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Figures

1 Quick Start

The following steps will help you to quickly set up and operate your IOLINE plotter. For detailed descriptions of the features and operation of the LP4000, please refer to referenced chapters of the manual.

Installation and Setup Steps

To install and set up your plotter, follow the steps below. Refer to the chapters indicated for detailed instructions:

1. Unpack plotter (Chapter 3)
2. Power up (Chapter 3)
3. Load paper or other plotting media (Chapter 4)
4. Load pen(s) (Chapter 4)
5. Install Multi-Pen Changer Option, if ordered (Chapter 8)
6. Set the plot limits (Chapter 5)
7. Make a test plot (Chapter 4)
8. Cable host computer to plotter (Chapter 3)

9. Set up for on-line plotting (Chapter 5)

10. Remove paper or other plotting media (Chapter 4)

Connecting the Power to the LP4000 Plotter

1. Set the power switch on the rear panel of the plotter to the *off* position.

2. Attach the IOLINE plotter power cord first to the plotter, then to an electrical outlet with a grounding connection (verify plotter voltage select).

3. Turn the plotter power switch on. The red power indicator should light on the keypad panel. At the same time, the yellow indicators will cycle during the plotter self test (approximately 5 seconds). Press [ALT]. After the self test, only the power indicator will remain on. The pen holder will move to the right side for position calibration. Refer to Chapter 8 for Pen Changer operation details.

Loading Paper Into the LP4000 Plotter

1. Position the paper over the drive shaft (gritty rod). Position the paper so that the edge of the paper closest to you is aligned with the row of suction holes (at the front of the plotter). See Figure 5-3.

2. Slide the Chart Hold Wheels over each side of the paper, approximately 3/8 inch to 1/2 inch in from the edge of the paper.

3. Press [CHART HOLD] on the keypad.

Loading a Pen into a Pen Flange

1. Insert a pen into a Pen Flange (pen adaptor).

2. Remove the pen cap.

3. Gently slide the Pen Flange into the Pen Holder from the front. If the Multi-Pen Changer and carrier are installed, slide the pen into the pen #1 stall. See Chapter 8.

Setting the LP4000 Plotter Limits

Arrows on the keypad indicate the direction the pen moves relative to the paper. See Chapter 5 for more information on keypad functions. To set the plotter limits:

1. Use the Arrow keys to position the pen at the near right corner of the paper, approximately 1/2 inch in from the right and front edges of the paper. See Figure 5-3.

2. Press the following keys in the sequence shown.

   [LL] [SIZE] [HOME 5 FAST] [SIZE]

   This sets the limits for an 'A' size (8-1/2 by 11 inch) drawing. See Table 5-1 for other sizes.

Making a Test Plot

1. Be sure "A" size paper is loaded, with the pen in the lower left corner.

2. Press [ALT] [`7]

   Note: If [`7] is held for at least 2.5 seconds, 4 pens will be used.

Connecting the LP4000 to the Host Computer

1. Be sure your communication cable is properly configured. See Chapter 2 for the proper pin and cable configuration for your host computer.

2. Attach one end of the cable to the Host/Modem port. Attach the other end of the cable to a serial port on the host computer.

3. Verify that the host's serial port has been selected properly.

4. Verify that the host communications parameters are set for 9600 baud, no parity, 8 data bits, 1 stop bit. For example, to set serial port 1 on MS/PC DOS computers, use the DOS command `MODE COM1:96,N,8,1,P`.

Setting the On Line Condition

1. Be sure you have completed the instructions above for loading paper and setting the plotter limits.

2. Use the Arrow keys to move the pen to the Lower Left corner of the plot. See Figure 5-3.

   Press [LL].

3. Press [SIZE] *n* [SIZE] [ON LINE], where *n* is a paper size. See Figure 5-4.

   If the *On Line* indicator lights, the plotter is ready to receive plot data from the host computer.

   Note: Some plots request a pen change at the beginning of the plot. In such cases, the red Pen light and one or more yellow lights indicate a pen change is required. See Fig 5-2 for pen number. Load requested pen.

4. Press [ALT] to continue.

Removing the Paper from the Plotter

1. Press the [ON LINE] key to take the plotter off line.

2. When the *On Line* light goes off,

   Press the [CHART HOLD] key to raise the Chart Hold Wheels

3. Remove the paper.

2) Introduction

The IOLINE LP4000 Plotter adds the convenience of a large production format in addition to its single pen and multiple pen capabilities. The IOLINE LP4000 Plotter has a useful plot area of 35.8 inches by 81.9 inches and supports a variety of paper sizes from 1.5 inches wide to architectural 'E' size drawings (36 x 48 inches and A0 through A4 metric sizes). Various plotting media can be accommodated in sizes up to 37.5 inches wide, and 83 inches long (or longer with roll media).

The tactile touch "snap action" keyboard lets you specify:

- On/off line modes
- Home and Origin position
- Floating origin position
- Chart viewing/plot pause
- Plotter self-test and reset functions
- Plot rotation
- Plot size selection
- Plotting scale
- Micro calibration
- Pen-moves up and down and eight directions
- Pen number selection
- Pen speed selections (up to 20 inches per second) and pen delay times
- Plotting Window and Viewport options
- hyperBUFFER modes (optional equipment)
- Baud rate selection
- Non-volatile memory programming

The keyboard panel indicator lights show you:

- Whether the power is on or off
- When a diagnostic test is in progress
- When a pen change is requested
- Warnings and error conditions
- When the plotter is ready to use

The LP4000 Plotter accepts a wide variety of plotting media including paper, mylar, and acetate. A wide selection of plotter pens are also well suited.

The LP4000 Plotter can plot ASCII characters automatically, drawing the character shapes directly from ROM-based character descriptions within the plotter and eliminates the need for special host-based software to create plotting characters.

The LP4000 Plotter has one RS-232-C communications port. The host computer may communicate directly with the LP4000 Plotter as a Data Terminal Equipment (DTE) device. A cable may be wired to permit communications with the plotter as if it were a Data Communications Equipment (DCE) device.

Specifications

This section lists the LP4000 specifications for your reference.

Physical Dimensions:

Overall Height:	8.75 inches
Base to Platen Height:	4.25 inches
Depth:	9.7 inches
Width:	48.95 inches
Net Weight:	47 pounds
Shipping Weight:	Approximately 63 pounds

Performance:

Addressable resolution:	.001 inch .0025 inch .1mm .005 inch .025mm
Servo resolution:	.0002 inch
Step size	.001 inch
Accuracy	0.2% of move or .010 inch, whichever is greater
Repeatability:	.001 inch .010 inch (with pen change)
Speed:	1 through 20 inches per second (1 ips increments) 20 inches per second axial 28 inches per second diagonal
Acceleration:	.1 to 2 g
Buffer size:	4,000 bytes
Non-volatile memory:	3 users, 20 settings each

Input Power Requirements:

100/120/220/240 VAC (±10%)
50/60 Hz single phase
180 watts

Environmental Range:

Operating Temperature:	0° - 35° C.
Relative Humidity:	30% - 90%

Other Features:

Paper Size:	From 1.5 by 1.5 inches to 37.5 inch wide rolls. Includes all Architectural and Engineering sizes A through E and ISO sizes A0 through A4. Accommodates roll media. Sizes are keypad selectable for standard architectural and engineering drawing sizes 'A' through 'E' (as well as metric sizes 'A4' through 'A0').
Margins:	
Default:	.5 inch on three sides, 1.5 inch on the fourth side.
Minimum:	Edge of medium on three sides, 1.2 inch on the fourth side.
Maximum Plotting Area:	Plotting medium area less margins. Maximum useful plot area is 35.8 x 81.9 inches.
Plotting Media:	Quality bond paper, vellum, double matte polyester, mylar, or acetate film.
Pens:	HP™ compatible (several manufacturers - ie., Koh-I-Noor™, Pentel™, and Staedtler™) liquid ink, disposable fiber tip, or roller ball. Pen adaptor accepts custom fit pens.

Interface:	Asynchronous serial RS-232-C, DB-25S connector, requires DB-25P mating connector on the cable.
Communication Protocol:	8 data bits, no parity, 1 stop bit
Baud Rates:	300, 1200, 2400, 4800, or 9600 (default).
Firmware:	DM/PL™ compatible (See Appendix A).
Options:	Multi-pen changer with 8, 12, 16, or 20 pens. Additional 4-pen trays available. hyperBUFFER: 512k byte optimizing computer/buffer. Sorts by pen number, reorder vectors for highest efficiency, spool plots, stores up to 1 megabyte of plot data. Metal plotter stand. (Oak stand is standard.)

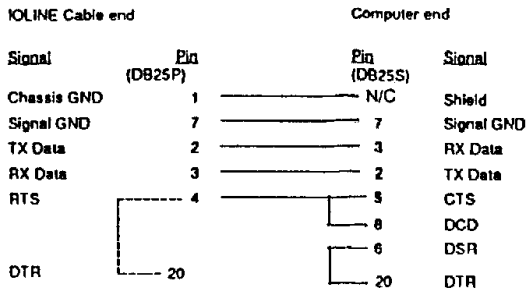
Plotter to Computer Interface

Host or Modem Port (DTE)

Pin Number	Signal	Signal Direction
1	Chassis ground	Shield (if available)
2	Transmit data to host	From plotter
3	Receive data from host	To plotter
4	Request To Send (RTS) to host	From plotter
5	Clear To Send (CTS) from host*	To plotter
7	Signal ground	N/A
20	Data Terminal Ready (DTR)	From plotter

Note: Pins 4 and 20 are internally jumpered.
** Not used in plotter logic.*

The plotter default communication setting is 9600 baud, no parity, 8 data bits, 1 stop bit, and either software (XON/XOFF) or hardware handshake (RTS) protocol. The plotter is a DTE device, and requires null-modem cabling, with a DB25P (male) connector at the plotter end. The following is recommended:



Note: Pins 4 and 20 at the plotter end are internally jumpered.

Figure 2-1. Cable diagram LP4000 to IBM-PC.

