ... $J_{2\ell_2}$, ... M_n, J_{n_1}, J_{n2} ... $J_{n\ell_n}$)

In option 1 and option 2, the arguments I_1 through I_n or M_1 through J_{n_n} are used to identify the images for which the channel program when operated will send the associated data from the 360 buffer area to the 2250 buffer. The identification is achieved in the same manner as described in GERASE. See section III. C. 11. A call to GOPCP will generally follow the call to GDISPL.

[1] This occurs when all points are out of range.

3. Subroutine GREAD

(Graphic - creates channel program to READ an image from the 2250 buffer).

This subroutine creates the channel program which when operated after a call to GOPCP will send the mode orders and data bytes associated with a specified identification from the 2250 buffer where it had been previously stored through use of the subroutine GDISPL to a specified area in the 360 storage. Since manual intervention via the alphameric keyboard may have altered the 2250 buffer, the GREAD subroutine enables the program to obtain the new information contained in the 2250 buffer. Only one map entry may be read at one time. Therefore only the first entry in the map which has the appropriate identification is read.

Call line:

option 1:

CALL GREAD (AREA, I_1)

option 2:

CALL GREAD (AREA, M_1, J_{11}, J_{12}, J_{13}, J_{14})

In option 1 and option 2, AREA specifies the address of the first location of an array of the 360 into which the portion of the 2250 buffer associated with image specified by I_1 or M_1 through J_{14} is to be read. Only 1 map entry may be referenced. The identification is achieved in the same manner as described in GERASE. See section III. C. 11. A call to GOPCP will generally follow the call to GREAD.

4. Subroutine GOPCP

(Graphic - Operate Channel Program)

This subroutine is used to start the operation of any channel program created by subroutine GDISPL, GREAD, or GWAIT and to wait until that channel program has been completed. Subroutine GOPCP also resets to zero the attention, unit check and device end channel end interrupt indicators found in the last 3 bits of GINK in the communications region. (See GWAIT for uses made of these indicators.) Prior to beginning execution of the channel program, however, a check is made (by inspecting the Graphic Control Byte) to determine whether an interrupt has occurred which has not yet been processed. If the GCB indicates that an interrupt has occurred, the channel program is not executed; instead, control is returned to the calling program to allow the interrupt to be processed.

Call line:

CALL GOPCP

5. Subroutines GOPEN and GCLOS

GOPEN (Graphic - Initialize Date Control Blocks)

This subroutine is used to initialize the data control blocks (GDCB1 and GDCB2) so that their associated data sets can be processed. (Control blocks are defined in Appendix E)

Some of the procedures performed by this subroutine are:

(a) Construction of the data extent block (DEB).

(b) Transfer of information from DD statements and data set labels to the data control blocks.

c. Verification or creation of standard labels

d. Loading of programmer-written appendage routines

(See Appendix D)

Call line:

CALL GOPEN

GCLOS (Graphic - Restore Data Control Blocks)

This routine restores the data control blocks (GDCB1 and GDCB2) so that processing of their associated data sets can be terminated. Some of the procedures performed by the program are:

a. Release of the data extent block (DEB).

b. Removal of information transferred to the data control block fields when OPEN was executed.

c. Verification or creation of Standard labels.

d. Release of programmer-written appendages.

Call line:

CALL GCLOS

6. Subroutine GWAIT

(Graphic WAIT for interrupts)

The GWAIT subroutine can perform the following functions:

a. Wait for an attention interrupt, and make a channel program which can obtain more information about the nature of the interrupt (i.e. read manual inputs or obtain sense bytes).

b. Set the appropriate bits in GINK for a light pen or keyboard interrupt, after determining the nature of the interrupt.

Call lines:

Option 1:

CALL GWAIT(0)

This option causes the program to look for an interrupt in two steps: (1) The program checks the attention bit of GINK in the communication region. If this bit is set to 1, the program goes on to process this interrupt. (2) If the attention bit in GINK is set to 0, then the program cycles, checking the graphic control byte (GCB). When the GCB is set to 1, the program stops cycling and goes on to process this interrupt.

Upon finding the interrupt by these 2 steps, the program stores the "u", "c", and "a" bits into GINK+6 bytes, resets the attention indicator "a" to zero, and creates a channel program which may be operated by a call to GOPCP. If this channel program is operated, it will either read the manual input bytes or the sense bytes, depending respectively on whether the unit check indicator is set to 0 or 1 in GINK (bit "u" of GINK). These manual input bytes or sense bytes are read into GMGE of the communications region.

Option 2:

CALL GWAIT(1)

If the programmer wishes to interpret the bytes stored in GMGE of the communications region by the calls to GWAIT(0) and GOPCP,

he should follow those calls with CALL GWAIT(1).

Subroutine GWAIT(1) waits for the completion of the channel program as in the other 2 options. Then it will store right adjusted into the first byte of GINK of the communications region the following code in binary:

0 if light pen caused the interrupt,

1-32 if the function key corresponding to 1-32 caused the interrupt,

33 if the end key on the alphameric keyboard caused the interrupt,

34 if the cancel key on the alphameric keyboard caused the interrupt.

In addition if the function keyboard is depressed, the eight bit binary overlay code is placed into the second byte of GINK. Otherwise a zero will be placed in the second byte. The last 2 bytes of GINK will remain unchanged.

The three values in GINK may then be obtained from the communications region for use by the FØRTRAN programmer by a call to GINKEY.

7. Subroutine GINKEY

(Graphic INterrupt KEY)

This subroutine is used to read into or out of GINK of the communications region.

Call line:

CALL GINKEY (IK_1, IK_2, IK_3, IK_4)

where

IK_1 is the address containing a control equal to 0 or 1 for reading out of or reading into GINK.

when "IK_1"=0

IK_2 is the address in which the first byte of GINK will be placed as an integer right adjusted.

IK_3 is the address in which the second byte of GINK will be placed as an integer right adjusted.

IK_4 is the address in which the third and fourth bytes of GINK will be placed as an integer right adjusted the resulting contents of $IK_4 \leq 7$.

when "IK_1"=1

IK_2 is the address containing the value to be stored in the first byte of GINK.

IK_3 is the address containing the value to be stored in the second byte of GINK.

IK_4 is the address containing the value to be stored in the third and fourth bytes of GINK. "IK_4" ≤ 7.

"IK_2" and "IK_3" will represent respectively the key 0 to 34 and the overlay as described in option 3 of section III. G. 6. "IK_4" is a number 0 to 7 representing the binary interrupt indicator bits u, c, and a described in section III. G. 5.

In addition to the above, when "IK_1=0 the program checks the graphic control byte (GCB): If the GCB=1, the attention bit in GINK in the

communications region is set to 1 and the GCB is set equal to zero. If the GCB=0, the program proceeds normally.

8. Subroutine GMGET

(Graphic - GET name corresponding to light pen interrupt from map)

This subroutine obtains the 4 level name of the image which has been touched by the light pen. The buffer address at the end of the interrupt must be stored in GMGE of the communications region. This storage takes place by operation the channel program made by GWAIT (0) if a light pen interrupt has occurred (See section III. G. 6.). The GMGET subroutine determines for which image this buffer address lies between the 1st location of the image orders in the 2250 and the last location of these image orders. The 1st location is found in the map and is therefore associated with the 4 level name of the image. The last location can be computed by the sum of the 1st location and the number of consecutive bytes occupied by the image. Subroutine GMGET then places each of the 4 levels of identification for that image into specified addresses.

Call lines:

CALL GMGET (N)

where

N is the first address of an array of 5 consecutive addresses into which the 1st, 2nd, 3rd, and 4th level names and the tag of 0 or 1 associated with the image are consecutively placed. (See section III. H. for explanation of the tag.) If the subroutine is unable to find

any of the entries in the map for which the buffer address touched with the light pen does not lie between the first and last location of the image orders in the 2250, a value of 7FFF will be placed in N and the other 4 locations will then remain unchanged. This would ordinarily represent an error in which the map has been destroyed although it might possibly occur by placing information into the 2250 buffer without employing these subroutines.

H. Image Tagging

1. General information

There are 2 subroutines GMPTAG and GMGTAG which place into or obtain from the map a tag bit associated with an image. A tag bit of 0 or 1 may be entered into the map entry of any image or group of images as desired by subroutine GMPTAG. The tag bit may be obtained from the map for any image as specified by subroutine GMGTAG. This tag bit of 0 or 1 is obtained also from the map entry of the image touched by the light pen when the following subroutines are employed:

```
CALL GWAIT (0)
CALL GOPCP
CALL GWAIT (1)
CALL GMGET (N)
```

2. Subroutine GMPTAG

(Graphic - Put TAG in Map)

This subroutine places the tag 0 or 1 into the map

corresponding to any image or images specified.

Call line:

option 1:

CALL GMPTAG (ITAG, I_1, I_2, I_3, ... I_n)

option 2:

CALL GMPTAG (ITAG, M_1, J_{11}, J_{12}, J_{13}, ... $J_{1\ell_1}$, M_2, J_{21}, J_{22}, J_{23}, ... $J_{2\ell_2}$, ... M_n, J_{n1}, J_{n2}, ... $J_{n\ell_n}$)

In option 1 and 2, ITAG is the address of the tag. "ITAG" = 0 or 1 whichever is to be placed into the map associated with images specified by I_1 through I_n or M_1 through $J_{n\ell_n}$. The identification is achieved in the same manner as described in GERASE. See section III. C. 11.

3. Subroutine GMGTAG

(Graphic - Get TAG from Map)

This subroutine obtains the tag 0 or 1 from the map area associated with a specified image and places it into a specified variable.

Call line:

option 1:

CALL GMGTAG (ADD, I_1)

option 2:

CALL GMGTAG (ADD, M_1, J_{11}, J_{12}, J_{13}, J_{14})

where

ADD is the specified address into which the tag is to be placed.

I_1 or M_1 through J_{14} is the identification of a single image achieved in the manner described in GERASE. See section III. C. 11.

I. Conversion Routines

1. Subroutine GCONVT

(Graphic - Convert data)

This subroutine converts data from character string to internal form. The conversion is strictly format controlled.

Call line:

CALL GCONVT (FMT, ARRAY, NBYTE, A1, A2, ..., AN)

where

FMT = Format to be used in the conversion

ARRAY = Location of character string to be converted

NBYTE = Maximum number of bytes in character string

A1,...AN = Location (or locations) in which to store the converted data. (array names used here must be subscripted.)

2. Subroutine QIOIN

This is a conversion package, written by Computer Usage Development Corporation, which is used by various subroutines to convert data internally. (See reference (3))

IV. FUTURE PLANS

It would be well to recognize that the subroutines presented here were designed with a modular structure to facilitate changes. As they stand now, they are to be used experimentally to determine desirable improvements. In this present form, they were found adequate in the case of one trumped-up problem and in 2 other problems with real physical meaning. What is needed now is a trial under the fire of a great variety of practical problems. Out of this fire there will arise a truly tempered tool for man machine relations or perhaps there will remain merely the charred ashes of this report.

But whichever is the case, experience will be gained and perhaps another stitch will be taken in that pattern of evolution which eventually clothes success.

Aside from the unknown problems which we hope can be resolved, there are some specific steps that may be taken to make these routines more available for use as follows:

A. Incorporate logarithmic and polar plots,

B. Make these subroutines available for use by NWL Displaytran,

C. Make possible the handling of random (not preplanned) interrupts from different 2250 terminals governed by a single program.

V. EXAMPLES

A. The following series of examples were written to provide illustrations of the coding of the eleven primary capabilities listed in sections II. B. and II. C. The examples, coded as subroutines and named EX1 through EX10, are in a 1-1 correspondence with the first 10 capabilities described under section II. B. (The 11th capability is included in EX10.)

It should be noted here that these examples were coded to be independent, each one being complete in itself. However, if it were desired to make them dependent, routines such as GUNIT, GUTTFY, GUMAP, etc. (see section II. B. and II. C.) would not need to be called in each example.

A brief explanation of each example will be given here, followed by a FORTRAN listing of the subroutine examples, a main calling program and sample data.

1. Draw grid (EX1)

This routine displays a simple grid on a portion of the 2250 screen (from (100,100) to (900,900) in raster units). The grid is set up with Xmin = Ymin = 0, Xmax = Ymax = 100, and the origin at (50,50) in user's coordinates. Tick marks are placed only at the end points on the grid and no labeling is done. After displaying the grid, the routine waits for an interrupt from the light pen and continues to the next example.

2. Label grid (EX2)

This routine re-displays the grid in example 1 above, but this time large tick marks are placed on the grid in 25-unit intervals. One small tick mark is inserted between each of the large ones and the labeled grid is displayed on the screen. After this display, the routine waits for an interrupt from the light pen and continues to the next example. The card which is read by this example places (F4.0) into FMTX and FMTY. Therefore, the labels on both the x and y axix will be represented by a maximum of 3 digits.

3. Plot points or symbols and draw vectors at specified grid coordinates.(EX3)

This routine uses part of the 2250 screen (from (50, 50) to (1000, 1000) in raster units) to plot points at user's coordinates (20, 20) and (40, 40). The symbol "*" is plotted at user's coordinates (60, 60) and (80, 80) and a vector is plotted from (20, 20) to (50, 20) in user's coordinates. (Limits on user's coordinates are the same as in the two previous examples.) After displaying these, the routine waits for an interrupt from the light pen and continues to the next example.

4. Obtain a count of the number of points (or ends of vectors) that exceed the specified grid boundaries. (EX4)

This routine, using the same limits as was set up in example 3 above, attempts to plot points at (-10, 20) and (40, 40), plot the

symbol "*" at (60, 110) and (110, 80), and plot a vector from (-10, 10) to (100, 10). (All coordinates given in user's coordinates.) The range has been set up from (0, 0) to (100, 100) in user's coordinates; therefore, since (40, 40) and (100, 10) are the only coordinates within this range, they are the only points displayed. The variable "IRANGE" contains the total number of points out of range. (IRANGE = 4) After receiving a light pen interrupt the routine proceeds to the next example.

5. Position the light beam (in raster units) and display textual material. (EX5)

This routine reads in and displays textual material (24 bytes) at coordinates (50, 800) in raster units. After the display, the routine waits for an interrupt form the light pen and continues to the next example.

6. Position the light beam (in user's coordinates) and display textual material. (EX6)

This routine reads in and displays textual material at (20, 20) and (20, 50) in user's coordinates. After a light pen interrupt, the routine proceeds to the next example.

7. Delay computation while waiting for an interrupt from the light pen, or from the end key or cancel key on the alphanumeric keyboard; then determine which of these interrupts took place. (EX7)

This routine reads in and displays textual material at the coordinates (5, 1000) in raster units, then waits for an interrupt. After

receiving an interrupt, the variable "I2" contains the information needed to determine which interrupt took place: I2 = 0 means a light pen interrupt, I2 = 33 means an end key interrupt, and I2 = 34 means a cancel key interrupt. After printing the value of I2, the routine proceeds to the next example.

8. Identify that portion of a displayed image which has been touched by the light pen. (EX8)

This routine reads in and displays textual material at coordinates (5, 1000) and (5, 500) in raster units. The text at (5, 1000) is named 1, 2, 3 while the text at (5, 500) is named 4, 5, 6 for identification. After a light pen interrupt, the variables "N1, N2, N3" will contain 1, 2, 3 or 4, 5, 6, depending on which of the two above texts was touched. The routine then continues to the next example.

9. Tag an image with a number 0 or 1 as desired and retrieve the tag. (EX9)

This routine reads in and displays textual material at the coordinates (5, 1000) in raster units. This image is then tagged with a 1 and the tag is then retrieved and placed in the variable "ADD." After receiving a light pen interrupt the routine continues to the next example.

10. Insert the cursor and read the contents of the 2250 buffer into the system 360 memory. (EX10)

This routine reads in and displays textual material at

coordinates (5, 1000) in raster units. A cursor is inserted in the position under the text, allowing the user to type in values at this position from the keyboard. After a light pen interrupt occurs, the text (which is in the 2250 buffer) is read off the screen and placed into the 360 memory in the variable "W". (Before this value may be used, however, it must be converted. (See GCONVT, section III. I.) After another light pen interrupt the program is terminated.

```
0001              CALL GOPEN
0002              CALL EX1
0003              CALL EX2
0004              CALL EX3
0005              CALL EX4
0006              CALL EX5
0007              CALL EX6
0008              CALL EX7
0009              CALL EX8
0010              CALL EX9
0011              CALL EX10
0012              RETURN
0013              END


0001              SUBROUTINE EX1
                C  DRAW GRID...XMAX=100, XMIN=0, YMAX=100, YMIN=0, ORIGIN=(50,50)
0002              COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003              CALL GUNIT(721)
0004              CALL GUTTEY(2,4000)
0005              CALL GUMAP(DM,100)
0006              CALL GUBUFF(DB,200)
0007              CALL GUCHAN(DC,400)
0008              CALL GUTYPE(1)
0009              CALL GUSIZE(100,100,900,900)
0010              CALL GUGRID(50.,50.,50.,50.,0,0,0)
0011              CALL GULIM(0.,0.,100.,100.)
0012              CALL GPGRID
0013              CALL GDISPL(10000)
0014              CALL GOPCP
0015              CALL GWAIT(0)
0016              CALL GERASE(10000)
0017              RETURN
0018              END


0001              SUBROUTINE EX2
                C  EL THE GRID IN EXAMPLE 1 ...INSERT TICK MARKS AND LABEL EVERY 25 UNITS
0002              COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003              READ(1,5) FMTX,FMTY
0004            5 FORMAT(4A4)
0005              CALL GUNIT(721)
0006              CALL GUTTEY(2,4000)
0007              CALL GUMAP(DM,100)
0008              CALL GUBUFF(DB,1000)
0009              CALL GUCHAN(DC,400)
0010              CALL GUTYPE(1)
0011              CALL GUSIZE(100,100,900,900)
0012              CALL GUGRID(50.,50.,25.,25.,1,1,0)
0013              CALL GULIM(0.,0.,100.,100.)
0014              CALL GPGRID
0015              CALL GPLABL(FMTX,FMTY)
0016              CALL GDISPL(10000)
0017              CALL GOPCP
0018              CALL GWAIT(0)
0019              CALL GERASE(10000)
0020              RETURN
00                END
```

```
0001            SUBROUTINE EX3
              C  PLOT POINTS,SYMBOLS,AND VECTORS
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            READ(1,5)ISY(3),ISY(4)
0004           5 FORMAT(2A4)
0005            CALL GUNIT(721)
0006            CALL GUTTEY(2,4000)
0007            CALL GUMAP(DM,100)
0008            CALL GUBUFF(DB,200)
0009            CALL GUCHAN(DC,400)
0010            CALL GUTYPE(1)
0011            CALL GUSIZE(50,50,1000,1000)
0012            CALL GULIM(0.,0.,100.,100.)
0013            CALL GUPLOT(1)
0014            X(1)=20.
0015            X(2)=40.
0016            X(3)=60.
0017            X(4)=80.
0018            Y(1)=20.
0019            Y(2)=40.
0020            Y(3)=60.
0021            Y(4)=80.
0022            ISY(1)=0
0023            ISY(2)=0
              C  PLOT TWO POINTS, TWO SYMBOLS
0024            CALL GPDATA(0,X(1),1,Y(1),1,ISY(1),4,4,0)
0025            X(5)=20.
0026            X(6)=50.
0027            Y(5)=20.
0028            Y(6)=20.
0029            CALL GUPLOT(0)
              C  PLOT VECTOR FROM (20,20) TO (50,20)
0030            CALL GPDATA(0,X(5),1,Y(5),1,ISY(1),0,2,0)
0031            CALL GDISPL (10000)
0032            CALL GOPCP
0033            CALL GWAIT(0)
0034            RETURN
0035            END
```

```
0001            SUBROUTINE EX4
              C  OBTAIN COUNT OF PTS. OUTSIDE RANGE
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            CALL GUNIT(721)
0004            CALL GUTTFY(2,4000)
0005            CALL GUMAP(DM,100)
0006            CALL GUBUFF(DB,200)
0007            CALL GUCHAN(DC,400)
0008            CALL GUTYPE(1)
0009            C LL GUSIZE(50,50,1000,1000)
0010            CALL GULIM(0.,0.,100.,100.)
0011            CALL GUPLOT(1)
0012            CALL GCOUNT(0,0)
0013            X(1)=-10.
0014            X(2)= 40.
0015            X(3)= 60.
0016            X(4)=110.
0017            Y(1)= 20.
0018            Y(2)= 40.
0019            Y(3)=110.
0020            Y(4)= 80.
0021            ISY(1)=0
0022            ISY(2)=0
0023            CALL GPDATA(0,X(1),1,Y(1),1,ISY(1),4,4,0)
0024            X(5)=-10.
0025            X(6)=100.
0026            Y(5)= 10.
0027            Y(6)=10.
0028            CALL GUPLOT(0)
0029            CALL GPDATA(0,X(5),1,Y(5),1,ISY(1),0,2,0)
0030            CALL GCOUNT(1,IRANGE)
0031            CALL GDISPL(10000)
0032            CALL GOPCP
0033            CALL GWAIT(0)
0034            RETURN
0035            END


0001            SUBROUTINE EX5
              C  POSITION LIGHT BEAM(RASTER UNITS)AND DISPLAY TEXTUAL MATERIAL
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            READ(1,5) X
0004          5 FORMAT(6A4)
0005            CALL GUNIT(721)
0006            CALL GUTTFY(2,4000)
0007            CALL GUMAP(DM,100)
0008            CALL GUBUFF(DB,200)
0009            CALL GUCHAN(DC,400)
0010            CALL GPPOSN(50,800)
0011            CALL GPTEXT(0,X(1),24)
0012            CALL GDISPL(10000)
0013            CALL GOPCP
0014            CALL GWAIT(0)
0015            RETURN
0016            END
```

```
0001            SUBROUTINE EX6
              C  POSITION LIGHT BEAM(GRID COORDINATES)AND DISPLAY TEXTUAL MATERIAL
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            READ(1,5)X,Y
0004           5 FORMAT(12A4)
0005            CALL GUNIT(721)
0006            CALL GUTTFY(2,4000)
0007            CALL GUMAP(DM,100)
0008            CALL GUBUFF(DB,200)
0009            CALL GUCHAN(DC,400)
0010            CALL GUTYPE(1)
0011            CALL GUSIZE(0,0,1023,1023)
0012            CALL GULIM(0.,0.,100.,100.)
0013            CALL GPBEAM(20.,20.)
0014            CALL GPTEXT(0,X(1),24)
0015            CALL GPBEAM(20.,50.)
0016            CALL GPRINT(0,Y,Y(6))
0017            CALL GDISPL(10000)
0018            CALL GOPCP
0019            CALL GWAIT(0)
0020            RETURN
0021            END
```

```
0001            SUBROUTINE EX7
              C  TEST AND DETERMINE INTERRUPTS
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            READ(1,5)X
0004           5 FORMAT(6A4)
0005            CALL GUNIT(721)
0006            CALL GUTTFY(2,4000)
0007            CALL GUMAP(DM,100)
0008            CALL GUBUFF(DB,200)
0009            CALL GUCHAN(DC,400)
0010            CALL GPPOSN(5,1000)
0011            CALL GPTEXT(0,X(1),24)
0012            CALL GDISPL(10000)
0013            CALL GOPCP
0014            CALL GWAIT(0)
0015            CALL GOPCP
0016            CALL GWAIT(1)
0017            CALL GINKEY(0,I2,I3,I4)
0018            WRITE(6,10)I2
0019           10 FORMAT(I5)
0020            RETURN
0021            END
```

```
0001            SUBROUTINE EX8
              C  IDENTIFY PORTION OF IMAGE TOUCHED BY LIGHT PEN
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            DIMENSION INAM(5)
0004            READ(1,5)X,Y
0005          5 FORMAT(12A4)
0006            CALL GUNIT(721)
0007            CALL GUTTFY(2,4000)
0008            CALL GUMAP(DM,100)
0009            CALL GUBUFF(DB,200)
0010            CALL GUCHAN(DC,400)
0011            CALL GUNAME(1,2,3)
0012            CALL GPPOSN(5,1000)
0013            CALL GPTEXT(0,X(1),24)
0014            CALL GUNAME(4,5,6)
0015            CALL GPPOSN(5,500)
0016            CALL GPTEXT(0,Y(1),24)
0017            CALL GDISPL(10000)
0018            CALL GOPCP
0019            CALL GWAIT(0)
0020            CALL GOPCP
0021            CALL GMGET(INAM)
0022            RETURN
0023            END
```

```
0001            SUBROUTINE EX9
              C  TAG AN IMAGE AND RETRIEVE THE TAG
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            READ(1,5)X
0004          5 FORMAT(6A4)
0005            CALL GUNIT(721)
0006            CALL GUTTFY(2,4000)
0007            CALL GUMAP(DM,100)
0008            CALL GUBUFF(DB,200)
0009            CALL GUCHAN(DC,400)
0010            CALL GUNAME(1,2,3)
0011            CALL GPPOSN(5,1000)
0012            CALL GPTEXT(0,X(1),24)
0013            ITAG=1
0014            CALL GMPTAG(ITAG,1,2,3)
0015            CALL GMGTAG(ADD,1)
0016            CALL GDISPL(10000)
0017            CALL GOPCP
0018            CALL GWAIT(0)
0019            RETURN
0020            END
```

```
0001            SUBROUTINE EX10
              C  INSERT CURSOR AND READ CONTENTS OF 2250 BUFFER
0002            COMMON DM(300),DC(100),DB(250),FMTX(2),FMTY(2),X(6),Y(6),ISY(4)
0003            DIMENSION W(50)
0004            READ(1,5)X
0005          5 FORMAT(6A4)
0006            CALL GUNIT(721)
0007            CALL GUTTFY(2,4000)
0008            CALL GUMAP(DM,100)
0009            CALL GUBUFF(DB,200)
0010            CALL GUCHAN(DC,400)
0011            CALL GUNAME (1,2,3)
0012            CALL GPPOSN(5,'000)
0013            CALL GPTEXT(0,X(1),24)
0014            CALL GMCURS(14,11000,1)
0015            CALL GDISPL(10000)
0016            CALL GOPCP
0017            CALL GWAIT(0)
0018            CALL GREAD(W,11000,1)
0019            CALL GOPCP
0020            CALL GWAIT(0)
0021            RETURN
0022            END
```

B. Figures 3 through 15 contain a series of photographs[1] taken of a program used to demonstrate graphic capabilities of the enclosed subroutines. The BPS version of the program was run at the Armed Forces Day celebration on May 8, 1966 at NWL for an entertaining enlightenment of the general public and future users. It was executed on the IBM 360/40 machine, using a 2250 console for the graphic display.[2] A brief description of the OS version of the program will be given, followed by a FORTRAN listing.

For explanatory purposes, the program will here be broken up into the following five parts:

1. Figure 3 illustrates the beginning of the program. The letters "NWL" appear in sequence on the screen, immediately followed by "PRESENTS". "NWL" is comprised of vectors, while the caption "PRESENTS" is merely the printing of large size hollerith data on the screen. Following this, figure 4 appears briefly.

2. Figure 5 is the beginning of a sequence in which a star continuously expands and contracts. By touching the screen with the light pen, the star can also be made to rotate in a clockwise direction. The pictures show various positions and sizes of the star. As the rapid sequence of pictures appear on the screen, they give the impression of motion.

[1] Photos were taken by a Kodak Retina Reflex IV camera with an f 1.9 lens using ASA 50 film.

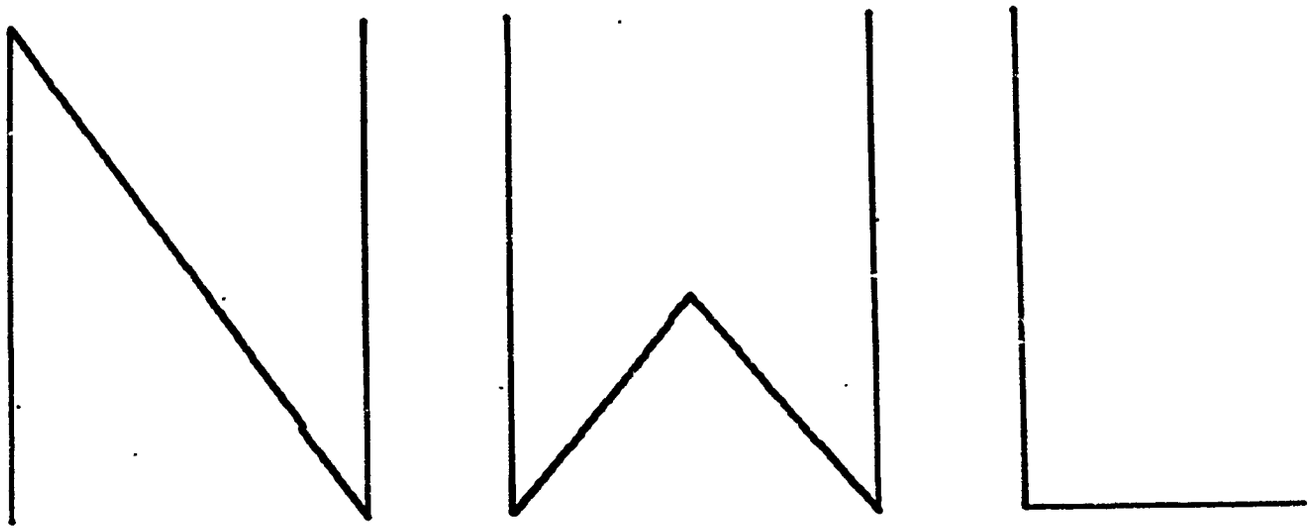
[2] The BPS version is fully described in Reference (4).

3. Another "motion picture" depicts a well-known baseball personality on his way to the opening game of the season. He walks across the page with vigor, knowing well that his team, with the aid of new computer techniques, at last has a good chance for a winning game. (Due to minor difficulty in evaluating the pitching staff the game was lost by 102 to 0.) Figure 10 is a composite picture illustrating the displayed image at various time intervals. It should be noted here, however, that in actuality this sequence produces an illusion of movement which cannot be illustrated by figure 10.

4. Figure 11 illustrates the ability of the computer to construct and alter on command simple geometric figures. By use of commands at the top of the screen, (activating a command merely entails touching it with the light pen) up to 80 individual boxes may be generated, moved about, expanded, compressed, etc., etc., resulting in a final figure composed of vertical and horizontal lines. After generating a new box, any previous box may be erased by touching it once with the light pen. When a newly generated box is touched by the light pen all previous boxes are erased. A newly generated box may be touched four times with the light pen before the entire image on the screen is erased and the program proceeds to the next part. (See (5) below.)

5. When the box routine has been completed, the program enters a sequence illustrating the display of the conic section equation. $Y = Ax^2 + Bxy + Cy^2 + Dx + Ey + F$. The user may type in the desired parameters for A, B, C, D, E, and F in the space provided at the top of

the screen. The G coefficient is a control: +1 means one curve is to be displayed, +2 means two curves are to be displayed simultaneously, and 0 means go back to the beginning of the program (Figure 3) and repeat the whole program. Figure 12 shows the original grid, while figures 13 and 14 show one and two curves respectively being displayed. To activate the program, the parameters desired are typed in and the light pen must be touched to the screen.



PRESENTS

Figure 3

AN ALL STAR

PERFORMANCE

Figure 4

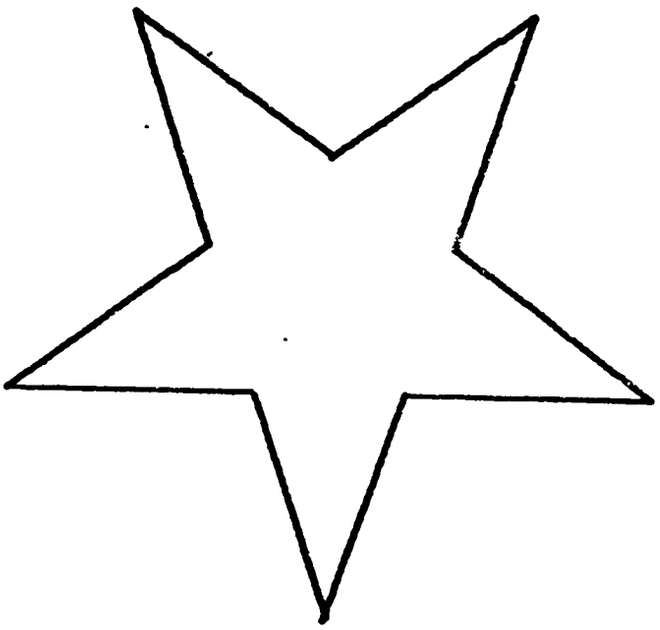


Figure 5

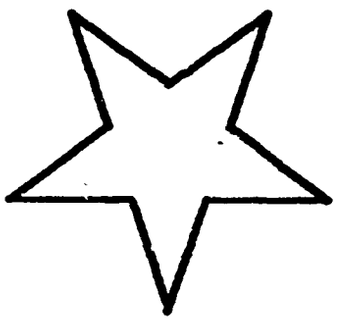


Figure 6

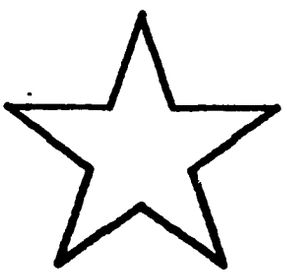


Figure 7

Figure 8

Figure 9

WHO DID YOU EXPECT? BATMAN?

