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PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

4041R02 PLOTTING ROMPACK

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____

070-4492-00
Product Group 76

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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Section 1
GENERAL DESCRIPTION

INTRODUCTION

The 4041 R02 Plotting Rompack allows you to make graphs and charts of data.

The R02 Plotting Rompack requires that the user have installed the 4041 R01 Graphics Rompack. Like the R01, the R02 can be used with any Tektronix terminal or any terminal that uses Tektronix 4010-compatible graphics codes, or with any Tektronix plotter or any plotter that uses Tektronix 4662-compatible graphics codes.

Included in the R02 Plotting Rompack are automatic plotting romcalls, override romcalls, and annotation romcalls.

Automatic plotting romcalls can be divided into two categories: plot romcalls and add romcalls.

Plot romcalls, given a set of data, draw a set of axes and tic marks, plot the data, and write a user-specifiable legend describing the graph. The locations of the tic marks on the axes can be determined by the program or specified by the user.

Plot romcalls include:

— XYPLOT: draws an axis, plots data given as x- and y-arrays, and optionally labels the resulting graph;

— YPLOT: draws an axis, plots data given as a y-array against a constantly increasing or decreasing x-value, and optionally labels the resulting graph.

Add romcalls add plots to a graph previously drawn using a PLOT romcall.

Add romcalls include:

— XYADD: plots data given as x- and y-arrays, and optionally labels the new curve on the graph;

— YADD: plots data given as a y-array against a constantly increasing or decreasing x-value, and optionally labels the new curve on the graph.

Override romcalls affect the way the automatic plotting romcalls plot data.

Override romcalls include:

— GRESET: restores all parameters governed by override romcalls to their default values;

— LEGEND: specifies the location of the upper left-hand corner of the legend box;

— ASK LEGEND: returns the current LEGEND parameters;

— OFFSET: specifies starting x-value and x-increment to use with YPLOT and YADD romcalls.

— ASK OFFSET: returns the current OFFSET parameters;

— SYMBOL: specifies the symbol to use to mark data points on the graph, as well as the frequency with which data points are displayed;

— ASK SYMBOL: returns the current SYMBOL parameters;

— XGRID: specifies whether tic marks should be extended from the x-axis to form a grid;

— ASK XGRID: returns the current XGRID parameters;

— XLABEL: specifies labels to use along x-axis with next XYPLOT or YPLOT romcall;

— ASK XLABEL: returns the current XLABEL parameters;

— XLOG: specifies whether the x-axis should be a linear or a logarithmic scale;

— ASK XLOG: returns the current XLOG parameter;

— XRANGE: specifies the range of x-values to plot;

— ASK XRANGE: returns the current XRANGE parameters;

— XTIC: specifies the starting value and increment of tic marks on the x-axis;

— ASK XTIC: returns the current XTIC parameters;

— YGRID: specifies whether tic marks should be extended from the y-axis to form a grid;

— ASK YGRID: returns the current YGRID parameters;

— YLABEL: specifies labels to use along y-axis with next XYPLOT or YPLOT romcall;

— ASK YLABEL: returns the current YLABEL parameters;

— YLOG: specifies whether the y-axis should be a linear or a logarithmic scale;

— ASK YLOG: returns the current YLOG parameter;

— YRANGE: specifies the range of y-values to plot;

— ASK YRANGE: returns the current YRANGE parameters;

— YTIC: specifies the starting value and increment of tic marks on the y-axis;

— ASK YTIC: returns the current YTIC parameters.

Annotation romcalls are used to annotate the graph.

Annotation romcalls include:

— TITLE: writes a title above the graph;

— XTITLE: writes a title below the x-axis;

— YTITLE: writes a title to the left of the y-axis, written vertically from top to bottom;

— SUBTITLE: writes a title below the main title above the graph.

Plot Format

Figure 1-1 illustrates the format of graphs drawn by the Plotting Rompack.

The position of the graph on the graphic device depends on the values of the viewport parameters.

The lengths of the X and Y axes default to ranges extending from the minimum to the maximum of the variables defining the graph. The Plotting Rompack includes romcalls that can adjust the ranges of the X and Y axes.

Symbols may be used to highlight data points at user-specified frequencies (e.g., every 2nd data point, every 10th data point, etc.).

Any or all of the titles may be left blank (default). When they are included, each is centered within its assigned field.

The legend location defaults to one character width in and four character heights up from the lower left-hand corner of the viewport. This location allows room to write four legends. If more than four curves are to appear on the graph, the legend location can be moved to make room for more than four legends.

Tic marks are automatically scaled onto the X- and Y-axes and labeled with numeric values. Romcalls are also available to specify frequency and labels of tic marks.

Exponents alongside either axis indicate the power of ten to which the data along the corresponding axis are to be raised. Exponents are always multiples of three.

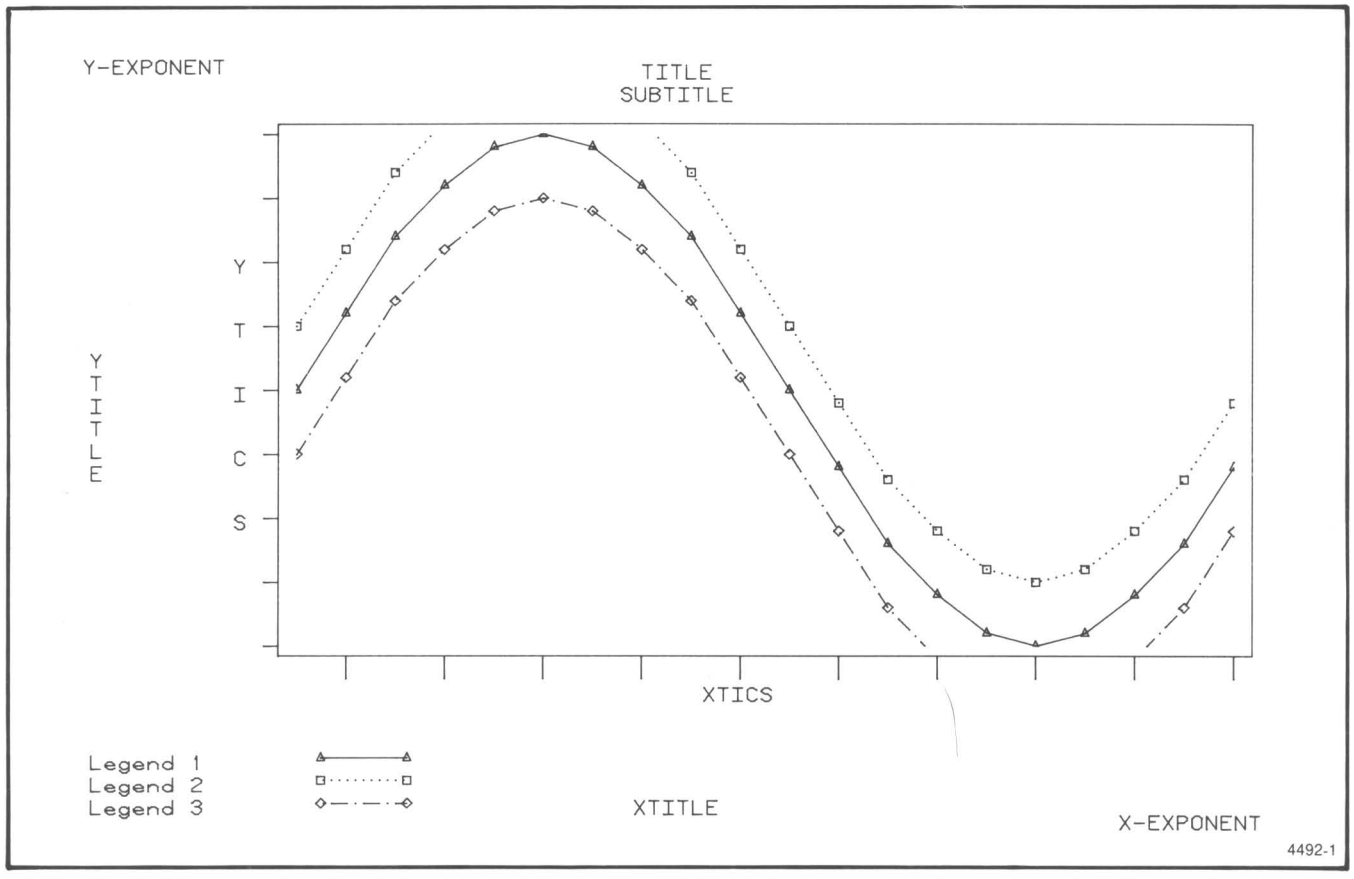

Figure 1-1. Format of Graphs Drawn by 4041R02 Plotting Rompack.

SPECIFICATIONS

Power Requirements

The power requirements for rom packs are included in the base instrument power requirements for the 4041. These requirements are:

Input Power: 120 Watts maximum

Output Power: 80 Watts maximum

Line Voltage Limits:

130V Range: 90-132 Volts
230V Range: 180-250 Volts

Line Frequency: 48-66 Hz

Line Fuse:

Low Range: 2.5A fast blow
High Range: 1.6A slow blow

Temperature

Operating: 32 to 130° F (0 to 55° C)
Non-Operating: −40 to 165° F (−40 to 75° C)

Altitude

Operating: 15,000 ft (4.5 km)
Non-Operating: 50,000 ft (15 km)

Humidity

Operating: 95% max
Non-Operating: 95% max at 150° F (65° C)

Static Immunity

Installed: 15 kV
Non-Installed: No immunity.

CAUTION

4041 Rom packs are static-sensitive when not installed. DO NOT TOUCH THE ROM LEADS ON THE UNDERSIDE OF THE ROM CARRIERS WITH AN INSTRUMENT OR FINGER — YOU MAY DAMAGE THE ROM PACK.

Vibration

Less than 0.025 inch (0.64 mm) p-p amplitude.

Shock

50 G's

Packaged Transportation

Meets NSTA requirements for packaged shock and vibration.

EMI

FCC Part 15, Subpart J, Class A requirements, and VDE 0871, Class B requirements.

Physical Specifications (with latchbar)

Length: 3.5 in. (8.89 cm)
Width: 1.05 in. (2.67 cm)
Height: 0.35 in. (0.89 cm)
Weight: 0.564 oz. (16.1 g)

Memory Requirements

The Plotting Rompack (R02) uses the same 1500 bytes of random access memory allocated by the Graphics Rompack (R01).

INSTALLATION AND REMOVAL

Note

When the 4041 is turned on, it automatically starts a series of self-tests. Part of this self-testing determines whether any rom packs are installed and checks that they are functioning correctly. Therefore, rom packs must be installed before turning on the 4041. The system does not recognize any rom packs unless they are correctly installed before the 4041 is turned on.

Removing the Rom Carrier

CAUTION

Turn the 4041 power off before removing the rom carrier. Never remove the rom carrier while the power is on. Removal with the power on can cause power fluctuations that can damage rom chips.

The rom carrier is a tray located behind the grill on the front of the 4041 (Figure 1-2).

To remove the carrier (if it is already installed), first remove the grill. The grill has a horizontal coin slot at its top; pry out the grill using a coin in the cutout. Pull the carrier out of its compartment using the carrier's plastic strap.

Putting the Rom Packs Into the Carrier

CAUTION

Do not touch the metal leads on the underside of the rom packs. The rom packs are static-sensitive and could be damaged by static charges from fingers or tools. Hold the rom packs by the plastic holders.

Figure 1-3 shows a rom pack and the rom carrier. The individual rom packs are placed into the carrier, and the carrier is slid into the compartment of the 4041.

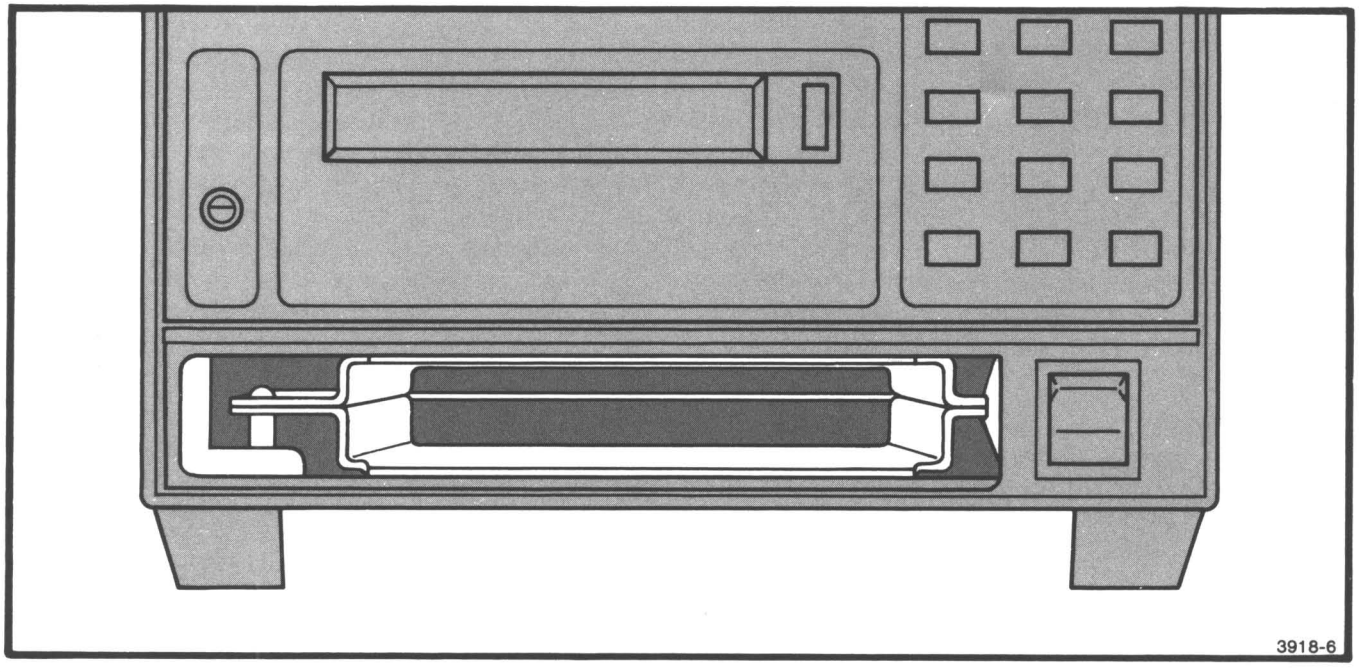

Figure 1-2. Location of Rom Carrier.

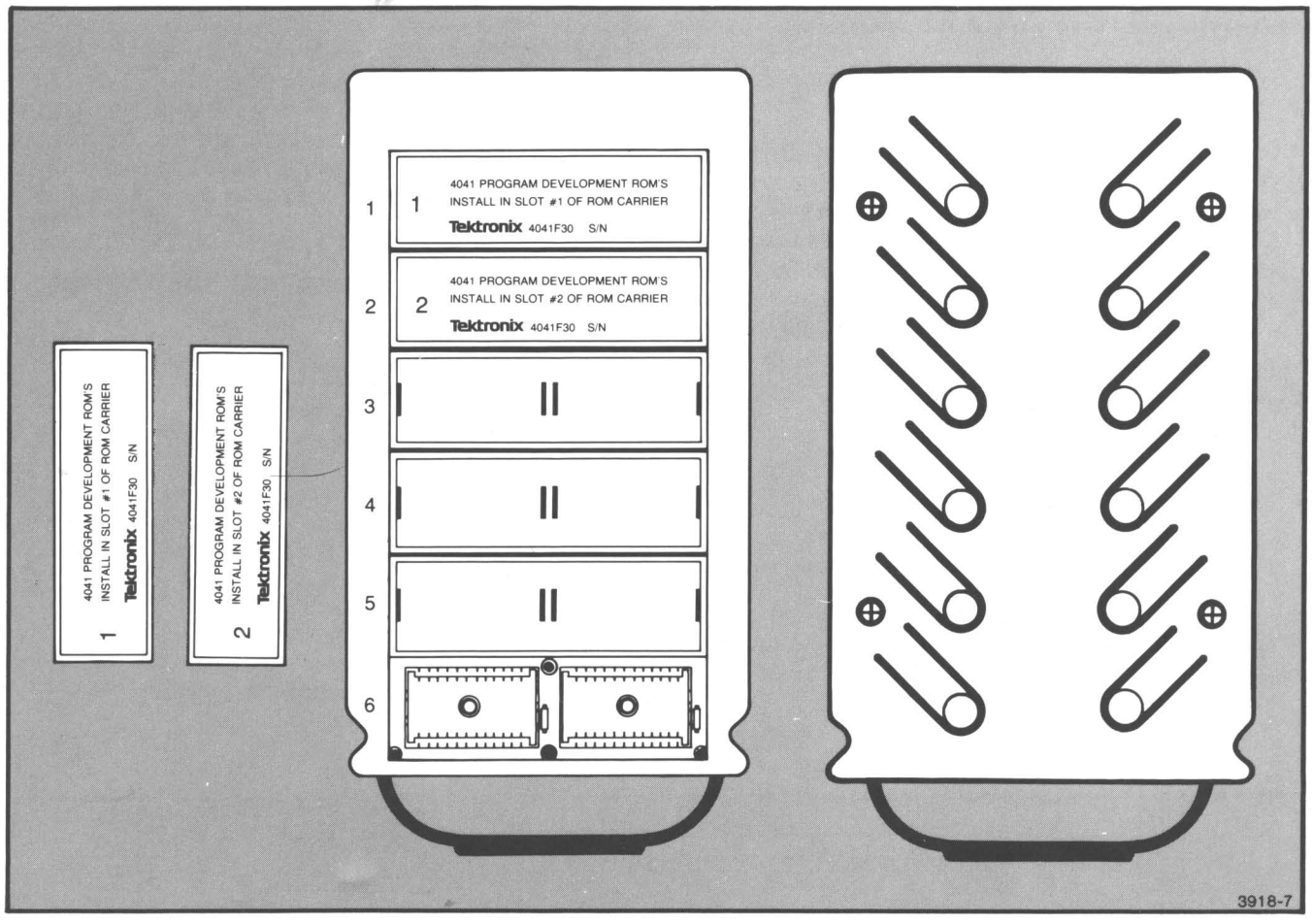

Figure 1-3. Rom Pack and Rom Carrier.