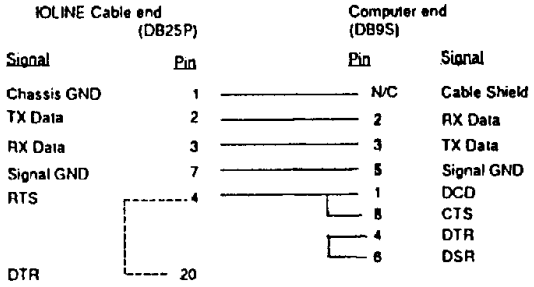


Figure 2-2. Cable diagram LP4000 to IBM-AT.

3 Installation

This section provides the plotter specifications, describes the LP4000 Plotter component parts and shows you how to install your IOLINE plotter correctly. It is important for you to read this section before installing your LP4000 plotter. If you have questions, contact your IOLINE sales representative.

Components Check List

The following components are included in the LP4000 packing box:

LP4000 Plotter

Qty	Component
1	The LP4000 plotter
1	Power cord
2	Pen flanges
4	Pens
1	Manual
1	Utility Diskette
1	Paper cutter
1	Tool kit

Multi-Pen Options

Qty	Component
1	Pen Tray Carrier
2	Pen Trays
8	Pen Flanges
1	Convenience rack (2 parts)

Power Source

Use the plotter only at one of the following voltages: 100, 120, 220, 240 VAC 50/60 Hz. Verify that the voltage select card is properly installed to

match available line voltage. Do not connect the plotter to a circuit that supplies power to brush type motors unless an isolation transformer or a high frequency filter has first been installed. Unless protected, electrical noise from brush type motors and other heavy electrical loads can cause plotter errors.

Operating Environment

Do not install or operate the IOLINE LP4000 Plotter under the following environmental conditions:

1. Ambient temperature exceeds 35° C (95 F).
2. Ambient humidity is outside the 30%-90% range. Use a humidifier or static electricity protection mat in extremely dry climates to prevent data destruction.
3. Constant vibration.
4. Direct sunlight.
5. Plotter supporting surface is not flat and level.
6. Corrosive atmosphere.
7. Strong magnetic fields, such as magnetic equipment or large motors.
8. The air is dusty. Excessive dust will damage the unit.

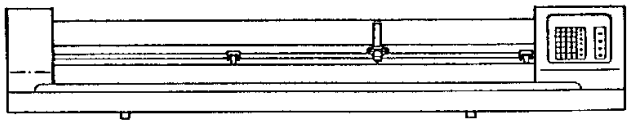


Figure 3-1. LP4000 Plotter Front View.

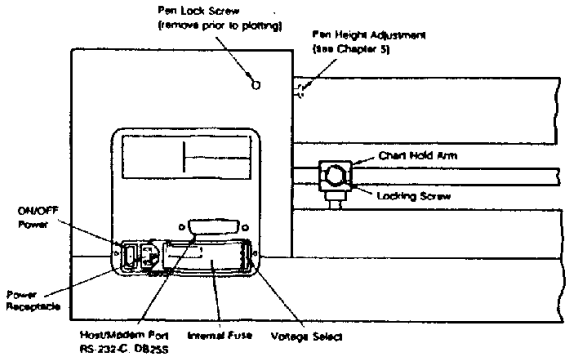


Figure 3-2. LP4000 Plotter Rear Panel View.

Selecting a Plotter Platform

The IOLINE LP4000 plotter may be placed on a sturdy elevated platform. Such a platform may be a table or one of the optional IOLINE plotter stands. Two IOLINE plotter stands are available that can support roll stock. When ordering, use the following part numbers:

- Oak, IOLINE part number PN 100767 (standard)
- Metal, IOLINE part number PN 100764 (optional)

To accommodate 'E' size drawing paper, the recommended height for the plotter supporting surface is 43 inches. If you use a table to support the plotter be sure it is level, smooth and clear of obstructions to paper movement.

Connecting the Plotter

The power connection is made through a conventional power cord with three prongs: live, neutral, and earth ground. The internal plotter frame and housing is connected to the ground lead, which protects you from electrical shock. If you are using a 3/2 adaptor in a 2-prong outlet be sure that the grounding wire is securely fastened to the outlet cover screw and that with either the 2- or 3-prong outlet, the ground lead is properly connected to a known ground.

Unlocking the Carriage/Pen Holder and Chart Hold Arms

The two Chart Hold Arms are shipped locked at the left side of the plotter. Loosen both Chart Hold thumb screws (white screws reached from the rear of the plotter) and slide one of the arms toward the right side. See Figures 3-1 and 3-2.

A foam block protects the pen holder from damage when the plotter is transported. Remove and save this foam block.

Connecting the Power to the Plotter

1. Be certain the power switch located on the rear panel is turned off.
2. Verify that a 250 volt, 2.0 amp fuse (Slow-Blow 3AG type) is in the fuseholder.
3. Verify that the voltage selector on the plotter rear panel is set to match available line voltage.
4. Plug the power cord tightly into the 3-prong power receptacle located on the rear panel.
5. Plug the power cord into the proper AC power source (wall outlet).

Plotter Default Settings

The settings shown in the list below are present as default whenever the power is turned on the LP4000 or when the plotter is reset.

1. Paper size: None.
2. Pen speed: 20 inches per second.
3. Diagonal pen speed: 1.4 times axial, if no speed is selected from the keypad. Otherwise, pen speed is restricted to axial speed.

   Host commands or keypad settings (fast mode) establish the maximum speed of manual pen movements.
4. Step size: .0025 inches
5. Acceleration: 1 g

Off Line Mode Default Settings

1. Pen number: zero (0).
2. Scale: 100% (both axes).
3. Plot rotation: Lower Left at the front, right side of paper in plotter, x-axis is paper movement direction, y-axis is pen motion direction.
4. Origin: same as that established by pressing the [u] key.
5. Pen up delay: 16 milliseconds before a pen move after a pen up.
6. Delay down delay: 50 milliseconds delay before a pen move after a pen down.
7. Communications parameters: 9600 baud, no parity, 8 data bits, 1 stop bit.

8. hyperBUFFER mode (if installed): Mode 3, full optimization.

Connecting the Plotter to the Computer

The LP4000 is designed to interface with a computer system in either *direct* or *pass-through/intercept* mode.

Direct Mode

In direct mode, connect the plotter to your host computer just as you would any other serial device, such as a printer. See Figure 3-3 and the configuration description below.

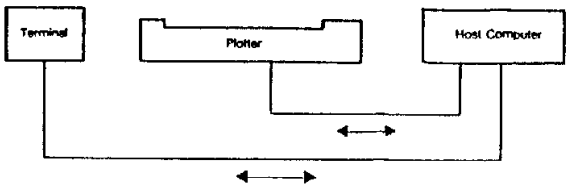


Figure 3-3. Connecting the Plotter.

1. Connect the male end of an interface cable (DB-25P, as described in this manual) to the Host or Modem port on the rear panel of the plotter.

2. Connect the other end of the interface cable to a host computer serial port.

3. Connect the host computer and the terminal as usual.

   Note: Be sure to correctly configure the serial port for computer output. See Chapter 1.

Pass-Through/Intercept Mode

In pass-through/intercept mode, the IOLINE plotter is connected between the host computer and a serial device, usually a display terminal. This configuration allows the host computer with a single serial port to communicate with both the IOLINE plotter and a serial device.

The pass-through/intercept mode also uses the IOLINE RS-232-C serial I/O port. See Figure 3-4 and the configuration description below.

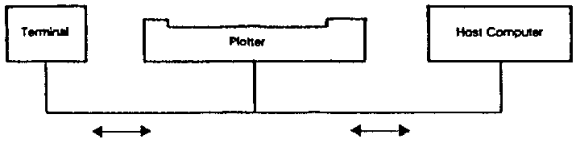


Figure 3-4. Connecting the Plotter as a Pass Through/Intercept Device.

1. Connect the male end (male RS-232-C) of an IOLINE interface cable to a "Y" cable attached to the plotter's Host/Modem Port.

2. Connect the other end of the interface cable to the host computer's I/O port where the host's serial device is normally connected.

3. Connect the display terminal to the plotter's I/O port using the "Y" interface cable (See Figure 3-5).

   Note: On some systems a male/female adaptor may be necessary.

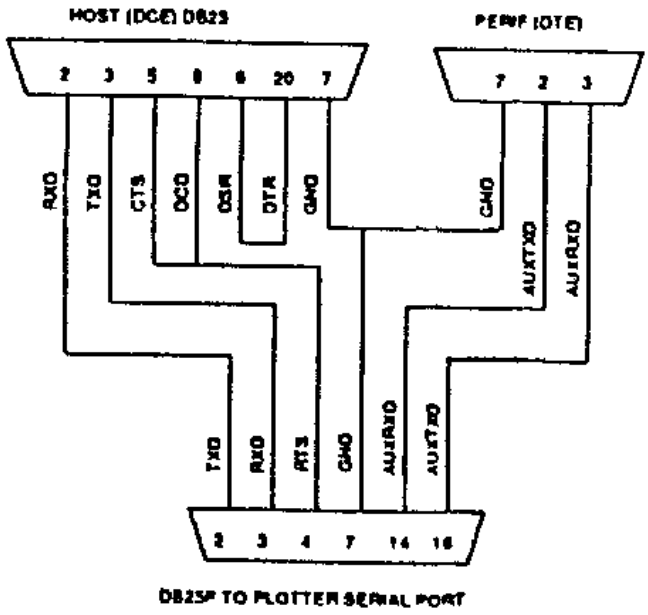


Figure 3-5. Figure 3-5. "Y" Cable Configuration.

4 Getting Started

This chapter provides information about the basic operation of the plotter. Read this section to begin using the plotter immediately. In addition, we recommend that you read the entire manual to find information that will help you take advantage of the many features of the LP4000.

Getting Power to the Plotter

If you need more assistance, refer to Chapter 3.