Figure 10

WAIT LEFT RIGHT UP DOWN EXPAND HEIGHT EXPAND LENGTH COMPRESS HEIGHT COMPRESS LENGTH GEN

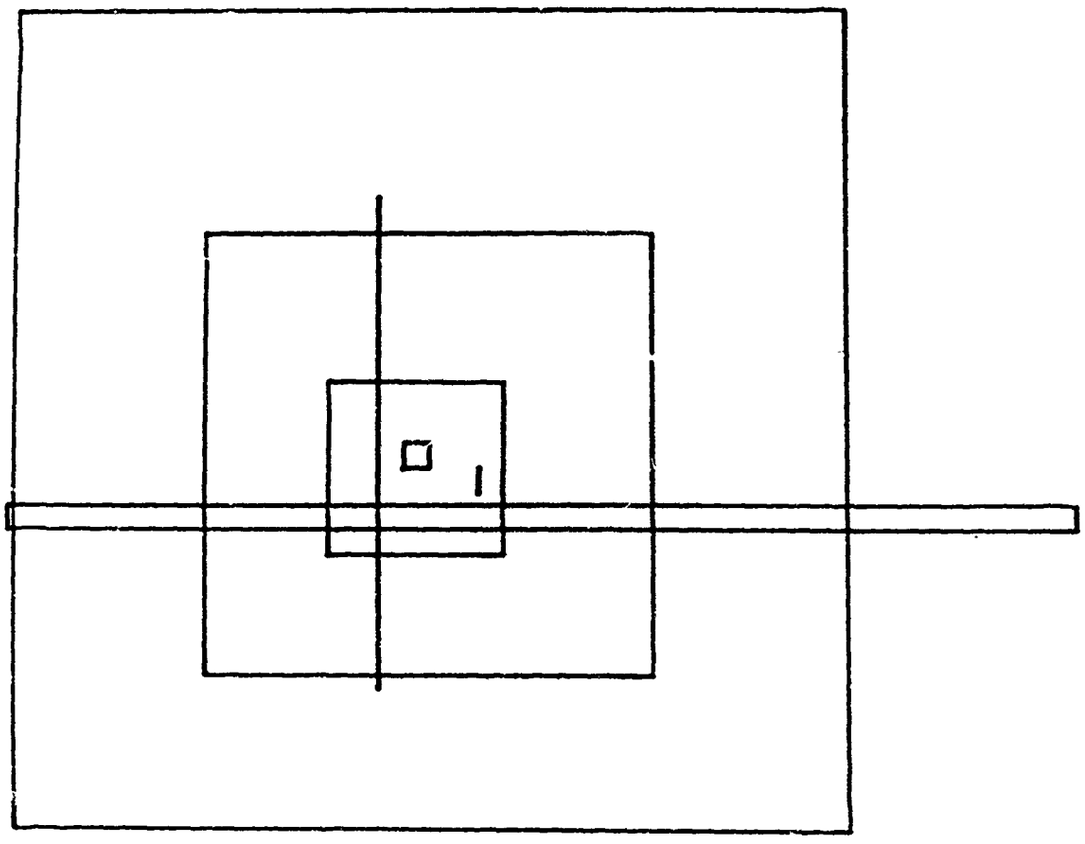


Figure 11

A=+0.0 B=+0.0 C=+0.0 D=+0.0 E=+0.0

F=+0.0 G=+1.0

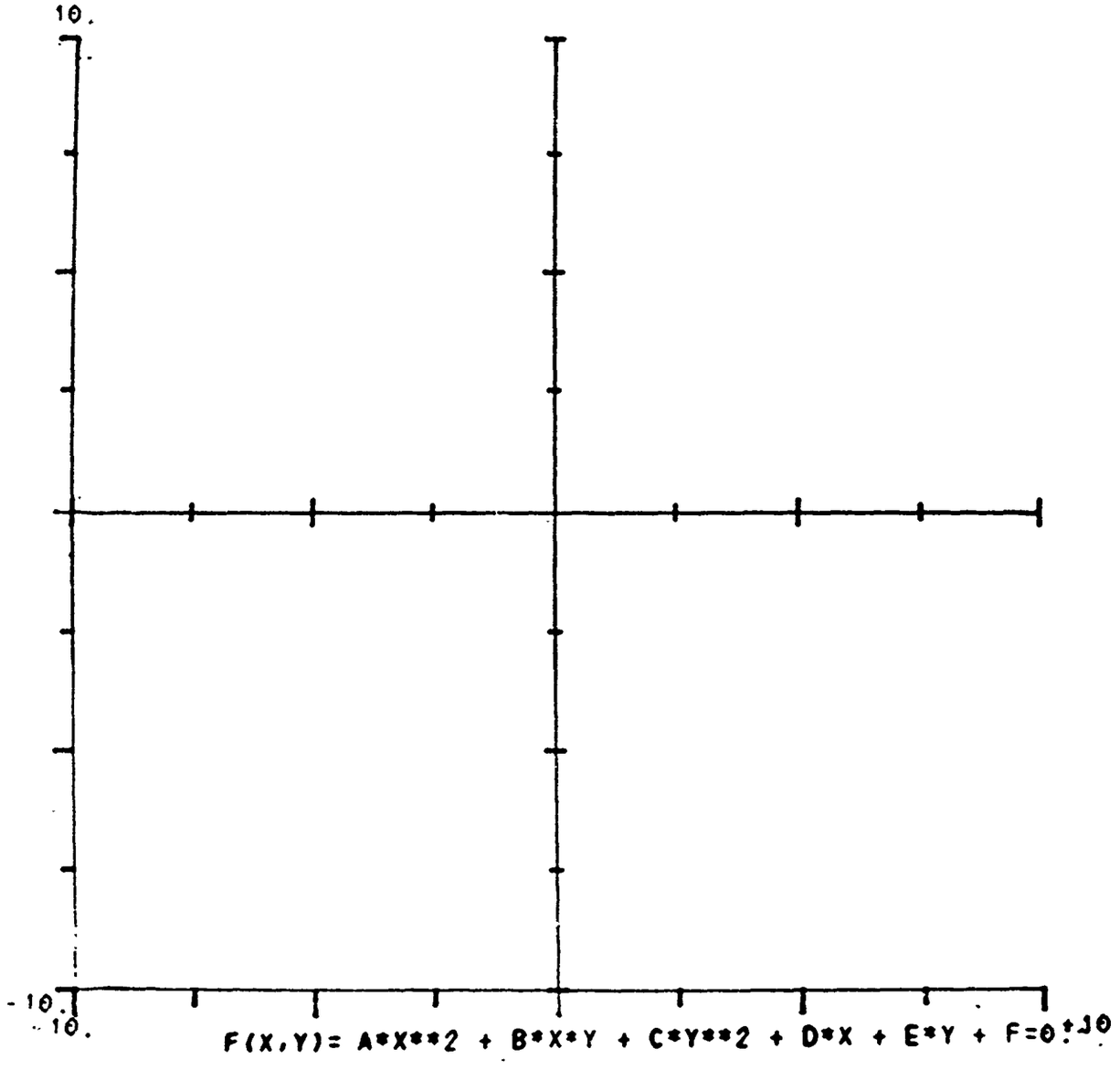


Figure 12

A=+3.0 B=+0.0 C=+2.0 D=+0.0 E=+0.0

F=-50. G=+2.0

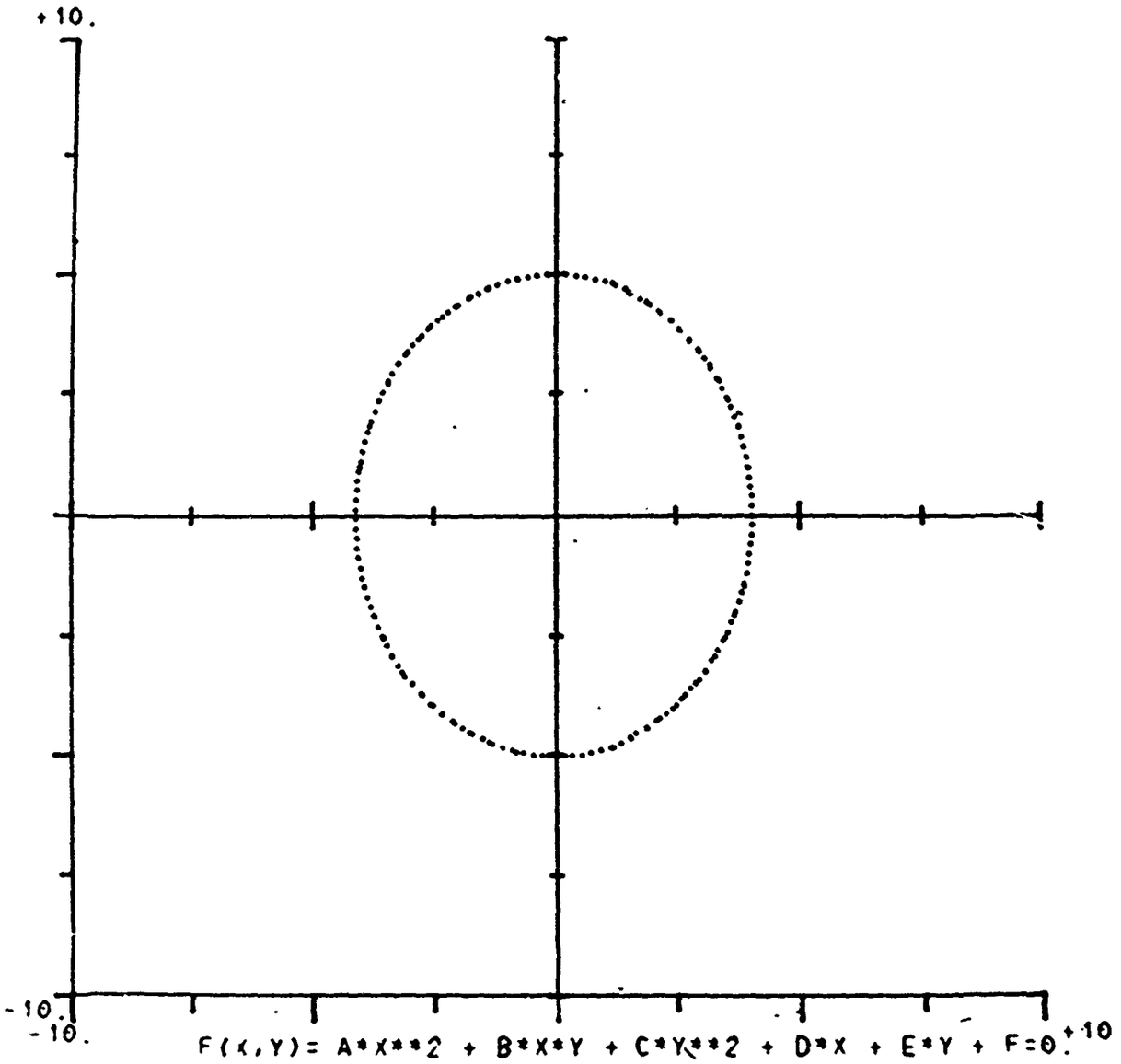


Figure 13

A=+2.0 B=+0.0 C=-3.0 D=+0.0 E=+0.0

F=-25. G=+2.0

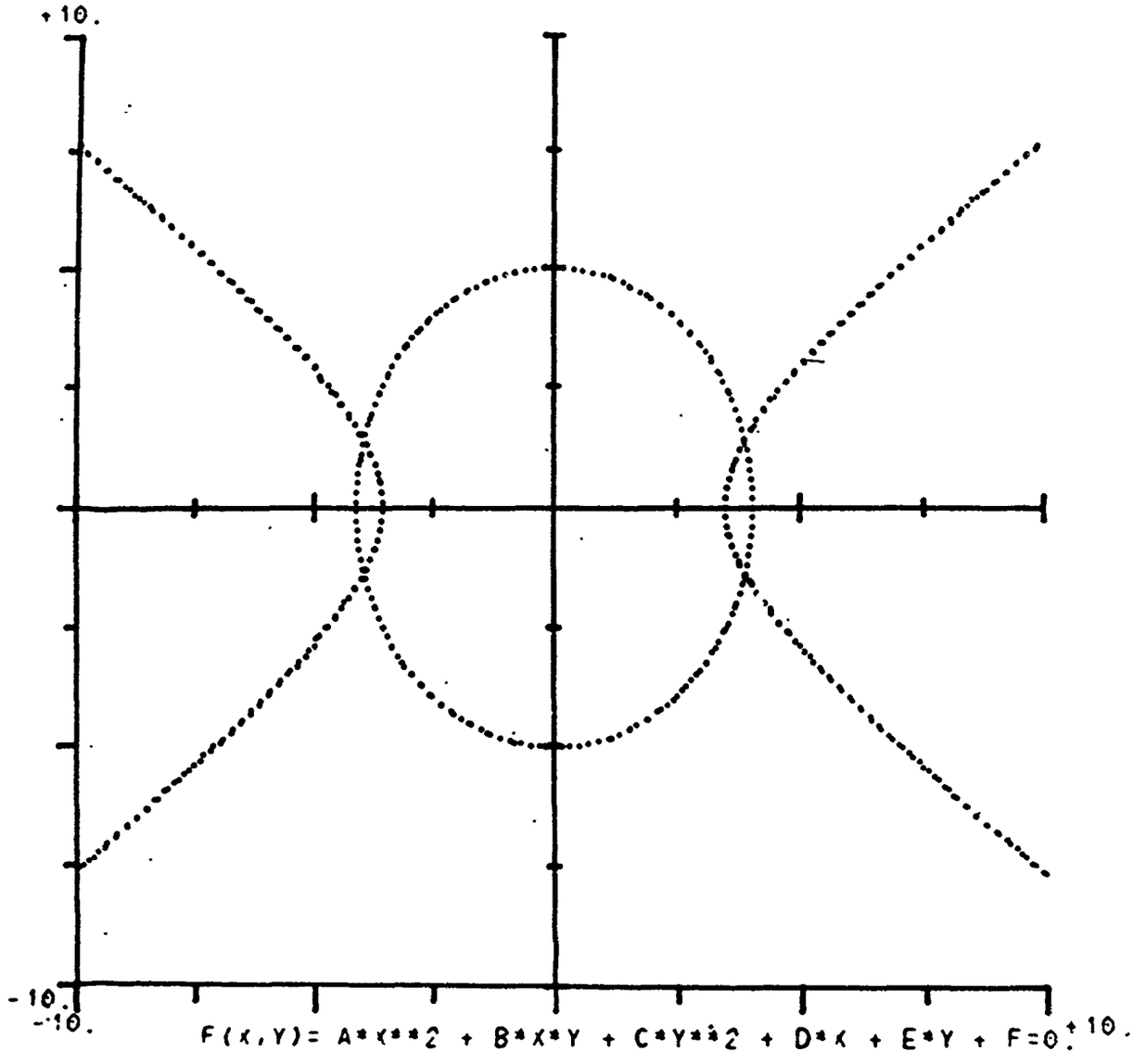


Figure 14

```
0001                COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20)
0002                COMMON X(350),Y(350),XC(5),YC(5),INAM(6)
0003                COMMON DH(4000)
0004                DIMENSION DM(30),DC(80)
0005                CALL GOPEN
0006                READ(5,4)Z1
0007                READ(5,4)Z2
0008                READ(5,4)Z3
0009                READ(5,4)Z4
0010                READ(5,4)Z5
0011                READ(5,4)Z6
0012                READ(5,4)Z7
0013                READ(5,4)Z8
0014              4 FORMAT(20A4)
0015                CALL GUNIT(721)
0016                CALL GUTTEY(5,4000)
0017              6 IYM=0
0018                CALL GUTYPE(1)
0019                CALL GULIM(0.,0.,1023.,1023.)
0020                CALL GUSIZE(0,0,1023,1023)
0021                CALL GUPLOT(0)
0022                CALL GUMAP(DM,30)
0023                CALL GUCHAN(DC,320)
0024                CALL GUBUFF(DH,4000)
0025                X(1)=50.
0026                Y(1)=400.
0027                X(2)=50.
0028                Y(2)=750.
0029                X(3)=300.
0030                Y(3)=400.
0031                X(4)=300.
0032                Y(4)=750.
0033                X(5)=400.
0034                Y(5)=750.
0035                X(6)=400.
0036                Y(6)=400.
0037                X(7)=525.
0038                Y(7)=550.
0039                X(8)=550.
0040                Y(8)=400.
0041                X(9)=650.
0042                Y(9)=750.
0043                X(10)=750.
0044                Y(10)=750.
0045                X(11)=750.
0046                Y(11)=400.
0047                X(12)=975.
0048                Y(12)=400.
```

```
0049              CALL GRDATA(0,X(1),1,Y(1),1,IYM,0,4,0)
0050              CALL GRISPL(10000)
0051              CALL GRPCP
0052              IWAIT=0
0053           50 IWAIT=IWAIT+1
0054              IF(IWAIT-25000)50,55,55
0055           55 CALL GRDATA(0,X(5),1,Y(5),1,IYM,0,5,0)
0056              CALL GRISPL(10000)
0057           56 CALL GRPCP
0058              IWAIT=0
0059           60 IWAIT=IWAIT+1
0060              IF(IWAIT-25000)60,65,65
0061           65 CALL GRDATA(0,X(10),1,Y(10),1,IYM,0,3,0)
0062              CALL GRISPL(10000)
0063           68 CALL GRPCP
0064              IWAIT=0
0065           70 IWAIT=IWAIT+1
0066              IF(IWAIT-40000)70,75,75
0067           75 CALL GRPOSN(400,250)
0068              CALL GRTEXT(1,Z1(1),8)
0069              CALL GRISPL(10000)
0070           78 CALL GRPCP
0071              IWAIT=0
0072          100 IWAIT=IWAIT+1
0073              IF(IWAIT-40000)100,105,105
0074          105 CALL GUMAP(DM,10)
0075              CALL GUCMAP(DC,320)
0076              CALL GUBUFF(DM,4000)
0077              CALL GRPOSN(300,500)
0078              CALL GRTEXT(1,Z1(3),3)
0079              CALL GRTEXT(1,Z1(6),4)
0080              CALL GRTEXT(1,Z1(8),4)
0081              CALL GRPOSN(300,400)
0082              CALL GRTEXT(1,Z1(9),11)
0083              CALL GRISPL(10000)
0084              CALL GRPCP
0085              IWAIT=0
0086          110 IWAIT=IWAIT+1
0087              IF(IWAIT-40000)110,115,115
0088          115 CALL STAR
0089          120 CALL SNOOP
0090          125 CALL MOVEST
0091              CALL CONICS
0092              GO TO 7
0093              END


0001              SUBROUTINE GRAPH1
0002              COMMON DM1(60),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20),
                 1        YZ1(350),YZ3(350), DM2(15),
                 2           IC,COEF(10), DT(100),DT1(30),DD(859)
0003              CALL GRISPL(10000)
0004              CALL GRPCP
0005              CALL GWAIT(0)
0006              CALL GREAD(DT,11100,1,2)
0007              CALL GRPCP
0008              RETURN
0009              END
```

```
S.0001          SUBROUTINE GRAPH2(A,IND)
S.0002          COMMON DM1(60),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20),
               )       YZ1(350),YZ3(350), DM2(15),
               2          IC,COEF(10), DT(100),DTI(30),DD(859)
S.0003          IF(COEF(7)-2.) 8,7,7
S.0004        7 IND= IND + 1
S.0005          IF(IND-2) 10,15,15
S.0006        8 IF(IND-1) 10,9  ,9
S.0007        9 IND= 0
S.0008          GO TO 10
S.0009       10 CALL GURUFF(DD,4090)
S.0010       15 IYM= 0
S.0011          IF(A-2.) 20,40,60
S.0012       20 DO 22 I=1,201
S.0013          IF(ABS(YZ1(I))-10.) 25,25,22
S.0014       22 CONTINUE
S.0015          GO TO 60
S.0016       25 CALL GPDATA(1,-10.,.1,YZ1,1,IYM,0,201,0)
S.0017          IF(IC-6) 30,100,30
S.0018       30 CALL GPDATA (2,YZ3     ,1,-10., .1,IYM,0,201,0 )
S.0019          GO TO 100
S.0020       40 DO 41 I=1,201
S.0021          IF(ABS(YZ3(I))-10.) 43,43,41
S.0022       41 CONTINUE
S.0023          GO TO 60
S.0024       43 IF(IC-4) 45,45,50
S.0025       45 CALL GPDATA (2,YZ3     ,1,-10., .1,IYM,0,201,0 )
S.0026          GO TO 100
S.0027       50 CALL GPDATA (2,YZ3     ,1,-10., .2,IYM,0,101,0 )
S.0028          CALL GPDATA (2,YZ3(102),1,-10., .2,IYM,0,101,0 )
S.0029          GO TO 100
S.0030       60 CALL NULL
S.0031      100 CALL GRAPH1
S.0032          IF(IND-1)150,900,150
S.0033      150 CALL GERASE(11100,1,3)
S.0034          IND= 0
S.0035      900 RETURN
S.0036          END
```

```
0001              SUBROUTINE EVAL (DP)                                      EVAL000
0002              COMMON DM1(60),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20),
                 1       YZ1(350),YZ3(350), DM2(15),
                 2          IC,   A(10), DT(100),DTI(30),DD(959)
0003              IXY= 0                                                    EVAL005
0004              AP= A(1)                                                  EVAL007
0005              BP= A(2)                                                  EVAL0071
0006              CP= A(3)                                                  EVAL0072
0007              DP= A(4)                                                  EVAL0073
0008              EP= A(5)                                                  EVAL0074
0009              FP= A(6)                                                  EVAL0075
0010              AA= ABS(AP)                                               EVAL008
0011              BA= ABS(BP)                                               EVAL0081
0012              CA= ABS(CP)                                               EVAL0082
0013              DA= ABS(DP)                                               EVAL0083
0014              EA= ABS(EP)                                               EVAL0084
0015              GO TO 3                                                   EVAL0085
0016           1000 AP= A(3)                                                EVAL0088
0017              BP= A(2)                                                  EVAL0089
0018              FP= A(6)                                                  EVAL0090
0019              CP= A(1)                                                  EVAL0093
0020              DP= A(5)                                                  EVAL0094
0021              EP= A(4)                                                  EVAL0095
0022              AA = CA                                                   EVAL0096
0023              DA = EA                                                   EVAL0097
0024              CA = ABS(CP)                                              EVAL0098
0025              EA = ABS(EP)                                              EVAL0099
0026              IF(BA + CA + EA) 3,950,3                                  EVAL010
0027            3 X= -10.                                                   EVAL0105
0028              DX= 0.1                                                   EVAL012
0029              DN= 1.                                                    EVAL016
0030              IC= 1                                                     EVAL020
0031              ID= 200                                                   EVAL021
0032            5 IF(BA + CA + EA) 8,30,8                                   EVAL026
0033            8 IF(AA + CA) 10,15,10                                      EVAL028
0034           10 IF(CP) 20,17,75                                           EVAL036
0035           15 IC= 3                                                     EVAL040
0036              GO TO 95                                                  EVAL0401
0037           17 IC= 2                                                     EVAL041
0038              GO TO 95                                                  EVAL0413
0039           20 AP= -AP                                                   EVAL044
0040              BP= -BP                                                   EVAL0441
0041              CP= -CP                                                   EVAL0442
0042              DP= -DP                                                   EVAL0443
0043              FP= -EP                                                   EVAL0444
0044              EP= -EP                                                   EVAL0445
0045              GO TO 75                                                  EVAL045
0046           30 IF(AA + DA) 32,55,32                                      EVAL050
```

```
0047          32 IF(AA ) 36,34,36                                          EVAL051
0048          34 R1= -EP/DP                                                EVAL052
0049             IC= 4                                                     EVAL0522
0050             GO TO 60                                                  EVAL0525
0051          36 IF(DA) 45,40,45                                           EVAL053
0052          40 EA= -EP/AP                                                EVAL054
0053             IF(EA)  55,43,43                                          EVAL0545
0054          43 R1= SQRT(EA)                                              EVAL055
0055             R2= -R1                                                   EVAL0551
0056             IC= 5                                                     EVAL0553
0057             GO TO 65                                                  EVAL0555
0058          45 DIS= DP * DP - 4. * AP * EP                               EVAL056
0059             IF(DIS) 55,50,50                                          EVAL057
0060          50 RE1= -DP/AP                                               EVAL058
0061             RE2= SQRT(DIS)/AP                                         EVAL0583
0062             R1= .5 * (RE1 + RE2)                                      EVAL0584
0063             R2= .5 * (RE1 - RE2)                                      EVAL0585
0064             IC= 5                                                     EVAL0586
0065             GO TO 65                                                  EVAL059
0066          55 R1=777.                                                   EVAL060
0067             DP= 3.0                                                   EVAL0605
0068             GO TO 950                                                 EVAL0606
0069          60 DO 63 I=1,201                                             EVAL065
0070             YZ3(I)= R1                                                EVAL066
0071          63 CONTINUE                                                  EVAL067
0072             GO TO 70                                                  EVAL0675
0073          65 DO 68 I=1,101                                             EVAL069
0074             YZ3(I)= R1                                                EVAL0684
0075             YZ3 (I+ 101) = R2                                         EVAL0685
0076          68 CONTINUE                                                  EVAL069
0077          70 IF(DP-3.) 71,950,71                                       EVAL070
0078          71 DP= 2.                                                    EVAL0704
0079             GO TO 900                                                 EVAL0705
0080          75 CH= 1./SQRT(DP)                                           EVAL124
0081             GO TO 95                                                  EVAL1243
0082          95 DO 225 I= 1,201                                           EVAL148
0083             BPX= BP * X + EP                                          EVAL150
0084             DF= DP * X + EP                                           EVAL152
0085             IF(IC-1) 96,98,96                                         EVAL153
0086          96 IF(ABS(BPX)-.0011 100,100,97                              EVAL1535
0087          97 IF(IC-3)98,175,98                                         EVAL154
0088          98 YF= AP * X * X + DF                                       EVAL156
0089             IF(IC-2)100,150,150                                       EVAL160
0090         100 EC= .5 * BPX * CH                                         EVAL1615
0091             EC2= EC * EC                                              EVAL1616
0092             YA= EC2 - YF                                              EVAL164
0093             IF(YA) 105,120,120                                        EVAL168
0094         105 IF(ABS(YA)-.005) 107,107,190                              EVAL169
```

```
0095          107 YA=0.                                                          EVAL1695
0096          120 IF(IXY) 122,122,123                                            EVAL180
0097          122 YZ1(I)= (DN * SQRT(YA) - EC) * CH                              EVAL1804
0098              GO TO 125                                                      EVAL1805
0099          123 YZ3(I)= (DN * SQRT(YA) - EC) * CH                              EVAL181
0100          125 DN= - DN                                                       EVAL184
0101              GO TO 200                                                      EVAL188
0102          150 IF(IXY) 152,152,153                                            EVAL192
0103          152 YZ1(I)= -YF/BPX                                                EVAL1924
0104              GO TO 200                                                      EVAL1925
0105          153 YZ3(I)= -YF/BPX                                                EVAL193
0106              GO TO 200                                                      EVAL196
0107          175 IF(IXY) 177,177,180                                            EVAL200
0108          177 YZ1(I)= -DF/BPX                                                EVAL2004
0109              GO TO 200                                                      EVAL2005
0110          180 YZ3(I)= -DF/BPX                                                EVAL201
0111              GO TO 200                                                      EVAL2011
0112          190 IF(IXY) 192,192,193                                            EVAL203
0113          192 YZ1(I) = 777.                                                  EVAL2032
0114              GO TO 195                                                      EVAL2034
0115          193 YZ3(I)= 777.                                                   EVAL2036
0116          195 ID= ID - 1                                                     EVAL2037
0117          200 X= X + DX                                                      EVAL204
0118          225 CONTINUE                                                       EVAL208
0119              IF(ID) 230,240,240                                             EVAL209
0120          230 DP= 3.0                                                        EVAL2095
0121              GO TO 950                                                      EVAL2096
0122          240 IF(IC-3) 900,250,900                                           EVAL210
0123          250 IF(PP) 900,255,900                                             EVAL2105
0124          255 IC= 6                                                          EVAL2106
0125              GO TO 950                                                      EVAL2108
0126          900 IF(IXY) 905,905,950                                            EVAL212
0127          905 IXY= 1                                                         EVAL216
0128              GO TO 1000                                                     EVAL220
0129          950 RETURN                                                         EVAL224
0130              END                                                            EVAL
```

```
0001              SUBROUTINE GRAPHS
0002              COMMON Z1(40),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20),
                 1        YZ1(250) YZ3(250), DM2(15),
                 2           IC,COEF(10), DT(100),DT1(30),DD(859)
0003              IND= 0
0004              CALL SETUP
0005              CALL GRAPH1
0006           10 I= 1
0007              A= 0.
0008           20 DT1(I)= DT(I+22)
0009              I= I + 1
0010              IF(I-10) 20,20,5
0011            5 CALL GCONVT(Z8,DT,79,COEF(1),COEF(2),COEF(3),COEF(4),COEF(5))
0012              CALL GCONVT(Z7,DT1,27,COEF(5),COEF(7))
0013              IF(COEF(7))25,100,25
0014           25 CALL EVAL(A)
0015              CALL GRAPHC(A,IND)
0016              GO TO 10
0017          100 RETURN1
0018              END
```

```
0001                SUBROUTINE SETUP
0002                DIMENSION X(4),Y(4)
0003                DIMENSION DC(150),DM(15),DC(25)
0004                COMMON DM1(40),Z4(20),Z5(20),Z6(40),Z7(20),Z8(30),
                   1        YZ1(350),YZ3(350), DM2(15),
                   2            IC,CCEE(10), DT0(100),DTI(30),DD(850)
0005                IYM=0
0006                CALL GUTYPE(1)
0007                CALL GUWIM(-10.,-10.,10.,10.)
0008                CALL GUSIZE(60,60,840,840)
0009                CALL GUPLOT (0)
0010                CALL GUWDEF(DC,600)
0011                CALL GUMAP(DM,5)
0012                CALL GUCHAN(DC,100)
0013                CALL GUNAME(1,1)
0014                CALL GUGRID(0.,0.,5.,5.,1,1,0)
0015                CALL GPGRID
0016                CALL GUNAME(1,2)
0017                CALL GUWDEF (DT,500)
0018                CALL GPPOSN (40,1000)
0019                CALL GPTEXT (0,74,80)
0020                CALL GPPOSN (40,950)
0021                CALL GPTEXT(0,75,29)
0022                CALL GPPOSN(30,860)
0023                CALL GPTEXT(0,Z5( 9), 4)
0024                CALL GPPOSN(860,30)
0025                CALL GPTEXT(0,75( 9), 4)
0026                CALL GPPOSN(30,30)
0027                CALL GPTEXT(0,75(13), 4)
0028                CALL GPPOSN(10,50)
0029                CALL GPTEXT(0,75(13), 4)
0030                CALL GPPOSN(170,20)
0031                CALL GPTEXT(0,Z6(21),53)
0032                CALL GMCURS (12,11100,1,2)
0033                CALL GUNAME(1,3)
0034                CALL GUPLOT(1)
0035                RETURN
0036                END
```

```
0001                SUBROUTINE TRNSF
0002                COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20)
0003                COMMON X(350),Y(350),XO(5),YO(5),INAM(5)
0004                COMMON ZPOLY(1000)
0005              50 IF(INAM(2)-2)1000,600,52
0006              52 IF(INAM(2)-4)600,700,54
0007              54 IF(INAM(2)-6)200,300,56
0008              56 IF(INAM(2)-8)400,500,58
0009              58 IF(INAM(2)-10)600,600,60
0010              60 IF(INAM(2)-12)600,600,1000
0011             200 DO 210 KAT=1,5
0012             210 X(KAT)=X(KAT)-10.
0013                 GO TO 900
0014             300 DO 310 KAT=1,5
0015             310 X(KAT)=X(KAT)+10.
0016                 GO TO 900
0017             400 DO 410 KAT=1,5
0018             410 Y(KAT)=Y(KAT)+10.
0019                 GO TO 900
0020             500 DO 510 KAT=1,5
0021             510 Y(KAT)=Y(KAT)-10.
0022                 GO TO 900
0023             600 XMA=X(1)
0024                 XMI=X(1)
0025                 YMA=Y(1)
0026                 YMI=Y(1)
0027                 DO 650 KAT=2,5
0028                 IF(XMA-X(KAT))610,615,615
0029             610 XMA=X(KAT)
0030                 GO TO 620
0031             615 IF(X(KAT)-XMI)616,620,620
0032             616 XMI=X(KAT)
0033             620 IF(YMA-Y(KAT))630,635,635
0034             630 YMA=Y(KAT)
0035                 GO TO 650
0036             635 IF(Y(KAT)-YMI)636,650,650
0037             636 YMI=Y(KAT)
0038             650 CONTINUE
0039                 RXMI=XMI
0040                 RXMA=XMA
0041                 RYMI=YMI
0042                 RYMA=YMA
0043             710 IF(INAM(2)-3)1500,2600,712
0044             712 IF(INAM(2)-5)700,700,714
0045             714 IF(INAM(2)-10)600,4400,716
0046             716 IF(INAM(2)-12)5600,6600,700
0047            1600 RXMA=XMA-5.
                C                    COMPRESSION HORIZONALLY & VERTICALLY
```

```
0048                BXMI=XMI+5.
0049                BYMA=YMA-5.
0050                BYMI=YMI+5.
0051                GO TO 8600
0052          3600  BXMA=XMA+5.
              C                          EXPANSION HORIZONTALLY & VERTICALLY
0053                BXMI=XMI-5.
0054                BYMA=YMA+5.
0055                BYMI=YMI-5.
0056                GO TO 8600
0057          4600  BYMI=YMI-5.
              C                          EXPANSION VERTICALLY
0058                BYMA=YMA+5.
0059                GO TO 8600
0060          4600  BXMA=XMA+5.
              C                          EXPANSION HORIZONTALLY
0061                BXMI=XMI-5.
0062                GO TO 8600
0063          5600  BYMA=YMA-5.
              C                          COMPRESSION VERTICALLY
0064                BYMI=YMI+5.
0065                GO TO 8600
0066          6600  BXMI=XMI+5.
              C                              COMPRESSION HORIZONTALLY
0067                BXMA=XMA-5.
0068          8600  XTRA=BXMA-BXMI
              C                               SEE IF IF IMAGE IS INSIDE OUT
0069                IF(XTRA)8690,8690,8610
0070          8610  YTRC=BYMA-BYMI
0071                IF(YTRC)8700,8700,8620
0072          8620  DIV=XMA-XMI
0073                IF(DIV)8640,8640,8630
0074          8630  XTRA=XTRA/DIV
0075                XTRB=BXMA-XTRA*XMA
0076                GO TO 8650
0077          8640  XTRA=1.
0078                XTRB=0.
0079          8650  DIV=YMA-YMI
0080                IF(DIV)8660,8660,8655
0081          8655  YTRC=YTRC/DIV
0082                YTRD=BYMA-YTRC*YMA
0083                GO TO 8670
0084          8660  YTRC=1.
0085                YTRD=0.
0086          8670  DO 8680 KAT=1,5
0087                X(KAT)=X(KAT)*XTRA+XTRB
0088          8680  Y(KAT)=YTRC*Y(KAT)+YTRD
0089                GO TO 900
```

```
0090          8690 BXMA=BXMA+.1
0091               BXMI=BXMI-.1
0092               GO TO 8600
0093          8700 BYMA=BYMA+.1
0094               BYMI=BYMI-.1
0095               GO TO 8610
0096           900 DO 940 KAT=1,5
0097               IF(X(KAT))950,910,910
0098           910 IF(1023.-X(KAT))950,920,920
0099           920 IF(Y(KAT))950,930,930
0100           930 IF(970.-Y(KAT))950,940,940
0101           940 CONTINUE
0102               GO TO 1000
0103           950 DO 960 KAT=1,5
0104               X(KAT)=XO(KAT)
0105           960 Y(KAT)=YO(KAT)
0106           700 CONTINUE
0107          1000 RETURN
0108               END
```

```
0001              SUBROUTINE MOVEST
0002              COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20)
0003              COMMON X(350),Y(350),XD(5),YD(5),INAM(5)
0004              COMMON DS(1000)
0005              DIMENSION DM(325),DC(80),DZ(50),DT(360)
0006              IYM=0
0007              IOU=0
0008            6 CALL GUTYPE(1)
0009              IOU=IOU+1
0010              IF(IOU-4) 7,7,9998
0011            7 CALL GUWIM(0.,0.,1023.,1023.)
0012              CALL GUSIZE(0,0,1023,1023)
0013              CALL GUPLOT(0)
0014              CALL GUMAP(DM,250)
0015              CALL GUCHAN(DC,320)
0016              CALL GUBUFF(DZ,200)
0017              CALL GUNAME(3,3)
0018              CALL GPPOSN(572,1008)
0019              CALL GPTEXT(0,Z3(1),6)
0020              CALL GUNAME(3,2)
0021              CALL GPPOSN(796,1008)
0022              CALL GPTEXT(0,Z3(2),8)
0023              CALL GUNAME(3,1)
0024              CALL GPPOSN(972,1008)
0025              CALL GPTEXT(0,Z3(17),3)
0026              CALL GUNAME(3,13)
0027              CALL GPPOSN(68,988)
0028              CALL GPTEXT(0,Z3(6),4)
0029              CALL GUNAME(3,5)
0030              CALL GPPOSN(180,988)
0031              CALL GPTEXT(0,Z3(8),4)
0032              CALL GUNAME(3,6)
0033              CALL GPPOSN(264,988)
0034              CALL GPTEXT(0,Z3(9),5)
0035              CALL GUNAME(3,7)
0036              CALL GPPOSN(362,988)
0037              CALL GPTEXT(0,Z3(11),2)
0038              CALL GUNAME(3,8)
0039              CALL GPPOSN(418,988)
0040              CALL GPTEXT(0,Z3(12),4)
0041              CALL GUNAME(3,9)
0042              CALL GPPOSN(530,988)
0043              CALL GPTEXT(0,Z3(13),6)
0044              CALL GUNAME(3,10)
0045              CALL GPPOSN(642,988)
0046              CALL GPTEXT(0,Z3(15),6)
0047              CALL GUNAME(3,11)
0048              CALL GPPOSN(754,988)
```

```
0049              CALL GPTEXT(0,Z3(13),6)
0050              CALL GUNAME(3,12)
0051              CALL GPPOSN(866,988)
0052              CALL GPTEXT(0,Z3(15),6)
0053              NS=0
0054              IJK=1
0055           10  X(1)=20.
0056              Y(1)=20.
0057              X(2)=40.
0058              Y(2)=20.
0059              X(3)=40.
0060              Y(3)=40.
0061              X(4)=20.
0062              Y(4)=40.
0063              X(5)=20.
0064              Y(5)=20.
0065           12 CALL GUNAME(2,1)
0066              NT=1
0067              CALL GUBUFF(DT,1400)
0068              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,5,0)
0069              CALL GDTSPL(10000)
0070              CALL GOPCP
0071              CALL GWAIT(0)
0072              CALL GOPCP
0073              CALL GWAIT(1)
96 0074           CALL GMGET(INAM)
0075              CALL GINKEY(1,0,0,2)
0076           13 IF(INAM(1)-2)500,602,1010
0077           1010 IF(INAM(2)-1)1020,600,1020
0078           1020 XO(1)=X(1)
0079              YO(1)=Y(1)
0080              XO(2)=X(2)
0081              YO(2)=Y(2)
0082              XO(3)=X(3)
0083              YO(3)=Y(3)
0084              XO(4)=X(4)
0085              YO(4)=Y(4)
0086              XO(5)=X(5)
0087              YO(5)=Y(5)
0088              IF(INAM(2)-13)1025,14,1025
0089           14 CALL GERASE(11000,2)
0090              GO TO 12
0091           1025 CALL TRNSF
0092              NT=NT+1
0093           15 IF(NT-10)25,25,20
0094           20 CALL GERASE(11000,2)
0095              NT=1
0096           25 CALL GUNAME(2,NT)
```

```
0097              CALL GUBUFF(DT,1400)
0098              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,5,0)
0099              CALL GINKEY(0,I1,I2,I3)
0100              KI3=I3/2
0101              IF(I3-2*KI3)35,30,35
0102           30 CALL GDISPL(11000,1,3,11100,2,NT)
0103              CALL GOPCP
0104              IWAIT=0
0105           32 IWAIT=IWAIT+1
0106              IF(1000-IWAIT)33,33,32
0107           35 X(1)=XO(1)
0108              Y(1)=YO(1)
0109              X(2)=XO(2)
0110              Y(2)=YO(2)
0111              X(3)=XO(3)
0112              Y(3)=YO(3)
0113              X(4)=XO(4)
0114              Y(4)=YO(4)
0115              X(5)=XO(5)
0116              Y(5)=YO(5)
0117           40 CALL GWAIT (0)
0118              CALL GOPCP
0119              CALL GWAIT (1)
0120              CALL GMGET (INAM)
0121              CALL GERASE(11000,2)
0122              CALL GUNAME(2,1)
0123              NT=1
0124              CALL GUBUFF (DT,1400)
0125              CALL GPDATA (0,X(1),1,Y(1),1,IYM,0,5,0)
0126              CALL GDISPL (10000)
0127              CALL GOPCP
0128              CALL GINKEY(1,0,0,2)
0129              GO TO 13
0130          500 CALL GERASE(11100,INAM(1),INAM(2))
0131          505 CALL GERASE(11000,2)
0132              GO TO 10
0133          600 NS=NS+1
0134              IF(NS-80) 601,601,602
0135          601 CALL GUNAME(1,NS)
0136              CALL GERASE(11000,2)
0137              IJK=IJK+1
0138              III=4060-4*IJK
0139              IF(III-25)602,602,603
0140          603 CALL GUBUFF(DS(IJK),III)
0141              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,5,0)
0142              CALL GRBUF(KKK)
0143              IJK=KKK/4+IJK+1
0144              GO TO 10
0145          9999 RETURN
0146           602 GO TO 6
0147              END
```

```
0001                SUBROUTINE STAR
0002                COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20)
0003                COMMON X(350),Y(350),XO(5),YO(5),INAM(5)
0004                COMMON ZPOLY(1000)
0005                DIMENSION D(11),E(11),A(20),B(6),C(13)
0006                IYM=0
0007                X(1)=36.
0008                X(2)=330.
0009                X(3)=218.
0010                Y(4)=512.
0011                X(5)=806.
0012                X(6)=694.
0013                X(7)=988.
0014                X(8)=624.
0015                X(9)=512.
0016                X(10)=400.
0017                X(11)=36.
0018                Y(1)=620.
0019                Y(2)=405.
0020                Y(3)=59.
0021                Y(4)=
0022                Y(5)=59.
0023                Y(6)=405.
0024                Y(7)=620.
0025                Y(8)=620.
0026                Y(9)=965.
0027                Y(10)=620.
0028                Y(11)=620.
0029                XOH=512.
0030                XOH=512.
0031                RSTMX=6.28
0032                RST=.628
0033                LIGHT=0
0034                KOUNT=3
0035                DO 4 I=1,11
0036                D(I)=X(I)-XOH
0037              4 E(I)=Y(I)-YOH
0038                CALL GINKEY(1,0,0,2)
0039                DO 125 MASK=1,KOUNT
0040                CALL SUPLOT(0)
0041                CALL SUTYPE(1)
0042                CALL SULIM(-162.,-162.,1186.,1186.)
0043                IK=161
0044                IJ=861
0045                MAX=IJ-IK
0046                MIN=3
0047                KSIGN=1
0048                XMIN=MIN
```

```
0049              XIJ=IJ
0050              XIK=IK
0051              ALIN=XIJ-XIK-XMIN
0052              PLOW=.025
0053              ALIN=(1.-PLOW)/ALIN
0054              BLIN=-XMIN*ALIN+PLOW
0055            5 IL=IJ-IK
0056              IF(KSIGN*(IL-MIN))25,25,8
0057            8 XIL=IL
0058              FIL=ALIN*XIL+BLIN
0059              KOF=FIL*40.+.5
0060              IWAIT=0
0061            6 IWAIT=IWAIT+1
0062              IF(IWAIT-1500)6,6,10
0063           10 CALL GUBUFF(A,80)
0064              CALL GUMAP(B,2)
0065              CALL GUCHAN(C,52)
0066              CALL GUSIZE(IK,IK,IJ,IJ)
0067              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,11,0)
0068              CALL GDISPL(10000)
0069              CALL GINKEY(0,LIGH,LIG,LIGHT)
0070              LIGHTS=LIGHT/2
0071              IF(LIGHT-LIGHTS*2) 50,40,50
0072           40 CALL GDPCP
0073              GO TO 40
0074           50 PSIC=0.
0075           51 PSIC=PSIC+PSI
0076              IF(PSIC-PSIMX)54,52,52
0077           54 COPC=COS(PSIC)
0078              SIPC=SIN(PSIC)
0079              DO 53 I=1,11
0080              X(I)=D(I)*COPC-E(I)*SIPC+XOH
0081              Y(I)=D(I)*SIPC+E(I)*COPC+YOH
0082           53 CONTINUE
0083              CALL GUBUFF(A,80)
0084              CALL GUMAP(B,2)
0085              CALL GUCHAN(C,52)
0086              CALL GUSIZE(IK,IK,IJ,IJ)
0087              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,11,0)
0088              CALL GDISPL(10000)
0089              CALL GDPCP
0090              IWAIT=0
0091           55 IWAIT=IWAIT+1
0092              IF(IWAIT-1500)55,55,51
0093           52 DO 60 I=1,11
0094              X(I)=D(I)+XOH
0095              Y(I)=E(I)+YOH
0096           60 CONTINUE
```

```
0097              CALL GUBUFF(A,80)
0098              CALL GUMAP(B,2)
0099              CALL GUCHAN(C,52)
0100              CALL GUSIZE(IK,IK,IJ,IJ)
0101              CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,11,0)
0102              CALL GDISP(10000)
0103              CALL GOPCP
0104              CALL GINKEY(1,0,0,2)
0105           40 IJ=IJ-KSIGN*KDE
0106              IK=IK+KSIGN*KDE
0107              GO TO 5
0108           25 IF(KSIGN)135,26,26
0109           26 KSIGN=-1
0110              IL=MIN
0111              MIN=MAX
0112              GO TO 8
0113          135 CONTINUE
0114              IWAIT=0
0115          400 IWAIT=IWAIT+1
0116              IF(IWAIT-25000)400,400,410
0117          410 RETURN
0118              END
```

100

```
0001              SUBROUTINE NULL
0002              COMMON DM1(60),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20),                NULL0000
                 1       YZ1(350),YZ3(350), DM2(15),
                 2          IC,COEF(10), DT(100),DTI(30),DD(859)
0003              CALL GPPOSN(270,600)
0004              CALL GPTEXT(0,26,80)                                             NULL024
0005              RETURN                                                           NULL028
0006              END                                                              NULL092
                                                                                   NULL
```

```
0001                  SUBROUTINE SNOOP
0002                  COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(:0),Z8(:0)
0003                  COMMON X(350),Y(350),XC(5),YC(5),INAM(5)
0004                  COMMON A( 000)
0005                  X(1)=31.
0006                  Y( )=64.
0007                  X(2)=5.
0008                  Y(2)=61.
0009                  X(3)=4.
0010                  Y(3)=64.
0011                  X(4)=4.
0012                  Y(4)=66.
0013                  X(5)=6.
0014                  Y(5)=69.
0015                  X(6)=9.
0016                  Y(6)=70.
0017                  X(7)= 2.
0018                  Y(7)=70.
0019                  X(8)=12.
0020                  Y(8)=71.
0021                  X(9)=13.
0022                  Y(9)=71.
0023                  X(10)=13
0024                  Y(10)=70.
0025                  X(11)=16
0026                  Y(11)=71.
0027                  X(12)=13.
0028                  Y(12)=70.
0029                  X(13)=23.
0030                  Y( 3)=65.
0031                  X(14)=23.
0032                  Y( 4)=63.
0033                  X(15)=17.
0034                  Y(15)=63.
0035                  X(16)=17.
0036                  Y(16)=65.
0037                  X(17)=16.
0038                  Y(17)=67.
0039                  X(18)=13.
0040                  Y(18)=70.
004                   X(19)=12.
0042                  Y(19)=70.
0043                  X(20)=11.
0044                  Y(20)=69.
0045                  X(21)=10.
0046                  Y(21)=67.
0047                  X(22)=9.
0048                  Y(22)=64.
```

```
0049                X(23)=9.
0050                Y(23)=62.
0051                X(24)=18.
0052                Y(24)=6?.
0053                X(25)=19.
0054                Y(25)=60.
0055                X(26)=2 .
0056                Y(26)=58.
0057                X(27)=2?.
0058                Y(27)=57.
0059                X(28)=30.
0060                Y(28)=59.
0061                X(29)=3?.
0062                Y(29)=59.
0063                X(30)=35.
0064                Y(30)=59.
0065                X(3 )=?7.
0066                Y(31)=55.
0067                X(32)=38.
0068                Y(32)=53.
0069                X(33)=38.
0070                Y(33)=51.
0071                X(34)=36.
0072                Y(34)=48.
0073                X(35)=32.
0074                Y(35)=46.
0075                X(36)=27.
0076                Y(36)=45.
0077                X(37)=22.
0078                Y(37)=41.
0079                X(38)=21.
0080                Y(38)=44.
0081                X(39)=21.
0082                Y(39)=43.
0083                X(40)=22.
0084                Y(40)=4 .
0085                X(41)=28.
0086                Y(41)=37.
0087                X(42)=31.
0088                Y(42)=34.
0089                X(43)=34.
0090                Y(43)=26.
0091                X(44)=34.
0092                Y(44)=20.
0093                X(45)=33.
0094                Y(45)=29.
0095                X(46)=34.
0096                Y(46)=29.
```

```
0097                X(47)=34.
0098                Y(47)=31.
0099                X(48)=32.
0100                Y(48)=34.
0101                X(49)=32.
0102                Y(49)=34.
0103                X(50)=31.
0104                Y(50)=33.
0105                X(51)=38.
0106                Y(51)=50.
0107                X(52)=39.
0108                Y(52)=50.
0109                X(53)=39.
0110                Y(53)=52.
0111                X(54)=38.
0112                Y(54)=53.
0113                X(55)=21.
0114                Y(55)=58.
0115                X(56)=19.
0116                Y(56)=55.
0117                X(57)=7.
0118                Y(57)=61.
0119                X(58)=2.
0120                Y(58)=48.
0121                X(59)=2.
0122                Y(59)=43.
0123                X(60)=5.
0124                Y(60)=41.
0125                X(61)=9.
0126                Y(61)=47.
0127                X(62)=10.
0128                Y(62)=50
0129                X(63)=10.
0130                Y(63)=55.
0131                X(64)=9.
0132                Y(64)=54.
0133                X(65)=8.
0134                Y(65)=60.
0135                X(66)=7.
0136                Y(66)=60
0137                X(67)=9.
0138                Y(67)=47.
0139                X(68)=15.
0140                Y(68)=45.
0141                X(69)=16.
0142                Y(69)=44.
0143                X(70)=17.
0144                Y(70)=42.
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0145                X(71)=16.
0146                Y(71)=40.
0147                X(72)=10.
0148                Y(72)=38.
0149                X(73)=9.
0150                Y(73)=36.
0151                X(74)=9.
0152                Y(74)=35.
0153                X(75)=13.
0154                Y(75)=32.
0155                X(76)=16.
0156                Y(76)=32.
0157                X(77)=16.
0158                Y(77)=30.
0159                X(78)=17.
0160                Y(78)=28.
0161                X(79)=19.
0162                Y(79)=27.
0163                X(80)=21.
0164                Y(80)=27.
0165                X(81)=24.
0166                Y(81)=30.
0167                X(82)=24.
0168                Y(82)=32.
0169                X(83)=19.
0170                Y(83)=36.
0171                X(84)=16.
0172                Y(84)=36.
0173                X(85)=21.
0174                Y(85)=39.
0175                X(86)=17.
0176                Y(86)=37.
0177                X(87)=21.
0178                Y(87)=27.
0179                X(88)=20.
0180                Y(88)=30.
0181                X(89)=13.
0182                Y(89)=32.
0183                X(90)=13.
0184                Y(90)=20.
0185                X(91)=13.
0186                Y(91)=20.
0187                X(92)=14.
0188                Y(92)=17.
0189                X(93)=17.
0190                Y(93)=12.
0191                X(94)= 8.
0192                Y(94)=11.
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0193                X(95)=14.
0194                Y(95)=11.
0195                X(96)=11.
0196                Y(96)=12.
0197                X(97)=4.
0198                Y(97)=16.
0199                X(98)=4.
0200                Y(98)=15.
0201                X(99)=5.
0202                Y(99)=13.
0203                X(100)=10.
0204                Y(100)=9.
0205                X(101)=15.
0206                Y(101)=8.
0207                X(102)=20.
0208                Y(102)=9.
0209                X(103)=21.
0210                Y(103)=10.
0211                X(104)=23.
0212                Y(104)=9.
0213                X(105)=24.
0214                Y(105)=6.
0215                X(106)=24.
0216                Y(106)=2.
0217                X(107)=26.
0218                Y(107)=2.
0219                X(108)=33.
0220                Y(108)=4.
0221                X(109)=36.
0222                Y(109)=7.
0223                X(110)=38.
0224                Y(110)=11.
0225                X(111)=38.
0226                Y(111)=13.
0227                X(112)=37.
0228                Y(112)=13.
0229                X(113)=35.
0230                Y(113)=12.
0231                X(114)=33.
0232                Y(114)=10.
0233                X(115)=30.
0234                Y(115)=8.
0235                X(116)=28.
0236                Y(116)=8.
0237                X(117)=27.
0238                Y(117)=10.
0239                X(118)=32.
0240                Y(118)=13.
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0241                X(119)=34.
0242                Y(119)=16.
0243                X(120)=34.
0244                Y(120)=20.
0245                X(121)=19.
0246                Y(121)=9.
0247                X(122)=17.
0248                Y(122)=8.
0249                X(123)=20.
0250                Y(123)=5.
0251                X(124)=20.
0252                Y(124)=4.
0253                X(125)=15.
0254                Y(125)=4.
0255                X(126)=11.
0256                Y(126)=5.
0257                X(127)=8.
0258                Y(127)=8.
0259                X(128)=7.
0260                Y(128)=11.
0261                X(129)=16.
0262                Y(129)=13.
0263                X(130)=14.
0264                Y(130)=11.
0265                X(131)=11.
0266                Y(131)=14.
0267                X(132)=9.
026                 Y(132)=15.
0269                X(133)=8.
0270                Y(133)=15.
0271                X(134)=7.
0272                Y(134)=14.
0273                X(135)=14.
0274                Y(135)=7.
0275                X(136)=13.
0276                Y(136)=5.
0277                X(137)=16.
0278                Y(137)=6.
0279                X(138)=15.
0280                Y(138)=4.
0281                X(139)=33.
0282                Y(139)=7.
0283                X(140)=34.
0284                Y(140)=5.
0285                X(141)=35.
0286                Y(141)=8.
0287                X(142)=36.
0288                Y(142)=7.
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0289                X( 43)=36.
0290                Y(143)=10.
0291                X(144)=37.
0292                Y( 44)=9.
0293                X(150)=13.
0294                Y(150)=20.
0295                X(151)=14.
0296                Y(151)=17.
0297                X(152)=18.
0298                Y(152)=.  .
0299                X(153)=12.
0300                Y( 53)=12.
0301                X(154)=8.
0302                Y(154)= 5.
0303                X(155)=4.
0304                Y( 55)=.6.
0305                X(156)=5.
0306                Y(156)=13.
0307                X(157)=6.
0308                Y(157)=12.
0309                X(158)=9.
0310                Y(158)=10.
0311                X(159)=12.
0312                Y(159)=9.
0313                X(160)=18.
0314                Y(160)=9.
0315                X(161)=22.
0316                Y(161)=9.
0317                X(162)=23.
0318                Y(162)=8.
0319                X(163)=23.
0320                Y(163)=6.
0321                X(164)=21.
0322                Y(164)=3.
0323                X(165)=22.
0324                Y(165)=2.
0325                X( 66)=29.
0326                Y(166)=2.
0327                X( 67)=33.
0328                Y(167)=2.
0329                X(168)=37.
0330                Y(168)=7.
0331                X(169)=37.
0332                Y(169)=9.
0333                X(170)=28.
0334                Y(170)=7.
0335                X(171)=27.
0336                Y(171)=8.
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0337                X(172)=27.
0338                Y(172)=10.
0339                X(173)=32.
0340                Y(173)=13.
0341                X(174)=34.
0342                Y(174)=16.
0343                X(175)=34.
0344                Y( 75)=20.
0345                X(176)=16.
0346                Y(176)=11.
0347                X(177)=15.
0348                Y(177)=13.
0349                X(178)=12.
0350                Y(178)=15.
0351                X(179)=11.
0352                Y(179)=14.
0353                X(180)=12.
0354                Y(180)=12.
0355                X(181)=13.
0356                Y(181)=9.
0357                X(182)=15.
0358                Y(182)=6.
0359                X(183)=19.
0360                Y(183)=4.
0361                X(184)=22.
0362                Y(184)=4.
0363                X(185)=18.
0364                Y(185)=9.
0365                X(186)=23.
0366                Y(186)=6.
0367                X(187)=19.
0368                Y(187)=4.
0369                X(188)=20.
0370                Y(188)=6.
0371                X(189)=17.
0372                Y(189)=5.
0373                X(190)=18.
0374                Y(190)=7.
0375                X(191)=31.
0376                Y(191)=5.
0377                X(192)=33.
0378                Y(192)=3.
0379                X(193)=33.
0380                Y( 93)=6.
0381                X(194)=35.
0382                Y(194)=5.
0383                X(195)=35.
0384                Y( 95)=7.
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0385                X(196)=36.
0386                Y(196)=6.
0387                X(197)=13.
0388                Y(197)=20.
0389                X(198)= 4.
0390                Y(198)=17.
0391                X(199)=18.
0392                Y(199)=12.
0393                X(200)= 7.
0394                Y(200)=11.
0395                X(201)= 4.
0396                Y(201)=11.
0397                X(202)=11.
0398                Y(202)=12.
0399                X(203)=4.
0400                Y(203)=16.
0401                X(204)=4.
0402                Y(204)=15.
0403                X(205)=5.
0404                Y(205)=13.
0405                X(206)=10.
0406                Y(206)=9.
0407                X(207)=15.
0408                Y(207)=8.
0409                X(208)=20.
0410                Y(208)=9.
0411                X(209)=21.
0412                Y(209)=8.
0413                X(210)=20.
0414                Y(210)=6.
0415                X(211)=19.
0416                Y(211)=3.
0417                X(212)=21.
0418                Y(212)=2.
0419                X(213)=30.
0420                Y(213)=2.
0421                X(214)=34.
0422                Y(214)=3.
0423                X(215)=37.
0424                Y(215)=6.
0425                X(216)=37.
0426                Y(216)=8.
0427                X(217)=35.
0428                Y(217)=8.
0429                X(218)=29.
0430                Y(218)=7.
0431                X(219)=27.
0432                Y(219)=8.
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0433                X(220)=27.
0434                Y(220)=10.
0435                X(221)=32.
0436                Y(221)=13.
0437                X(222)=34.
0438                Y(222)=16.
0439                X(223)=34.
0440                Y(223)=20.
0441                X(224)= 2.
0442                Y(224)=8.
0443                X(225)=12.
0444                Y(225)=6.
0445                X(226)=20.
0446                Y(226)=4.
0447                X(227)=27.
0448                Y(227)=8.
0449                X(228)=31.
0450                Y(228)=9.
0451                X(229)=34.
0452                Y(229)=9.
0453                X(230)=34.
0454                Y(230)=8.
0455                X(231)=31.
0456                Y(231)=8.
0457                X(232)=32.
0458                Y(232)=7.
0459                X(233)=32.
0460                Y(233)=4.
0461                X(234)=33.
0462                Y(234)=3.
0463                X(235)=34.
0464                Y(235)=6.
0465                X(236)=35.
0466                Y(236)=4.
0467                X(237)=35.
0468                Y(237)=7.
0469                X(238)=36.
0470                Y(238)=5.
0471                X(239)=13.
0472                Y(239)=20.
0473                X(240)=14.
0474                Y(240)=17.
0475                X(241)=17.
0476                Y(241)= 2.
0477                X(242)=12.
0478                Y(242)= 2.
0479                X(243)=7.
0480                Y(243)=15.
```

```
0481                X(244)=4.
0482                Y(244)=17.
0483                X(245)=4.
0484                Y(245)=15.
0485                X(246)=9.
0486                Y(246)=10.
0487                X(247)=13.
0488                Y(247)=9.
0489                X(248)=12.
0490                Y(248)=10.
0491                X(249)=14.
0492                Y(249)=11.
0493                X(250)=12.
0494                Y(250)=12.
0495                X(251)=13.
0496                Y(251)=9.
0497                X(252)=12.
0498                Y(252)=8.
0499                X(253)=12.
0500                Y(253)=6.
0501                X(254)=13.
0502                Y(254)=5.
0503                X(255)=22.
0504                Y(255)=2.
0505                X(256)=26.
0506                Y(256)=2.
0507                X(257)=24.
0508                Y(257)=3.
0509                X(258)=28.
0510                Y(258)=4.
0511                X(259)=25.
0512                Y(259)=6.
0513                X(260)=23.
0514                Y(260)=7.
0515                X(261)=20.
0516                Y(261)=7.
0517                X(262)=21.
0518                Y(262)=9.
0519                X(263)=23.
0520                Y(263)=9.
0521                X(264)=23.
0522                Y(264)=7.
0523                X(265)=28.
0524                Y(265)=3.
0525                X(266)=31.
0526                Y(266)=3.
0527                X(267)=34.
0528                Y(267)=4.
```

```
0529                X(268)=37.
0530                Y(268)=8.
0531                X(269)=38.
0532                Y(269)=10.
0533                X(270)=37.
0534                Y(270)=[illegible].
0535                X(271)=35.
0536                Y(271)=11.
0537                X(272)=30.
0538                Y(272)=8.
0539                X(273)=27.
0540                Y(273)=7.
0541                X(274)=27.
0542                Y(274)=10.
0543                X(275)=32.
0544                Y(275)=13.
0545                X(276)=34.
0546                Y(276)=16.
0547                X(277)=34.
0548                Y(277)=20.
0549                X(278)=22.
0550                Y(278)=5.
0551                X(279)=22.
0552                Y(279)=2.
0553                X(280)=24.
0554                Y(280)=5.
0555                X(281)=24.
0556                Y(281)=2.
0557                X(282)=26.
0558                Y(282)=4.
0559                X(283)=26.
0560                Y(283)=2.
0561                X(284)=35.
0562                Y(284)=5.
0563                X(285)=32.
0564                Y(285)=7.
0565                X(286)=36.
0566                Y(286)=7.
0567                X(287)=35.
0568                Y(287)=8.
0569                X(287)=13.
0570                Y(287)=20.
0571                X(288)=14.
0572                Y(288)=17.
0573                X(289)= 6.
0574                Y(289)=13.
0575                X(290)=15.
0576                Y(290)=13.
```

```
0577                X(30 )=.3.
0578                Y(301)=12.
0579                X(302)=11.
0580                Y(302)=13.
0581                X(303)=10.
0582                Y(303)= 3.
0583                X(304)=8.
0584                Y(304)=12.
0585                X(305)=8.
0586                Y(305)=10.
0587                X(306)=11.
0588                Y(306)=5.
0589                X(307)=14.
0590                Y(307)=2.
0591                X(308)=17.
0592                Y(308)=2.
0593                X(309)=18.
0594                Y(309)=3.
0595                X(310)=18.
0596                Y(310)=4.
0597                X(311)=15.
0598                Y(311)=7.
0599                X(312)=15.
0600                Y(312)=8.
0601                X(313)=18.
0602                Y(313)=10.
0603                X(314)=19.
0604                Y(314)=9.
0605                X(315)=21.
0606                Y(315)=9.
0607                X(316)=26.
0608                Y(316)=10.
0609                X(317)=26.
0610                Y(317)=9.
0611                X(318)=27.
0612                Y(318)=6.
0613                X(319)=32.
0614                Y(319)=6.
0615                X(320)=36.
0616                Y(320)=8.
0617                X(321)=38.
0618                Y(321)=10.
0619                X(322)=39.
0620                Y(322)=12.
0621                X(323)=39.
0622                Y(323)=15.
0623                X(324)=38.
0624                Y(324)=15.
```

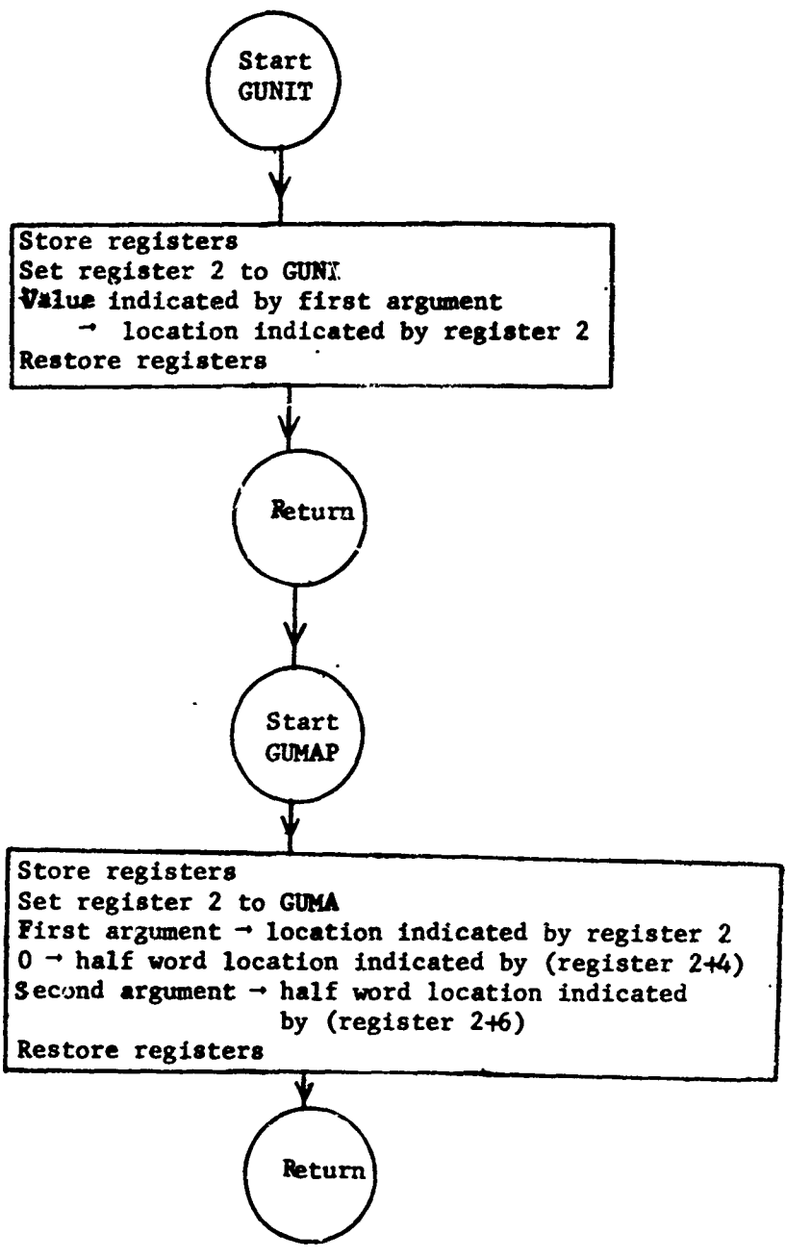
```
0625                X(325)=34.
0626                Y(325)=13.
0627                X(326)=32.
0628                Y(326)=10.
0629                X(327)=30.
0630                Y(327)=11.
0631                X(328)=30.
0632                Y(328)=12.
0633                X(329)=32.
0634                Y(329)=13.
0635                X(330)=34.
0636                Y(330)=16.
0637                X(331)=34.
0638                Y(331)=20.
0639                X(332)=9.
0640                Y(332)=13.
0641                X(333)=3.
0642                Y(333)=16.
0643                X(334)=3.
0644                Y(334)=15.
0645                X(335)=4.
0646                Y(335)=13.
0647                X(336)=7.
0648                Y(336)=11.
0649                X(337)=9.
0650                Y(337)=11.
0651                X(338)=13.
0652                Y(338)=7.
0653                X(339)=11.
0654                Y(339)=5.
0655                X(340)=14.
0656                Y(340)=5.
0657                X(341)=13.
0658                Y(341)=3.
0659                X(342)=15.
0660                Y(342)=4.
0661                X(343)=14.
0662                Y(343)=2.
0663                X(344)=36.
0664                Y(344)=12.
0665                X(345)=38.
0666                Y(345)=10.
0667                X(346)=35.
0668                Y(346)=10.
0669                X(347)=36.
0670                Y(347)=8.
0671                CALL SNOOP1
0672                RETURN
0673                END
```

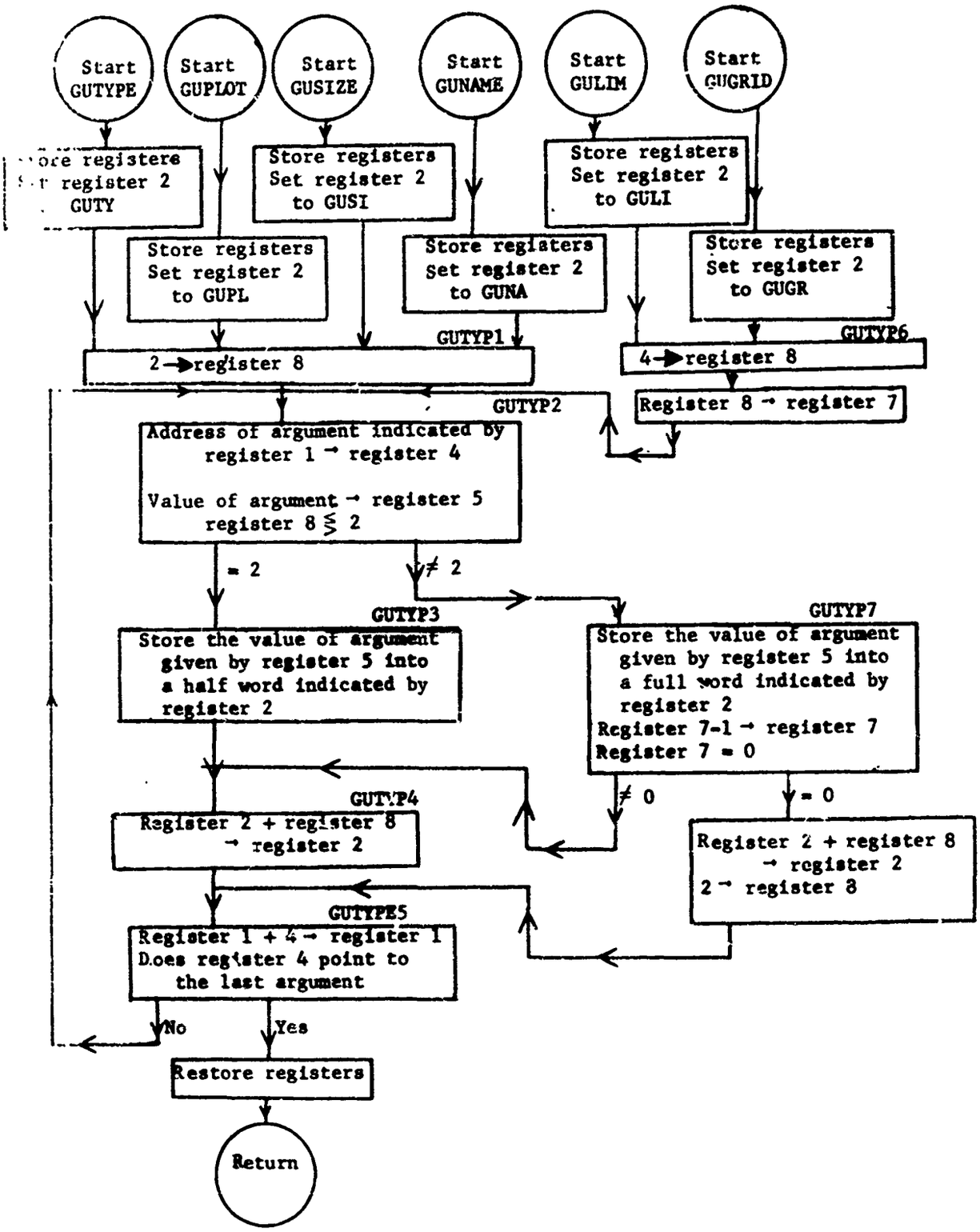
```
0001            SUBROUTINE SNOOP1
0002            COMMON Z1(20),Z2(20),Z3(20),Z4(20),Z5(20),Z6(40),Z7(20),Z8(20)
0003            COMMON X(350),Y(350),XC(5),YC(5),INAM(5)
0004            COMMON A(1000)
0005            DIMENSION       B(9),C(20)
0006            IYM=0
0007            CALL GUTYPE( )
0008            CALL GULIM(0.,0.,40.,75.)
0009            ISWA=0
0010            IDEL=25
0011         45 IKMI=
0012            IJMI=1
0013            IKMA=121
0014            IJMA=[illegible]
0015         48 ITYPE=1
0016            IDT=1
0017         50 CALL GUBUFF(A,1600)
0018            CALL GUMAP(B,2)
0019            CALL GUCHAN(C,80)
0020            CALL  GSIZE(IKMI,IJMI,IKMA,IJMA)
0021            CALL GUNAME(1)
0022            CALL GPDATA(0,X(1),1,Y(1),1,IYM,0,14,0)
0023            CALL GPDATA(0,X(15),1,Y(15),1,IYM,0,9,0)
0024            CALL GPDATA(0,X(24),1,Y(24),1,IYM,0,21,0)
0025            CALL GPDATA(0,X(45),1,Y(45),1,IYM,0,6,0)
0026            CALL GPDATA(0,X(5 ),  ,Y(5 ),1,IYM,0,[illegible],0)
0027            CALL GPDATA(0,X(55),1,Y(55),1,IYM,0,2,0)
0028            CALL GPDATA(0,X(57),1,Y(57),1,IYM,0,10,0)
0029            CALL GPDATA(0,X(67),1,Y(67),1,IYM,0,18,0)
0030            CALL GPDATA(0,X(85),1,Y(85),1,IYM,0,2,0)
0031            CALL GPDATA(0,X(87),1,Y(87),1,IYM,0,2,0)
0032            CALL GPDATA(0,X(89),1,Y(89),1,IYM,0,2,0)
0033         55 IF(ITYPE-2).[illegible]0,120,60
0034         60 IF(ITYPE-4)130,140,150
0035        110 CALL GUNAME(1,1)
0036            CALL GPDATA(0,X(91),1,Y(91),1,IYM,0,30,0)
0037            CALL GPDATA(0,X( 21),.,Y(12,),1,IYM,0,8,0)
0038            CALL GPDATA(0,X(129),1,Y(129),1,IYM,0,6,0)
0039            CALL GPDATA(0,X(135),1,Y(135),1,IYM,0,2,0)
0040            CALL GPDATA(0,X(137),1,Y(137),1,IYM,0,2,0)
0041            CALL GPDATA(0,X(139),1,Y(139),1,IYM,0,2,0)
0042            CALL GPDATA(0,X(141),1,Y(141),1,IYM,0,2,0)
0043            CALL GPDATA(0,X(143),1,Y(143),1,IYM,0,2,0)
0044            GO TO 200
0045        120 CALL GUNAME(1,1)
0046            CALL GPDATA(0,X(150),1,Y(150),1,IYM,0,26,0)
0047            CALL GPDATA(0,X(176),1,Y(176),1,IYM,0,5,0)
0048            CALL GPDATA(0,X(181),1,Y(181),1,IYM,0,4,0)
```

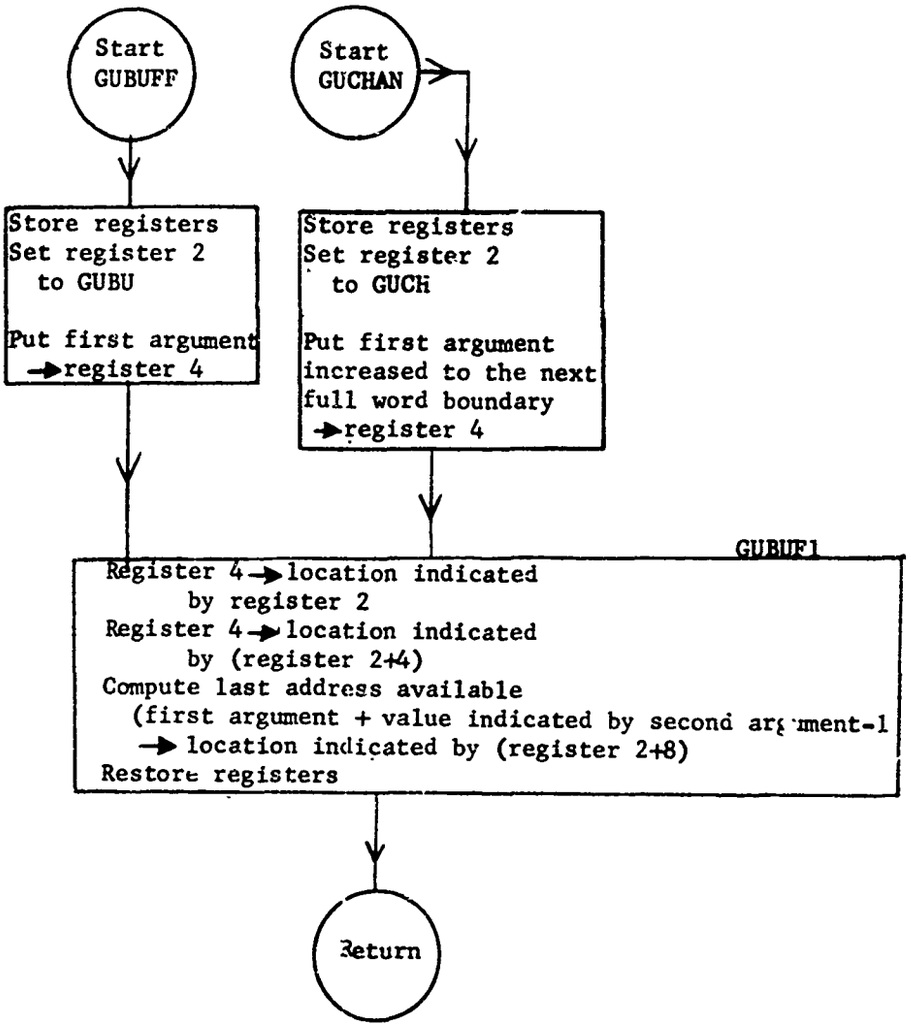
```
0049              CALL GPDATA(0,X(185),1,Y(185),1,IYM,0,2,0)
0050              CALL GPDATA(0,X(187),1,Y(187),1,IYM,0,2,0)
0051              CALL GPDATA(0,X(189),1,Y(189),1,IYM,0,2,0)
0052              CALL GPDATA(0,X(191),1,Y(191),1,IYM,0,2,0)
0053              CALL GPDATA(0,X(193),1,Y(193),1,IYM,0,2,0)
0054              CALL GPDATA(0,X(195),1,Y(195),1,IYM,0,2,0)
0055              GO TO 200
0056          130 CALL GUNAME(1,1)
0057              CALL GPDATA(0,X(197),1,Y(197),1,IYM,0,27,0)
0058              CALL GPDATA(0,X(224),1,Y(224),1,IYM,0,3,0)
0059              CALL GPDATA(0,X(227),1,Y(227),1,IYM,0,4,0)
0060              CALL GPDATA(0,X(231),1,Y(231),1,IYM,0,2,0)
0061              CALL GPDATA(0,X(233),1,Y(233),1,IYM,0,2,0)
0062              CALL GPDATA(0,X(235),1,Y(235),1,IYM,0,2,0)
0063              CALL GPDATA(0,X(237),1,Y(237),1,IYM,0,2,0)
0064              GO TO 200
0065          140 CALL GUNAME(1,1)
0066              CALL GPDATA(0,X(239),1,Y(239),1,IYM,0,12,0)
0067              CALL GPDATA(0,X(251),1,Y(251),1,IYM,0,14,0)
0068              CALL GPDATA(0,X(265),1,Y(265),1,IYM,0,13,0)
0069              CALL GPDATA(0,X(278),1,Y(278),1,IYM,0,2,0)
0070              CALL GPDATA(0,X(280),1,Y(280),1,IYM,0,2,0)
0071              CALL GPDATA(0,X(282),1,Y(282),1,IYM,0,2,0)
0072              CALL GPDATA(0,X(284),1,Y(284),1,IYM,0,2,0)
0073              CALL GPDATA(0,X(286),1,Y(286),1,IYM,0,2,0)
0074              GO TO 200
0075          150 CALL GUNAME(1,1)
0076              CALL GPDATA(0,X(297),1,Y(297),1,IYM,0,35,0)
0077              CALL GPDATA(0,X(332),1,Y(332),1,IYM,0,6,0)
0078              CALL GPDATA(0,X(338),1,Y(338),1,IYM,0,2,0)
0079              CALL GPDATA(0,X(340),1,Y(340),1,IYM,0,2,0)
0080              CALL GPDATA(0,X(342),1,Y(342),1,IYM,0,2,0)
0081              CALL GPDATA(0,X(344),1,Y(344),1,IYM,0,2,0)
0082              CALL GPDATA(0,X(346),1,Y(346),1,IYM,0,2,0)
0083          200 CALL GDISPL(10000)
0084              CALL GOPCP
0085              IF(ISWA-1)202,210,215
0086          202 WAIT=0.
0087          204 WAIT=WAIT+1.
0088          205 CALL GPPOSN (0,400)
0089              CALL GPTEXT (0,Z2(1),19)
0090              CALL GPPOSN (380,400)
0091              CALL GPTEXT (1,Z2(8),7)
0092              ISWA=1
0093              GO TO 200
0094          210 WAIT=0.
0095          212 WAIT=WAIT+1.
0096          215 WAIT=0.
```

