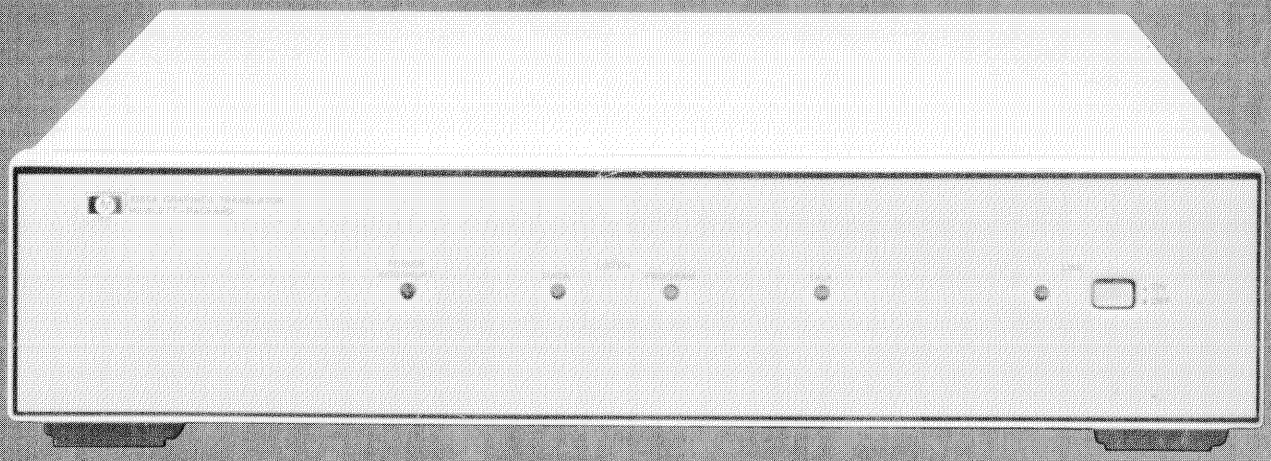
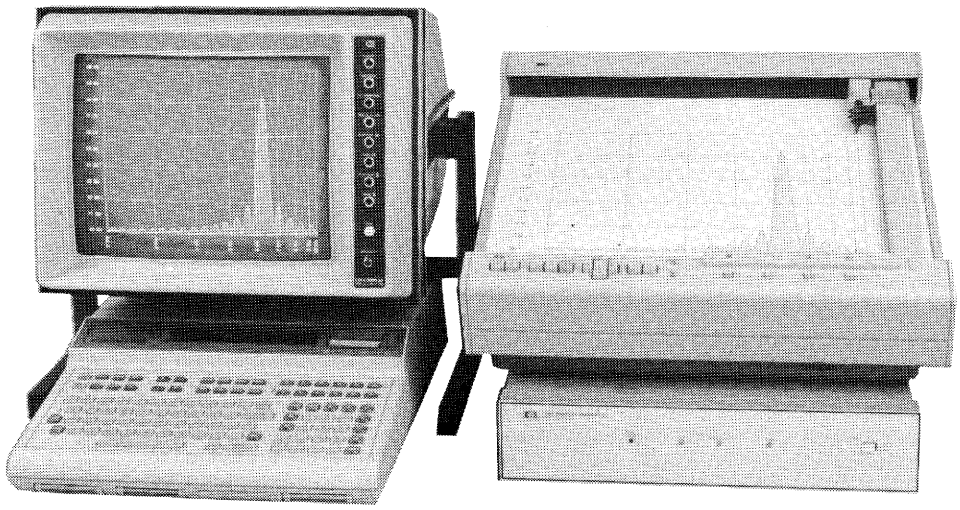
Hewlett-Packard 1350A Graphics Translator Operating and Programming



Operators Guide

Model 1350A
Graphics Translator



Model 1350A with Calculator, X-Y Display, and X-Y Plotter

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PART NO. 01350-90903
MICROFICHE NO. 01350-90803

PRINTED: NOVEMBER 1978

Manual Summary

Overview

Key points about your Graphics Translator.

Chapter 1: Introduction

Description, Interface, and Outputs.

Chapter 2: General Programming

Information about the controlling computer communicating with the 1350A using Graphic Translator Machine Language (GTML).

Chapter 3: Plotting

Describes the instructions needed to perform all plotting movements.

Chapter 4: Text

Describes the instructions that enable the 1350A to display alphanumeric characters and symbols.

Chapter 5: Files

Explains memory organization and how to develope files using file instructions.

Chapter 6: Display Blanking

Explains how to display information on combinations of displays using Auxiliary Instructions.

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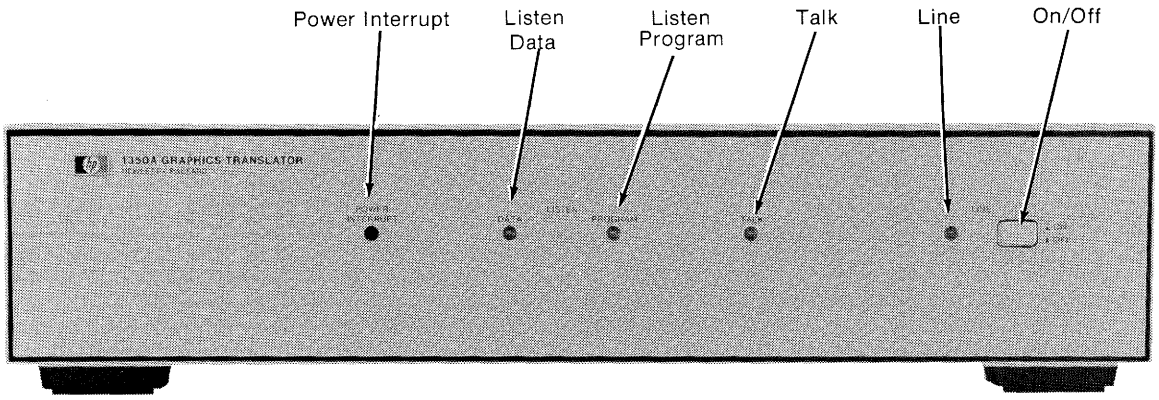


Model 1350A Front-panel Controls and Connectors

Power Interrupt - Indicates voltage changes in AC power that could cause HP-IB bus information or information stored in 1350A memory to be altered.

Listen Data - Indicates data is being transferred from the controller to the 1350A.

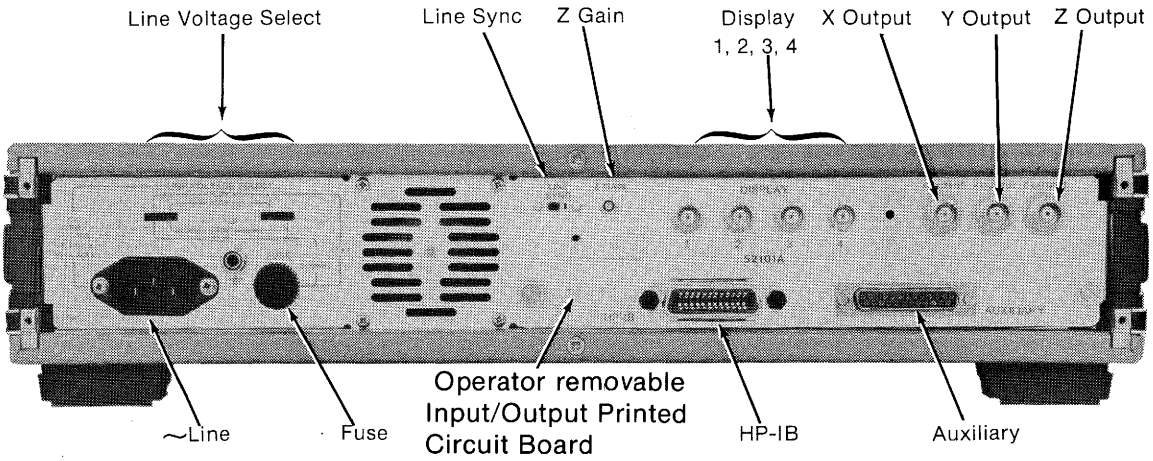
Listen Program - Indicates the 1350A has been addressed by the controller and the 1350A is "listening," ready to receive information from the controller.

Talk - Indicates the controller has given the 1350A a talk address and is waiting to receive data from the 1350A. This state should never occur, as the 1350A is not configured to transmit data to to the controlling computer (HP-IB).

Line - Indicates if AC power line is on or off.

On/Off - Turns AC power line on or off.

Overview



Model 1350A Rear-panel Controls and Connectors

Line Voltage Select - Selects desired AC line voltage.

Line Sync - Synchronizes 1350A to AC power line.

Z Gain - Adjusts output amplitude of Z axis signal.

Display 1, 2, 3, 4 - Provides TTL blanking to four separate displays.

X Output - X axis analog output signal for display input.

Y Output - Y axis analog output signal for display input.

Z Output - Z axis analog output signal for display input.

~Line - Connector for AC power cord.

Fuse - AC line protection.

HP-IB - Connector for Hewlett-Packard Interface Bus Cable (from controller).

Auxiliary - Connector that has TTL blanking outputs (Display 1, 2, 3, 4) as well as information to control the Hewlett-Packard 1338A Tri-color Display. (More information may be found in Appendix C.)

Chapter 1
Introduction

General

This Operators Manual will acquaint you with the Model 1350A Graphics Translator features and capabilities. To aid in operating the Graphics Translator HP-IB I/O, and RS-232C information is provided. Additional information in the Programming section of this manual will explain how to program the Graphics Translator. Service information is available in the Service Manual.

Description

The Graphics Translator converts digital information to analog signals capable of driving the X, Y, and Z inputs of a random plotting directed beam CRT display.

The Translator accepts digital information from a controller through either the Hewlett-Packard Interface Bus (HP-IB) or RS-232C Interface Bus (optional).