1. Make certain there are no obstructions to the Pen Holder or to the air exhaust in the bottom of the plotter.

2. Turn on the power switch. The panel lights should sequence immediately. If the power indicator does not light, check that the power cord is plugged in and that a fuse is in the fuseholder. If a fuse is needed, replace it only with a 2 Amp, slow blow, 3 AG type fuse. Press [ALT] to indicate that the pen path is clear of obstructions and to finish self test.

   The fan sound heard after power up is normal; the fan provides cooling and suction pressure for holding the plotting media to the plotter's platten.

Plotter Paper

Any size from 1.5 x 1.5 inches to 36 inch wide rolls can be used. Bond paper, vellum (translucent paper) and double matte film (polyester, mylar, etc) are all popular media. Large plots should be made on material which weighs 1.5 to 4.5 oz per sq yd (50 to 150 gm per sq m). The material should be flat, it should accept and "remember" the grit pattern and it must resist stretching. (The chart hold wheels on the plotter tension the paper to help hold it flat.) The material must also be compatible with the pen and ink type to be used.

Loading the Paper

The term *paper* used throughout this document means any plotting media you are using at the time. Paper and media are also often referred to as charts. Most check plots can be done on any type of bond paper that is clean and free of wrinkles.

Loading Cut Sheets

1. Place the paper over the platen with the long dimension of the paper perpendicular to the platen. The right edge of the paper should be about 2 inches from the right side of the platen. See Figure 5-3.

2. Slide the paper in until the edge of the paper nearest you is aligned with the near edge of the suction holes on the platen. Use these holes to align the paper exactly.

3. Slide the left Chart Hold Arm so that it is 3/8 inch to the right of the left edge of the paper. Then slide the right Chart Hold Arm so that is about 3/8 inch to the left of the right edge of the paper.

4.Press the CHART HOLD key to lower the Chart Hold Arms.

You will find the most comfortable method and position for loading various sizes of paper as you gain experience using the plotter. The plotter can be loaded from the rear or from the front. Paper may be placed at any convenient position across the width of the platen.

Note: Do not place paper closer than 1/4 inch to either side of the platen. Do not place a paper edge at the center of the platen where the Chart Hold Wheel would be over the drive shaft center bearing.

If repeated plots are to be made using the same size paper, the locking screws on the back side of the Chart Hold Arms may be tightened to maintain their fixed position. (See Figures 3-1 and 3-2.)

Loading Roll Paper Stock

Prior to plotting, cut paper from roll stock and feed into the front of the plotter by using the following procedure:

1. Allow several feet of paper to hang freely from the front and back platens. Reach through under the plotter and pinch the front and back left edges of the paper together. Similarly, align the right edges of the front and back portions. The paper should now be square with the plotter chassis. Slide the paper left or right as required and lower the pinch wheels. Using the 2 or 8 keys, move the paper until the desired trim line is over the cutter guide track.

2. Place the paper cutter into the recess beneath the edge of the platen nearest you and to one side of the paper.

3. Cut off the paper using the bottom edge of the platen as a guide.

Assembling the Pen and Flange

The pen flanges (adaptors) supplied with the LP4000 are reusable (reorder PN 37.040505 from your parts dealer). One has been mounted with a pen. Make a note of how the flange is mounted. (Figures 3-1 and 8-1.)

1. A new pen can be mounted by hand by inserting it into a flange until it has stopped against the web on the flange.

2. To remove a pen from its flange, replace the pen cap and, holding the flange firmly, push on the pen *cap* until the pen slides out.

Remember: pens are disposable, flanges are not. You may want to preload flanges with a pen of every color or type that a plot requires prior to plotting.

Loading the Pen Into the Plotter

Test the pen (packed with your LP4000) on scratch paper to be sure the pen inks well.

1. Remove the cap and insert the pen flange into the holder (from the front, between the upper fork of the pen holder and the jaw), while gently raising the holder to avoid letting the pen point touch the platen or the paper.

   Note: You may lift the pen holder gently until it stops against the dust cover without causing damage.

   CAUTION: Do not use the pen holder to move the pen side to side. Damage to the pen holder assembly will result in reduced plot quality.

   The pen is now loaded and ready for plotting.

Moving the Pen From the Keypad

1. Press one Direction key at a time (see Chapter 5) to move the pen in the direction of the arrow. Try each key separately.

   CAUTION: Do not use the pen holder to move the pen side to side. Damage to the pen holder assembly will result in reduced plot quality.

Making a Test Plot

The IOLINE self test routines check the plotter's logic circuitry and mechanical performance. To make a test plot:

1. Use the Direction keys described in Chapter 5 to move the pen so that the pen point is approximately 1/2 inch to the left of the right hand edge of the paper, and approximately 1/2 inch behind the edge of the paper nearest you. This position is Lower Left at coordinates 0,0. See Figure 5-3 for paper orientation.

   Note: The raised pen position is slightly ahead of the pen's paper contact point.

2. Press the [ALT] key.

   This lights the *Alt* indicator next to the [ALT] key.

3. Press the [`7] key. This turns off the *Alt* indicator.

   You will see the plotter draw a test plot. The self-test also shows the following information:

   - The programmed ROM revision number.
   - A plot of the resident character set.

- A plot of the LP4000 line types.
- The programmed revision number of the hyperBUFFER™, if it is installed.

Note: Defining the lower left corner in this manner is a shortcut method of establishing the paper dimension parameters for the self-test plot. For an on line plot you must set either the upper right corner or the plot size before the plotter will go on line. (See Chapter 5)

Preparing to Plot from the Host Computer

Complete the following tasks before plotting from the host computer:

1. Make sure the baud rate of the plotter (default 9600) matches that of the computer. See Chapter 5 to set the plotter baud rate.

   Note: The plotter will not communicate at 9600 baud, no parity, 7 data bits, and 1 stop bit. All other combinations at 9600 baud are acceptable.

2. Load the paper.

3. Set the lower left corner (LL) and upper right corner (UR), or paper size. See Chapter 5.

4. Press the ON LINE key.

   Note: If the On Line indicator lights, you have performed the key entry properly. A flashing Error light and flashing Size light indicate a error in setting the lower left corner, the upper right corner, or plot size. The plotter will not go on line until these values are correctly entered.

5. If the plotter does not respond refer to Chapter 9 for maintenance information.

5 Using the LP4000 Plotter

The plotter keypad console performs special functions to guide the LP4000 Plotter's activities. This chapter describes the keypad and other plotter functions. Figure 5-1 shows the IOLINE keypad console.

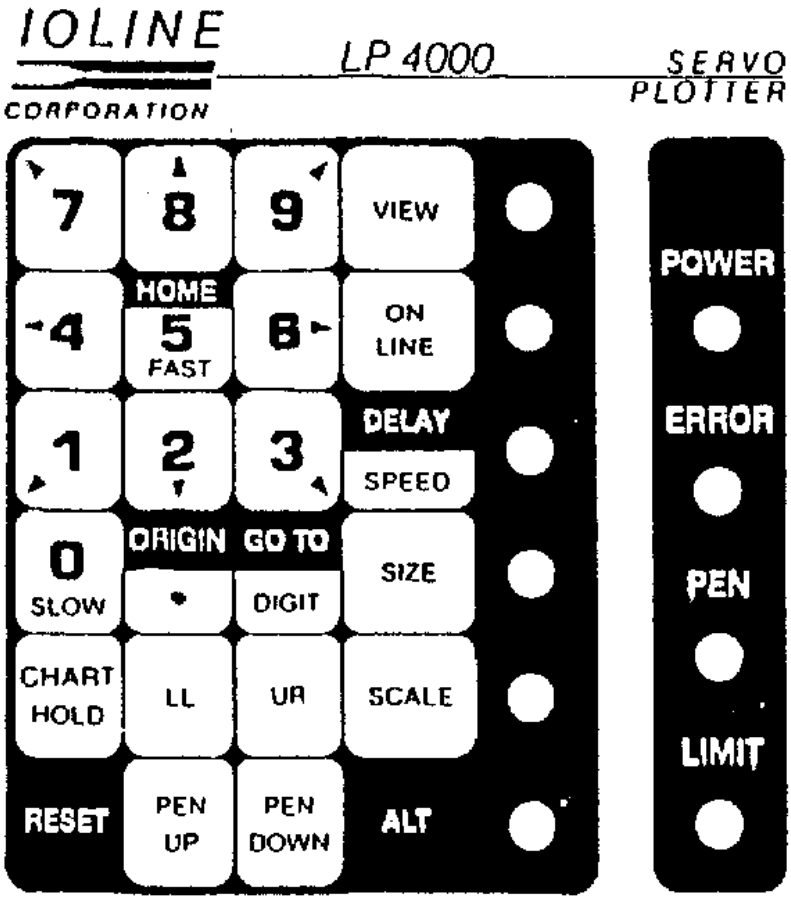


Figure 5-1. The IOLINE Keypad.

The keys perform tasks singly or in combination with other keys. When you need to perform a multi-key task, press each key of the sequence one at a time. *Note: Each direction key moves the pen in the direction indicated on the key. These movements are relative to the paper or plotting medium.*

Key	Description
7	Numeric 7 key; Direction key.
4	Numeric 4 key; Direction key.
1	Numeric 1 key; Direction key.
0 SLOW	Numeric zero key; Manual mode slow pen movement key.
CHART HOLD	Toggle key which holds or releases the paper from the drive drum.
RESET	Used with the ALT key to clear plotter memory and reset all limits, modes, and functions to default settings.
8	Numeric 8 key; Direction key.
HOME 5 FAST	Numeric 5 key; Manual mode fast pen movement key; Used with ALT key to move the pen to the lower left corner defined as Home.
2	Numeric 2 key; Down movement key.
ORIGIN .	Separator for numeric entries; Combined with the ALT key to set the current pen location as the new origin (0,0) (See Chapter 7).
LL	Sets the lower left corner of the plot. See Figure 5-3.
PEN UP	Raises the pen from the surface of the paper.
9	Numeric 9 key; Direction key.