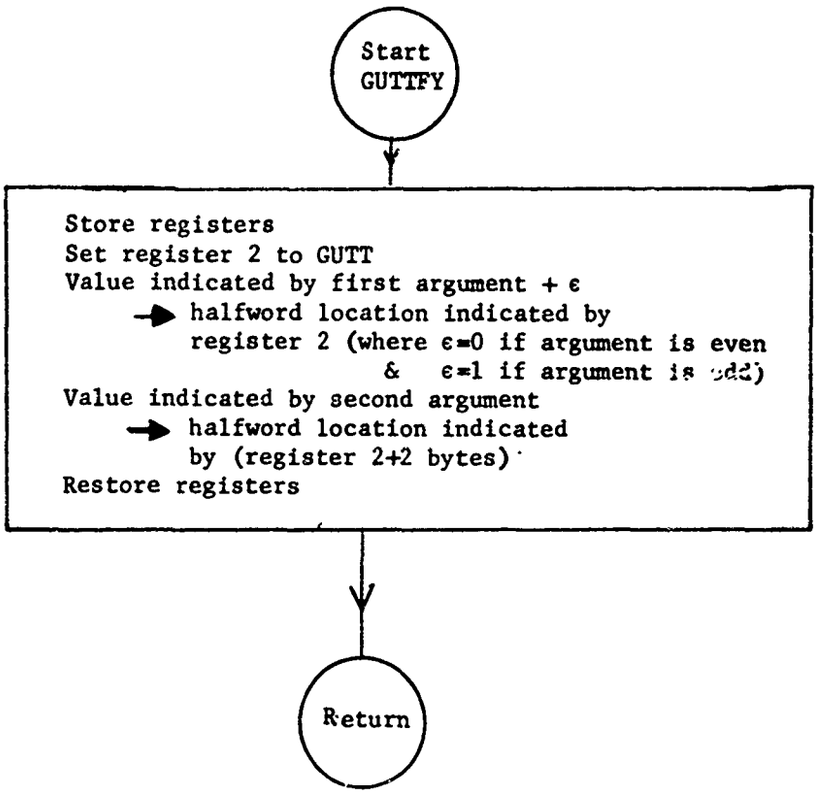
```
0097          217 WAIT=WAIT+1.
0098          220 IKMI=IKMI+IDEL
0099              IKMA=IKMA+IDEL
0100              IF(IKMA-990)225,225,400
0101          225 ISWA=2
0102              ITYPE=ITYPE+IDT
0103              IF(ITYPE-6)230,240,240
0104          230 IF(ITYPE)240,240,50
0105          240 IDT=-IDT
0106              ITYPE=ITYPE+IDT
0107              GO TO 225
0108          400 RETURN
0109              END
```

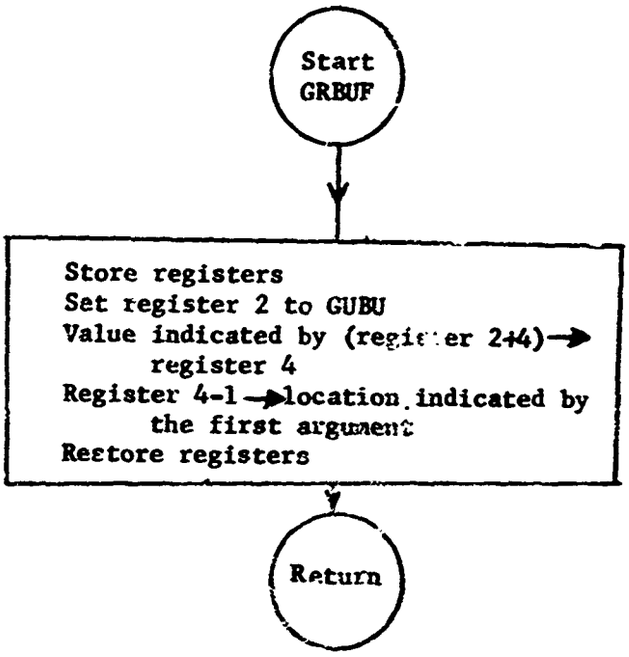
VI. FLOW CHARTS



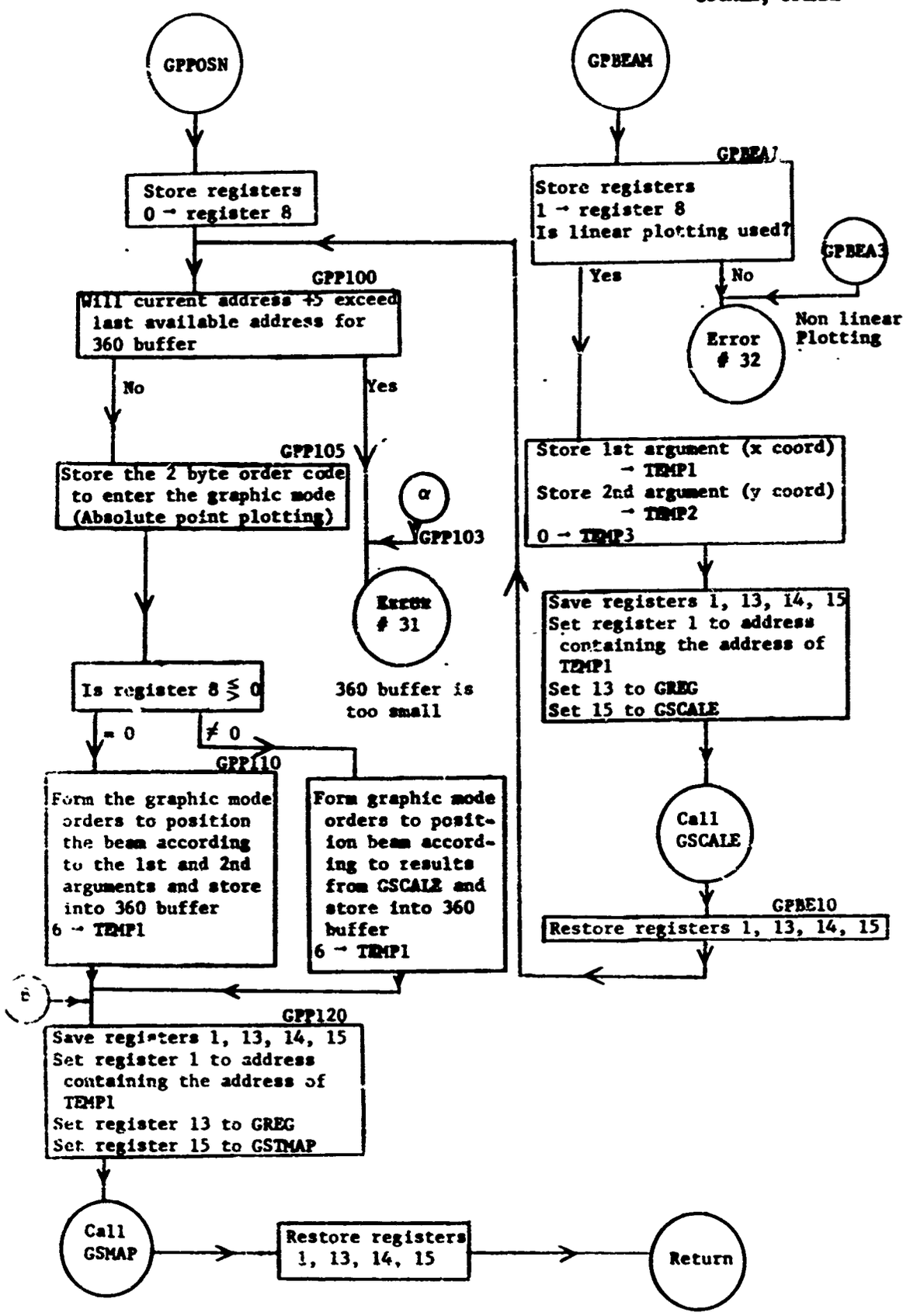

Start GUTYPE
Start GUPLOT
Start GUSIZE
Start GUNAME
Start GULIM
Start GUGRID
Store registers Set register 2 to GUTY
Store registers Set register 2 to GUPL
Store registers Set register 2 to GUSI
Store registers Set register 2 to GUNA
Store registers Set register 2 to GULI
Store registers Set register 2 to GUGR
GUTYP1
2 → register 8
GUTYP6
4 → register 8
Register 8 → register 7
GUTYP2
Address of argument indicated by register 1 → register 4
Value of argument → register 5
register 8 ≶ 2
= 2
≠ 2
GUTYP3
Store the value of argument given by register 5 into a half word indicated by register 2
GUTYP7
Store the value of argument given by register 5 into a full word indicated by register 2
Register 7-1 → register 7
Register 7 = 0
≠ 0
= 0
GUTYP4
Register 2 + register 8 → register 2
Register 2 + register 8 → register 2
2 → register 8
GUTYPE5
Register 1 + 4 → register 1
Does register 4 point to the last argument
No
Yes
Restore registers
Return

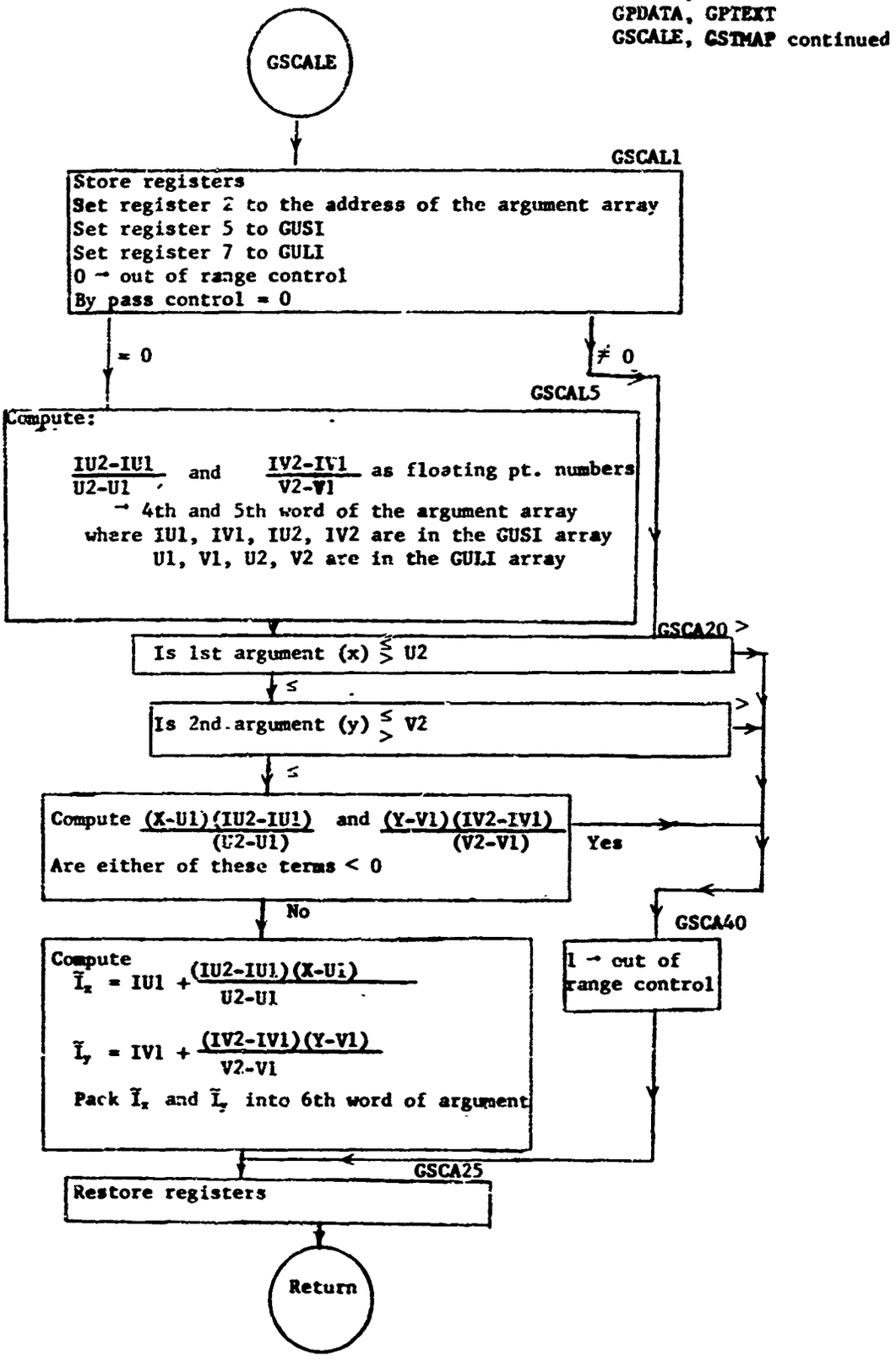

Start
GUBUFF
Start
GUCHAN
Store registers
Set register 2
to GUBU
Put first argument
→register 4
Store registers
Set register 2
to GUCH
Put first argument
increased to the next
full word boundary
→register 4
GUBUF1
Register 4→location indicated
by register 2
Register 4→location indicated
by (register 2+4)
Compute last address available
(first argument + value indicated by second argument-1
→location indicated by (register 2+8)
Restore registers
Return

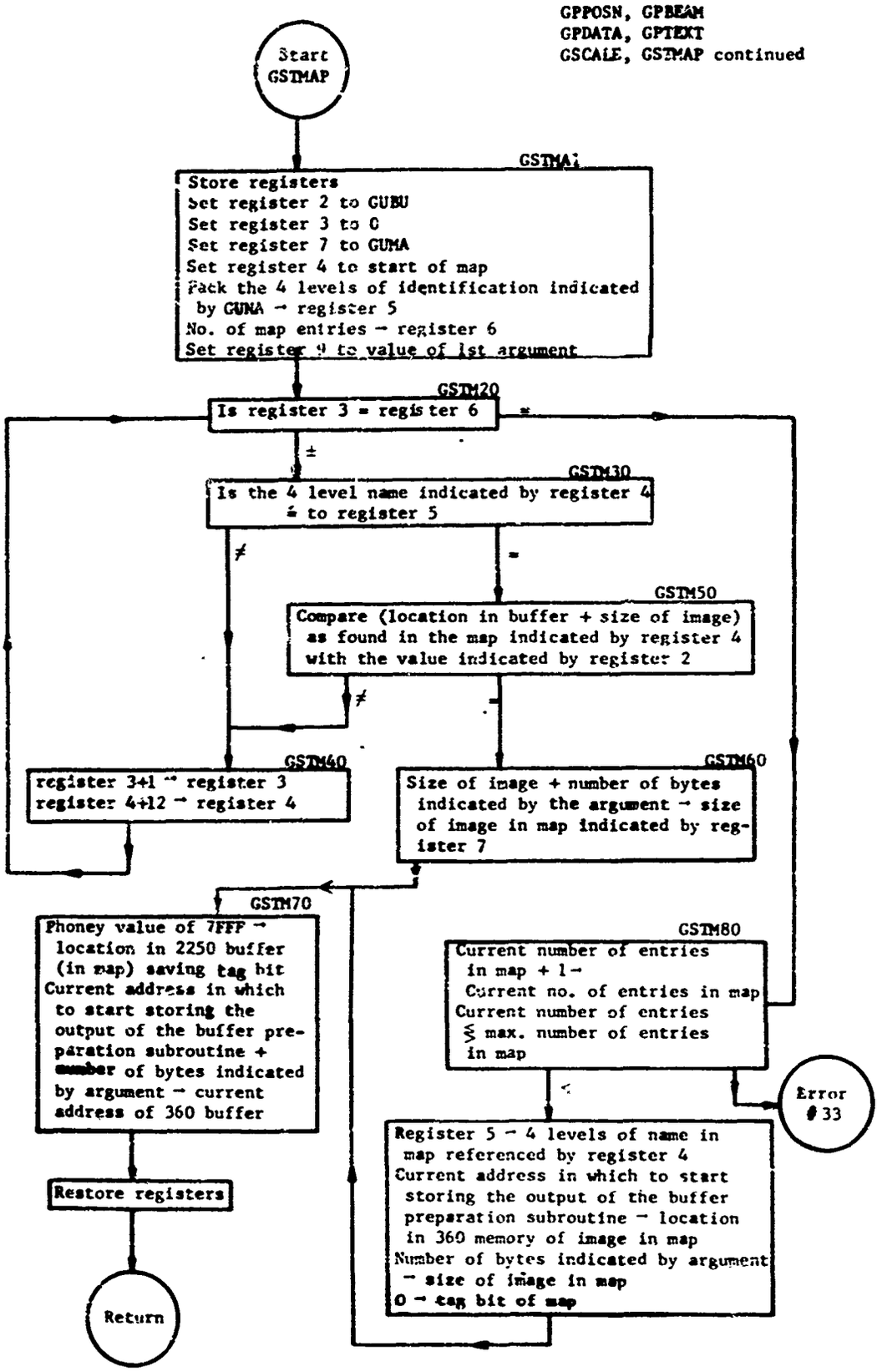

Start
GUTTFY
Store registers
Set register 2 to GUTT
Value indicated by first argument + ε
→ halfword location indicated by
register 2 (where ε=0 if argument is even
& ε=1 if argument is odd)
Value indicated by second argument
→ halfword location indicated
by (register 2+2 bytes)
Restore registers
Return

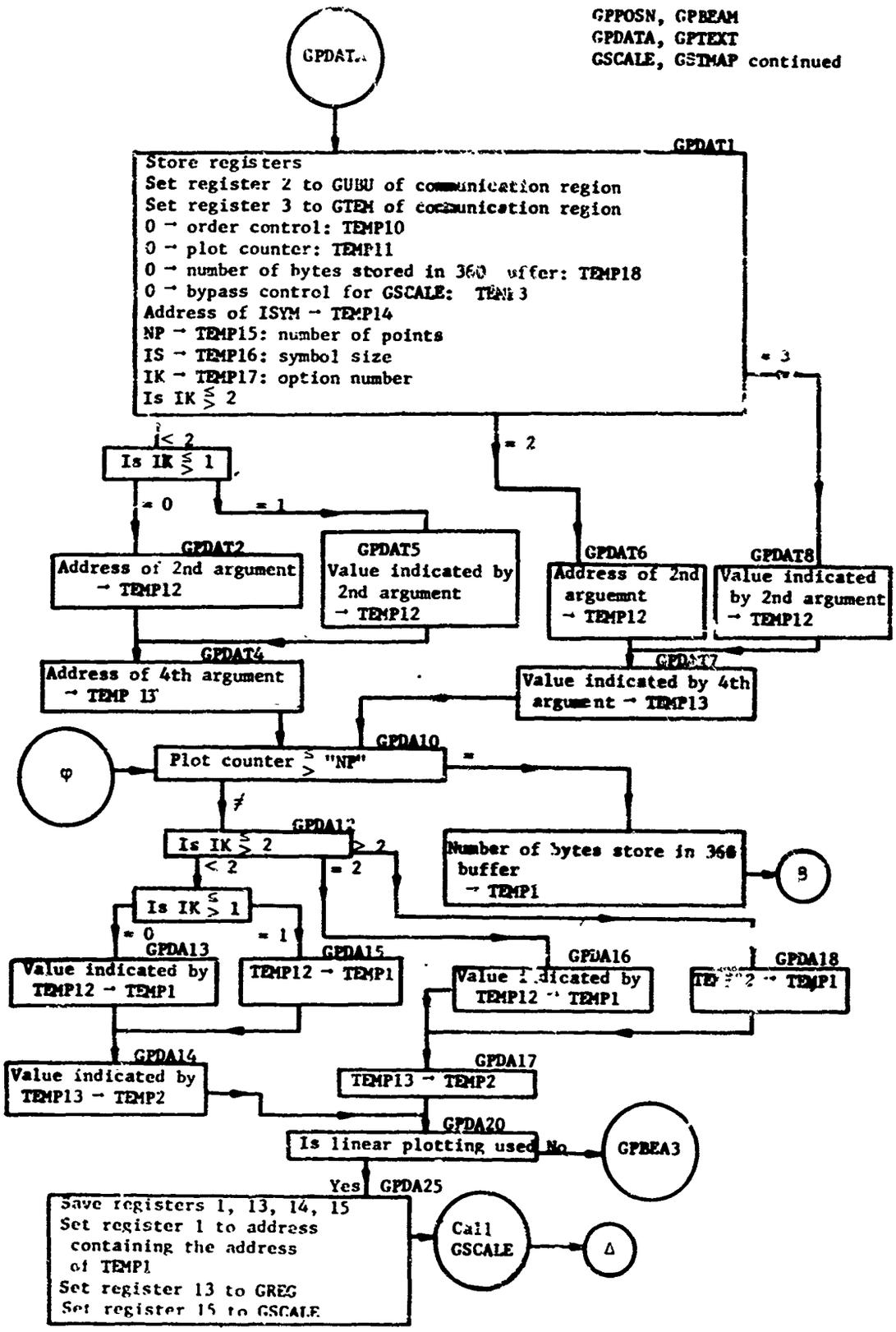

Start
GRBUF
Store registers
Set register 2 to GUBU
Value indicated by (register 2+4)→
register 4
Register 4-1→location indicated by
the first argument
Restore registers
Return

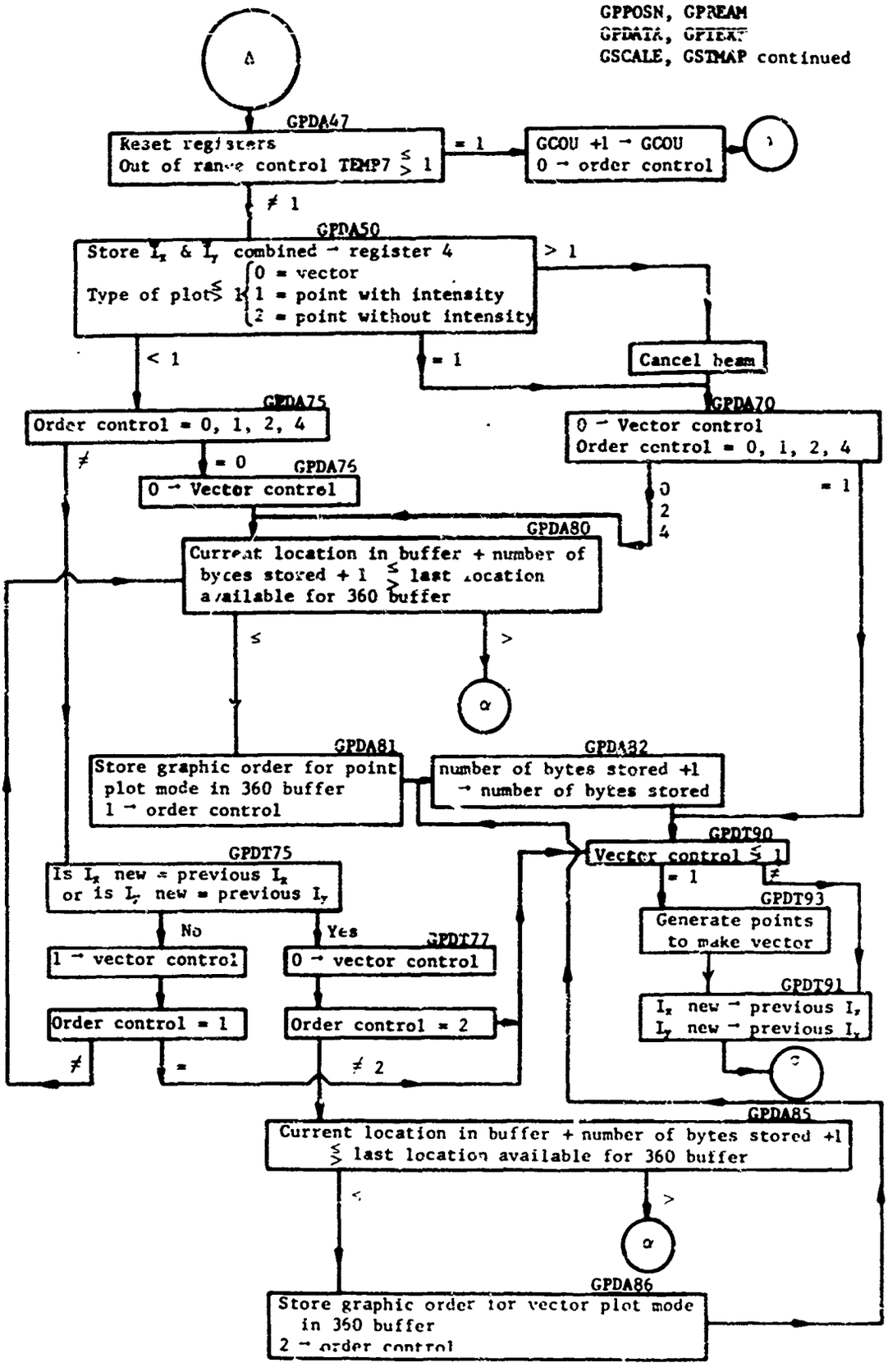
GPPOSN, GPBEAM
GPDATA, GPTEXT
GSCALE, GSTMAP

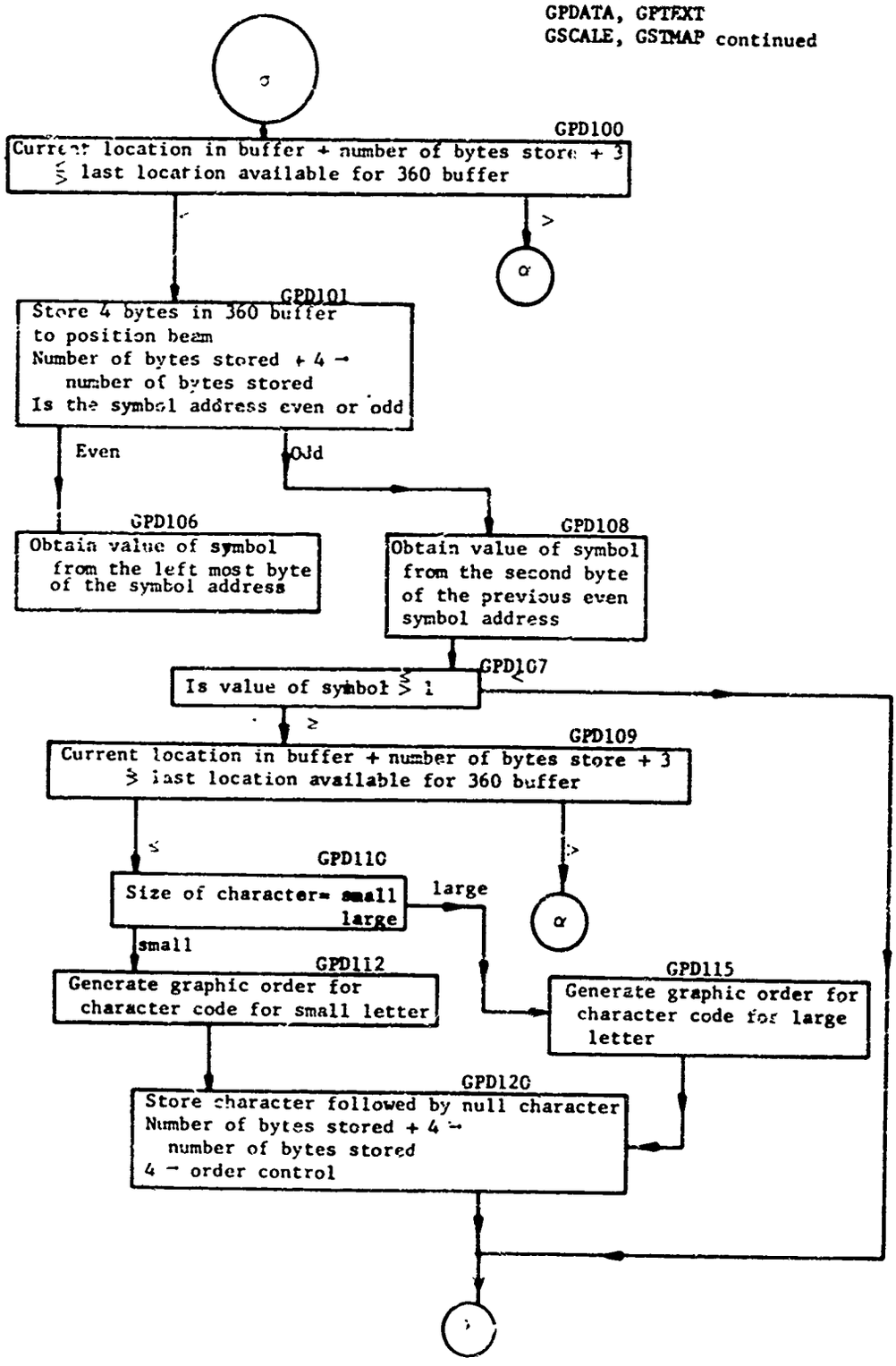


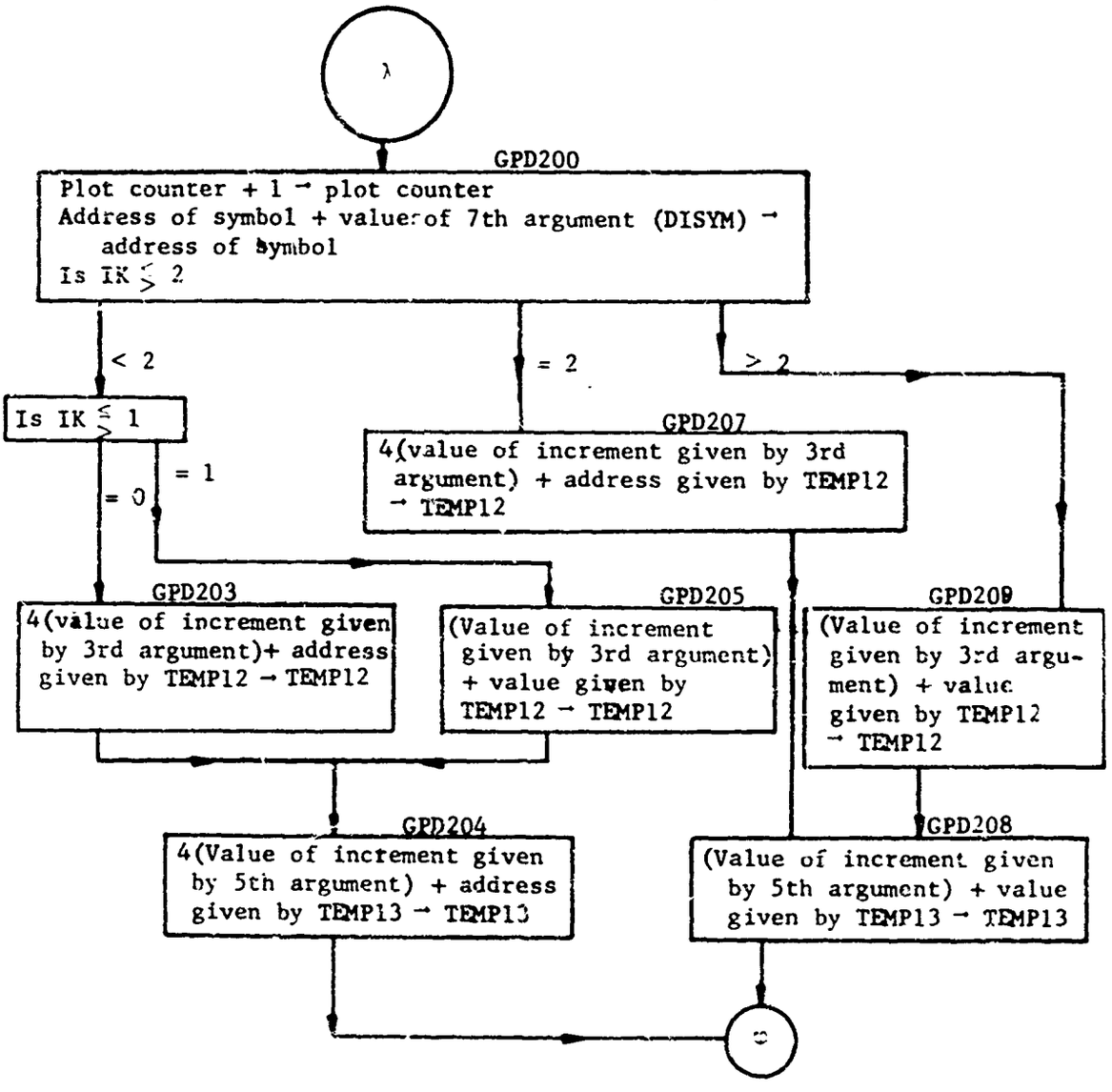

GSCALE
GSCAL1
Store registers
Set register 2 to the address of the argument array
Set register 5 to GUSI
Set register 7 to GULI
0 → out of range control
By pass control = 0
= 0
≠ 0
GSCAL5
Compute:
(IU2-IU1)/(U2-U1) and (IV2-IV1)/(V2-V1) as floating pt. numbers
→ 4th and 5th word of the argument array
where IU1, IV1, IU2, IV2 are in the GUSI array
U1, V1, U2, V2 are in the GULI array
GSCA20
Is 1st argument (x) ≤ > U2
≤
Is 2nd argument (y) ≤ > V2
>
≤
Compute (X-U1)(IU2-IU1)/(U2-U1) and (Y-V1)(IV2-IV1)/(V2-V1)
Are either of these terms < 0
Yes
No
GSCA40
1 → out of range control
Compute
Ĩx = IU1 + (IU2-IU1)(X-U1)/(U2-U1)
Ĩy = IV1 + (IV2-IV1)(Y-V1)/(V2-V1)
Pack Ĩx and Ĩy into 6th word of argument
GSCA25
Restore registers
Return

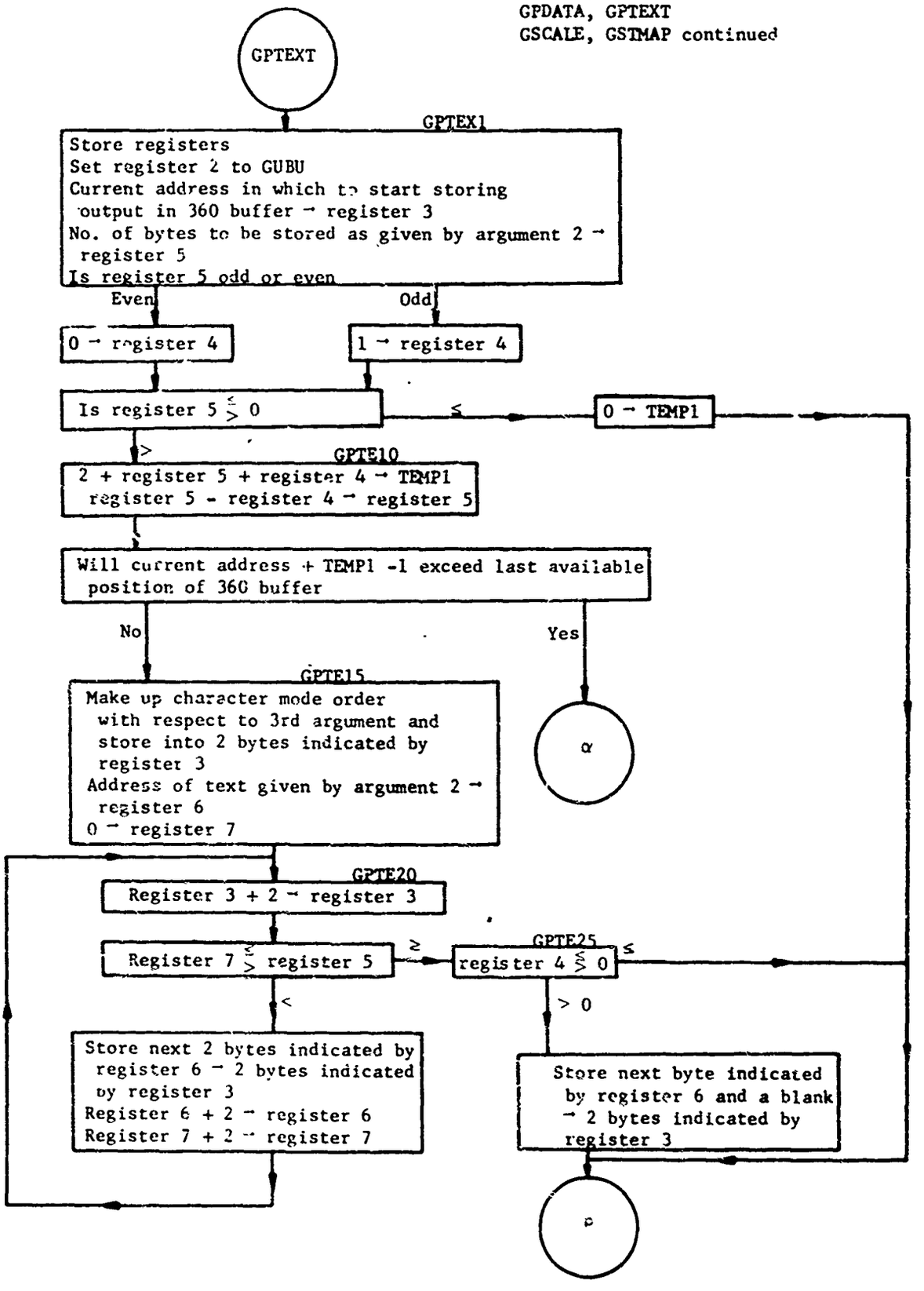

Start GSTMAP
GSTMA1
Store registers
Set register 2 to GUBU
Set register 3 to 0
Set register 7 to GUMA
Set register 4 to start of map
Pack the 4 levels of identification indicated by GUNA → register 5
No. of map entries → register 6
Set register 9 to value of 1st argument
GSTM20
Is register 3 = register 6
=
±
GSTM30
Is the 4 level name indicated by register 4 = to register 5
≠
=
GSTM50
Compare (location in buffer + size of image) as found in the map indicated by register 4 with the value indicated by register 2
≠
=
GSTM40
register 3+1 → register 3
register 4+12 → register 4
GSTM60
Size of image + number of bytes indicated by the argument → size of image in map indicated by register 7
GSTM70
Phoney value of 7FFF → location in 2250 buffer (in map) saving tag bit
Current address in which to start storing the output of the buffer preparation subroutine + number of bytes indicated by argument → current address of 360 buffer
GSTM80
Current number of entries in map + 1 → Current no. of entries in map
Current number of entries ≤ max. number of entries in map
Error #33
Register 5 → 4 levels of name in map referenced by register 4
Current address in which to start storing the output of the buffer preparation subroutine → location in 360 memory of image in map
Number of bytes indicated by argument → size of image in map
0 → tag bit of map
Restore registers
Return


GPDAT..
GPDAT1
Store registers
Set register 2 to GUBU of communication region
Set register 3 to GTEM of communication region
0 → order control: TEMP10
0 → plot counter: TEMP11
0 → number of bytes stored in 360 buffer: TEMP18
0 → bypass control for GSCALE: TEMP3
Address of ISYM → TEMP14
NP → TEMP15: number of points
IS → TEMP16: symbol size
IK → TEMP17: option number
Is IK ≤ > 2
= 3
= 2
i< 2
Is IK ≤ > 1
= 0
= 1
GPDAT2
Address of 2nd argument → TEMP12
GPDAT5
Value indicated by 2nd argument → TEMP12
GPDAT6
Address of 2nd arguemnt → TEMP12
GPDAT8
Value indicated by 2nd argument → TEMP12
GPDAT4
Address of 4th argument → TEMP 13
GPDAT7
Value indicated by 4th argument → TEMP13
φ
GPDA10
Plot counter ≤ > "NP"
=
≠
GPDA12
Is IK ≤ > 2
< 2
= 2
> 2
Number of bytes store in 360 buffer → TEMP1
9
Is IK ≤ > 1
= 0
= 1
GPDA13
Value indicated by TEMP12 → TEMP1
GPDA15
TEMP12 → TEMP1
GPDA16
Value indicated by TEMP12 → TEMP1
GPDA18
TEMP2 → TEMP1
GPDA14
Value indicated by TEMP13 → TEMP2
GPDA17
TEMP13 → TEMP2
GPDA20
Is linear plotting used
No
GPBEA3
Yes
GPDA25
Save registers 1, 13, 14, 15
Set register 1 to address containing the address of TEMP1
Set register 13 to GREG
Set register 15 to GSCALE
Call GSCALE
Δ


A
GPDA47
Reset registers
Out of range control TEMP7 ≤ > 1
= 1
GCOU +1 → GCOU
0 → order control
1
≠ 1
GPDA50
Store Ix & Iy combined → register 4
Type of plot ≤ > 1
0 = vector
1 = point with intensity
2 = point without intensity
> 1
< 1
= 1
Cancel beam
GPDA75
Order control = 0, 1, 2, 4
GPDA70
0 → Vector control
Order control = 0, 1, 2, 4
≠
= 0
GPDA76
0 → Vector control
0
2
4
= 1
GPDA80
Current location in buffer + number of byces stored + 1 ≤ > last location available for 360 buffer
≤
>
α
GPDA81
Store graphic order for point plot mode in 360 buffer
1 → order control
GPDA82
number of bytes stored +1
→ number of bytes stored
GPDT90
Vector control ≤ 1
= 1
≠
GPDT75
Is Ix new = previous Ix
or is Iy new = previous Iy
No
Yes
GPDT77
GPDT93
Generate points to make vector
1 → vector control
0 → vector control
GPDT91
Ix new → previous Ix
Iy new → previous Iy
Order control = 1
Order control = 2
≠
=
≠ 2
2
GPDA85
Current location in buffer + number of bytes stored +1 ≤ > last location available for 360 buffer
≤
>
α
GPDA86
Store graphic order for vector plot mode in 360 buffer
2 → order control


GPD100
Current location in buffer + number of bytes store + 3 ≤ last location available for 360 buffer
>
GPD101
Store 4 bytes in 360 buffer to position beam
Number of bytes stored + 4 → number of bytes stored
Is the symbol address even or odd
Even
Odd
GPD106
Obtain value of symbol from the left most byte of the symbol address
GPD108
Obtain value of symbol from the second byte of the previous even symbol address
GPD107
Is value of symbol ≥ 1
≥
GPD109
Current location in buffer + number of bytes store + 3 ≥ last location available for 360 buffer
≤
>
GPD110
Size of character= small large
large
small
GPD112
Generate graphic order for character code for small letter
GPD115
Generate graphic order for character code for large letter
GPD120
Store character followed by null character
Number of bytes stored + 4 → number of bytes stored
4 → order control


λ
GPD200
Plot counter + 1 → plot counter
Address of symbol + value of 7th argument (DISYM) → address of symbol
Is IK ≤ > 2
< 2
= 2
> 2
Is IK ≤ > 1
= 0
= 1
GPD207
4(value of increment given by 3rd argument) + address given by TEMP12 → TEMP12
GPD203
4(value of increment given by 3rd argument)+ address given by TEMP12 → TEMP12
GPD205
(Value of increment given by 3rd argument) + value given by TEMP12 → TEMP12
GPD209
(Value of increment given by 3rd argument) + value given by TEMP12 → TEMP12
GPD204
4(Value of increment given by 5th argument) + address given by TEMP13 → TEMP13
GPD208
(Value of increment given by 5th argument) + value given by TEMP13 → TEMP13
C


GPTEXT
GPTEX1
Store registers
Set register 2 to GUBU
Current address in which to start storing output in 360 buffer → register 3
No. of bytes to be stored as given by argument 2 → register 5
Is register 5 odd or even
Even
Odd
0 → register 4
1 → register 4
Is register 5 ≤ > 0
≤
0 → TEMP1
>
GPTE10
2 + register 5 + register 4 → TEMP1
register 5 - register 4 → register 5
Will current address + TEMP1 -1 exceed last available position of 360 buffer
No
Yes
GPTE15
Make up character mode order with respect to 3rd argument and store into 2 bytes indicated by register 3
Address of text given by argument 2 → register 6
0 → register 7
α
GPTE20
Register 3 + 2 → register 3
Register 7 ≤ > register 5
≥
GPTE25
register 4 ≤ > 0
≤
<
> 0
Store next 2 bytes indicated by register 6 → 2 bytes indicated by register 3
Register 6 + 2 → register 6
Register 7 + 2 → register 7
Store next byte indicated by register 6 and a blank → 2 bytes indicated by register 3
β

Assignment of temporary storage for GSCALE

TEMP1 : GTEM + 0 bytes : X floating point
TEMP2 : GTEM + 4 bytes : Y floating point } INPUT
TEMP3 : GTEM + 8 bytes : control to bypass

TEMP4 : GTEM + 12 bytes : $\frac{IU_2 - IU_1}{U_2 - U_1}$ floating point

TEMP5 : GTEM + 16 bytes : $\frac{IV_2 - IV_1}{V_2 - V_1}$ floating point

TEMP6 : GTEM + 20 bytes : $\tilde{I}_x$ & $\tilde{I}_y$ combined

TEMP7 : GTEM + 24 bytes : Out of range control

TEMP8 : GTEM + 28 bytes : $IU_2 - IU_1$; $\tilde{I}_x$ unnormalized F. P.

TEMP9 : GTEM + 32 bytes : $IV_2 - IV_1$; $\tilde{I}_y$ unnormalized F.P.

Assignment of temporary storage for GPDATA in addition to GSCALE

TEMP10 : GTEM + 36 bytes : order control

TEMP11 : GTEM + 40 bytes : plot counter

TEMP12 : GTEM + 44 bytes : address R value R address R value R

TEMP13 : GTEM + 48 bytes : address S address S value S value S

TEMP14 : GTEM + 52 bytes : address ISYM

TEMP15 : GTEM + 56 bytes : value NP

TEMP16 : GTEM + 60 bytes : value IS

TEMP17 : GTEM + 64 bytes : value IK

TEMP18 : GTEM + 68 bytes : number of bytes stored

TEMP19 : GTEM + 72 bytes : vector control

TEMP20 : GTEM + 76 bytes : previous $\tilde{I}_x$

TEMP21 : GTEM + 80 bytes : previous $\tilde{I}_y$

TEMP22 : GTEM + 84 bytes : $\tilde{I}_x$ old floating point

TEMP23 : GTEM + 88 bytes : $\tilde{I}_y$ old floating point

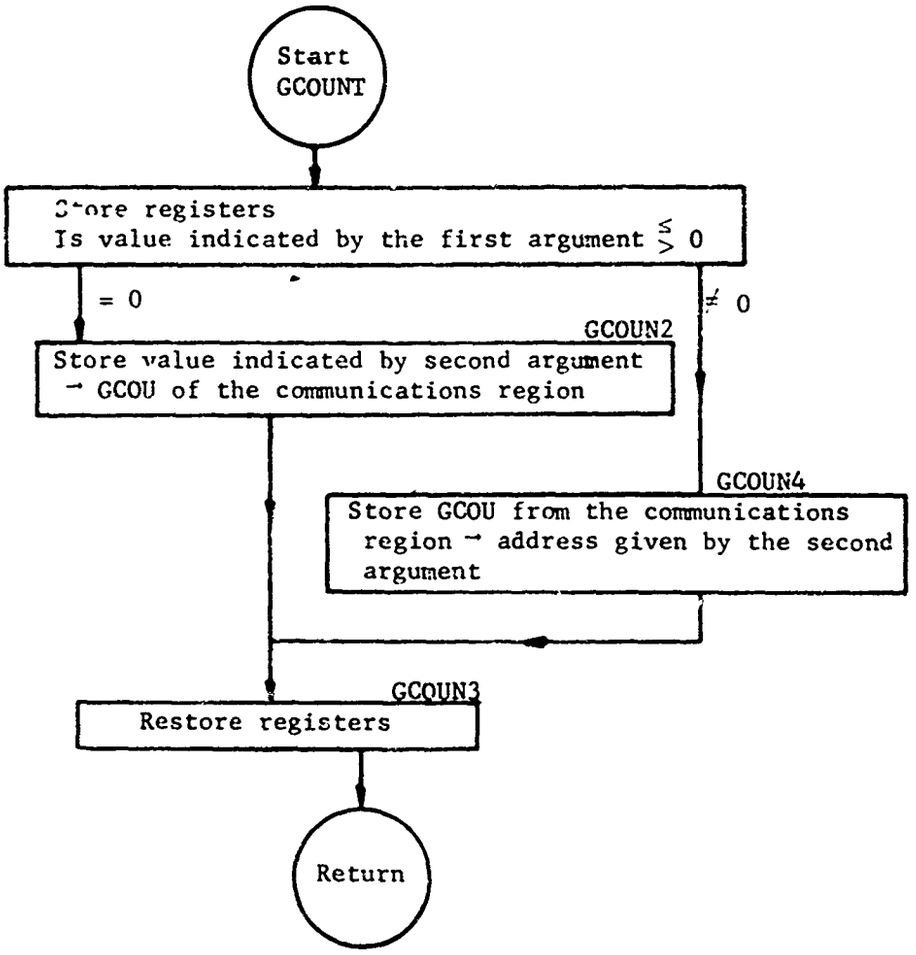
TEMP24 : GTEM + 92 bytes : $\tilde{I}_x$ new floating point

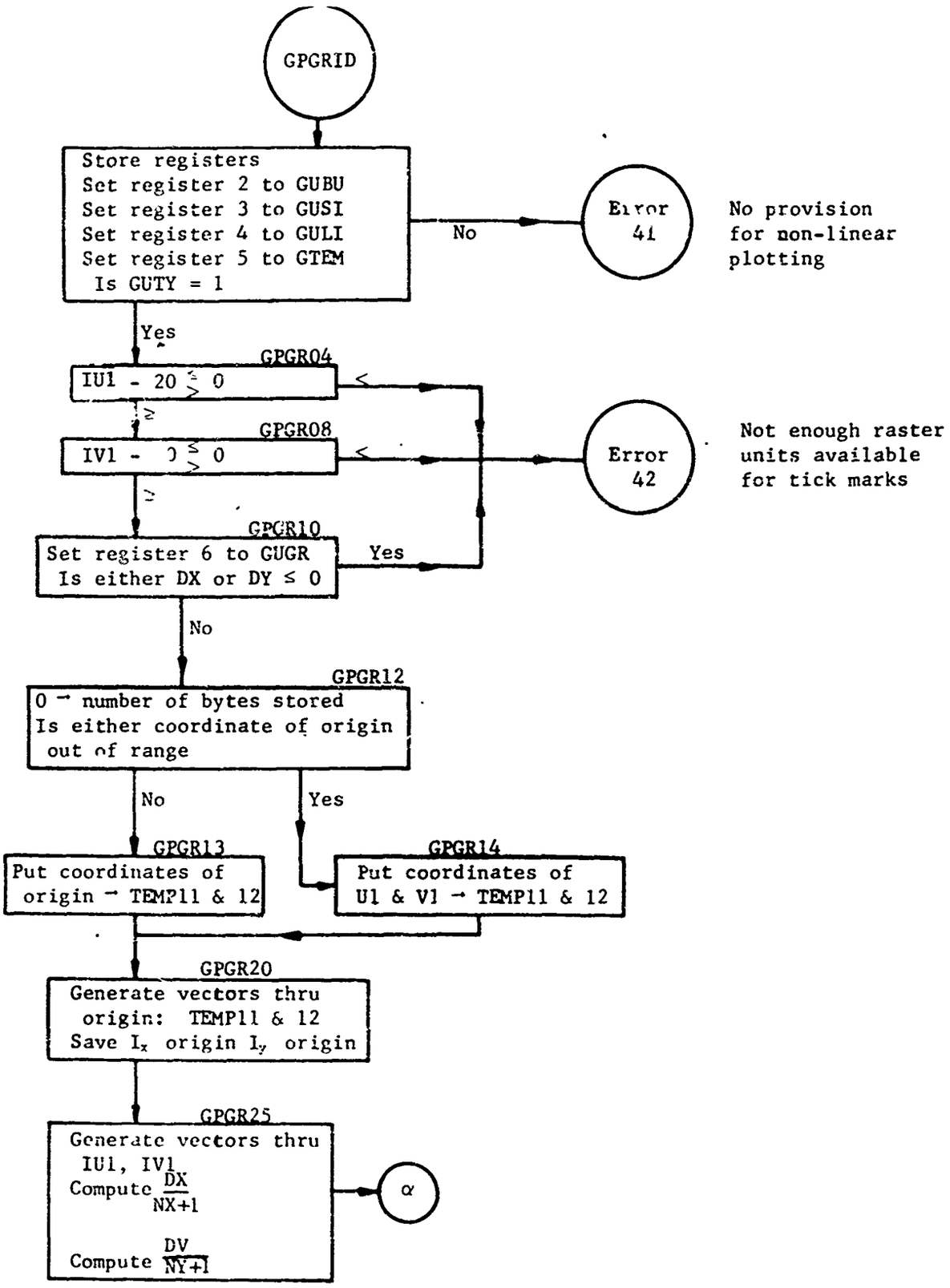
TEMP25 : GTEM + 96 bytes : $\tilde{I}_y$ new floating point

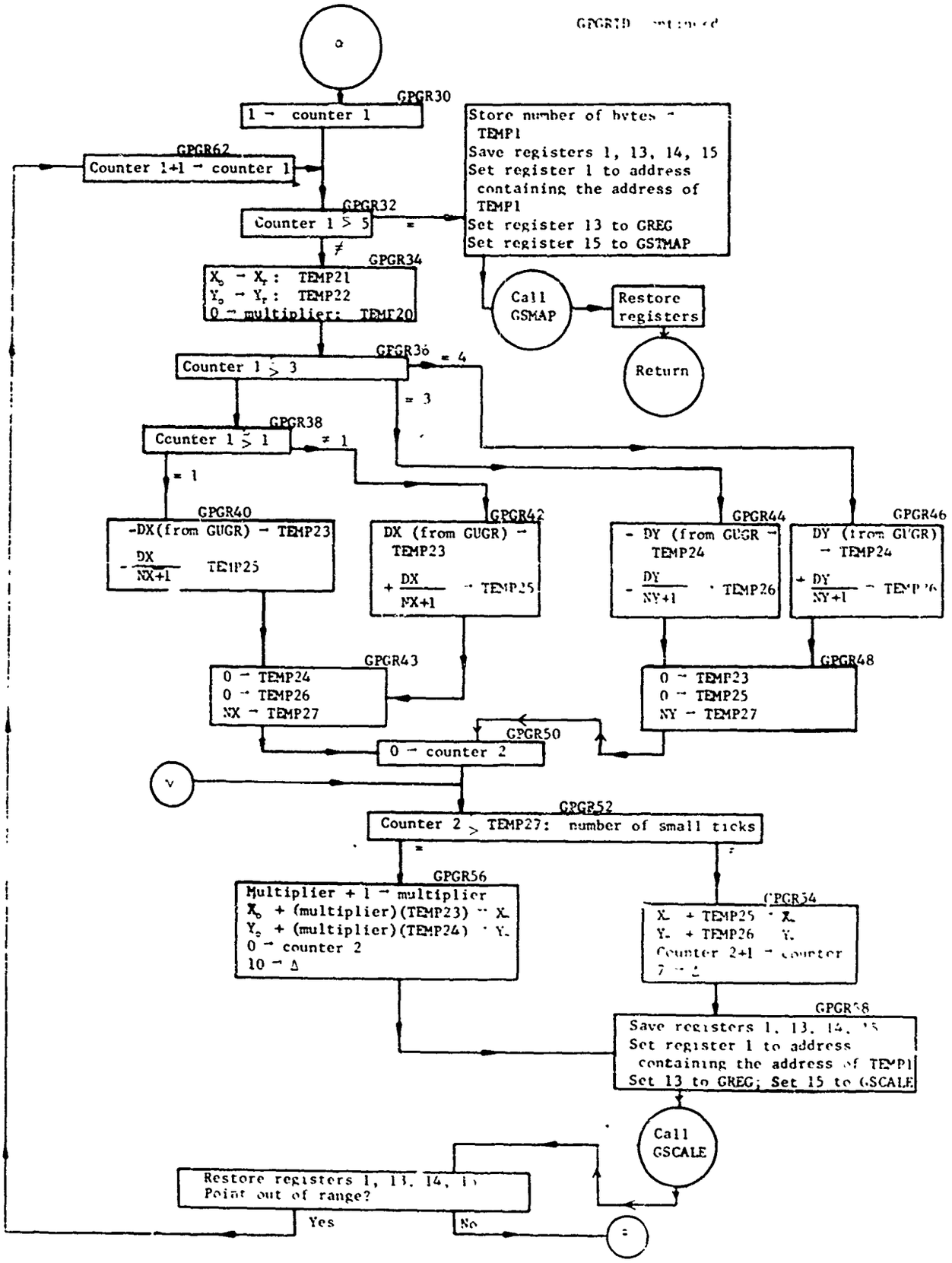
TEMP26 : GTEM +100 bytes : $|\tilde{I}_x$ new $-I_x$ old $|$ floating point