The Translator stores the information in a 2048-word RAM (Random Access Memory) which is continually accessed to generate vectors and characters for refreshing one or more displays. Each digital word can be the coordinate of a vector endpoint, an upper or lower case character, number, or special symbol.

The memory (RAM) may be divided into as many as 32 independent files. The files may be selectively erased, written into, blanked or flashed as a function of software. An internal switch also allows hardware blinking. Files may be of any length as long as the total combined lengths do not exceed the 2048 word memory size.

A character generator ROM (Read Only Memory) contains the information to produce a modified set of ASCII characters (Appendix E). The ASCII set is compatible with a Hewlett-Packard 9825A Computer Keyboard. The characters are stroke type similar to the characters made by a plotter. Through software the size (X1, X2, X4, X8) and rotation (0° or 90°) may be defined.

Types of Display

The 1350A generates vectors at high rates. To fully benefit from this capability, the display used must be of the directed beam type having an X-Y bandwidth of at least 3 MHz and Z axis rise time ≤40 ns.

AC Line Voltage

The instrument is normally set at the factory for the applicable line voltage of the shipment destination. However, this selection should be checked before applying power.

CAUTION

DAMAGE TO THE INSTRUMENT MAY RESULT IF THE LINE VOLTAGE SELECTION SWITCH IS NOT CORRECTLY SET FOR THE PROPER INPUT POWER SOURCE. FOR MORE INFORMATION REFER TO APPENDIX A AND B.

Interface

The 1350A may be interfaced to the controller using either HP-IB or RS-232C. (RS-232C is optional.) Both Bus structures are discussed below.

HP-IB

The HP-IB capability is defined in accordance with IEEE Standard 488-1975, "Standard Digital Interface for Programmable Instrumentation".

As many as 14 instruments can be connected to the same interface bus. However, the maximum cable length that can be used must not exceed (a) two metres (6.5 ft) times the number of instruments connected to the bus or (b) 20 metres (65.6 ft) whichever is less.

The listen address for the 1350A (ASCII Code) is selected by the HP-IB Select Code Switch (S1) located on the removable Input/Output Prited Circuit Board. See photograph in Chapter 6 for location.

RS-232C

RS-232C Bus circuitry may be installed as a purchased option in place of the standard HP-IB. The RS-232C option is configured for SIMPLEX operation. The 1350A is a receive only device.

The data received by the 1350A over the RS-232C Bus is asynchronous, with a selectable data rate from 75 to 9600 baud.

The RS-232C option is compatible with European type CCITT V24 Bus structure.

The 1350A does not contain the necessary hardware to allow data to be transmitted from the 1350A to another instrument on the bus. As a result the 1350A cannot be used in Loop Configurations.

For additional information on RS-232C Bus structure, refer to the 1350A Service Manual.

Outputs

X, Y, and Z Analog Outputs

The 1350A has 50 ohm X, Y, and Z outputs that can drive several displays in a parallel configuration with the last display terminated in 50 ohms. The number of displays that can be driven without degradation of the display image is dependent on the type and length of the interconnecting cables.

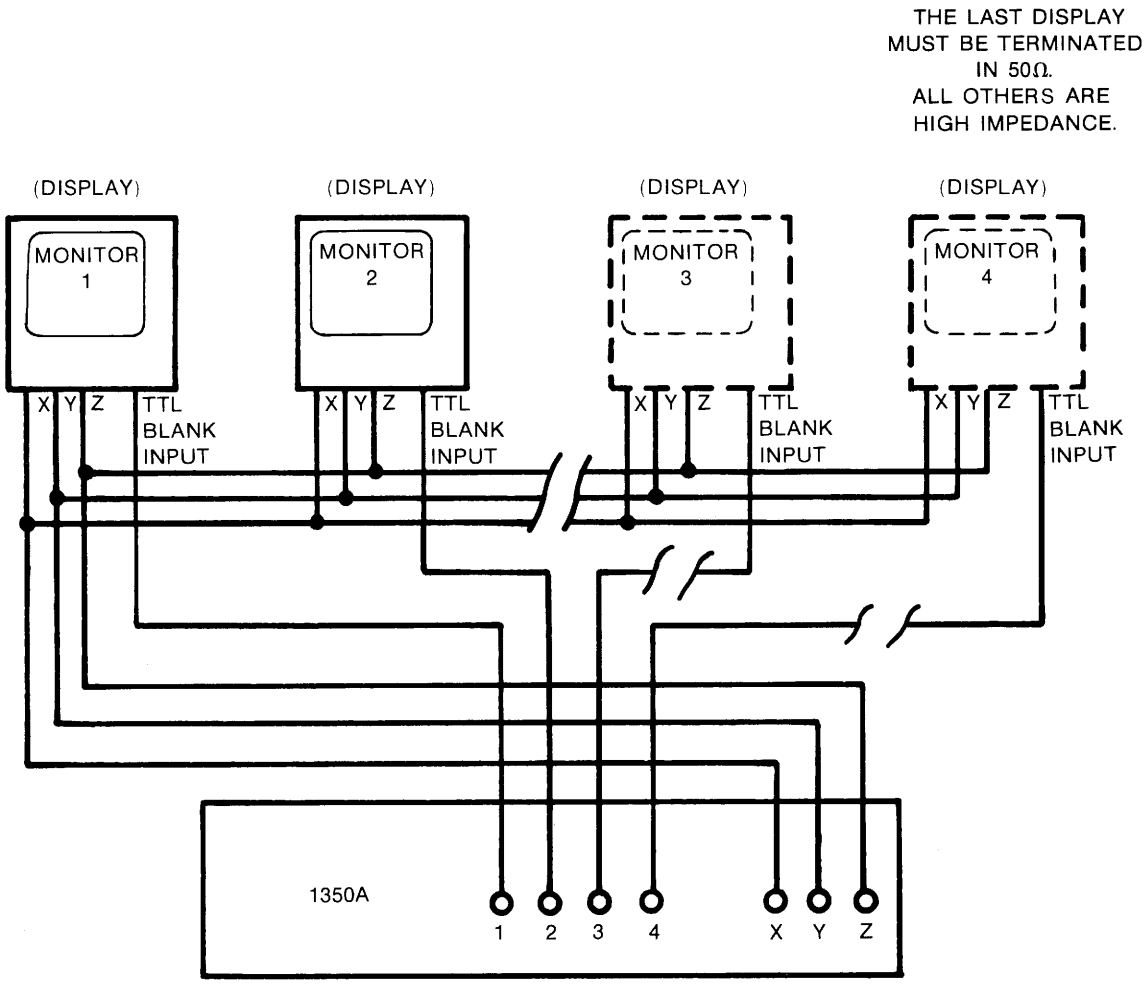
Refer to the following figure for 1350A Display interconnections. Ensure that the input terminations of the displays are as indicated.

TTL Blanking Outputs

The 1350A has four TTL Blanking Outputs for controlling the interconnected displays, each with the same or different information displayed. These outputs drive the TTL Blanking inputs of the displays, and select which display or displays are to be unblanked.

The TTL outputs can also be used in conjunction with the hardware blink feature for highlighting information on any combination of three displays. (The TTL output that controls the fourth display cannot be used to control a display if the hardware blink feature is used.)

More information on the TTL Blanking Outputs can be found in Chapter 6 of this manual.



TTL OUTPUTS

1350A/Display Interconnections

Auxiliary Connector

The Auxiliary Connector is provided on the rear panel for connecting the 1350A to the Hewlett-Packard Model 1338A Tri-color Display. The signals interfacing the 1350A and 1338A may also be used in other applications. More information may be found in Appendix C.

Z Axis Adjustment

Z Axis Gain Adjustment is provided to aid in interfacing to the display. Set up procedure for uniform vectors is: 1. Set 1350A Z Gain (rear panel) fully clockwise; 2. Set display intensity control fully counterclockwise; 3. Turn 1350A Z Gain counterclockwise until no vectors are viewed; 4. Turn display intensity clockwise until all vectors have uniform intensity.

Point Blanking

The Point Blanking switch is located internally. When the switch is set to the blank position the display is blanked during the time interval between vectors.

If the 1350A is used to control a 1338A Tri-color Display the switch should be set to the blank position.

The position of the switch is set to unblank at the factory. Access to the Point Blanking switch requires removal of the bottom cover and should be referred to qualified service personnel only.

Line Sync

For systems having severe ground loop problems, or environments with strong magnetic fields (ac line frequency) the 1350A may be internally synchronized to the ac power line (switch on rear panel).

Line Sync should be used only when absolutely necessary. When it is used the display rate may be reduced to the point that flicker may become objectionable.

Chapter 2
General Programming

The controlling computer communicates with the 1350A using Graphic Translator Machine Language (GTML).

GTML consists of 18 two letter instructions. Some instructions include a numerical parameter. The parameters are positive integers.

Example: PA5, 300;

The controlling computer must be capable of communication with the Hewlett-Packard Interface Bus. Additional information may be found in IEEE Standard 488-1975, "Standard Digital Interface for Programmable Instrumentation."

9825A Requirements

The HP 98034A Interface Card is used to connect the 1350A to the 9825A.

The 9825A must have a 98212A General I/O ROM installed to communicate over the HP-IB. The 98213A General I/O - Extended I/O ROM, the 98214A General I/O - Extended I/O ROM for the 9862A Plotter, and the 98216A General I/O - Extended I/O ROM for the 9872A Plotter will also work.

The 98210A String Variable/Advanced Programming ROM is not required. However, it does make the system much more versatile.

Installation

Check the Line Voltage Selection switches for proper setting (see Appendix A). Connect the 1350A X, Y, Z, and TTL Outputs to the Input of the displays to be used. Connect the 98034A HP-IB Card to the 1350A and the 9825A.

HP-IB Select Code

The 1350A listen address is set at the factory for 18. The HP-IB is set for 7. The resulting address 718 is used in the examples.

The 1350A is a listen only instrument, with no local mode.

The listen address may be changed by removing the plug-in Input/Output Printed Circuit Board from the rear panel of the 1350A. The address switch is S1.