6	Numeric 6 key; Direction key.
3	Numeric 3 key; Direction key.
GO TO ORIGIN	Reports the current pen location (*x*,*y*) to the host computer; Used with the ALT key to set and initiate a pen move as specified from the keypad.
UR	Sets the upper right corner of the plot to the current pen location. See Figure 5-3.
PEN DOWN	Lowers the pen onto the paper surface.
VIEW	A toggle key that positions the paper to the front of the plotter for viewing. When pressed again, the paper returns to the plot position and resumes plotting. An indicator light signifies the view mode has been selected. The light remains on until the key is pressed again.
ON LINE	Toggle key – On or off line. On line, the plotter may be controlled by the host computer; off line, the plot buffer is cleared up to the next [;:], the plotter is not in use and all plotter defaults are in effect. While the plotter is on line, the On Line indicator remains lit.
DELAY SPEED	Sets the delay time between pen up (or down) and the next move. Numeric values entered from the keypad determine the maximum plotter speed. Indicators show whether Delay or Speed mode has been selected and show when the plotter is ready to receive more keypad input. Used with the ALT key, Delay mode is selected.
SIZE	Used with a numeric keypad code to select the paper size. Sizes may be one of ten ANSI architectural and engineering paper sizes 'A' through 'E' or one of five ISO metric sizes 'A0' through 'A4'. An indicator light signifies the plotter is ready to receive further keypad input. The light remains on until the SIZE key is pressed again. See Figure 5-4.

[SCALE] Used in sequence with a numeric code to set the plot scale for either or both the *x* and *y* axes. An indicator light signifies the scale setting mode has been selected.

[ALT] Acts like a typewriter shift lock key to select any Alt function. Press one key at a time; the status indicator beside this key indicates that [ALT] has been pressed and is waiting for one of the Alt key commands to be entered. *The [ALT] key must precede other Alt keys; it is not used in combination with them.*

Status Indicators

The indicator functions are:

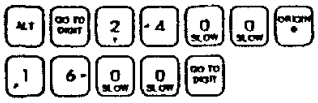
Indicator	Description
Power	The red power indicator lights when the power is turned on. If this light fails when the power switch is in the On position, check the power cord connection or check the fuse.
Error	Reflects an error condition. Unless the error is fatal, you can correct your entry and continue. A fatal error terminates the current plot. Plotter reset cancels fatal errors.
Pen	Indicates a request for pen change. The yellow status indicators as a group show the pen number requested by the host computer program. Press the [ALT] key to resume a plot when the pen has been changed.
Limit	Indicates a pen move command from the host computer which is outside the limits of the plotting area defined by setting the lower left and setting the plot size. Once this light comes on it remains on until any key is pressed. *Note: No vectors outside the plotting limits are plotted.*

Common keypad Alternate functions include:

Key	Description
[ALT] [-4]	Micro-calibration Test Plot.
[ALT] [HOME 5 FAST]	Moves the curser to the Home position, the lower left corner.
[ALT] [DELAY SPEED]	Delay time for pen up and pen down. Numeric values set the delays in milliseconds for: a. The pen to remain stationary after a Pen Up command is executed. Remains in effect until the pen moves in either axis. b. The pen to remain stationary after a Pen Down command is executed. Remains in effect until the pen moves in either axis. Delay entries take the form: [ALT] [DELAY SPEED] *du.dd* [DELAY SPEED] where *du* = delay for pen up and *dd* = delay for pen down in milliseconds.
[ALT] [GO TO DIGIT] *x,y* [GO TO DIGIT]	Allows pen moves to a specific (x,y) location on the plot.

Note: All (x,y) coordinates are expressed in units of "steps". Each step is 0.0025 inch (400 steps per inch) measured along either axis. If a metric paper size has previously been selected, the step size is 0.10 mm.

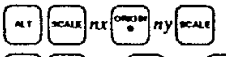
For example, to move the pen to location x = 6 inches (6 x 400=2400 steps), y = 4 inches (4 x 400=1600 steps), press this sequence:



Sets the current pen location as the new plot origin (0,0). The default location of the pen for origin is at the Lower Left (LL) location.

Commands Not Indicated On the Keypad

Key	Description
	hyperBUFFER disable. Vector sorting optimization disabled.
	hyperBUFFER enable, but no vector sorting optimization
	hyperBUFFER enable, pen sort only optimization
	hyperBUFFER enable, full vector sorting optimization (default)
	Communications line (serial) test (used with diagnostic program)
	Set baud rate to 1200
	Set baud rate to 2400
	Set baud rate to 300
	Set baud rate to 4800

	Set baud rate to 9600
	Micro-calibration test plot
	Self Test plot
	Select pen number *n* (n = 0-20) (multipen option only)
	Manually separates plots for spooling in hyperBUFFER if host does not send "@" at end of plot.
	Ignores pen change requests.
	Re-enable the pen change feature
	Micro-calibration entry
	Set Window lower left *x,y* coordinates (in .0025 inch increments or .1 millimeter increments for metric sizes).
	Set Window upper right *x,y* coordinates (in .0025 inch increments or .1 millimeter increments for metric sizes).
	Set Viewport lower left *x,y* coordinates (in .0025 inch increments or .1 millimeter increments for metric sizes).
	Set Viewport upper right *x,y* coordinates (in .0025 inch or .1 millimeter increments for metric sizes).
	Toggle beeper on/off

Power-On Test

A power-on self test occurs when you turn on the plotter or press

The power self test takes a few seconds to verify proper functioning of Read Only Memory (ROM) and Random Access Memory (RAM). If the ROM or RAM tests fail, the yellow status indicators display an error code. If an error is indicated, you should jot down the on/off condition of the indicators for your IOLINE service representative. Before reporting the error, however, try the test again by turning the plotter power off and on. If the test fails again, report the error light status codes to your IOLINE service representative.

Taking the Plotter On or Off Line

In On Line mode, a host computer may control the plotter. To take the plotter on line (after setting LL and UR) or off line:

Press the 

key.

This key toggles the On Line/Off Line mode. The *On Line* status indicator lights when the plotter is on line.

***Note:** Toggling the plotter off line during a plot clears the plot buffer. This means that plot parameters for Units, Origin, Host Pen Speed, Host Windows, and Line Type are reset to default values or to any values entered via the keypad.*

The following keys may be used with the plotter on line:

Entering Commands from the Keypad

Each key on the keypad serves one or more functions. Each numeric key represents its number value when you want to key in a number. These

numeric keys also generate pen movements. These keys are discussed throughout this chapter as they are used to perform the tasks for which the plotter was designed.

If You Make an Entry Error

If a syntax error is made in entering a command from the keypad, the command function is not effected. However, if the command is correct but with wrong values, you may reenter the correct value by pressing the function setting sequence again, or you may reset the plotter. Remember, when you reset the plotter *all* keypad selections are reset to their default values.

Most invalid entries are indicated by the *Error light. The next valid keypad entry turns off the Error* light, unless a plotting error (limit or illegal command) has been made by the host computer. Whenever you are uncertain about the setting or the keypad entries you have made, reset the plotter or turn the plotter Off and On again. All previously entered function selections are cancelled and set back to the default modes and values.

To clear the plotter memory and reset all limits, modes, and functions to their default settings:

Press 

.

Responding to a Pen Change Request Code

When a command is sent to the plotter from the host computer to change a pen (if the plotter is on line) the plotter stops, raises the pen and lights the red *Pen* indicator to alert you that a pen change request has occured. The correct pen number is displayed as a binary code on the yellow function

lights (*VIEW* indicator least significant). The specific pen change values are shown in the table below.

Pen Number Codes
As displayed on Status Lights

Pen Number →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VIEW	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●
ON LINE	●	○	○	●	●	○	○	●	●	○	○	●	●	○	○	●	●	○	○	●
DELAY/SPEED	●	●	●	○	○	○	○	●	●	●	●	○	○	○	○	●	●	●	●	○
SIZE	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	●	●	●	●	●
SCALE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○
ALT (not used)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Key: ○=on (lighted), ●=off (dark)

Figure 5-2. Pen Number Codes.

After the pen change, press [ALT] to resume plotting.

Ignoring Pen Change Requests

To ignore pen change requests:

1. Take the plotter off line.
2. Press [ALT] [PEN DOWN]

   All subsequent pen change commands are ignored until the plotter is reset. *Caution: When the pen changes are ignored, always begin a plot with a pen in the pen holder.*

You may later re-enable pen changes by following these steps:

1. Take the plotter off line.
2. Press [ALT] [PEN UP]

Some programs assume the pen holder is empty and request a pen change before beginning the plot.

Moving the Plotter Pen

The plotter pen may be moved in a number of ways via the keypad.

1. You can raise and lower the pen from the paper surface as follows:

   Press the [PEN UP] or [PEN DOWN] keys.

2. The View key interrupts plotting so you can view the plot. The View key stops the plot and moves the paper toward you for viewing. When pressed again, the pen returns to its previous position and plotting resumes.

   Note: In View mode, [RESET] *terminates the plot.*

3. To move the pen from its current location to the Home position at the lower left corner (LL or Home):

   Press [ALT] then [HOME 5 FAST]

   Note: The lower left corner (LL) must be already set or no movement will occur.

4. When the plotter is off line, the eight keypad Arrow (Direction) keys can move the plotter pen in any of the directions indicated by the key. The pen movement keys are:

   [1] [2] [3] [4] [6] [7] [8] [9]

Fast Mode

The fast pen movement mode allows rapid pen movements, beginning first with a slow speed, then an intermediate speed, and finally fast. The slow and intermediate speeds are about 2 seconds each. To set fast pen movements, ensure the plotter is off line, then

press [5 FAST].

The maximum fast mode speed is the value established by the SPEED key. Fast mode is the plotter default speed and remains in effect until a slow mode is selected.

Slow Mode

The slow pen movement mode allows the pen to move in single or multiple increments of .0025 inch. To set slow speed, ensure the plotter is off line, then

press [0 SLOW].

Holding down a Direction key for more than one second generates multiple, slow pen movements.