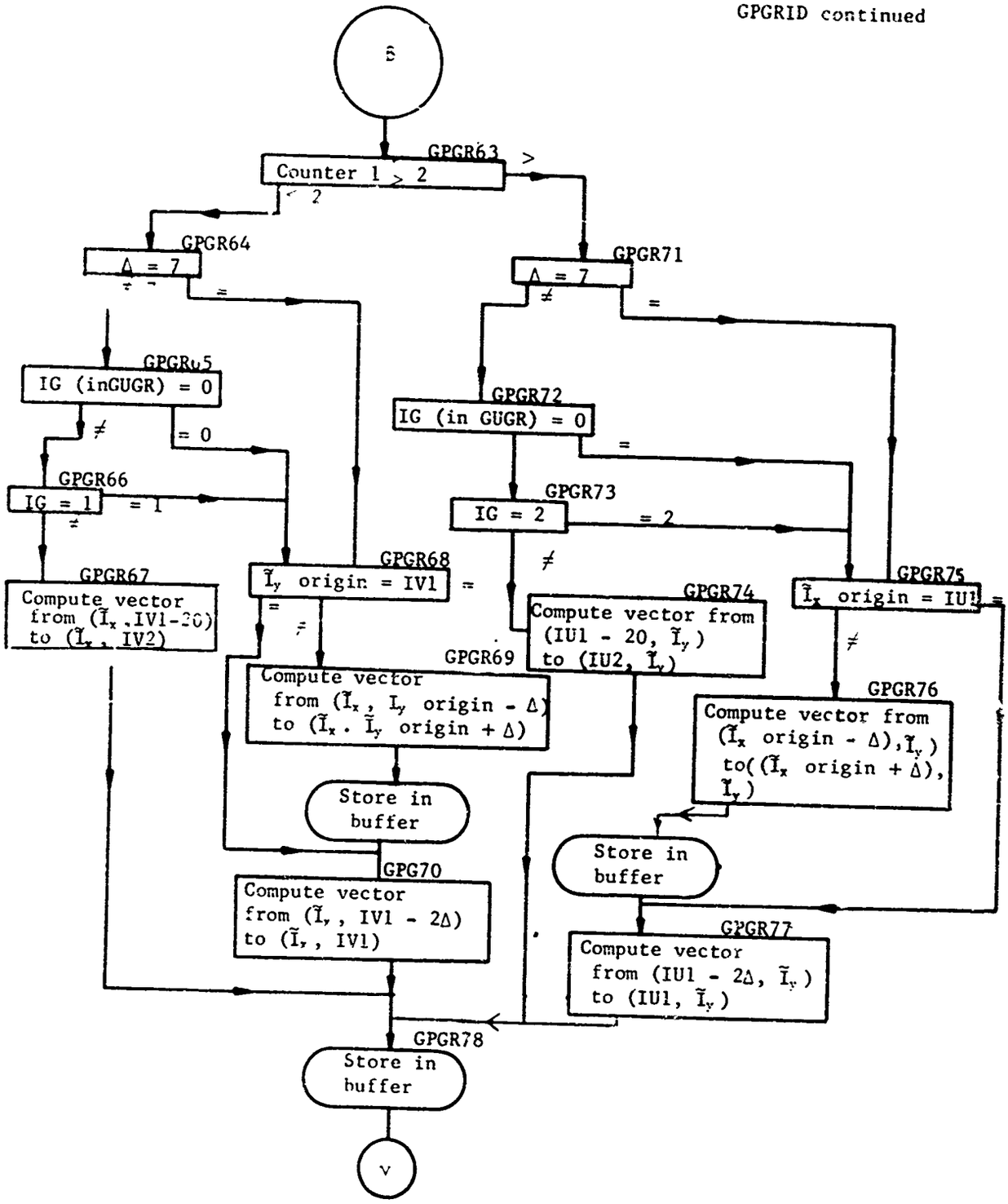
TEMP27 : GTEM +104 bytes : p

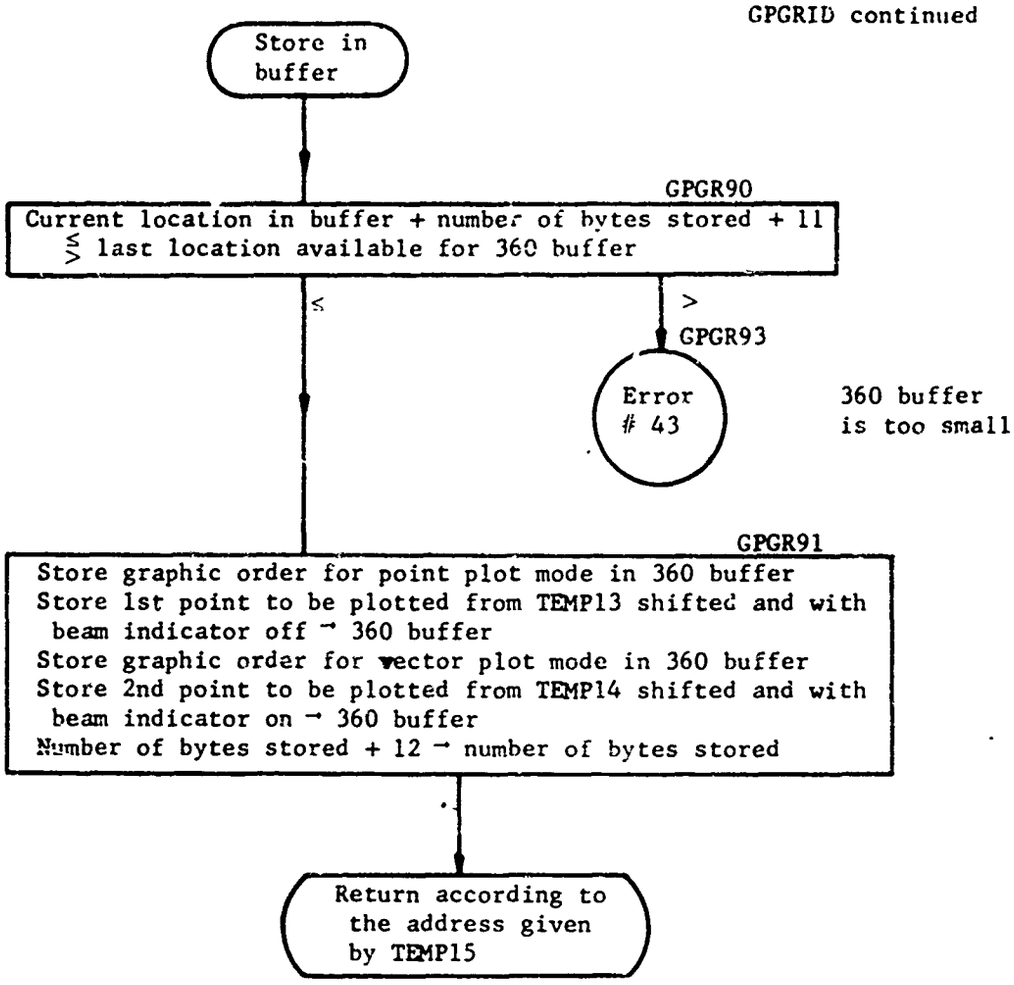
TEMP28 : GTEM +108 bytes : Intermediate $\tilde{I}_x$ or $\tilde{I}_y$


Start
GCOUNT
Store registers
Is value indicated by the first argument ≤ > 0
= 0
≠ 0
GCOUN2
Store value indicated by second argument
→ GCOU of the communications region
GCOUN4
Store GCOU from the communications region → address given by the second argument
GCOUN3
Restore registers
Return


GPGRID
Store registers
Set register 2 to GUBU
Set register 3 to GUSI
Set register 4 to GULI
Set register 5 to GTEM
Is GUTY = 1
No
Error 41
No provision for non-linear plotting
Yes
GPGR04
IU1 - 20 ≤ > 0
GPGR08
IV1 - 0 ≤ > 0
Error 42
Not enough raster units available for tick marks
GPGR10
Set register 6 to GUGR
Is either DX or DY ≤ 0
Yes
No
GPGR12
0 → number of bytes stored
Is either coordinate of origin out of range
No
Yes
GPGR13
Put coordinates of origin → TEMP11 & 12
GPGR14
Put coordinates of U1 & V1 → TEMP11 & 12
GPGR20
Generate vectors thru origin: TEMP11 & 12
Save I_x origin I_y origin
GPGR25
Generate vectors thru IU1, IV1
Compute $\frac{DX}{NX+1}$
Compute $\frac{DV}{NY+1}$
α


GPGR30
1 → counter 1
GPGR62
Counter 1+1 → counter 1
GPGR32
Counter 1 ≤ 5
≠
=
Store number of bytes → TEMP1
Save registers 1, 13, 14, 15
Set register 1 to address containing the address of TEMP1
Set register 13 to GREG
Set register 15 to GSTMAP
Call GSMAP
Restore registers
Return
GPGR34
$X_0 \rightarrow X_T$: TEMP21
$Y_0 \rightarrow Y_T$: TEMP22
0 → multiplier: TEMP20
GPGR36
Counter 1 ≥ 3
= 4
= 3
GPGR38
Ccunter 1 ≤ 1
≠ 1
= 1
GPGR40
-DX(from GUGR) → TEMP23
$-\frac{DX}{NX+1}$ TEMP25
GPGR42
DX (from GUGR) → TEMP23
$+\frac{DX}{NX+1}$ → TEMP25
GPGR44
- DY (from GUGR → TEMP24
$-\frac{DY}{NY+1}$ · TEMP26
GPGR46
DY (from GUGR) → TEMP24
$+\frac{DY}{NY+1}$ → TEMP26
GPGR43
0 → TEMP24
0 → TEMP26
NX → TEMP27
GPGR48
0 → TEMP23
0 → TEMP25
NY → TEMP27
GPGR50
0 → counter 2
GPGR52
Counter 2 ≥ TEMP27: number of small ticks
=
≠
GPGR56
Multiplier + 1 → multiplier
X_0 + (multiplier)(TEMP23) → X_0
Y_0 + (multiplier)(TEMP24) → Y_0
0 → counter 2
10 → Δ
GPGR54
X_0 + TEMP25 → X_0
Y_0 + TEMP26 → Y_0
Counter 2+1 → counter
7 → Z
GPGR58
Save registers 1, 13, 14, 15
Set register 1 to address containing the address of TEMP1
Set 13 to GREG; Set 15 to GSCALE
Call GSCALE
Restore registers 1, 13, 14, 15
Point out of range?
Yes
No


B
GPGR63
Counter 1 > 2
> 2
GPGR64
Δ = 7
≠
=
GPGR71
Δ = 7
≠
=
GPGR65
IG (inGUGR) = 0
≠
= 0
GPGR72
IG (in GUGR) = 0
=
GPGR66
IG = 1
= 1
≠
GPGR73
IG = 2
= 2
≠
GPGR67
Compute vector from (Ĩx, IV1-20) to (Ĩx, IV2)
GPGR68
Ĩy origin = IV1
=
≠
GPGR74
Compute vector from (IU1 - 20, Ĩy) to (IU2, Ĩy)
GPGR75
Ĩx origin = IU1
=
≠
GPGR69
Compute vector from (Ĩx, Iy origin - Δ) to (Ĩx, Ĩy origin + Δ)
GPGR76
Compute vector from (Ĩx origin - Δ), Ĩy) to ((Ĩx origin + Δ), Ĩy)
Store in buffer
Store in buffer
GPG70
Compute vector from (Ĩx, IV1 - 2Δ) to (Ĩx, IV1)
GPGR77
Compute vector from (IU1 - 2Δ, Ĩy) to (IU1, Ĩy)
GPGR78
Store in buffer
V


Store in buffer
GPGR90
Current location in buffer + number of bytes stored + 11 ≤ last location available for 360 buffer
≤
>
GPGR93
Error # 43
360 buffer is too small
GPGR91
Store graphic order for point plot mode in 360 buffer
Store 1st point to be plotted from TEMP13 shifted and with beam indicator off → 360 buffer
Store graphic order for vector plot mode in 360 buffer
Store 2nd point to be plotted from TEMP14 shifted and with beam indicator on → 360 buffer
Number of bytes stored + 12 → number of bytes stored
Return according to the address given by TEMP15

Assignment of temporary storage for GPGRID in addition to GSCALE

TEMP10 : GTEM + 36 bytes : number of bytes stored

TEMP11 : GTEM + 40 bytes : x coordinate of origin unnormalized F.P.

TEMP12 : GTEM + 44 bytes : y coordinate of origin unnormalized F. P.

TEMP13 : GTEM + 48 bytes : x and y coordinates of vecotr to be plotted. 1st point

TEMP14 : GTEM + 52 bytes : x and y coordinate of vector to be plotted. 2nd point

TEMP15 : GTEM + 56 bytes : address return from vector generation

TEMP16 : GTEM + 60 bytes : NX+1; $\frac{DX}{NX+1}$ floating point

TEMP17 : GTEM + 64 bytes : NY+1; $\frac{DY}{NY+1}$ floating point

TEMP18 : GTEM + 68 bytes : counter 1 for section of graph; counter 2 count small ticks

TEMP19 : GTEM + 72 bytes : $\tilde{I}_x$ origin & $\tilde{I}_y$ origin

TEMP20 : GTEM + 76 bytes : multiplier for spacing of large ticks.

TEMP21 : GTEM + 80 bytes : X_r

TEMP22 : GTEM + 84 bytes : Y_r

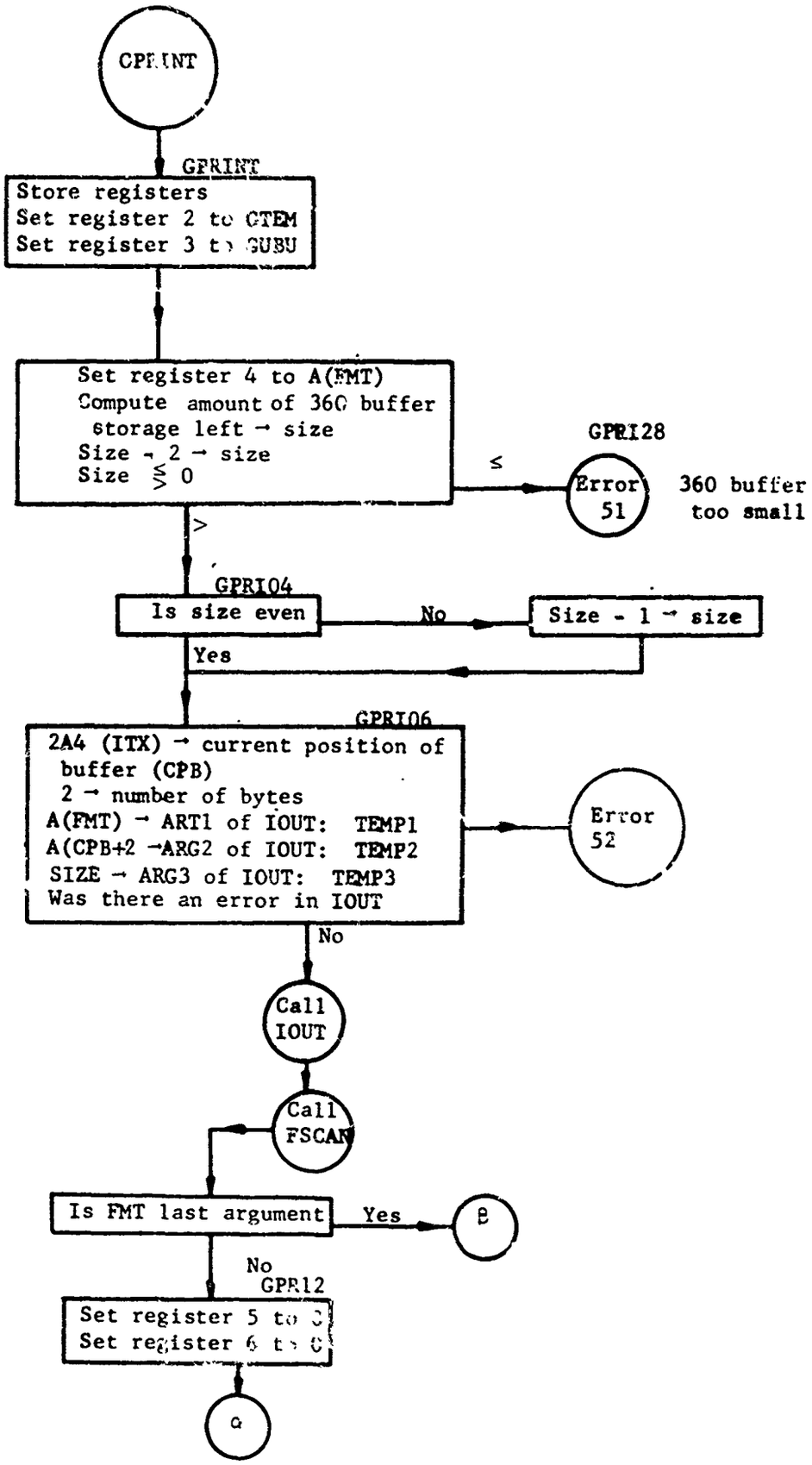
TEMP23 : GTEM + 88 bytes : X increment for large ticks

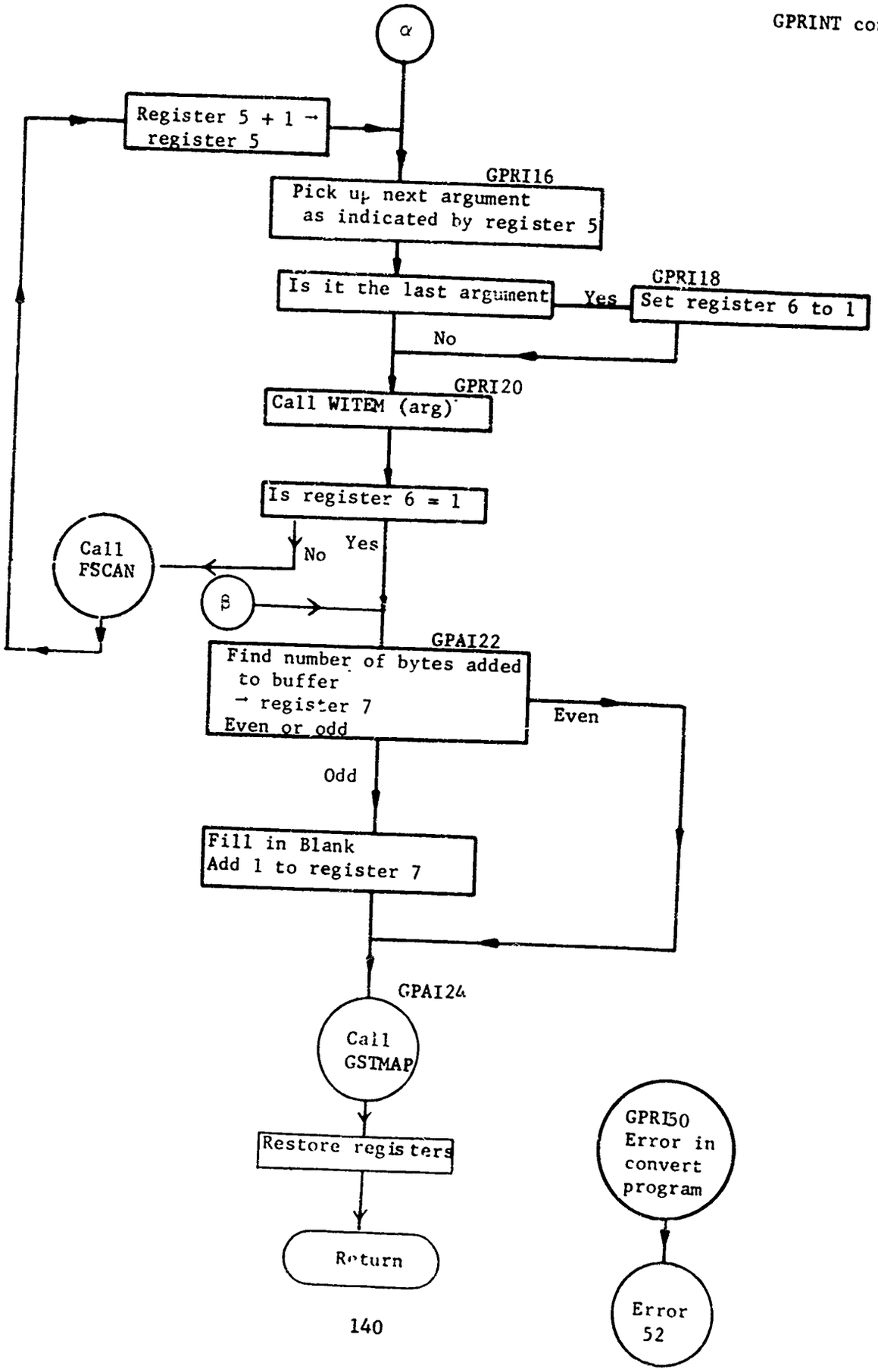
TEMP24 : GTEM + 92 bytes : Y increment for large ticks

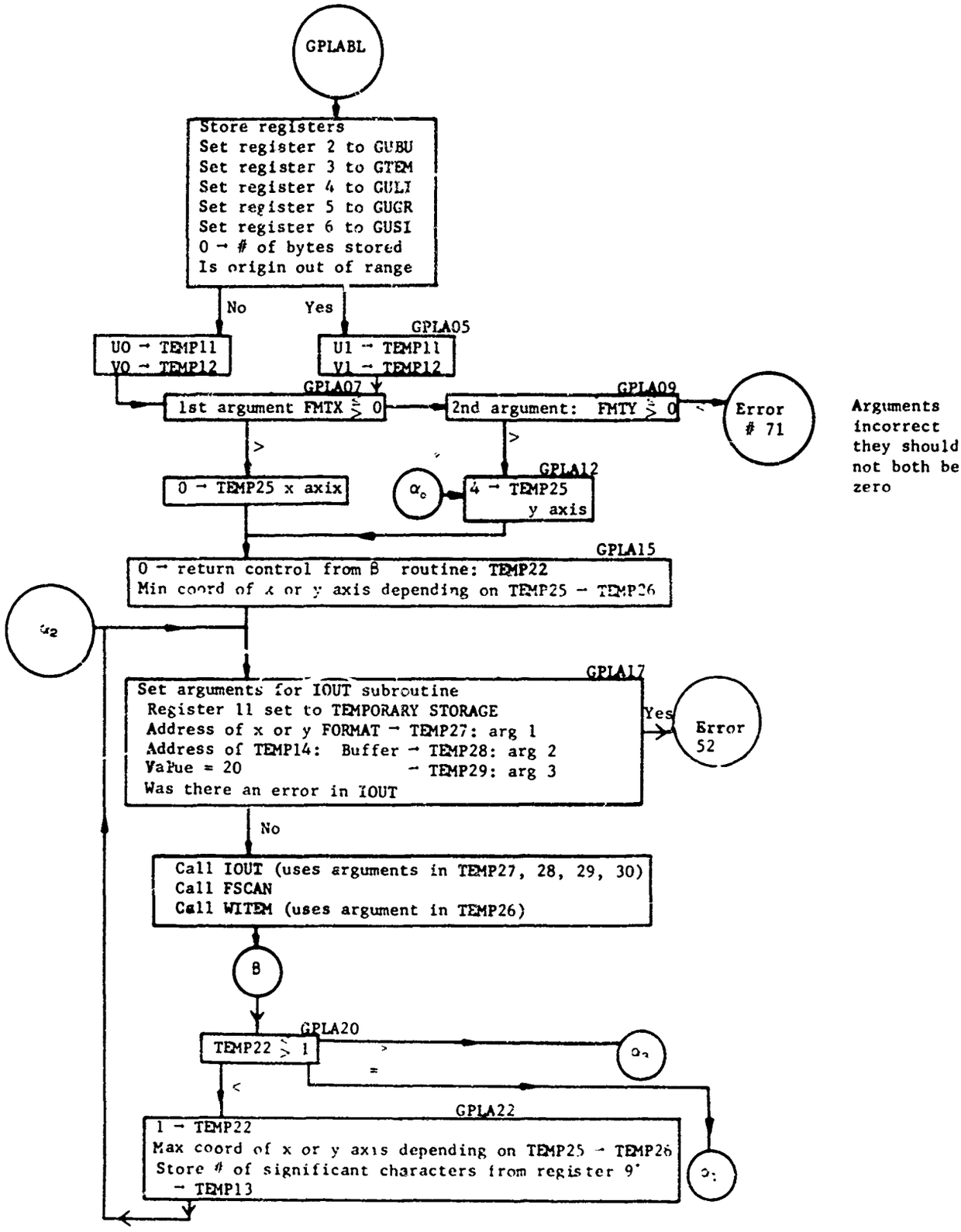
TEMP25 : GTEM + 96 bytes : X increment for samll ticks

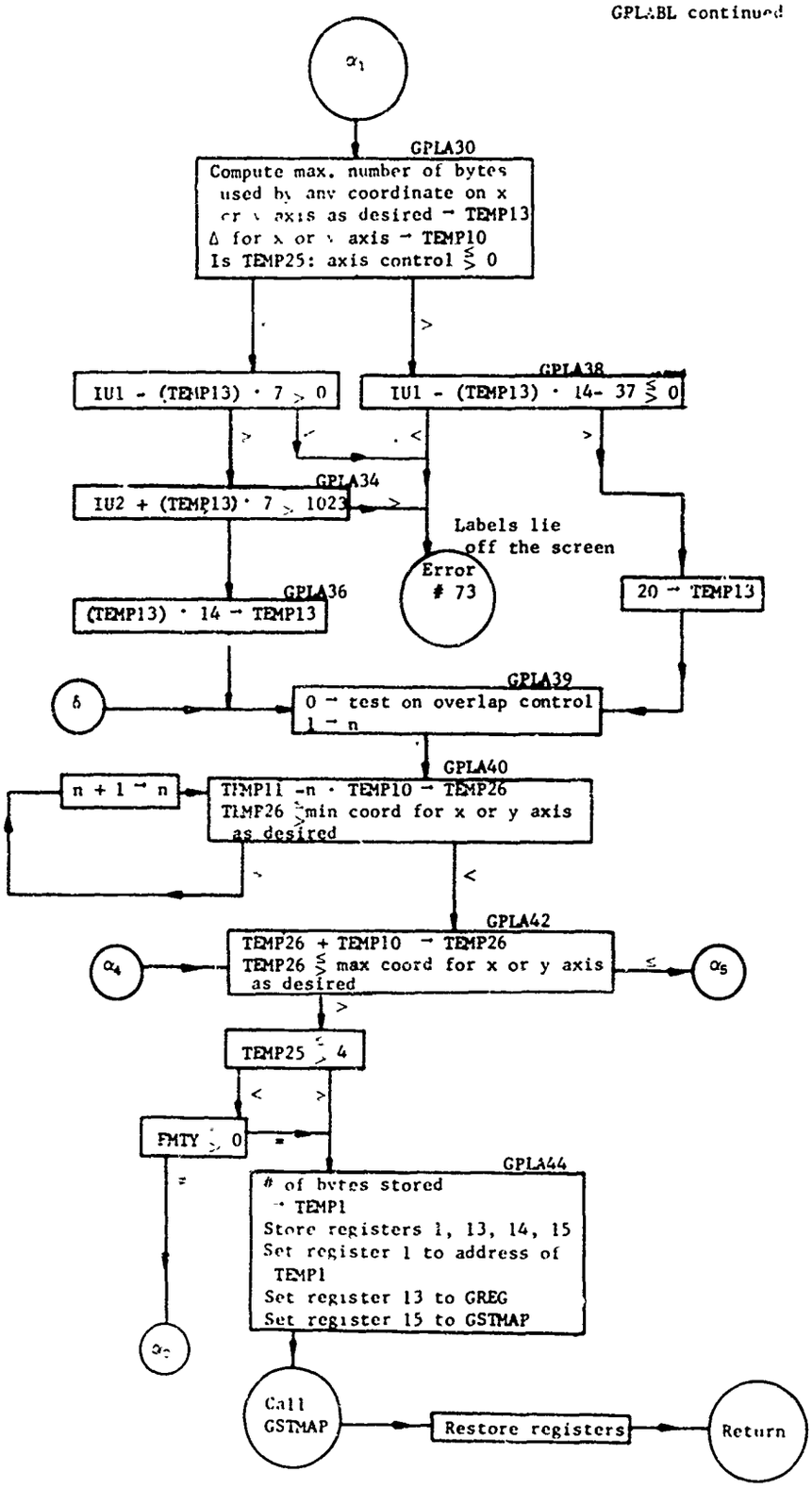
TEMP26 : GTEM +100 bytes : Y increment for small ticks

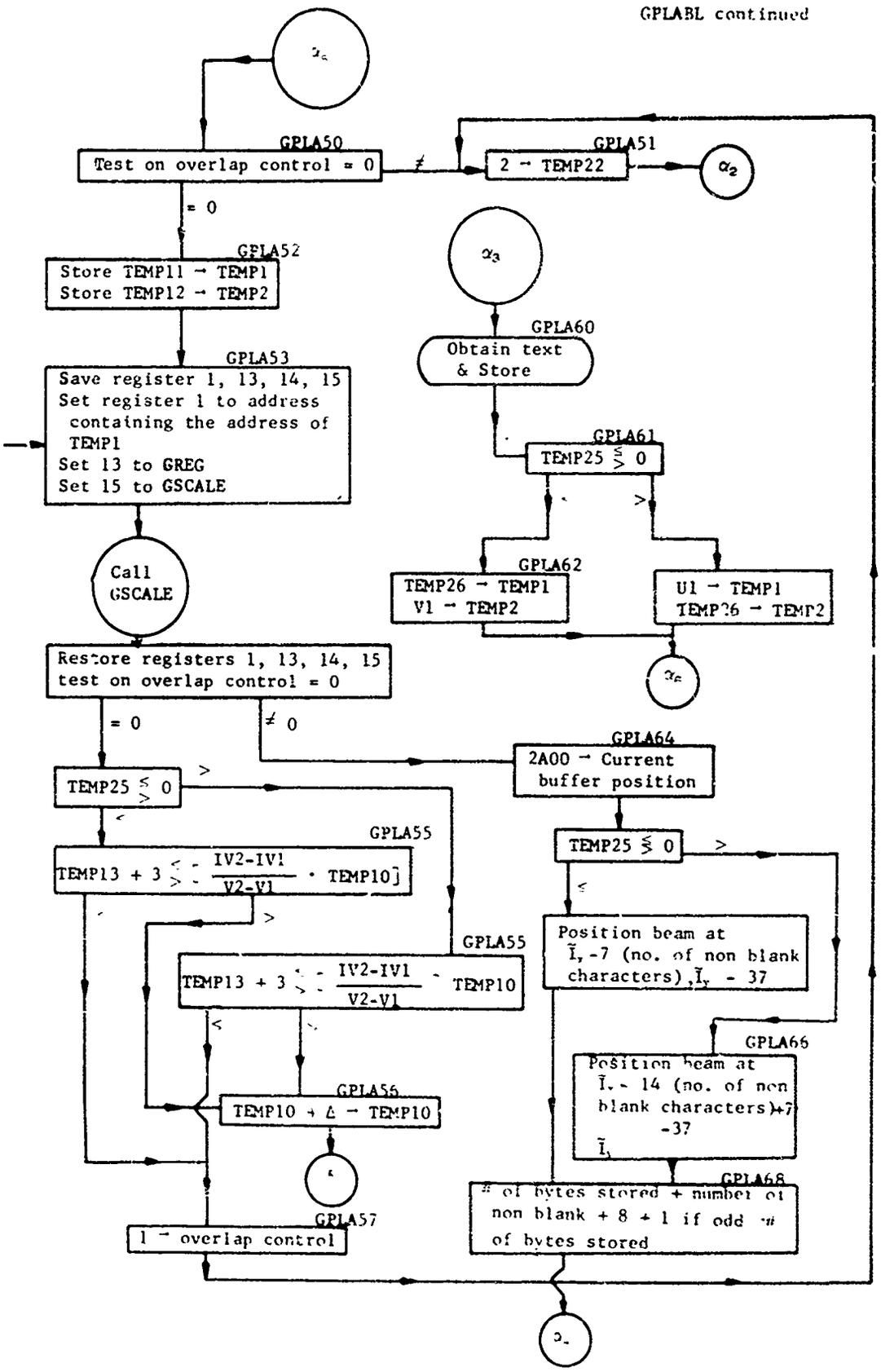
TEMP27 : GTEM +104 bytes : Number of intermediate tick marks & Δ


GPRINT
GPRINT
Store registers
Set register 2 to CTEM
Set register 3 to GUBU
Set register 4 to A(FMT)
Compute amount of 360 buffer storage left → size
Size - 2 → size
Size ≶ 0
≤
GPRI28
Error 51
360 buffer too small
>
GPRI04
Is size even
No
Size - 1 → size
Yes
GPRI06
2A4 (ITX) → current position of buffer (CPB)
2 → number of bytes
A(FMT) → ART1 of IOUT: TEMP1
A(CPB+2 →ARG2 of IOUT: TEMP2
SIZE → ARG3 of IOUT: TEMP3
Was there an error in IOUT
Error 52
No
Call IOUT
Call FSCAN
Is FMT last argument
Yes
B
No
GPR12
Set register 5 to 0
Set register 6 to 0
A

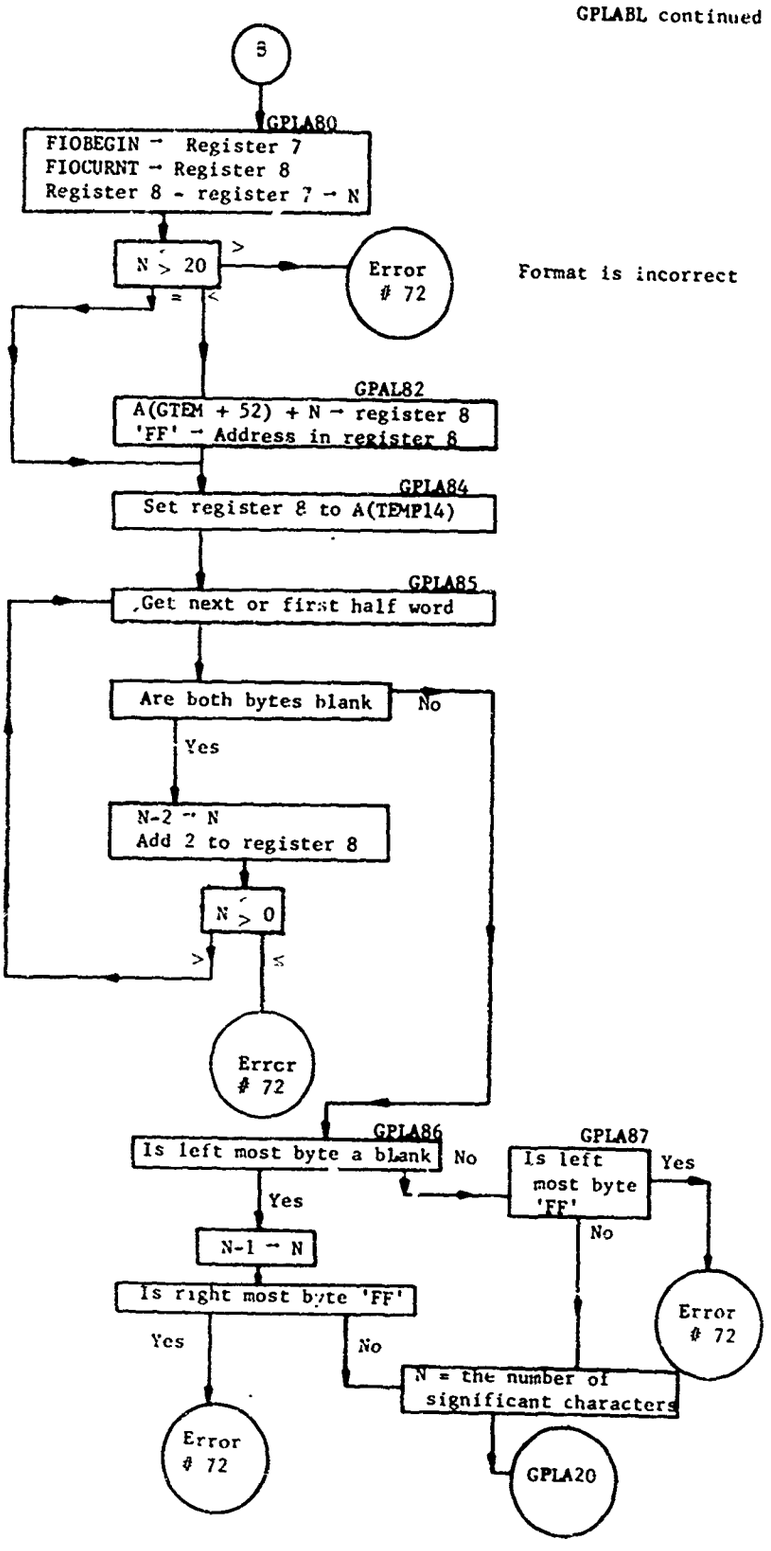

α
Register 5 + 1 → register 5
GPRI16
Pick up next argument as indicated by register 5
Is it the last argument
Yes
GPRI18
Set register 6 to 1
No
GPRI20
Call WITEM (arg)
Is register 6 = 1
No
Yes
Call FSCAN
β
GPAI22
Find number of bytes added to buffer → register 7 Even or odd
Even
Odd
Fill in Blank
Add 1 to register 7
GPAI24
Call GSTMAP
Restore registers
Return
GPRI50
Error in convert program
Error 52

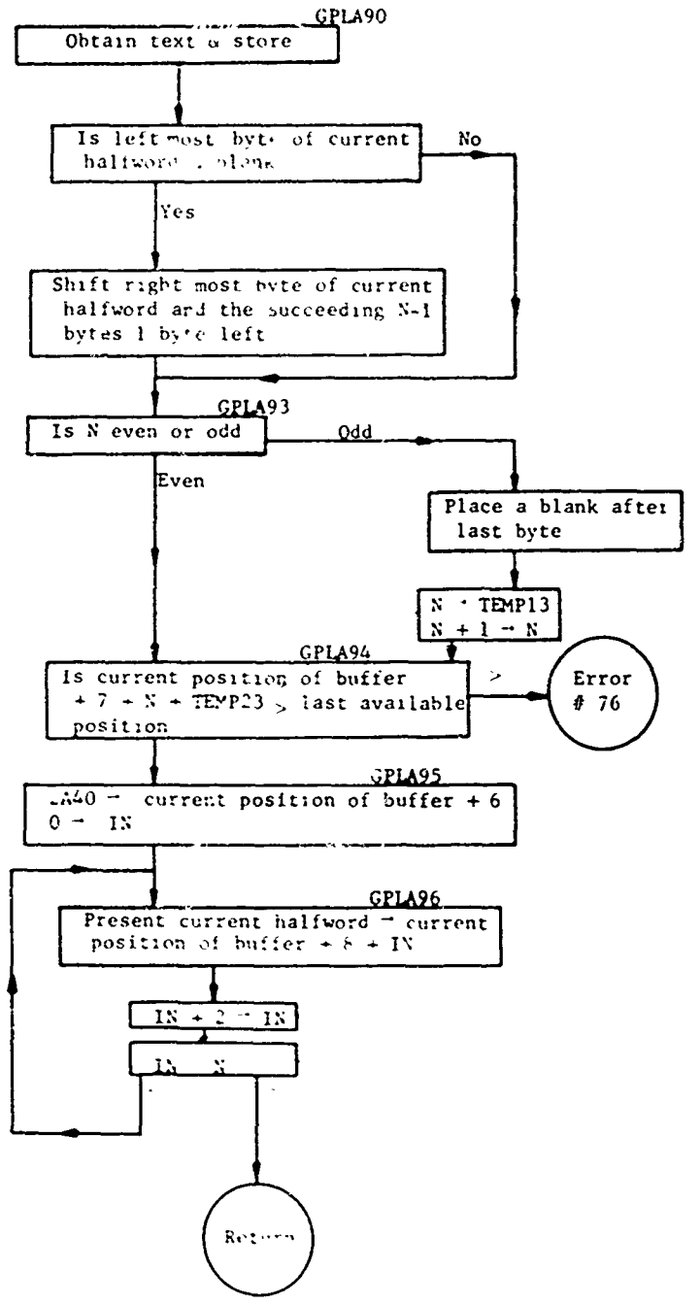

GPLABL
Store registers
Set register 2 to GUBU
Set register 3 to GTEM
Set register 4 to GULI
Set register 5 to GUGR
Set register 6 to GUSI
0 → # of bytes stored
Is origin out of range
No
Yes
GPLA05
U0 → TEMP11
V0 → TEMP12
U1 → TEMP11
V1 → TEMP12
GPLA07
1st argument FMTX ≷ 0
GPLA09
2nd argument: FMTY ≷ 0
Error # 71
Arguments incorrect they should not both be zero
>
>
0 → TEMP25 x axix
GPLA12
4 → TEMP25 y axis
GPLA15
0 → return control from B routine: TEMP22
Min coord of x or y axis depending on TEMP25 → TEMP26
GPLA17
Set arguments for IOUT subroutine
Register 11 set to TEMPORARY STORAGE
Address of x or y FORMAT → TEMP27: arg 1
Address of TEMP14: Buffer → TEMP28: arg 2
Value = 20 → TEMP29: arg 3
Was there an error in IOUT
Yes
Error 52
No
Call IOUT (uses arguments in TEMP27, 28, 29, 30)
Call FSCAN
Call WITEM (uses argument in TEMP26)
B
GPLA20
TEMP22 ≷ 1
>
=
<
GPLA22
1 → TEMP22
Max coord of x or y axis depending on TEMP25 → TEMP26
Store # of significant characters from register 9
→ TEMP13


α1
GPLA30
Compute max. number of bytes used by any coordinate on x or y axis as desired → TEMP13
Δ for x or y axis → TEMP10
Is TEMP25: axis control ≶ 0
IU1 - (TEMP13) · 7 ≷ 0
GPLA38
IU1 - (TEMP13) · 14- 37 ≶ 0
GPLA34
IU2 + (TEMP13) · 7 ≷ 1023
Labels lie off the screen
Error # 73
GPLA36
(TEMP13) · 14 → TEMP13
20 → TEMP13
δ
GPLA39
0 → test on overlap control
1 → n
GPLA40
n + 1 → n
TEMP11 -n · TEMP10 → TEMP26
TEMP26 ≷ min coord for x or y axis as desired
GPLA42
TEMP26 + TEMP10 → TEMP26
TEMP26 ≶ max coord for x or y axis as desired
α4
α5
TEMP25 ≷ 4
FMTY ≷ 0
GPLA44
# of bytes stored → TEMP1
Store registers 1, 13, 14, 15
Set register 1 to address of TEMP1
Set register 13 to GREG
Set register 15 to GSTMAP
α6
Call GSTMAP
Restore registers
Return


GPLA50
Test on overlap control = 0
≠
GPLA51
2 → TEMP22
= 0
GPLA52
Store TEMP11 → TEMP1
Store TEMP12 → TEMP2
GPLA53
Save register 1, 13, 14, 15
Set register 1 to address containing the address of TEMP1
Set 13 to GREG
Set 15 to GSCALE
Call GSCALE
Restore registers 1, 13, 14, 15
test on overlap control = 0
= 0
≠ 0
GPLA60
Obtain text & Store
GPLA61
TEMP25 ≤ > 0
GPLA62
TEMP26 → TEMP1
V1 → TEMP2
U1 → TEMP1
TEMP26 → TEMP2
GPLA64
2A00 → Current buffer position
TEMP25 ≤ > 0
GPLA55
TEMP13 + 3 ≤ > (IV2-IV1)/(V2-V1) · TEMP10
GPLA55
TEMP13 + 3 ≤ > (IV2-IV1)/(V2-V1) · TEMP10
GPLA56
TEMP10 + Δ → TEMP10
GPLA57
1 → overlap control
TEMP25 ≤ > 0
Position beam at Ĩ, -7 (no. of non blank characters), Ĩ, - 37
GPLA66
Position beam at Ĩ, - 14 (no. of non blank characters)+7 -37 Ĩ,
GPLA68
# of bytes stored + number of non blank + 8 + 1 if odd # of bytes stored

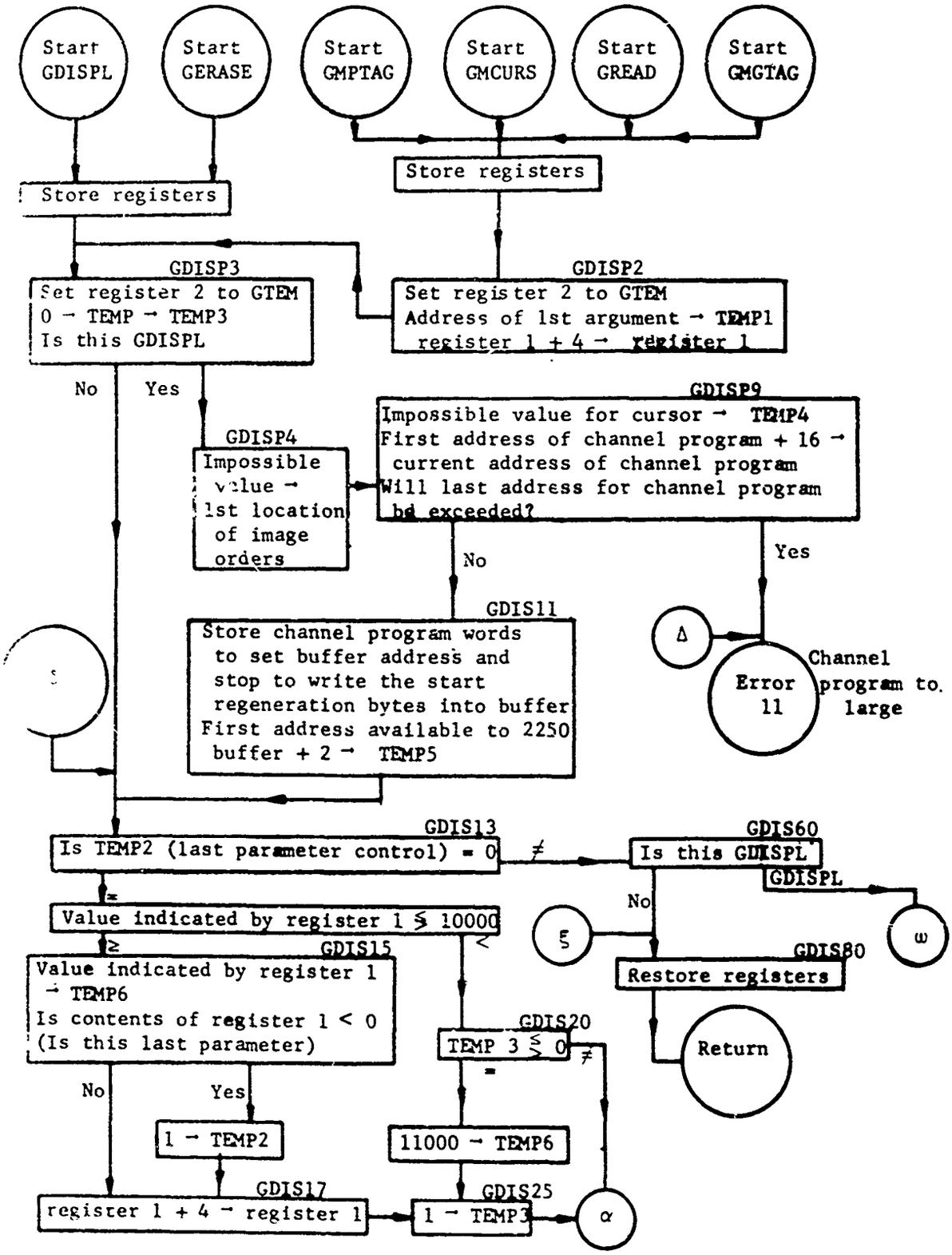
GPLABL continued



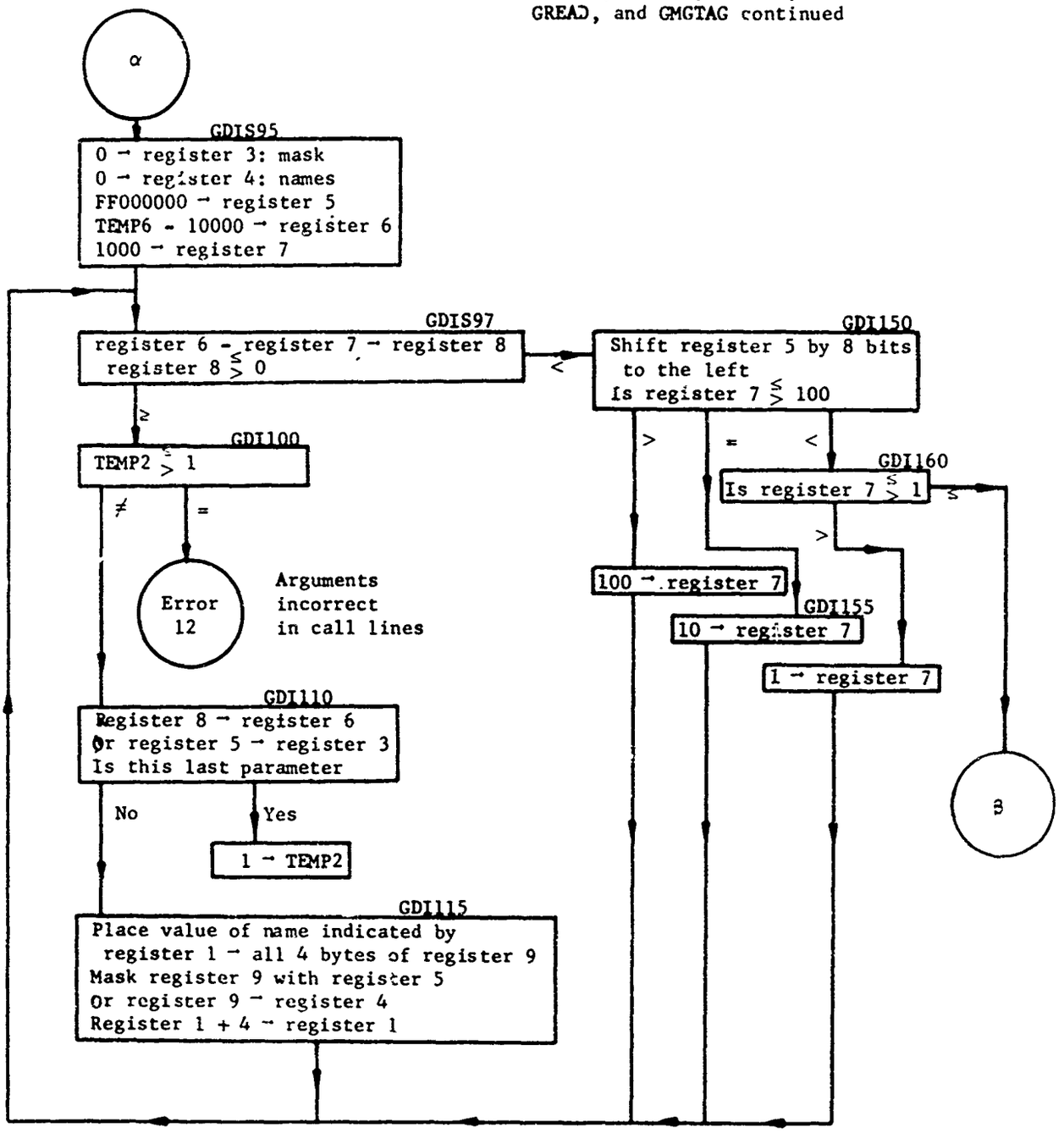

GPLA90
Obtain text & store
Is left most byte of current halfword . blank
No
Yes
Shift right most byte of current halfword and the succeeding N-1 bytes 1 byte left
GPLA93
Is N even or odd
Odd
Even
Place a blank after last byte
N + TEMP13
N + 1 → N
GPLA94
Is current position of buffer + 7 + N + TEMP23 > last available position
>
Error # 76
GPLA95
A40 → current position of buffer + 6
0 → IN
GPLA96
Present current halfword → current position of buffer + 8 + IN
IN + 2 → IN
IN N
Return

Assignment of temporary storage for GPLABL in addtion to GSCALE

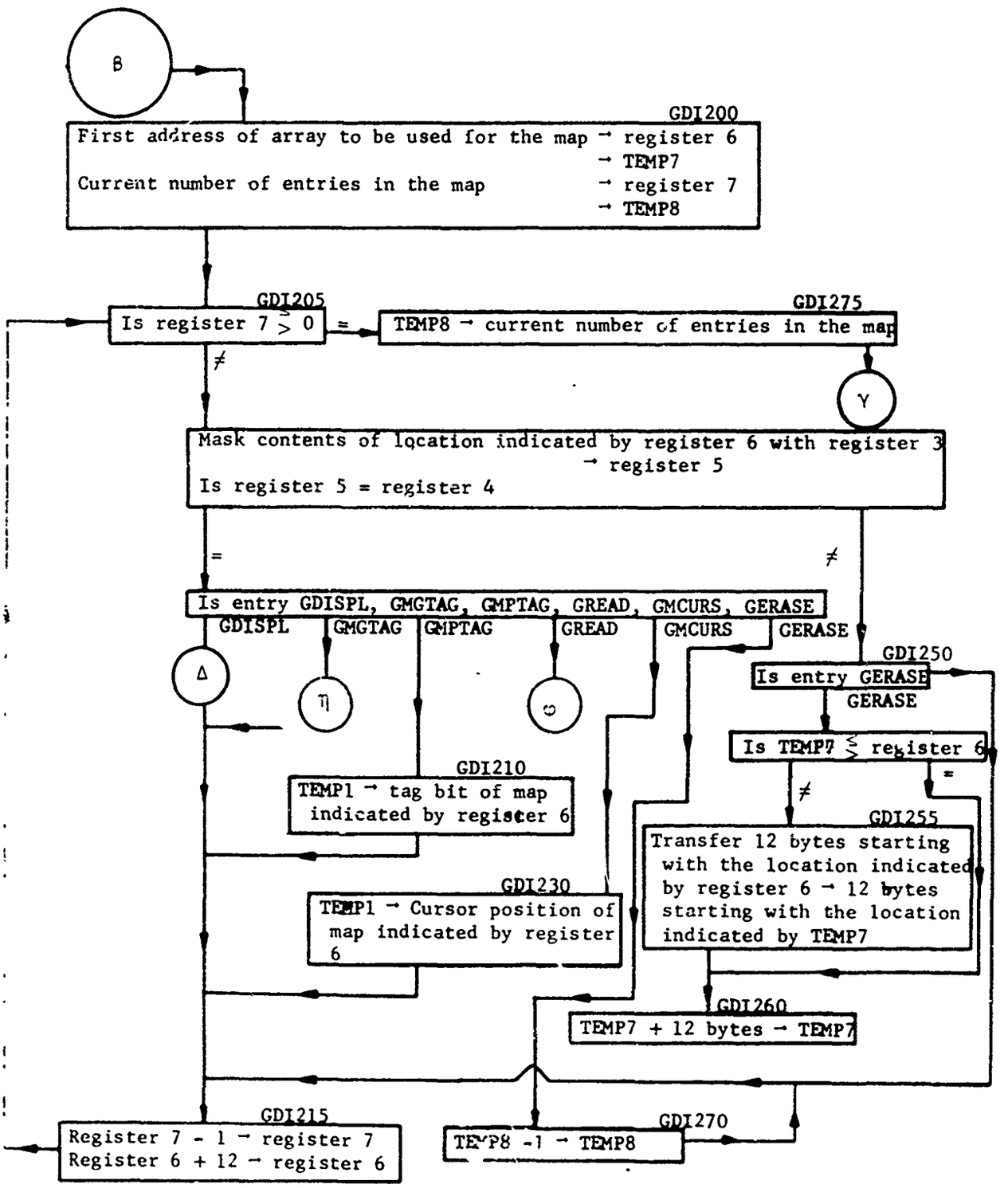
TEMP 10	GTEM + 36 bytes	Δ for x or y axis floating point	
TEMP 11	GTEM + 40 bytes	U origin floating point	
TEMP 12	GTEM + 44 bytes	V origin floating point	
TEMP 13	GTEM + 48 bytes	number of significant characters	
TEMP 14	GTEM + 52 bytes	buffer	
TEMP 15	GTEM + 56 bytes		
TEMP 16	GTEM + 60 bytes		
TEMP 17	GTEM + 64 bytes		
TEMP 18	GTEM + 68 bytes		
TEMP 19	GTEM + 72 bytes		
TEMP 20	GTEM + 76 bytes	n floating point	
TEMP 21	GTEM + 80 bytes	test on overlap control	
TEMP 22	GTEM + 84 bytes	return control from β routine	
TEMP 23	GTEM + 88 bytes	number of bytes added to buffer	
TEMP 24	GTEM + 92 bytes	scale factor · TEMP 10 unnormalized F. P.	
TEMP 25	GTEM + 96 bytes	0 = x axis or 4 = y axis computation	
TEMP 26	GTEM + 100 bytes	value to be converted	Input to IOUT FSCAN WITEN
TEMP 27	GTEM + 104 bytes	x or y format	
TEMP 28	GTEM + 108 bytes	address of buffer	
TEMP 29	GTEM + 112 bytes	number of bytes in buffer	
TEMP 30	GTEM + 116 bytes	error return	