For address 18 (binary 10010), switch sections 2 and 5 should be on. 1, 3, and 4 should be off. Section 5 is the most significant bit. See photograph in Chapter 6 for location.

Up and Running?

The simplest way to confirm the 9825A, HP-IB (98034A), and 1350A are communicating is:

1. Turn the 1350A off, then on. The Power Interrupt light should be on. If it isn't, repeat. If Line light is not on and Power Interrupt will not come on, consult a qualified service person.

2. Type cli 7 on the 9825A. Press EXECUTE. The instruction cli 7 clears the HP-IB, and allows the 9825A to control the bus.

3. Type wtb 718,20,13,10 on the 9825A. Press EXECUTE. This clears the Power Interrupt, and the light should go out.

If the Power Interrupt light will not go out, check the Address Select Switch on the HP-IB (98034A) and S1 on the 1350A plug in board.

If they are correct, refer the problem to qualified service personnel.

Program Examples

The HP 9825A Desk Top Computer is used for the examples in this manual. An understanding of the 9825A is required.

The examples were printed on a HP 9871A Printer.

The 9825A write (wrt) statement automatically sends the ASCII equivalent of a Carriage Return and Line Feed over the HP-IB to the 1350A after completion of the program line. As a result the last 1350A instruction in a program line will "appear" to not have been terminated.

The 9825A write binary (wtb) statement does not send a Carriage Return and Line Feed after completion of a program line. Therefore binary 13 and 10 must follow the last 1350A instruction in a program line.

Since semicolons (;) are used in 9825A and 1350A instructions, none of the programs contain multiple 9825A instructions. To reduce programming time and instruction execution time, 1350A instructions are combined to form multiple instruction lines for the 1350A, with two-colons (::) terminating each 1350A instruction.

Instruction Format

The 1350A receives instructions in standard ASCII Code. It will recognize its instructions in either upper or lower case. Lower case will be used in the examples of this manual.

Instructions using single numerical parameters must be delimited by a comma (,).

Instructions using two numerical parameters, must have the first parameter delimited by a comma (,). The second parameter must be delimited by a semicolon (;).

All 1350A instructions must be terminated by a Carriage Return and Line Feed, or two colons (::).

Using a Different Computer

The computer being used with a 1350A must be capable of interfacing with HP-IB. See IEEE Standard 488-1975.

The computer language being used must be able to send the 1350A instructions in the proper format.

Below is a Fortan IV example sending PA[X parameter], [Y parameter]; to the 1350A.

WRITE(i,n)X,Y

n,2HPA,I4,1H,,I4,1H;

where i = address of device the information is being sent to

n = statement number of the format statement

X,Y = variables for 1350A X and Y coordinate parameters

PA = two letter instruction for 1350A

H = size of character field

I = size of integer field

If the computer does not automatically send carriage return and line feed at the end of a format statement, the format statement will appear as:

n,2HPA,I4,1H,,I4,1H;,2H:: Fortran IV statement

PA XXXX,YYYY;:: 1350A Instruction

Graphic Translator Machine Language Mnemonics

Chapter 2 Initialization

EM	Erase Memory
EN	Erase Name
EX	Erase auXiliary
BM	Blank Memory
UM	Unblank Memory

Chapter 3 Plotting

PA	Plot Absolute
PE	Pen Enable

Chapter 4 Text

TX	TeXt
CS	Character Size

Chapter 5 Files

FL	Find Location
NF	Name File
SN	Stop Name
FF	Find File
EF	Erase File
BF	Blank File
UF	Unblank File

Chapter 6 Display Blanking

WX	Write auXiliary
SX	Stop auXiliary

Initialization

The following initialization instructions must be the first instructions in all 1350A programs.

`0: cli 7`	Clears the HP-IB, allowing the computer to control the HP-IB.
`1: wtb 718,3,13,10`	3, insures the 1350A is not in the text mode. (ASCII ETX)
`2: wtb 718,20,13,10`	20, clears 1350A Power Interrupt. (ASCII DC4)
`3: wrt 718,"em::"`	Erases the entire 1350A memory contents. (This Chapter)
`4: wrt 718,"en::"`	Erases any file names that may be in 1350A memory. (This Chapter)
`5: wrt 718,"ex::"`	Erases Auxiliary control bits that may be in 1350A memory. (This Chapter)
`6: wrt 718,"sn::"`	Insures no files are named until instructed to do so. (Chapter 5)
`7: wrt 718,"sx::"`	Insures no words are sent to a different display until instructed to do so. (Multiple display applications.) (Chapter 6)
`8: wrt 718,"um::"`	Insures all 1350A memory locations are unblanked. (This Chapter)

Combining 1350A Instructions

The same Initialization sequence may be written as follows:

```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
```

Erase Memory

Syntax:

EM (parameter is not required)

Erase Memory erases the entire memory content of the 1350A, i.e., vector coordinates and pen status information. Normally this instruction is used for initialization.

Erase Names

Syntax:

EN (parameter is not required)

Erase Names erases all file names from the 1350A memory. All memory locations are assigned File Name 0. Information stored in memory is not changed. Normally this instruction is used for initialization.

Erase Auxiliary

Syntax:

EX (parameter is not required)

Erase Auxiliary changes the Auxiliary Blanking Status (Chapter 6) of all 2048 memory locations in the 1350A to WX0, unblanking all displays, allowing all information in memory to be displayed on all displays. Normally this instruction is used for initialization.

Blank Memory

Syntax:

BM (parameter not required)

Blank Memory (BM) blanks the entire 1350A memory. No information will be displayed on any display or displays connected to the 1350A.

Unblank Memory

Syntax:

UM (parameter is not requred)

Unblank Memory (UM) unblanks the entire 1350A memory. However, not all information stored in memory will be displayed. Pen Enable status, File instructions, and Auxiliary instructions may still keep some information blanked.

Chapter 3
Plotting

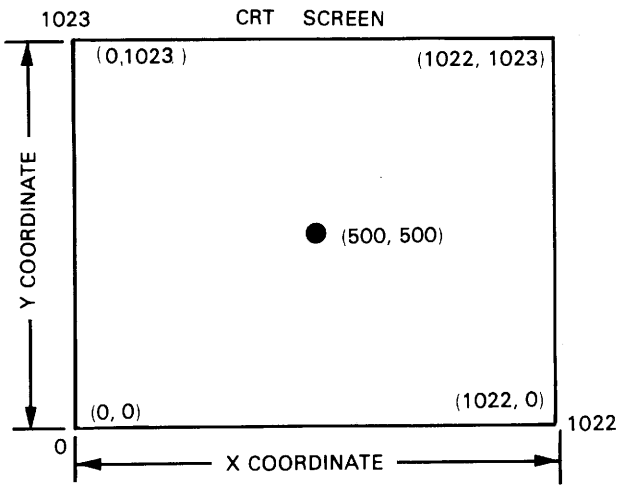
This chapter describes the instructions needed to perform all plotting movements, and blank or unblank the CRT.

Plotting moves are made to an absolute set of coordinates.

The Display Area

The plotting area defined on the CRT is divided into vector coordinates.

The absolute plotting area is shown below:



CRT X, Y Coordinates

The Plot Absolute Instruction (PA)

The Plot Absolute instruction PA provides the means to position the CRT beam to the point specified by the X and Y coordinate parameters that complete the command.

Plot Absolute

Syntax:

PA [X coordinate], [Y coordinate];

A PA command requires that both the X and Y coordinates be specified (coordinate pair).

The X coordinate parameter (0 thru 1022) specifies the absolute X location the CRT beam is moved to. The Y coordinate parameter (0 thru 1023) specifies the absolute Y location.

Any number of coordinate pairs can be listed after the PA instruction, separated by semicolons.

Syntax:

PA [X coordinate], [Y coordinate]; [X coordinate], [Y coordinate];

The CRT beam will move to each point in the order given.

If the point specified by a PA command lies beyond the edge of the 1350A vector area (greater than 1022 for X and 1023 for Y), indeterminate vectors are drawn until a point inside the area is specified.

The Pen Enable Instruction (PE)

The Pen Enable instruction PE blanks or unblanks the next vector(s) without changing the vector location.

Pen Enable

Syntax:

PE [0],	blanks next vector(s)
PE [1],	unblanks next vector(s)

Commands to blank or unblank the CRT may occur before or after Plot Absolute instructions, allowing lines to be connected or not connected.

If a Pen Enable instruction is not specified after other instructions, the CRT will assume the state (blanked or unblanked) of the previous PE instruction.

The following example program combines PA and PE instructions using the 9825A. A triangle will be displayed on the CRT.

```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
2: wrt 718,"pe0,::pa400,400;"
3: wrt 718,"pe1,::pa500,500;600,400;400,400;::pe0,"
4: end
```

Plotting with Variables

In most applications, it is necessary to plot using variables rather than fixed numbers.

The values of the X and Y variables have the same parameters as PA instructions.

When using the 9825A Computer, a format statement defining the length of each variable must preceed the plot command and must be referenced. The following example using the 9825A illustrates the use of variables in plotting a circle on the CRT.

Note in line 2 the comma and semicolon inside quotation marks separating the variables will be sent as part of the field.

In line 5, wrt 718.1, the .1 references the format statement in line 2. The format statement must also include the 1. The number following fmt may be any integer from 0 thru 9. If no number is specified, 0 is assumed. More information may be found on format statements in the 9825A I/O Programming Manual.

```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
2: fmt 1,f4.0,",",f4.0,";"
3: wrt 718,"pe0,"
4: for A=0 to 360 by 10
5: wrt 718.1,"pa",200sin(A)+500,200cos(A)+500
6: wrt 718,"pe1,"
7: next A
8: end
```

Chapter 4
Text

This chapter describes the instructions that enable the 1350A to display alphanumeric characters and symbols.

Size and rotation of the characters and symbols can be specified.

The Text Instruction (TX)

The Text instruction TX provides the means to display text, expressions, or string variables.