Moving the Pen to Specific Coordinates

In addition to moving the plotter pen manually, pen moves may be set and initiated using coordinates specified from the keypad. The procedure is:

1. Press [ALT] [GO TO DIGIT]
2. Enter *x,y* coordinates as numbers of step increments.

3. Press [GO TO DIGIT] again.

   For example if you want to move the pen to location X = 6 inches, Y = 4 inches,

   Press:

   [ALT] [GO TO DIGIT] [2] [-4] [0 SLOW] [0 SLOW] [ORIGIN] [.1] [6-] [0 SLOW] [0 SLOW] [GO TO DIGIT]

Note: All x,y coordinates are communicated to the plotter in units of steps. For English paper sizes, each step is .0025 inches or 400 steps per inch of pen travel on each axis. For metric paper sizes, the step size is .1 millimeters, or 100 steps per centimeter.

The [ALT] [GO TO DIGIT] combination may also be used to move the pen. For example, to move the pen to the lower left corner of the paper,

press [ALT] [GO TO DIGIT] [LL].

or to move the pen to the upper right corner of the paper,

press [ALT] [GO TO DIGIT] [UR].

Selecting a Pen From the Multiple Pen Tray

On plotters equipped with the Multi-Pen Changer Option (Chapter 8), you can select alternate pens via the keypad when the plotter is off line. To select a pen, enter its pen number via the keypad:

Press [ALT] [CHART HOLD] *n* [CHART HOLD]

where *n* represents a pen number between 0 and 20.

Pen number 0 places the current pen in its holder. Pen numbers greater than 20 generate an error.

Setting the Maximum Plotter Speed

Use the DELAY SPEED key followed by numeric keys (shown below) to select the default maximum plotter speed.

One of 20 user-defined maximum pen speeds may be selected from the keypad or from the host computer. Numeric codes 1 through 20 correspond to inches per second pen speed. Speeds may be limited in various ways. See Keypad Command List.

At the default speed – and speeds set from the host – the diagonal speed is up to about 1.4 times the axial speed. For example, at 20 ips axial, the diagonal (45 degrees) speed is about 28 ips. When the speed is set from the keypad however, the diagonal speed is restricted to the axial speed. This improves the plot quality with certain types of pens. Speed settings from the keypad also restrict manual move speeds (using arrow keys).

The pen speed is adjustable to provide optimum line quality for a combination of pen type and paper. Slower speeds are appropriate with slow-flowing inks on nonabsorbent papers, and for large, heavy media. Try several settings to find the best line quality. The plotter may be on line or off line when the speed is reset.

To set the pen speed,

press [DELAY SPEED] *n* [DELAY SPEED] where *n* is the speed code.

For example, to set the pen speed to 8 ips,

press [DELAY SPEED] [8] [DELAY SPEED].

Any change in the speed remains in memory until a new pen speed is entered, a different paper size is specified, the plotter is reset, or the power is turned off.

Acceleration

To set pen and paper acceleration,

press [ALT] [RATE] [DELAY SPEED] *n* [DELAY SPEED]

where *n* is 10 times the desired acceleration. Maximum acceleration is 2 g (n=20).

Delaying Pen Movement Time

Pen movements either up or down may be controlled from the keypad. The approximate delay time in milliseconds may be entered for how long:

- the pen is to remain stationary between a Pen Up movement and any subsequent movement along either axis.
- the pen is to remain stationary between a Pen Down movement and any subsequent movement along either axis.

These delays are important; they allow the pen time to settle before moving across the paper. Reducing delay times can substantially reduce the plot time, particularly if the plot contains large amounts of text. However, shorter delay times may also reduce plot quality.

The default pen up delay time is 16 milliseconds; default pen down delay time is 50 milliseconds. With experimentation, you can optimize these delay times for particular plotting media and pen types. For example, to set the pen up delay = 20 ms and the pen down delay = 45 ms,

press [ALT] [DELAY SPEED] [2] [0 SLOW] [ORIGIN] [-4] [HOME 5 FAST] [DELAY SPEED]

Note: The practical range for delay settings is between 10 and 50 milliseconds for the pen up delay, and between 40 and 100 milliseconds for the down delay. The actual maximum for either is 255 milliseconds.

The new settings remain in effect until new settings are entered, the plotter is reset, or until the power is turned off.

Setting the Lower Left Corner

Here's how to set the current pen location to be the lower left corner (LL) of the plot. Remember that the paper moves in and out of the plotter along its *x* axis (the horizontal axis).

1. Load the plotting media. The plotting origin ($x,y = 0,0$) relative to the plotting surface must be established before starting a plot. Press LL to set the lower left plotting Limits at the current pen location (see Figure 5-3). During a plot, the pen will not plot outside these limits in the *-x,-y* directions. The pen will, however, go outside the limits with manual pen moves. These limits are effective even if the origin is moved with the Origin command. Normally, the lower left corner should be placed at approximately 1/2 inch inside both the right hand edge and leading edge of the plotting media.

2. To set the lower left corner, use the direction keys to move the pen to the lower left corner of the paper.

3. Press [ll].

   The lower left corner remains in memory until the plotter is reset, you set a new LL, or until you turn off the plotter power.

Note: The plotter will not go on line until the lower left has been set.

As the following diagram indicates, the lower left corner locates the $x,y = 0,0$ coordinates. In the default orientation (as shown), the *x* axis is the paper movement direction, and the *y* axis is the pen movement direction.

Selecting Paper Size

Note: Establish an upper right corner (UR) by selecting a paper size or as described explicitly in the next section. The plotting medium size can be selected (between ten ANSI architectural and engineering paper sizes, 'A' through 'E' and metric sizes 'A0' through 'A4').

With the plotter off line, you may select a standard chart or paper using a numeric code sequence from Figure 5-4.

Note: Always select the lower left corner before completing these steps.

1. Set the lower left corner to the present pen position by pressing [ll].
2. Press [size]. The *Size* indicator lights.
3. Enter the numeric code for the desired plot size. See Figure 5-4.
4. Then press [size] again. The *Size* indicator turns off.

Note: If the combination of lower left (LL) and paper size entries places the upper right (UR) beyond the limits of the plotter, the keypad indicators marked LIMIT and ERROR will light.

The selected size remains in memory until a new size is entered, the plotter is reset, or the power is turned off to the plotter.

Note: Paper size parameters set with this key may be different from the actual paper size, or different from the size of the plot and assumptions about the paper size made by the host computer.

See Figure 5-4, and the sections about [ll] and [ur].

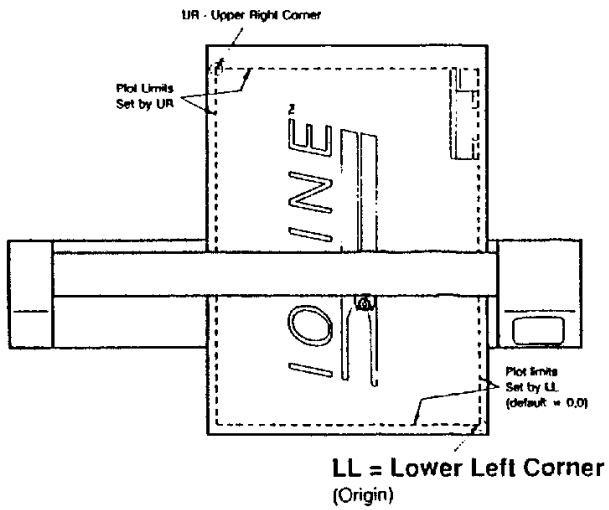


Figure 5-3. Default Plot Orientation.

Setting the Upper Right Corner

***Note:** Use this procedure if the paper size has not been specified.*

Paper sizes can be set to any nonstandard size by using the direction keys to move the pen to the desired upper right corner of the plotting area. This location is usually about one half inch (.5 inch) inside the left edge of the paper (the top edge of the plot), and about 1.5 inch from the far edge of the paper. This plot size provides sufficient margin to ensure that the paper can be firmly held by the Drive Drum and Chart Hold Arms.

Always set the lower left corner before setting the upper right corner. The upper right corner sets the $+x,+y$ outer limits, and determines the area

believed by the plotter to be the paper size (See the "Selecting Paper Size" section for more about standard paper size selections).

1. Move the pen to the upper right corner of the paper.
2. Press the [UR] key.
3. The current pen location becomes the upper right corner of the plot as shown in Figure 5-3.

This setting remains in memory until a new upper right corner is set, the plotter is reset, or until you turn off the plotter power.

The plotting medium (paper) is oriented with the long dimension (x axis) perpendicular to the plotter platen, and the shorter dimension (y axis) in the direction of the pen movement (left and right across the width of the platen).

Plotting Media Sizes
(Default Orientation)

Architectural ANSI

Keypad Code	Drawing Size	Dimension (inches) x y	Useful Plot Size (inches) x y
0	A	12 x 9	10 x 8
1	B	18 x 12	16 x 11
2	C	24 x 18	22 x 17
3	D	36 x 24	34 x 23
4	E	48 x 36	46 x 35

Engineering ANSI

Keypad Code	Drawing Size	Dimension (inches) x y	Useful Plot Size (inches) x y
5	A	11 x 8.5	9 x 7.5
6	B	17 x 11	15 x 10
7	C	22 x 17	20 x 16
8	D	34 x 22	32 x 21
9	E	44 x 34	42 x 33

ISO

Keypad Code	Drawing Size	Dimension (mm) x y	Useful Plot Size (mm) x y
10	A0	1189 x 841	1138 x 816
11	A1	841 x 594	790 x 569
12	A2	594 x 420	543 x 395
13	A3	420 x 297	369 x 272
14	A4	297 x 210	246 x 185

Custom Sizes

15 Two sizes available under 3 users (6 total) stored in non-
16 volatile memory (NOV RAM).

Fig 5-4. Plotting Media Sizes (Default Orientation).

Note: All other standard or nonstandard paper sizes up to 37.5 inches wide (useful plot size maximum is approx. 35.8 x 81.9 inches) are selectable by setting the lower left and upper right parameters. When other than the default Plot Rotation is used, the plot limits are automatically set such that the widest margin is on the far side of the plot when viewing the plot in the plotter. See Plot Rotation Section.