The rom carrier holds up to six rom packs. The individual rom packs specify a particular slot in the carrier where they must be placed. Match the numbers on the rom packs with the numbers on the carrier.

To insert rom packs into the rom carrier, place the rom pack right side up over the desired slot and gently press the pack into position. The rom packs are keyed and will only go in one way. When properly inserted, the top of the rom pack should be flush with the top of the rom carrier. Be gentle.

Removing Rom Packs from the Rom Carrier

Figure 1-5 also shows the underside of the rom carrier. To remove rom packs from the carrier, turn the carrier over. Gently press the two indentations over the rom pack that must be removed; the rom pack will pop out of the carrier.

Putting the Rom Carrier Into the 4041

The rom carrier is placed in the compartment covered by the grill on the front panel of the 4041.

CAUTION

The 4041 power must be turned off before the rom carrier is installed. Inserting the rom carrier with the power on could cause power fluctuations that could damage the rom chips.

If the 4041's power is on, turn it off. Snap out the grill by prying at the coin slot at the top of the grill.

Slide the rom carrier into position in its compartment with the rom-pack-side up and the carrier handle last. Press the carrier firmly into place to securely seat the rom connectors.

Make certain that the carrier is seated all the way in the compartment and is securely held in place.

Replace the front panel grill. The grill should easily snap back into place; if it does not, check that the rom carrier is inserted all the way. The grill's coin slot should be at the top.

Section 2
REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
\- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
\- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
\- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077

Fig. 1 EXPLODED VIEW

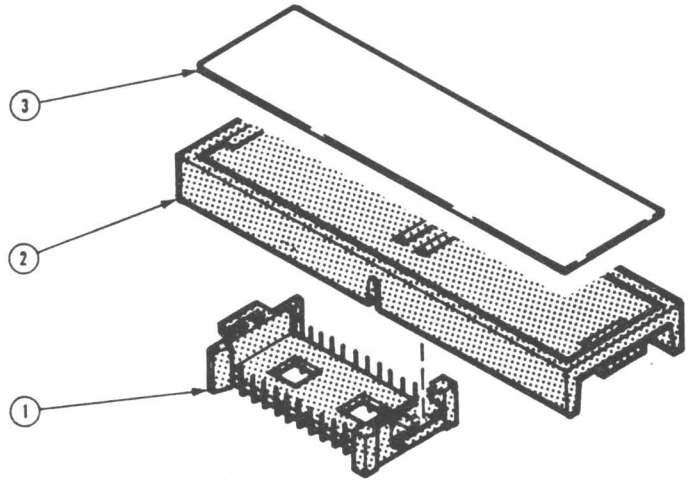

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	119-1624-00			1		ROM CARRIER:W/ROM	80009	119-1624-00
	---- ----			–		(U5; LOW NUMBERED SLOTS, DESIGNATED UXX)		
	119-1625-00			1		ROM CARRIER:W/ROM	80009	119-1625-00
	---- ----			–		(U10; HIGH NUMBERED SLOTS, DESIGNATED UXXX)		
-2	105-0897-00			1		LATCH BAR,CHIP CA:	80009	105-0897-00
-3	334-4915-00			1		MARKER IDENT:4041 GRAPHICS ROM	80009	334-4915-00

STANDARD ACCESSORIES

	070-4490-00			1		MANUAL,TECH:REFERENCE	80009	070-4490-00
	070-4492-00			1		MANUAL TECH:INSTRUCTION	80009	070-4492-00

Section 3

AUTOMATIC PLOTTING ROMCALLS

Automatic plotting romcalls can be divided into two categories: plot romcalls and add romcalls.

Plot romcalls, given a set of data, create a set of axes with tic marks and plot the data. Plot romcalls also add legends to a graph.

Plot romcalls include:

— XYPLOT: draws an axis, plots data given as x- and y-arrays, and optionally labels the resulting graph;

— YPLOT: draws an axis, plots data given as a y-array against a constantly increasing or decreasing x-value, and optionally labels the resulting graph.

The ASK PLOT romcall returns the current boundaries, in user data units and graphic data units, of the frame for the latest PLOT romcall.

Add romcalls add curves to a graph previously drawn using a PLOT romcall.

Add romcalls include:

— XYADD: plots data given as x- and y-arrays, and optionally labels the new curve on the graph;

— YADD: plots data given as a y-array against a constantly increasing or decreasing x-value, and optionally labels the new curve on the graph.

Number Restrictions

The allowable range for data values to be plotted is: ±3.40282E+38, maximum distance from zero; ±2.98374E−39, minimum distance differentiable from zero. (See Figure 3-1.)

In addition, an underflow error is generated if the highest data value to be plotted on an axis differs from the lowest data value to be plotted on the same axis by more than 38 orders of magnitude and the LOG parameter for that axis is still set to 0. (See the descriptions of the XLOG and YLOG romcalls in Section 4 for more information.)

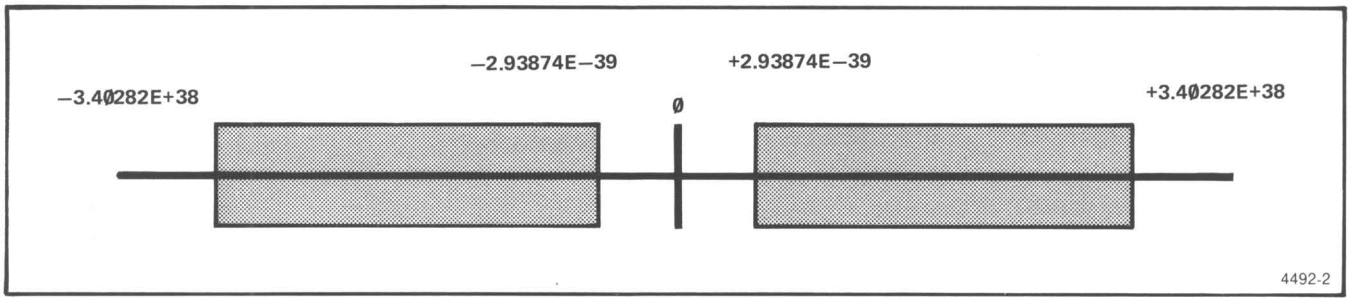

Figure 3-1. Number Range for 4041R02 Plotting Rom.

The "ASK PLOT" Romcall

Syntax Form: [line-no.] RCALL "ASK PLOT",{numvar} ,{numvar} ,{numvar} ,{numvar}
{numarray} {numarray} {numarray} {numarray}
,{numvar} ,{numvar} ,{numvar} ,{numvar}
{numarray} {numarray} {numarray} {numarray}

Descriptive Form: [line-no.] RCALL "ASK PLOT",low-x-graph-data,
high-x-graph-data,
low-y-graph-data,
high-y-graph-data,
low-x-frame,
high-x-frame,
low-y-frame,
high-y-frame

Purpose

The ASK PLOT romcall returns the low and high x and y values of the user data space and device data frame.

Explanation

The R02 Plotting Rompack maps data onto a subset of the viewport set up by the 4041R01 Graphics Rompack. The ASK PLOT romcall returns the coordinates of that subset.

When the ASK PLOT romcall is executed, the first four arguments returned contain the effective "window", or user data space, used by the Plotting Rompack for the latest Plot romcall. The last four arguments contain the effective "viewport", or device data space, used for the latest Plot romcall.

Relationship Between Graphics Rom and Plotting Rom Coordinates

The 4041R01 Graphics Rom defines a "window" in user data coordinates and a "viewport" in graphic device coordinates.

The 4041R02 Plotting Rom uses a portion of this viewport to define a "frame" on which to draw graphs.

After the 4041R02 Plotting Rom draws a graph, the window and viewport used by the 4041R01 romcalls ("MOVE", "DRAW", etc.) are the same as before — THEY ARE NOT REFERENCED TO THE COORDINATES OF THE GRAPH.

The ASK PLOT romcall is especially useful when you wish to execute MOVE and DRAW romcalls on the frame defined by the Plotting Rompack. The ASK PLOT romcall returns the current "window" and "viewport" values of the R02-defined frame.

You can then execute a WINDOW romcall using the first four values returned, and a VIEWPORT romcall using the last four. The R01 romcall coordinates are now synchronized with the graph. Subsequent MOVE, DRAW, RMOVE, RDRAW, etc., romcalls will execute only within the portion of the graphic device surface bounded by the graph.

A good programming practice is to execute all the PLOT and ADD romcalls that will be used in a graph before adjusting the viewport and executing MOVEs, DRAWs, etc.

Example:

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Rcall "xrange",0,120
130     Rcall "yrange",0,100
140     Rcall "xyplot"
150     Rcall "ask plot",loxw,hixw,loyw,hiyw,loxv,hixv,loyv,hiyv
160     Rcall "window",loxw,hixw,loyw,hiyw
170     Rcall "viewport",loxv,hixv,loyv,hiyv
```

Line 150 returns the current "viewport" coordinates of the graph in variables Loxv, Hixv, Loyv, and Hiyv, and the current "window" coordinates of the graph in variables Loxw, Hixw, Loyw, and Hiyw.

Line 160 then adjusts the window appropriately, while line 170 adjusts the viewport.

The XYADD Romcall

Syntax Form: [line-no.] RCALL "XYADD",{numarray},{numarray}[,strexp]

Descriptive Form: [line-no.] RCALL "XYADD",Xname,Yname[,legend]

Purpose

The XYADD romcall allows the user to add another plot to a graph previously generated using the XYPLOT or YPLOT romcalls.

Explanation

The XYADD romcall must be preceded by an XYPLOT or YPLOT romcall.

The XYADD romcall adds another curve to the graph generated by an XYPLOT or YPLOT romcall. It uses the same x- and y-range as the original PLOT romcall.

If a legend is specified within the romcall, it is written in the current legend location. The maximum length of a legend is 15 characters. A small sample of the linestyle, color, and symbol used to draw the curve accompanies the legend.

The current position is undefined after this romcall is executed.

Example

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Dim a(21),b(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
160       A(j)=j*5
170       B(j)=sin(i)*20+20
180       J=j+1
190       Next i
200     Rcall "xyplot",a,b,"Legend 1"
210     Rcall "linestyle",2
220     Rcall "xyadd",a,b+5,"Legend 2"
230     Rcall "linestyle",3
240     Rcall "xyadd",a,b-5,"Legend 3"
250     End
```

Line 200 plots arrays A and B, using a solid line and the legend "Legend 1".

Line 220 adds a plot of array A vs. "array" B+5 (i.e., the array of values that result when from adding 5 to each element of array B), using a dotted line and the legend "Legend 2".

Line 240 adds a plot of array A vs. "array" B−5, using a dash-dot line and the legend "Legend 3".

The resulting graph is shown in Figure 3-2.

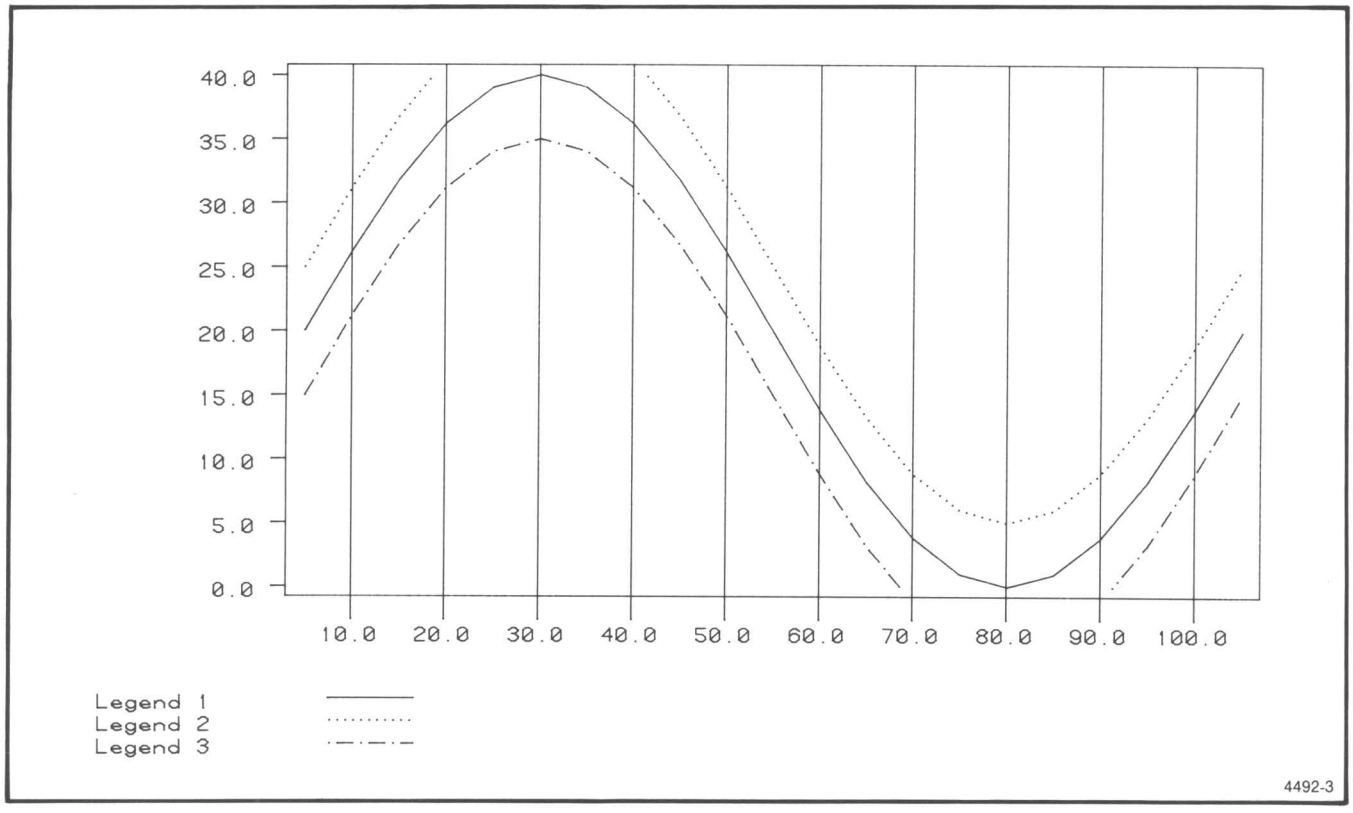

Figure 3-2. Use of XYADD Romcall.

The XYPLOT Romcall

Syntax Form: [line-no.] RCALL "XYPLOT" [,{numarray},{numarray}[,strexp]]

Descriptive Form: [line-no.] RCALL "XYPLOT" [,xname,yname[,legend]]

Purpose

The XYPLOT romcall draws the axes for the graph, plots the curve defined by the arrays given, and writes a legend for the plotted data. Used with no arguments, this romcall draws the axes for the graph only.

Explanation

The XYPLOT romcall draws axes and tic marks for a graph within the current viewport. The axes and tic marks are drawn with solid lines in the current color. The data curve is plotted in the current linestyle.

If the XRANGE and YRANGE parameters have not been previously set, the Plotting Rompack makes the axes long enough to encompass the entire range of values in the x- and y-arrays. It then sets up the graph with some "padding" space so that the plot will not touch the axes.

If no arguments are included in the XYPLOT romcall and the XRANGE and YRANGE parameters have been set, the axes are drawn using solid lines in the current color. If the XRANGE and YRANGE parameters have not been set, attempting to execute an XYPLOT romcall with no arguments results in an error.

If a legend is specified within the romcall, it is written in the current legend location. The maximum length of a legend is 15 characters. A small sample of the linestyle, color, and symbol used to draw the curve accompanies the legend.

All titles and the legend are written out in the current textsize.

The current position is undefined after the XYPLOT romcall is executed.

Example

```
120     Open #1:"gpib(pri=1):"
130     Rcall "ginit",1,4662,2
140     Dim a(21),b(21)
150     J=1
160     Long i
170     For i=0 to 2*pi step pi/10
180       A(j)=(j-1)*5
190       B(j)=sin(i)*20+20
200       J=j+1
210       Next i
220     Rcall "xyplot",a,b,"Legend 1"
230     End
```

Line 220 plots array A (on the x-axis) against array B (on the y-axis), and writes the legend "Legend 1" in the default legend location.

The resulting graph is shown in Figure 3-3.