Text

Syntax:

TX [information to be displayed] ETX

The information following TX and preceeding the ETX is the only information that is displayed.

The text mode can be terminated only by sending an ASCII ETX at the end of the character string. Other ASCII Character equivalents between 3 and 30 at the end of the character string, will execute control functions in the 1350A. For example, (13) causes a carriage return, and (10) causes a linefeed.

When in the text mode, control functions affecting labeling, such as carriage return and line feed, must be entered before termination of the text mode.

For a complete list of the 1350A Modified ASCII Character Set, see Appendix E.

Preconditioning the 1350A for Text Mode

The 1350A is normally preconditioned prior to entering the text mode of operation. Depending on the operation situation, the following conditions should be considered while writing software:

Position of the CRT Beam (PA)

The CRT beam must be positioned to the proper location using the Plot Absolute instruction before plotting the text, characters, or symbols.

Pen Up or Down (PE)

The CRT should be unblanked (pen down, PE1) before a TX instruction.

General Character Size Information

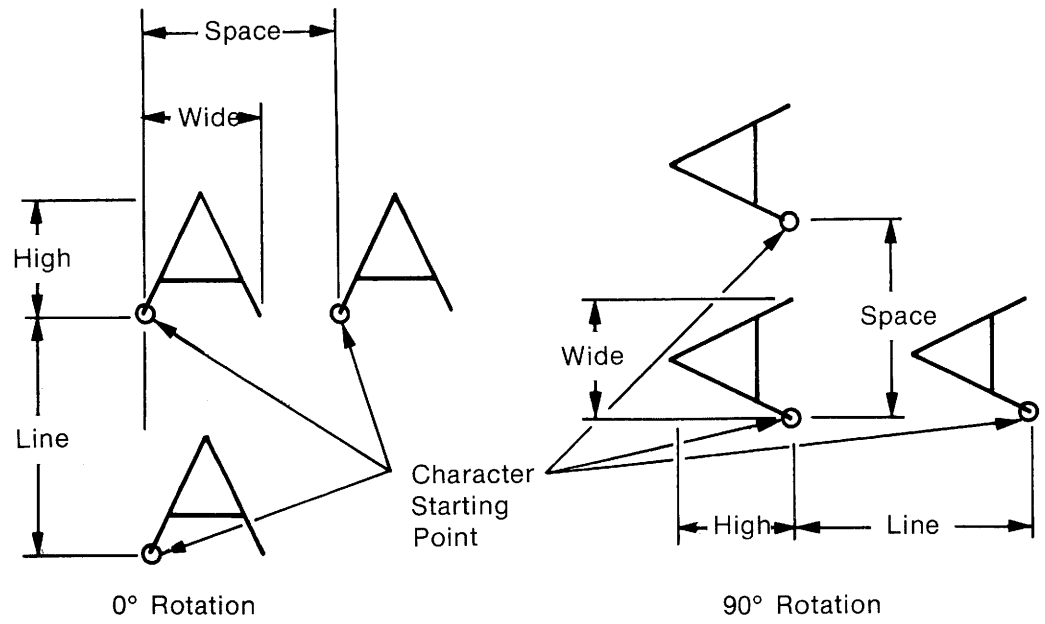
Four sizes of characters are selectable, X1, X2, X4, and X8.

When using the smallest size, 49 lines of 82 characters per line are available. However, the total number of characters displayed cannot exceed memory size (2K). As the size of the characters is increased, the possible total number of characters that can be displayed is decreased, due to limits of absolute plotting area.

The characters may be rotated counterclockwise 90° about the starting point.

When plotting near the edge of the plotting area,consideration should be given to the location of the starting point. If part of the character is plotted beyond the limits of the display area, that part of the character will not be plotted.

As shown below, the starting point is the lower left corner of the character. If the character is rotated, the starting point is still the same corner of the character.



Character Size

Character size must be specified before the 1350A is instructed to go to the text mode. The size of characters will be that of the last character size instruction preceeding the text instruction.

The Character Size Instruction (CS)

The character size instruction CS determines the size and rotation of characters in the text mode.

Character Size

Syntax:

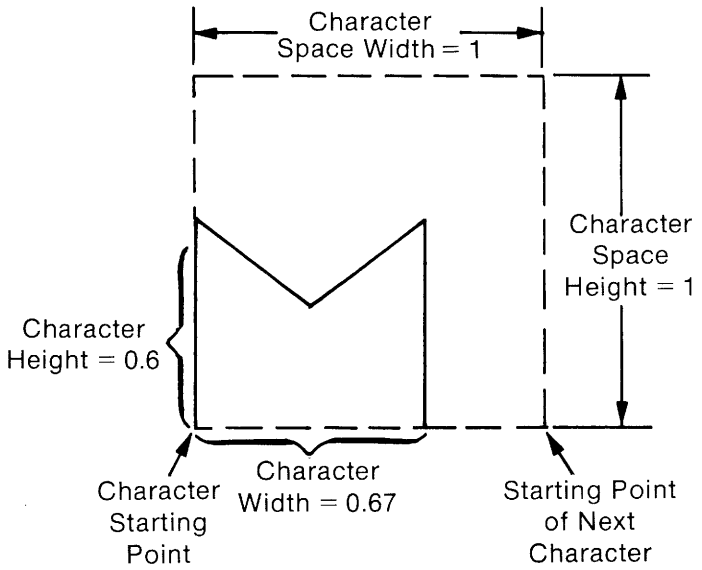
CS [size and rotation parameter],

Character Size and Rotation Parameters

Size	Rotation	Parameter
1X	0°	0
2X	0°	1
4X	0°	2
8X	0°	3
1X	90°	4
2X	90°	5
4X	90°	6
8X	90°	7

Spacing between Characters and the Character Grid

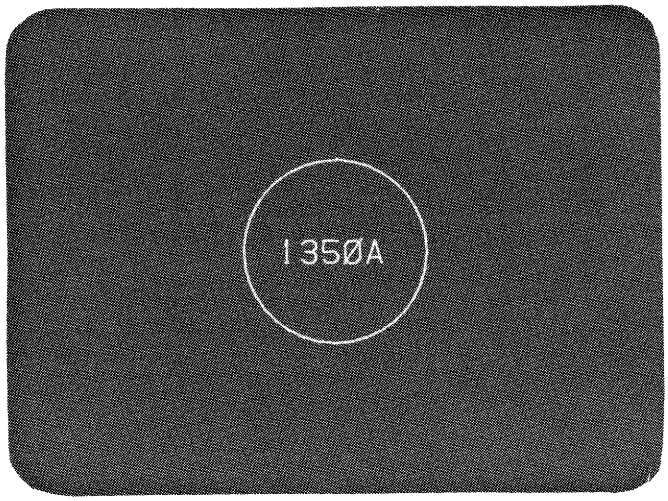
Character spacing and line spacing are functions of character size. In the diagram below, you can see the relative position of a character, in this case M, within the character-space field. The character-space field is set indirectly by the CS instruction, since the character space height is approximately 1.66 times the character's height and the character space width is approximately 1.5 times the character width. The space above and beside a character becomes the spacing between lines and characters.



Character Spacing

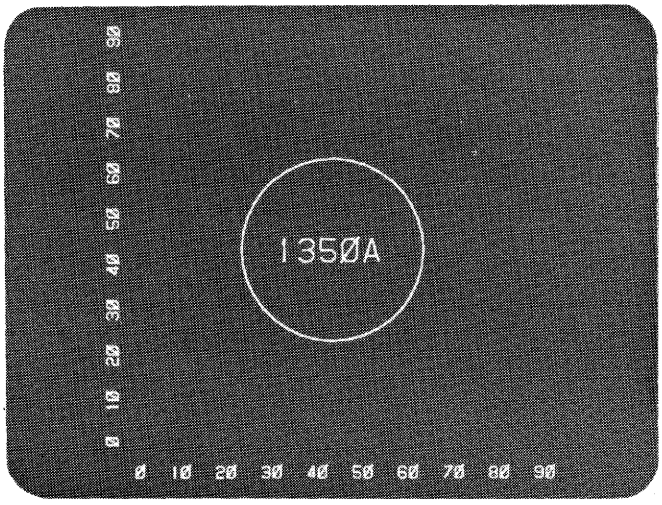
The following example using the 9825A Computer demonstrates the Text mode of operation with Character Size specified:

```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
2: fmt 1,f4.0,",",f4.0,";"
3: wrt 718,"pe0,::pa330,475;"
4: wtb 718,"pe1,::cs2,::tx 1350A",3,13,10
5: wrt 718,"pe0,"
6: for A=0 to 360 by 10
7: wrt 718.1,"pa",200sin(A)+500,200cos(A)+500
8: wrt 718,"pe1,"
9: next A
10: end
```



The following example shows how to use variables to label using a 9825A. This type of labeling is useful for graphs.

```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
2: fmt 1,f4.0,",",f4.0,";"
3: fmt 2,f4.0,1b
4: wrt 718,"pe0,::pa330,475;"
5: wtb 718,"pe1,::cs2,::tx 1350A",3,13,10
6: wrt 718,"pe0,"
7: for A=0 to 360 by 10
8: wrt 718.1,"pa",200sin(A)+500,200cos(A)+500
9: wrt 718,"pe1,"
10: next A
11: 0→I
12: for X=0 to 900 by 100
13: wrt 718.1,"pe0,::pa",X,0
14: wrt 718.2,"pe1,::cs1,::tx",I,3
15: I+10→I
16: next X
17: 0→J
18: for Y=0 to 900 by 100
19: wrt 718.1,"pe0,::pa",30,Y
20: wrt 718.2,"pe1,::cs5,::tx",J,3
21: J+10→J
22: next Y
23: end
```



Another method of labeling using variables in the X axis only is:

```
0: fmt 1,5f5.0,1b
1: 10→X
2: wrt 718.1,"pe1,::cs1::tx",X,X+10,X+20,X+30,3
```

Chapter 5
Files

This chapter discusses Memory Organization and File instructions.