Example: To select Engineering 'D' size paper with a plotting area of 21 x 32 inches, indicate the lower left corner and set the paper size:

press [LL]

press [SIZE] [8] [SIZE].

Setting a New Origin

This function sets the current pen location to 0,0. Follow these steps to set a new origin:

1. Raise the pen. Press [PEN UP].
2. Use the direction keys to move the pen to the desired origin location on the paper.
3. Press the [ALT] [ORIGIN] keys.

This sets the current pen location as the new origin of the plotting coordinates (0,0). The default location of the origin is at the lower left location.

Here is another method of establishing a new origin from the plotter keypad.

1. Locate the pen using [ALT] [GO TO ORIGIN] *x,y* [GO TO ORIGIN].
2. Press the [ALT] [ORIGIN] keys as described above.

   Use this method to describe the desired new plot origin.

The new origin settings remain in effect until another setting is entered, the pen is moved to the Home position, the plotter is reset, or until the power is turned off.

Note: A Home command from the Host does not reset the origin (as set from keypad) to LL. Origin can be set from the Host as well as from the keypad. If the first Host move is in the Relative mode, the plotter assumes the pen move is from the current position (which may be at a location other than LL or the new origin).

Changing the Scale of a Plot

The *x* and *y* axes can be scaled independently to accommodate different plot sizes or different aspect (height-to-width) ratios. The default scale is 1:1 (100%) on both axes.

Scaling values can be entered via the keypad

Scaling is done in sequence with a numeric code which sets the scale of a plot for the *x* axis, *y* axis, or both the *x* and *y* axes. When entering a new scale, the *Scale* indicator lights.

The scaling factors entered via the keypad are in the form of whole *percents* of the current *x* and *y* scale factors. Thus, to rescale a plot from the default 1:1 to 2:.5 (1:.25 ratio), the scaling factors are x = 200% and y = 50% of the old values.

Up to 3 digits of scaling values – representing scale changes from 1% to 999% of the previous values – can be entered via the keypad. When both x and y scale values are keyed, decimal points must separate the x and y values. For example, to change to a new scale where $x' = .25 * x$ and $y' = 9.99 * y$ (25% : 999%), take the plotter off line by pressing

[ON LINE]. Then

press [SCALE] [2 .] [HOME 5 FAST] [ORIGIN .] [9] [9] [9] [SCALE]

You can also scale the *x* and *y* axes to the same new value by omitting the decimal point. For example, to change the scale ratio to *x,y* = .5:.5 enter:

1. Press [ON LINE] to take the plotter off line.
2. Press [SCALE] [HOME 5 FAST] [0 BLOW] [SCALE].

The scale setting remains in memory until a new scale is set, the plotter is reset, or until the power is turned off to the plotter.
Scale settings also apply to the Self Test plot.

Adjusting Micro-calibration

Plotters can have variations in drawing accuracy in both orthogonal directions due to variations in the paper drive mechanism, paper density, humidity, and temperature. Typically, the accuracy of a plot is within 0.2% overall. By using the Micro-calibration feature, you can adjust the variance to within 0.05% (depending on measurement techniques). *Note: The Scale command operates independently of the Micro-calibration resolution.*

Here's how to make a calibration plot:

1. Load the paper into the plotter. For maximum accuracy, the paper should be the same size, and at the same location on the platen as the final intended plot.
2. Set the lower left (LL) corner, the upper right (UR) corner (or Size).
3. Press [ALT] [- 4].

   The plot is always in the normal orientation (not affected by rotation settings), with lines drawn from the origin (0,0). Two sets of connected lines are drawn: one for measurement in inches and the other in centimeters. At the maximum *x* and *y* locations, there are short lines perpendicular to the *x* and *y* axes. Pairs of measuring marks for both *x* and *y* axes are indicated on the plot in either inches or centimeters. The measurement between the parallel lines are intended to be in whole inch (or centimeter) increments, as will fit within the plotting set limits.

4. Measure and write down the distance between any marks in both the *x* and *y* directions (inches or centimeters). The difference between the measured distance and the nearest whole inch (or centimeter) should be small. Remember, the *x* direction is always in the paper motion direction, and the *y* direction is always the pen motion direction. All measurements must be accurate to three decimal places.

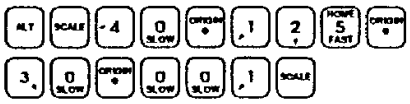
   For example:

   $x = 40.125$ inches or $x = 101.918$ centimeters

   and

   $y = 30.001$ inches or $y = 76.203$ centimeters

5. Here's a sample calibration for $x = 40.125$ inches and $y = 30.001$ inches. Enter the calibration measurements using the keypad as follows:

   Note: Up to three digits after the decimal may be entered for each measurement.

   The new microcalibration setting remains in the plotter memory until a new calibration setting is made, the plotter is reset or the plotter power is turned off. These values may also be stored in the plotter non-volatile memory. See "Storing Plot Parameters".

Setting Plot Rotation

This special function provides the ability to rotate a plot to any of four orientations: Normal (default); 90; 180; and 270 degrees. One particular application of this feature is to place the widest margin on any specified side of a drawing.

Relative to the default plot orientation, the other orientations (90, 180, 270 degrees) are with the plot rotated in a *CLOCKWISE* direction. The relative location and direction of the lower left and upper right pen positions are used to determine the plot rotation. The plotting limits are established at the lower left and upper right positions.

The Plot Rotation can be set as follows:

1. Move the pen to the desired lower left (plot Origin) position.

   Press [LL]

2. Move the pen to the desired upper right location.

   Press [UR]

   or

   Move the pen a short distance in the direction of the desired upper right location.

   Use the [SIZE] *n* [SIZE] sequence to enter the paper size.

Note: The size key is used to set limits corresponding to the standard paper sizes as indicated in Figure 5-4. However, the useful plot dimensions change according to the rotation selected, leaving approximately 1.5 inch as the wide margin (far side).

Setting the Plotter Digitizer Mode

In the Digitizer mode, the plotter reports the current *x,y* pen location to the host computer.

Press the [GO TO DIGIT] key.

Use this function in conjunction with the manual pen move keys to digitize the coordinates of a design.

This key is used in conjunction with the *ED* command as described in Chapter 10. When the plotter processes an *ED* command received from the

host computer, the plotter goes off line automatically, and the *DIGIT key is enabled.*

Once off line, the manual move keys (arrow keys) are also enabled so that the pen can be placed at the desired location to be digitized. It is recommended that a dry pen, stylus, or "bomb sight" pen be used instead of a functional pen which might draw unwanted lines on the drawing being digitized. Here's how:

1. Move the pen to near the desired location, lower it, then move it to accurately point to the location to be digitized.
2. The [0 SLOW] key may be used to achieve the finest pointing resolution.
3. Press [GO TO DIGIT] to send the plotter back on line.

A message consisting of the current pen coordinates is reported to the host computer. An *ED command must be sent from the host for each point to be digitized.*

Window and Viewport Features

A window or viewport is established from the keypad when the plotter is off line and remains in effect after the plotter is taken on line or receives a window command from the host computer. A Window/Viewport command from the host overrides a window and viewport defined from the keypad. Then, when the plotter is changed from on line to off line, the window/viewport selected from the keypad takes effect again.

If you choose not to establish a window or viewport from the keypad, a default window and viewport are automatically established based on the paper size you select.

If you select a viewport which exceeds the paper size, the error light is lit and the current window and viewport are not changed. If the host computer

selects a viewport or window which exceeds the paper size, or the window/viewport parameters are in error, the following error lights are lit:

- Error
- View
- On Line
- Scale
- Alt

The current Window/Viewport settings remain, and plotting continues.

Here's how to define a window and viewport from the keypad.

[ALT] [VIEW] *n1,n2,n3,n4,n5,n6,n7,n8* [VIEW]

The *n* coordinates relate to the following entries:

n1 = window lower left x coordinate
n2 = window lower left y coordinate
n3 = window upper right x coordinate
n4 = window upper right y coordinate
n5 = viewport lower left x coordinate
n6 = viewport lower left y coordinate
n7 = viewport upper right x coordinate
n8 = viewport upper right y coordinate

Each of these coordinates must be entered in units of .0025 inch (or in units of .1 mm if a metric paper size has been selected).

With the window or viewport established, the lower left or upper right corners of the window or viewport can be set:

[ALT] [GO TO DIGIT] [SCALE] [LL] or [ALT] [GO TO DIGIT] [SCALE] [UR]

To position the pen at the lower left or upper right of the viewport, enter the following keystrokes:

[ALT] [GO TO DIGIT] [VIEW] [LL] or [ALT] [GO TO DIGIT] [VIEW] [UR]

Storing Plot Parameters in Non-volatile Memory

The LP4000 is equipped with a programmable, non-volatile memory capable of storing a variety of plotter control parameters set by 3 different users. Each user is assigned an identity number 1, 2 or 3. By pressing

[ALT] [UR] [,1],

the values stored under user number 1 are loaded. If no user number is entered or if ALT UR 0 is pressed, variables are reset to factory default values. The 3 sets of user variables remain in memory, for use when loaded.

After pressing ALT / UR / n to identify yourself as user #n, any previously set lower left and upper right plot boundary is lost.

The memory functions of the plotter can be programmed in either of two ways: A diskette provided with the plotter contains a utility labeled README.EXE which permits memory programming from a host computer. Memory functions may also be programmed from the plotter keypad. A listing of the current status of all variables may be plotted as well.

Plot Current Status of the Memory

To plot a list of the current value of all variables in non-volatile memory for all users:

1. Turn the plotter on.
2. Place A size paper (8 1/2 x 11 inch) in the plotter, lower the chart wheels, position the pen near the lower left corner of the paper.
3. Press [ALT] [UR] [,1]: Identify yourself as user #1.
4. Press [ALT] [,1]: Change to the programming mode.
5. Press [ALT] [9']: Print the memory status and exit the programming mode.