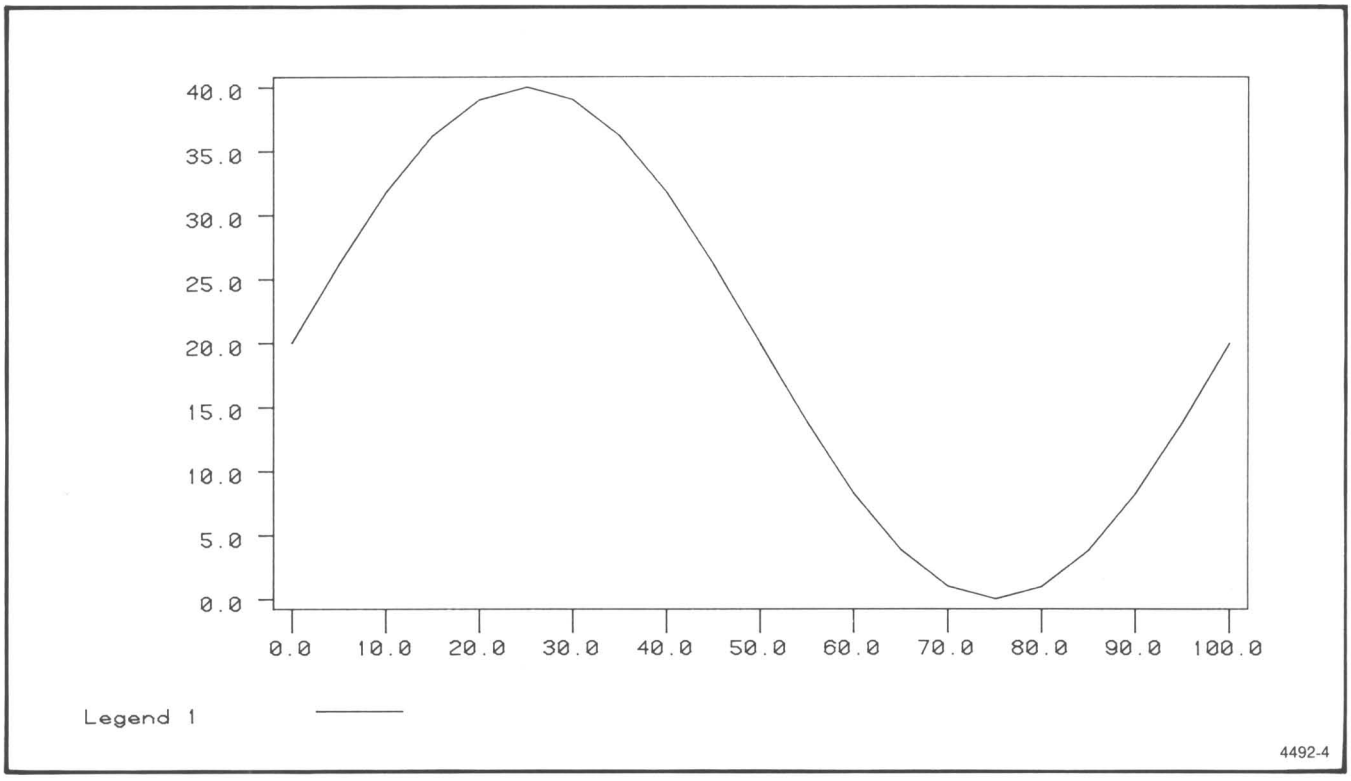

Figure 3-3. Use of XYPLOT Romcall.

The YADD Romcall

Syntax Form: [line-no.] RCALL "YADD", {numarray} [,strexp]

Descriptive Form: [line-no.] RCALL "YADD", yvalues [,legend]

Purpose

The YADD romcall allows the user to add another curve to a graph previously generated using the XYPLOT or YPLOT romcalls.

Explanation

The YADD romcall must be preceded by an XYPLOT or YPLOT romcall.

The YADD romcall adds another curve to the graph generated by an XYPLOT or YPLOT romcall. It uses the same x- and y-range as the original PLOT romcall.

If a legend is specified within the romcall, it is written in the current legend location. The maximum length of a legend is 15 characters. A small sample of the linestyle used to draw the curve accompanies the legend.

The current position is undefined after this romcall is executed.

Example

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Dim a(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
170       A(j)=sin(i)*20+20
180       J=j+1
190       Next i
200     Rcall "yplot",a,"Legend 1"
210     Rcall "linestyle",2
220     Rcall "yadd",a+5,"Legend 2"
230     Rcall "linestyle",3
240     Rcall "yadd",a-5,"Legend 3"
250     End
```

Line 200 plots array A against a steadily increasing x-axis value (default: starting value 0, increment 1), using a solid line and the legend "Legend 1".

Line 220 plots "array" A+5 (i.e., the array that results when you add 5 to each element of array A) against a steadily increasing x-axis value, using a dotted line and the legend "Legend 2".

Line 240 plots "array" A−5 against a steadily increasing x-axis value, using a dash-dot line and the legend "Legend 3".

The resulting graph is shown in Figure 3-4.

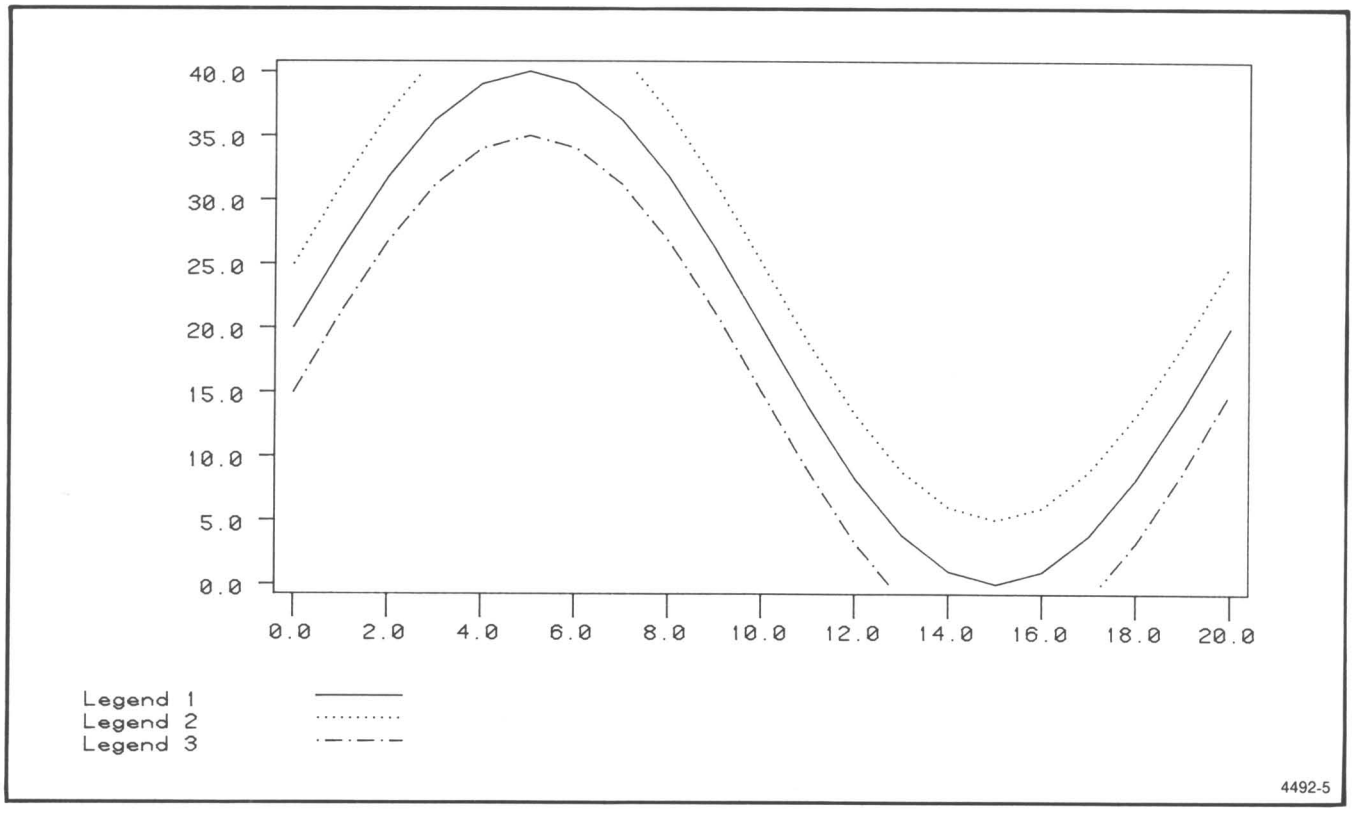

Figure 3-4. Use of YADD Romcall.

The YPLOT Romcall

Syntax Form: [line-no.] RCALL "YPLOT"[,{numarray}[,strexp]]

Descriptive Form: [line-no] RCALL "YPLOT"[,Yvalues[,legend]]

Purpose

The YPLOT romcall draws the axes for the graph, plots a set of Y data values against a constantly increasing or decreasing X-value, and writes a legend for the plotted data. Used with no arguments, this romcall draws the axes for the graph only.

Explanation

The YPLOT romcall draws axes and tic marks for a graph within the current viewport. The axes and tic marks are drawn with solid lines in the current color. The data curve is plotted using the current linestyle.

If the OFFSET parameters have not been set, the Plotting Rompack uses a default starting x coordinate of 0 and a default x increment of 1. The axes are drawn with some "padding" so that the plotted data will not touch the axes.

If no arguments are included in the YPLOT romcall and the XRANGE and YRANGE parameters have been set, the axes are drawn using solid lines in the current color. If the XRANGE and YRANGE parameters have not been set, attempting to execute a YPLOT romcall with no arguments results in an error.

If a legend is specified within the romcall, it is written in the current legend location. The maximum length of a legend is 15 characters. A small sample of the linestyle and symbol used to draw the curve accompanies the legend.

The current position is undefined after the YPLOT romcall is executed.

Example

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Dim a(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
160       A(j)=sin(i)*20+20
170       J=j+1
180       Next i
190     Rcall "yplot",a,"Legend 1"
200     End
```

Line 190 plots array A against a steadily increasing x-axis value (default: starting value 0, increment 1), using the legend "Legend 1". The resulting graph is shown in Figure 3-5.

Section 4

OVERRIDE ROMCALLS

These romcalls affect the way the automatic plotting romcalls plot data.

Parameters set up by override romcalls remain in effect until specifically undone or until the GRESET romcall is executed.

The override romcalls include:

— GRESET: restores all parameters governed by override romcalls to their default values;

— LEGEND: specifies the location of the upper left-hand corner of the legend box;

— ASK LEGEND: returns the current LEGEND parameters;

— OFFSET: specifies starting x-value and x-increment to use with YPLOT and YADD romcalls.

— ASK OFFSET: returns the current OFFSET parameters;

— SYMBOL: specifies the symbol to use to mark data points on the graph, as well as the frequency with which data points are displayed;

— ASK SYMBOL: returns the current SYMBOL parameters;

— XGRID: specifies whether tic marks should be extended from the x-axis to form a grid;

— ASK XGRID: returns the current XGRID parameters;

— XLABEL: specifies labels to use along x-axis with next XYPLOT or YPLOT romcall;

— ASK XLABEL: returns the current XLABEL parameters;

— XLOG: specifies whether the x-axis should be a linear or a logarithmic scale;

— ASK XLOG: returns the current XLOG parameter;

— XRANGE: specifies the range of x-values to plot;

— ASK XRANGE: returns the current XRANGE parameters;

— XTIC: specifies the starting value and increment of tic marks on the x-axis;

— ASK XTIC: returns the current XTIC parameters;

— YGRID: specifies whether tic marks should be extended from the y-axis to form a grid;

— ASK YGRID: returns the current YGRID parameters;

— YLABEL: specifies labels to use along y-axis with next XYPLOT or YPLOT romcall;

— ASK YLABEL: returns the current YLABEL parameters;

— YLOG: specifies whether the y-axis should be a linear or a logarithmic scale;

— ASK YLOG: returns the current YLOG parameter;

— YRANGE: specifies the range of y-values to plot;

— ASK YRANGE: returns the current YRANGE parameters;

— YTIC: specifies the starting value and increment of tic marks on the y-axis;

— ASK YTIC: returns the current YTIC parameters.

Executing an XGRID, YGRID, XLABEL, YLABEL, XLOG, YLOG, XRANGE, YRANGE, XTIC, or YTIC romcall "invalidates" the current graph's parameters. The next automatic plotting romcall to be executed must then be a "plot" romcall, not an "add" romcall.

The GRESET Romcall

Syntax and Descriptive Forms: [line-no.] RCALL "GRESET"

Purpose

The GRESET romcall resets the LEGEND, OFFSET, SYMBOL, XGRID, YGRID, XLABEL, YLABEL, XLOG, YLOG, XRANGE, YRANGE, XTIC, and YTIC parameters to their default values.

Explanation

The GRESET romcall should not be executed between a PLOT romcall and an ADD romcall.

Table 4-1 shows the values to which GRESET restores parameters.

Table 4-1
DEFAULT VALUES RESTORED BY GRESET

Parameter	Default Value
LEGEND	One character-width from left edge and four character-heights from bottom edge of viewport
OFFSET	Starting value=0; increment=1
SYMBOL	Symbol index=0 (no symbol); symbol frequency=1
XGRID, YGRID	0 (no extended tic marks)
XLABEL, YLABEL	Labels as specified by XTIC, YTIC
XLOG, YLOG	0 (linear scales)
XRANGE, YRANGE	Automatic mode
XTIC, YTIC	Automatic mode

Example

```
1000 Rcall "greset"
```

Resets 4041R02 Plotting Rompack parameters to their default values.

The LEGEND Romcall

Syntax Form: [line-no.] RCALL "LEGEND" [,numexp,numexp[,numexp]]

Descriptive Form: [line-no.] RCALL "LEGEND" [,x-legend-coordinate,y-legend-coordinate[,AUTO-flag]]

The ASK LEGEND Romcall

Syntax Form: [line-no.] RCALL "ASK LEGEND",numvar,numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK LEGEND",x-legend-coordinate, y-legend-coordinate,AUTO-flag

Purpose

The LEGEND romcall specifies the location of the upper left-hand corner of the legend box in graphic device units, and specifies whether or not the location of the legend box is to be determined by the Plotting Rompack or specified by the user.

The ASK LEGEND romcall returns the current x- and y-coordinates of the upper left-hand corner of the legend box in graphic device units, and the current value of the auto-legend parameter.

Explanation

The first two arguments in the LEGEND romcall specify the x- and y-coordinates of the legend box in graphic device units.

When used without arguments, the LEGEND romcall restores the coordinates of the upper left-hand corner of the legend box to its default location (one character width from the left edge and four character heights from the bottom edge of the viewport).

The third argument in the LEGEND romcall specifies whether or not the location of the upper left-hand corner of the legend box is to be determined by the Plotting Rompack or by the user. When the absolute value of this argument rounds to zero, the location of the upper left-hand corner of the legend box is determined by the user; otherwise, this location is determined by the Plotting Rompack.

When the third argument evaluates to other than zero, the value of the first two arguments is effectively ignored.

The LEGEND romcall should not be executed between a PLOT romcall and an ADD romcall.

The first two arguments in the ASK LEGEND romcall return the current coordinates of the upper left-hand corner of the legend box. The third argument tells whether this location is currently being determined by the Plotting Rompack (1) or by the user (0).

PLOT and ADD Romcalls and the Legend Location

Each PLOT romcall writes its legend in the current legend location, i.e., the last location specified by a LEGEND romcall, or the default location if no LEGEND romcall has been executed.

After each PLOT or ADD romcall is executed, an internal counter moves the "effective" legend location down by one character height. Thus, a PLOT romcall can write one legend, an ADD romcall can write its legend one character height below that, another ADD romcall can write its legend one character height below that, etc. The actual legend location (the one that will be used by the next PLOT romcall) is not changed, however.

While there is no limit to the number of legends that can be written, the legends are clipped to the viewport. Thus, using the default legend locations to write legends for a plot romcall and four add romcalls would result in the fourth add romcall's legend being clipped (i.e., not displayed on the graphic device).

To avoid this problem, be sure to set an appropriate legend location if you plan to write more than three legends for the same graph.

Example

```
120     Open #1:"GPIB0:"
130     Rcall "ginit",1,4662,1
140     Dim a(21),b(21)
150     J=1
160     Long i
170     For i=0 to 2*pi step pi/10
180       A(j)=(j-1)*5
190       B(j)=sin(i)*20+20
200       J=j+1
210       Next i
220     Rcall "legend",40,60
230     Rcall "xyplot",a,b,"Legend 1"
240     End
```

Line 220 sets the legend location to the point (40,60) in device ("viewport") coordinates.

When line 230 plots array A vs. array B, the legend "Legend 1" is written at the new legend location. The resulting graph is shown in Figure 4-1.

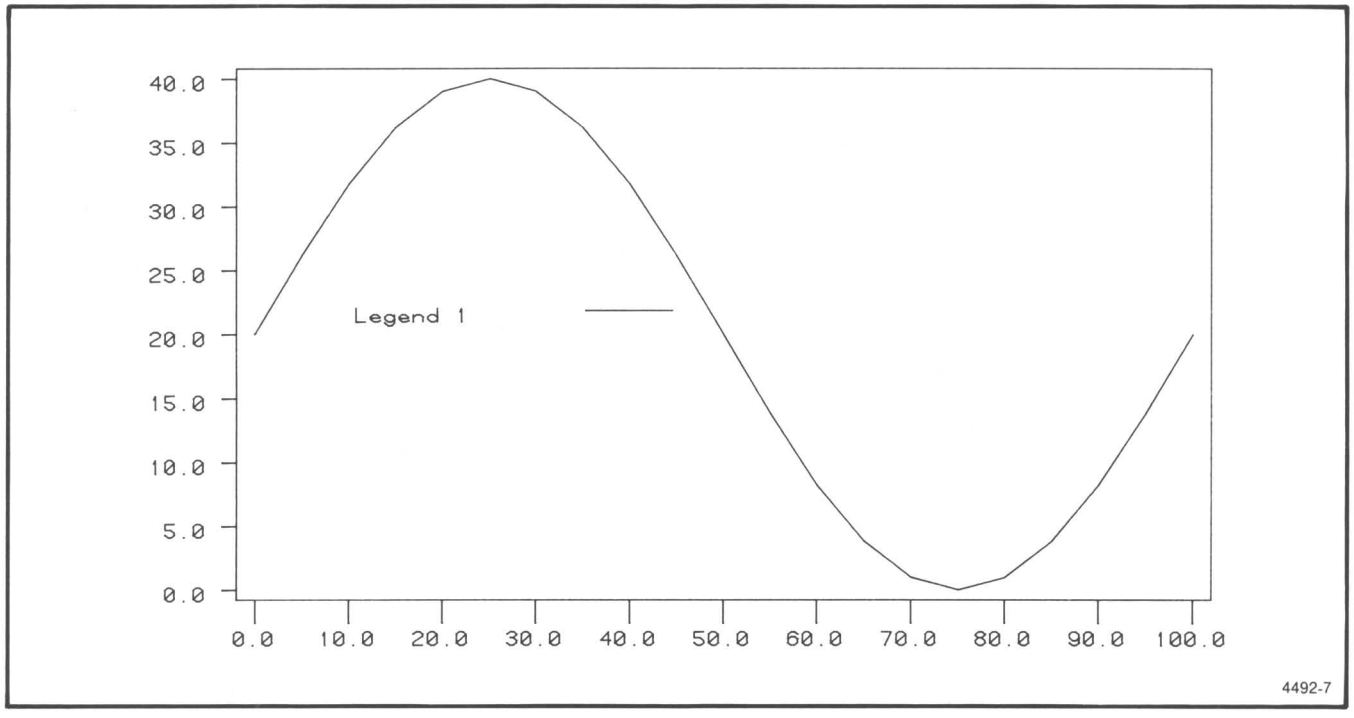

Figure 4-1. Use of LEGEND Romcall.