Each vector coordinate, character, or symbol is one Memory location or word.

A total of 2048 words may be stored.

The words may be all PA instructions or all text characters and symbols, or a combination.

Wrap-around

If total memory size is exceeded, a Wrap-around condition exists. Wrap-around is not the same as PA X and Y coordinates exceeding plotting area size. When Wrap-around occurs, words that do not have room to be written into memory (locations greater than 2047), will be written into the first memory locations starting with location 0000.

NOTE

Any time information is stored at a location containing previously stored information, the original information will be replaced by the new information.

Example:

Word 2060 will be Wrapped-around to location 13, i.e., 2060–2048=12, counting 0000 as the first location.

Memory Word Format

Each word contains information for one X coordinate, Y coordinate, pen status, file number, status of the file containing that word (file blanked or unblanked), and which display or displays will be affected.

X INFO	Y INFO	PEN STATUS	FILE NO.	FILE BLANKING STATUS	AUX BLANKING
PA	PA OR TEXT CHAR	PE1 PE0	NF SN	BF UF	WX SX

If status information is not sent to the 1350A before or after each PA instruction, character, or symbol, (as required), the conditions of the previous PA instruction, character, or symbol, are assumed.

File Instructions

The 1350A memory may be divided into as many as 32 files. Each file can have as little as one word, or the entire memory (2048 words) may be named as one file.

The initialization statement erases all file names, and assigns all memory locations to file zero. Therefore, if a file is not named, the entire memory remains file zero.

The total size of all files must not exceed memory size.

From a software point of view, blanking and unblanking a complete file is simpler and more efficient than it is to blank and unblank each memory location that contains the vectors, characters, or symbols.

Vectors, characters, or symbols that must be displayed continuously, as opposed to those to be displayed periodically during a program should be assigned to different files.

Find Location

Syntax:

FL [memory location],

Find Location moves the write pointer to the specified memory location. The parameter for the memory location is 0000 thru 2047.

The next word written into memory after Find Location (FL) is executed will be written into the location found.

Name File

Syntax:

NF [file number],

Name File names sequential memory locations as part of the indicated file. The parameter for file names is 0 thru 31. Other file parameters are used for 1338A Tri-Color Display applications. These are discussed in the Appendix D.

When a subsequent vector coordinate (PA), character, or symbol, is sent, it is stored as one word in memory, and becomes part of the file named.

Stop Naming

Syntax:

SN (parameter is not required)

Stops Naming memory locations as part of the file named.

If a file is being named, SN should be sent before naming another file. There are conditions in which information can be lost if SN is not sent before another file is named. When developing a file, the location the write pointer is pointing to, becomes the first location of the file.

The Importance of Stop Naming (SN)

Example:

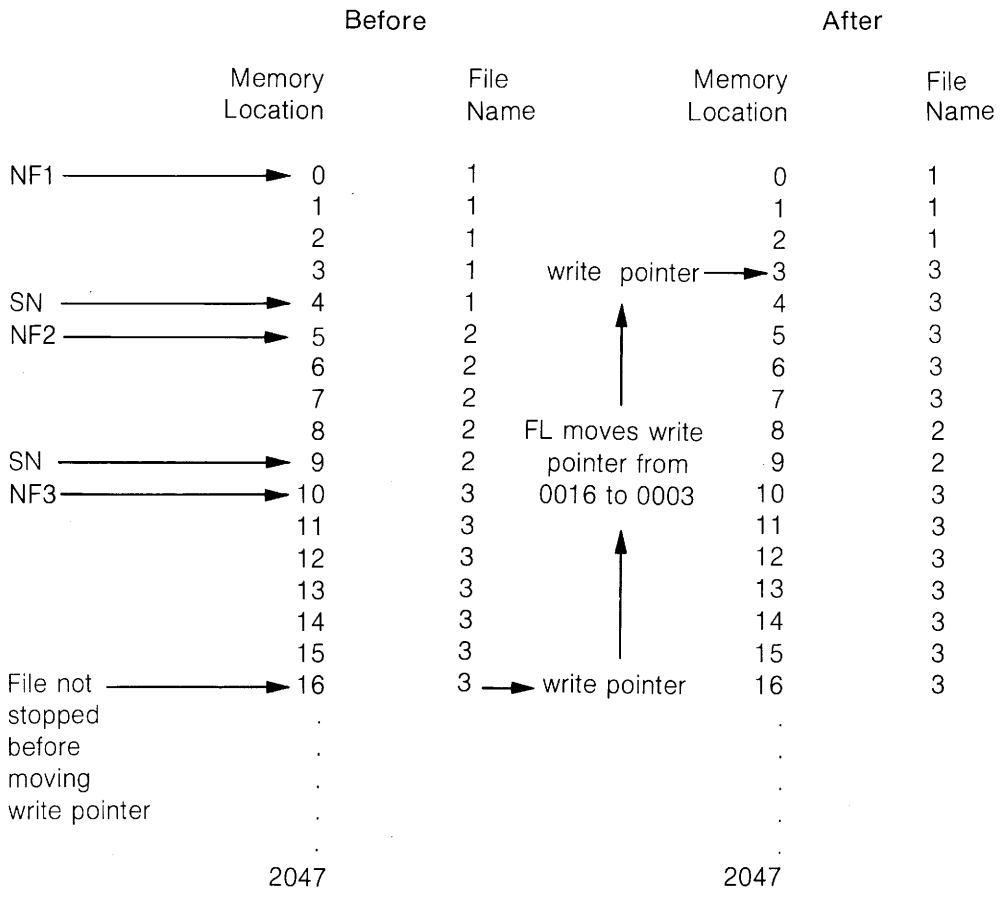
The information in file 1, memory location 0003 and 0004, and file 2, location 0005 thru 0007 needs to be changed.

The write pointer is at file 3, location 0016. FL 0003, is sent, moving the write pointer to location 0003.

Stop Name (SN) for file 3 was not sent before moving the write pointer (FL).

After the write pointer was moved (FL 0003), information at locations 0003 thru 0007 is changed. However, file 3 still remaining "open" renames memory locations 0003 thru 0007 as part of file 3.

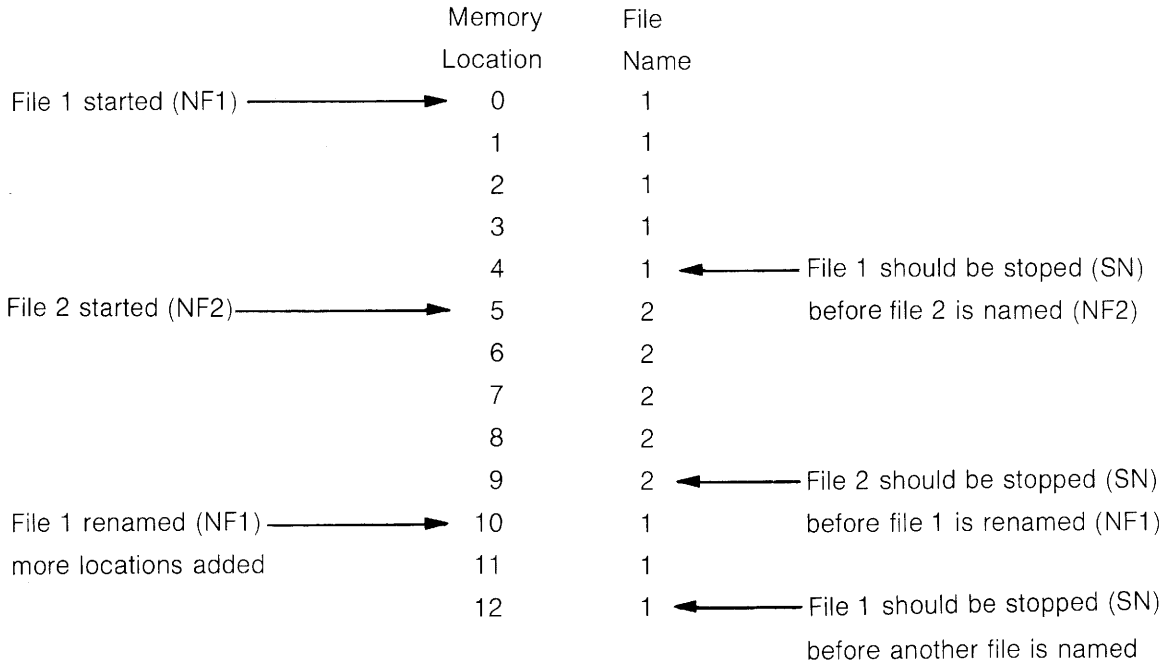
As a result, part of files one and two are now missing. Considerable work with FL, NF, and SN would have to be done to restore the memory to proper order.



All words in a file do not have to be grouped together.

Example:

If a file has been stopped (SN) and more memory locations need to be added to it.



This method works very well when the contents of the file is not going to be changed, i.e., a file containing graph scales or axes, as opposed to a file containing information to be plotted on a graph that is continually being updated.

When working with this type of file organization, the memory locations for each word must be known.

Exceeding File Size

The size of a file can be exceeded and information written into the next file.

Example:

If the information is to be changed in all locations of file 1 (eight in the previous example), and FL 0000, is sent, (moving the write pointer to location 0000), and all eight words are written sequentially, the last three words are written into file 2 (location 0005 thru 0007), and become part of file 2, and the information previously stored in the first three words of file 2 (0005 thru 0007) is lost. The write pointer should have been moved to location 0010 (FL 0010) before writing the last three words of file 1.

Developing Files

A simpler and more efficient way of updating information is to have all file locations grouped together. This may be accomplished by naming files of predetermined size.

The size of the file can be determined by adding together all PA instructions, characters, and symbols that are to be stored in one file.

When storing information, the location of the write pointer becomes the first location of a file. Therefore, Find Location (FL) must be sent before naming the file.

A memory location must have information written into it to become part of a file. A "Dummy" program is used to do this.