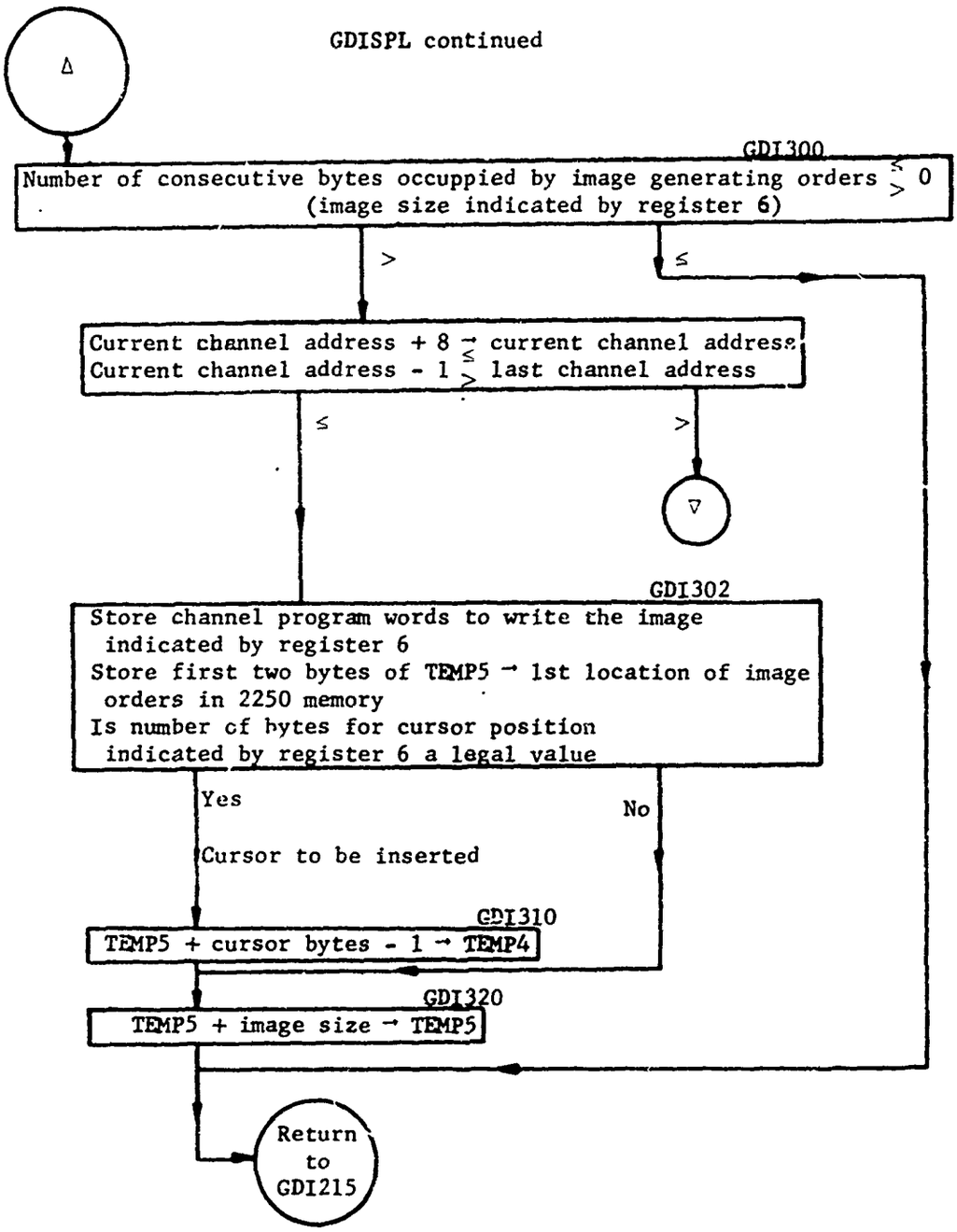

Start GDISPL
Start GERASE
Start GMPTAG
Start GMCURS
Start GREAD
Start GMGTAG
Store registers
Store registers
GDISP3
Set register 2 to GTEM
0 → TEMP → TEMP3
Is this GDISPL
GDISP2
Set register 2 to GTEM
Address of 1st argument → TEMP1
register 1 + 4 → register 1
No
Yes
GDISP9
Impossible value for cursor → TEMP4
First address of channel program + 16 →
current address of channel program
Will last address for channel program
be exceeded?
GDISP4
Impossible
value →
1st location
of image
orders
No
Yes
GDIS11
Store channel program words
to set buffer address and
stop to write the start
regeneration bytes into buffer
First address available to 2250
buffer + 2 → TEMP5
Δ
Channel
Error
11
program to.
large
GDIS13
Is TEMP2 (last parameter control) = 0
≠
GDIS60
Is this GDISPL
GDISPL
=
Value indicated by register 1 ≶ 10000
≥
<
No
ξ
ω
GDIS15
Value indicated by register 1
→ TEMP6
Is contents of register 1 < 0
(Is this last parameter)
GDIS80
Restore registers
Return
GDIS20
TEMP 3 ≶ 0
≠
=
No
Yes
1 → TEMP2
11000 → TEMP6
GDIS17
register 1 + 4 → register 1
GDIS25
1 → TEMP3
α

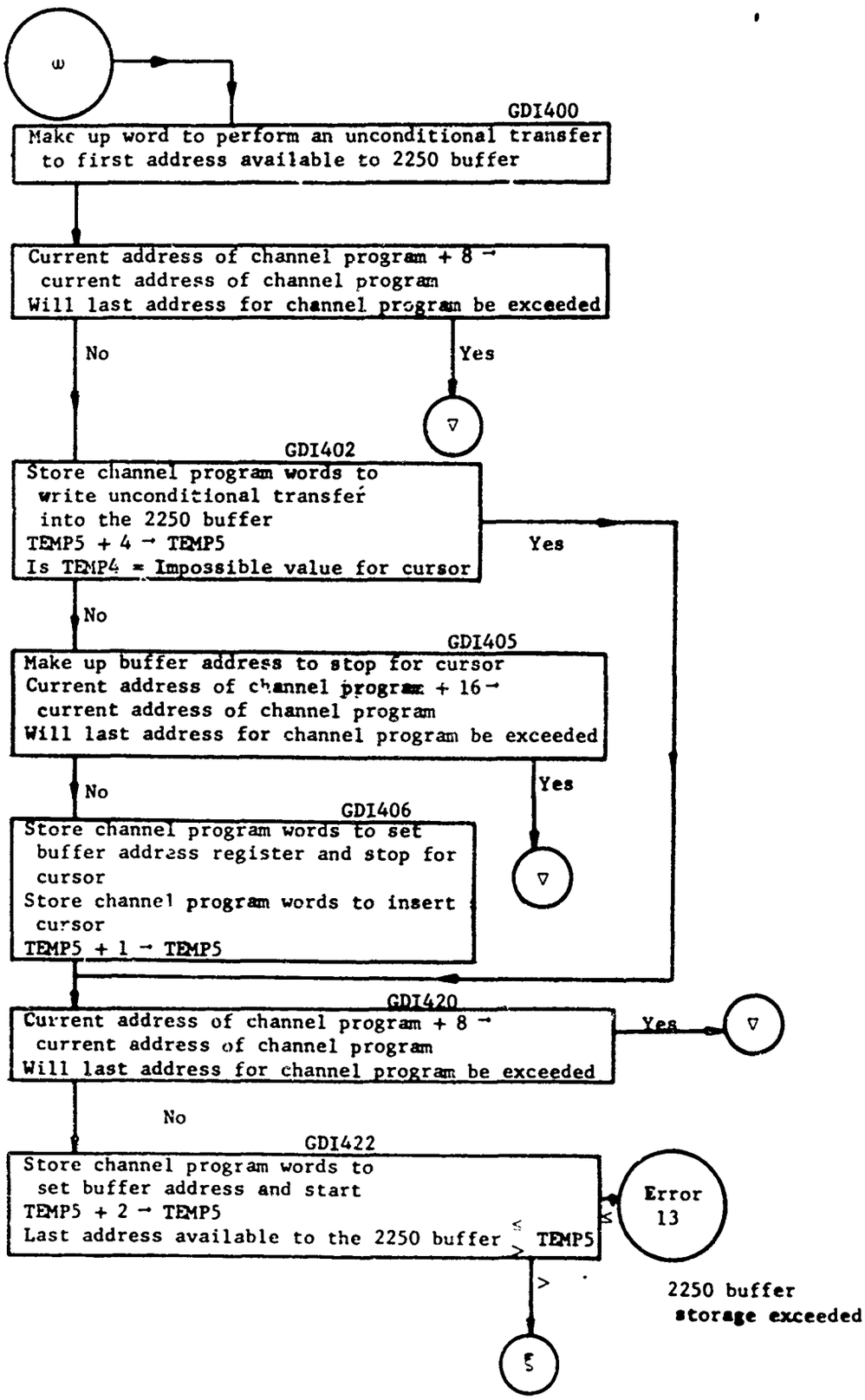
GDISPL, GERASE, GMPTAG, GMCURS
GREAD, and GMGTAG continued



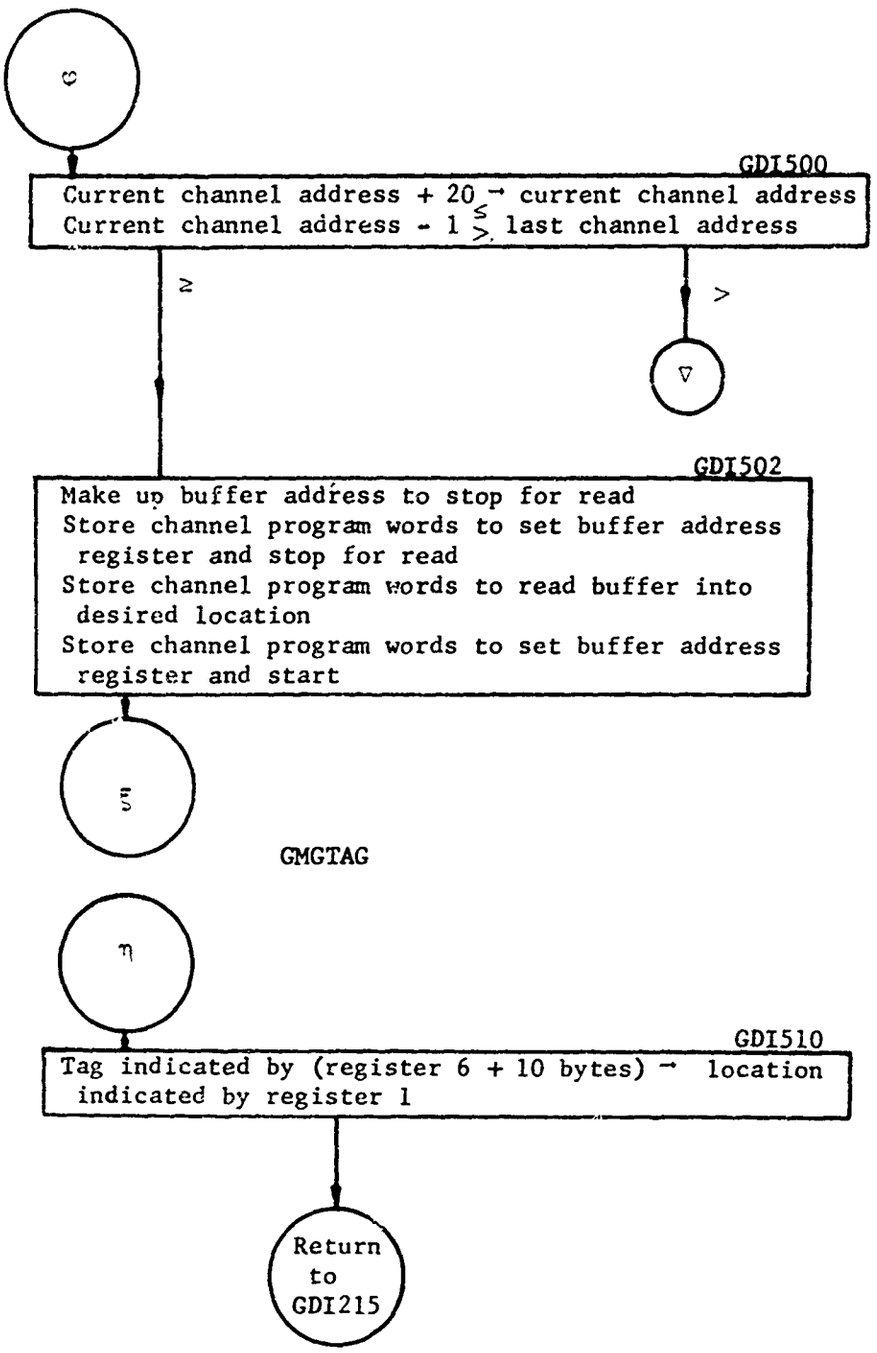
GDISPL, GERASE, GMTPAG, GMCURS
GREAD And GMGTAG continued




GDISPL continued
Δ
GDI300
Number of consecutive bytes occuppied by image generating orders ≤ > 0
(image size indicated by register 6)
>
≤
Current channel address + 8 → current channel address
Current channel address - 1 ≤ > last channel address
≤
>
∇
GDI302
Store channel program words to write the image
indicated by register 6
Store first two bytes of TEMP5 → 1st location of image
orders in 2250 memory
Is number of bytes for cursor position
indicated by register 6 a legal value
Yes
No
Cursor to be inserted
GDI310
TEMP5 + cursor bytes - 1 → TEMP4
GDI320
TEMP5 + image size → TEMP5
Return
to
GDI215

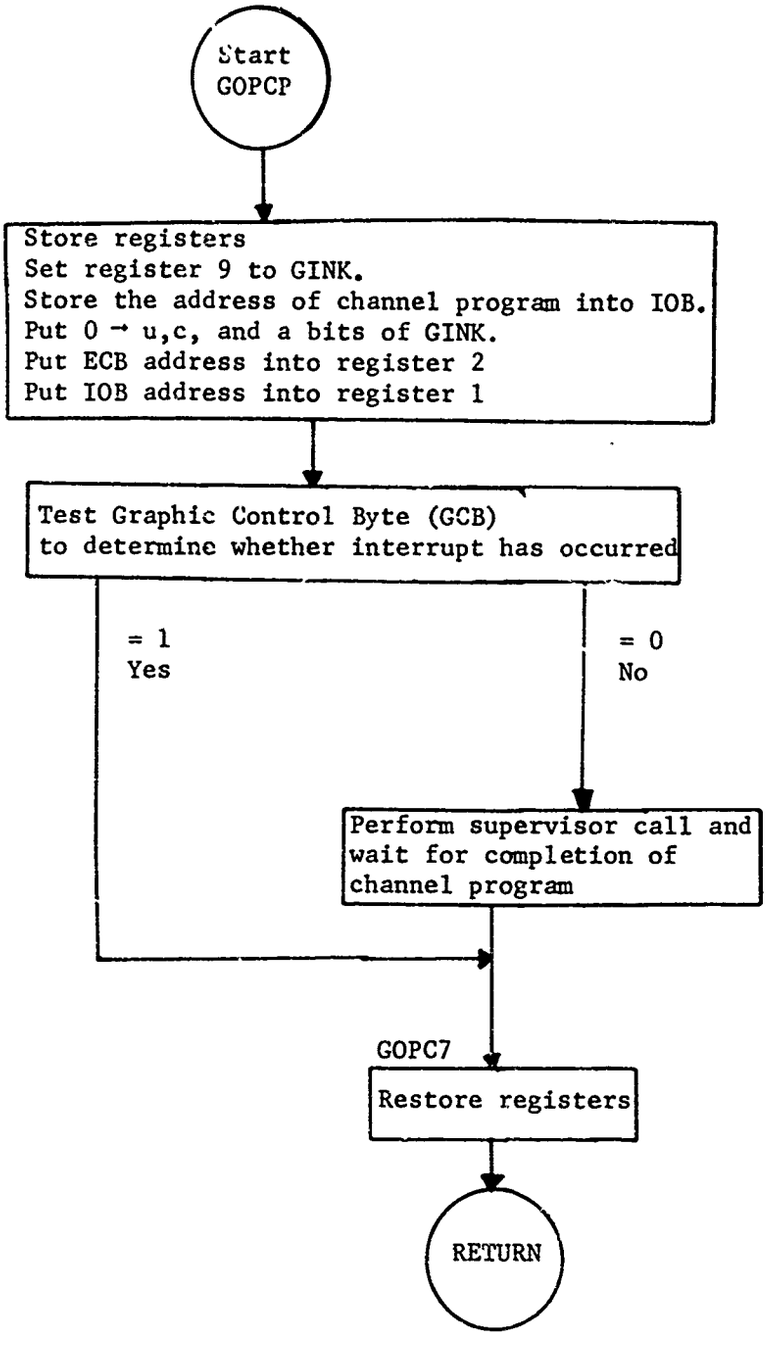

ω
GDI400
Make up word to perform an unconditional transfer to first address available to 2250 buffer
Current address of channel program + 8 → current address of channel program
Will last address for channel program be exceeded
No
Yes
∇
GDI402
Store channel program words to write unconditional transfer into the 2250 buffer
TEMP5 + 4 → TEMP5
Is TEMP4 = Impossible value for cursor
Yes
No
GDI405
Make up buffer address to stop for cursor
Current address of channel program + 16 → current address of channel program
Will last address for channel program be exceeded
Yes
No
GDI406
Store channel program words to set buffer address register and stop for cursor
Store channel program words to insert cursor
TEMP5 + 1 → TEMP5
∇
GDI420
Current address of channel program + 8 → current address of channel program
Will last address for channel program be exceeded
Yes
∇
No
GDI422
Store channel program words to set buffer address and start
TEMP5 + 2 → TEMP5
Last address available to the 2250 buffer ≤ TEMP5
Error 13
>
2250 buffer storage exceeded
ξ

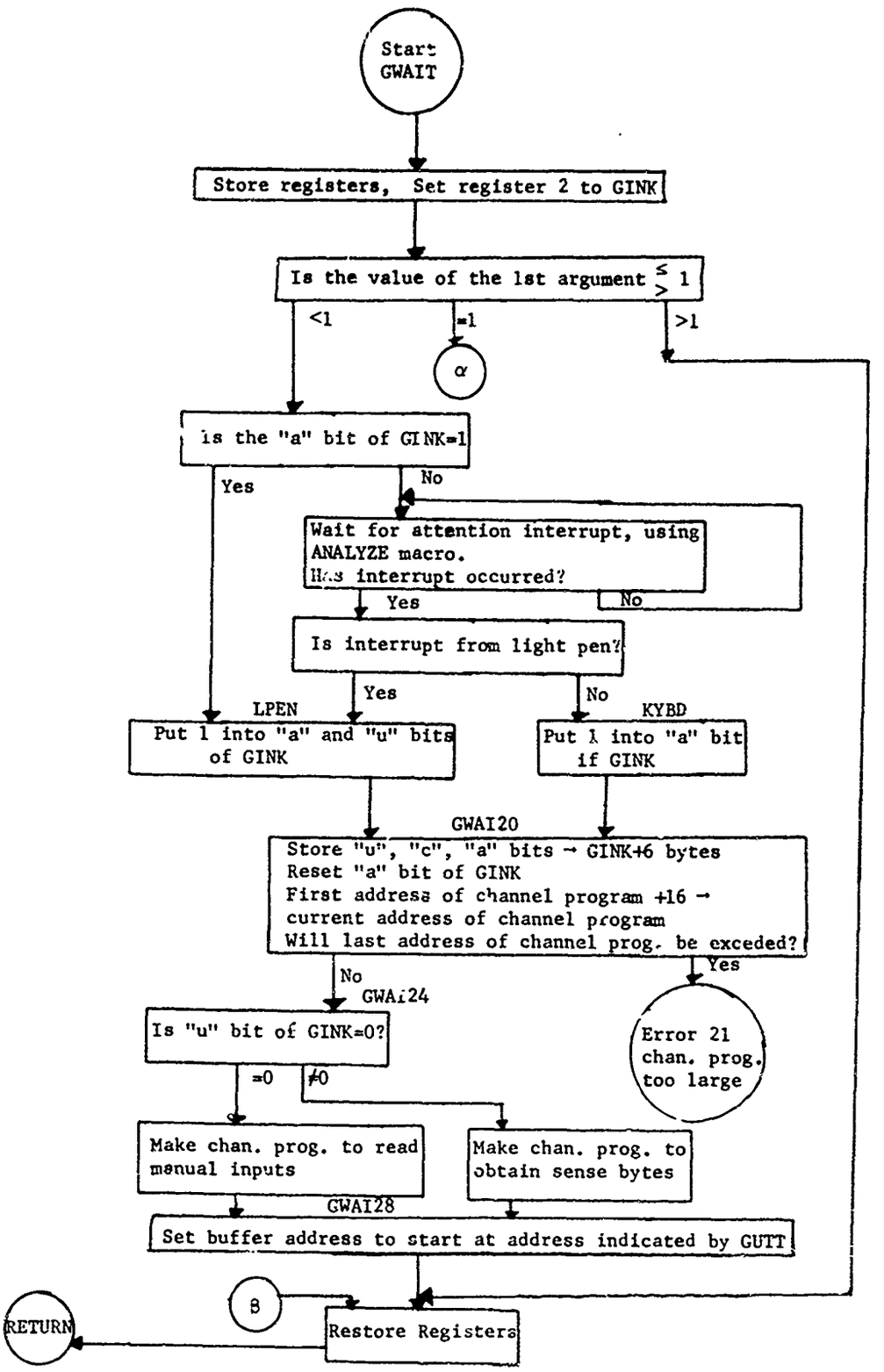
GREAD continued



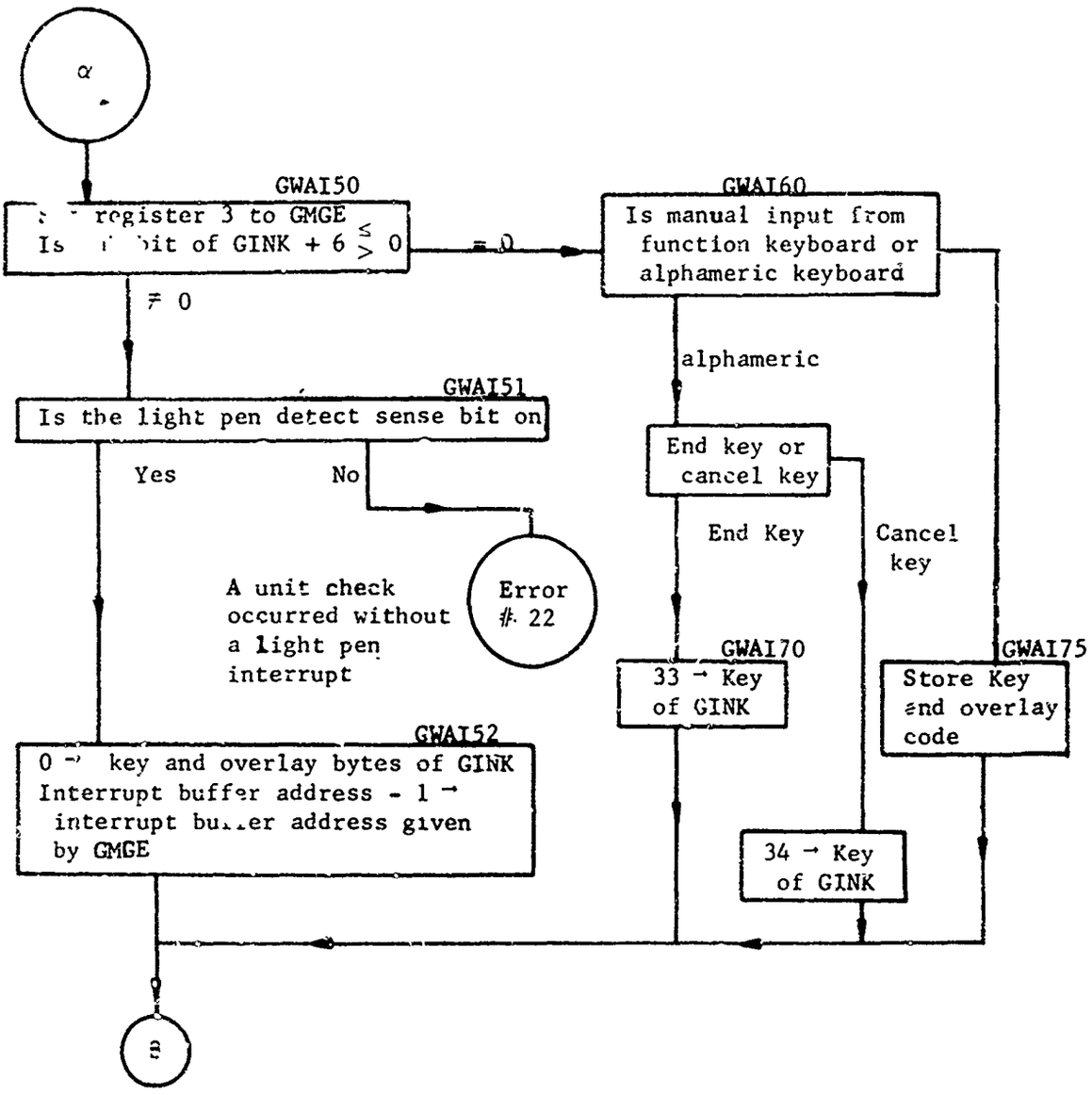
Assignment of temporary storage (GTEM) for GDISPL, GERASE, GMPTAG, GMCURS, GREAD, and GMGTAG

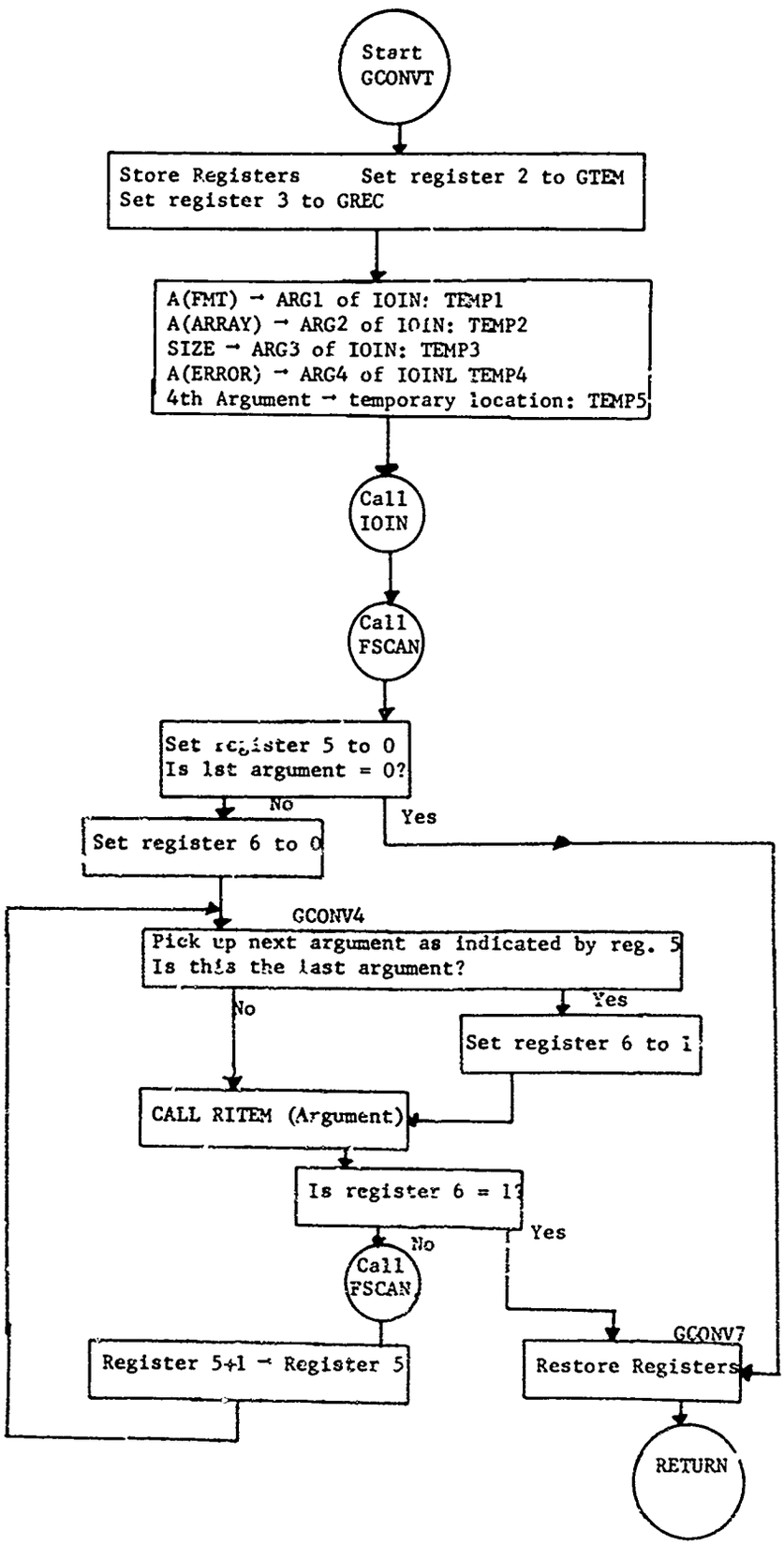
TEMP1	:	GTEM + 0 bytes	:	- location of 1st argument
TEMP2	:	GTEM + 4 bytes	:	- last parameter control
TEMP3	:	GTEM + 8 bytes	:	- 1st time through control
TEMP4	:	GTEM +12 bytes	:	- cursor found indicator
TEMP5	:	GTEM +16 bytes	:	- next byte to be used in buffer
TEMP6	:	GTEM +20 bytes	:	- mask from argument list
TEMP7	:	GTEM +24 bytes	:	- position of map during erase
TEMP8	:	GTEM +28 bytes	:	- number of entries in map

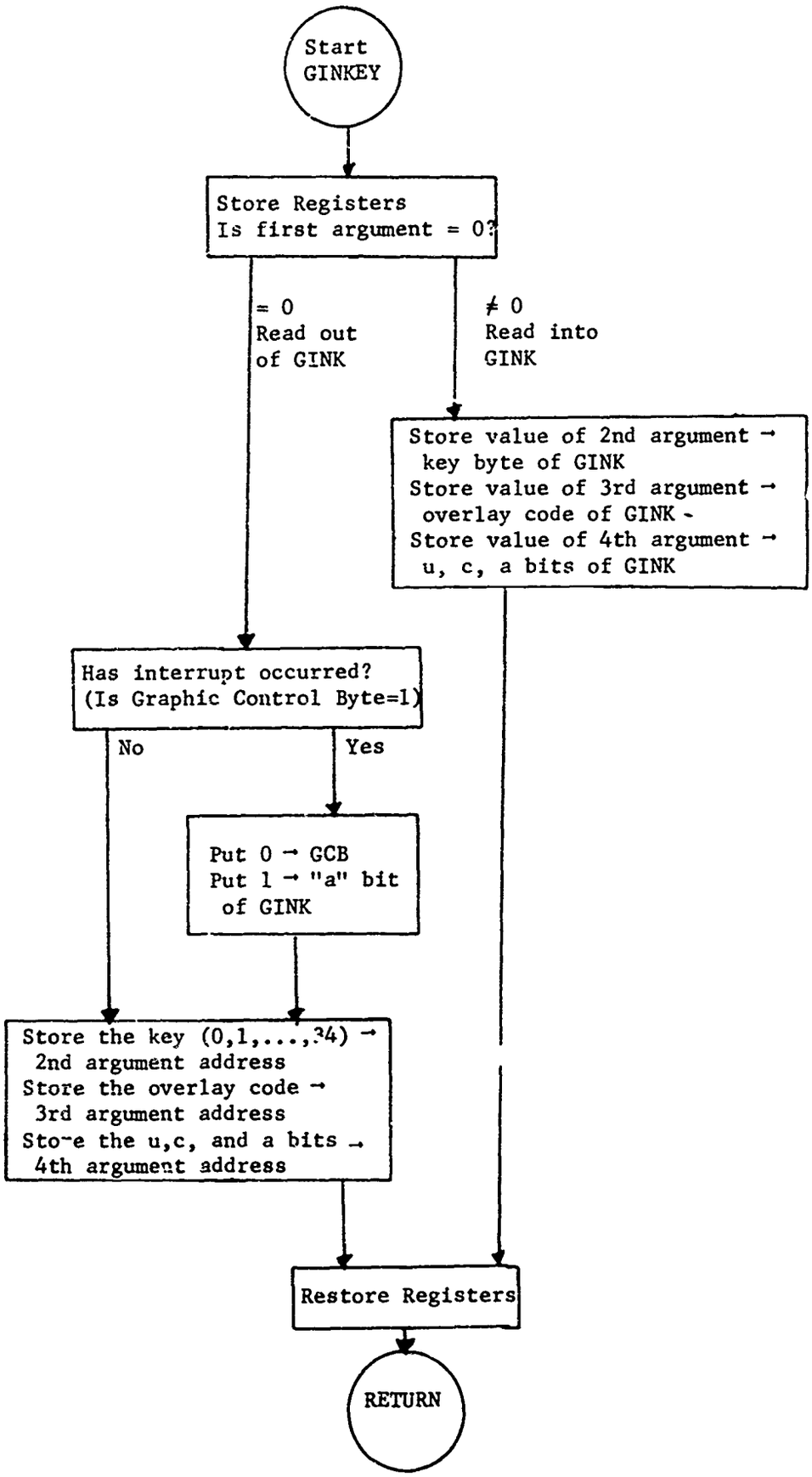

Start
GOPCP
Store registers
Set register 9 to GINK.
Store the address of channel program into IOB.
Put 0 → u,c, and a bits of GINK.
Put ECB address into register 2
Put IOB address into register 1
Test Graphic Control Byte (GCB)
to determine whether interrupt has occurred
= 1
Yes
= 0
No
Perform supervisor call and
wait for completion of
channel program
GOPC7
Restore registers
RETURN

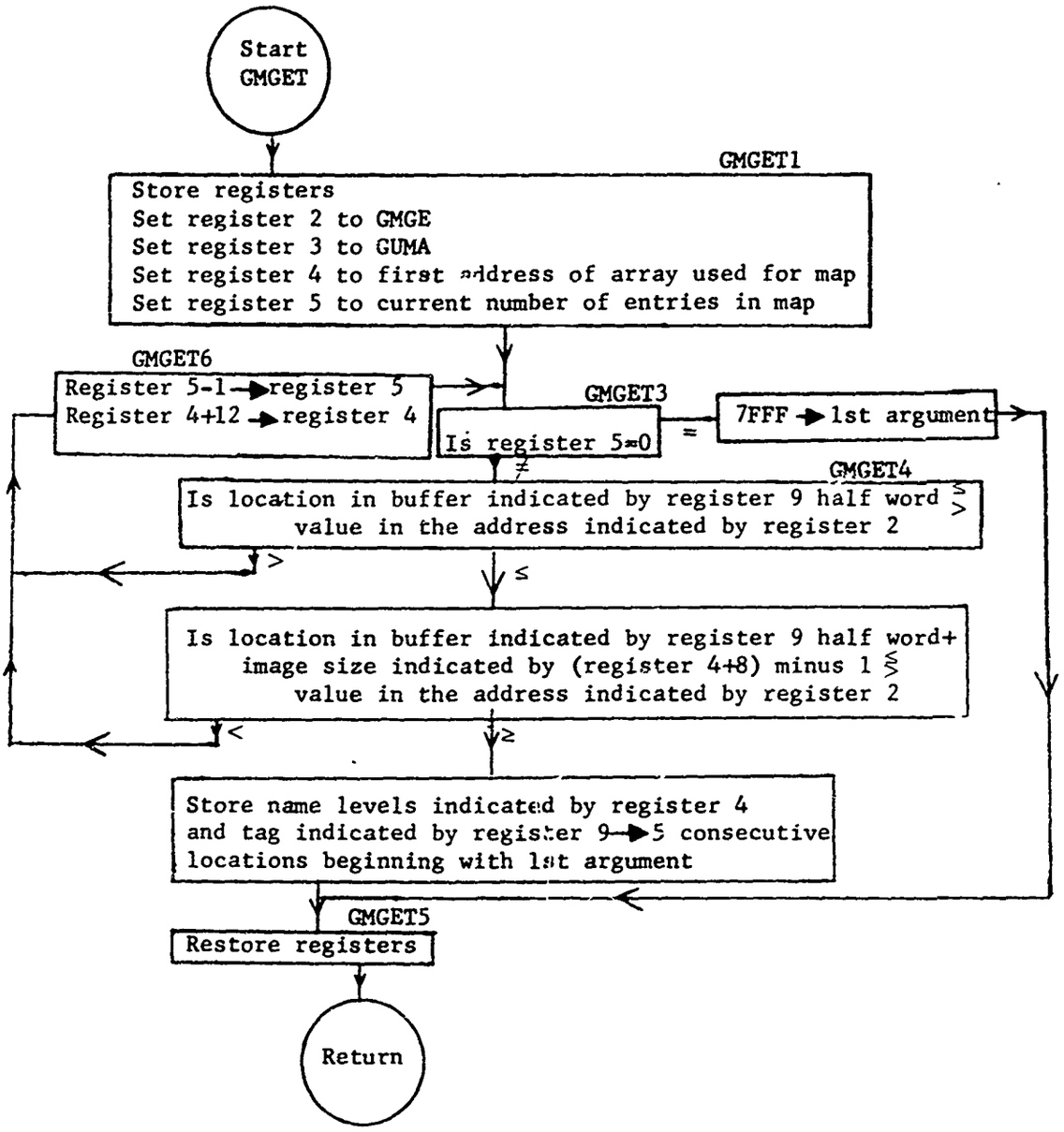

Start GWAIT
Store registers, Set register 2 to GINK
Is the value of the 1st argument ≤ > 1
<1
=1
>1
α
is the "a" bit of GINK=1
Yes
No
Wait for attention interrupt, using ANALYZE macro.
Has interrupt occurred?
Yes
No
Is interrupt from light pen?
Yes
No
LPEN
KYBD
Put 1 into "a" and "u" bits of GINK
Put 1 into "a" bit if GINK
GWAI20
Store "u", "c", "a" bits → GINK+6 bytes
Reset "a" bit of GINK
First address of channel program +16 → current address of channel program
Will last address of channel prog. be exceeded?
Yes
No
GWAI24
Error 21 chan. prog. too large
Is "u" bit of GINK=0?
=0
≠0
Make chan. prog. to read manual inputs
Make chan. prog. to obtain sense bytes
GWAI28
Set buffer address to start at address indicated by GUTT
β
RETURN
Restore Registers

GWAIT continued




Start GCONVT
Store Registers Set register 2 to GTEM
Set register 3 to GREC
A(FMT) → ARG1 of IOIN: TEMP1
A(ARRAY) → ARG2 of IOIN: TEMP2
SIZE → ARG3 of IOIN: TEMP3
A(ERROR) → ARG4 of IOINL TEMP4
4th Argument → temporary location: TEMP5
Call IOIN
Call FSCAN
Set register 5 to 0
Is 1st argument = 0?
No
Yes
Set register 6 to 0
GCONV4
Pick up next argument as indicated by reg. 5
Is this the last argument?
No
Yes
Set register 6 to 1
CALL RITEM (Argument)
Is register 6 = 1?
No
Yes
Call FSCAN
GCONV7
Register 5+1 → Register 5
Restore Registers
RETURN


Start GINKEY
Store Registers
Is first argument = 0?
= 0
Read out of GINK
≠ 0
Read into GINK
Store value of 2nd argument → key byte of GINK
Store value of 3rd argument → overlay code of GINK
Store value of 4th argument → u, c, a bits of GINK
Has interrupt occurred? (Is Graphic Control Byte=1)
No
Yes
Put 0 → GCB
Put 1 → "a" bit of GINK
Store the key (0,1,...,34) → 2nd argument address
Store the overlay code → 3rd argument address
Store the u,c, and a bits → 4th argument address
Restore Registers
RETURN


Start GMGET
GMGET1
Store registers
Set register 2 to GMGE
Set register 3 to GUMA
Set register 4 to first address of array used for map
Set register 5 to current number of entries in map
GMGET6
Register 5-1 → register 5
Register 4+12 → register 4
GMGET3
Is register 5=0
=
7FFF → 1st argument
≠
GMGET4
Is location in buffer indicated by register 9 half word ≷ value in the address indicated by register 2
>
≤
Is location in buffer indicated by register 9 half word+ image size indicated by (register 4+8) minus 1 ≶ value in the address indicated by register 2
<
≥
Store name levels indicated by register 4 and tag indicated by register 9 → 5 consecutive locations beginning with 1st argument
GMGET5
Restore registers
Return

VII CODING LISTING [1]

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```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GOPENX  CSECT
                                    2         ENTRY GOPEN
                                    3         ENTRY GCLOS
                                    4         EXTRN GDCB1
                                    5         EXTRN GDCB2
000000 C7D6D7C5D5                   6         DC    CL5'GOPEN'
000005 05                           7         DC    X'5'
000006                              8         USING *,15
000006 90EC D00C            00000C  9 GOPEN   STM   14,9,12(13)
                                   10         OPEN  (GDCB1,,GDCB2)
00000A 0700                        11+        CNOP  0,4
00000C 4510 F012            000018 12+        BAL   1,*+12 LOAD REG1 W/LIST ADDR.
000010 0C                          13+        DC    AL1(0) OPTION BYTE
000011 000000                      14+        DC    AL3(GDCB1) DCB ADDRESS
000014 80                          15+        DC    AL1(128) OPTION BYTE
000015 000000                      16+        DC    AL3(GDCB2) DCB ADDRESS
000018 0A13                        17+        SVC   19 ISSUE OPEN SVC
00001A 9829 D01C            00001C 18         LM    2,9,28(13)
00001E 07FE                        19         BCR   15,14
000020 C7C3D3D6E2                  20         DC    CL5'GCLOS'
000025 05                          21         DC    X'5'
000026                             22         USING *,15
000026 90E9 D00C            00000C 23 GCLOS   STM   14,9,12(13)
                                   24         CLOSE (GDCB1,,GDCB2)
00002A 0700                        25+        CNOP  0,4
00002C 4510 F012            000038 26+        BAL   1,*+12 BRANCH AROUND LIST
000030 00                          27+        DC    AL1(0) OPTION BYTE
000031 000000                      28+        DC    AL3(GDCB1) DCB ADDRESS
000034 80                          29+        DC    AL1(128) OPTION BYTE
000035 000000                      30+        DC    AL3(GDCB2) DCB ADDRESS
000038 0A14                        31+        SVC   20 ISSUE CLOSE SVC
00003A 9829 D01C            00001C 32         LM    2,9,28(13)
00003E 07FE                        33         BCR   15,14
                                   34         END
```


[1] Listings for the memory to memory conversion routines described in Reference (2) (IOUT, FSCAN, WITEM) are not included in this memorandum.

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                                1 GUBUFX CSECT
                                      2        ENTRY GUBUFF
                                      3        ENTRY GUCHAN
                                      4          EXTRN GUBU
                                      5          EXTRN GUCH
000000 C7E4C2F4C6C640                 6          DC    CL7'GUBUFF
000007 07                             7          DC    X'7'
000008                                8          USING *,15
000008 90E5 D00C            0000C     9 GUBUFF STM   14,5,12(13)
00000C 5820 F05C            00064    10          L     2,GUBU10
000010 5830 F064            0006C    11          L     3,GUBU12
000014 5840 1000            00000    12        L     4,0(0,1)
000018 07F3                          13        BCR   15,3
                                     14        DROP  15
00001A C7E4C3C8C1D540                15          DC    CL7'GUCHAN
000021 07                            16          DC    X'7'
000022                               17          USING *,15
000022 90E5 D00C            0000C    18 GUCHAN STM   14,5,12(13)
000026 5820 F046            00068    19          L     2,GUBU11
00002A 5840 1000            00000    20        L     4,0(0,1)
00002E 8840 0003            00003    21        SRL   4,3(0)
000032 4A40 F04E            00070    22        AH    4,GUBU13
000036 8940 0003            00003    23        SLL   4,3(0)
00003A 5830 F04A            0006C    24        L     3,GUBU12
00003E 07F3                          25        BCR   15,3
                                     26        DROP  15
000040                               27        USING *,3
000040 5040 2000            00000    28 GUBUF1 ST    4,0(0,2)
000044 5040 2004            00004    29        ST    4,4(0,2)
000048 5840 1000            00000    30        L     4,0(0,1)
00004C 5850 1004            00004    31        L     5,4(0,1)
000050 5E40 5000            00000    32        AL    4,0(0,5)
000054 4A40 3030            00070    33        AH    4,GUBU13
000058 5040 2008            00008    34        ST    4,8(0,2)
00005C 98E5 D01C            0001C    35        LM    2,5,28(13)
000060 07FE                          36        BCR   15,14
000062 0700                          37        CNOP  0,4
000064 0C000000                      38 GUBU10   DC    A(GUBU)
000068 0C000000                      39 GUBU11   DC    A(GUCH)
00006C 0C000040                      40 GUBU12 DC      A(GUBUF1)
000070 0C01                          41 GUBU13 DC      X'0001'
                                     42        END
```

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```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GRBUFX   CSECT
                                    2          ENTRY GRBUF
                                    3          EXTRN GUBU
000000 C7D9C2F4C6                   4          DC    CL5'GRBUF'
000005 05                           5          DC    X'5'
000006                              6          USING *,15
000006 9CE4 F00C             0000C  7 GRBUF    STM   14,4,12(13)
00000A 5820 F01E             00024  8          L     2,GRBUF1
00000E 5830 1000             00000  9          L     3,0(0,1)
000012 5840 2004             00004 10          L     4,4(0,2)
000016 5840 2000             00000 11          S     4,0(0,2)
00001A 5040 3000             00000 12          ST    4,0(0,3)
00001E 9824 D01C             0001C 13          LM    2,4,28(13)
000022 07FE                        14          BCR   15,14
000024                             15          CNOP  0,4
000024 00000000                    16 GRBUF1  DC    A(GUBU)
                                   17          END
```

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```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GUMAPX   CSECT
                                    2          ENTRY GUMAP
                                    3          EXTRN GUMA
000000 C7E4D4C1D7                   4          DC    CL5'GUMAP'
000005 05                           5          DC    X'5'
000006                              6          USING *,15
000006 9CE5 F00C             0000C  7 GUMAP    STM   14,5,12(13)
00000A 5820 F022             00028  8          L     2,GUMAP1
00000E 5830 1000             00000  9          L     3,0(0,1)
000012 5C30 2000             00000 10          ST    3,0(0,2)
000016 5840 1004             00004 11          L     4,4(0,1)
00001A 5850 4000             00000 12          L     5,0(0,4)
00001E 5C50 2004             00004 13          ST    5,4(0,2)
000022 9825 D01C             0001C 14          LM    2,5,28(13)
000026 07FE                        15          BCR   15,14
000028                             16          CNOP  0,4
000028 00000000                    17 GUMAP1  DC    A(GUMA)
                                   18          END
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                F01JAN67  1/11/68
000000                              1 GUNITX  CSECT
                                    2         ENTRY GUNIT
                                    3         EXTRN GUNI
000000 C7E4D5C9E3                   4         DC    CL5'GUNIT'
000005 05                           5         DC    X'5'
000006                              6         USING *,15
000006 90E4 D00C            0000C   7 GUNIT   STM   14,4,12(13)
00000A 5820 F01A            00020   8         L     2,G1
00000E 5830 1000            00000   9         L     3,0(0,1)
000012 5840 3000            00000  10         L     4,0(0,3)
000016 5040 2000            00000  11         ST    4,0(0,2)
00001A 9824 D01C            0001C  12         LM    2,4,28(13)
00001E 07FE                        13         BCR   15,14
000020                             14         CNOP  0,4
000020 0C000000                    15 G1      DC    A(GUNI)
                                   16         END
```



```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                F01JAN67  1/11/68
000000                              1 GUTTEX  CSECT
                                    2         ENTRY GUTTEY
                                    3         EXTRN GUTT
000000 C7E4E3E3C5E8E4               4         DC    CL7'GUTTEY'
000007 07                           5         DC    X'7'
000008                              6         USING *,15
000008 90E5 D00C            0000C   7 GUTTEY  STM   14,5,12(13)
00000C 5820 F034            0003C   8         L     2,GUTTE1
000010 5840 1000            00000   9         L     4,0(0,1)
000014 5850 4000            00000  10         L     5,0(0,4)
000018 1845                        11         LR    3,5
00001A 4A50 F038            00040  12         AH    5,GUTTE2
00001E 5450 F038            00040  13         N     5,GUTTE2
000022 4050 2000            00000  14         STH   5,0(0,2)
000026 1E53                        15         SR    5,3
000028 5840 1004            00004  16         L     4,4(0,1)
00002C 5840 4000            00000  17         L     4,0(0,4)
000030 1845                        18         SR    4,5
000032 4040 2002            00002  19         STH   4,2(0,2)
000036 9825 D01C            0001C  20         LM    2,5,28(13)
00003A 07FE                        21         BCR   15,14
00003C                             22         CNOP  0,4
00003C 0C000000                    23 GUTTE1  DC    A(GUTT)
000040 0C01FFFF                    24 GUTTE2  DC    X'0001FFFF'
                                   25         END
```

```
   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GUTYPX   CSECT
                                    2          ENTRY GUTYPE
                                    3          ENTRY GUPLOT
                                    4          ENTRY GUSIZE
                                    5          ENTRY GULIM
                                    6          ENTRY GUGRID
                                    7          ENTRY GUNAME
                                    8          EXTRN GUTY
                                    9          EXTRN GUPL
                                   10          EXTRN GUSI
                                   11          EXTRN GULI
                                   12          EXTRN GUGR
                                   13          EXTRN GUNA
000000 C7E4E3E8D7C540              14          DC    CL7'GUTYPE
000007 07                          15          DC    X'7'
000008                             16          USING *,15
000008 90EB D00C             0000C 17 GUTYPE   STM   14,8,12(13)
00000C 5820 F010             00018 18          L     2,GUTYPA
000010 5830 F0EC             000F4 19          L     3,GUTY13
000014 07F3                        20          BCR   15,3
000016 0000                        
000018 00000000                    21 GUTYPA   DC    A(GUTY)
                                   22          DROP  15
00001C C7E4D7D3D6F340              23          DC    CL7'GUPLOT '
000023 07                          24          DC    X'7'
000024                             25          USING *,15
000024 90EB D00C             0000C 26 GUPLOT   STM   14,8,12(13)
000028 5820 F010             00034 27          L     2,GUPLOA
00002C 5830 F0D0             000F4 28          L     3,GUTY13
000030 07F3                        29          BCR   15,3
000032 0000                        
000034 00000000                    30 GUPLOA   DC    A(GUPL)
                                   31          DROP  15
000038 C7E4E2C9E9C540              32          DC    CL7'GUSIZE
00003F 07                          33          DC    X'7'
000040                             34          USING *,15
000040 90EB D00C             0000C 35 GUSIZE   STM   14,8,12(13)
000044 5820 F010             00050 36          L     2,GUSIZA
000048 5830 F0B4             000F4 37          L     3,GUTY13
00004C 07F3                        38          BCR   15,3
00004E 0000                        
000050 00000000                    39 GUSIZA   DC    A(GUSI)
                                   40          DROP  15
000054 C7E4D3C9D4                  41          DC    CL5'GULIM'
000059 05                          42          DC    X'5'
00005A                             43          USING *,15
00005A 90EB D00C             0000C 44 GULIM    STM   14,8,12(13)
00005E 5820 F012             0006C 45          L     2,GULIMA
000062 5830 F09A             000F4 46          L     3,GUTY13
000066 47F0 F078             00082 47          BC    15,GUTYP6
00006A 0000                        
00006C 00000000                    48 GULIMA   DC    A(GULI)
                                   49          DROP  15
000070 C7E4C7D9C9C540              50          DC    CL7'GUGRID
000077 07                          51          DC    X'7'
000078                             52          USING *,5
```

```
   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000078 90E9 C00C             0000C    53 GUGRID  STM   14,8,12(13)
00007C 5820 F010             00088    54         L     2,GUGRIA
000080 5830 F07C             000F4    55         L     3,GUTY13
000084 47F0 F05A             000D2    56         BC    15,GUTYP6
000088 00000000                       57 GUGRIA  DC    A(GUGR)
                                      58         DROP  15
00008C C7E4D5C1D4C540                 59         DC    CL7'GUNAME
000093 07                             60         DC    X'7'
000094                                61         USING *,15
000094 90E9 C00C             0000C    62 GUNAME  STM   14,8,12(13)
000098 5820 F010             000A4    63         L     2,GUNAMA
00009C 5830 F060             000F4    64         L     3,GUTY13
0000A0 07F3                           65         BCR   15,3
0000A2 0000
0000A4 00000000                       66 GUNAMA  DC    A(GUNA)
                                      67         DROP  15
0000A8                                68         USING *,3
0000A8 4F80 3048             000F0    69 GUTYP1  LH    8,GUTY12
0000AC 5E40 1000             00000    70 GUTYP2  L     4,0(0,1)
0000B0 5E50 4000             00000    71         L     5,0(0,4)
0000B4 4980 3048             000F0    72         CH    8,GUTY12
0000B8 4760 3034             0000C    73         BC    6,GUTYP7
0000BC 4050 2000             00000    74 GUTYP3  STH   5,0(0,2)
0000C0 1E28                           75 GUTYP4  ALR   2,8
0000C2 4A10 304A             000F2    76 GUTYP5  AH    1,GUTY12+2
0000C6 1264                           77         LTR   6,4
0000C8 47A0 3004             000AC    78         BC    10,GUTYP2
0000CC 9818 F018             00018    79         LM    1,8,24(13)
0000D0 07FE                           80         BCR   15,14
0000D2 4880 304A             000F2    81 GUTYP6  LH    8,GUTY12+2
0000D6 1878                           82         LR    7,8
0000D8 47F0 3004             000AC    83         BC    15,GUTYP2
0000DC 5C50 2000             00000    84 GUTYP7  ST    5,0(0,2)
0000E0 4670 3018             000C0    85         BCT   7,GUTYP4
0000E4 1E28                           86         ALR   2,8
0000E6 4880 3048             000F0    87         LH    8,GUTY12
0000EA 47F0 301A             000C2    88         BC    15,GUTYP5
0000EE 0700                           89         CNOP  0,4
0000F0 00020004                       90 GUTY12  DC    X'00020004'
0000F4 000000A8                       91 GUTY13  DC    A(GUTYP1)
                                      92         END
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GCOUNX   CSECT
                                    2          ENTRY GCOUNT
                                    3          EXTRN GCOU
000000 C7C3D6E4D5F340               4          DC    CL7'GCOUNT '
000007 07                           5          DC    X'7'
000008                              6          USING *,15
000008 9CE4 C00C              0000C 7 GCOUNT   STM   14,4,12(13)
00000C 5820 F038              00040 8          L     2,GCOUN5
000010 5830 1000              00000 9          L     3,0(0,1)
000014 5840 3000              00000 10         L     4,0(0,3)
000018 5830 1004              00004 11         L     3,4(0,1)
00001C 5540 F03C              00044 12         CL    4,GCOUN6
000020 4760 F02A              00032 13         BC    6,GCOUN4
000024 5840 3000              00000 14 GCOUN2  L     4,0(0,2)
000028 4040 2000              00000 15         STH   4,0(0,2)
00002C 9824 D01C              0001C 16 GCOUN3  LM    2,4,28(13)
000030 07FE                         17         BCR   15,14
000032 4840 2000              00000 18 GCOUN4  LH    4,0(0,2)
000036 5040 3000              00000 19         ST    4,0(0,3)
00003A 47F0 F024              00020 20         BC    15,GCOUN3
00003E 0700                         21         CNOP  0,4
000040 0C000000                     22 GCOUN5  DC    A(GCOU)
000044 0C000000                     23 GCOUN6  DC    F'0'
                                    24         END
```

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LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GMPTAX   CSECT
                                    2         ENTRY GMPTAG
                                    3         ENTRY GMCURS
                                    4         ENTRY GERASE
                                    5         ENTRY GDISPL
                                    6         ENTRY GREAD
                                    7         ENTRY GMGTAG
                                    8         EXTRN GUBU
                                    9         EXTRN GUMA
                                   10         EXTRN GUCH
                                   11         EXTRN GTEM
                                   12         EXTRN GUTT
                                   13         EXTRN GREG
                                   14         EXTRN GDIAGN
000000 C7D4C7F3C1C740              15         DC    CL7'GMPTAG'
000007 07                          16         DC    X'7'
000008                             17         USING *,15
000008 90EA C00C          0000C    18 GMPTAG  STM   14,10,12(13)
00000C 5820 F55C          00564    19         L     2,GMN002
000010 58F0 F55C          00564    20         L     15,GMN001
000014 07F2                        21         BCR   15,2
                                   22         DROP  15
000016 C7D4C3E4D9C7C540            23         DC    CL7'GMCURS '
000010 07                          24         DC    X'7'
00001F                             25         USING *,15
00001E 90EA C00C          0000C    26 GMCURS  STM   14,10,12(13)
000022 5820 F546          00564    27         L     2,GMN001
000026 58F0 F546          00564    28         L     15,GMN001
00002A 07F2                        29         BCR   15,2
                                   30         DROP  15
00002C C7C4C9E2C9C3C540            31         DC    CL7'GDISPL '
000033 07                          32         DC    X'7'
000034                             33         USING *,15
000034 90EA C00C          0000C    34 GDISPL  STM   14,10,12(13)
000038 5820 F534          00568    35         L     2,GMN002
00003C 58F0 F530          00564    36         L     15,GMN001
000040 07F2                        37         BCR   15,2
                                   38         DROP  15
000042 C7C5D9C1E2C540              39         DC    CL7'GERASE '
000049 07                          40         DC    X'7'
00004A                             41         USING *,15
00004A 90EA C00C          0000C    42 GERASE  STM   14,10,12(13)
00004E 5820 F51E          00568    43         L     2,GMN002
000052 58F0 F51A          00564    44         L     15,GMN001
000056 07F2                        45         BCR   15,2
                                   46         DROP  15
000058 C7D9C5C1C4                  47         DC    CL5'GREAD'
00005D 05                          48         DC    X'5'
00005E                             49         USING *,15
00005E 90EA C00C          0000C    50 GREAD   STM   14,10,12(13)
000062 5820 F506          00564    51         L     2,GMN001
000066 58F0 F506          00564    52         L     15,GMN002
00006A 07F2                        53         BCR   15,2
                                   54         DROP  15
00006C C7D4C7E3C1C740              55         DC    CL7'GMGTAG '
000073 07                          56         DC    X'7'
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                  FOIJAN67  :/11/68