The OFFSET Romcall

Syntax Form: [line-no.] RCALL "OFFSET" [,numexp,numexp]

Descriptive Form: [line-no.] RCALL "OFFSET" [,xoffset,xincrement]

The ASK OFFSET Romcall

Syntax Form: [line-no.] RCALL "ASK OFFSET",numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK OFFSET",xoffset,xincrement

Purpose

The OFFSET romcall sets the starting x-value and x-increment to use with YPLOT and YADD romcalls.

The ASK OFFSET romcall returns the current OFFSET parameters.

Explanation

With no arguments, the OFFSET romcall returns the OFFSET parameters to their default values (starting x-value=0 and x-increment=1).

The OFFSET romcall may be used between a PLOT and an ADD romcall.

Example

```
100     Open #1:"comm:"
110     Rcall "ginit",1,4662,2
120     Dim a(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
160       A(j)=sin(i)*20+20
170       J=j+1
180       Next i
190     Rcall "page"
200     Rcall "xrange",0,50
210     Rcall "symbol",1
220     Rcall "yplot",a,"Legend 1"
230     Rcall "linestyle",2
240     Rcall "offset",7,2
250     Rcall "symbol",2
260     Rcall "yadd",a,"Legend 2"
270     Rcall "linestyle",3
280     Rcall "offset",5,5
290    Rcall "symbol",3
300     Rcall "yadd",a,"Legend 3"
310     End
```

Line 220 plots array A against a constantly increasing x-value, using the default starting x-value of 0 and the default x-increment of 1.

Line 240 sets the starting x-value to 7 and the x-increment to 2 for subsequent YADDs or YPLOTs. Line 260 plots array A using these values.

Line 280 sets both the starting x-value and the x-increment to 5 for subsequent YADDs or YPLOTs. Line 300 then plots array A using these values.

The resulting graph is shown in Figure 4-2.

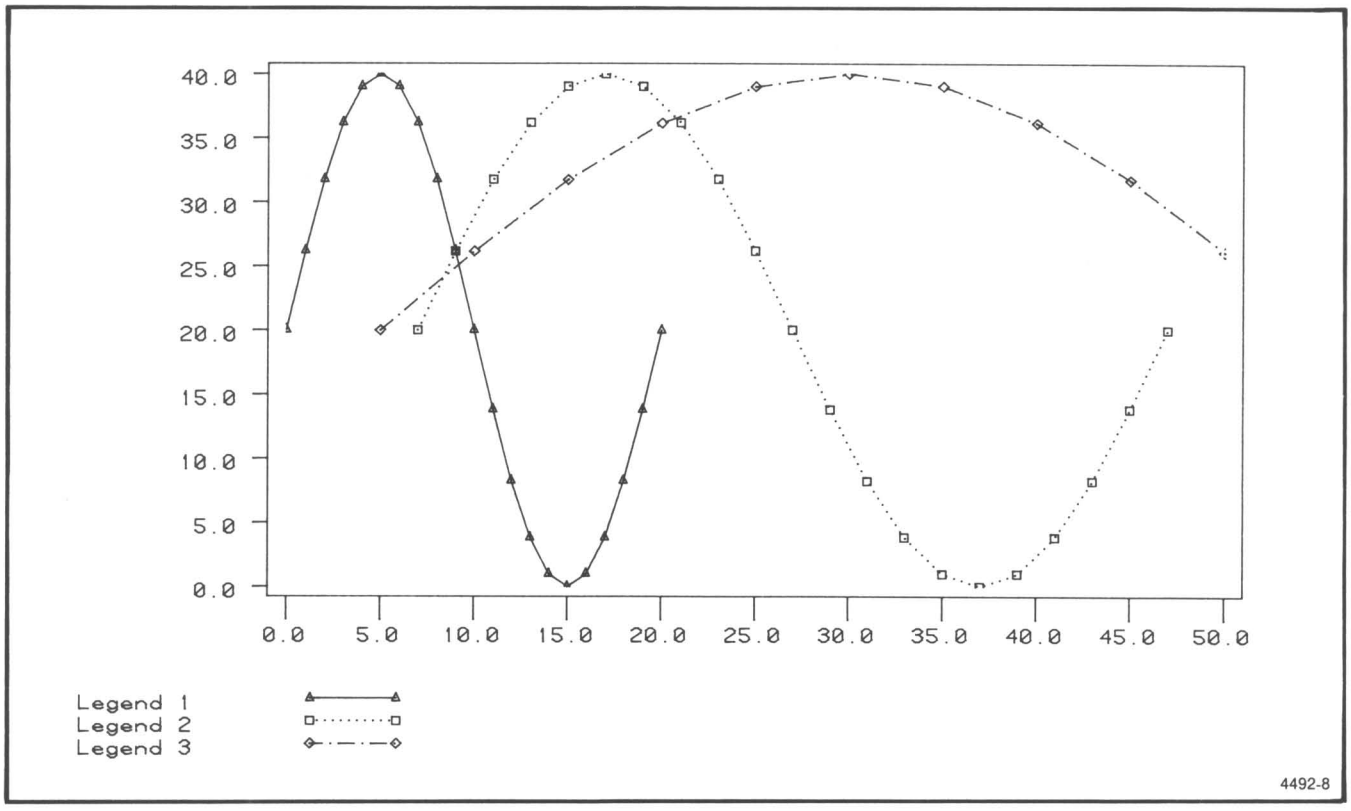

Figure 4-2. Use of OFFSET Romcall.

The SYMBOL Romcall

Syntax Form: [line-no.] RCALL "SYMBOL" [,numexp [,numexp]]

Descriptive Form: [line-no.] RCALL "SYMBOL" [,symbol-index [,frequency]]

The ASK SYMBOL Romcall

Syntax Form: [line-no.] RCALL "ASK SYMBOL",numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK SYMBOL",symbol-index,frequency

Purpose

The SYMBOL romcall specifies what symbol to use to mark data points on the graph, and specifies the frequency of appearance of the symbols.

The ASK SYMBOL romcall returns the SYMBOL parameters (symbol index and symbol frequency).

Explanation

The symbol frequency parameter specifies the frequency of appearance of the symbol. For example, if the value of the frequency parameter is 5, the symbol is drawn at every fifth data point.

When used with no arguments, the SYMBOL romcall returns the symbol index to its default value of 0 and the symbol frequency to its default value of 1.

The symbols corresponding to different values of the symbol index are shown in Table 4-2.

Table 4-2
SYMBOL INDEX VALUES

0	no symbol
1	triangle
2	square
3	diamond
4	star
5	circle
6	inverted triangle

The SYMBOL romcall may be used between a PLOT and an ADD romcall.

Example

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Dim a(21),b(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
160       A(j)=j*5
170       B(j)=sin(i)*20+20
180       J=j+1
190       Next i
200     Rcall "symbol",1
210     Rcall "xyplot",a,b,"Legend 1"
220     Rcall "symbol",2
230     Rcall "linestyle",2
240     Rcall "xyadd",a,b+5,"Legend 2"
250     Rcall "symbol",3
260     Rcall "linestyle",3
270     Rcall "xyadd",a,b-5,"Legend 3"
280     End
```

Line 200 sets the symbol index to 1. Line 210 then plots array A vs. array B using symbol 1 (triangle).

Line 220 sets the symbol index to 2. Line 240 then plots array A vs. array B+5 using symbol 2 (square).

Line 250 sets the symbol index to 3. Line 270 then plots array A vs. array B−5 using symbol 3 (diamond).

The resulting graph is shown in Figure 4-3.

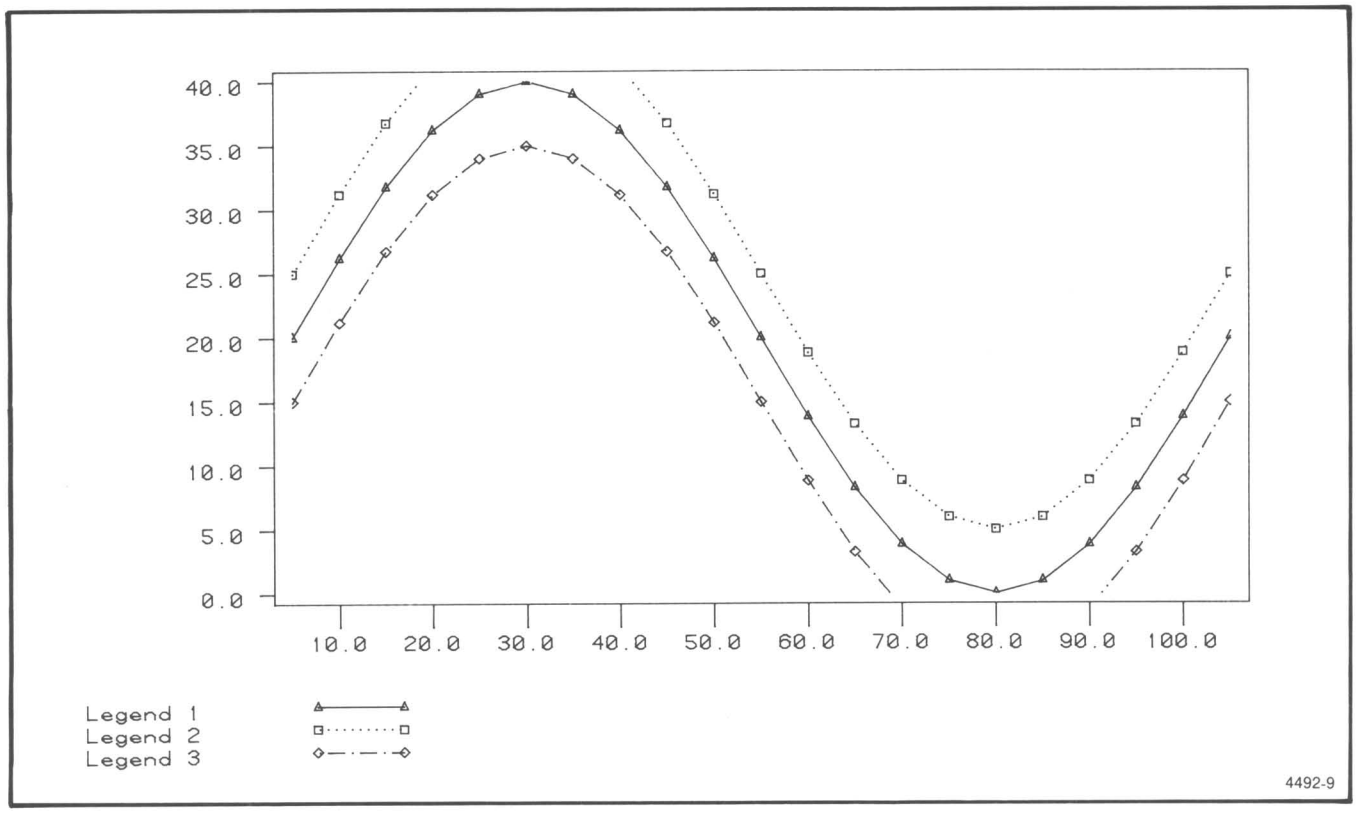

Figure 4-3. Use of SYMBOL Romcall.

The XGRID Romcall

Syntax Form: [line-no.] RCALL "XGRID" [,numexp]

Descriptive Form: [line-no.] RCALL "XGRID" [,boolean]

The ASK XGRID Romcall

Syntax Form: [line-no.] RCALL "ASK XGRID",numvar

Descriptive Form: [line-no.] RCALL "ASK XGRID",xgrid-value

Purpose

The XGRID romcall extends the x-axis tic marks across the graph if the XGRID parameter is set to 1, and writes out normal tic marks if the XGRID parameter is set to 0.

The ASK XGRID romcall returns the current value of the XGRID parameter.

Explanation

The XGRID romcall's argument is interpreted as a boolean value. If the absolute value of this argument is equal to or greater than 0.5, the XGRID parameter is set to 1.

When used without arguments, the XGRID romcall returns the XGRID parameter to its default value (0).

Long tic marks can be helpful in determining specific values along a curve, in graphs where precision is important. (See example.)

Example

```
100     Open #1:"gpib(pri=1):"
110     Rcall "ginit",1,4662,2
120     Dim a(21),b(21)
130     J=1
140     Long i
150     For i=0 to 2*pi step pi/10
160       A(j)=j*5
170       B(j)=sin(i)*20+20
180       J=j+1
190       Next i
200     Rcall "xgrid",1
210     Rcall "xyplot",a,b,"Legend 1"
220     Rcall "linestyle",2
230     Rcall "xyadd",a,b+5,"Legend 2"
240     Rcall "linestyle",3
250     Rcall "xyadd",a,b-5,"Legend 3"
260     End
```

Line 200 sets the XGRID parameter to 1. When the XYPLOT romcall is executed in line 210, the x-axis tic marks are extended across the entire height of the graph. The resulting graph is shown in Figure 4-4.

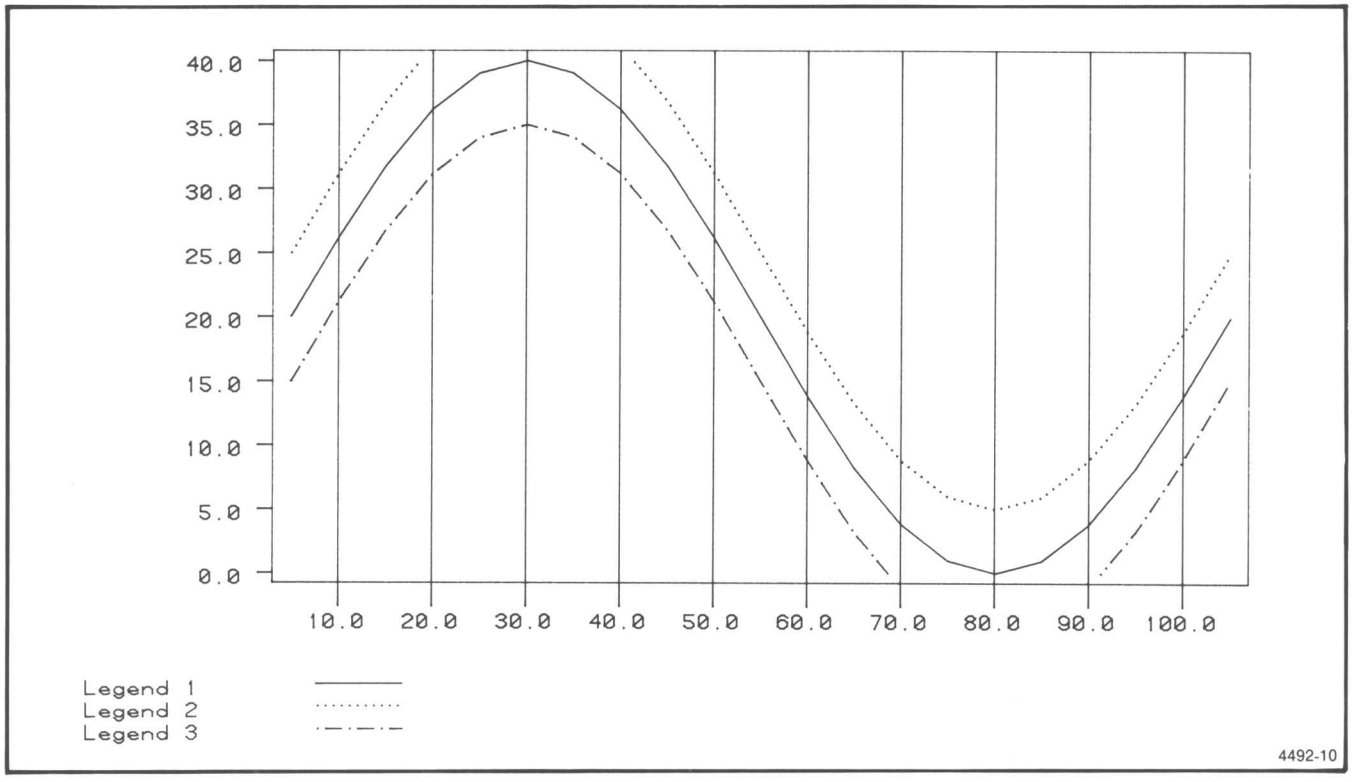

Figure 4-4. Use of XGRID Romcall.

The XLABEL Romcall

Syntax Form: [line-no.] RCALL "XLABEL" [,strarray[,numexp]]

Descriptive Form: [line-no.] RCALL "XLABEL" [,x-label-array[,AUTO-parameter]]

The ASK XLABEL Romcall

Syntax Form: [line-no.] RCALL "ASK XLABEL",strarray,numvar

Descriptive Form: [line-no.] RCALL "ASK XLABEL",x-label-array,AUTO-parameter

Purpose

The XLABEL romcall sets the tic mark labels to use on the x-axis the next time an XYPLOT or YPLOT romcall is executed.

The ASK XLABEL romcall returns a string array containing the current values of the x-axis labels, and a numeric value indicating whether or not the x-axis labels are being set automatically.

Explanation

Used with no arguments, the XLABEL romcall causes the Plotting rompack to use automatic labeling for x-axis tic marks.

The first argument in the XLABEL romcall specifies the string array to use as the set of X-axis labels.

If the XLABEL array contains more labels than there are tic marks on the x-axis, the extra labels are ignored.

If the XLABEL array contains fewer labels than there are tic marks on the x-axis, tic marks after the last one for which there are labels remain unlabeled.

Each x-axis label can contain at most 20 characters. If the length of a label is greater than the length between its accompanying tic mark and the next tic mark, the next label will over-write the previous one. To prevent surprises, therefore, it is a good programming practice to use the XTIC and XLABEL romcalls in tandem.

The second argument in the XLABEL romcall tells whether or not the 4041 is to generate x-axis labels automatically. If the absolute value of this argument rounds to zero, the x-axis labels are set using the string array given by the first argument in the XLABEL romcall. Otherwise, the labels are set automatically, and the first argument is ignored.

XLABEL allocates memory that would otherwise be available for user programs and data. This memory is freed when the user: (1) executes an XLABEL romcall with no arguments; (2) executes a GINIT or GRESET romcall; or (3) executes a DELE ALL or DELE VAR ALL statement.

Example