The plotter will produce a list of the current status of all variables under each user.

```
              IOLINE LP4000 PERSONAL USER PARAMETERS

                          NU   - 2
                          NC   - 2

U1   -                   U2   -                   U3   -

PCA  - 1                 PCA  - 1                 PCA  - 1
AP   - 1                 AP   - 1                 AP   - 1
LAN  - 0                 LAN  - 0                 LAN  - 0
AV   - 0                 AV   - 0                 AV   - 0
ES   - 3                 ES   - 3                 ES   - 3
MC   - +.00000,+.00000   MC   - +.00000,+.00000   MC   - +.00000,+.00000
BR   - 9                 BR   - 9                 BR   - 9
PM   - 1,2,3,4           PM   - 1,2,3,4           PM   - 1,2,3,4
       5,6,7,8                  5,6,7,8                  5,6,7,8
CP15 - 0,0               CP15 - 0,0               CP15 - 0,0
CP16 - 0,0               CP16 - 0,0               CP16 - 0,0
UD   - 16                UD   - 16                UD   - 16
DD   - 50                DD   - 50                DD   - 50
PDV  - 20                PDV  - 20                PDV  - 20
PUV  - 20                PUV  - 20                PUV  - 20
EV   - 20                EV   - 20                EV   - 20
FV   - 20                FV   - 20                FV   - 20
EP   - 0                 EP   - 0                 EP   - 0
CV   - 0                 CV   - 0                 CV   - 0
AC   - 10                AC   - 10                AC   - 10
```

(See next section for explanation of variables.)

Programming the Memory via the Host Computer

1. Turn on plotter.
2. Put plotter on-line using [ALT] [6 -], without pens or paper.

3. Insert IOLINE diskette into drive a.

4. Type A:README <return>:

   The following message will appear on the host screen:

```
            LP 3700 / LP 4000
          DIAGNOSTICS DISKETTE

     1> Read explanation of files
     2> Run keypad Program (set-up user parameters)
     3> Run Diagnostics Program
     4> Send Demo. plot to plotter
     5> Select Com. port/Baudrate
     6> Quit This Program

     Enter option...
```

5. Press 2 to run the KEYPAD program and follow instructions as they appear on the screen.

6. Set communication parameters.

7. From the MAIN MENU, select the user number (1,2, or 3) to be programmed:

```
              Ioline LP 4000 Programmer
MAIN MENU
```

0> View user 0 parameters (factory defaults). These values cannot be changed.

1> Select user 1 parameters.
To view and change the settings stored under user 1.

2> Same, but for user 2.

3> same, but for user 3.

4> Program current parameters.
After setting variables for any user, return to this MAIN MENU and program (store) these new values.

5> Abandon changes since last programming. Variables remain unchanged.

6> Reset user variables to factory default values.
Changes variables to the values set originally.

7> Default unit size EC2.
Five choices of step size are available as the default value. Note that choosing an English or Metric paper size selects the units (400 steps per inch or 10 per mm.) for the custom plot sizes for all users.

8> Write current parameters to a disk file.
Stores user values in a disk file for later use.

9> Read new parameters from a disk file.
Reprograms the plotter memory using data stored in a disk file.

A> Power-up user 0 (BU).
Four choices (0 - 3) of automatic default to user "n" on Power-up or reset can be stored in memory.

B> Plotter boot sequence.
Up to 30 keypad keystrokes ca be stored in the plotter memory to be processed on power-up or reset. For example, a user may boot with ALT / UR / 1 / LL / SIZE / 6 / SIZE / ON LINE and be on line with user 1 values laded and B size paper limits set each time power is turned on.

Q> Quit

The following is a brief description of each personal user parameter and the options available for each parameter:

```
Enter > Main Menu                                    User number n
```

A> (PCA-Pen Changer Automatic) This parameter allows the status of the pen-changer (optional) to be set. By entering A, the choices will toggle between automatic and manual pen changes.

B> (AP-Active Pen Changer) This parameter allows the plotter to ignore pen requests from the host. Press B to toggle choices (ignore/respond).

C> (LAN-Select Plotter Language) The plotter language is DMPL or HPGL. Press C to toggle between choices.

D> (AV-Auto View) The automatic view function executes a move along the x axis each time a paper size is set. This stabilizes the paper prior to plotting. To toggle auto view on and off, enter D.

E> (HB-hyperBuffer Optimization) There are four levels of optimization for the hyperBuffer (optional). Press E. Enter the optimization mode desired as follows:

Mode 0 - hyperBUFFER disabled, no optimization
Mode 1 - hyperBUFFER enabled, no optimization
Mode 2 - hyperBUFFER enabled, pen sort only
Mode 3 - hyperBUFFER full optimization

F> (MC - Micro-calibration) The micro-calibration parameter allows each user to set precise calibration factors tailored to a specific plotting medium and pinch wheel location. Enter the measured length of X and Y lines which should be whole inches or centimeters in length (use the ALT 4 test plot).

G> (BR-Baud Rate) The default baud rate is 9600 baud. If a different baud rate is desired, press G:

Select baud rate: (300,1200,2400,4800,9600):

H> (PM-Pen Map) Multi-pen plotters can be programmed to re-map pen numbers from the host. Various users may number their pens differently. For example, the host may send a request for pen 3. By re-mapping, the plotter can be instructed to get pen 7 instead of pen 3. Press H. The first number appearing is the host pen number. Enter the pen number you wish the plotter to respond with, or return for default value.

I> (CP15-Custom Plot Size 15) There are two custom plot sizes available to each user. Press I:

Enter custom plot size x-axis value: return
Enter custom plot size y-axis value: return
(Units are inches if English or mm if metric. See MAIN MENU item 7.)

J> (CP16-Custom Plot Size 16) This parameter sets custom plot size 16. Press J:

Enter custom plot size x-axis value: return
Enter custom plot size y-axis value: return

K> (UD-Pen Up Delay) The default value for pen up delay is 16 ms. To change this delay and accommodate different pen types, press K:

Pen up delay <2-250ms>: return

L> (DD-Pen Down Delay) The pen down delay may also be changed from the default setting of 50ms. Press L

Pen down delay < 2-250ms >: return

M> (PDV-Pen Down Velocity) Pen down velocity may be varied independent of pen up velocity. Slower writing speeds are desirable when using some pens. Pen speeds sent from the host affect only the pen down velocity. Pen up velocity remains as previously set or at the default value. Press M

Enter new velocity <1-20>: return

N> (PUV-Pen Up Velocity) The pen travel velocity with the pen up can be set between 1 and 20 ips (inches per second). Default is 20 ips. Speed requests from the host control pen down speeds. Press N:

Enter new velocity <1-20>: return

O> (HV-Host Velocity) When the maximum pen velocity available from the host/software is below the maximum desired plotter velocity, the plotter can be programmed to move at a speed greater than the software speed after receiving the host maximum speed. Press O:

HV-expected max host velocity <1-20>: return
PV-desired max plotter velocity <1-20>: return

P> (KP-Keypad rules) The plotter velocity will be the lowest value received, whether from the host or the keypad, unless this parameter is set to KEYPAD, in which case the speed set on the keypad will rule all velocity decisions. Press P to toggle between choices (keypad or host rules).

Q> (CV-Constrain Velocity) When pen down moves are diagonal, the speed at which the pen travels over paper will be as much as 40% faster than the specified (axial) speed, unless moves are limited by this parameter setting. Press Q to toggle between constrained and unconstrained diagonal pen down speeds.

R> (PA-Plotter Acceleration) When large paper sizes are being used, it may be desirable to lower the pen acceleration from the default of 1.0g. Pen acceleration may also be set as high as 2.0g. Press R:

Enter new acceleration <0.1-2.0>: return

After all desired changes have been made, return to the main menu and choose selection 4. This will program the plotter with the personal user parameters, which will be available at each plotter power on. After programming, quit by pressing Q.

Personal user parameters may also be saved as a disk file. Several users may store their customized plotter memory parameters in their own disk

files and re-program the plotter memory when convenient. Select option 8 of the (KEYPAD.EXE) main menu and name the file containing the plotter memory variables.

Example

User #2 has stored a custom paper size under SIZE 15 and wishes to plot on that paper.

1. Turn the plotter on.
2. Press [ALT] [UR] [2].
3. Install paper and move the pen to the lower left corner.
4. Press [LL] [SIZE] [.1] [HOME 5 FAST] [SIZE].
5. Press [ON LINE].
6. Send the drawing from the host to the plotter.

Note: Any programmed parameters can be changed from the keypad before pressing "ON LINE".

Programming the Memory via the Plotter Keypad

The plotter non-volatile memory may be programmed directly from the keypad using commands from the Keypad Command List, Group 2 and Group 3, described below. (Group 1 commands do not affect memory.)

1. Turn the plotter on.
2. Press [ALT] [UR] [.1] (or 2 or 3 as desired):

   Identifies you as one of the 3 numbered users.

3. Enter the desired values from the KEYPAD COMMAND LIST. Select values from Group 2.
4. Press [ALT] [.1]:

   Enters the memory programming mode.
5. Enter the desired values from the KEYPAD COMMAND LIST. Select values from Group 3.
6. Press [ALT] [CR LINE]:

   Saves these changes and exit the programming mode.

LP4000 Keypad Command List

Commands are divided into 3 groups:

1. Controls not affecting memory.
2. Controls which change plotter variables temporarily or in the non-volatile memory (entered before pressing: [ALT] [.1]).
3. Controls which are used only when programming the plotter memory (entered after pressing: [ALT] [.1]).