Example using a 9825A Computer:

```
0: fmt 1,f4.0,","
1: wrt 718,"f1 0000,"          moves write pointer
2: for F=1 to 8                files names
3: wrt 718.1,"nf",F            names files
4: for N=1 to 200              memory locations in each file
                               blanks "Dummy" vector coordinates
5: wrt 718,"pe0,::pa0,0;"      "Dummy" vector coordinates
6: next N
7: wrt 718,"sn"                stops naming the file
8: next F
```

The 1350A Initialization Statement (refer to Chapter 2) must be sent only once. If it is sent after the files are named, the Erase Memory (EM), and Erase Names (EN), will do exactly that, and the memory will contain one file (file 0) with nothing stored in it. Erase Memory (EM) will not change the files. Erase Names (EN) will erase the file boundaries.

If the main progam contains the Initialization Statement, then the "Dummy" should be part of the main program.

After running the "Dummy" program, the memory will contain eight files named 1, 2, 3, 4, 5, 6, 7, and 8. Each file contains 200 memory locations. The remainder of the memory will be file 0, containing 447 locations.

Using the instructions Find Location (FL) and Find File (FF), information may now be inserted at the desired locations within a file.

Find File

Syntax:

FF [file name],

The file names are 0 thru 31.

Find File (FF) automatically moves the write pointer to the first memory location of the file found.

Find File (FF) is a good instruction to use when writing information into a file for the first time, or when changing the entire contents of a file.

If a memory location other than the first location of a file is to be changed, Find Location (FL) must be used.

Memory locations remain sequential from 0000 thru 2047 regardless of the files.

Example:

In the "Dummy" program, the write pointer was moved to 0000 (FL0000). The files contain the following locations:

File one	0	thru	199
File two	200	thru	399
File three	400	thru	599
File four	600	thru	799
File five	800	thru	999
File six	1000	thru	1199
File seven	1200	thru	1399
File eight	1400	thru	1599
File zero	1600	thru	2047

Due to the initialization statement the entire memory was named file 0. Any location not being named will remain part of file 0.

Erase File

Syntax:

EF [file name],

Erase File (EF), erases the information of all memory locations contained in the file named. The file name is that of previously named files.

The previously named memory locations of a file, remain as elements of that file.

Erase File (EF) moves the write pointer to location zero. Therefore, the write pointer must be moved using either Find File (FF), or Find Location (FL), before entering new information into memory (PA coordinates, characters, or symbols). If the write pointer is not moved, the information will be stored at location zero, and the sequential locations following, changing previously stored information.

Blank File

Syntax:

BF [file name],

Blank File (BF) blanks all PA coordinates, characters, and symbols contained in the file named. The file name is that of previously named files.

Unblank File

Syntax:

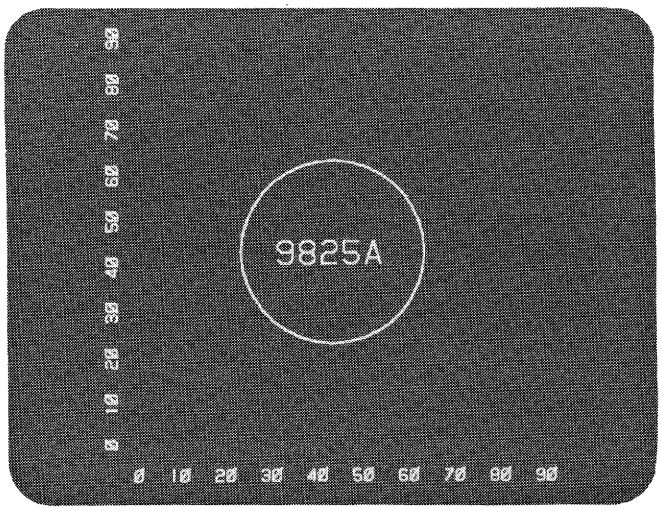
UF [file name],

Unblank File (UF) unblanks all PA coordinates, characters, and symbols contained in the file names. The file name is that of previously named files.

In the following example using the 9825A, all of the file instructions are used except Find Location (FL). The program presents the example in Chapter 4. The instructions have been divided into files, then a blinking routine lines 26-34 blinks each file. The last lines 36-38 completely rewrite file one. They could have been entered manually.

```
 0: cli 7
 1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
 2: fmt 1,f4.0,",",f4.0,";"
 3: fmt 2,f4.0,lb
 4: fmt 3,f4.0,","
 5: wrt 718,"nf1,::pe0,::pa330,475;"
 6: wtb 718,"pe1,::cs2,::tx 1350A",3,13,10
 7: wrt 718,"pe0,::sn::nf2,"
 8: for A=0 to 360 by 10
 9: wrt 718.1,"pa",200sin(A)+500,200cos(A)+500
10: wrt 718,"pe1,"
11: next A
12: wrt 718,"sn::nf3,"
13: 0→I
14: for X=0 to 900 by 100
15: wrt 718.1,"pe0,::pa",X,0
16: wrt 718.2,"pe1,::cs1,::tx",I,3
17: I+10→I
18: next X
19: wrt 718,"sn::nf4,"
20: 0→J
21: for Y=0 to 900 by 100
22: wrt 718.1,"pe0,::pa",30,Y
23: wrt 718.2,"pe1,::cs5,::tx",J,3
24: J+10→J
25: next Y
26: wrt 718,"sn"
```

```
27: for L=1 to 4
28: for M=1 to 5
29: wrt 718.3,"bf",L
30: wait 200
31: wrt 718.3,"uf",L
32: wait 200
33: next M
34: next L
35: wait 1000
36: wrt 718,"efl,::ffl,::pe0,::pa380,475;"
37: wtb 718,"pel,::cs2,::tx9825A",3,13,10
38: wrt 718,"pe0,"
39: end
```



Another way to change the text in file one (line 6) would be:

```
0: wrt 718,"f1 0002,"
1: wtb 718,"pel,::cs2,::tx9825A",3,13,10
```

Note Character Size 2 (cs2) must be sent before the text instruction. The last character size sent to the 1350A was cs5 in line 23. As indicated in Chapter 4, the 1350A remains in a given character size until told to change to a different one.

Chapter 6
Display Blanking

Auxiliary Instructions

This chapter discribes Auxiliary Instructions.

The Auxiliary Instructions are used to display information on combinations of displays using the four TTL Outputs of the 1350A.

The TTL Outputs are connected to the displays as shown in Chapter 1.

Switch S2 on the removable Input/Output Printed Circuit Board allows the TTL Outputs to be internally mixed with a "Blanking Oscillator" to blink the information being displayed.

Wrtite Auxiliary

Syntax:

WX [TTL Blanking and Unblanking Parameter],

The Write Auxiliary instruction blanks or unblanks the displays in various combinations determined by the parameter sent.

TTL Blanking and Unblanking Parameter

WX Parameter	Display 1	2	3	4
0	U	U	U	U
1		U	U	U
2	U		U	U
3			U	U
4	U	U		U
5		U		U
6	U			U
7				U
8	U	U	U	
9		U	U	
10	U		U	
11			U	
12	U	U		
13		U		
14	U			
15				

U = Display unblanked

= Display blanked

To understand Auxiliary Instructions, think about the sequence of instructions in the program.

When a WX instruction occurs in a program, the information following the WX will be displayed on the displays indicated by the TTL Parameter. When another WX instruction occurs, the information following it will be displayed on the displays indicated by the TTL Parameter for that WX instruction.

The combination of displays the information is being displayed on, remains in effect regardless of changes in the information.

To change the combination of unblanked displays, the WX instruction parameter must be changed.

Before sending another WX instruction, Stop Auxiliary (SX) should be sent. If SX is not sent, the same problems that can be encountered when using files and not sending SN, can be encountered when using WX to assign Auxiliary Blanking Status to memory locations.

Stop Auxiliary

Syntax:

SX (parameter is not required)

Stop Auxiliary stops assigning the Auxiliary Blanking Status of each memory location to the displays indicated in the WX instruction.

The Importance of Stop Auxiliary

When using the Write Auxiliary instructions, Stop Auxiliary should be sent before using the following instructions: UM, BM, EF, UF, BF, EM, PA, and TX. These instructions are all associated with displaying or not displaying information on displays. (PE is part of the PA and TX instructions.)

If SX is not sent, the new information being developed could be assigned to the displays indicated by the current WX parameter. The information could be displayed unintentionally or be displayed on the wrong display or displays.

Updating Displayed Information

If a program is developed sequentially (WX instruction, then the information to be displayed following, with more information added to the same WX instruction later in the program), it becomes difficult to update the information, or to display the entire group of information on different displays at a later time.

One way to simplify the problem is to combine the information into a file. Then preceed the file with a WX instruction. If the information is to be displayed on a different display or displays, only one change needs to be made, the WX parameter.

Example: wrt 718,"wx3,::uf4,::sx" displays file 4 information on displays 3 and 4.
wrt 718,"wx12,::uf4,::sx" displays file 4 information on displays 1 and 2.

If the information needs to be updated, it is easy to find in the 1350A memory because it is grouped together as one file. After sending Stop Auxiliary, Find File is used to move the write pointer, then the information is changed (see Chapter 5).

Hardware Blinking

Using internal 1350A blinking circuits, TTL Outputs 1, 2, and 3 can be set to blink the display automatically any time Write Auxiliary instructions 8 thru 15 directs them to unblank (see table below).

When using the blinking feature, Display 4 must remain blanked.

To allow the hardware blinking circuit to blink a display, the associated hardware blink switch (S2) must be in the on position (see photograph of 1350A Input/Output Printed Circuit Board). This may be accomplished by removing the plug-in board from the rear panel of the 1350A.

If Display 4 is unblanked using Write Auxiliary instructions 0 thru 7, the hardware blinking circuit will be disabled and Displays 1, 2, and 3 will no longer blink. The Displays will still be unblanked regardless of S2 switch settings.

The 1350A is shipped from the factory with all Hardware Blink Switches (S2) set to the off position.