```
100 Integer a(12),b(6),i
110 Read a,b
120 Data 2,8,23,33,52,54,63,82,91,106,113,133
130 Data 53,60,64,76,96,97
140 Xlab1$="JFMAMJJASOND"
150 Dim xlabel$(12) to 1
160 For i=1 to 12
170   Xlabel$(i)=seg$(xlab1$,i,1)
180   Next i
190 Open #1:"gpib(pri=1):"
200 Rcall "ginit",1,4662,2
210 Rcall "offset",1,1
220 Rcall "xlabel",xlabel$
230 Rcall "yplot",a
240 Rcall "offset",4,1
250 Rcall "linestyle",2
260 Rcall "yadd",b
270 End
```

When line 210 is executed, string array Xlabel$ contains the characters "J", "F", "M", "A", etc. Line 210 sets the offset values to plot the first element of an array against an x-axis value of 1, with increment 1. Line 220 sets the x-axis labels to the characters contained in string array Xlabel$. Line 230 then plots array A, using the predetermined x-axis labels and offset values.

Note that the string array used for x-labels is the one most recently specified in an XLABEL romcall. Thus, changing the values stored in Xlabel$ after line 210 would not affect the x-labels written by subsequent plot or add romcalls unless another XLABEL romcall was executed.

Line 240 sets the offset values to plot the first element of any array against x-axis value 4. Line 260 then plots array B, using this offset value and the same labels as before.

The resulting graph is shown in Figure 4-5.

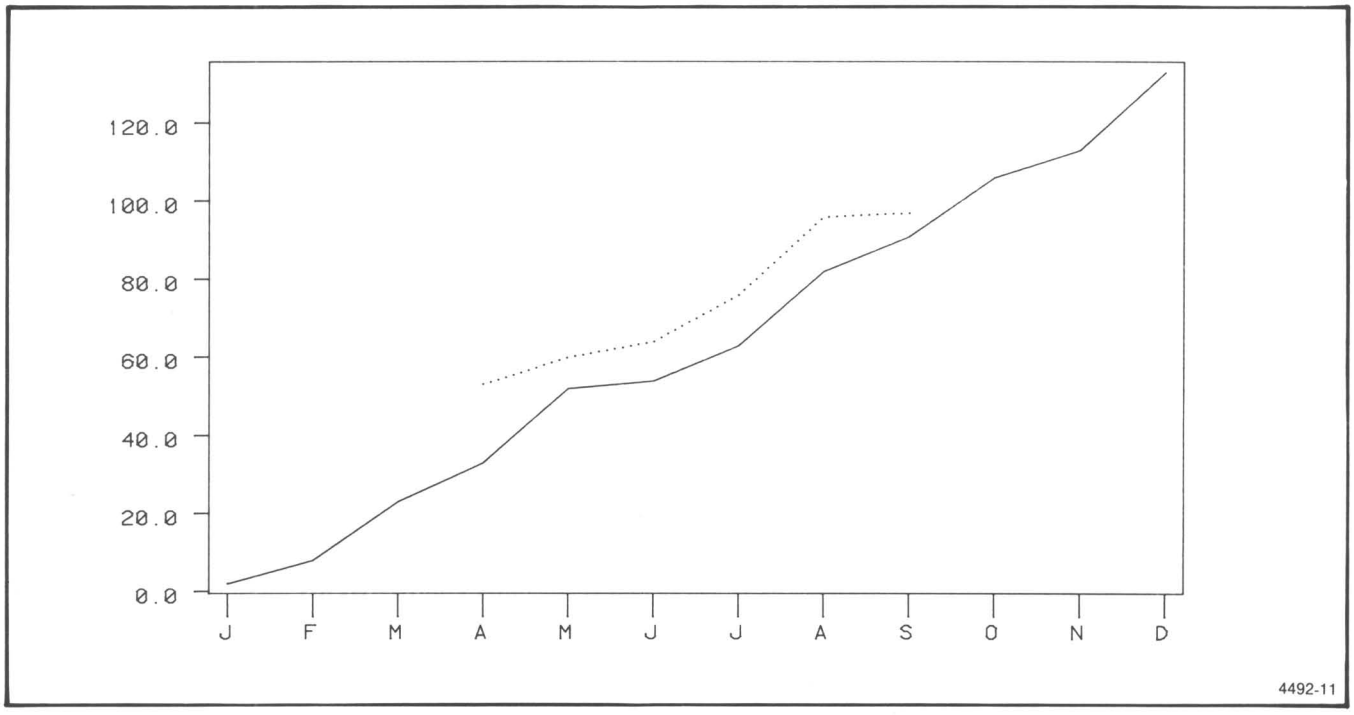

Figure 4-5. Use of XLABEL Romcall.

The XLOG Romcall

Syntax Form: [line-no.] RCALL "XLOG" [,numexp]

Descriptive Form: [line-no.] RCALL "XLOG" [,boolean]

The ASK XLOG Romcall

Syntax Form: [line-no.] RCALL "ASK XLOG",numvar
Descriptive Form: [line-no.] RCALL "ASK XLOG",xlog-value

Purpose

The XLOG romcall makes the x-axis a logarithmic scale if the XLOG parameter is set to 1, and makes it a linear scale if the XLOG parameter is set to 0.

The ASK XLOG romcall returns the current value of the XLOG parameter.

Explanation

The XLOG romcall's argument is interpreted as a boolean value. If the absolute value of this argument is equal to or greater than 0.5, the XLOG parameter is set to 1.

When used without arguments, the XLOG romcall returns the XLOG parameter to its default value (0).

Example

```
120     Dim x(16),y(16)
130     Integer i
140     For i=1 to 16
150       X(i)=10^i
160       Y(i)=2*lgt(x(i))+2
170       Next i
180     Open #1:"GPIB0:"
190     Rcall "ginit",1,4662,1
200     Rcall "xlog",1
210     Rcall "xyplot",x,y
220     End
```

Line 200 sets the XLOG parameter to 1, making the x-axis a logarithmic scale. Line 210 then plots array X vs. array Y, using a linear scale for the y-axis and a logarithmic scale for the x-axis. The resulting graph is shown in Figure 4-6.

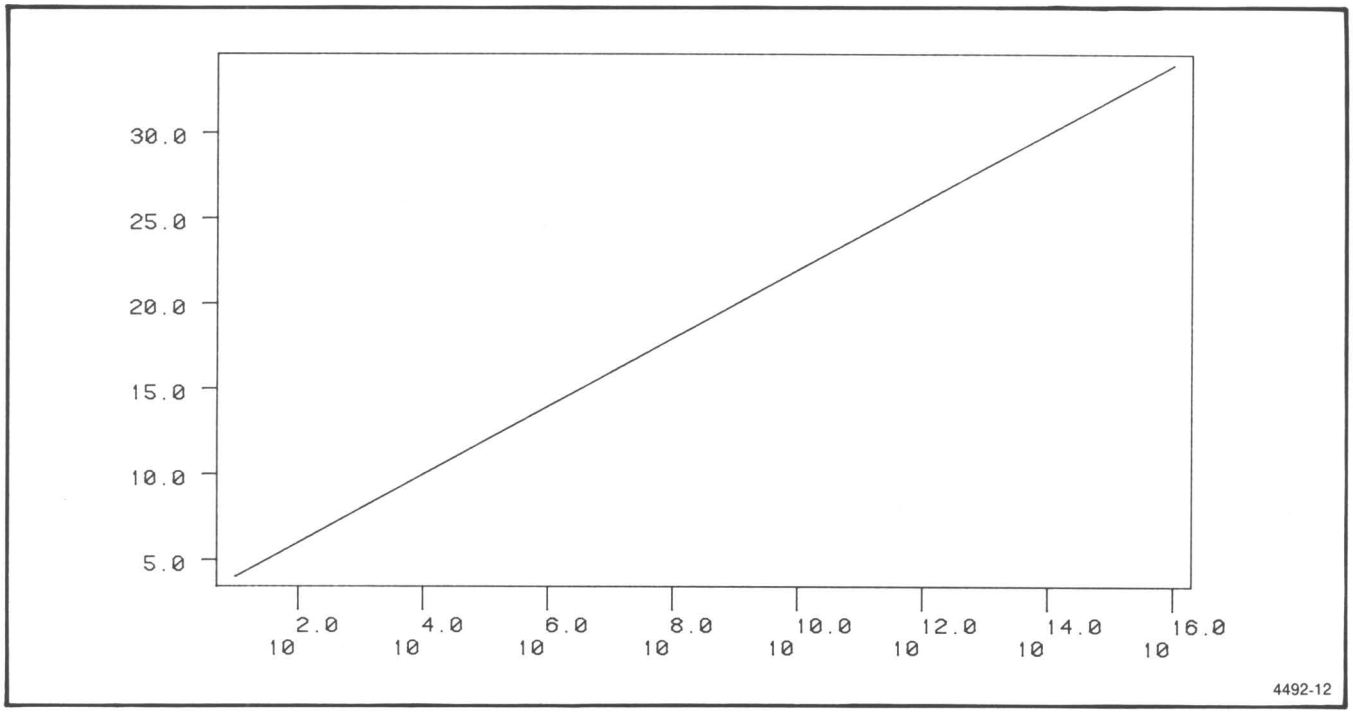

Figure 4-6. Use of XLOG Romcall.

The XRANGE Romcall

Syntax Form: [line-no.] RCALL "XRANGE" [,numexp,numexp[,numexp]]

Descriptive Form: [line-no.] RCALL "XRANGE" [,xstart,xstop[,AUTO-flag]]

The ASK XRANGE Romcall

Syntax Form: [line-no.] RCALL "ASK XRANGE",numvar,numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK XRANGE",xstart,xstop,AUTO-flag

Purpose

The XRANGE romcall specifies the range of X values to plot, and the status of the automatic x-ranging parameter.

The ASK XRANGE romcall returns the current XRANGE parameters.

Explanation

When used without arguments, the XRANGE romcall returns the XRANGE Auto-Flag to its default value.

The first two arguments in the XRANGE romcall specify the lower and upper limits, in user data units, of the range of x-values to be plotted.

The third argument in the XRANGE romcall specifies the status of the automatic x-ranging parameter. When the absolute value of this argument is less than 0.5, the XRANGE parameters are manually set (i.e., specified by the user). Otherwise, the XRANGE parameters are automatically set, and are determined by the range of x-values actually being plotted. When the XRANGE parameters are automatically set, the first two arguments are effectively ignored.

If the first two arguments are included in an XRANGE romcall but no third argument is included, the value of the third argument defaults to zero.

The first and second arguments in the ASK XRANGE romcall return the current lower and upper limits of the range of x-values to be plotted. The third argument tells whether the XRANGE values are currently being determined by the Plotting Rompack (1) or by the user (0).

Examples:

Example 1:

```
120     Dim x(19),y(19)
130     Integer i,j
140     Set angle 1
150     J=90
160     For i=1 to 19
170       X(i)=j
180       Y(i)=sin(j)
190       J=j+10
200       Next i
210     Open #1:"gpib(pri=1):"
220     Rcall "ginit",1,4662,2
230     Rcall "xyplot",x,y
240     End
```

Example 2:

```
120     Dim x(19),y(19)
130     Integer i,j
140     Set angle 1
150     J=90
160     For i=1 to 19
170       X(i)=j
180       Y(i)=sin(j)
190       J=j+10
200       Next i
210     Open #1:"gpib(pri=1):"
220     Rcall "ginit",1,4662,2
225     Rcall "xrange",0,360
230     Rcall "xyplot",x,y
240     End
```

In Example 1, the x-axis range defaults to the range of the data to be plotted, from 90 to 270. The resulting graph is shown in Figure 4-7.

In Example 2, line 225 sets the x-axis range to the range 0 to 360. The resulting graph is shown in Figure 4-8.

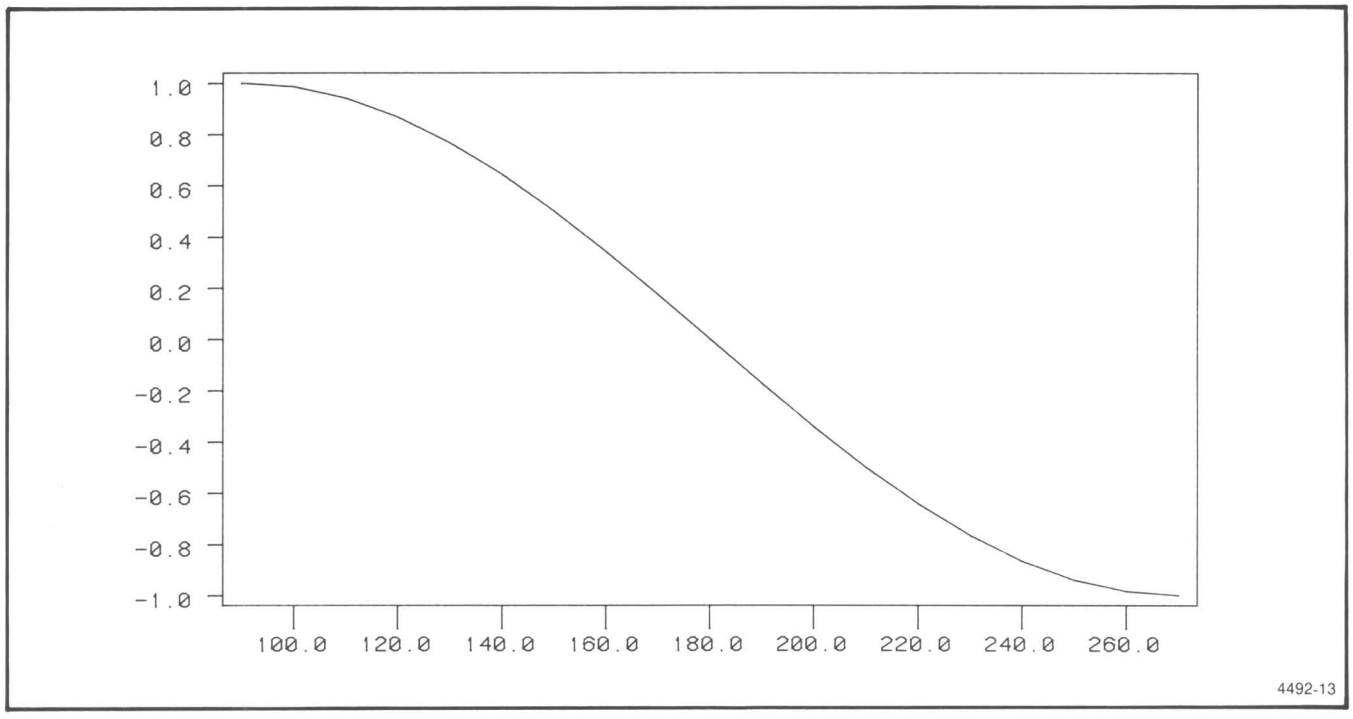

Figure 4-7. No XRANGE Romcall.

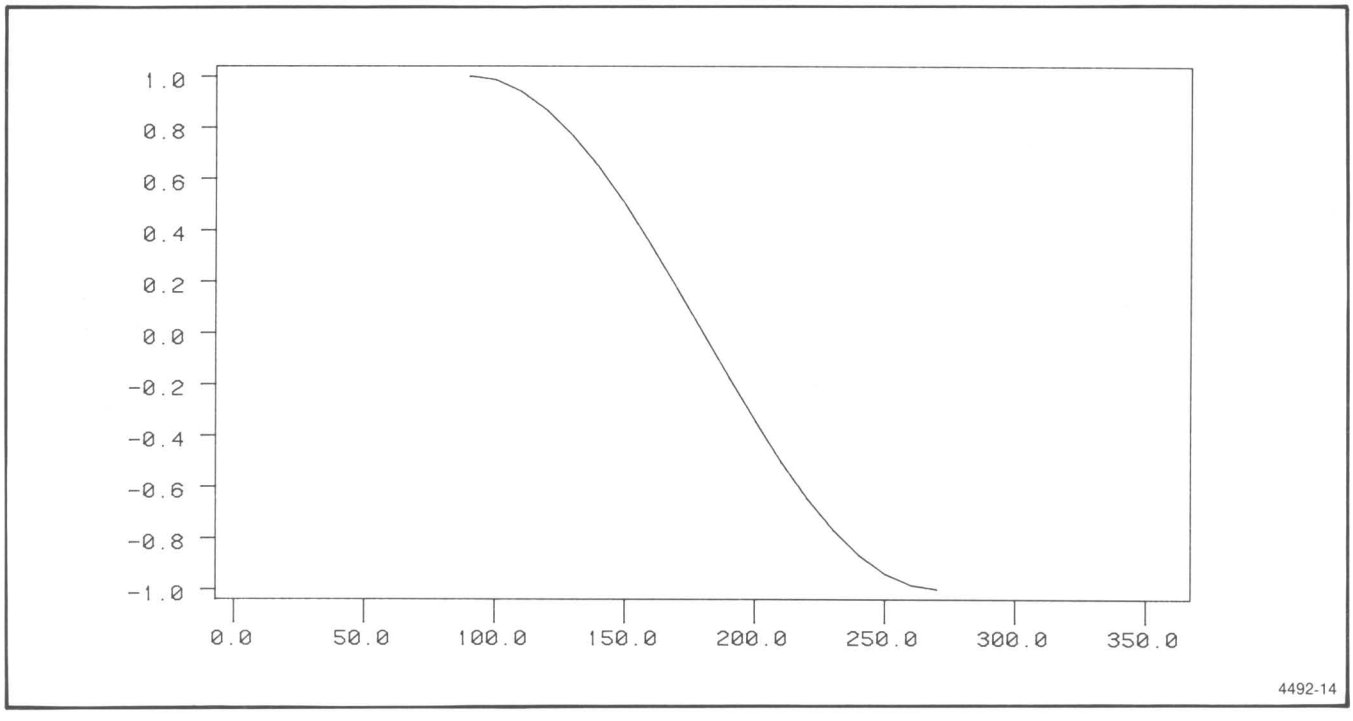

Figure 4-8. Use of XRANGE Romcall.

The XTIC Romcall

Syntax Form: [line-no.] RCALL "XTIC" [,numexp,numexp[,numexp]]

Descriptive Form: [line-no.] RCALL "XTIC" [,xstart,xincrement[,AUTO-flag]]

The ASK XTIC Romcall

Syntax Form: [line-no.] RCALL "ASK XTIC",numvar,numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK XTIC",xstart,xincrement,AUTO-flag

Purpose

The XTIC romcall specifies the first tic mark value and the increment between tic marks along the x-axis. This romcall also specifies whether or not tic mark spacing is to be determined automatically.

The ASK XTIC romcall returns the current XTIC parameters.

Explanation

When used without arguments, the XTIC romcall returns the system to automatic tic-mark spacing (dependent on actual data).

The first two arguments in the XTIC romcall specify the starting value and increment for tic marks along the x-axis.

The x increment must evaluate to a nonzero number.

If the XLOG parameter is set to 0, the second argument in the XTIC romcall specifies the linear increment between successive tic marks. If the XLOG parameter is set to 1, the second argument in the XTIC romcall specifies the amount by which the exponent is to be incremented between successive tic marks.

The third argument in the XTIC romcall specifies whether or not tic mark spacing along the x-axis is to be determined by the Plotting Rompack. If the absolute value of this argument evaluates to zero, the tic mark spacing is determined by the user; otherwise, the tic mark spacing is determined by the Plotting Rompack.

If the first two arguments are included in the romcall, but no third argument is included, the value of the third argument defaults to zero.

The XTIC romcall is useful primarily to make tic marks easy to read and to make logical spacing between tics according to the axis units.

The first two arguments of the ASK XTIC romcall return the current start and increment values for the x-axis. The third argument tells whether the XTIC values are currently being determined by the Plotting Rompack (1) or by the user (0).

The ASK XTIC romcall can be used to give different graphs a similar appearance by assigning them the same XTIC starting and increment values.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
205     Rcall "xtic",0,90
210     Rcall "xyplot",x,y
220     End
```