000074                             57         USING *,15
000074 90EA 000C                00000C     58 GMGTAG STM   14,10,12(13)
000078 5820 F4B0                000564     59         L     2,GMN001
00007C 58EF F4B0                000564     60         L     15,GMN001
000080 07F2                                61         BCR   15,2
                                           62         DROP  15
000082                                     63         USING *,15
000082 58E0 F4F6                000578     64 GDISP2    L     2,GMN006
000086 5830 1000                000000     65           L     3,0(0,1)
00008A 5030 2000                000000     66           ST    3,0(0,2)
00008E 4A30 F580                000602     67           AH    1,GMN038+2
000092 58E0 F4F6                000578     68 GDISP3    L     2,GMN006
000096 1833                                69           SR    3,3
000098 5030 2004                000004     70           ST    3,4(0,2)
00009C 5030 2008                000008     71           ST    3,8(0,2)
0000A0 5830 F50E                000590     72           L     3,GMN012
0000A4 5930 F010                000010     73           C     3,16(0,15)
0000A8 4780 F0D0                000152     74           BC    8,GDISI3
0000AC 58E0 F4FE                000570     75 GDISP4    L     2,GMN004
0000B0 5840 2000                000000     76           L     4,0(0,2)
0000B4 4850 2006                000004     77           LH    5,4(0,2)
0000B8 4A50 F52E                0005A4     78 GDISP5    CH    5,GMN017
0000BC 4780 F0FA                0000DC     79           BC    8,GDISP9
0000C0 4850 400A                0000DA     80           LH    5,10(0,4)
0000C4 5A60 F52E                0005A4     81 GDISP6    A     6,GMN017
0000C8 5E60 F52A                0005E4     82           AL    6,GMN031
0000CC 4060 400A                0000DA     83           STH   6,10(0,4)
0000D0 4A50 F51A                0005B8     84           SH    5,GMN014
0000D4 4A40 F520                0005A2     85           AH    4,GMN016+2
0000D8 47F0 F0E6                0000B8     86           BC    15,GDISP5
0000DC 5830 F526                0005A8     87 GDISP9    L     3,GMN018
0000E0 5030 200C                00000C     88           ST    3,12(0,2)
0000E4 5830 F4F2                000574     89           L     3,GMN005
0000E8 5840 2000                000000     90           L     4,0(0,2)
0000EC 1854                                91           LR    5,4
0000EE 4A50 F51E                0005A6     92           AH    5,GMN016
0000F2 5050 2004                000004     93           ST    5,4(0,2)
0000F6 4A50 F5BA                0005B8     94           SH    5,GMN014
0000FA 5050 2008                000008     95           CL    5,8(0,2)
0000FE 47A4 F0FC                00011E     96           BC    4,GDISI2
000102 41A0 F52A                0005AC     97 GDISI0    LA    1,GMN019
000106 5810 F4FE                000580     98 GDISI1    L     13,GMN008
00010A 58F0 F532                0005B4     99           L     15,GMNG21
00010E 1CCF                               100           BALR  14,15
                                          101           ABEND 999,DUMP
000110                                    102+          CNOP  0,4
000110 47F0 F0FC                000118    103+          B     **8 BRANCH AROUND CONSTANT
000114 80                                 104+          DC    AL1(128) DUMP/STEP CODE
000115 000307                             105+          DC    AL3(999) COMPLETION CODE
000118 58C0 F002                000114    106+          L     1,*-4 LOAD CODES INTO REG 1
00011C 0A0D                               107+          SVC   13 LINK TO ABEND ROUTINE
00011E 58D0 F536                0005B8    108 GDISI2   L     5,GMN022
000122 58E0 F4FA                000570    109          AL    5,GMN007
000126 5050 4000                000000    110          ST    5,0(0,4)            CHAN=0700GUTT
00012A 58D0 F542                0005C4    111          L     5,GMN023+4
00012E 5050 4004                000004    112          ST    5,4(0,4)            CHAN=60000002
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LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT

000132 5E50 F53F            005C0   113            L     5,GMN023
000136 5C50 4008            00008   114            ST    5,8(0,4)
00013A 5E50 F542            005C4   115            L     5,GMN023+4
00013E 5C50 400C            0000C   116            ST    5,12(0,4)
000142 5B50 F4FA            0057C   117            L     5,GMN007
000146 4E60 F000            00000   118            LH    6,0(0,5)
00014A 4A60 F544            005C6   119            AH    6,GMN023+6
00014F 5C60 2010            00010   120            ST    6,16(0,2)
000152 5E30 2004            00004   121 GDIS13     L     3,4(0,2)
000156 4930 F522            005A4   122            CH    3,GMN017
00015A 4760 F128            001AA   123            BC    6,GDIS60
00015E 5E40 1000            00000   124            L     4,0(0,1)
000162 5E50 4000            00000   125            L     5,0(0,4)
000166 5950 F546            005C8   126            C     5,GMN026
00016A 4740 F108            00188   127            BC    4,GDIS20
00016E 5C50 2014            00014   128 GDIS15     ST    5,20(0,2)
000172 4940 F522            005A4   129            CH    4,GMN017
000176 47A0 F100            00182   130            BC    10,GDIS17
00017A 4850 F516            00598   131            LH    5,GMN014
00017E 5C50 2004            00004   132            ST    5,4(0,2)
000182 4A10 F584            00606   133 GDIS17     AH    1,GMN038+6
000186 47F0 F11C            0019E   134            BC    15,GDIS25
00018A 5E40 2008            00008   135 GDIS20     L     4,8(0,2)
00018E 4940 F522            005A4   136            CH    4,GMN017
000192 4760 F13A            001BC   137            BC    6,GDIS95
000196 5E40 F556            005D8   138            L     4,GMN028
00019A 5C40 2014            00014   139            ST    4,20(0,2)
00019E 4840 F516            00598   140 GDIS25     LH    4,GMN014
0001A2 5C40 2008            00008   141            ST    4,8(0,2)
0001A6 47F0 F13A            001BC   142            BC    15,GDIS95
0001AA 5E30 F010            00010   143 GDIS60     L     3,16(0,13)
0001AE 5530 F50E            00590   144            CL    3,GMN012
0001B2 4780 F34E            003D0   145            BC    8,GDI400
0001B6 98FA C018            00018   146 GDIS80     LM    1,10,24(13)
0001BA 07FF                         147            BCR   15,14
0001BC 1E33                         148 GDIS95     SR    3,3
0001BE 1843                         149            LR    4,3
0001C0 5E50 F526            005A8   150            L     5,GMN018
0001C4 5E60 2014            00014   151            L     6,20(0,2)
0001C8 5E60 F546            005C8   152            S     6,GMN026
0001CC 5E70 F54A            005CC   153            L     7,GMN025
0001D0 1E86                         154 GDIS97     LR    8,6
0001D2 1E87                         155            SR    8,7
0001D4 4980 F522            005A4   156            CH    8,GMN017
0001D8 4740 F1AA            0022C   157            BC    4,GDI150
0001DC 5E90 2004            00004   158 GDI100     L     9,4(0,2)
0001E0 4990 F516            00598   159            CH    9,GMN014
0001E4 4760 F16E            001F0   160            BC    6,GDI110
0001E8 4110 F55A            005DC   161            LA    1,GMN029
0001EC 47F0 F084            00106   162            BC    15,GDIS11
0001F0 1E68                         163 GDI110     LR    6,8
0001F2 1E35                         164            OR    3,5
0001F4 5E90 3000            00000   165            L     9,0(0,1)
0001F8 4990 F522            005A4   166            CH    9,GMN017
0001FC 47A0 F186            00208   167            BC    10,GDI115
000200 48A0 F516            00598   168          LH      10,GMN014

CHAN-0100GMN050   2A82

CHAN-06000002
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000204 50A0 2004            00004   169          ST    10,4(0,2)
000208 58A0 C000            00000   170 GDI115   L     10,0(0,9)
00020C 189A                         171          LR    9,10
00020E 88A0 0008            00008   172          SLL   10,8(0)
000212 189A                         173          OR    9,10
000214 88A0 0008            00008   174          SLL   10,8(0)
000218 189A                         175          OR    9,10
00021A 88A0 C008            00008   176          SLL   10,8(0)
00021E 189A                         177          OR    9,10
000220 1495                         178          NR    9,5
000222 1649                         179          OR    4,9
000224 4A10 F584            00606   180          AH    1,GMN038+6
000228 47F0 F14E            00100   181          BC    15,GDIS97
00022C 8850 C008            00008   182 GDI150   SRL   5,8(0)
000230 5970 F54E            00500   183          C     7,GMN026
000234 4780 F1C2            00244   184          BC    8,GDI155
000238 4740 F1CA            0024C   185          BC    4,GDI160
00023C 5870 F54E            00500   186          L     7,GMN026
000240 47F0 F14E            00100   187          BC    15,GDIS97
000244 5870 F552            005D4   188 GDI155   L     7,GMN027
000248 47F0 F14E            00100   189          BC    15,GDIS97
00024C 4970 F516            00598   190 GDI160   CH    7,GMN014
000250 47C0 F1DA            0025C   191          BC    12,GDI200
000254 4870 F516            00598   192          LH    7,GMN014
000258 47F0 F14E            00100   193          BC    15,GDIS97
00025C 5850 F4FE            00570   194 GDI200   L     5,GMN004
000260 5860 5000            00000   195          L     6,0(0,5)
000264 5060 2018            00018   196          ST    6,24(0,2)
000268 4870 5004            00004   197          LH    7,4(0,5)
00026C 5070 201C            0001C   198          ST    7,28(0,2)
000270 4970 F522            005A4   199 GDI205   CH    7,GMN017
000274 4780 F28C            0033E   200          BC    8,GDI275
000278 5880 6000            00000   201          L     8,0(0,6)
00027C 1483                         202          NR    8,3
00027E 1584                         203          CLR   8,4
000280 4763 F26C            002EE   204          BC    6,GDI250
000284 5880 C010            00010   205          L     8,16(0,13)
000288 5580 F506            00588   206          CL    8,GMN010      IS ENTRY GMCURS
00028C 4780 F254            002D6   207          BC    8,GDI230
000290 5580 F512            00594   208          CL    8,GMN013      IS ENTRY GREAD
000294 4790 F458            004DA   209          BC    8,GDI500
000298 5590 F50E            00590   210          CL    8,GMN012      IS ENTRY GDISPL
00029C 47E0 F2CC            0034E   211          BC    8,GDI300
0002A0 5580 F50A            0058C   212          CL    8,GMN011      IS ENTRY GERASE
0002A4 4780 F2AC            0032E   213          BC    8,GDI270
0002A8 5580 F502            00584   214          CL    8,GMN009      IS ENTRY GMGTAG
0002AC 4780 F4CA            0054C   215          BC    8,GDI510
0002B0 5830 2000            00000   216 GDI210   L     8,0(0,2)
0002B4 5890 9000            00000   217          L     9,0(0,9)
0002B8 8990 000F            0000F   218          SLL   9,15(0)
0002BC 4680 600A            0000A   219          LH    8,10(0,6)
0002C0 5480 F552            005D4   220          N     8,GMN031
0002C4 1E89                         221          ALR   8,9
0002C6 4080 600A            0000A   222          STH   8,10(0,6)
0002CA 4A70 F516            00598   223 GDI215   SH    7,GMN014
0002CE 4A60 F520            005A2   224          AH    6,GMN016+2
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 LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000202 47F0 F11E             00270   225          BC    15,GDI205
000206 5E30 2000             00000   226 GDI230   L     8,0(0,2)
00020A 4830 6006             00006   227          LH    9,6(0,6)
00020E 5430 F56A             005E8   228          N     9,GMN032
000212 5E90 F000             00000   229          AL    9,0(0,8)
000216 4C90 6006             00006   230          STH   9,6(0,6)
00021A 47F0 F248             002CA   231          BC    15,GDI215
00021E 5E80 F010             00010   232 GDI250   L     8,16(0,13)
000222 5580 F50A             0058C   233          CL    8,GMN011
000226 47B0 F248             002CA   234          BC    6,GDI215
00022A 5580 2018             00018   235          C     6,24(0,2)
00022E 4780 F22C             0021E   236          BC    8,GDI260
000232 5E80 2018             00018   237 GDI255   L     8,24(0,2)
000236 5E90 6000             00000   238          L     9,0(0,6)
00023A 5C90 8000             00000   239          ST    9,0(0,8)
00023E 5E90 6004             00004   240          L     9,4(0,6)
000242 5C90 8004             00004   241          ST    9,4(0,8)
000246 5E90 6008             00008   242          L     9,8(0,6)
00024A 5C90 8008             00008   243          ST    9,8(0,8)
00024E 5E80 2018             00018   244 GDI260   L     8,24(0,2)
000252 4A80 F520             005A2   245          AH    8,GMN016+2
000256 5C80 2018             00018   246          ST    8,24(0,2)
00025A 47F0 F248             002CA   247          BC    15,GDI215
00025E 5E80 201C             0001C   248 GDI270   L     8,28(0,2)
000262 4E30 F516             00598   249          SH    8,GMN014
000266 5C80 201C             0001C   250          ST    8,28(0,2)
00026A 47F0 F248             002CA   251          BC    15,GDI215
00026E 5E50 F4EE             00570   252 GDI275   L     5,GMN004
000272 5E80 201C             0001C   253          L     8,28(0,2)
000276 4C80 5004             00004   254          STH   8,4(0,5)
00027A 47C0 F000             00152   255          BC    15,GDIS15
00027E 4E80 6008             00008   256 GDI300   LH    8,8(0,6)
000282 4A80 F522             005A4   257          CH    8,GMN017
000286 47B0 F248             002CA   258          BC    8,GDI215
00028A 5E50 F4F2             00574   259          L     5,GMN005
00028E 5E90 5004             00004   260          L     9,4(0,5)
000292 1E89                          261          LR    8,9
000294 4A80 F5A8             0062A   262          AH    8,GMN047+2
000298 5C80 5004             00004   263          ST    8,4(0,5)
00029C 4E80 F516             00598   264          SH    8,GMN014
0002A0 5580 5008             00008   265          CL    8,8(0,5)
0002A4 47A0 F080             00102   266          BC    10,GDIS10
0002A8 5E80 6004             00004   267 GDI302   L     8,4(0,6)
0002AC 8E80 0008             00008   268          SRL   8,8(0)
0002B0 5E80 F56A             005EC   269          AL    8,GMN033
0002B4 5C80 9000             00000   270          ST    8,0(0,9)
0002B8 5E80 F56F             005F0   271          L     8,GMN034
0002BC 4A80 6008             00008   272          AH    8,8(0,6)
0002C0 5C80 9004             00004   273          ST    8,4(0,9)
0002C4 4E90 600A             0000A   274          LH    9,10(0,6)
0002C8 5490 F522             005A4   275          N     9,GMN017
0002CC 5E90 2010             00010   276          AL    9,16(0,2)
0002D0 4C90 600A             0000A   277          STH   9,10(0,6)
0002D4 4E90 6006             00006   278          LH    9,6(0,6)
0002D8 5490 F572             005F4   279          N     9,GMN035
0002DC 4590 F522             005A4   280          CH    9,GMN017
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CHAN 0100ADDR OF 360 BUFFER

0600SIZE

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   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000380 4780 F33E             003C0   281          BC     8,GDI320
000384 5E90 2010             00010   282 GDI310   AL     9,16(0,2)
000388 4E90 F516             00598   283          SH     9,GMN014
00038C 5C90 200C             0000C   284          ST     9,12(0,2)
000390 5E90 2010             00010   285 GDI320   L      9,16(0,2)
000394 4A90 600B             00008   286          AH     9,8(0,6)
000398 5C90 2010             00010   287          ST     9,16(0,2)
00039C 47F0 F248             00248   288          BC     15,GDI215
0003A0 5880 F4EA             0057C   289 GDI400   L      8,GMN007
0003A4 4E90 8000             00000   290          LH     9,0(0,8)
0003A8 5E90 F576             005E8   291          AL     9,GMN036
0003AC 5C90 8004             00004   292          ST     9,4(0,8)      MAKE TRANSFER UNCOND. TO FIRST ADDR.
0003B0 5850 F4E2             00574   293          L      5,GMN005          AVAILABLE TO 2250
0003B4 5E90 5004             00004   294          L      9,4(0,5)
0003B8 1889                          295          LR     8,9
0003BA 4A80 F5A8             0062A   296          AH     8,GMN047+2
0003BE 5C80 5004             00004   297          ST     8,4(0,5)
0003C2 4E80 F516             00598   298          SH     8,GMN014
0003C6 5580 5008             00008   299          CL     8,8(0,5)
0003CA 4740 F080             00102   300          BC     10,GDIS10
0003CE 5E90 F57F             00600   301 GDI402   L      9,GMN038
0003D2 5E80 F4EA             0057C   302          AL     8,GMN007
0003D6 5C90 8000             00000   303          ST     8,0(0,9)      CHAN-0100(GUTT+4)
0003DA 5E80 F582             005E4   304          L      8,GMN038+4
0003DE 5C80 8004             00004   305          ST     8,4(0,9)      CHAN-60000004
0003E2 5E90 2010             00010   306          L      9,16(0,2)
0003E6 4A90 F584             00606   307          AH     9,GMN038+6
0003EA 5C90 2010             00010   308          ST     9,16(0,2)
0003EE 5E90 200C             0000C   309          L      9,12(0,2)
0003F2 5590 F526             005A8   310          CL     9,GMN018
0003F6 4730 F402             00484   311          BC     8,GDI420
0003FA 4E90 200E             0000E   312 GDI405   LH     9,14(0,2)
0003FE 5E80 F4EA             0057C   313          L      8,GMN007
000402 4290 8008             00008   314          STH    9,8(0,8)      BUFFER ADDR. FOR CURSOR
000406 5E90 5004             00004   315          L      9,4(0,5)
00040A 1889                          316          LR     8,9
00040C 4A80 F586             00608   317          AH     8,GMN038
000410 5C80 5004             00004   318          ST     8,4(0,5)
000414 4E80 F516             00598   319          SH     8,GMN014
000418 5580 5008             00008   320          CL     8,8(0,5)
00041C 4740 F080             00102   321          BC     10,GDIS10
000420 5E80 F5A6             00628   322 GDI406   L      8,GMN047
000424 5E90 F4EA             0057C   323          AL     8,GMN007
000428 5C90 8000             00000   324          ST     8,0(0,9)      CHAN-0700(GUTT+8)
00042C 5E80 F542             005C4   325          L      8,GMN023+4
000430 5C80 8004             00004   326          ST     8,4(0,9)      CHAN-60000002
000434 5E90 F5EA             0060C   327          L      8,GMN040
000438 5E90 F5BF             005E9   328          AL     8,GMN041
00043C 5C90 8008             00008   329          ST     8,8(0,9)      CHAN-0F00(GMN031)
000440 5E90 F592             00614   330          L      8,GMN042
000444 5C80 800C             0000C   331          ST     8,12(0,9)     CHAN-60000001
000448 5E90 2010             00010   332          L      9,16(0,2)
00044C 4A90 F51C             0059F   333          AH     9,GMN015+2
000450 5C90 2010             00010   334          ST     9,16(0,2)
000454 5E90 5004             00004   335 GDI420   L      9,4(0,5)
000458 1E89                          336          LR     8,9
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 LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000488 4880 F548           0062A   337           AH    8,GMN047+2
00048C 5080 9004           00004   338           ST    8,4(0,9)
000490 4880 F516           00598   339           SH    8,GMN014
000494 5580 9008           00008   340           CL    8,8(0,9)
000498 47A0 F0B0           00102   341           BC    10,GDIS10
00049C 5880 F5A2           00624   342 GDI422    L     8,GMN046
0004A0 5E80 F4FA           0057C   343           AL    8,GMN007
0004A4 5C80 9000           00000   344           ST    8,0(0,9)        CHAN-3700(GUTT)
0004A8 4880 F544           005C6   345           LH    8,GMN023+6
0004AC 5080 9004           00004   346           ST    8,4(0,9)        CHAN-00000002
0004B0 5890 2010           00010   347           L     9,16(0,2)
0004B4 4890 F544           005C6   348           AH    9,GMN023+6
0004B8 5090 2010           00010   349           ST    9,16(0,2)
0004BC 5880 F4FA           0057C   350           L     8,GMN007
0004C0 4890 8000           00000   351           LH    9,0(0,8)
0004C4 4890 8002           00002   352           AH    9,2(0,8)
0004C8 5590 2010           00010   353           CL    9,16(0,2)
0004CC 4720 F134           001B6   354           BC    2,GDIS80
0004D0 4110 F59A           0061C   355           LA    1,GMN044
0004D4 47F0 F084           00106   356           BC    15,GDIS11
0004D8 5850 F4F2           00574   357 GDI500    L     5,GMN005
0004DC 5890 5000           00000   358           L     9,0(0,5)
0004E0 1889                        359           LR    8,9
0004E2 4880 F598           0061A   360           AH    8,GMN043+2
0004E6 5080 9004           00004   361           ST    8,4(0,9)
0004EA 4880 F516           00598   362           SH    8,GMN014
0004EE 5580 9008           00008   363           CL    8,8(0,9)
0004F2 47A0 F0B0           00102   364           BC    10,GDIS10
0004F6 4880 A00A           0000A   365 GDI502    LH    8,10(0,6)
0004FA 5480 F5E2           005F4   366           N     8,GMN031
0004FE 5EA0 F4FA           0057C   367           L     10,GMN007
000502 4C80 A008           00008   368           STH   8,8(0,10)
000506 5890 F5A6           00628   369           L     8,GMN047
00050A 5E80 F4FA           0057C   370           AL    8,GMN007
00050E 5C80 9000           00000   371           ST    8,0(0,9)        "HAN 0700(GUTT+8)
000512 5880 F5E2           005C4   372           L     8,GMN023+4
000516 5080 9004           00004   373           ST    8,4(0,9)        CHAN 60000002
00051A 5880 2000           00000   374           L     8,0(0,2)
00051E 5E80 F5AA           0062C   375           AL    8,GMN048
000522 5C80 9008           00008   376           ST    8,8(0,9)        CHAN 0200(FIRST ARG)
000526 4880 6008           00008   377           LH    8,8(0,6)
00052A 5E80 F56F           005F0   378           AL    8,GMN034        CHAN 6000(NO. OF BYTES)
00052E 5C80 900C           0000C   379           ST    8,12(0,9)
000532 5880 F5A2           00624   380           L     8,GMN046
000536 5E80 F4FA           0057C   381           AL    8,GMN007
00053A 5080 9010           00010   382           ST    8,16(0,9)       CHAN 2700(GUTT)
00053E 4880 F544           005C6   383           LH    8,GMN023+6
000542 5C80 9014           00014   384           ST    8,20(0,9)       CHAN 00000002
000546 47F0 F134           001B6   385           BC    15,GDIS80
00054A 4890 600A           0000A   386 GDI510    LH    9,10(0,6)
00054E 5490 F522           005A4   387           N     9,GMN017
000552 8E90 C00F           0000F   388           SRL   9,15(0)
000556 5880 2000           00000   389           L     8,0(0,2)
00055A 5C90 8000           00000   390           ST    9,0(0,8)
00055E 47F0 F248           002CA   391           BC    15,GDI215
000562                             392           CNOP  0,4
```

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  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000564.0C000082                     393 GMN001 DC     A(GDISP2)
000568 0C000092                     394 GMN002 DC     A(GDISP3)
00056C 0C000000                     395 GMN003 DC     A(GUBU)
000570 0C000C00                     396 GMN004 DC     A(GUMA)
000574 0C000C00                     397 GMN005 DC     A(GUCH)
000578 0C000C00                     398 GMN006 DC     A(GTEM)
00057C 0C000C00                     399 GMN007 DC     A(GUTT)
000580 0C000000                     400 GMN008 DC     A(GREG)
000584 0C000074                     401 GMN009 DC     A(GMGTAG)
000588 0C00001F                     402 GMN010 DC     A(GMCURS)
00058C 0C000C4A                     403 GMN011 DC     A(GERASE)
000590 0C000034                     404 GMN012 DC     A(GDISPL)
000594 0C00005E                     405 GMN013 DC     A(GREAD)
000598 0C010C00                     406 GMN014 DC     X'00010000'
00059C 2A820003                     407 GMN015 DC     X'2A820003'
0005A0 0C10000C                     408 GMN016 DC     X'0010000C'
0005A4 0C008C00                     409 GMN017 DC     X'00008000'
0005A8 FF000000                     410 GMN018 DC     X'FF000000'
0005AC 0C0005B0                     411 GMN019 DC     A(GMN020)
0005B0 0C00000B                     412 GMN020 DC     F'11'
0005B4 0C000000                     413 GMN021 DC     A(GDIAGN)
0005B8 07000000                     414 GMN022 DC     X'07000000'
0005BC 0C000000
0005C0 0100059C60000002             415 GMN023 CCW    01,GMN015,X'60',2
0005C8 0C002710                     416 GMN024 DC     F'10000'
0005CC 0C0003E8                     417 GMN025 DC     F'1000'
0005D0 0C000064                     418 GMN026 DC     F'100'
0005D4 0C00000A                     419 GMN027 DC     F'10'
0005D8 0C002AF8                     420 GMN028 DC     F'11000'
0005DC 0C0005E0                     421 GMN029 DC     A(GMN030)
0005E0 0C00000C                     422 GMN030 DC     F'12'
0005E4 0C007FFF                     423 GMN031 DC     X'00007FFF'
0005E8 0C00FF00                     424 GMN032 DC     X'0000FF00'
0005EC 01000C00                     425 GMN033 DC     X'01000000'
0005F0 6C000000                     426 GMN034 DC     X'60000000'
0005F4 0C0000FF                     427 GMN035 DC     X'000000FF'
0005F8 2AFF0000                     428 GMN036 DC     X'2AFF0000'
0005FC 0C000000
000600 0100C0466C000004             429 GMN038 CCW    1,4,X'60',4
000608 0C100000                     430 GMN039 DC     X'00100000'
00060C 0F000000                     431 GMN040 DC     X'0F000000'
000610 0C0005F4                     432 GMN041 DC     A(GMN031)
000614 60000001                     433 GMN042 DC     X'60000001'
000618 0C000014                     434 GMN043 DC     X'00000014'
00061C 0C000620                     435 GMN044 DC     A(GMN045)
000620 0C000000                     436 GMN045 DC     F'13'
000624 27000C00                     437 GMN046 DC     X'27000000'
000628 07000008                     438 GMN047 DC     X'07000008'
00062C 02000C00                     439 GMN048 DC     X'02000000'
                                    440        END
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GMGETX   CSECT
                                    2         ENTRY GMGET
                                    3         EXTRN GMGE
                                    4         EXTRN GUMA
000000 C7D4C7C5E3                   5         DC    CL5'GMGET'
000005 05                           6         DC    X'5'
000006                              7         USING *,15
000006 90EA F00C            0000C   8 GMGET   STM   14,10,12(13)
00000A 5870 1000            00000   9 GMGET1  L     7,0(0,1)
00000E 5820 F0A8            000A8  10         L     2,GMGE16
000012 5830 F0AC            000AC  11         L     3,GMGE17
000016 5840 3000            00000  12         L     4,0(0,3)
00001A 4850 3004            00004  13         LH    5,4(0,3)
00001E 4950 F0AA            000B0  14 GMGET3  CH    5,GMGE18
000022 4760 F02C            00032  15         BC    6,GMGET4
000026 5830 F0AA            000B0  16         L     3,GMGE18
00002A 5070 7000            00000  17         ST    3,0(0,7)
00002E 47F0 F090            00096  18         BC    15,GMGET5
000032 4860 400A            0000A  19 GMGET4  LH    6,10(0,4)
000036 5460 F0AA            000B0  20         N     6,GMGE18
00003A 4960 2002            00002  21         CH    6,2(0,2)
00003E 4720 F096            0009C  22         BC    2,GMGET6
000042 4A60 4008            00008  23         AH    6,8(0,4)
000046 4E60 F0AE            000B4  24         SH    6,GMGE19
00004A 4960 2002            00002  25         CH    6,2(0,2)
00004E 4740 F09C            0009C  26         BC    4,GMGET6
000052 4890 4000            00000  27         LH    8,0(0,4)
000056 8880 0008            00008  28         SRL   8,8(0)
00005A 5480 F0B2            000B8  29         N     8,GMGE20
00005E 5080 7000            00000  30         ST    8,0(0,7)
000062 4880 4000            00000  31         LH    8,0(0,4)
000066 5480 F0B2            000B8  32         N     8,GMGE20
00006A 5080 7004            00004  33         ST    8,4(0,7)
00006E 4880 4002            00002  34         LH    8,2(0,4)
000072 8880 0008            00008  35         SRL   8,8(0)
000076 5480 F0B2            000B8  36         N     8,GMGE20
00007A 5080 7008            00008  37         ST    8,8(0,7)
00007E 4880 4002            00002  38         LH    8,2(0,4)
000082 5480 F0B2            000B8  39         N     8,GMGE20
000086 5080 700C            0000C  40         ST    8,12(0,7)
00008A 4880 400A            0000A  41         LH    8,10(0,4)
00008E 8880 001F            0001F  42         SRL   8,31(0)
000092 5080 7010            00010  43         ST    8,16(0,7)
000096 98EA C01C            0001C  44 GMGET5  LM    2,10,28(13)
00009A 07FE                        45         BCR   15,14
00009C 4E50 F0AE            000B4  46 GMGET6  SH    5,GMGE19
0000A0 4A40 F0B0            000B6  47         AH    4,GMGE19+2
0000A4 47F0 F018            0001E  48         BC    15,GMGET3
0000A8                             49         CNOP  0,4
0000A8 0C000000                    50 GMGE16  DC    A(GMGE)
0000AC 0C000000                    51 GMGE17  DC    A(GUMA)
0000B0 0C007FFF                    52 GMGE18  DC    X'00007FFF'
0000B4 0C01000C                    53 GMGE19  DC    X'0001000C'
0000B8 0C0000FF                    54 GMGE20  DC    X'000000FF'
                                   55         END
```

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 LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GPPOSX   CSECT
                                    2          ENTRY GPPOSN
                                    3          ENTRY GPBEAM
                                    4          ENTRY GPDATA
                                    5          ENTRY GPTEXT
                                    6          ENTRY GSTMAP
                                    7          ENTRY GSCALE
                                    8          EXTRN GUBU
                                    9          EXTRN GUMA
                                   10          EXTRN GUSI
                                   11          EXTRN GULI
                                   12          EXTRN GUNA
                                   13          EXTRN GUTY
                                   14          EXTRN GTEM
                                   15          EXTRN GDIAGN
                                   16          EXTRN GREG
                                   17          EXTRN GCOU
                                   18          EXTRN GUPL
000000 C7D7C2C5C1D440              19          DC    CL7'GPBEAM '
000007 07                          20          DC    X'7'
000008                             21          USING *,15
000008 90EA D00C        0000C      22 GPBEAM   STM   14,10,12(13)
00000C 5820 F0D8        008E0      23          L     2,GPPOS1
000010 58F0 F0DC        008E4      24          L     15,GPPOS2
000014 07F2                        25          BCR   15,2
                                   26          DROP  15
000016 C7C4C1E3C14040              27          DC    CL7'GDATA '
00001D 07                          28          DC    X'7'
00001E                             29          USING *,15
00001E 90EA D00C        0000C      30 GPDATA   STM   14,10,12(13)
000022 5820 F0CA        008E8      31          L     2,GPPOS3
000026 58F0 F0C8        008E4      32          L     15,GPPOS2
00002A 07F2                        33          BCR   15,2
                                   34          DROP  15
00002C C7D7E3C5E7E340              35          DC    CL7'GPTEXT '
000033 07                          36          DC    X'7'
000034                             37          USING *,15
000034 90EA D00C        0000C      38 GPTEXT   STM   14,10,12(13)
000038 5820 F0B8        008EC      39          L     2,GPPOS4
00003C 58F0 F0B0        008E4      40          L     15,GPPOS2
000040 07F2                        41          BCR   15,2
                                   42          DROP  15
000042 C7E2E3D4C10740              43          DC    CL7'GSTMAP '
000049 07                          44          DC    X'7'
00004A                             45          USING *,15
00004A 90ZA D010        00010      46 GSTMAP   STM   2,10,16(13)
00004E 5820 F0A6        008E0      47          L     2,GPPOS5
000052 58F0 F09A        008E4      48          L     15,GPPOS2
000056 07F2                        49          BCR   15,2
                                   50          DROP  15
000058 C7E2C3C1D3C540              51          DC    CL7'GSCALE '
00005F 07                          52          DC    X'7'
000060                             53          USING *,15
000060 90ZA D010        00010      54 GSCALE   STM   2,10,16(13)
000064 5820 F094        008E4      55          L     2,GPPOS6
000068 58F0 F094        008E4      56          L     15,GPPOS2
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000006C 07F2                         57           BCR   15,2
                                     58           DROP  15
000006E C7D7D7D6F2D540               59           DC    CL7'GPPOSN
000075 07                            60           DC    X'7'
000076                               61           USING *,15
000076 9CEA C00C             0000C   62 GPPOSN    STM   14,10,12(13)
00007A 4880 F8C2             00938   63           LH    8,GPP023
00007E 5820 F8B2             00BF8   64 GPP100    L     2,GPPOS7
000082 5E30 2004             00004   65           L     3,4(0,2)
000086 1843                          66           LR    4,3
000088 4A40 F8B4             0092A   67           AH    4,GPP019+2
00008C 4E40 F8A4             0091A   68           SH    4,GPP015+2
000090 5540 2008             00008   69           C     4,8(0,2)
000094 4740 F030             000A6   70           BC    4,GPP105
000098 4110 F8A6             0091C   71 GPP103    LA    1,GPP016
00009C 5ED0 F89E             009..   72           L     13,GPP014
0000A0 5EF0 F89A             00910   73           L     15,GPP013
0000A4 05EF                          74           BALR  14,15
0000A6 4840 F8AE             00924   75 GPP105    LH    4,GPP018
0000AA 4C40 3000             00000   76           STH   4,0(0,3)
0000AE 4980 F8C2             00938   77           CH    8,GPP023
0000B2 4763 F1DE             00254   78           BC    6,GPBE20
0000B6 5E50 1000             00000   79 GPP110    L     5,0(0,1)
0000BA 5E40 5000             00000   80           L     4,0(0,5)
0000BE 8940 0010             00010   81           SLL   4,16(0)
0000C2 5E50 1004             00004   82           L     5,4(0,1)
0000C6 5C40 5000             00000   83           AL    4,0(0,5)
0000CA 8940 0002             00002   84           SLL   4,2(0)
0000CE 5E40 F8DA             00950   85 GPP115    AL    4,GPP029
0000D2 1854                          86           LR    5,4
0000D4 8850 0010             00010   87           SRL   5,16(0)
0000D8 4C50 3002             00002   88           STH   5,2(0,3)
0000DC 4C40 3004             00004   89           STH   4,4(0,3)
0000E0 4840 F8B4             00924   90           LH    4,GPP019+2
0000E4 5850 F8B6             0090C   91           L     5,GPP012
0000E8 5C40 5000             00000   92           ST    4,0(0,5)
0000EC 5E40 F8DE             00914   93 GPP120    L     4,GPP014
0000F0 5C10 4000             00000   94           ST    1,0(0,4)
0000F4 9CDE 4004             00004   95           STM   13,15,4(4)
0000F8 5E10 F8B6             0092C   96           L     1,GPP020
0000FC 5ED0 F8DE             00914   97           L     13,GPP014
000100 5EF0 F8DA             00930   98           L     15,GPP021
000104 05EF                          99           BALR  14,15
000106 9BDE 4004             00004  100           LM    13,15,4(4)
00010A 5E10 4000             00000  101           L     1,0(0,4)
00010E 98DA C01C             0001C  102           LM    2,10,28(13)
000112 07FE                         103           BCR   15,14
000114 5E20 F8B2             00BF8  104 GSTMAL    L     2,GPP0S7
000118 1F33                         105           SR    3,3
00011A 5E70 F8B6             0092C  106           L     7,GPP020
00011E 5E40 7000             00000  107           L     4,0(0,7)
000122 5E60 F8BE             00904  108           L     6,GPP010
000126 4E50 6000             00000  109           LH    5,0(0,6)
00012A 8E50 0008             00008  110           SLL   5,8(0)
00012E 4A50 6002             00002  111           AH    5,2(0,6)
000132 8E50 0008             00008  112           SLL   5,8(0)
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   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000134 4A50 C004              00004   113          AH    5,4(0,6)
000138 8850 0008              00008   114          SLL   5,8(0)
00013C 4A50 C006              00006   115          AH    5,6(0,6)
000140 4860 7004              00004   116          LH    6,4(0,7)
000144 5830 1000              00000   117          L     9,0(0,1)
000148 5890 C000              00000   118          L     9,0(0,9)
00014C 1C35                           119 GSTM20   CR    3,6
00014E 4730 F130              001A6   120          BC    8,GSTM80
000152 5550 4000              00000   121 GSTM30   C     5,0(0,4)
000156 4790 F0F2              00168   122          BC    8,GSTM50
00015A 4A30 F8A4              0091A   123 GSTM40   AH    3,GPPO15+2
00015E 4A40 F8A2              00918   124          AH    4,GPPO15
000162 47F0 F0D8              0014E   125          BC    15,GSTM20
000166 5E80 4004              00004   126 GSTM50   L     8,4(0,4)
00016A 8E80 C008              00008   127          SRL   8,8(0)
00016E 4A80 4008              00008   128          AH    8,8(0,4)
000172 5590 2004              00004   129          C     8,4(0,2)
000176 4760 F0F6              0015C   130          BC    6,GSTM40
00017A 4880 4008              00008   131 GSTM60   LH    8,8(0,4)
00017E 1A89                           132          AR    8,9
000180 4C80 4008              00008   133          STH   8,8(0,4)
000184 4A30 400A              0000A   134 GSTM70   LH    8,10(0,4)
000188 5480 F8C2              00938   135          N     8,GPPO23
00018C 4A30 F8B2              00928   136          AH    8,GPPO19
000190 4C80 400A              0000A   137          STH   8,10(0,4)
000194 5E90 2004              00004   138          L     8,4(0,2)
000198 1A89                           139          AR    8,9
00019A 5C90 2004              00004   140          ST    8,4(0,2)
00019E 982A C010              00010   141          LM    2,10,16(13)
0001A2 07FE                           142          BCR   15,14
0001A4 4F80 7004              00004   143 GSTM80   LH    8,4(0,7)
0001A8 4A80 F8A4              0091A   144          AH    8,GPPO15+2
0001AC 4C80 7004              00004   145          STH   8,4(0,7)
0001B0 4580 7006              00006   146          CH    8,6(0,7)
0001B4 47C0 F152              001C8   147          BC    12,GSTM90
0001B8 4110 F902              00978   148          LA    1,GPPO39
0001BC 5ED0 F89E              00914   149          L     13,GPPO14
0001C0 5EF0 F89A              00910   150          L     15,GPPO13
0001C4 05EF                           151          BALR  14,15
0001C6 5050 4000              00000   152 GSTM90   ST    5,0(0,4)
0001CA 5880 2004              00004   153          L     8,4(0,2)
0001CE 8580 0008              00008   154          SLL   8,8(0)
0001D2 5C80 4004              00004   155          ST    8,4(0,4)
0001D6 4C90 4008              00008   156          STH   9,8(0,4)
0001DA 4880 F8B2              00928   157          LH    8,GPPO19
0001DE 4C80 400A              0000A   158          STH   8,10(0,4)
0001E2 47F0 F110              00186   159          BC    15,GSTM70
0001E6 4880 F8A4              0091A   160 GPBFA1   LH    8,GPPO15+2
0001EA 5E20 F892              00908   161          L     2,GPPO11
0001EE 4E30 2000              00000   162          LH    3,0(0,2)
0001F2 4930 F8A4              0091A   163          CH    3,GPPO15+2
0001F6 4780 F194              0020A   164          BC    8,GPBEA5
0001FA 4110 F8CA              00940   165 GPBEA3   LA    1,GPPO25
0001FE 5ED0 F89E              00914   166          L     13,GPPO14
000202 5EF0 F89A              00910   167          L     15,GPPO13
000206 05EF                           168          BALR  14,15
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 LOC   OBJECT CODE     ADDR1  ADDR2  STMT   SOURCE STATEMENT
00020A 5E70 F896             00900   169 GPBEA5   L     7,GPP012
00020E 5E30 1000             00000   170          L     3,0(0,1)
000212 5E40 3000             00000   171          L     4,0(0,3)
000216 5040 7000             00000   172          ST    4,0(0,7)
00021A 5E30 1004             00004   173          L     3,4(0,1)
00021E 5E40 3000             00000   174          L     4,0(0,3)
000222 5040 7004             00004   175          ST    4,4(0,7)
000226 4E40 F9C2             00938   176          LH    4,GPP023
00022A 5040 7008             00008   177          ST    4,8(0,7)
00022E 5E40 F89E             00914   178          L     4,GPP014
000232 5010 4000             00000   179          ST    1,0(0,4)
000236 90DE 4004             00004   180          STM   13,15,4(4)
00023A 5E10 F8F6             00920   181          L     1,GPP020
00023E 5E00 F89E             00914   182 GPBEA9   L     13,GPP014
000242 58E0 F89E             00934   183          L     15,GPP022
000246 05EF                          184          BALR  14,15
000248 98DE 4004             00004   185 GPBE10   LM    13,15,4(4)
00024C 5E10 4000             00000   186          L     1,0(0,4)
000250 47E0 F008             00078   187          BC    15,GPP100
000254 5E40 7014             00C14   188 GPBE20   L     4,20(0,7)
000258 47E0 F058             000CE   189          BC    15,GPP115
00025C 5E20 1000             00000   190 GSCALL   L     2,0(0,1)
000260 5E50 F89A             00900   191          L     5,GPP0S0
000264 5070 F8D6             00940   192          L     7,GPP028
000268 4E40 F9C2             00938   193          LH    4,GPP023
00026C 5040 2018             00018   194          ST    4,24(0,2)
000270 5E30 2008             00008   195          L     3,8(0,2)
000274 4E20 F9C2             00938   196          LH    2,GPP023
000278 4750 F24A             002C0   197          BC    6,GSCA20
00027C 4E60 F004             00004   198 GSCAL5   LH    6,4(0,5)      IV2
000280 4E50 5000             00000   199          SH    5,0(0,5)      IV2-IV1
000284 5150 F9D2             00948   200          AL    5,GPP027      MAKE FLOATING POINT NUMBER
000288 5050 201C             0001C   201          ST    5,28(0,2)     FL PT  (IV2-IV1)
00028C 4E60 5006             00006   202          LH    6,6(0,5)      IV2
000290 4E60 5002             00002   203          SH    6,2(0,5)      IV2-IV1
000294 5E50 F9D2             00948   204          AL    5,GPP027
000298 5050 2020             00020   205          ST    5,32(0,2)     FL PT  (IV2-IV1)
00029C 7E00 7008             00008   206          LE    0,8(0,7)      U2
0002A0 7E31 7000             00000   207          SE    3,0(0,7)      U2-U1
0002A4 7E20 201C             0001C   208          LE    2,28(0,2)
0002A8 3E30                          209          DER   2,0
0002AA 7E00 7000             00000   210          STE   2,12(0,2)     (V2-V1)/(V2-IV1)
0002AE 7E10 7000             00000   211          LE    1,12(0,7)     V2
0002B2 7E31 7004             00004   212          SE    3,4(0,7)      V2-V1
0002B6 7E20 2020             00020   213          LE    2,32(0,2)
0002BA 3E30                          214          DER   3,0
0002BC 7021 2010             00010   215          STE   2,16(0,2)     (V2-V1)/(IV2-IV1
0002C0 7E40 7000             00000   216 GSCA20   LE    4,0(0,7)
0002C4 7E41 7008             00008   217          CE    4,8(0,7)
0002C8 4720 C0CA             002A0   218          BC    2,GSCA40
0002CC 7E61 2004             00004   219          LE    6,4(0,2)
0002D0 7E51 7000             00000   220          CE    5,12(0,7)
0002D4 4720 C0CA             002A0   221          BC    2,GSCA40
0002D8 7E41 7010             00010   222          SE    4,16(0,7)
0002DC 7E41 7004             00004   223          SE    4,4(0,7)
0002E0 7E41 7018             00018   224          SE    4,12(0,7)
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LOC   OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                              F01JAN67   1/11/68

0002D4 70E0 2010               00010   225          ME    6,26(0,2)
0002D8 7560 F3CA               00950   226          CE    4,GPP029
0002DC 4740 F3CA               00340   227          BC    4,GSCA40
0002E0 7560 F3CA               00950   228          CE    6,GPP029
0002E4 4740 F2CA               00340   229          BC    4,GSCA40
0002E8 7A40 F8DE               00954   230          AE    4,GPP030
0002EC 7A50 F8DE               00954   231          AE    6,GPP030
000300 7E40 F8F2               00948   232          AU    4,GPP027
000304 7E60 F8F2               00948   233          AU    6,GPP027
000308 7060 201C               0001C   234          STE   4,28(0,2)
00030C 7060 2020               00020   235          STE   6,32(0,2)
000310 4840 201E               0001E   236          LH    4,30(0,2)
000314 4A40 5000               00000   237          AH    4,0(0,5)
000318 4040 201E               0001E   238          STH   4,30(0,2)
00031C 4860 2022               00022   239          LH    6,34(0,2)
000320 4A60 5002               00002   240          AH    6,2(0,5)
000324 4060 2022               00022   241          STH   6,34(0,2)
000328 8940 0012               00012   242          SLL   4,18(0)
00032C 8960 0010               00010   243          SLL   6,16(0)
000330 8860 000E               0000E   244          SRL   6,14(0)
000334 1E46                            245          ALR   4,6
000336 5040 2014               00014   246          ST    4,20(0,2)
00033A 982A D010               00010   247 GSCA25   LM    2,10,16(13)
00033E 07FE                            248          BCR   15,14
000340 4840 F8A4               0091A   249 GSCA40   LH    4,GPP015+2
000344 5040 2018               00018   250          ST    4,24(0,2)
000348 47F0 F2C4               0033A   251          BC    15,GSCA25
00034C 5820 F882               008F8   252 GPDAT1   L     2,GPP057
000350 5830 F896               0090C   253          L     3,GPP012
000354 4840 F8C2               00938   254          LH    4,GPP023
000358 5040 3024               00024   255          ST    4,36(0,3)                       ORDER CONTROL
00035C 5040 3028               00028   256          ST    4,40(0,3)                       PLOT CONTROL
000360 5040 3044               00044   257          ST    4,68(0,3)
000364 5040 3008               00008   258          ST    4,8(0,3)
000368 5850 1014               00014   259          L     5,20(0,1)
00036C 5050 3034               00034   260          ST    5,52(0,3)                       ADDRESS ISYM
000370 5850 101C               0001C   261          L     5,28(0,1)
000374 5860 5000               00000   262          L     6,0(0,5)
000378 5060 3038               00038   263          ST    6,56(0,3)                       NP
00037C 5850 1020               00020   264          L     5,32(0,1)
000380 5860 5000               00000   265          L     5,0(0,5)
000384 5060 303C               0003C   266          ST    6,60(0,3)                       IS
000388 5850 1000               00000   267          L     5,0(0,1)
00038C 5860 5000               00000   268          L     6,0(0,5)
000390 5060 3040               00040   269          ST    6,64(0,3)
000394 4960 F8B0               00926   270          CH    6,GPP018+2
000398 4780 F352               003C8   271          BC    8,GPDAT6
00039C 4720 F366               003DC   272          BC    2,GPDA18
0003A0 4960 F8A4               0091A   273          CH    6,GPP015+2
0003A4 4780 F346               003BC   274          BC    8,GPDAT5
0003A8 5850 1004               00004   275 GPDAT2   L     5,4(0,1)               I=1
0003AC 5050 302C               0002C   276 GPDAT3   ST    5,44(0,3)
0003B0 5850 100C               0000C   277          L     5,12(0,1)
0003B4 5050 3030               00030   278 GPDAT4   ST    5,48(0,3)
0003B8 47F0 F372               003E8   279          BC    15,GPDA19
0003BC 5860 1004               00004   280 GPDAT5   L     6,4(0,1)               I=1
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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE	STATEMENT	
0003C0	5E50 6000		00000	281		L 5,0(0,6)	
0003C4	47F0 F33C		003AC	282		BC 15,GPDAT3	
0003C8	5E50 1004		00004	283	GPDAT6	L 5,4(0,1)	I=2
0003CC	5C50 302C		0002C	284	GPDAT7	ST 5,44(0,3)	
0003D0	5E50 100C		0000C	285		L 6,12(0,1)	
0003D4	5E50 6000		00000	286		L 5,0(0,6)	
0003D8	47F0 F33E		003B4	287		BC 15,GPDAT4	
0003DC	5E60 1004		00004	288	GPDAT8	L 6,4(0,1)	I=3
0003E0	5E50 6000		00000	289		L 5,0(0,6)	
0003E4	47F0 F354		003CC	290		BC 15,GPDAT7	
0003E8	5E50 3038		00038	291	GPDA10	L 5,56(0,3)	
0003EC	5C50 3028		00028	292		C 5,40(0,3)	
0003F0	47D0 F396		00400	293		BC 6,GPDA12	
0003F4	5E40 3044		00044	294		L 4,68(0,3)	
0003F8	5C40 3000		00000	295		ST 4,0(0,3)	
0003FC	47F0 F076		000FC	296		BC 15,GPP120	
000400	5E50 3040		00040	297	GPDA12	L 6,64(0,3)	
000404	4560 F8D0		00026	298		CH 6,GPP018+2	
000408	4730 F3C4		0043C	299		BC 8,GPDA16	
00040C	4720 F3DE		00454	300		BC 2,GPDA18	
000410	4560 F8A4		0091A	301		CH 6,GPP015+2	
000414	4780 F3DE		00434	302		BC 8,GPDA15	
000418	5E60 302C		0002C	303	GPDA13	L 6,44(0,3)	I=0
00041C	5E50 6000		00000	304		L 5,0(0,6)	
000420	5C50 3000		00000	305	GPDA14	ST 5,0(0,3)	
000424	5E60 3030		00030	306		L 6,48(0,3)	
000428	5E50 6000		00000	307		L 5,0(0,6)	
00042C	5C50 3004		00004	308		ST 5,4(0,3)	
000430	47F0 F3E6		00456	309		BC 15,GPDA20	
000434	5E50 302C		0002C	310	GPDA15	L 5,44(0,3)	I=1
000438	47F0 F3AA		00420	311		BC 15,GPDA14	
00043C	5E60 302C		0002C	312	GPDA16	L 6,44(0,3)	I=2
000440	5E50 6000		00000	313		L 5,0(0,6)	
000444	5C50 3000		00000	314	GPDA17	ST 5,0(0,3)	
000448	5E50 3030		00030	315		L 5,48(0,3)	
00044C	5C50 3004		00004	316		ST 5,4(0,3)	
000450	47F0 F3E6		00456	317		BC 15,GPDA20	
000454	5E50 302C		0002C	318	GPDA18	L 5,44(0,3)	I=3
000458	47F0 F3CE		00444	319		BC 15,GPDA17	
00045C	5E60 F8B2		00908	320	GPDA20	L 6,GPP011	
000460	4E50 6000		00000	321		LH 5,0(0,6)	
000464	4550 F8A4		0091A	322		CH 5,GPP015+2	
000468	4760 F186		001FC	323		BC 6,GPBEA3	
00046C	5E50 F89F		00914	324	GPDA25	L 5,GPP014	
000470	5C10 5000		00000	325		ST 1,0(0,5)	
000474	9CDF 5004		00004	326		STM 13,15,4(5)	
000478	5810 F8B6		0092C	327		L 1,GPP020	
00047C	58D0 F89F		00914	328		L 13,GPP014	
000480	58F0 F8BF		00934	329		L 15,GPP022	
000484	05EF			330		BALR 14,15	
000486	98DF 5004		00004	331	GPDA47	LM 13,15,4(5)	
00048A	5810 5000		00000	332		L 1,0(0,5)	
00048E	5860 3018		00018	333		L 6,24(0,3)	
000492	4560 F8A4		0091A	334		CH 6,GPP015+2	
000496	4760 F440		00486	335		BC 6,GPDA50	
00049A	5E40 F8C6		0093C	336		L 4,GPP024	