Hardware Blink Switch Settings (S2)

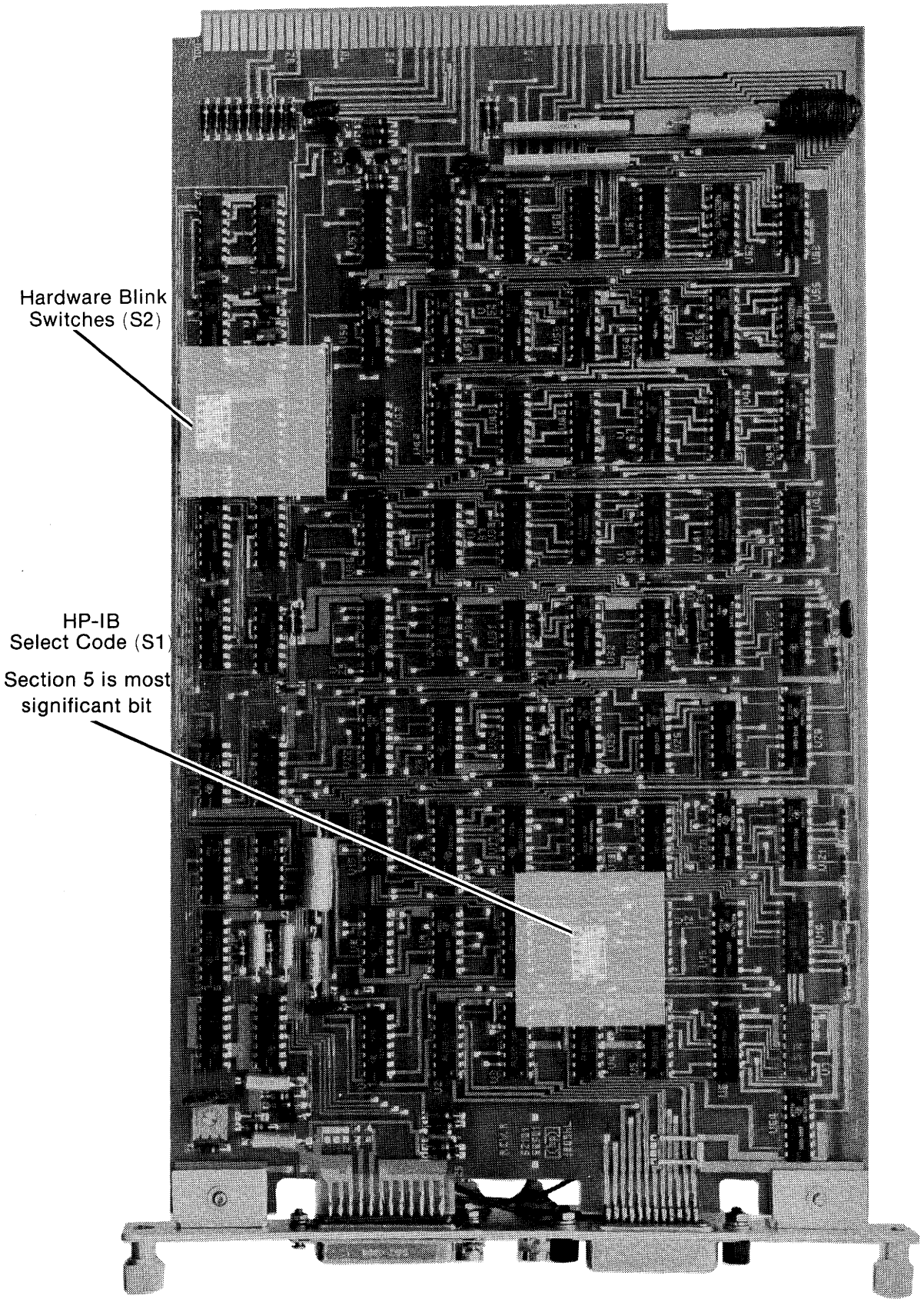
WX Inst	Display 1	2	3	4
0	U	U	U	*
1		U	U	*
2	U		U	*
3			U	*
4	U	U		*
5		U		*
6	U			*
7				*
8	B	B	B	
9		B	B	
10	B		B	
11			B	
12	B	B		
13		B		
14	B			
15				

U = Display unblanked, not blinking

= Display blanked

* = If display 4 is unblanked using WX0-7, Hardware blinking is disabled on displays 1, 2, and 3 regardless of S2 switch settings.

B = Display blinking

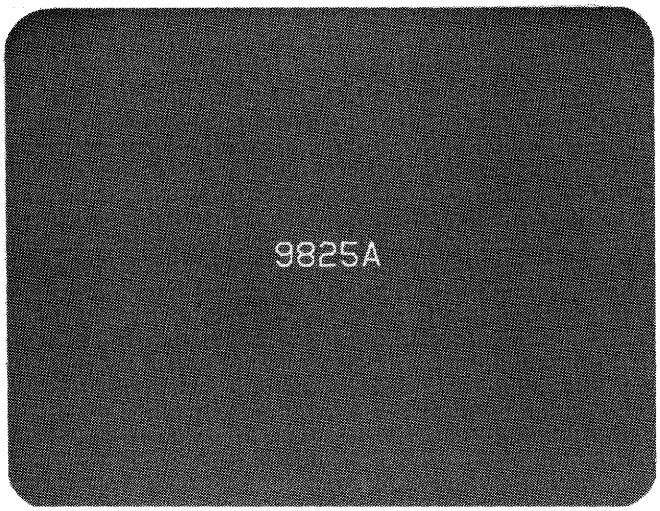


1350A Input/Output Printed Circuit Board

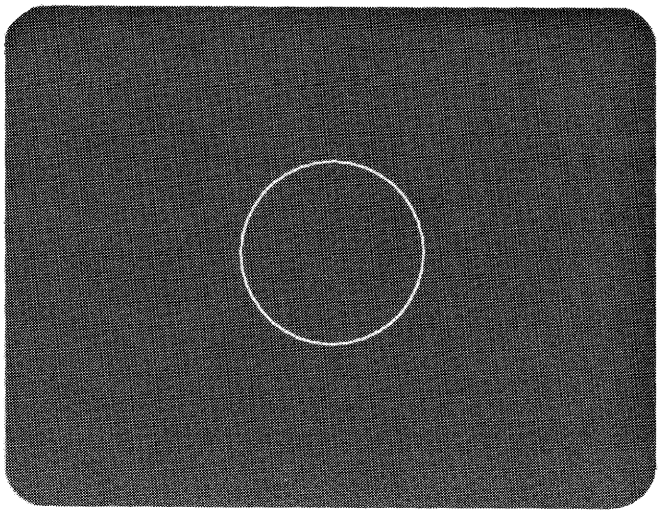
The following program uses WX instructions to display different information on displays. The information is the same as used for Files in Chapter 5.

The blinking information is due to the software. For continuous hardware blinking, the hardware blink switches must be turned on as indicated in the Hardware Blink Switch Setting Table.

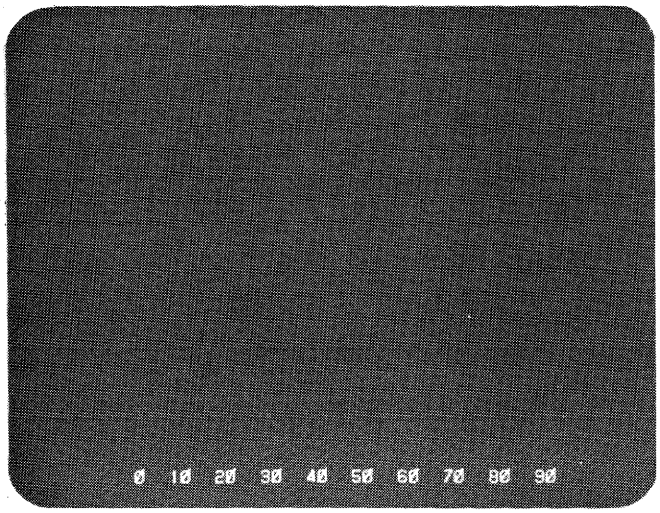
Display 1, "9825A", WX 14,
TTL Output 1



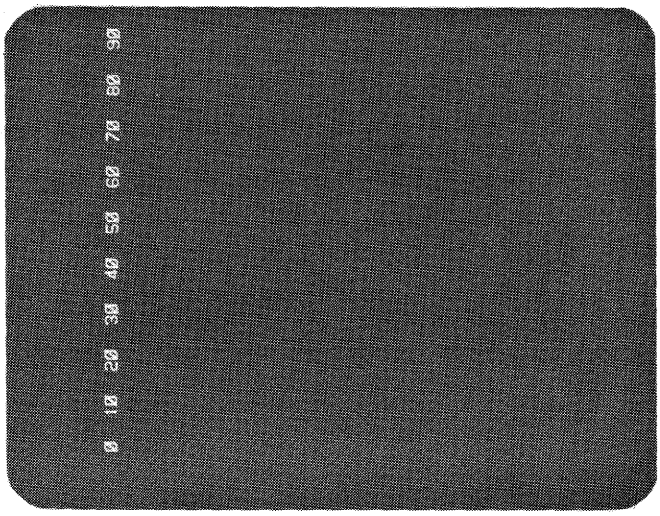
Display 2, "circle", WX 13,
TTL Output 2