Line 205 specifies that x-axis tic marks are to be drawn at a starting x-value of 0, with an increment of 90 between successive tic marks. The resulting graph is shown in Figure 4-9.

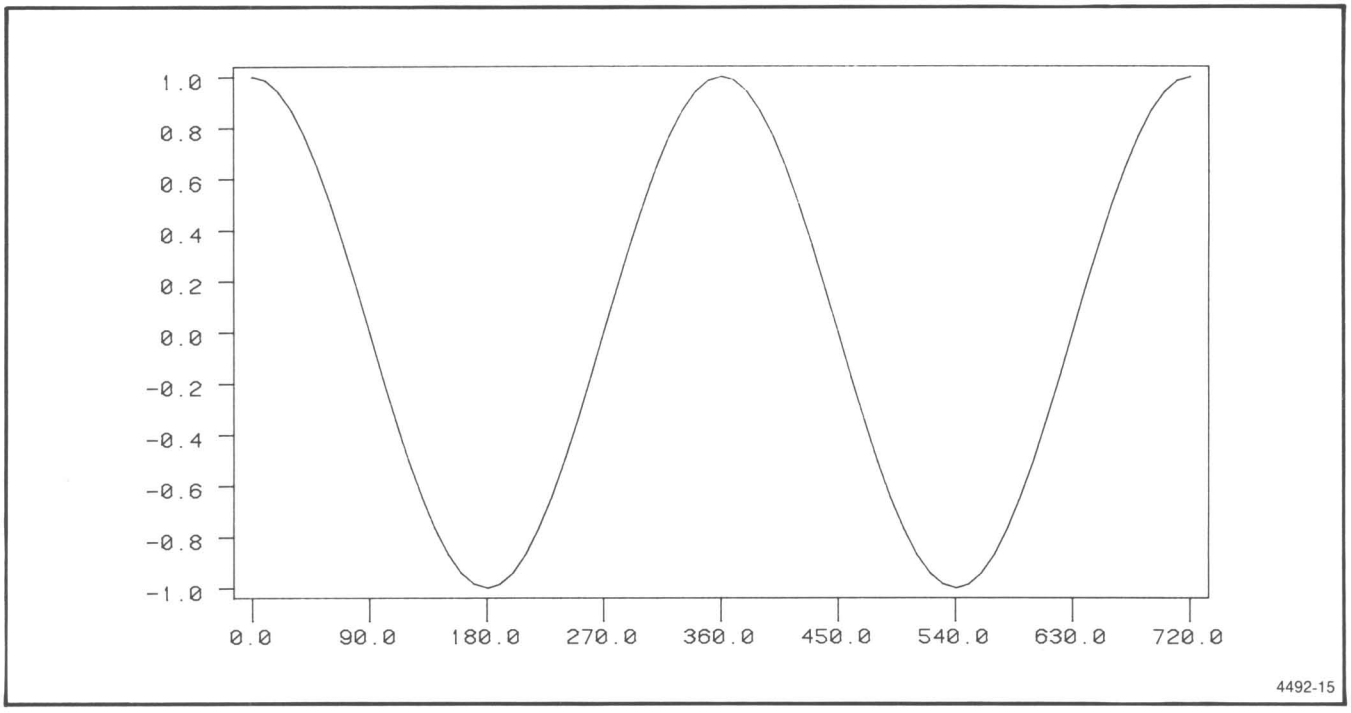

Figure 4-9. Use of XTIC Romcall.

The YGRID Romcall

Syntax Form: [line-no.] RCALL "YGRID" [,numexp]

Descriptive Form: [line-no.] RCALL "YGRID" [,boolean]

The ASK YGRID Romcall

Syntax Form: [line-no.] RCALL "ASK YGRID",numvar

Descriptive Form: [line-no.] RCALL "ASK YGRID",ygrid-value

Purpose

The YGRID romcall extends the y-axis tic marks across the graph if the YGRID parameter is set to 1, and writes out normal tic marks if the YGRID parameter is set to 0.

The ASK YGRID romcall returns the current value of the YGRID parameter.

Explanation

The YGRID romcall's argument is interpreted as a boolean value. If the absolute value of this argument is equal to or greater than 0.5, the YGRID parameter is set to 1.

When used without arguments, the YGRID romcall returns the YGRID parameter to its default value (0).

Long tic marks can be helpful in determining specific values along a curve, in graphs where precision is important. (See example.)

Example

```
100     Integer a(12),b(6),i
110     Read a,b
120     Data 2,8,23,33,52,54,63,82,91,106,113,133
130     Data 53,60,64,76,96,97
140     Xlab1$="JFMAMJJASOND"
150     Dim xlabel$(12) to 1
160     For i=1 to 12
170       Xlabel$(i)=seg$(xlab1$,i,1)
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "offset",1,1
220     Rcall "xlabel",xlabel$
230     Rcall "ygrid",1
240     Rcall "linestyle",2
250     Rcall "yplot",a
260     Rcall "offset",4,1
270     Rcall "linestyle",3
280     Rcall "yadd",b
290     End
```

Line 230 sets the YGRID parameter to 1. When the next plot romcall is executed, the y-axis tic marks will be extended across the width of the graph.

Line 250 plots array A (on the y-axis) against a steadily increasing x value. Line 280 adds a plot of array B against a steadily increasing x value to this graph. The resulting graph is shown in Figure 4-10.

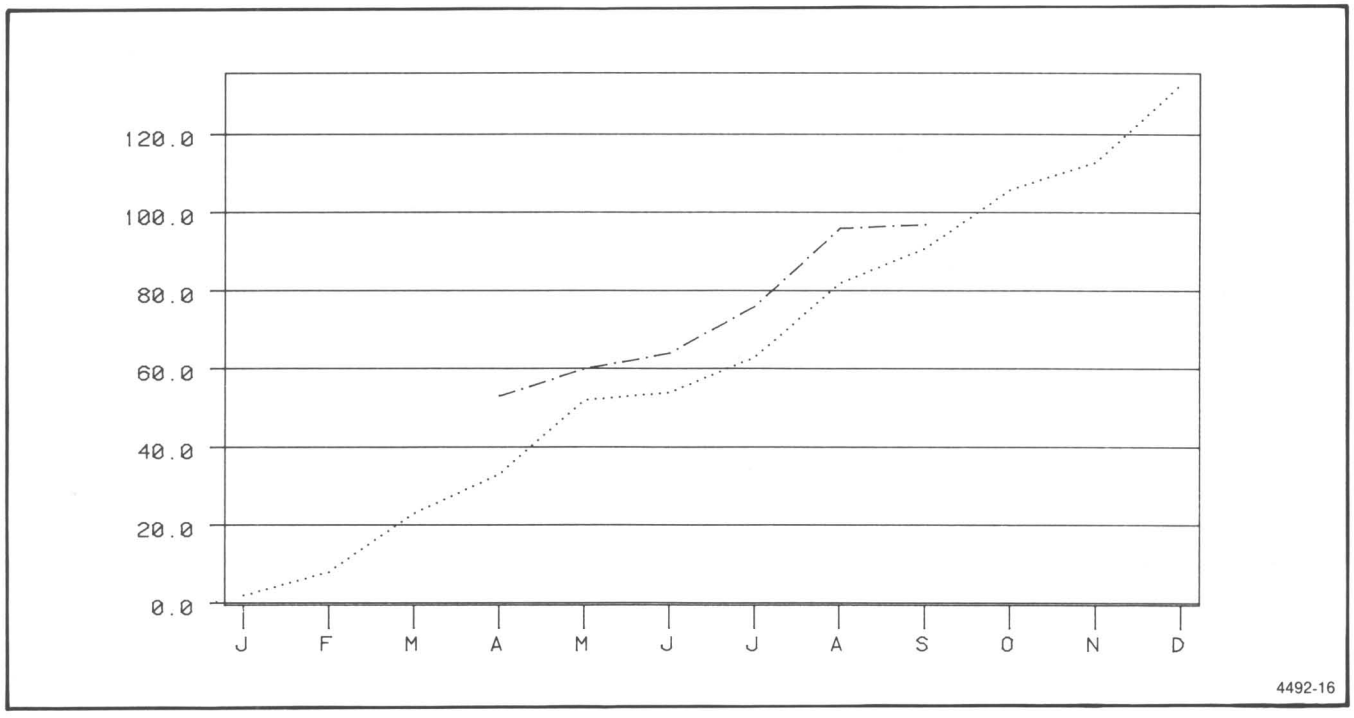

Figure 4-10. Use of YGRID Romcall.

The YLABEL Romcall

Syntax Form: [line-no.] RCALL "YLABEL" [,strarray[,numexp]]

Descriptive Form: [line-no.] RCALL "YLABEL" [,y-label-array[,AUTO-parameter]]

The ASK YLABEL Romcall

Syntax Form: [line-no.] RCALL "YLABEL",strarray,numvar

Descriptive Form: [line-no.] RCALL "YLABEL",y-label-array,AUTO-parameter

Purpose

The YLABEL romcall sets the tic mark labels to use on the y-axis the next time an XYPLOT or YPLOT romcall is executed.

The ASK YLABEL romcall returns a string array containing the current values of the y-axis labels, and a numeric expression indicating whether or not the y-axis labels are being set automatically.

Explanation

Used with no arguments, the YLABEL romcall causes the Plotting Rompack to use automatic labeling for y-axis tic marks.

The first argument in the YLABEL romcall specifies the string array to use as the set of Y-axis labels.

If the YLABEL string contains more labels than there are tic marks on the y-axis, the extra labels are ignored.

If the YLABEL string contains fewer labels than there are tic marks on the y-axis, tic marks after the last for which there are labels remain unlabeled.

Each y-axis label can contain at most eight characters.

The second argument in the YLABEL romcall tells whether or not the 4041 is to generate y-axis labels automatically. If the absolute value of this argument rounds to zero, the y-axis labels are set using the string array given by the first argument in the YLABEL romcall. Otherwise, the labels are set automatically, and the first argument is ignored.

YLABEL allocates memory that would otherwise be available for user programs and data. This memory is freed when the user: (1) executes a YLABEL romcall with no arguments; (2) executes a GINIT or GRESET romcall; or (3) executes a DELE ALL or DELE VAR ALL statement.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "ytic",-1,0.25
220     Dim ylabel$(9) to 4
230     Ylabel$(1)="-1"
240     Ylabel$(2)="-3/4"
250     Ylabel$(3)="-1/2"
260     Ylabel$(4)="-1/4"
270     Ylabel$(5)="0"
280     Ylabel$(6)="1/4"
290     Ylabel$(7)="1/2"
300     Ylabel$(8)="3/4"
310     Ylabel$(9)="1"
320     Rcall "ylabel",ylabel$
330     Rcall "xyplot",x,y
340     End
```

Lines 230 to 310 stores characters denoting the numbers from −1 to 1, in increments of 1/4, in string array Ylabel$.

Line 320 sets the y-axis labels to the characters contained in Ylabel$.

Line 330 plots array X vs. array Y. The resulting graph is shown in Figure 4-11.

Note that the string array used for Y-labels is the one most recently specified in a YLABEL romcall. Thus, changing the values stored in Ylabel$ after line 320 would not affect the Y-labels written by subsequent plot or add romcalls unless another YLABEL romcall were executed.

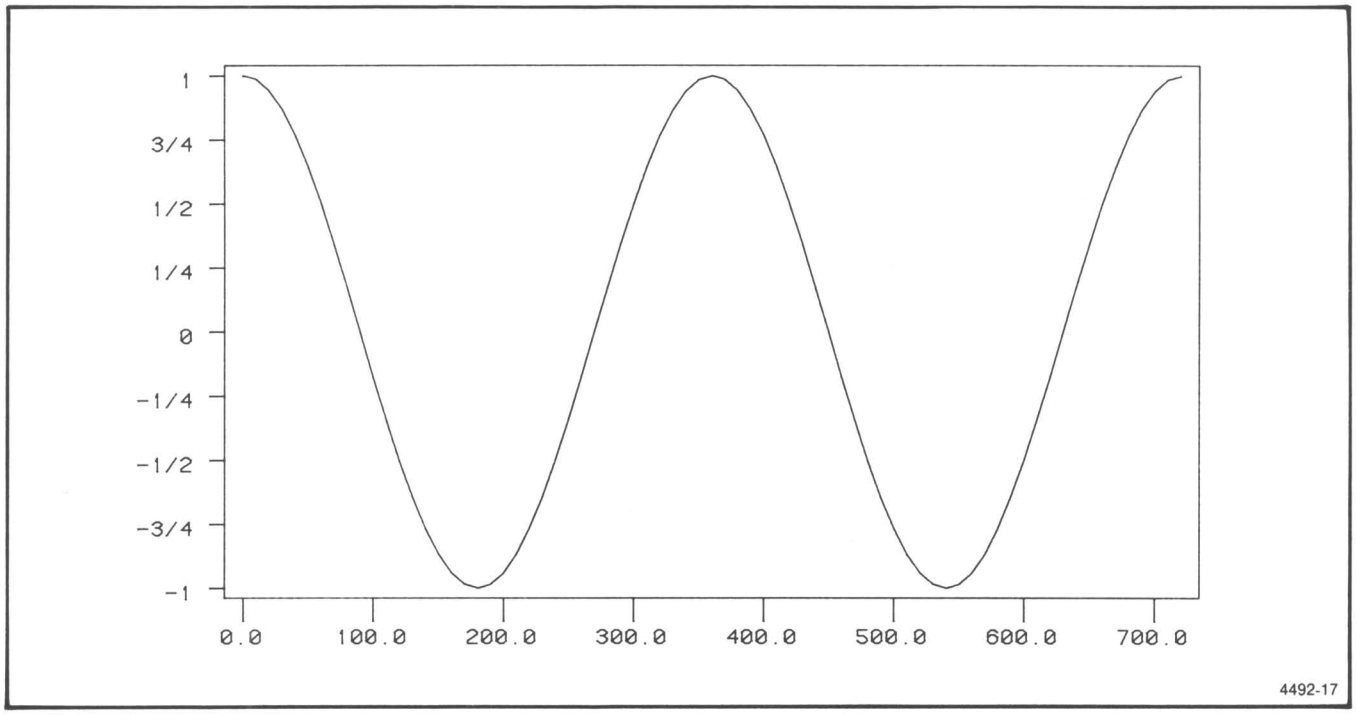

Figure 4-11. Use of YLABEL Romcall.

The YLOG Romcall

Syntax Form: [line-no.] RCALL "YLOG" [,numexp]

Descriptive Form: [line-no.] RCALL "YLOG" [,boolean]

The ASK YLOG Romcall

Syntax Form: [line-no.] RCALL "ASK YLOG",numvar

Descriptive Form: [line-no.] RCALL "ASK YLOG",ylog-value

Purpose

The YLOG romcall makes the y-axis a logarithmic scale if the YLOG parameter is set to 1, and makes it a linear scale if the YLOG parameter is set to 0.

The ASK YLOG romcall returns the current value of the YLOG parameter.

Explanation

The YLOG romcall's argument is interpreted as a boolean value. If the absolute value of this argument is equal to or greater than 0.5, the YLOG parameter is set to 1.

When used without arguments, the YLOG romcall returns the YLOG parameter to its default value (0).

Example