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   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000049E 4E60 4000            00000   337          LH    6,0(0,4)
00004A2 4A60 F8A4            0091A   338          AH    6,GPP015+2
00004A6 4C60 4000            00000   339          STH   6,0(0,4)
00004AA 4E60 F8C2            00938   340          LH    6,GPP023
00004AE 5C60 3024            00024   341          ST    6,36(0,3)
00004B2 47F0 F71A            00790   342          BC    15,GPD200
00004B6 5E40 3014            00014   343 GPDA50   L     4,20(0,3)
00004BA 5E50 F8F2            00958   344          L     5,GPP031
00004BE 4850 6000            00000   345          LH    5,0(0,6)
00004C2 4A50 F8A4            0091A   346          CH    5,GPP015+2
00004C6 4740 F47C            004F2   347          BC    4,GPDA75
00004CA 4780 F464            004DA   348          BC    8,GPDA70
00004CE 4A50 F8F0            00966   349          CH    5,GPP034+2
00004D2 4780 F47C            004F2   350          BC    8,GPDA75
00004D6 5E40 F8DA            00950   351          AL    4,GPP029
00004DA 4E50 F8C2            00938   352 GPDA70   LH    5,GPP023
00004DE 5050 3048            00048   353          ST    5,72(0,3)
00004E2 5E50 3024            00024   354          L     5,36(0,3)
00004E6 4A50 F8A4            0091A   355          CH    5,GPP015+2
00004EA 4780 F4EC            00562   356          BC    8,GPDT90
00004EE 47F0 F600            00676   357          BC    15,GPDA80
00004F2 5E50 3024            00024   358 GPDA75   L     5,36(0,3)
00004F6 4A50 F8A4            0091A   359          CH    5,GPP015+2
00004FA 4740 F4C8            0053E   360          BC    4,GPDT76
00004FE 5E50 F8E2            00958   361          L     5,GPP031
000502 4E50 5000             00000   362          LH    5,0(0,5)
000506 4A50 F8C2             00938   363          CH    5,GPP023
00050A 4780 F4D4             0054A   364          BC    8,GPDT77
00050E 4E60 301E             0001E   365 GPDI75   LH    6,30(0,3)
000512 4E60 304E             0004E   366          SH    6,78(0,3)
000516 4780 F4D4             0054A   367          BC    8,GPDT77
00051A 4E60 3022             00022   368          LH    6,34(0,3)
00051E 4B60 3052             00052   369          SH    6,82(0,3)
000522 4780 F4D4             0054A   370          BC    8,GPDT77
000526 4E70 F8A4             0091A   371          LH    7,GPP015+2
00052A 5C70 3048             00048   372          ST    7,72(0,3)
00052E 5E70 3024             00024   373          L     7,36(0,3)
000532 4A70 F8A4             0091A   374          CH    7,GPP015+2
000536 4780 F4EC             00562   375          BC    8,GPDT90
00053A 47F0 F600             00676   376          BC    15,GPDA80
00053E 4E70 F8C2             00938   377 GPDT76   LH    7,GPP023
000542 5C70 3048             00048   378          ST    7,72(0,3)
000546 47F0 F600             00676   379          BC    15,GPDA80
00054A 4E70 F8C2             00938   380 GPDT77   LH    7,GPP023
00054E 5C70 3048             00048   381          ST    7,72(0,3)
000552 5E70 3024             00024   382          L     7,36(0,3)
000556 4A70 F8B0             00926   383          CH    7,GPP018+2
00055A 4780 F4EC             00562   384          BC    8,GPDT90
00055E 47F0 F634             006A4   385          BC    15,GPDA85
000562 5E70 3048             00048   386 GPDT90   L     7,72(0,3)
000566 4A70 F8A4             0091A   387          CH    7,GPP015+2
00056A 4780 F50C             00592   388          BC    8,GPDT93
00056E 4E70 301E             0001E   389 GPDT91   LH    7,30(0,3)
000572 5C70 3046             00046   390          ST    7,76(0,3)
000576 4E70 3022             00022   391          LH    7,34(0,3)
00057A 5C70 3050             00050   392          ST    7,80(0,3)
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LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000576 4780 F060             00060   393          BC    15,GPD100
00057A 58F0 3040             00040   394 GPDT93   L     7,76(0,3)
00057E 5EF0 F8F2             00948   395          AL    7,GPP027
000582 5E70 3054             00054   396          ST    7,84(0,3)
000586 5EF0 3050             00050   397          L     7,80(0,3)
00058A 5EF0 F8F2             00948   398          AL    7,GPP027
00058E 5E70 3058             00058   399          ST    7,88(0,3)
000592 4E70 301E             0001E   400          LH    7,30(0,3)
000596 5E70 F8D2             00948   401          AL    7,GPP027
00059A 5E70 305C             0005C   402          ST    7,92(0,3)
00059E 4E70 3022             00022   403          LH    7,34(0,3)
0005A2 5EF0 F8D2             00948   404          AL    7,GPP027
0005A6 5E70 3060             00060   405          ST    7,96(0,3)
0005AA 7E20 305C             0005C   406          LE    2,92(0,3)
0005AE 7E20 3054             00054   407          SE    2,84(0,3)      IXNEW-IXOLD
0005B2 3C02                          408          LPER  0,2
0005B4 7C00 3064             00064   409          STE   0,100(0,3)
0005B8 7E40 3060             00060   410          LE    4,96(0,3)
0005BC 7E40 3058             00058   411          SE    4,88(0,3)
0005C0 3D42                          412          DER   4,2            SLOPE
0005C2 3C04                          413          LPER  0,4            /SLOPE/
0005C4 5E70 F8EA             0095C   414          L     7,GPP032
0005C8 5C70 3068             00068   415          ST    7,104(0,3)     P
0005CC 7E20 F8EA             00960   416          LE    2,GPP033
0005D0 7E60 F8EA             00960   417          CE    6,GPP033
0005D4 4720 F5AC             005E2   418          BC    12,GPDT95
0005D8 3D26                          419          DER   2,6
0005DA 5E70 305C             0005C   420 GPDT95   L     7,92(0,3)
0005DE 5E70 3054             00054   421          C     7,84(0,3)
0005E2 4720 F57A             005E0   422          BC    2,GPDT96
0005E6 3D22                          423          LNER  2,2
0005E8 3D42                          424 GPDT96   MER   4,2
0005EA 3E62                          425 GPDT98   LER   6,2
0005EC 7C60 3068             00068   426          ME    6,104(0,3)
0005F0 3C06                          427          LPER  0,6
0005F2 7C00 3064             00064   428          CE    0,100(0,3)
0005F6 4720 F4FA             0056E   429          BC    2,GPDT91
0005FA 7E60 3054             00054   430          AE    6,84(0,3)
0005FE 7E60 F8DE             00954   431          AE    6,GPP030
000602 7E60 F8D2             00948   432          AU    6,GPP027
000606 3E04                          433          LER   0,4
000608 7C00 3068             00068   434          ME    0,104(0,3)
00060C 7E00 3058             00058   435          AE    0,88(0,3)
000610 7E00 F8DE             00954   436          AE    0,GPP030
000614 7E00 F8D2             00948   437          AU    0,GPP027
000618 7C60 306C             0006C   438          STE   6,108(0,3)
00061C 4860 306E             0006E   439          LH    6,110(0,3)
000620 8960 0010             00010   440          SLL   6,16(0)
000624 7C00 306C             0006C   441          STE   0,108(0,3)
000628 4860 306E             0006E   442          AH    6,110(0,3)
00062C 8960 0002             00002   443          SLL   6,2(0)
000630 5870 2004             00004   444          L     7,4(0,2)
000634 5E80 3044             00044   445          L     8,68(0,3)
000638 1E97                          446          LR    9,7
00063A 1E98                          447          AR    9,8
00063C 4A90 F8E0             00966   448          AH    9,GPP034+2
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000548 5590 2008            00008   449          C     9,8(0,2)
00064C 4720 F022            00098   450          BC    2,GPP103
000650 1896                         451 GPDT99   LR    9,6
000652 9890 C010            00010   452          SPL   9,16(0)
000656 4098 7000            00000   453          STH   9,0(8,7)
00065A 4068 7002            00002   454          STH   6,2(8,7)
00065E 4A90 F8FE            00944   455          AH    8,GPP034
000662 5080 3044            00044   456          ST    8,68(0,3)
000666 7860 3068            00068   457          LE    6,104(0,3)
00066A 7A60 F8F6            0095C   458          AE    6,GPP032
00066E 7060 3068            00068   459          STE   6,104(0,3)
000672 47F0 F57C            00562   460          BC    15,GPDT99
000676 5E70 2004            00004   461 GPDA80   L     7,4(0,2)
00067A 5E80 3044            00044   462          L     8,68(0,3)
00067E 1897                         463          LR    9,7
000680 1A98                         464          AR    9,8
000682 4A90 F9A4            0091A   465          AH    9,GPP015+2
000686 5590 2008            00008   466          C     9,8(0,2)
00068A 4720 F022            00098   467          BC    2,GPP103
00068E 4890 F8AE            00924   468 GPDA81   LH    9,GPP018
000692 4098 7000            00000   469          STH   9,0(8,7)
000696 4E70 F9A4            0091A   470          LH    7,GPP015+2
00069A 5070 3024            00024   471          ST    7,36(0,3)
00069E 4A90 F9B0            00926   472 GPDA82   AH    9,GPP018+2
0006A2 5080 3044            00044   473          ST    8,68(0,3)
0006A6 47F0 F45C            00562   474          BC    15,GPDT99
0006AA 5E70 2004            00004   475 GPDA85   L     7,4(0,2)
0006AE 5E80 3044            00044   476          L     8,68(0,3)
0006B2 1897                         477          LR    9,7
0006B4 1A98                         478          AR    9,8
0006B6 4A90 F9A4            0091A   479          AH    9,GPP015+2
0006BA 5590 2008            00008   480          C     9,8(0,2)
0006BE 4720 F022            00098   481          BC    2,GPP103
0006C2 4890 F8F2            00968   482 GPDA86   LH    9,GPP035
0006C6 4098 7000            00000   483          STH   9,0(8,7)
0006CA 4E70 F9B0            00926   484          LH    7,GPP018+2
0006CE 5070 3024            00024   485          ST    7,36(0,3)
0006D2 47F0 F528            00498   485          BC    15,GPDA82
0006D6 5E70 2004            00004   487 GPD100   L     7,4(0,2)
0006DA 5E80 3044            00044   488          L     8,68(0,3)
0006DE 1897                         489          LR    9,7
0006E0 1A98                         490          AR    9,8
0006E2 4A90 F8F0            00966   491          AH    9,GPP034+2
0006E6 5590 2008            00008   492          C     9,8(0,2)
0006EA 4720 F022            00098   493          BC    2,GPP103
0006EE 1894                         494 GPD101   LR    9,4
0006F0 9890 C010            00010   495          SRL   9,16(0)
0006F4 4098 7000            00000   496          STH   9,0(8,7)
0006F8 4043 7002            00002   497          STH   4,2(8,7)
0006FC 4A80 F8F2            00964   498          AH    8,GPP024
000700 5080 3044            00044   499          ST    8,68(0,3)
000704 5580 3034            00034   500 GPD105   L     8,52(0,3)
000708 8980 C01F            0001F   501          SLL   9,31(0)
00070C 4A90 F9A4            0091A   502          AH    9,GPP015+2
000710 4720 F0B6            00770   503          BC    2,GPD108
000714 5580 3034            00034   504 GPD106   L     8,52(0,3)
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  LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT

000718 4870 9000            00000   505          LH    7,0(0,9)
00071C 5470 F8F6            0096C   506 GPD107   N     7,GPP036
000720 4970 F8A4            0091A   507          CH    7,GPP015+2
000724 4740 F71A            00790   508          BC    4,GPD200
000728 47F0 F6E6            00744   509          BC    15,GPD109
00072C 5890 3034            00034   510 GPD108   L     9,52(0,3)
000730 8890 0001            00001   511          SRL   9,1(0)
000734 8990 0001            00001   512          SLL   9,1(0)
000738 4870 9000            00000   513          LH    7,0(0,9)
00073C 8970 0008            00008   514          SLL   7,8(0)
000740 47F0 F6A6            0071C   515          BC    15,GPD107
000744 5840 2004            00004   516 GPD109   L     4,4(0,2)
000748 1894                         517          LR    9,4
00074A 5880 3044            00044   518          L     8,68(0,3)
00074E 1A98                         519          AR    9,8
000750 4A90 F8E0            00966   520          AH    9,GPP034+2
000754 5990 2008            00008   521          C     9,8(0,2)
000758 4720 F022            0   8   522          BC    2,GPP103
00075C 5890 303C            0003C   523 GPD110   L     9,60(0,3)
000760 4990 F8A4            0091A   524          CH    9,GPP015+2
000764 4780 F6FE            00774   525          BC    8,GPD115
000768 4890 F8FA            00970   526 GPD112   LH    9,GPP037
00076C 4098 4000            00000   527          STH   9,0(8,4)
000770 47F0 F7C.            0077C   528          BC    15,GPD120
000774 4890 F3FC            00372   529 GPD115   LH    9,GPP037+2
000778 4098 4000            00000   530          STH   9,0(8,4)
00077C 4078 4002            00002   531 GPD120   STH   7,2(8,4)
000780 4A80 F8EE            00964   532          AH    8,GPP034
000784 5080 3044            00044   533          ST    8,68(0,3)
000788 4870 F8EE            00964   534          LH    7,GPP034
00078C 5070 3024            00024   535          ST    7,36(0,3)
000790 5870 3028            00028   536 GPD200   L     7,40(0,3)
000794 4A70 F8A4            0091A   537          AH    7,GPP015+2
000798 5070 3028            00028   538          ST    7,40(0,3)
00079C 5870 3034            00034   539          L     7,52(0,3)
0007A0 5890 1018            00018   540          L     9,24(0,1)
0007A4 5E70 9000            00000   541          AL    7,0(0,9)
0007A8 5070 3034            00034   542          ST    7,52(0,3)
0007AC 5870 3040            00040   543          L     7,64(0,3)
0007B0 4970 F8B0            00926   544          CH    7,GPP018+2
0007B4 4780 F78E            00804   545          BC    8,GPD207
0007B8 4720 F7B6            0082C   546          BC    2,GPD209
0007BC 4970 F8A4            0091A   547          CH    7,GPP015+2
0007C0 4780 F77A            007F0   548          BC    8,GPD205
0007C4 5870 1008            00008   549 GPD203   L     7,8(0,1)                    IK=0
0007C8 5890 7000            00000   550          L     9,0(0,7)
0007CC 8B90 0002            00002   551          SLA   9,2(0)
0007D0 5E90 302C            0002C   552          AL    9,44(0,3)
0007D4 5090 302C            0002C   553          ST    9,44(0,3)
0007D8 5870 1010            00010   554 GPD204   L     7,16(0,1)
0007DC 5890 7000            00000   555          L     9,0(0,7)
0007E0 8B90 0002            00002   556          SLA   9,2(0)
0007E4 5E90 3030            00030   557          AL    9,48(0,3)
0007E8 5090 3030            00030   558          ST    9,48(0,3)
0007EC 47F0 F372            0035E   559          BC    15,GPDA10
0007F0 7840 302C            0002C   560 GPD205   LE    4,44(0,3)                   IK=1
```

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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
0007F4 5870 1008             00008   561          L     7,8(0,1)
0007F8 7840 7000             00000   562          AE    4,0(0,7)
0007FC 7040 302C             0002C   563          STE   4,44(0,3)
000800 47F0 F7E2             007D8   564          BC    15,GPD204
000804 5870 1008             00008   565 GPD207   L     7,8(0,1)          IK=?
000808 5890 7000             00000   566          L     9,0(0,7)
00080C 8890 0002             00002   567          SLA   9,2(0)
000810 5A90 302C             0002C   568          AL    9,44(0,3)
000814 5090 702C             0002C   569          ST    9,44(0,3)
000818 7840 3030             00030   570 GPD208   LE    4,48(0,3)
00081C 5870 1010             00010   571          L     7,16(0,1)
000820 7A40 7000             00000   572          AE    4,0(0,7)
000824 7040 3030             00030   573          STE   4,48(0,3)
000828 47F0 F372             003E8   574          BC    15,GPDA10
00082C 7840 302C             0002C   575 GPD209   LE    4,44(0,3)         IK=?
000830 5870 1008             00008   576          L     7,8(0,1)
000834 7A40 7000             00000   577          AE    4,0(0,7)
000838 7040 702C             0002C   578          STE   4,44(0,3)
00083C 47F0 F7A2             00813   579          BC    15,GPD209
000840 5820 F8E2             008F8   580 GPTFX1   L     2,GPP057
000844 5830 2004             00004   581          L     3,4(0,2)
000848 5840 1008             00008   582          L     4,8(0,1)
00084C 5850 4000             00000   583          L     5,0(0,4)
000850 4A40 F8A4             00918   584          LH    4,GPP015+2
000854 1445                          585          NR    4,5
000856 5870 F8FC             00900   586          L     7,GPP012
00085A 4950 F8C2             00938   587          CH    5,GPP023
00085E 4720 F71E             00860   588          BC    2,GPTF10
000862 4850 F8C2             00938   589          LH    6,GPP023
000866 5060 7000             00000   590          ST    6,0(0,7)
00086A 47F0 F87E             008FC   591          BC    15,GPP120
00086E 1855                          592 GPTF10   LR    6,5
000870 1A64                          593          AR    6,4
000872 4A60 F8FC             00934   594          AH    6,GPP012+2
000876 5060 7000             00000   595          ST    6,0(0,7)
00087A 1554                          596          SLR   5,4
00087C 1A65                          597          ALR   6,5
00087E 4A50 F8A4             0091A   598          SH    5,GPP015+2
000882 5850 2008             00008   599          C     5,8(0,2)
000886 4720 F872             00948   600          BC    2,GPP103
00088A 5870 1000             00000   601 GPTF15   L     7,0(0,1)
00088E 5860 7000             00000   602          L     6,0(0,7)
000892 4870 F8A4             00952   603          LH    7,GPP035+2
000896 1476                          604          NR    7,6
000898 4A70 F8FF             00974   605          AH    7,GPP038
00089C 5070 7000             00000   606          ST    7,0(0,7)
0008A0 5850 1004             00004   607          L     5,4(0,1)
0008A4 1F77                          608          SLR   7,7
0008A6 4A30 F8A0             00924   609 GPTF20   AH    3,GPP018+2
0008AA 1576                          610          CLR   7,6
0008AC 4710 F8AE             008C4   611          BC    10,GPTF25
0008B0 4860 6000             00000   612          LH    8,0(0,6)
0008B4 4080 2000             00000   613          STH   8,0(0,2)
0008B8 4A60 F8F8             00926   614          AH    6,GPP018+2
0008BC 4A70 F920             00946   615          AH    7,GPP018+2
0008C0 47F0 F820             00946   616          BC    15,GPTF20
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 LOC   OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
0008C4 4540 F8C2            00038   617 GPTE25   CH    4,GPP023
0008C8 4780 F07E            000EC   618          BC    8,GPP120
0008CC 4880 C000            00000   619          LH    8,0(0,6)
0008D0 5490 F9E6            0096C   620          N     8,GPP036
0008D4 4A80 F900            00976   621          AH    8,GPP038+2
0008D8 4080 3000            00000   622          STH   8,0(0,3)
0008DC 47F0 F07E            000EC   623          BC    15,GPP120
0008E0 00000EF8                     624 GPPCS1   DC    A(GPBEA1)
0008E4 00000076                     625 GPPCS2   DC    A(GPP0SN)
0008E8 00000340                     626 GPPCS3   DC    A(GPDAT1)
0008EC 00001B40                     627 GPPCS4   DC    A(GPTEX1)
0008F0 00000114                     628 GPPCS5   DC    A(GSTMA1)
0008F4 00000250                     629 GPPCS6   DC    A(GSCAL1)
0008F8 00000000                     630 GPPCS7   DC    A(GUBU)
0008FC 00000000                     631 GPPCS8   DC    A(GUMA)
000900 00000000                     632 GPPCS9   DC    A(GUSI)
000904 00000000                     633 GPPC10   DC    A(GUNA)
000908 00000000                     634 GPPC11   DC    A(GUTY)
00090C 00000000                     635 GPP012   DC    A(GTEM)
000910 00000000                     636 GPPC13   DC    A(GDIAGN)
000914 00000000                     637 GPPC14   DC    A(GREG)
000918 00C0C001                     638 GPPC15   DC    X'00C0C001'
00091C 00000520                     639 GPPC16   DC    A(GPP017)
000920 0000001F                     640 GPPC17   DC    F'31'
000924 2A000002                     641 GPPC18   DC    X'2A000002'
000928 7FFF0006                     642 GPPC19   DC    X'7FFF0006'
00092C 00000F0F                     643 GPPC20   DC    A(GPP012)
000930 00000C4A                     644 GPPC21   DC    A(GSTMAP)
000934 00000C60                     645 GPPC22   DC    A(GSCALE)
000938 00008000                     646 GPPC23   DC    X'00008000'
00093C 00000000                     647 GPPC24   DC    A(GCGU)
000940 00000C44                     648 GPPC25   DC    A(GPP026)
000944 00000020                     649 GPPC26   DC    F'32'
000948 46000000                     650 GPPC27   DC    X'46000000'
00094C 00000000                     651 GPPC28   DC    A(GUL1)
000950 40000000                     652 GPPC29   DC    X'40000000'
000954 40800000                     653 GPPC30   DC    E'.5'
000958 00000000                     654 GPPC31   DC    A(GUPL)
00095C 41200000                     655 GPPC32   DC    E'2.0'
000960 41100000                     656 GPPC33   DC    E'1.0'
000964 00040003                     657 GPPC34   DC    X'00040003'
000968 2A020005                     658 GPPC35   DC    X'2A020005'
00096C 0000FF00                     659 GPPC36   DC    X'0000FF00'
000970 2A442A45                     660 GPPC37   DC    X'2A442A45'
000974 2A400040                     661 GPPC38   DC    X'2A400040'
000978 00000F7C                     662 GPPC39   DC    A(GPP040)
00097C 00003C21                     663 GPPC40   DC    F'33'
                                    664          END
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GPLABX   CSECT
                                    2          ENTRY GPLABL
                                    3          EXTRN GUBU
                                    4          EXTRN GTEM
                                    5          EXTRN GULI
                                    6          EXTRN GUGR
                                    7          EXTRN GUSI
                                    8          EXTRN GREG
                                    9          EXTRN GSCALE
                                   10          EXTRN GSTMAP
                                   11          EXTRN IOUT
                                   12          EXTRN FSCAN
                                   13          EXTRN WITEM
                                   14          EXTRN GDIAGN
                                   15          EXTRN GCNVRT
000000 C7D7D3C1C2C340              16          DC     CL7'GPLABL '
000007 07                          17          DC     X'7'
000008                             18          USING  *,15
000008 90EC D00C           0000C   19 GPLABL   STM    14,12,12(13)
00000C 5820 F55C           00564   20          L      2,GPL001
000010 5830 F560           00568   21          L      3,GPL002
000014 5840 F564           0056C   22          L      4,GPL003
000018 5850 F568           00570   23          L      5,GPL004
00001C 5860 F56C           00574   24          L      6,GPL005
000020 1B77                        25          SR     7,7
000022 5070 2050           00050   26          ST     7,80(0,2)
000026 7800 5000           00000   27          LE     0,0(0,5)
00002A 7900 4000           00000   28          CE     0,0(0,4)
00002E 4740 F052           0005A   29          BC     4,GPLA05
000032 7900 4008           00008   30          CE     0,8(0,4)
000036 4720 F052           0005A   31          BC     2,GPLA05
00003A 7820 5004           00004   32          LE     2,4(0,5)
00003E 7920 4004           00004   33          CE     2,4(0,4)
000042 4740 F052           0005A   34          BC     4,GPLA05
000046 7920 400C           0000C   35          CE     2,12(0,4)
00004A 4720 F052           0005A   36          BC     2,GPLA05
00004E 7009 2028           00029   37 GPLA04   STE    0,40(0,2)
000052 7020 202C           0002C   38          STE    2,44(0,2)
000056 47F0 F05F           00066   39          BC     15,GPLA07
00005A 7800 4000           00000   40 GPLA05   LE     0,0(0,4)
00005E 7820 4004           00004   41          LE     2,4(0,4)
000062 47F0 F046           0004E   42          BC     15,GPLA04
000066 5870 1000           00000   43 GPLA07   L      7,0(0,1)
00006A 5870 7000           00000   44          L      7,0(0,7)
00006E 4970 F58C           00594   45          CH     7,GPL013
000072 4720 F078           00080   46          BC     12,GPLA09
000076 1B77                        47          SR     7,7
000078 5070 2060           00060   48          ST     7,96(0,2)
00007C 47F0 F08E           000A6   49          BC     15,GPLA15
000080 5870 1004           00004   50 GPLA09   L      7,4(0,1)
000084 5870 7000           00000   51          L      7,0(0,7)
000088 4970 F58C           00594   52          CH     7,GPL013
00008C 4720 F096           000AE   53          BC     2,GPLA12
000090 4110 F594           0059C   54          LA     1,GPL015
000094 5810 F570           00578   55 GPLA10   L      13,GPL006
000098 58F0 F59R           00590   56          L      15,GPL012
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000D9C 05EF                         57           BALR  14,15
000D9E 4870 F58E                 00596    58 GPLA12  LH    7,GPL013+2
000DA2 5070 3060                 00060    59         ST    7,96(0,3)
000DA6 4870 F58C                 00594    60 GPLA15  LH    7,GPL013
000DAA 5070 3054                 00054    61         ST    7,84(0,3)
000DAE 5870 3060                 00060    62         L     7,96(0,3)
000DB2 5887 4000                 00000    63         L     8,0(7,4)
000DB6 5080 3064                 00064    64         ST    8,100(0,3)
000DBA 4180 F618                 00620    65 GPLA17  LA    11,QTERMREC
000DBE 5B80 F608                 00610    66         S     11,GPL046
000DC2 5870 3060                 00060    67         L     7,96(0,3)
000DC6 5887 1000                 00000    68         L     8,0(7,1)
000DCA 5080 3068                 00068    69         ST    8,104(0,3)
000DCE 5870 F598                 005A0    70         L     7,GPL016
000DD2 5070 306C                 0006C    71         ST    7,108(0,3)
000DD6 5870 F59C                 005A4    72         L     7,GPL017
000DDA 5070 3070                 00070    73         ST    7,112(0,3)
000DDE 5870 F570                 00578    74         L     7,GPL006
000DE2 5010 7038                 00038    75         ST    1,56(0,7)
000DE6 90DF 703C                 0003C    76         STM   13,15,60(7)
000DEA 5810 F5A4                 005AC    77         L     1,GPL020
000DEE 58F0 F57C                 00584    78         L     15,GPL009
000DF2 05EF                         79           BALR  14,15
000DF4 98DF 703C                 0003C    80         LM    13,15,60(7)
000DF8 58F0 F580                 00588    81         L     15,GPL010
000DFC 05EF                         82           BALR  14,15
000DFE 98DF 703C                 0003C    83         LM    13,15,60(7)
000E02 5810 7038                 00033    84         L     1,56(0,7)
000E06 7800 3074                 00064    85         LE    0,100(0,3)
000E0A 7C00 3074                 00074    86         STE   0,116(0,3)
000E0E 4180 3074                 00074    87         LA    8,116(0,3)
000E12 5080 3000                 00000    88         ST    8,0(0,3)
000E16 9680 3000          00000          89         OI    0(3),X'80'
000E1A 5830 3060                 00060    90         L     8,96(0,3)
000E1E 5893 1000                 00000    91         L     9,0(8,1)
000E22 5890 9000                 00000    92         L     9,0(0,9)
000E26 5490 F60C                 00614    93         N     9,GPL047
000E2A 5990 F610                 00618    94         C     9,GPL048
000E2E 4760 F168                 00170    95         BC    6,GPLA19
000E32 7830 3064                 00064    96         LE    0,100(0,3)
000E36 7900 F5F4                 005FC    97         CE    0,GPL040
000E3A 47A0 F13E                 00146    98         BC    10,GPLA18
000E3E 7B00 F5F0                 005F8    99         SF    0,GPL039
000E42 47F0 F142                 0014A   100         BC    15,GPLA1A
000E46 7B00 F5F0                 005F8   101 GPLA18  AE    0,GPL039
000E4A 7E00 F5F4                 005FC   102 GPLA1A  AU    0,GPL040
000E4E 7C00 3074                 00074   103         STE   0,116(0,3)
000E52 5880 3074                 00074   104         L     8,116(0,3)
000E56 5480 F614                 0061C   105         N     8,GPL049
000E5A 4980 F58C                 00594   106         CH    8,GPL013
000E5E 47A0 F164                 0016C   107         BC    10,GPLA1B
000E62 8980 0001                 00001   108         SLL   8,1(0)
000E66 8880 0001                 00001   109         SRL   8,1(0)
000E6A 1288                         110           LCR   8,8
000E6C 5080 3074                 00074   111 GPLA1B  ST    8,116(0,3)
000E70 5810 F560                 00568   112 GPLA19  L     1,GPL002
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  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000174 58F0 F584            0058C   113          L     15,GPL011
000178 05EF                         114          BALR  14,15
00017A 98DF 703C            0003C   115          LM    13,15,60(7)
00017E 5E10 7038            00038   116          L     1,56(0,7)
000182 47F0 F43C            00444   117          BC    15,GPLA80
000186 5E70 3054            00054   118 GPLA20   L     7,84(0,3)
00018A 4970 F5AC            00584   119          CH    7,GPL022
00018E 4720 F404            0040C   120          BC    2,GPLA60
000192 4780 F1AA            001B2   121          BC    8,GPLA30
000196 4986 F5AC            00584   122 GPLA22   LH    8,GPL022
00019A 5C40 3054            00054   123          ST    8,84(0,3)
00019E 5E70 3060            00060   124          L     7,96(0,3)
0001A2 5E87 4008            00008   125          L     8,8(7,4)
0001A6 5C80 3064            00064   126          ST    8,100(0,3)
0001AA 5C90 3030            00030   127          ST    9,48(0,3)
0001AE 47F0 F0B2            000BA   128          BC    15,GPLA17
0001B2 5990 3030            00030   129 GPLA30   C     9,48(0,3)
0001B6 47C0 F1B6            001BE   130          BC    12,GPLA31
0001BA 5C90 3030            00030   131          ST    9,48(0,3)
0001BE 5E70 3060            00060   132 GPLA31   L     7,96(0,3)
0001C2 7E07 5008            00008   133          LE    0,8(7,5)
0001C6 7C00 3024            00024   134          STE   0,36(0,3)
0001CA 4970 F58C            00594   135          CH    7,GPL013
0001CE 4720 F200            00208   136          BC    2,GPLA38
0001D2 5E70 3030            00C30   137          L     7,48(0,3)
0001D6 4C70 F5D4            005DC   138          MH    7,GPL032
0001DA 4980 6000            00000   139          LH    8,0(0,6)
0001DE 1E87                         140          SR    8,7
0001E0 4990 F58C            00594   141          CH    9,GPL013
0001E4 47A0 F1E8            001F0   142          BC    10,GPLA34
0001E8 4110 F5C0            005C8   143 GPLA32   LA    1,GPL027
0001EC 47F0 F0BC            000B4   144          BC    15,GPLA10
0001F0 4880 6004            00004   145 GPLA34   LH    8,4(0,6)
0001F4 1A87                         146          AR    8,7
0001F6 5930 F5D8            005E0   147          C     9,GPL033
0001FA 4720 F1E0            001E8   148          BC    2,GPLA32
0001FE 1A73                         149 GPLA36   AR    7,7
000200 5C70 3030            00030   150          ST    7,48(0,3)
000204 47F0 F222            0022A   151          BC    15,GPLA39
000208 5E70 3030            00030   152 GPLA38   L     7,48(0,3)
00020C 4C70 F5D6            005DE   153          MH    7,GPL032+2
000210 4A70 F5D6            005DE   154          AH    7,GPL032+2
000214 4880 6000            00000   155          LH    8,0(0,6)
000218 1E87                         156          SR    8,7
00021A 4930 F58C            00594   157          CH    3,GPL013
00021E 4740 F1E0            001E8   158          BC    4,GPLA32
000222 5E80 F5A0            005A4   159          L     8,GPL017
000226 5C80 3030            00030   160          ST    8,48(0,3)
00022A 4870 F58C            00594   161 GPLA39   LH    7,GPL013
00022E 5C70 3050            00050   162          ST    7,80(0,3)
000232 7E00 F5DC            005E4   163          LE    0,GPL034
000236 7C00 304C            0004C   164          STE   0,76(0,3)
00023A 7E00 3024            00024   165 GPLA40   LE    0,36(0,3)
00023E 7C00 304C            0004C   166          ME    0,76(0,3)
000242 7E20 3028            00028   167          LE    2,40(0,3)
000246 3E20                         168          SER   2,0
```

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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000248 7C20 3064            00064   169          STE   2,100(0,3)
00024C 5870 3060            00060   170          L     7,96(0,3)
000250 7927 4000            00000   171          CE    2,0(7,4)
000254 4740 F260            00268   172          BC    4,GPLA42
000258 7800 304C            0004C   173          LE    0,76(0,3)
00025C 7A00 F5DC            005E4   174          AE    0,GPL034
000260 7C00 304C            0004C   175          STE   0,76(0,3)
000264 47F0 F232            0023A   176          BC    15,GPLA40
000268 7800 3064            00064   177 GPLA42   LE    0,100(0,3)
00026C 5870 3060            00060   178          L     7,96(0,3)
000270 7A00 3024            00024   179          AE    0,36(0,3)
000274 7C00 3064            00064   180          STE   0,100(0,3)
000278 7907 4008            00008   181          CE    0,8(7,4)
00027C 47C0 F2C0            002C8   182          BC    12,GPLA50
000280 4970 F5BE            005B6   183          CH    7,GPL013+2
000284 47A0 F290            00298   184          BC    10,GPLA44
000288 5870 1004            00004   185          L     7,4(0,1)
00028C 5870 7000            00000   186          L     7,0(0,7)
000290 4970 F59C            00594   187          CH    7,GPL013
000294 4760 F096            0009E   188          BC    6,GPLA12
000298 5870 3058            00058   189 GPLA44   L     7,88(0,3)
00029C 5070 3000            00000   190          ST    7,0(0,3)
0002A0 5870 F570            00578   191          L     7,GPL006
0002A4 5010 7038            00038   192          ST    1,56(0,7)
0002A8 9C0F 703C            0003C   193          STM   13,15,60(7)
0002AC 5810 F5A8            005B0   194          L     1,GPL021
0002B0 5800 F570            00578   195          L     13,GPL006
0002B4 5EF0 F578            00580   196          L     15,GPL008
0002B8 05EF                         197          BALR  14,15
0002BA 9BDF 703C            0003C   198          LM    13,15,60(7)
0002BE 5810 7038            00038   199          L     1,56(0,7)
0002C2 98EC D00C            0000C   200          LM    14,12,12(13)
0002C6 07FE                         201          BCR   15,14
0002C8 5871 3050            00050   202 GPLA50   L     7,80(0,3)
0002CC 4970 F59C            00594   203          CH    7,GPL013
0002D0 4780 F2D8            002E0   204          BC    8,GPLA52
0002D4 4971 F5B8            005C0   205 GPLA51   CH    7,GPL025
0002D8 5071 3054            00054   206          ST    7,84(0,3)
0002DC 47F0 F0B2            000BA   207          BC    15,GPLA17
0002E0 5870 3028            00028   208 GPLA52   L     7,40(0,3)
0002E4 5070 3000            00000   209          ST    7,0(0,3)
0002E8 5871 302C            0002C   210          L     7,44(0,3)
0002EC 5071 3004            00004   211          ST    7,4(0,3)
0002F0 5870 F570            00578   212 GPLA53   L     7,GPL006
0002F4 5C10 7038            00038   213          ST    1,56(0,7)
0002F8 9C0F 703C            0003C   214          STM   13,15,60(7)
0002FC 5810 F5A8            005B0   215          L     1,GPL021
000300 5800 F570            00578   216          L     13,GPL006
000304 5EF0 F574            0057C   217          L     15,GPL007
000308 05EF                         218          BALR  14,15
00030A 9BDF 703C            0003C   219          LM    13,15,60(7)
00030E 5811 7038            00038   220          L     1,56(0,7)
000312 5871 3050            00050   221          L     7,80(0,3)
000316 4970 F59C            00594   222          CH    7,GPL013
00031A 4750 F37A            00382   223          BC    6,GPLA64
00031E 5871 3060            00060   224          L     7,96(0,3)
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   LOC  OBJECT CODE     ADDR1  ADDR2  STMT   SOURCE STATEMENT
000322 4870 F5BC             00594   225          CH    7,GPL013
000326 4720 F34E             00356   226          BC    2,GPLA55
00032A 7E00 300C             0000C   227          LE    0,12(0,3)
00032E 7E20 3024             00024   228          LF    2,36(0,3)
000332 3C02                          229 GPLA54    MER   0,2
000334 7A00 F5F0             005F8   230          AE    0,GPL039
000338 7E00 F5F4             005FC   231          AU    0,GPL040
00033C 7C00 305C             0005C   232          STE   0,92(0,3)
000340 4880 305E             0005E   233          LH    8,94(0,3)
000344 5E70 3030             00030   234          L     7,48(0,3)
000348 4A70 F5EA             005F2   235          AH    7,GPL037+2
00034C 1978                          236          CR    7,8
00034E 4720 F35A             00362   237          BC    2,GPLA56
000352 4700 F36E             00376   238          BC    12,GPLA57
000356 7E00 3010             00010   239 GPLA55    LE    0,16(0,3)
00035A 7E20 3024             00024   240          LE    2,36(0,3)
00035E 47F0 F32A             00332   241          BC    15,GPLA54
000362 5E70 3060             00060   242 GPLA56    L     7,96(0,3)
000366 7E00 3024             00024   243          LE    0,36(0,3)
00036A 7A07 5008             00008   244          AE    0,8(7,5)
00036E 7C00 3024             00024   245          STE   0,36(0,3)
000372 47F0 F222             0022A   246          BC    15,GPLA39
000376 4870 F5AC             005B4   247 GPLA57    LH    7,GPL022
00037A 5C70 3050             00050   248          ST    7,80(0,3)
00037E 47F0 F2CC             002D4   249          BC    15,GPLA51
000382 5E70 2004             00004   250 GPLA64    L     7,4(0,2)
000386 5A70 3058             00058   251          A     7,88(0,3)
00038A 4890 F5E0             005E8   252          LH    9,GPL035
00038E 4C90 7000             00000   253          STH   8,0(0,7)
000392 5880 3060             00060   254          L     8,96(0,3)
000396 4980 F58C             00594   255          CH    8,GPL013
00039A 4720 F3CE             003D6   256          BC    2,GPLA66
00039E 5880 3030             00030   257          L     8,48(0,3)
0003A2 4C80 F5D4             005DC   258          MH    8,GPL032
0003A6 4E80 F5D4             005DC   259          SH    8,GPL032
0003AA 4AA0 301E             0001E   260          LH    10,30(0,3)
0003AE 1AA8                          261          SR    10,8
0003B0 8BA0 0010             00010   262          SLL   10,16(0)
0003B4 4E80 3022             00022   263          LH    8,34(0,3)
0003B8 4E80 F5F2             005EA   264          SH    8,GPL035+2
0003BC 1AA8                          265 GPLA65    AR    10,8
0003BE 8BA0 0002             00002   266          SLL   10,2(0)
0003C2 5EA0 F5E4             005EC   267          AL    10,GPL036
0003C6 4CA0 7004             00004   268          STH   10,4(0,7)
0003CA 8BA0 0010             00010   269          SRL   10,16(0)
0003CE 4CA0 7002             00002   270          STH   10,2(0,7)
0003D2 47F0 F3EC             003F4   271          BC    15,GPLA68
0003D6 5880 3030             00030   272 GPLA66    L     8,48(0,3)
0003DA 4C90 F5D6             005DE   273          MH    8,GPL032+2
0003DE 4A80 F602             0060A   274          AH    8,GPL043+2
0003E2 48A0 6000             00000   275          LH    10,0(0,6)
0003E6 1AA8                          276          SR    10,8
0003E8 8BA0 0010             00010   277          SLL   10,16(0)
0003EC 4E80 3022             00022   278          LH    8,34(0,3)
0003F0 47F0 F3B4             003BC   279          BC    15,GPLA65
0003F4 5870 3058             00058   280 GPLA68    L     7,88(0,3)
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 LOC   OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
0003F8 1E79                          281           ALR   7,9
0003FA 4A70 F5E8                     282           AH    7,GPL037
0003FE 5490 F5EC                     283           N     9,GPL038
000402 1E79                          284           ALR   7,9
000404 5070 305A                     285           ST    7,88(0,3)
000408 47F0 F260                     286           BC    15,GPLA42
00040C 47F0 F4PE                     287 GPLA60    BC    15,GPLA90
000410 5E70 3060                     288 GPLA61    L     7,96(0,3)
000414 4A70 F58C                     289           CH    7,GPL013
000418 4720 F42P                     290           BC    12,GPLA62
00041C 5E70 4000                     291           L     7,0(0,4)
000420 5070 3000                     292           ST    7,0(0,3)
000424 5E70 3064                     293           L     7,100(0,3)
000428 5070 3004                     294           ST    7,4(0,3)
00042C 47F0 F2E8                     295           BC    15,GPLA53
000430 5E70 3064                     296 GPLA62    L     7,100(0,3)
000434 5070 3000                     297           ST    7,0(0,3)
000438 5E70 4004                     298           L     7,4(0,4)
00043C 5070 3004                     299           ST    7,4(0,3)
000440 47F0 F2E8                     300           BC    15,GPLA53
000444 5B90 F61P                     301 GPLA90    L     9,TRCONVRT
                                     302           DROP  15
000000                               303           USING QCONVRT,9
000448 5E70 5018                     304           L     7,FIOBEGIN
00044C 5E80 501C                     305           L     8,FIOCURNT
                                     306           DROP  9
000308                               307           USING GPLABL,15
000450 1E98                          308           LR    9,8
000452 1E47                          309           SR    9,7
000454 5990 F5CC                     310           C     9,GPL017
000458 4740 F460                     311           BC    4,GPLA82
00045C 4740 F46A                     312           BC    8,GPLA84
000460 4110 F5B4                     313 GPLA81    LA    1,GPL024
000464 47F0 F08C                     314           BC    15,GPLA10
000468 5E30 F5D8                     315 GPLA82    L     9,GPL016
00046C 1E19                          316           ALR   8,9
00046E 92FF 8000          00000      317           MI    0(8),X'FF'
000472 5E80 F598                     318 GPLA84    L     8,GPL016
000476 4E70 F000                     319 GPLA85    LH    7,0(0,8)
00047A 4A70 F5AF                     320           CH    7,GPL022+2
00047E 4760 F4BF                     321           BC    6,GPLA86
000482 4E90 F5B8                     322           SH    9,GPL025
000486 4E90 F5B8                     323           AH    9,GPL025
00048A 4590 F5BC                     324           CH    9,GPL013
00048E 4720 F46E                     325           BC    2,GPLA85
000492 47F0 F456                     326           BC    15,GPLA81
000496 5470 F5C4                     327 GPLA86    N     7,GPL02P
00049A 4A70 F5BA                     328           CH    7,GPL025+2
00049E 4760 F4P2                     329           BC    6,GPLA87
0004A2 4E30 F5AC                     330           SH    3,GPL022
0004A6 4E70 P000                     331           LH    7,0(0,8)
0004AA 5470 F5CP                     332           N     7,GPL029
0004AE 5E70 F5CP                     333           CL    7,GPL029
0004B2 4743 F45P                     334           BC    8,GPLA81
0004B6 47F0 F15C                     335           BC    15,GPLA20
0004BA 5470 F5C4                     336 GPLA87    N     7,GPL02P
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   LOC   OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000480 4780 F458              00460   337           BC    8,GPLA82
000482 47F0 F17E              001B4   338           BC    15,GPLA20
000486 4E70 E000              00000   339 GPLA00    LH    7,0(0,E)
00048A 5A70 F5C4              005CC   340           N     7,GPL028
00048E 4A70 F5BA              005C2   341           CH    7,GPL025+2
000492 4760 F4FA              004F2   342           BC    6,GPLA93
000496 1EAB                           343           LR    10,B
000498 1B77                           344           SR    7,7
00049A D200 A000 A001 00000 00001     345 GPLA91    MVC   0(1,10),1(10)
0004A0 4A70 F5AC              00584   346           AH    7,GPL022
0004A4 1979                           347           CR    7,9
0004A6 47A0 F4FA              004F2   348           BC    10,GPLA93
0004AA 4AA0 F5AC              00584   349           AH    10,GPL022
0004AE 47F0 F4D2              004DA   350           BC    15,GPLA91
0004B2 1B70                           351 GPLA93    LR    7,9
0004B4 5C90 2030              00030   352           ST    9,48(0,3)
0004B8 5A70 F5EC              005F4   353           N     7,GPL038
0004BC 4780 F50C              00514   354           BC    8,GPLA94
0004C0 1E78                           355           LR    7,8
0004C2 1A79                           356           AR    7,9
0004C4 9400 7000 00000                357           NI    0(7),X'00'
0004C8 9640 7000 00000                358           OI    0(7),X'40'
0004CC 5C90 2030              00030   359           ST    9,48(0,2)
0004D0 4A70 F5AC              00584   360           AH    9,GPL022
0004D4 5E70 2004              00004   361 GPLA94    L     7,4(0,2)
0004D8 1A79                           362           AR    7,9
0004DA 5A70 2058              00058   363           A     7,88(0,2)
0004DE 4A70 F5D4              00600   364           AH    7,GPL032
0004E2 5C70 2008              00008   365           C     7,8(0,2)
0004E6 4720 F520              00538   366           BC    12,GPLA95
0004EA 4110 F5EC              00604   367           LA    1,GPL042
0004EE 5800 F570              00578   368           L     13,GPL006
0004F2 58F0 F598              00590   369           L     15,GPL012
0004F6 05EF                           370           BALR  14,15
0004F8 5E70 2004              00004   371 GPLA95    L     7,4(0,2)
0004FC 5A70 2058              00058   372           A     7,88(0,2)
000500 4EA0 F600              00608   373           LH    10,GPL043
000504 4CA0 7006              00006   374           STH   10,6(0,7)
000508 1B66                           375           SR    6,6
00050A 4EA6 8000              00000   376 GPLA96    LH    10,0(6,8)
00050E 4CA6 7008              00008   377           STH   10,8(6,7)
000512 4A60 F5B8              005C0   378           AH    6,GPL025
000516 1969                           379           CR    6,9
000518 4740 F542              0054A   380           BC    4,GPLA96
00051C 5860 F56C              00574   381           L     6,GPL005
000520 47F0 F408              00410   382           BC    15,GPLA61
000524 00000000                       383 GPLC01    DC    A(GUBU)
000528 00000000                       384 GPLC02    DC    A(GTEM)
00052C 00000000                       385 GPLC03    DC    A(GUL1)
000530 00000000                       386 GPLC04    DC    A(GUGR)
000534 00000000                       387 GPLC05    DC    A(GUST)
000538 00000000                       388 GPLC06    DC    A(GREG)
00053C 00000000                       389 GPLC07    DC    A(GSCALE)
000540 00000000                       390 GPLC08    DC    A(GSTMAP)
000544 00000000                       391 GPLC09    DC    A(IOUT)
000548 00000000                       392 GPLC10    DC    A(FSCAN)
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000530 00000000                    393 GPLC11   DC    A(WITEM)
000534 00000000                    394 GPLC12   DC    A(GOTAGN)
000538 00000004                    395 GPLC13   DC    X'00000004'
00053C 00700C47                    396 GPLC14   DC    F'71.0'
000540 00000E08                    397 GPLC15   DC    A(GPLC14)
000544 00000034                    398 GPLC16   DC    A(GTEM+52)
000548 00000C14                    399 GPLC17   DC    F'20'
00054C 00000E44                    400 GPLC18   DC    A(GPLC17)
000550 00000C48                    401 GPLC20   DC    A(GTEM+104)
000554 00000168                    402 GPLC21   DC    A(GPLC02)
000558 00140400                    403 GPLC22   DC    X'00140400'
00055C 00000C48                    404 GPLC23   DC    F'72'
000560 00000588                    405 GPLC24   DC    A(GPLC23)
000564 00024000                    406 GPLC25   DC    X'00024000'
000568 00000C48                    407 GPLC26   DC    F'73'
00056C 00000564                    408 GPLC27   DC    A(GPLC26)
000570 00FFFF00                    409 GPLC28   DC    X'0000FF00'
000574 000000FF                    410 GPLC29   DC    X'000000FF'
000578 00000C50                    411 GPLC30   DC    F'80'
00057C 00000E04                    412 GPLC31   DC    A(GPLC30)
000580 00070008                    413 GPLC32   DC    X'0007000F'
000584 00000FFF                    414 GPLC33   DC    F'1023'
000588 41100000                    415 GPLC34   DC    E'1.0'
00058C 2A000025                    416 GPLC35   DC    X'2A000025'
000590 40000000                    417 GPLC36   DC    X'40000000'
000594 00080003                    418 GPLC37   DC    X'00080003'
000598 00000001                    419 GPLC38   DC    X'00000001'
00059C 40500000                    420 GPLC39   DC    F'.5'
0005A0 46000000                    421 GPLC40   DC    X'46000000'
0005A4 00000C48                    422 GPLC41   DC    F'73.0'
0005A8 00000E0C                    423 GPLC42   DC    A(GPLC41)
0005AC 2A000014                    424 GPLC43   DC    X'2A000014'
0005B0 00000008                    425 GPLC45   DC    A(GPLABL)
0005B4 00000040                    426 GPLC46   DC    F'64.0'
0005B8 00FF0000                    427 GPLC47   DC    X'00FF0000'
0005BC 00000000                    428 GPLC49   DC    X'00000000'
0005C0 80FFFFFF                    429 GPLC49   DC    X'80FFFFFF'
0005C4                             430          CNOP  0,8
0005C8 00000000                    431 QTERMREC DC    A(QCNVRT)
0005C8                             432 TRCCNVRT EQU   QTERMREC
                                   433 ******  DUMMY SECTION FOR COMMUNICATION REGION                    1    1

000000                             435 QCONVRT  DSECT                                                   1    3
000000                             436 FIRSTIN  DS    F       ADDRESS OF BEGINNING OF FORMAT STATEMENT   IDN00570
000004                             437 FINEXT   DS    F       ADDRESS OF NEXT FORMAT ELEMENT             IDN00580
000008                             438 FIFORMAT DS    F       CONDENSED FORMAT ELEMENT                   IDN00590
                                   439 *                        BYTE 0 - FORMAT CODE (A,I,F,D ETC.)    IDN00600
                                   440 *                        BYTE 1 - WIDTH                         IDN00610
                                   441 *                        BYTE 2 - NUMBER OF PLACES AFTER DECIMAL PT.  IDN00620
                                   442 *                        BYTE 3 - CURRENT SCALING FACTOR        IDN00630
00000C                             443 FINNERCT DS    CL1     GROUP COUNT FOR INNER PARENTHESES          IDN00640
00000D                             444 FINNERAD DS    CL3       ADDRESS OF INNER LEFT PARENTHESIS        IDN00650
000010                             445 FIOUTRCT DS    CL1     GROUP COUNT FOR OUTER                      IDN00660
000011                             446 FIOUTRAD DS    CL3       ADDRESS OF OUTER                         IDN00670
000014                             447 FISLASH  DS    CL1                                                IDN00680
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000018                  448 FIOIND   DS    CL1                                                    IONO0690
000016                  449 FIELDCT  DS    H       FIELD COUNT FOR CURRENT FORMAT ELEMENT         IONO0700
000018                  450 FIOBEGIN DS    F       BEGINNING OF I/O AREA                          IONO0710
00001C                  451 FIOCURNT DS    F       CURRENT POSITION IN AREA                       IONO0720
000020                  452 FIOSIZE  DS    F       SIZE OF AREA                                   IONO0730
000024                  453 FIERRADD DS    F       ADDRESS OF ERROR ROUTINE                       IONO0740
000028                  454 FIMESADD DS    F       ADDRESS OF ERROR MESSAGE                       IONO0750
00002C                  455 FIRECPWR DS    F       INTRA-PROGRAM COMMUNICATION, WORK AREA         IONO0760
                        456 *                                                                     IONO0770
                        457 *       REGISTER SAVE AREAS                                           IONO0780
000030                  458 FISAV1   DS    8F      SAVE AREA FOR LEVEL 1 ROUTINES                 IONO0790
000050                  459 FISAV2   DS    15F     SAVE AREA FOR LEVEL 2 ROUTINES                 IONO0800
000088                  460 FISAV3   DS    F       SAVE AREA FOR LEVEL 3 ROUTINES                 IONO0810
                        461 *                                                                     IONO0820
                        462 *                                                                     IONO0830
                        463 *       VARIABLES USED IN FORMAT SCANNING ROUTINE                     IONO0840
000090                  464 FGSWITCH DS    CL1     MULTI-PURPOSE SWITCH        **ON**   **OFF**  IONO0850
                        465 *FGCOMA      BIT 0     COMMA FOUND BEFORE           YES      NO      IONO0860
                        466 *FGCTEL      BIT 1     COUNT CURRENT ELEMENT        COUNT    DON'T   IONO0870
                        467 *            BIT 2     UNUSED                                        IONO0880
                        468 *FGCNFT      BIT 3     CONV.F.CODE SINCE LAST (     YES      NO      IONO0890
                        469 *FGPCT       BIT 4     BEGINNING OF FORMAT STMNT.   YES      NO      IONO0900
                        470 *FGSIGN      BIT 5     SCALE FACTOR SIGN            MINUS    PLUS    IONO0910
                        471 *FGINPT      BIT 6     INPUT OR OUTPUT              INPUT    OUTPUT  IONO0920
000091                  472 FGGCTSAV DS    CL1     SAVE AREA FOR INNER GROUP COUNT                IONO0930
000092                  473 FGWELMS  DS    H       COUNT OF NUMBER ELEMENTS FOR ERROR ID.         IONO0940
000098                  474 FGWCRKAR DS    0D                  DOUBLE WORD FOR CONVERSIONS        SCN01140
                        475 *                                                                     IONO0950
                        476 *                                                                     IONO0960
                        477 *       VARIABLES FOR CONVERSION ROUTINES                             IONO0970
000098                  478 FECVAREA DS    20                  DECIMAL CONVERT AREA               IONO0980
0000A8                  479 FEDATUM  DS    D                   INTEGER STORAGE                    IONO0990
0000B0                  480 FEINTGER DS    D                   TEMPORARY                          IONO1000
0000B8                  481 FEDIGIT  DS    F                   DIGIT STORAGE                      IONO1010
0000BC                  482 FEXPON   DS    F                   EXPONENT STORAGE                   IONO1020
0000C0                  483 FEREGPOS DS    F                   START OF SIGNIFICANT DIGITS        IONO1030
0000C4                  484 FESWITCH DS    CL1                 SCAN SWITCHES                      IONO1040
                        485         END
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 LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GPRINX   CSECT
                                    2          ENTRY GPRINT
                                    3          EXTRN FSCAN
                                    4          EXTRN WITEM
                                    5          EXTRN IOUT
                                    6          EXTRN GTEM
                                    7          EXTRN GUBU
                                    8          EXTRN GSTMAP
                                    9          EXTRN GDIAGN
                                   10          EXTRN GREG
                                   11          EXTRN GCNVRT
000000 C7D7D9C9D5F340               12          DC    CL7'GPRINT
000007 07                           13          DC    X'7'
000008                              14          USING *,15
000008 90EC D00C             0000C  15 GPRINT   STM   14,12,12(13)
00000C 5820 F17C             00184  16 GPR102   L     2,GPR002
000010 5830 F178             00180  17          L     3,GPR001
000014 5840 1004             00004  18          L     4,4(0,1)
000018 5850 3008             00008  19          L     5,8(0,3)
00001C 5850 2004             00004  20          S     5,4(0,2)
000020 5850 F198             001A0  21          S     5,GPR008
000024 47C0 F154             00150  22          BC    12,GPR128
000028 1F65                         23          LR    6,5
00002A 5460 F198             001A0  24          N     6,GPR008
00002E 4780 F02E             00036  25          BC    8,GPR106
000032 5E50 F198             001A0  26          S     5,GPR009
000036 5E60 1000             00000  27 GPR106   L     6,0(0,1)
00003A 5E60 6000             00000  28          L     6,0(0,6)
00003E 4E70 F19E             001A6  29          LH    7,GPR010+2
000042 1476                         30          NR    7,6
000044 4E70 F19C             001A4  31          AH    7,GPR010
000048 5E60 2004             00004  32          L     6,4(0,2)
00004C 4E70 6000             00000  33          STH   7,0(0,6)
000050 4E80 F1A0             001A8  34 GPR109   LH    8,GPR011
000054 5C90 2010             00010  35          ST    8,16(0,2)
000058 1F68                         36          AR    6,8
00005A 5C60 2004             00004  37          ST    6,4(0,2)
00005E 5C50 2014             00014  38          ST    5,20(0,2)
000062 5C50 2008             00008  39          ST    5,8(0,2)
000066 5C40 2000             00000  40          ST    4,0(0,2)
00006A 5850 F1A8             001B0  41          L     5,GPR013
00006E 5C50 200C             0000C  42          ST    5,12(0,2)
000072 9680 200C             0000C  43          OI    12(2),X'80'
000076 5850 F194             00190  44          L     5,GPR008
00007A 5C10 503E             0003E  45          ST    1,56(0,5)
00007E 90DE 503C             0003C  46          STM   13,15,60(5)
000082 5810 F17C             00184  47          L     1,GPR002
000086 4130 F1CA             001E0  48          LA    11,OTERMREC
00008A 5B30 F1C8             001D0  49          S     11,GPR021
00008E 5850 F188             00190  50          L     15,GPR005
000092 05EF                         51          BALR  14,15
000094 98DE 503C             0003C  52          LM    13,15,60(5)
000098 5850 F180             00188  53          L     15,GPR003
00009C 05EF                         54          BALR  14,15
00009E 98DE 503C             0003C  55          LM    13,15,60(5)
0000A2 5811 F13A             0003A  56          L     1,56(0,5)
```

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  LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000DA6 1F55                        57           SR    5,5
000DA8 5950 1004              00004 58           C     5,4(0,1)
000DAC 4720 F0FE              00106 59           BC    2,GPRI22
000DB0 1F66                         60 GPRI12     SR    6,6
000DB2 5E75 1008              00008 61 GPRI16     L     7,8(5,1)
000DB6 4970 F198              001A0 62           CH    7,GPR009
000DBA 4720 F0BA              000C2 63           BC    2,GPRI20
000DBE 5660 F198              001A0 64 GPRI18     L     6,GPR009
000DC2 5070 2000              00000 65 GPRI20     ST    7,0(0,2)
000DC6 9680 2000 00000              66           OI    0(2),X'80'
000DCA 5870 F194              0019C 67           L     7,GPR008
000DCE 5010 7038              00038 68           ST    1,56(0,7)
000DD2 90DF 703C              0003C 69           STM   13,15,60(7)
000DD6 5E10 F17C              00184 70           L     1,GPR002
000DDA 5EF0 F184              0018C 71           L     15,GPR004
000DDE 05EF                         72           BALR  14,15
000DE0 98DF 703C              0003C 73           LM    13,15,60(7)
000DE4 5960 F198              001A0 74           C     6,GPR009
000DE8 4780 F0FE              00106 75           BC    8,GPRI22
000DEC 90DF 703C              0003C 76           STM   13,15,60(7)
000DF0 5EF0 F180              00188 77           L     15,GPR003
000DF4 05EF                         78           BALR  14,15
000DF6 98DF 703C              0003C 79           LM    13,15,60(7)
000DFA 5E10 703B              00038 80           L     1,56(0,7)
000DFE 4A50 F1AC              00184 81           AH    5,GPR014
000E02 47F0 F0AA              00092 82           BC    15,GPRI16
000E06 5650 F1D8              001E0 83 GPRI22     L     5,TRCONVRT
                                    84           DROP  15
000000                              85           USING QCONVRT,5
000E0A 5660 5018              00018 86           L     6,FIOBEGIN
000E0E 5E70 501C              0001C 87           L     7,FIOCURNT
000E12 1E76                         88           SR    7,6
                                    89           DROP  5
000008                              90           USING GPRINT,15
000E14 5A70 2010              00010 91           A     7,16(0,2)
000E18 1E67                         92           LR    6,7
000E1A 5460 F198              001A0 93           N     6,GPR009
000E1E 4780 F128              00130 94           BC    8,GPRI24
000E22 5F60 3004              00004 95           L     6,4(0,3)
000E26 1A67                         96           AR    6,7
000E28 9640 6000 00000              97           OI    0(6),X'40'
000E2C 5A70 F198              001A0 98           A     7,GPR009
000E30 5070 2000              00000 99 GPRI24     ST    7,0(0,2)
000E34 5660 F194              0019C 100          L     6,GPR008
000E38 5010 6038              00038 101          ST    1,56(0,6)
000E3C 90DF 603C              0003C 102          STM   13,15,60(6)
000E40 5E10 F180              00188 103          L     1,GPR015
000E44 5ED0 F194              0019C 104          L     13,GPR008
000E48 5EF0 F18C              00194 105          L     15,GPR006
000E4C 05EF                         106          BALR  14,15
000E4E 98DF 603C              0003C 107          LM    13,15,60(6)
000E52 5E10 6038              00038 108          L     1,56(0,6)
000E56 98EC C00C              0000C 109          LM    14,12,12(13)
000E5A 07FE                         110          BCR   15,14
000E5C 4110 F188              001C0 111 GPRI28     LA    1,GPR017
000E60 5ED0 F194              0019C 112          L     13,GPR009
```

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  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                    F01JAN67  1/11/68