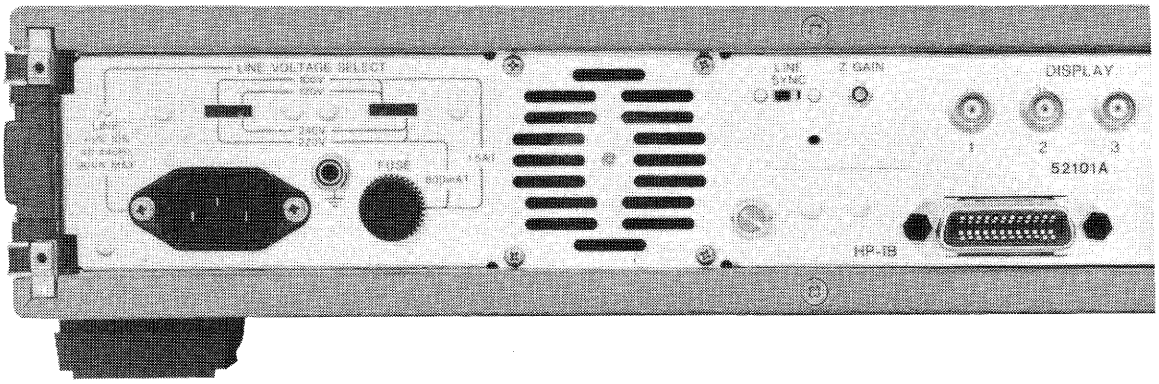
Display 3, "horizontal graph axis", WX 11,
TTL Output 3



Display 4, "vertical graph axis", WX7
TTL Output 4



```
0: cli 7
1: wtb 718,3,20,13,10,"em::en::ex::sn::sx::um::"
2: fmt 1,f4.0,",",f4.0,";"
3: fmt 2,f4.0,1b
4: fmt 3,f4.0,","
5: wrt 718,"wx14,::nf1,::pe0,::pa330,475;"
6: wtb 718,"pe1,::cs2,::tx 1350A",3,13,10
7: wrt 718,"pe0,::sn::sx::wx13,::nf2,"
8: for A=0 to 360 by 10
9: wrt 718.1,"pa",200sin(A)+500,200cos(A)+500
10: wrt 718,"pe1,"
11: next A
12: wrt 718,"sn::sx::wx11,::nf3,"
13: 0→I
14: for X=0 to 900 by 100
15: wrt 718.1,"pe0,::pa",X,0
16: wrt 718.2,"pe1,::cs1,::tx",I,3
17: I+10→I
18: next X
19: wrt 718,"sn::sx::wx7,::nf4,"
20: 0→J
21: for Y=0 to 900 by 100
22: wrt 718.1,"pe0,::pa",30,Y
23: wrt 718.2,"pe1,::cs5,::tx",J,3
24: J+10→J
25: next Y
26: wrt 718,"sn::sx"
27: for L=1 to 4
28: for M=1 to 5
29: wrt 718.3,"bf",L
30: wait 200
31: wrt 718.3,"uf",L
32: wait 200
33: next M
34: next L
35: wait 1000
36: wrt 718,"ef1,::ff1,::pe0,::pa380,475;"
37: wtb 718,"pe1,::cs2,::tx9825A",3,13,10
38: wrt 718,"pe0,"
39: end
```



Line Voltage Select Switch Location

Appendix A

AC Power Requirements

The 1350A Graphics Translator requires a power souce of 100, 120, 220, or 240 volts AC +5% −10%, single phase, 48 Hz to 440 Hz. Average power dissipation at 60 Hz, 120 V without any options is approximately 80 watts.

> **CAUTION**
>
> INSTRUMENT DAMAGE MAY RESULT IF THE LINE VOLTAGE SELECTION SWITCHES ARE NOT SET CORRECTLY FOR THE INPUT POWER SOURCE BEING USED.

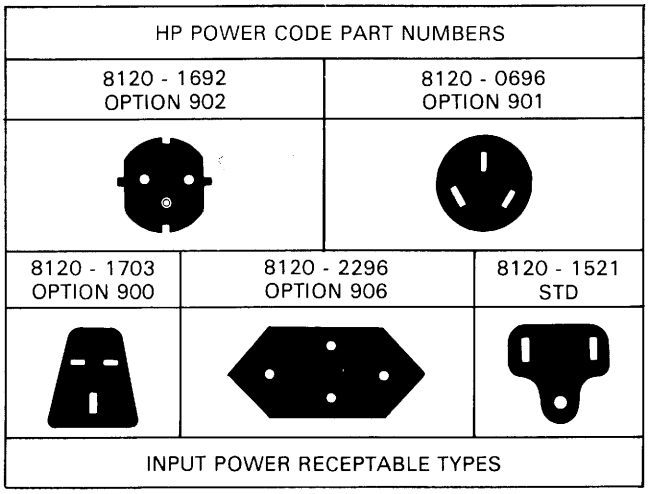
The instrument is normally set at the factory for the applicable line voltage of the shipment destination. However, this selection should be checked before applying power.

To operate the instrument from any other AC power source, proceed as follows:

1. Disconnect the 1350A power cord from the power source.
2. Using a blade-type screwdriver, position the rear-panel Line Voltage Select switches for the desired AC voltage input.
3. For 220 V - 240 V inputs, replace the rear-panel fuse F1 with the 800 mAT fuse (HP Part Number 2110-0020).
4. Connect the 1350A input power cord to the power source.

Appendix B
Power Cord

The Power Cord required depends on the AC input voltage and the country in which the instrument is to be used. The following figure illustrates standard power receptacle (wall outlet) configurations. The HP Part Number shown above each receptacle drawing specifies the power cord equipped with the appropriate mating plug for that receptacle. If the appropriate power cord is not included with your instrument, notify the nearest HP Sales/Service Office and a replacement cord will be provided.



HP Power Cord Part Numbers

Appendix C
Auxiliary Connector

The Auxiliary Connector is provided on the rear panel for connecting the 1350A to the Hewlett-Packard Model 1338A Tri-color Display.

The signals interfacing the 1350A and 1338A may also be used for other applications. The applications are numerous, and beyond the scope of this manual.

The Hewlett-Packard Part Number for the connector that mates with the Auxiliary Connector is 1251-0063. The Manufacturer's Part Number is ITT DBM-25P.

All signals, input or output, at the Auxiliary Connector are standard TTL levels.

Following is a description of all 25 pins.

Pin 1. No connection.

Pin 2. No connection.

Pin 3. No connection.

Pin 4. Same as BNC connector for DISPLAY 1. Unblanks Display 1 of 4 to display information.

Pin 5. Same as BNC connector for DISPLAY 2. Unblanks Display 2 of 4 to display information.

Pin 6. When pin 6 is low, the 1350A is indicating to the device connected to the Auxiliary Connector that it should be in a remote mode, ready to accept information from the 1350A. Pin 6 is also used as a power up reset, holding off pin 9 and pin 13 operation during the reset period.

Pins 7, 8. Pins 7 and 8 provide a 2 bit binary code indicating the color being output by the 1350A. As indicated in Appendix D the color is determined by the file names being used.

Binary Color Code

File Name	Color	MSB Pin 7	LSB Pin 8
16-31	Yellow	0	0
32-47	Red	0	1
48-63*	Yellow	1	0
0-15	Green	1	1

*Files 48-63 not used due to "Wrap-around".

Pin 9. Pin 9 is a positive edge clock that occurs within 25 ns minimum after the binary data. The color data is valid only at the clock edge.

Pin 10. Pin 10 is low while drawing vectors in the 1350A.

Pin 11. Pin 11 is +5 V supply with a 10 ohm resistor in series.

Pin 12. Pin 12 is +5 V supply with a 10 kohm resistor in series.

Pin 13. A low state from the device connected to the Auxiliary Connector will hold-off the 1350A from outputing vectors.

Pin 14, 15, 16. Internal 1350A grounds for signals.

Pin 17. Same as BNC connector for DISPLAY 3. Unblanks Display 3 of 4 to display information.

Pin 18. Same as BNC connector for DISPLAY 4. Unblanks Display 4 of 4 to display information.

Pins 19-25. Internal 1350A grounds for +5 V supply and chassis ground.

Appendix D

File Names for 1338A Tri-color Applications

This section describes the unique use of Files for selecting the color in the 1338A Tri Color Display (refer to Chapter 5 "Files" of this manual).

The File Name (NF) determines the binary code sent to the 1338A. The following table shows the file names and the corresponding colors. Files greater than 47 must not be used due to "Wrap-around".

GREEN	YELLOW	RED
0	16	32
1	17	33
2	18	34
3	19	35
4	20	36
5	21	37
6	22	38
7	23	39
8	24	40
9	25	41
10	26	42
11	27	43
12	28	44
13	29	45
14	30	46
15	31	47

Only 32 files (0 through 31) are used in the 1350A. However, file names 0-47 are necessary to select all three colors in the 1338A.

Files names 32 through 47 "Wrap-around" into files 0 through 15. For example, data entered into file 35 is displayed in red by the 1338A, but due to "Wrap-around" the data is automatically stored in file 3 by the 1350A.

As shown in the following example, files 0 through 7 are used for green, therefore files 32 through 39 cannot be used for red. Conversely files used for red must be able to "Wrap-around" into the unused green files.

	GREEN	YELLOW	RED	
GREEN FILES	0	16	32	CAN NOT BE USED FOR RED
	1	17	33	
	2	18	34	
	3	19	35	
	4	20	36	
	5	21	37	
	6	22	38	
	7	23	39	
CAN NOT BE USED FOR GREEN	8	24	40	RED FILES
	9	25	41	
	10	26	42	
	11	27	43	
	12	28	44	
	13	29	45	
	14	30	46	
	15	31	47	

The specific number of file names for green or red will depend on the user's requirements. Since there are only sixteen files for green and red, file management is important.

Appendix E

1350A Modified ASCII Character Set

0	SPACE	32	SPACE	64	@	96	`
1	SPACE	33	!	65	A	97	a
2	SPACE	34	"	66	B	98	b
*3	SPACE	35	#	67	C	99	c
4	SPACE	36	$	68	D	100	d
5	SPACE	37	%	69	E	101	e
6	SPACE	38	&	70	F	102	f
7	SPACE	39	'	71	G	103	g
8	BACKSPACE	40	(	72	H	104	h
9	INVERSE LINE FEED	41	)	73	I	105	i
*10	LINE FEED	42	*	74	J	106	j
11	VERT TIC MARK I	43	+	75	K	107	k
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PRINTED IN U.S.A.
NOVEMBER 1978