```
100     Dim y(16)
110     Integer i
120     For i=1 to 16
130       Y(i)=45*i^i+32*i+16
140       Next i
150     Open #1:"gpib(pri=1):"
160     Rcall "ginit",1,4662,2
165     Rcall "ylog",1
170     Rcall "yplot",y
180     End
```

Line 165 sets the YLOG parameter to 1, making the y-axis a logarithmic scale. Line 170 then plots array Y (on the logarithmic scale) against a steadily increasing x value. The resulting graph is shown in Figure 4-12.

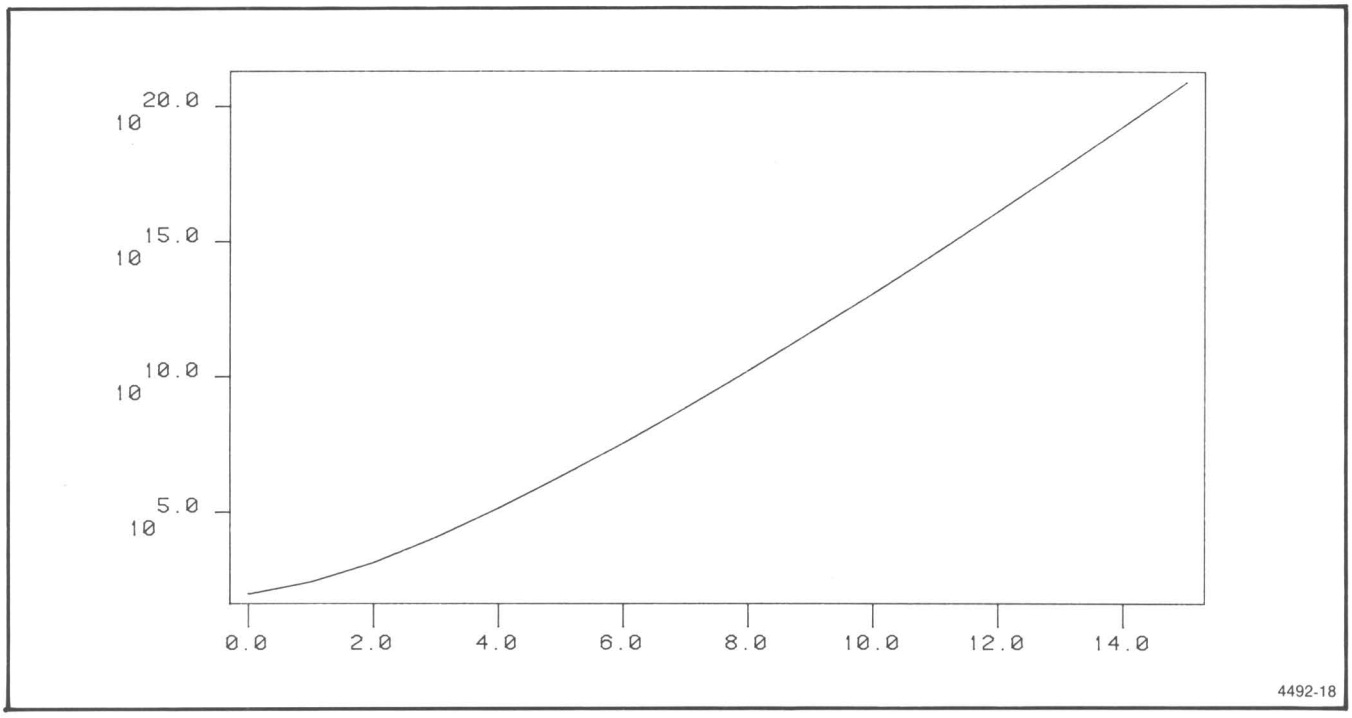

Figure 4-12. Use of YLOG Romcall.

The YRANGE Romcall

Syntax Form: [line-no.] RCALL "YRANGE" [,numexp,numexp[,numexp]]

Descriptive Form: [line-no.] RCALL "YRANGE" [,ystart,ystop[,AUTO-flag]]

The ASK YRANGE Romcall

Syntax Form: [line-no.] RCALL "ASK YRANGE",numvar,numvar,numvar

Descriptive Form: [line-no.] RCALL "ASK YRANGE",ystart,ystop,AUTO-flag

Purpose

The YRANGE romcall specifies the range of y values to plot, and the status of the automatic y-ranging parameter.

The ASK YRANGE romcall returns the current YRANGE parameters.

Explanation

When used without arguments, the YRANGE romcall returns the YRANGE Auto-Flag to its default value.

The first two arguments in the YRANGE romcall specify the lower and upper limits, in user data units, of the range of y-values to be plotted.

The third argument in the YRANGE romcall specifies the status of the automatic y-ranging parameter. When the absolute value of this argument is less than 0.5, the YRANGE parameters are manually set (i.e., specified by the user). Otherwise, the YRANGE parameters are automatically set, and are determined by the range of y-values actually being plotted. When the YRANGE parameters are automatically set, the first two arguments are effectively ignored.

If the first two arguments are included in a YRANGE romcall, but no third argument is included, the value of the third argument defaults to 0.

The YRANGE romcall should not be executed between a PLOT and an ADD romcall.

The first and second arguments in the ASK YRANGE romcall return the current lower and upper limits of the range of y-values to be plotted. The third argument tells whether the YRANGE values are currently being determined by the Plotting Rompack (1) or by the user (0).

Examples:

Example 1:

```
120     Dim x(37),y(37)
130     Integer i
140     Set angle 1
150     For i=1 to 37
160       X(i)=10*(i-1)
170       Y(i)=sin(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "xyplot",x,y
220     End
```

Example 2:

```
120     Dim x(37),y(37)
130     Integer i
140     Set angle 1
150     For i=1 to 37
160       X(i)=10*(i-1)
170       Y(i)=sin(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
205     Rcall "yrange",-2,2
210     Rcall "xyplot",x,y
220     End
```

Example 1 plots array X vs. array Y using the default YRANGE values (determined by the data to be plotted; in this case, from −1 to 1). The resulting graph is shown in Figure 4-13.

In Example 2, line 205 sets the YRANGE parameters to −2 and 2. Line 210 then plots array X vs. array Y, using this Y-range. The resulting graph is shown in Figure 4-14.

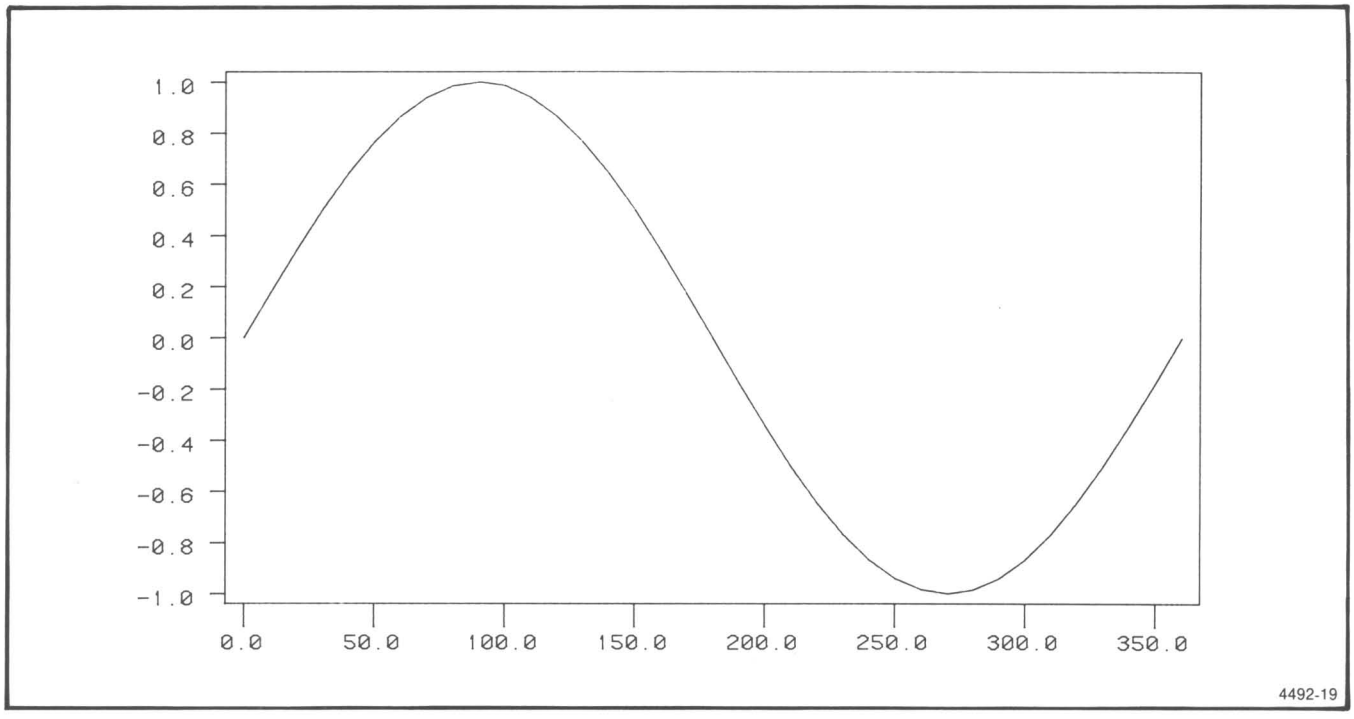

Figure 4-13. Default YRANGE.

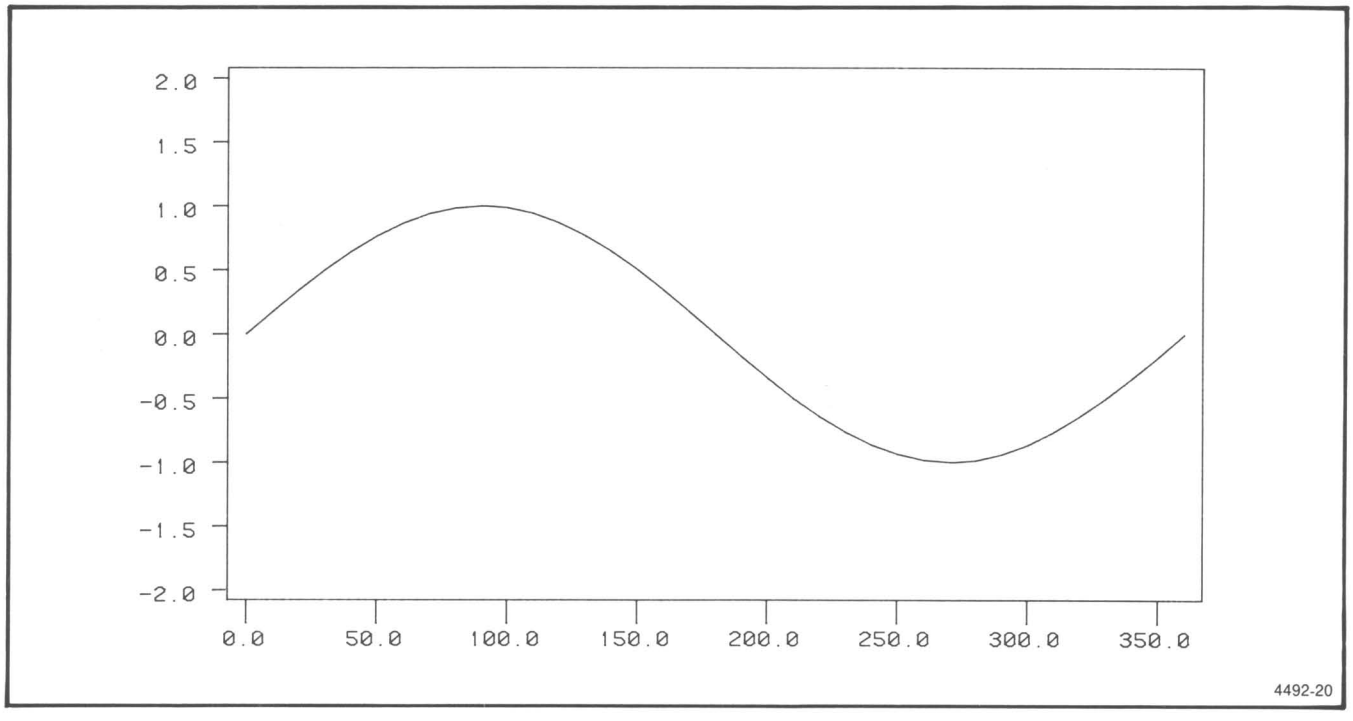

Figure 4-14. Use of YRANGE Romcall.

The YTIC Romcall

Syntax Form: [line-no.] RCALL "YTIC" [,numexp,numexp[,numexp]]

Descriptive Form: [line-no.] RCALL "YTIC" [,ystart,yincrement[,AUTO-flag]]

The ASK YTIC Romcall

Syntax Form: [line-no.] RCALL "ASK YTIC",numvar,numvar,numvar
Descriptive Form: [line-no.] RCALL "ASK YTIC",ystart,yincrement,AUTO-flag

Purpose

The YTIC romcall specifies the first tic mark value and the increment between tic marks along the y-axis. This romcall also specifies whether or not tic mark spacing is to be determined automatically.

The ASK YTIC romcall returns the current YTIC parameters.

Explanation

When used without arguments, the YTIC romcall returns the system to automatic tic-mark spacing (dependent on actual data).

The first two arguments in the YTIC romcall specify the starting value and increment for tic marks along the y-axis.

The y increment must evaluate to a nonzero number.

If the YLOG parameter is set to 0, the second argument in the YTIC romcall specifies the linear increment between successive tic marks. If the YLOG parameter is set to 1, the second argument in the YTIC romcall specifies the amount by which the exponent is to be incremented between successive tic marks.

The third argument in the YTIC romcall specifies whether or not tic mark spacing along the y-axis is to be determined by the Plotting Rompack. If the absolute value of this argument evaluates to zero, the tic mark spacing is determined by the user; otherwise, the tic mark spacing is determined by the Plotting Rompack.

If the first two arguments are included in the romcall, but no third argument is included, the value of the third argument defaults to zero.

The YTIC romcall is useful primarily to make tic marks easy to read and to make logical spacing between tics according to the axis units.

The first two arguments of the ASK YTIC romcall return the current start and increment values for the y-axis. The third argument tells whether the YTIC values are currently being determined by the Plotting Rompack (1) or by the user (0).

The ASK YTIC romcall can be used to give different graphs a similar appearance by assigning them the same YTIC starting and increment values.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
205     Rcall "ytic",-1,0.25
210     Rcall "xyplot",x,y
220     End
```

Line 205 specifies that y-axis tic marks are to start at a y-value of −1, and appear at increments of 0.25.

Line 210 then plots array X vs. array Y.

The resulting graph is shown in Figure 4-15.

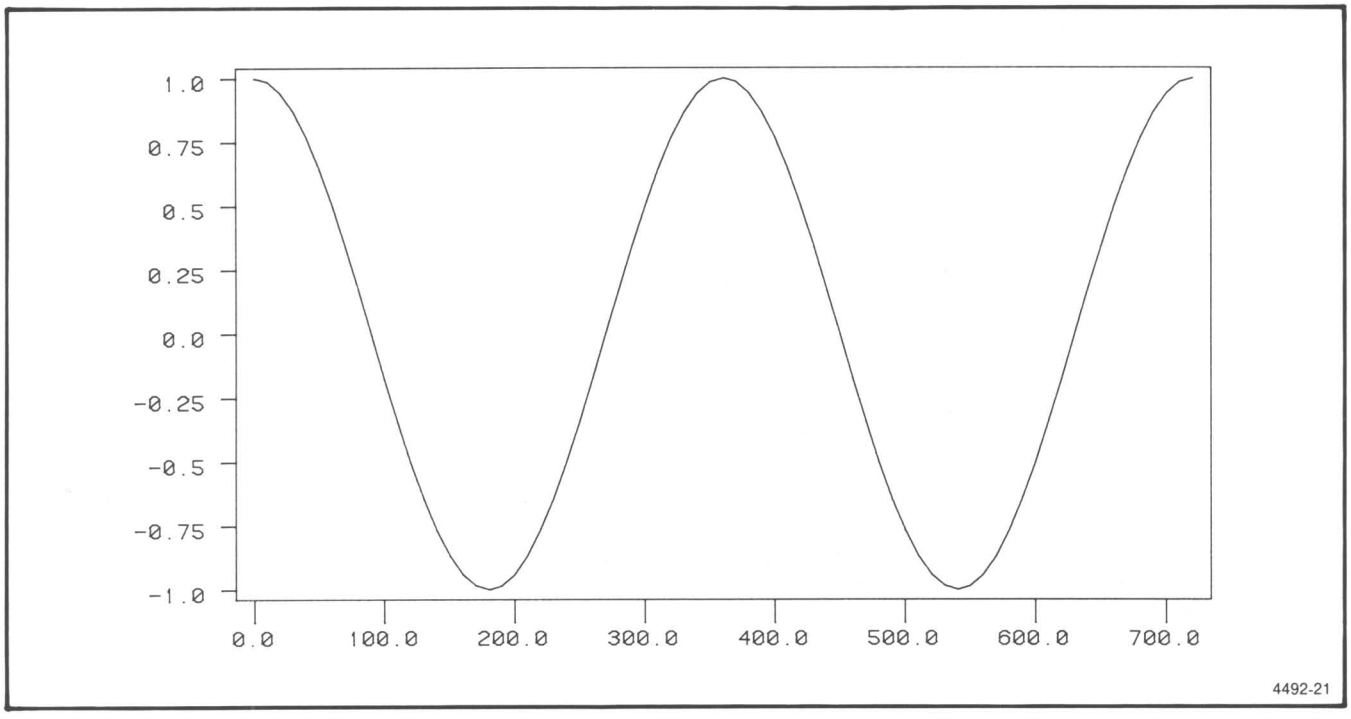

Figure 4-15. Use of YTIC Romcall.