000164 58F0 F190             00198  113            L     15,GPR007
000168 05EF                         114            BALR  14,15
00016A 98DF 503C             0003C  115 GPRI50     LM    13,15,60(5)
00016E 5870 F1C0             001C8  116            L     7,GPR019
000172 5070 7018             00018  117            ST    7,24(0,7)
000176 4110 F18C             001C4  118            LA    1,GPR018
00017A 58F0 F190             00198  119            L     15,GPR007
00017E 05EF                         120            BALR  14,15
000180 0C000C00                     121 GPRC01     DC    A(GUBU)
000184 0C000000                     122 GPRC02     DC    A(GTEM)
000188 0C000000                     123 GPRC03     DC    A(FSCAN)
00018C 0C000000                     124 GPRC04     DC    A(WITEM)
000190 0C000C00                     125 GPRC05     DC    A(IOUT)
000194 0C000000                     126 GPRC06     DC    A(GSTMAP)
000198 0C000000                     127 GPRC07     DC    A(GDIAGN)
00019C 0C000000                     128 GPRC08     DC    A(GREG)
0001A0 0C000001                     129 GPRC09     DC    X'00000001'
0001A4 2A400005                     130 GPRC10     DC    X'2A400005'
0001A8 0C028000                     131 GPR011     DC    X'00028000'
0001AC 0C000C14                     132 GPR012     DC    A(GTEM+20)
0001B0 0C00016A                     133 GPR013     DC    A(GPRI50)
0001B4 0C040000                     134 GPR014     DC    X'00040000'
0001B8 0C000184                     135 GPR015     DC    A(GPR002)
0001BC 0C000033                     136 GPR016     DC    F'51.0'
0001C0 0C0001BC                     137 GPR017     DC    A(GPR016)
0001C4 0C000C18                     138 GPR018     DC    A(GTEM+24)
0001C8 0C000034                     139 GPRC19     DC    F'52.0'
0001CC 0C0001C8                     140 GPRC20     DC    A(GPR019)
0001D0 1C000040                     141 GPR021     DC    F'64.0'
0001D4 0C000C0C                     142 GPRC22     DC    A(GPRI02)
0001D8 0C000008                     143 GPR023     DC    A(GPRINT)
0001DC 07000700                     144            CNOP  0,8
0001E0 0C000000                     145 QTERMREC   DC    A(QCNVRT)
0001E0                              146 TRCCNVRT   EQU   QTERMREC
                                    147 ******  DUMMY SECTION FOR COMMUNICATION REGION                1    1


000000                              149 QCONVRT    DSECT                                             1    3
000000                              150 FIBEGIN    DS    F       ADDRESS OF BEGINNING OF FORMAT STATEMENT    IONO0571
000004                              151 FINEXT     DS    F       ADDRESS OF NEXT FORMAT ELEMENT              IONO0580
000008                              152 FIFORMAT   DS    F       CONDENSED FORMAT ELEMENT                    IONO0590
                                    153 *                           BYTE 0 - FORMAT CODE (A,I,F,D ETC.)     IONO0600
                                    154 *                           BYTE 1 - WIDTH                          IONO0610
                                    155 *                           BYTE 2 - NUMBER OF PLACES AFTER DECIMAL PT. IONO0620
                                    156 *                           BYTE 3 - CURRENT SCALING FACTOR         IONO0630
00000C                              157 FINNERCT   DS    CL1     GROUP COUNT FOR INNER PARENTHESES           IONO0640
00000D                              158 FINNERAD   DS    CL3       ADDRESS OF INNER LEFT PARENTHESIS         IONO0650
000010                              159 FIOUTRCT   DS    CL1     GROUP COUNT FOR OUTER                       IONO0660
000011                              160 FIOUTRAD   DS    CL3       ADDRESS OF OUTER                          IONO0670
000014                              161 FISLASH    DS    CL1                                                 IONO0680
000015                              162 FIOIND     DS    CL1                                                 IONO0690
000016                              163 FIELDCT    DS    H       FIELD COUNT FOR CURRENT FORMAT ELEMENT      IONO0700
000018                              164 FIOBEGIN   DS    F       BEGINNING OF I10 AREA                       IONO0710
00001C                              165 FIOCURNT   DS    F       CURRENT POSITION IN AREA                    IONO0720
000020                              166 FIOSIZE    DS    F       SIZE OF AREA                                IONO0730
000024                              167 FIERRADD   DS    F       ADDRESS OF ERROR ROUTINE                    IONO0740
```

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LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                                                    F01JAN67   1/11/68
                                 168 FIMESADD DS    F       ADDRESS OF ERROR MESSAGE                                    IDN00750
000028                           169 FIRCRWR  DS    F       INTRA-PROGRAM COMMUNICATION, WORK AREA                      IDN00760
00002C                           170 *                                                                               IDN00770
                                 171 *       REGISTER SAVE AREAS                                                     IDN00780
000030                           172 FISAV1   DS    8F      SAVE AREA FOR LEVEL 1 ROUTINES                              IDN00790
000050                           173 FISAV2   DS    15F     SAVE AREA FOR LEVEL 2 ROUTINES                              IDN00800
00003C                           174 FISAV3   DS    F       SAVE AREA FOR LEVEL 3 ROUTINES                              IDN00810
                                 175 *                                                                               IDN00820
                                 176 *                                                                               IDN00830
                                 177 *       VARIABLES USED IN FORMAT SCANNING ROUTINE                               IDN00840
000090                           178 FGSWITCH DS    CL1     MULTI-PURPOSE SWITCH          **ON**    **OFF**         IDN00850
                                 179 *FGCOMA      BIT 0     COMMA FOUND BEFORE             YES       NO             IDN00860
                                 180 *FGCTEL      BIT 1     COUNT CURRENT ELEMENT          COUNT     DON'T          IDN00870
                                 181 *            BIT 2     UNUSED                                                   IDN00880
                                 182 *FGCNFT      BIT 3     CONV.F.CODE SINCE LAST (       YES       NO             IDN00890
                                 183 *FGFCT       BIT 4     BEGINNING OF FORMAT STMNT.     NO        YES            IDN00900
                                 184 *FGSIGN      BIT 5     SCALE FACTOR SIGN              MINUS     PLUS           IDN00910
                                 185 *FGINPT      BIT 6     INPUT OR OUTPUT                INPUT     OUTPUT         IDN00920
000091                           186 FGGCTSAV DS    CL1     SAVE AREA FOR INNER GROUP COUNT                         IDN00930
000092                           187 FG#ELMS  DS    H       COUNT OF NUMBER ELEMENTS FOR ERROR ID.                  IDN00940
000098                           188 FGWORKAR DS    0D                    DOUBLE WORD FOR CONVERSIONS               SCN01140
                                 189 *                                                                               IDN00950
                                 190 *                                                                               IDN00960
                                 191 *       VARIABLES FOR CONVERSION ROUTINES                                       IDN00970
000098                           192 FECVAREA DS    2D                    DECIMAL CONVERT AREA                      IDN00980
0000A8                           193 FEDATUM  DS    D                     INTEGER STORAGE                           IDN00990
0000B0                           194 FETMPER  DS    D                     TEMPORARY                                 IDN01000
0000B8                           195 FADIGIT  DS    F                     DIGIT STORAGE                             IDN01010
0000BC                           196 FEXPON   DS    F                     EXPONENT STORAGE                          IDN01020
0000C0                           197 FEREGPOS DS    F                     START OF SIGNIFICANT DIGITS               IDN01030
0000C4                           198 FESWITCH DS    CL1                   SCAN SWITCHES                             IDN01040
                                 199          END
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                                    F01JAN67   1/11/68
000000                                   1 GOPCPX   CSECT
                                         2          ENTRY GOPCP
                                         3          EXTRN GUCH
                                         4          EXTRN GINK
                                         5          EXTRN GUNI
                                         6          EXTRN GTEM
                                         7          EXTRN GIOB1
                                         8          EXTRN GECB1
                                         9       EXTRN GDCB1
000000 C7D6D7C3D7                       10          DC    CL5'GOPCP'
000005 05                               11          DC    X'5'
000006                                  12          USING *,15
000006 9CE9 F00C              0000C     13 GOPCP    STM   14,9,12(13)
00000A 187F                             14          LR    7,15
00000C 5890 F066              00068     15          L     9,GOPCP2
000010 5820 F062              00068     16 GOPC4    L     2,GOPCP1
000014 5830 2000              00000     17          L     3,0(0,2)
000018 5840 F072              00078     18          L     4,GOPCP5
00001C 5C30 4010              00010     19          ST    3,16(0,4)
000020 1B44                             20          SR    4,4
000022 4C40 9002              00002     21          STH   4,2(0,9)
000026 5820 F07A              00080     22          L     2,GOPCP7
00002A 5810 F072              00078     23          L     1,GOPCP5
00002E 5850 F082              00088     24          L     5,GOPC10
000032 5850 5020              00020     25          L     5,44(0,5)    A(UCB) INTO R5
000036 5850 5020              00020     26          L     5,32(0,5)    A(GCB) INTO R5
00003A 91FF 501B       0001B            27          TM    27(5),X'FF'
00003E 4780 F044              0004A     28          BZ    GOPC2
000042 47F0 F05C              00062     29          BC    15,GOPC7
000046 47F0 F05C              00062     30          BC    15,GOPC7
00004A 0A00                             31 GOPC2    SVC   0
00004C                                  32          CNOP  0,4
00004C 187F                             33          LR    15,7
00004E 0700                             34          CNOP  0,4
                                        35          WAIT  ECB=(2)
000050 1812                             36+         LR    1,(2) LOAD PARAMETER REG 1
000052 4100 0001              00001     37+         LA    0,1(0,0) COUNT OMITTED,1 USED
000056 0A01                             38+         SVC   1 LINK TO WAIT ROUTINE
000058                                  39          CNOP  0,4
000058 187F                             40          LR    15,7
00005A 0700                             41          CNOP  0,4
00005C D203 2000 F09A 00000 00090       42          MVC   0(4,2),=F'0'
000062 9823 F01C              0001C     43 GOPC7    LM    2,9,28(13)
000066 07FE                             44          BCR   15,14
000068                                  45          CNOP  0,4
000068 00000000                         46 GOPCP1   DC    A(GUCH)
00006C 00000000                         47 GOPCP2   DC    A(GINK)
000070 00000000                         48 GOPCP3   DC    A(GUNI)
000074 00000000                         49 GOPCP4   DC    A(GTEM)
000078 00000000                         50 GOPCP5   DC    A(GIOB1)
00007C 00040000                         51 GOPCP6   DC    X'00040000'
000080 00000000                         52 GOPCP7   DC    A(GECB1)
000084 0100                             53 GOPCP8   DC    X'0100'
000086 0001                             54 GOPCP9   DC    X'0001'
000088 0000F000                         55 GOPC10   DC    A(GDCB1)
                                        56          END

  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                                    F01JAN67   1/11/68
000090 00000000                         57                 =F'0'
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GINKEX   CSECT
                                    2         ENTRY GINKEY
                                    3         EXTRN GINK
                                    4         EXTRN GDCB1
000000 C7C9D5D2C5E7E940             5         DC    CL7'GINKEY'
000007 07                           6         DC    X'7'
000008                              7         USING *,15
000008 90EB C00C              0000C 8 GINKEY STM   14,8,12(13)
00000C 5E20 1000              00000 9         L     2,0(0,1)
000010 5E30 2000              00000 10        L     3,0(0,2)
000014 5840 F0A8              000B0 11        L     4,GINKE4
000018 5F50 1004              00004 12        L     5,4(0,1)
00001C 5E60 1008              00008 13        L     6,8(0,1)
000020 5E70 100C              0000C 14        L     7,12(0,1)
000024 4530 F0BC              00094 15        CH    3,GINKE7
000028 4760 F06C              00074 16        BC    6,GINKE5
00002C 5E80 F090              00098 17        L     8,GINKE9
000030 5E80 802C              0002C 18        L     8,44(0,8)
000034 5E80 8020              00020 19        L     8,32(0,8)
000038 91FF 801B        00018       20        TM    27(8),X'FF'
00003C 4780 F048              0005C 21        BZ    GINKE2
000040 9400 801B        00018       22          NI    27(8),X'00'
000044 4880 4002              00002 23        LH    8,2(0,4)
000048 5680 F094              0009C 24        O     8,GINKE8
00004C 4080 4002              00002 25        STH   8,2(0,4)
000050 4E20 4000              00000 26 GINKE2 LH    2,0(0,4)
000054 1E32                         27        LR    3,2
000056 8F30 0008              00008 28        SRL   3,8(0)
00005A 5030 5000              00000 29        ST    3,0(0,5)
00005E 5420 F0BC              00094 30        N     2,GINKE7
000062 5020 6000              00000 31        ST    2,0(0,6)
000066 4E20 4002              00002 32        LH    2,2(0,4)
00006A 5020 7000              00000 33        ST    2,0(0,7)
00006E 9828 D01C              0001C 34 GINKE3 LM    2,8,28(13)
000072 07FE                         35        BCR   15,14
000074 5E20 5000              00000 36 GINKE5 L     2,0(0,5)
000078 8920 0008              00008 37        SLL   2,8(0)
00007C 5E20 6000              00000 38        AL    2,0(0,6)
000080 8920 0010              00010 39        SLL   2,16(0)
000084 5E20 7000              00000 40        AL    2,0(0,7)
000088 5020 4000              00000 41        ST    2,0(0,4)
00008C 47F0 F066              0006C 42        BC    15,GINKE3
000090                              43        CNOP  0,4
000090 0C000000                     44 GINKE6 DC    A(GINK)
000094 0C0000FF                     45 GINKE7 DC    X'000000FF'
000098 0C000000                     46 GINKE8 DC    A(GDCB1)
00009C 0C000001                     47 GINKE9 DC    X'00000001'
                                    48        END
```

```
  LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                                  F01JAN67  1/11/68
000000                              1 GWAITX  CSECT
                                    2         ENTRY GWAIT
                                    3         ENTRY POLST1
                                    4         EXTRN GLNK
                                    5         EXTRN GUCH
                                    6         EXTRN GMGF
                                    7         EXTRN GUTT
                                    8         EXTRN GDIAG1
                                    9         EXTRN GREG
                                   10         EXTRN GDCB2
000000 C7E6C1C9E3                  11         DC    CL5'GWAIT'
000005 05                          12         DC    X'5'
000006                             13         USING *,15
000006 90EA F00C          0000C    14 GWAIT  STM   14,10,12(13)
00000A 18AF                        15         LR    10,15
                                   16         DROP  15
000006                             17         USING GWAIT,10
00000C 5820 A1FE          00204    18         L     2,GWA01
000010 5890 A20E          00214    19         L     9,GWA06
000014 5000 9000          00000    20         ST    13,0(0,9)
000018 1D09                        21         LR    13,9
00001A 5850 1000          00000    22 GWAI10 L     5,0(0,1)
00001E 5860 5000          00000    23         L     6,0(0,5)
000022 5960 A202          00208    24         CL    6,GWA02
000026 4780 A194          0018A    25         BC    8,GWAI50
00002A 4720 A176          0017C    26         BC    2,GWAI40
00002E 4890 2002          00002    27         LH    9,2(0,2)
000032 5490 A202          00208    28         N     9,GWA02
000036 4760 A0E2          000E8    29         BC    6,LPEN
                                   30 GWAI15 ANALYZ POLST1,PNTR1
00003A                             31+        CNOP  2,4 ALIGN TO A HALF WORD BNDRY.
00003A 41E0 A04E          00054    32+GWAI15 LA    14,A0001+4 LOAD RETURN ADDRESS
00003E 58F0 A04A          00050    33+        L     15,A0001 LOAD ANLZ ROUTINE ADR.IN REG15
000042 051F                        34+        BALR  1,15 PLACE STARTING ADDRESS OF
                                   35+*                                   PARAMETER LIST IN REG1 AND
                                   36+*                                   BRANCH TO ANLZ ROUTINE
000044 00000000                    37+        DC    A(POLST1) POINTER TO DCB LIST STARTING ADR
000048 00000000                    38+        DC    A(PNTR1) POINTER TO TABLE STARTING ADR.
00004C 00000000                    39+        DC    4XL1'00' RESERVE STORAGE FOR RESUME PTR
000050 00000000                    40+A0001   DC    V(ANLZ) PTR TO ANLZ ROUTINE
000054 58E0 1004          00004    41+        L     14,4(0,1) LOAD TABLE PTR
000058 4110 A05A          00060    42+        LA    1,B0001
00005C 47F1 F000          00000    43+        B     0(1,15)
000060 47F0 A082          00088    44+B0001   B     C0001 0 LP
000064 47F0 A082          00088    45+        B     C0001 4 KYBD
000068 47F0 A082          00088    46+        B     C0001 8 AE
00006C 47F0 A082          00088    47+        B     C0001 12 EOS
000070 41F0 0004          00004    48+        LA    15,4 16 LOAD CODE NO POSTED GCBS
000074 47F0 A0A6          000AC    49+        B     H0001+10 BRANCH
000078 41F0 000C          0000C    50+        LA    15,12 24 LOAD CODE FOR PARAM MISSING
00007C 47F0 A0A6          000AC    51+        B     H0001+10 BRANCH
000080 41F0 0010          00010    52+        LA    15,16 32 LOAD CODE WORD 5 MISSING
000084 47F0 A0A6          000AC    53+        B     H0001+10 BRANCH
000088 58IE F000          00000    54+C0001   L     1,0(14,15) LOAD ROUTINE ADDRESS FROM TABLE
00008C 4110 1000          00000    55+        LA    1,0(0,1) ZERO HI ORDER BYTE
000090 41F0 0000          00000    56+        LA    15,0 LOAD COMPARE ADDRESS
```

```
   LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000094 191F                          57+          CLR   1,15 TEST FOR ZERO ADDRESS
000096 4770 A09C                00A2 58+          BC    7,H0001 BRANCH IF ADDRESS NOT ZERO
00009A 41F0 0008                0008 59+          LA    15,8 LOAD CODE FOR ATTENTION OCCURED
                                     60+*                                 BUT NO ROUTINE PROVIDED
00009E 47F0 A0A6                00AC 61+          B     H0001+10 BRANCH
0000A2 18F1                          62+H0001     LR    15,1 LOAD WHERE TO GO ADDRESS
0000A4 1810                          63+          LR    1,0 OUTPUT AREA ADR TO REG1
0000A6 05EF                          64+          BALR  14,15 BRANCH TO ROUTINE
0000A8 41F0 0000                0000 65+          LA    15,0 LOAD NORMAL RETURN CODE
                                     66           STIMER WAIT,BINTVL=TIME
0000AC 4110 A25A                0260 67+          LA    1,TIME LOAD PARAMETER REG 1
0000B0 4100 0011                0011 68+          LA    0,17(0,0) LOAD FLAG BYTE
0000B4 8900 C01*                0018 69+          SLL   0,24(0) SHIFT TO HI-ORDER BYTE
0000B8 0A2F                          70+          SVC   47 ISSUE STIMER SVC
0000BA 47F0 A034                003A 71           B     GWAI15
0000BE 0C00
0000C0 0C0000000000000000           72 POLST1    DC    3F'0'
0000CC 00000FF0                     73 PNTR1     DC    A(LPEN)
0000D0 00000FF8                     74           DC    A(KYBD)
0000D4 00000C00                     75           DC    A(0)
0000D8 00000C00                     76           DC    A(0)
0000DC 00000FF0                     77           DC    A(OPT1)
0000E0 0C00000000000000             78 OPT1      DC    2F'0'
0000E8 4840 2002                0002 79 LPEN      LH    4,2(0,2)
0000EC 5640 A256                025C 90           O     4,GWA23
0000F0 4040 2002                0002 81           STH   4,2(0,2)
0000F4 47F0 A0FE                0104 82           B     GWAI20
0000F8 4840 2002                0002 83 KYBD      LH    4,2(0,2)
0000FC 5640 A202                0208 84           O     4,GWA02
000100 4040 2002                0002 85           STH   4,2(0,2)
000104 4840 2002                0002 86 GWAI20    LH    4,2(0,2)
000108 4C40 2006                0006 87           STH   4,6(0,2)
00010C 8840 0001                0001 88           SRL   4,1(0)
000110 8940 0001                0001 89           SLL   4,1(0)
000114 4040 2002                0002 90           STH   4,2(0,2)
000118 5870 A20A                0210 91 GWAI22    L     7,GWA04
00011C 5880 7000                0000 92           L     8,0(0,7)
000120 1598                          93           LR    9,8
000122 4A90 A222                0228 94           AH    9,GWA10
000126 5090 7004                0004 95           ST    9,4(0,7)
00012A 5E90 A202                0208 96           SL    9,GWA02
00012E 5590 7008                0008 97           CL    9,8(0,7)
000132 4700 A13E                0144 98           BC    12,GWAI24
000136 41A0 A24C                024C 99           LA    1,GWA19
00013A 5800 A20E                0214 100 GWAI23   L     13,GWA06
00013E 58E0 A23A                0240 101          L     15,GWA16
000142 05EF                          102          BALR  14,15
000144 5440 A226                022C 103 GWAI24   N     4,GWA11
000148 4710 A14E                0154 104          BC    8,GWAI26
00014C 5870 A21A                021A 105          L     7,GWA07
000150 47F0 A152                0158 106          BC    15,GWAI28
000154 5870 A22A                0230 107 GWAI25   L     7,GWA12
000158 5A70 A21A                0220 108 GWAI26   AL    7,GWA08
00015C 5070 8000                0000 109          ST    7,0(0,8)
000160 5870 A21C                021C 110          L     7,GWA07+4
000164 5070 8004                0004 111          ST    7,4(0,8)
```

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  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000168 5E70 A21E            00224   112          L     7,GWA09
00016C 5E70 A242            00248   113          AL    7,GWA18
000170 5C70 800A            00008   114          ST    7,8(0,8)
000174 5E70 A206            00200   115          L     7,GWA03
000178 5C70 800C            0000C   116          ST    7,12(0,8)
00017C 5E90 A20E            00214   117 GWAI40   L     9,GWA06
000180 5E00 9000            00000   118          L     13,0(0,9)
000184 9EEA D00C            0000C   119          LM    14,10,12(13)
000188 07FE                         120          BCR   15,14
00018A 5E30 A21A            00220   121 GWAI50   L     3,GWA08
00018E 4E40 3006            00006   122          LH    4,6(0,2)
000192 5440 A22E            0022C   123          N     4,GWA11
000196 4780 A1BE            001C4   124          BC    8,GWAI60
00019A 4E40 3000            00000   125 GWAI51   LH    4,0(0,3)
00019E 5440 A22E            00234   126          N     4,GWA13
0001A2 4760 A1AB            001AF   127          BC    6,GWAI52
0001A6 4110 A24E            00254   128          LA    1,GWA21
0001AA 47F0 A134            0013A   129          BC    15,GWAI23
0001AE 1E44                         130 GWAI52   SR    4,4
0001B0 4C40 3000            00000   131          STH   4,0(0,2)
0001B4 4E40 3002            00002   132          LH    4,2(0,3)
0001B8 5F40 A202            00208   133          SL    4,GWA02
0001BC 4C40 3002            00002   134          STH   4,2(0,3)
0001C0 47F0 A176            0017C   135          BC    15,GWAI40
0001C4 5E40 3000            00000   136 GWAI60   L     4,0(0,3)
0001C8 1B54                         137          LR    5,4
0001CA 5440 A232            00238   138          N     4,GWA14
0001CE 4780 A1EE            001EE   139          BC    8,GWAI75      TRANSFER ON FUNCTION KEYBOARD
0001D2 5450 A236            0023C   140          N     5,GWA15
0001D6 4760 A1E0            001E6   141          BC    6,GWAI70      TRANSFER ON END KEY
0001DA 4F50 A240            00246   142          LH    5,GWA17+2
0001DE 4C50 3000            00000   143 GWAI62   STH   5,0(0,2)
0001E2 47F0 A176            0017C   144          BC    15,GWAI40
0001E6 4F50 A23F            00244   145 GWAI70   LH    5,GWA17
0001EA 47F0 A1D8            001DE   146          BC    15,GWAI62
0001EE 5E40 3000            00000   147 GWAI75   L     4,0(0,3)
0001F2 8940 0008            00008   148          SLL   4,8(0)
0001F6 8E40 0010            00010   149          SRL   4,16(0)
0001FA 4C40 2000            00000   150          STH   4,0(0,2)
0001FE 47F0 A176            0017C   151          BC    15,GWAI40
000202 0700                         152          CNOP  0,4
000204 0C000000                     153 GWAC1    DC    A(GINK)
000208 0C000001                     154 GWAC2    DC    X'00000001'
00020C 0C000002                     155 GWAC3    DC    X'00000002'
000210 0C000000                     156 GWAC4    DC    A(GUCH)
000214 0C000000                     157 GWAC6    DC    A(GREG)
000218 040000004C000004             158 GWAC7    CCW   4,0,X'60',4
000220 0C000000                     159 GWAC8    DC    A(GMGS)
000224 27000000                     160 GWAC9    DC    X'27000000'
000228 00100000                     161 GWA10    DC    X'00100000'
00022C 00000004                     162 GWA11    DC    X'00000004'
000230 0E000000                     163 GWA12    DC    X'0E000000'
000234 00000080                     164 GWA13    DC    X'00000080'
000238 80000000                     165 GWA14    DC    X'80000000'
00023C 20000000                     166 GWA15    DC    X'20000000'
000240 00000000                     167 GWA16    DC    A(GDIAGN)
```

```
 LOC   OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000244 21002200                     168 GWA17    DC    X'21002200'
000248 0C000000                     169 GWA18    DC    A(GUTT)
00024C 0C000250                     170 GWA19    DC    A(GWA20)
000250 0C000015                     171 GWA20    DC    X'00000015'
000254 0C000258                     172 GWA21    DC    A(GWA22)
000258 0C000016                     173 GWA22    DC    X'00000016'
00025C 0C000005                     174 GWA23    DC    X'00000005'
000260 0C0000C8                     175 TIME     DC    F'200'
                                    176          END
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                              1 GCONVX   CSECT
                                    2          ENTRY GCONVT
                                    3          EXTRN FSCAN
                                    4          EXTRN RITEM
                                    5          EXTRN IOIN
                                    6          EXTRN GTEM
                                    7          EXTRN GDIAGN
                                    8          EXTRN GREG
                                    9          EXTRN GCNVRT
000000 C7C3D6D5E5F340               10          DC    CL7'GCONVT '
000007 07                           11          DC    X'7'
000008                              12          USING *,15
000008 9CEC D00C            0000C   13 GCONVT  STM   14,12,12(13)
00000C 5820 F0DC            000E4   14          L     2,GCON2
000010 5830 F0E0            000E8   15          L     3,GCON3
000014 5840 1000            00000   16          L     4,0(0,1)
000018 5C40 2000            00000   17          ST    4,0(0,2)
00001C 5840 1004            00004   18          L     4,4(0,1)
000020 5C40 2004            00004   19          ST    4,4(0,2)
000024 5840 1008            00008   20          L     4,8(0,1)
000028 5C40 2008            00008   21          ST    4,8(0,2)
00002C 5840 100C            0000C   22          L     4,12(0,1)
000030 5040 2010            00010   23          ST    4,16(0,2)
000034 5840 F0FC            00104   24          L     4,GCON10
000038 5C40 200C            0000C   25          ST    4,12(0,2)
00003C 5850 F0E0            000E8   26          L     5,GCON3
000040 5C10 5038            00038   27          ST    1,56(0,5)
000044 90DF 503C            0003C   28          STM   13,15,60(5)
000048 5810 F0DC            000E4   29          L     1,GCON2
00004C 41B0 F108            00110   30          LA    11,QTERMREC
000050 5B80 F0E8            000F0   31          S     11,GCON5
000054 58F0 F0EC            000F4   32          L     15,GCON6
000058 05EF                         33          BALR  14,15
00005A 98DF 503C            0003C   34          LM    13,15,60(5)
00005E 58F0 F0F0            000F8   35          L     15,GCON7
000062 05EF                         36          BALR  14,15
000064 98DF 503C            0003C   37          LM    13,15,60(5)
000068 5810 5038            00038   38          L     1,56(0,5)
00006C 1855                         39          SR    5,5
00006E 5550 1000            00000   40          C     5,0(0,1)
000072 4720 F0C4            000CC   41          BC    2,GCONV7
000076 1866                         42          SR    6,6
000078 5875 100C            0000C   43 GCONV4  L     7,12(5,1)
00007C 4570 F0E8            00100   44          CH    7,GCON9
000080 4720 F080            00088   45          BC    2,GCONV6
000084 5860 F0E8            00100   46          L     6,GCON9
000088 5C70 2000            00000   47 GCONV6  ST    7,0(0,2)
00008C 9680 2000      00000         48          OI    0(2),X'80'
000090 5870 F0E0            000E8   49          L     7,GCON3
000094 5C10 7038            00038   50          ST    1,56(0,7)
000098 90DF 703C            0003C   51          STM   13,15,60(7)
00009C 5810 F0DC            000E4   52          L     1,GCON2
0000A0 58F0 F0F4            000FC   53          L     15,GCON9
0000A4 05EF                         54          BALR  14,15
0000A6 98DF 703C            0003C   55          LM    13,15,60(7)
0000AA 5560 F0E8            00100   56          C     6,GCON9
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT
000DAE 4780 F0C4             00CC    57           BC     8,GCONV7
000DB2 90DF 703C             003C    58           STM    13,15,60(7)
000DB6 58E0 F0E0             00E8    59           L      15,GCON7
000DBA 05EF                          60           BALR   14,15
000DBC 98DF 703C             003C    61           LM     13,15,60(7)
000DC0 5810 7038             0039    62           L      1,56(0,7)
000DC4 4A50 F0D8             00E0    63           AH     5,GCON1
000DC8 47F0 F070             0078    64           BC     15,GCONV4
000DCC 98EC D00C             000C    65 GCONV7    LM     14,12,12(13)
000DD0 07FE                          66           BCR    15,14
000DD2 98DF 503C             003C    67 GCONV8    LM     13,15,60(5)
000DD6 5810 F100             0108    68           L      1,GCON11
000DDA 58F0 F0E4             00EC    69           L      15,GCON4
000DDE 05EF                          70           BALR   14,15
000DE0 00040000                      71 GCON1     DC     X'00040000'
000DE4 00000000                      72 GCON2     DC     A(GTEM)
000DE8 00000000                      73 GCON3     DC     A(GREG)
000DEC 00000000                      74 GCON4     DC     A(GDTAGN)
000DF0 00000040                      75 GCON5     DC     F'64.0'
000DF4 00000000                      76 GCON6     DC     A(IOIN)
000DF8 00000000                      77 GCON7     DC     A(FSCAN)
000DFC 00000000                      78 GCON8     DC     A(RITEM)
000100 00000001                      79 GCON9     DC     X'00000001'
000104 00000002                      80 GCON10    DC     A(GCONV8)
000108 00000F0                       81 GCON11    DC     A(GCON5)
00010C 07000700                      82                  CNOP   0,8
000110 00000000                      83 QTERMREC  DC     A(GCNVRT)
000110                               84 TRCONVRT  EQU    QTERMREC
                                     85 ******   DUMMY SECTION FOR COMMUNICATION REGION                    1     1
000000                               87 QCONVRT   DSECT                                                   1     3
000000                               88 FIBEGIN   DS     F       ADDRESS OF BEGINNING OF FORMAT STATEMENT  IQN00571
000004                               89 FINEXT    DS     F       ADDRESS OF NEXT FORMAT ELEMENT            IQN00580
000008                               90 FIFORMAT  DS     F       CONDENSED FORMAT ELEMENT                  IQN00590
                                     91 *                          BYTE 0 - FORMAT CODE (A,I,F,D ETC.)   IQN00600
                                     92 *                          BYTE 1 - WIDTH                        IQN00610
                                     93 *                          BYTE 2 - NUMBER OF PLACES AFTER DECIMAL PT. IQN00620
                                     94 *                          BYTE 3 - CURRENT SCALING FACTOR       IQN00630
00000C                               95 FINNERCT  DS     CL1     GROUP COUNT FOR INNER PARENTHESES         IQN00640
00000D                               96 FINNERAD  DS     CL3       ADDRESS OF INNER LEFT PARENTHESIS       IQN00650
000010                               97 FIOUTRCT  DS     CL1     GROUP COUNT FOR OUTER                     IQN00660
000011                               98 FIOUTRAD  DS     CL3       ADDRESS OF OUTER '                      IQN00670
000014                               99 FISLASH   DS     CL1                                               IQN00680
000015                              100 FIOIND    DS     CL1                                               IQN00690
000016                              101 FIELDCT   DS     H       FIELD COUNT FOR CURRENT FORMAT ELEMENT    IQN00700
000018                              102 FIOBEGIN  DS     F       BEGINNING OF IIO AREA                     IQN00710
00001C                              103 FIOCURNT  DS     F       CURRENT POSITION IN AREA                  IQN00720
000020                              104 FIOSIZE   DS     F       SIZE OF AREA                              IQN00730
000024                              105 FIERRADD  DS     F       ADDRESS OF ERROR ROUTINE                  IQN00740
000028                              106 FIMESADD  DS     F       ADDRESS OF ERROR MESSAGE                  IQN00750
00002C                              107 FIRCWR    DS     F       INTRA-PROGRAM COMMUNICATION, WORK AREA    IQN00760
                                    108 *                                                                  IQN00770
                                    109 *       REGISTER SAVE AREAS                                        IQN00780
000030                              110 FISAV1    DS     8F      SAVE AREA FOR LEVEL 1 ROUTINES            IQN00790
000050                              111 FISAV2    DS     15F     SAVE AREA FOR LEVEL 2 ROUTINES            IQN00800
```

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  LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                                                    F01JAN67  1/11/68
000D8C                           112 FISAV3   DS    F        SAVE AREA FOR LEVEL 3 ROUTINES                          ION00810
                                 113 *                                                                          ION00820
                                 114 *                                                                          ION00830
                                 115 *       VARIABLES USED IN FORMAT SCANNING ROUTINE                          ION00840
000D90                           116 FGSWITCH DS    CL1      MULTI-PURPOSE SWITCH          **ON**   **OFF**    ION00850
                                 117 *FGCOMA      BIT 0     COMMA FOUND BEFORE             YES      NO         IONOO860
                                 118 *FGCTEL      BIT 1     COUNT CURRENT ELEMENT          COUNT    DON'T      ION00870
                                 119 *            BIT 2     UNUSED                                              IONOO880
                                 120 *FGCNFT      BIT 3     CONV.F.CODE SINCE LAST (       YES      NO         ION00890
                                 121 *FGPCT       BIT 4     BEGINNING OF FORMAT STMNT.     NO       YES        ION00900
                                 122 *FGSIGN      BIT 5     SCALE FACTOR SIGN              MINUS    PLUS       ION00910
                                 123 *FGINPT      BIT 6     INPUT OR OUTPUT                INPUT    OUTPUT     ION00920
000D91                           124 FGGCTSAV DS    CL1      SAVE AREA FOR INNER GROUP COUNT                     ION00930
000D92                           125 FGNELMS  DS    H        COUNT OF NUMBER ELEMENTS FOR ERROR ID.              IONOO940
000D98                           126 FGWCONAR DS    DD                  DOUBLE WORD FOR CONVERSIONS              SC001140
                                 127 *                                                                          ION00950
                                 128 *                                                                          ION00960
                                 129 *       VARIABLES FOR CONVERSION ROUTINES                                  ION00970
000D98                           130 FECVAREA DS    2D                  DECIMAL CONVERT AREA                    ION00980
000DA8                           131 FEDATUM  DS    D                   INTEGER STORAGE                         ION00990
000DB0                           132 FEINTGER DS    D                   TEMPORARY                               ION01000
000DB8                           133 FEDIGIT  DS    F                   DIGIT STORAGE                           ION01010
000DBC                           134 FEXPON   DS    F                   EXPONENT STORAGE                        ION01020
000DC0                           135 FEBEGPOS DS    F                   START OF SIGNIFICANT DIGITS             ION01030
000DC4                           136 FESWITCH DS    CL1                 SCAN SWITCHES                           ION01040
                                 137          END
```

```
 LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                                    F01JAN67  1/11/68
000000                              1 GDCPX    CSECT
                                    2          ENTRY GDCB1
                                    3          ENTRY GDCB2
                                    4          EXTRN GIOB1
                                    5          EXTRN PQLST1
000000 C7C4C3C2F1                   6          DC    CL5'GDCB1'
000005 05                           7          DC    X'5'
000006                              8          USING *,15
                                    9 GDCB1    DCB   DSORG=PS,MACRF=(E),DDNAME=GCRT1,IOBAD=GIOB1,DEVD=DA,     X
                                                      XENDA=WG,CENDA=WH
                                   10                 *,***  IH8063  DDNAME SHORT-PADDED TO 8 CHAR


                                   12+*                       DATA CONTROL BLOCK
                                   13+*
000006                             14+        ORG   *-0 TO ELIMINATE UNUSED SPACE
000008                             15+GDCB1   DS    OF ORIGIN ON WORD BOUNDRY
000008                             16+        ORG   *+0 TO ORIGIN GENERATION

                                   18+*                       DIRECT ACCESS DEVICE INTERFACE

000008 0C000C0000000000            20+        DC    BL16'0' FDAD,DVTBL
000018 0C000000                    21+        DC    A(0) KEYLE,DEVT,TRBAL
                                   23+*                       COMMON ACCESS METHOD INTERFACE

00001C 0C                          25+        DC    AL1(0) BUFNO
00001D 0C0001                      26+        DC    AL3(1) BUFCB
000020 0C00                        27+        DC    AL2(0) BUFL
000022 4000                        28+        DC    BL2'0100000000000000' DSORG
000024 0C000C00                    29+        DC    A(GIOB1) IOBAD

                                   31+*                       FOUNDATION EXTENSION

000028 0C                          33+        DC    BL1'00000000' BFTEK,BFALN
000029 0C0001                      34+        DC    AL3(1) EODAD
00002C 0C                          35+        DC    BL1'00000000' RECFM
00002D 0C0000                      36+        DC    AL3(0) EXLST

                                   38+*                       FOUNDATION BLOCK

000030 C7C3D5E3F1404040            40+        DC    CL8'GCRT1' DDNAME
000038 02                          41+        DC    BL1'00000010' OFLGS
000039 0C                          42+        DC    BL1'00000000' IFLG
00003A FC08                        43+        DC    BL2'1111000000001000' MACR

                                   45+*                       EXCP APPENDAGE LIST

00003C FFFFFFFF                    47+        DC    XL4'FFFFFFFF' IMSK
000040 00000000                    48+        DC    XL4'00000000' UMSK
000044 FC40                        49+        DC    CL2'0' EDEA
000046 FC40                        50+        DC    CL2'0' PCIA
000048 FC40                        51+        DC    CL2'0' SIOA
00004A E6C8                        52+        DC    CL2'WH' CENDA
00004C E6C7                        53+        DC    CL2'WG' XENDA
00004E FC40                        54+        DC    CL2'0' AERR
```

```
  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT                                                    F01JAN67  1/11/68

                                     55 GDCP2    DCB   DSORG=GS,MACRF=(R,W),DDNAME=GCRT2,POLST=POLST1
                                     56              *,***  IHB072  EXLST NOT SPECIFIED-PRESET TO 0
                                     57              *,***  IHB063  DDNAME SHORT-PADDED TO 8 CHAR
000350                               58+         ORG   *-0 ELIMINATE UNUSED SPACE
000350                               59+GDCB2    DS    0F ORIGIN ON FULL WORD BOUNDRY
000350                               60+         ORG   *+0 ORIGIN GENERATION
000350 000000000000000000            61+         DC    14XL1'00'
00035E 00                            62+         DC    AL1(0) CTYPE
00035F 000000000000                  63+         DC    5XL1'00'
000364 000000000000                  64+         DC    6XL1'00'
00036A 0080                          65+         DC    BL2'0000000010000000' DSORG
00036C 00000000                      66+         DC    4XL1'00'
000070 01                            67+         DC    AL1(1) GNCP
000071 000000                        68+         DC    AL3(POLST1) POLST
000074 00                            69+         DC    1XL1'00'
000075 000000                        70+         DC    AL3(0) EXLST
000078 C7C3D5E3E2404040              71+         DC    CL8'GCRT2' DDNAME
000080 02                            72+         DC    BL1'00000010' OFLGS
000081 00                            73+         DC    X'00' IFLG
000082 2020                          74+         DC    BL2'0010000000100000' MACRF
                                     75          END

  LOC  OBJECT CODE     ADDR1 ADDR2  STMT   SOURCE STATEMENT

000000                               1 GIOP1X   CSECT
                                     2          ENTRY GIOP1
                                     3          ENTRY GECB1
                                     4          EXTRN GDCB1
                                     5          EXTRN GUNI
                                     6          EXTRN GINK
                                     7          EXTRN GREG
                                     8          EXTRN GDIAGN
000000                               9          DS    0F
000000 42000000                     10 GIOP1    DC    X'42000000'
000004 00000000                     11          DC    A(GECB1)
000008 00000000                     12          DC    X'00000000'
00000C 00000000                     13          DC    X'00000000'
000010 00000000                     14          DC    X'00000000'                ADDRESS OF CHANNEL
000014 00000000                     15          DC    A(GDCB1)
000018 00000000                     16          DC    X'00000000'
00001C 00010000                     17          DC    X'00010000'
000020 00000000                     18          DC    X'00000000'
000024 00000000                     19          DC    X'00000000'
000028 00000000                     20 GECB1    DC    X'00000000'
00002C 00000000                     21          DC    A(GUNI)
000030 00000000                     22          DC    A(GINK)
000034 00000000                     23          DC    A(GREG)
000038 00000000                     24          DC    A(GDIAGN)
                                    25          END
```

```
  LOC. OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                    F01JAN67   1/11/69
000000                              1 IGG019WG CSECT
000000                              2          USING *,15
000000 50D0 F038            00038   3 IGWG1    ST    13,WG1
000004 41D0 F03C            0003C   4          LA    13,WG10
000008 90EC D000            00000   5          STM   14,12,0(13)
00000C 58A0 202C            0002C   6          L     10,44(0,2)
000010 48D0 A002            00002   7          LH    13,2(0,10)
000014 41A0 7004            00004   8          LA    10,4(0,7)
000018 48C0 A000            00000   9          LH    12,0(0,10)
00001C 41D0 F078            00078  10 IGWG5    LA    13,WG11
000020 90EC D000            00000  11          STM   14,12,0(13)
000024 58D0 F038            00038  12          L     13,WG1
                                   13          ABEND 999,DUMP
000028                             14+         CNOP  0,4
000028 47F0 F030            00030  15+         B     *+8 BRANCH AROUND CONSTANT
00002C 8C                          16+         DC    AL1(128) DUMP/STEP CODE
00002D 0003E7                      17+         DC    AL3(999) COMPLETION CODE
000030 5810 F02C            0002C  18+         L     1,*-4 LOAD CODES INTO REG 1
000034 0A0D                        19+         SVC   13 LINK TO ABEND ROUTINE
000036 07FE                        20          BCR   15,14
000038 00000000                    21 WG1     DC    X'00000000'
00003C 00000000000000000           22 WG10    DC    15F'0'
000078 00000000000000000           23 WG11    DC    15F'0'
                                   24          END
```

```
   LOC   OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT
000000                                   1 IGG019WH CSECT
000000                                   2          USING *,15
000000 5000 F074             00074       3 IGWH1    ST    13,WH2
000004 4100 F07C             0007C       4          LA    13,WH4
000008 9CEC D000             00000       5          STM   14,12,0(13)
00000C 58A0 202C             0002C       6          L     10,44(0,2)
000010 48D0 A002             00002       7          LH    13,2(0,10)
000014 41A0 7004             00004       8          LA    10,4(0,7)
000018 48C0 A000             00000       9          LH    12,0(0,10)
00001C 19CD                             10          CR    12,13
00001E 4760 F054             00054      11          BC    6,IGWH2
000022 58A0 200C             0000C      12          L     10,12(0,2)
000026 55A0 F070             00070      13          CL    10,WH1
00002A 4760 F054             00054      14          BC    6,IGWH2
00002E 58A0 2030             00030      15          L     10,48(0,2)
000032 48D0 A002             00002      16          LH    13,2(0,10)
000036 56D0 F078             00078      17          O     13,WH3
00003A 40D0 A002             00002      18          STH   13,2(0,10)
00003E 4100 F088             00088      19          LA    13,WH5
000042 90EC D000             00000      20          STM   14,12,0(13)
000046 4100 F07C             0007C      21          LA    13,WH4
00004A 98EC D000             00000      22          LM    14,12,0(13)
00004E 58D0 F074             00074      23          L     13,WH2
000052 07FE                             24          BCR   15,14
000054 4100 F088             00088      25 IGWH2    LA    13,WH5
000058 9CEC D000             00000      26          STM   14,12,0(13)
00005C 58D0 F074             00074      27          L     13,WH2
                                        28          ABEND 999,DUMP
000060                                  29+         CNOP  0,4
000060 47F0 F068             00068      30+         B     *+8 BRANCH AROUND CONSTANT
000064 8C                               31+         DC    AL1(128) DUMP/STEP CODE
000065 0C03E7                           32+         DC    AL3(999) COMPLETION CODE
000068 5810 F064             00064      33+         L     1,*-4 LOAD CODES INTO REG 1
00006C 0A0D                             34+         SVC   13 LINK TO ABEND ROUTINE
00006E 0700                             35          CNOP  0,4
000070 0C000000                         36 WH1      DC    X'0C000000'
000074 0C000000                         37 WH2      DC    X'00000000'
000078 0C000002                         38 WH3      DC    X'00000002'
00007C 0C000000000000000                39 WH4      DC    15F'0'
000088 0C000000000000000                40 WH5      DC    15F'0'
                                        41          END
```

```
FORTRAN IV G LEVEL 0, MOD 0             GDIAGN          DATE = 68011        00/40/10            PAGE 0001

0001                SUBROUTINE GDIAGN(N)
0002                DIMENSION GB(7),GM(3),FMT(4),GC(14)
0003                DATA FMT/16H(9HERROR     I2) /
0004                L=N
0005                CALL GUBUFF(GB,28)
0006                CALL GUMAP(GM,1)
0007                CALL GUCHAN(GC,56)
0008                CALL GUNAME(77,77,77,77)
0009                CALL GPPOSN(425,495)
0010                CALL GPRINT(1,FMT,N)
0011                CALL GDISPL(11111,77,77,77,77)
0012                CALL GOPCP
0013                CALL GWAIT(0)
0014                RETURN
0015                END
```

VIII. DIAGNOSTICS

Error messages are displayed on the 2250 screen in the form ERROR XX, where XX is the number of the error. This is done by subroutine GDIAGN. In order to have the message displayed on the 2250 screen, however, the user must have called the subroutines GUNIT and GUTTFY.

The error numbers and corresponding messages are listed below under the subroutines in which the errors occur.

SUBROUTINES GDISPL, GERASE, GMCURS, GMGTAG, GMPTAG, GREAD

11. The channel program is too large. Reserve more storage in calling the subroutine GUCHAN.

12. Arguments in the call lines are incorrect.

13. The storage of the 2250 buffer is exceeded. Allow more storage in calling GUTTFY or attempt to reduce the size of the display.

SUBROUTINE GWAIT

21. The channel program is too large. Reserve more storage in calling the subroutine GUCHAN.

22. A unit check occurred without a light pen interrupt. This indicates 2250 machine trouble.

SUBROUTINES GPBEAM, GPDATA, GPPOSN, GPTEXT, GSCALE, GSTMAP

31. The 360/40 buffer is too samll. Reserve more storage in calling the subroutine GUBUFF.

32. An attempt has been made to do non-linear plotting. At present no provisions have been made for this. The argument to the subroutine

GUTYPE must be the fixed point integer 1.

SUBROUTINE GPGRID

33. The map storage area is too small. Reserve more storage in calling GUMAP.

41. Same as 32.

42. There are not enough raster units available for tick marks.

43. The 360/40 buffer is too small. Reserve more storage in calling the subroutine GUBUFF.

SUBROUTINE GPRINT

51. The 360/40 buffer is too small. Reserve more storage in calling the subroutine GUBUFF.

52. An error occurred in conversion routines. (See DISPLAY-TRAN by Computer Usage Company). There is probably an incorrect FORMAT being used as an argument in calling the subroutine GPRINT or GPLABL.

SUBROUTINE GPLABL

71. Arguments in the call line are incorrect.

72. The FORMAT which is used as an argument is incorrect.

73. The labels lie off the 225Q screen. Either allow more raster units for appropriate margin in calling the subroutine GUSIZE or alter the FORMAT used for labelling.

76. The 360/40 buffer is too small. Reserve more storage in calling the suborutine GUBUFF.

The problem programmer can also use the diagnositc subroutine if he desires to display error numbers on the 2250. The call line is as follows:

```
CALL GDIAGN (IERR)
```

where

IERR is the address containing the value of the error "IERR" ≤ 99.

REFERENCES

1. IBM System Reference Library. IBM System/360 Component Description, IBM 2250 Display Unit Model I.

2. DISPLAYTRAN - Format Directed Memory-to-Memory Conversion Routines - Computer Usage Development Corporation.

3. Progress report to NWL for period ending March 1-31, 1966, under contract N178-8873, submitted by Computer Concepts Inc.

4. Technical Report No. 2074, NWL, 23 Aug 1966.

5. IBM System Reference Library, IBM System/360. Operating System, System Programmer's Guide.

APPENDIX A

COMMUNICATIONS REGION

COMMUNICATION REGION

The communication region is a storage area which contains information furnished by and/or used by several subroutines. This area is also used as data area for storage of intermediate results.

	Description	No. of Bytes	Argument names[1] in call lines
GUBU	First address of array to be used for the 360 buffer	4	AB
	Current address in which to start storing the output of the buffer preparation subroutine to be operated next	4	
	Last address available for 360 buffer	4	AB+"NB"-1
GUMA	First address of array to be used for the map	4	AM
	Current number of entries in the map	2	
	Maximum number of entries permitted in the map	2	"M"
GUCH	First address available to be used for the channel program	4	"AC"
	Current address in which to start storing the channel program	4	
	Last address available for the channel program	4	"AC"+"NC"-1

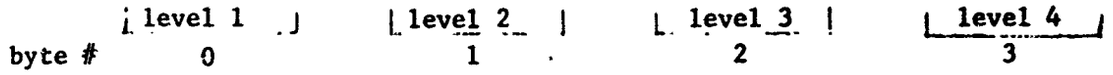
[1] All values are right adjusted and quotation marks indicate the contents of the address.

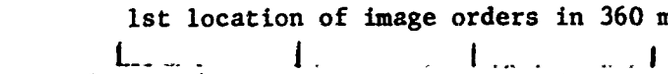
GUTT	First address available to the 2250 buffer	2	"MT"
	No. of bytes available to the 2250 buffer	2	"NT"
	Transfer unconditional to first address available to the 2250	4	
	Buffer address to stop for reading or inserting cursor	2	
	Not used	2	
GUNI	Device address	4	"IDA"
GUNA	1st level name	2	"N1"
	2nd level name	2	"N2"
	3rd level name	2	"N3"
	4th level name	2	"N4"
GUTY	Type of grid (i.e. linear in x & y, polar	2	"ITYPE"
GUPL	Plotting mode (i.e. vector, point)	2	"I"
GULI	Lower limit of abscissa values to be plotted	4	"U1"
	Lower limit of ordinate values to be plotted	4	"V1"
	Upper limit of abscissa values to be plotted	4	"U2"
	Upper limit of ordinate values to be plotted	4	"V2"

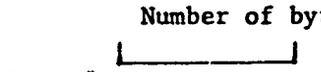
GUSI	Raster unit corresponding to "U1"	2	"IU1"
	Raster unit corresponding to "V1"	2	"IV1"
	Raster unit corresponding to "U2"	2	"IU2"
	Raster unit corresponding to "V2"	2	"IV2"
GUGR	Horizontal coordinate of origin of grid	4	"XO"
	Vertical coordinate of origin of grid	4	"YO"
	Horizontal interval between labeled tick marks	4	"DX"
	Vertical interval between labled tick marks	4	"DY"
	Number of tick marks in the "DX"interval	2	"NX"
	Number of tick marks in the "DY" interval	2	"NY"
	Control on horizontal and vertical grid lines	2	"IG"
GCOU	Number of points outside of plot limits	2	"IE"
GMGE	Sense bytes or manuel input bytes	4	
GINK	The key 0-34	1	"IK2"
	The overlay code or zero	1	"IK3"
	Interrupt indicators u, c, a bits	2	"IK4"
	Prevention of interrupt bit, p bit	2	
	Previous u, c, a bits	2	

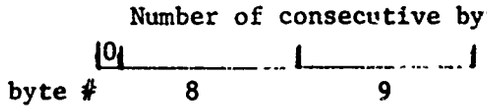
GTEM	Temporary storage	18
GREG	Storage of registers between subroutines	16

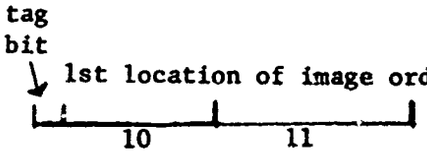
THE MAP


level 1
level 2
level 3
level 4
byte #
0
1
2
3


1st location of image orders in 360 memory
byte #
4
5
6


Number of bytes for cursor position
byte #
7


Number of consecutive bytes occupied by image generating orders
0
byte #
8
9


tag
bit
1st location of image orders in 2250 memory
10
11

APPENDIX C - SUBROUTINES AT A GLANCE

		Page
CALL GUNIT	(IDA)	10
CALL GUNAME	(N1, N2, N3, N4)	16
	(N1, N2, N3)	
	(N1, N2)	
	(N1)	
CALL GUBUFF	(AB, NB)	17
CALL GUMAP	(AM, M)	20
CALL GUCHAN	(AC, NC)	22
CALL GUTTFY	(MY, NT)	23
CALL GKBUF	(IBUF)	23
CALL GUTYPE	(ITYPE)	27
CALL GULIM	(U1, V1, U2, V2)	27
CALL GUSIZE	(IU1, IV1, IU2, IV2)	28
CALL GUGRID	(XO, YO, DX, DY, NX, NY, IG)	29
CALL GUPLØT	(I)	33
CALL GPPØSN	(I, J)	37
CALL GPBEAM	(C, D)	38
CALL GPDATA	(0, R, IDR, S, IDS, ISYM, IDSYM, NP, IS)	38
	(1, R, DR, S, IDS, ISYM, IDSYM, NP, IS)	
	(2, R, IDR, S, DS, ISYM, IDSYM, NP, IS)	
	(3, R, DR, S, DS, ISYM, IDSYM, NP, IS)	

CALL GCØUNT	(IT, IE)	41
CALL GPTEXT	(ITX, ATX, NTX)	41
CALL GPGRID		44
CALL GPRINT	(ITX, FMT, A1, A2, ...AN)	45
CALL GPLABL	(FMTX, FMTY)	46
CALL GDISPL	(I_1, I_2, I_3,...I_n)	47
GERASE	(M_1, J_{11}, J_{12}, J_{13},... $J_{1\ell_1}$, M_2, J_{21}, J_{22},... ... $J_{2\ell_2}$,... M_n, J_{n1}, J_{n2}, ... $J_{n\ell_n}$)	24
CALL GMCURS	(IG, I_1, I_2, I_3,...I_n)	43
GMPTAG	(IG, M_1, J_{11}, J_{12}, J_{13},... $J_{1\ell_1}$, M_2, J_{21}, J_{22},... ...$J_{2\ell_2}$, ...M_n, J_{n1}, J_{n2},... $J_{n\ell_n}$)	56
CALL GREAD	(AREA, I)	48
	(AREA, M_1, J_{11}, J_{12}, J_{13}, J_{14})	
CALL GØPCP		49
CALL GOPEN		50
CALL GCLOS		50
CALL GWAIT	(L)	51
CALL GINKEY	(IK1, IK2, IK3, IK4)	53
CALL GMGET	(N)	54
CALL GCONVT	(FMT, ARRAY, NBYTE, A1, A2, ..., AN)	57

PROGRAMMER - WRITTEN APPENDAGES

The appendages used here are designed to give the user additional control over certain I/O operations during channel program execution. They reside in the SVC library and are executed in the supervisor state. (For a detailed definition of the procedures involved, see Reference (5)).

A. Channel End Appendage (IGG019WH)

This routine receives control from the supervisor whenever a channel end, channel end with unit exception, or channel end with wrong length record occur without any other abnormal end conditions. If the channel program has been successfully completed, the routine places a 1 into the "c" bit of GINK and returns control to supervisor. If the channel program has not been successfully completed, or if the wrong unit has been referenced, the program dumps.

B. Abnormal End Appendage (IGG019WG)

This appendage is entered when a unit check, channel chaining check, program check, or protection check is detected with normal ending conditions. The routine merely stores the registers and dumps.

For a detailed description on how these appendages operate, see Reference (5).

CONTROL BLOCKS

A. Input/Output Block (GIOB1)

The input/output block is used for communication between the problem program and the system. It provides the addresses of other control blocks, and maintains information about the channel program, such as the type of chaining and the progress of I/O operations.

B. Event Control Block (GECB1)

The event control block provides a completion code that describes whether the channel program was completed with or without error.

C. Data Control Blocks (GDCB1 and GDCB2)

The data control blocks provide the system with information about the characteristics and processing requirements of a data set to be read or written by a channel program.

D. Data Extent Block (DEB)

The data extent block contains one or more extent entries for the associated data set, as well as other control information.

For a detailed explanation of these control blocks, see Reference (5).

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13. ABSTRACT

A group of subroutines is described which facilitates the utilization of the buffered IBM 2250 display terminal associated with an IBM System/360. The routines provide a means of displaying graphs and textual material and provide for efficient use of the light pen and other associated devices.

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