Section 5

ANNOTATION ROMCALLS

Annotation romcalls put titles on the graph.

Annotation romcalls include:

— SUBTITLE: writes a title below the main title above the graph;

— TITLE: writes a title above the graph;

— XTITLE: writes a title below the x-axis;

— YTITLE: writes a title to the left of the y-axis, written vertically from top to bottom.

Titles are written onto the graphic device only when an annotation romcall is executed.

Attempting to execute an annotation romcall without executing a PLOT romcall previously results in an error.

The SUBTITLE Romcall

Syntax Form: [line-no.] RCALL "SUBTITLE",strexp

Descriptive Form: [line-no.] RCALL "SUBTITLE",title-contents

Purpose

The SUBTITLE romcall writes a subtitle below the main title above the graph.

Explanation

The subtitle is written out centered on and clipped to the viewport, using the current color and textsize.

The SUBTITLE romcall may be used without using the TITLE romcall beforehand.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "xyplot",x,y
220     Rcall "title","THIS IS THE TITLE"
230     Rcall "subtitle","THIS IS THE SUBTITLE"
240     End
```

Line 210 plots array X vs. array Y. Line 220 then writes a title to the graph, and line 230 writes a subtitle.

The resulting graph is shown in Figure 5-1.

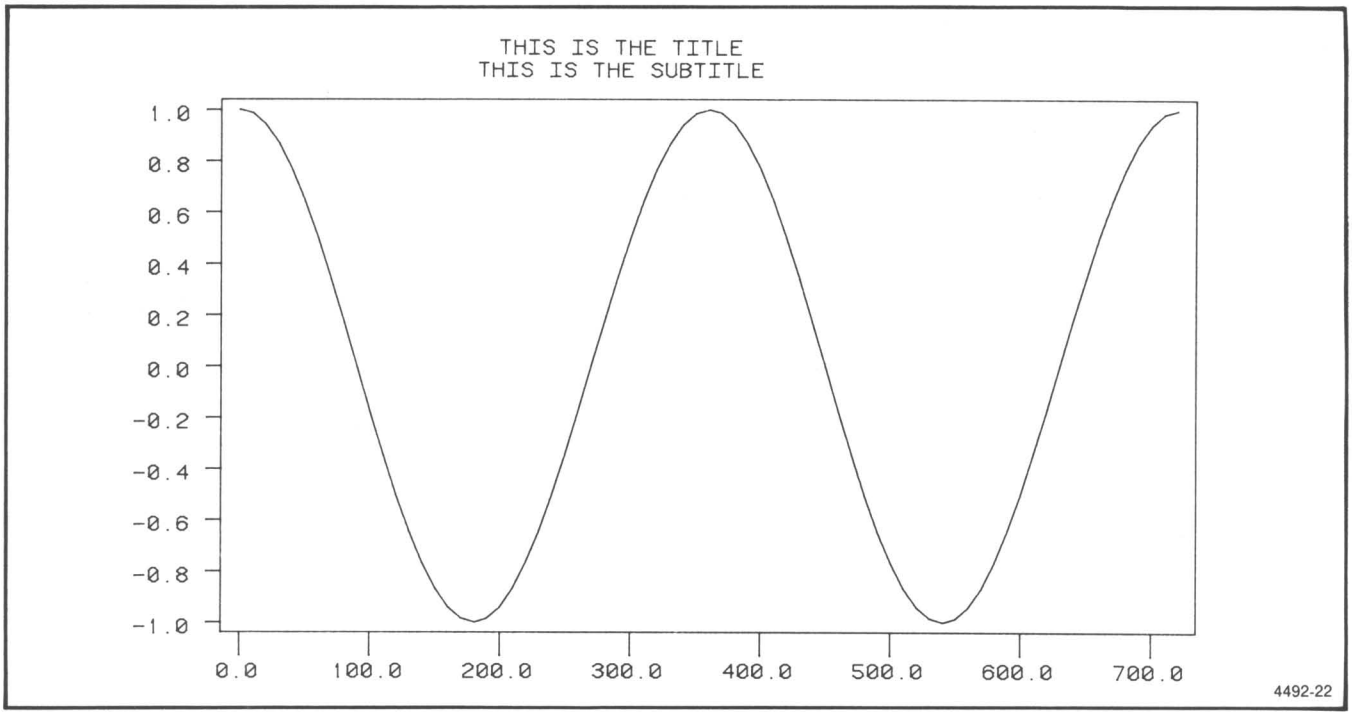

Figure 5-1. Use of SUBTITLE Romcall.

The TITLE Romcall

Syntax Form: [line-no.] RCALL "TITLE",strexp

Descriptive Form: [line-no.] RCALL "TITLE",subtitle-contents

Purpose

The TITLE romcall writes a title above the graph.

Explanation

The title is written out centered on and clipped to the viewport, using the current color and textsize.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "xyplot",x,y
220     Rcall "title","THIS IS THE TITLE"
230     End
```

Line 210 plots array X vs. array Y.

Line 220 adds a title to the graph.

The resulting graph is shown in Figure 5-2.

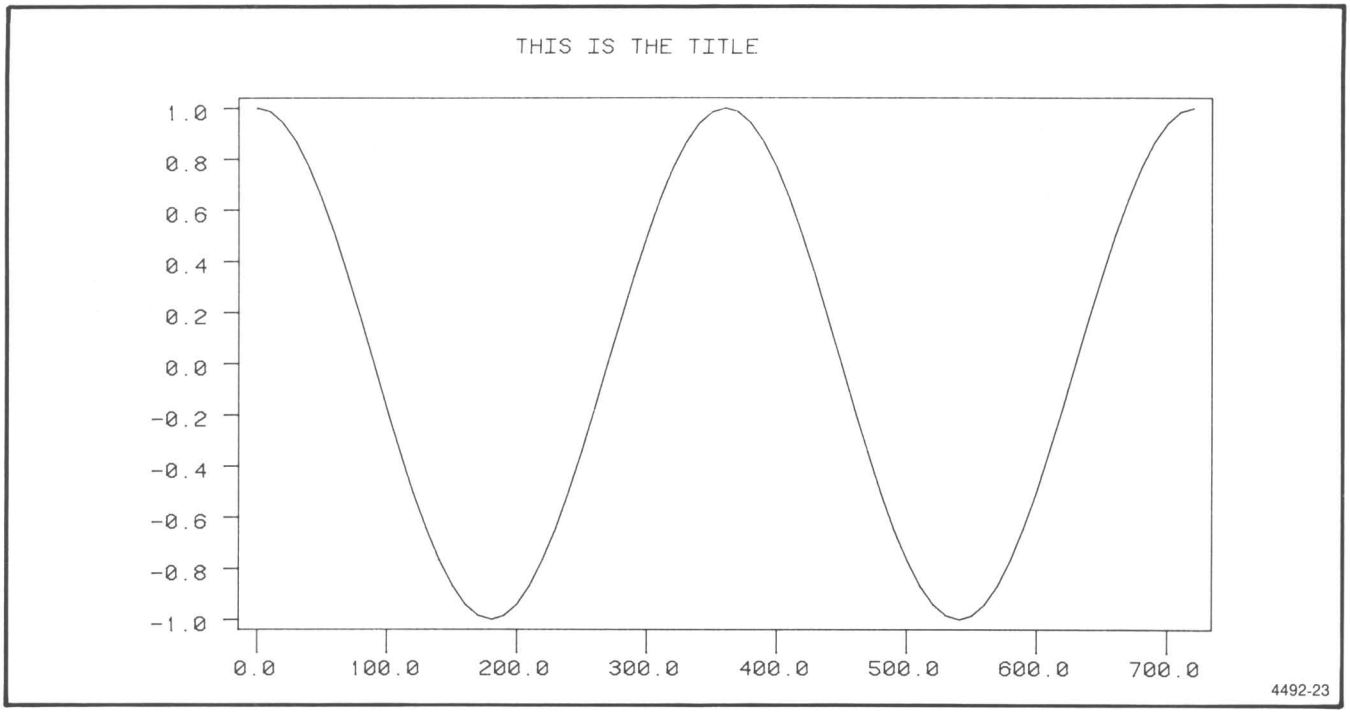

Figure 5-2. Use of TITLE Romcall.

The XTITLE Romcall

Syntax Form: [line-no.] RCALL "XTITLE",strexp

Descriptive Form: [line-no.] RCALL "XTITLE",xtitle-contents

Purpose

The XTITLE romcall writes a title below the x-axis.

Explanation

The x-axis title is written out centered on and clipped to the viewport, using the current color and textsize.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "xyplot",x,y
220     Rcall "xtitle","THIS IS THE X TITLE"
230     End
```

Line 210 plots array X vs. array Y.

Line 220 adds an x-axis title to the graph.

The resulting graph is shown in Figure 5-3.

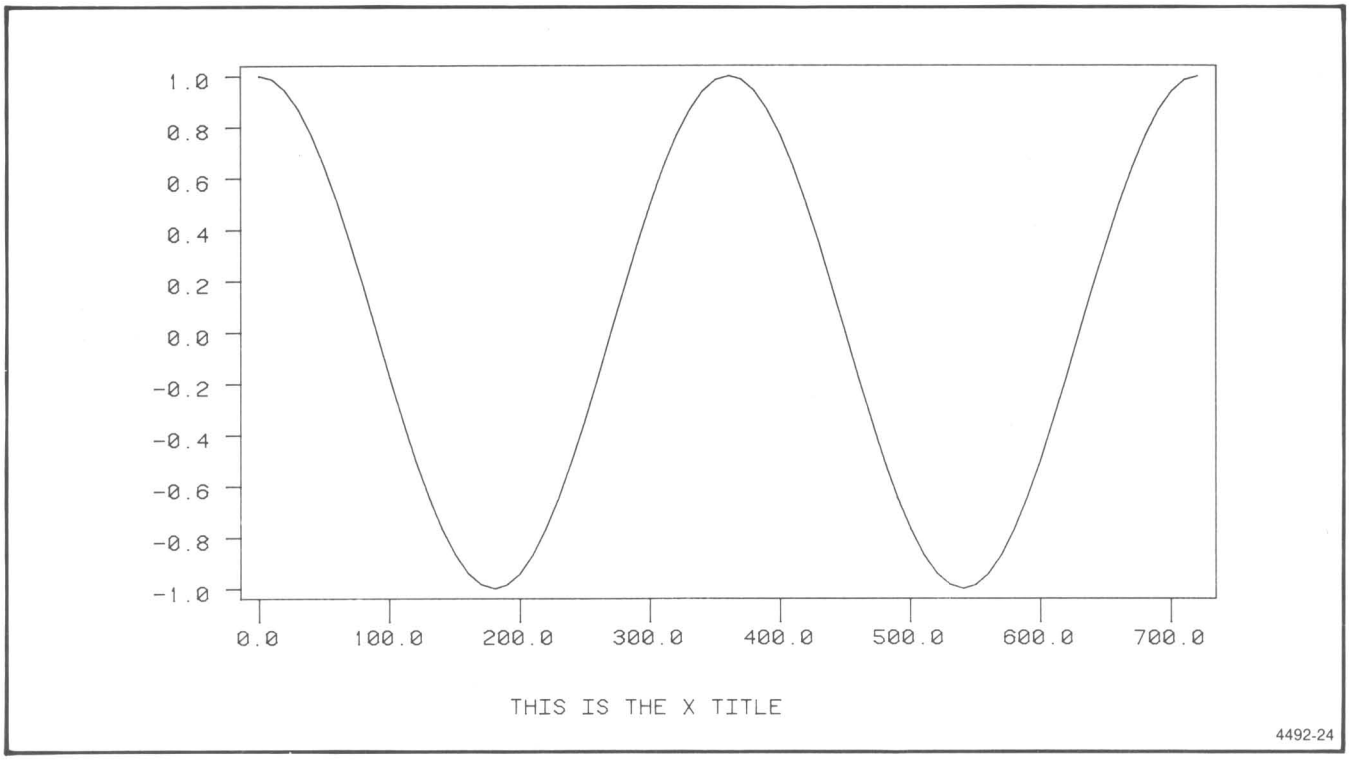

Figure 5-3. Use of XTITLE Romcall.

The YTITLE Romcall

Syntax Form: [line-no.] RCALL "YTITLE",strexp

Descriptive Form: [line-no.] RCALL "YTITLE",ytitle-contents

Purpose

The YTITLE romcall writes a title to the left of the y-axis. The title is written vertically from top to bottom.

Explanation

The y-axis title is written out centered on and clippped to the viewport, using the current color and textsize.

Example

```
120     Dim x(73),y(73)
130     Integer i
140     Set angle 1
150     For i=1 to 73
160       X(i)=10*(i-1)
170       Y(i)=cos(x(i))
180       Next i
190     Open #1:"gpib(pri=1):"
200     Rcall "ginit",1,4662,2
210     Rcall "xyplot",x,y
220     Rcall "ytitle","THIS IS THE Y TITLE"
230     End
```

Line 210 plots array X vs. array Y.

Line 220 adds a y-axis title to the graph.

The resulting graph is shown in Figure 5-4.

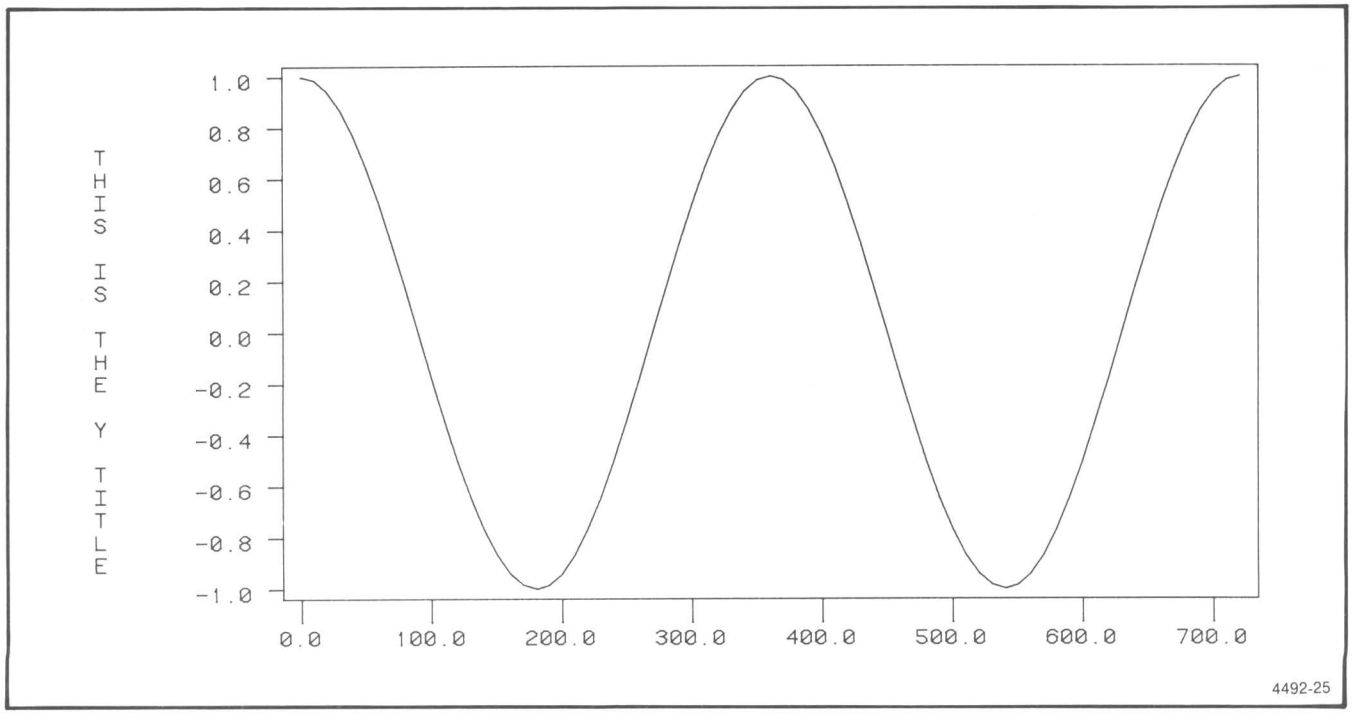

Figure 5-4. Use of YTITLE Romcall.

Appendix A
ERROR MESAGES

Error Number	Meaning
0	Graphics rompack is not loaded.
1	Rompack not initialized — Need to call GINIT or GDEVICE.
2	Wrong number of arguments.
30	Values that must be different are equal or are too close to be differentiated.
31	Value that must be nonzero is zero.
32	Value that must be a positive nonzero value is not.
33	Value that must be greater than or equal to zero is not.
35	Wrong argument type.
40	XRANGE and YRANGE have not been executed. PLOT with no arguments is invalid.
41	Tried to add a curve where no axis has been drawn.
42	Tried to add a title where no axis has been drawn OR axis has been invalidated by subsequent override romcall.
43	Tried to execute ADD romcall after override romcall invalidated original graph.
44	Cannot graph scalar values.
45	Viewport too small to accommodate graph.
46	Cannot take logarithm of a number less than or equal to zero.
50	Symbol out of range.

Note: For errors that pertain to rom packs, the actual error number returned by the 4041 is equal to the rompack error number (i.e., 1, 2, etc.) plus an offset that depends on the rompack's slot position in the rom carrier.

ASK$("ROMPACK") returns the names of all rompacks recognized by the system, along with the error-number offset for each rompack.

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