Group 1:

The following commands do not affect the plotter non-volatile memory:

Key	Description
[ALT] [HOME 5 FAST]	Move to Home position
[ALT] [ORIGIN *]	Set Origin
[ALT] [GO TO SIGHT] *x* [ORIGIN *] *y*	GOTO = Move to coordinates *x* and *y* = 0.0025" increments, or 0.1mm increments if metric paper size is selected)
[ALT] [2 ~]	Communications line (serial) test
[ALT] [- 4]	Micro-calibration test plot
[ALT] [` 7]	Self Test Plot
[ALT] [` 7]	Self Test Plot in 4 colors (bold [` 7] for at least 2.5 seconds)
[ORIGIN *]	(decimal) After host has transmitted, sends "@" to bBUFFER (signifies end of plot — for separating spooled drawings).
[ALT] [CHART HOLD] *n* [CHART HOLD]	Select pen number *n* = 0-20

Group 2:

The following commands may be used to temporarily change the plotter memory variables or to re-program the plotter memory. During programming, these variables are entered after pressing ALT UR n, but BEFORE pressing ALT 1 (ie before entering the programming mode).

Note: A programmable parameter can be different for each user.

Key	Description
ALT DELAY SPEED *du* ORIGIN *dd* DELAY SPEED	Set pen up and pen down delay
DELAY SPEED *n* DELAY SPEED	Set pen speed
ALT 0 SLOW 0 SLOW	hyperBUFFER disable, no optimization
ALT 0 SLOW . 1	hyperBUFFER enable, no optimization
ALT 0 SLOW 2	hyperBUFFER enable, pen sort only optimization
ALT 0 SLOW 3	hyperBUFFER enable, full optimization (default)
ALT 3 . 1	Set baud rate to 1200
ALT 3 2	Set baud rate to 2400
ALT 3 3	Set baud rate to 300
ALT 3 4	Set baud rate to 4800
ALT 3 9	Set baud rate to 9600
ALT CHART HOLD *n* ORIGIN *m* CHART HOLD	Reassign host pen number *n* (n=1-8) to plotter pen number *m* (m=1-16).
ALT PEN DOWN	Pen changer disable

ALT PEN UP	Pen changer enable (default)
ALT SCALE *nx* ORIGIN *ny* SCALE	Micro-calibration entry
ALT VIEW *wllx* ORIGIN *wlly* ORIGIN	Set Window and Viewport lower left *x,y* coordinates (in 400 units per inch increments)
wurx ORIGIN *wury* ORIGIN	Set Window and Viewport upper right *x,y* coordinates
vllx ORIGIN *vlly* ORIGIN	Set Window and Viewport lower left *x,y* coordinates
vurx ORIGIN *vury* VIEW	Set Window and Viewport upper right *x,y* coordinates

Note: The following commands use a dot [.] optional command to indicate that the preceding (keypad) speed entered will be used, independent of speed requests from the host. A speed value followed by pressing the Pen Down key constrains the pen velocity on diagonal moves to the velocity on axis

Key	Description
DELAY SPEED *np* [ORIGIN] DELAY SPEED	Define plotter velocity. np = 1 - 20. Both pen down and pen up speeds are equal.
DELAY SPEED *np* ORIGIN *nh* DELAY SPEED	Define maximum velocity. *np* = Selected maximum plotter speed (1 - 20ips) *nh* = Maximum host velocity command expected (1 - 20ips), *np* >= *nh*

DELAY SPEED *nd* [ORIGIN] PEN DOWN *nu* [ORIGIN] PEN UP DELAY SPEED	Set pen down and pen up speed. The decimal may be placed in either or both places indicated.
DELAY SPEED *nu* [ORIGIN] PEN UP DELAY SPEED	Retain previous pen down speed and set new pen up speed.
DELAY SPEED *nd* [ORIGIN] PEN DOWN DELAY SPEED	Set pen down speed only. Pen up speed will be at max. (20ips, or previously set limit). Limits diagonal speed to axial speed.
ALT SIZE DELAY SPEED *n* DELAY SPEED	Set acceleration (g) x 10, n = 1 to 20 default is 1 g, n = 10.

All pen speed, acceleration and delay variables may be set from the plotter keypad while plotting.

Group 3:

Note: A programmable parameter can be different for each *user*

A global *programmamable parameter is the same for* all *users (indicated by an "*" in the list).*

The following commands are used ONLY when programming the plotter memory functions (after pressing ALT / 1). Press

ALT UP *n*

to identify yourself as user n (n=1,2,3), then press

ALT 1

to change to the programming mode.

Key	Description
ALT 1	Program Mode (programmable user settings)
ALT HOME 5 FAST	Escapes from program mode without programming the non-volatile memory. Current changes to settings are retained.
ALT 6- 1	Pen Changer Status: Present and active
ALT 6- 2	Present but not active; lights active and plotter stops for manual pen changes unless disabled with ALT PEN DOWN
ALT 6- HOME 5 FAST	DM/PL plotter language
ALT 6- 6-	HP-GL plotter language
ALT 7 1	• Coordinate Addressing (for host commands only): .001 inch (EC1)
ALT 7 2	• .0025 inch (EC2) (default)
ALT 7 3	• .1 mm (ECM)
ALT 7 4	• .005 inch (EC5)
ALT 7 HOME 5 FAST	• .025mm (ECN)
ALT 9	Plot current setup parameters for users 1-3 (on A-size paper)
ALT LL ... RESET	• Plotter executes your key sequence <keypad entries> each time power is turned on.

ALT UR *n* UR	* Load parameters for user *n* on power-up
ALT ON LINE	Save new parameters (programs plotter), then escapes to normal mode.
ALT SIZE *n* SIZE	Custom Paper Size (*n* = 15 or 16, retains current paper size set by LL and UR as size 15 or 16)
ALT VIEW 0 SLOW	Auto View OFF
ALT VIEW , 1	Auto View ON (upon setting paper size)
RESET	Reset user (current user number only) parameters to factory defaults from ROM (then remain in program mode)

Example

A user wishes to store a custom paper size (44 X 25.5 inch paper, ie 42 X 24.5 inch plotting area) and set the pen down velocity to be 12 in/sec. no matter what speed is sent from the host. User I.D. #2 is chosen and memory programming is from the plotter keypad:

1. Turn the plotter on.
2. Press ALT UR 2 - Open as user #2
3. Move the pen to a point near the right side of the plotter, leaving room for 24.5 inches of pen travel.
4. Press LL - define lower left corner of a plot.
5. Move the pen to x=42, y=24.5. Press:

   ALT GO TO DIGIT

   , 1 6 8 0 SLOW 0 SLOW

ORIGIN 9 8 0 SLOW 0 SLOW GO TO DIGIT

Bottom, left and top margins are 0.5 inches, the right margin is 1.5 inches. Keypad moves can be precise if the

ALT GO TO DIGIT

function is used. Moves will be in units of 400 steps per inch (or 10 steps per mm if a metric paper size has been selected).

6. Press UR - define the upper right corner.
7. Press DELAY SPEED , 1 2 ORIGIN PEN DOWN DELAY SPEED - Sets pen down speed at 12 in/sec, independent of speeds requested from the host. Pen up speed remains at the value set by the plotter (default 20 ips).
8. Press ALT , 1 - Change to the memory programming mode.
9. Press ALT SIZE , 1 HOME 5 FAST SIZE - Define a 42 X 24.5 inch plot area under User #2, size 15.
10. Press ALT ON LINE - Store current settings in the plotter non-volatile memory and exit to the normal plotting mode.

The plotter may now be turned off or reset. User #2 would call for custom paper size 15 by positioning the pen correctly, pressing

ALT UR 2 LL SIZE , 1 HOME 5 FAST SIZE ON LINE and sending

the plot from the host computer. The pen up speed would be 20 in/sec (default) while the pen down speed would be held fixed at 12 in/sec.

Example

User #3 wishes to program the plotter memory with custom micro-calibration values and enable the Auto View function to pre-condition the paper prior to plotting. The programming is to be done from the plotter keypad:

1. Turn the plotter on.
2. Press [ALT] [USR] [3] - Opens as user #3.
3. Place pen and paper in the plotter in the normal manner, defining the lower left and upper right with

   [LL] [SHIFT] /1 [SHIFT] or [LL] (move) [USR] .
4. Press [ALT] [-4] - Makes a micro-calibration test plot.
5. Remove the paper and carefully measure the actual distance (XX.XXX) between any convenient X line pairs. Similarly, measure the distance (YY.YYY) between any convenient Y line pairs. The plotter will calculate the correction factor by assuming the goal distance was the nearest whole number. You must use inch units when measuring on the inch plot or centimeter units when measuring on the metric plot.
6. Press [ALT] [SCALE] XX.XXX.YY.YYY [SCALE] - Enters the new micro-calibration factors.
7. Press [ALT] [,1] - Changes to the memory programming mode.
8. Press [ALT] [VIEW] [,1] - Enables the Auto View function.
9. Press [ALT] [ON LINE] - Programs the plotter memory with the values established in step #6 and exits to the normal plotting mode.

6 Troubleshooting

The LP 3700 plotter has few conditions that need troubleshooting. If you ever have trouble with the plotter, follow the diagnostic steps below. In most cases the condition will quickly be resolved. If you have a condition which is not mentioned in this chapter, call your IOLINE Service Representative (See Appendix B).

Using the Diagnostic Diskette

This diskette has been provided to aid in the initial plotter installation, or if an electrically noisy environment is suspected of contaminating plot data while being transmitted.

1. Insert the utility diskette into floppy drive A: of your host computer.
2. Change to the A: drive. At the C:> prompt, enter "A:" followed by carriage return.
3. At the A:> prompt, type "README" followed by carriage return.
4. Menu is displayed. Follow the instructions.

EXAMPLE: To verify communications between the host and the plotter:

Type ... **README** <return>

The following screen is displayed:

```
LP3700 / LP4000 Diagnostic Diskette



1> Read explanation of files

2> Run Keypad Program (set-up user parameters)

3> Run Diagnostics Program

4> Send Demo. plot to plotter

5> Select Com. port / Baudrate

6> Quit This Program

Enter Option ...
```

You type **3** to proceed with the cable diagnostics program. Follow the menu instructions.

Troubleshooting Specific Conditions

Some common problems and suggested troubleshooting procedures are outlined below.

No Power to the Plotter

1. Verify that the power cord is properly attached to the plotter and is plugged into an electrical outlet.

2. Verify that the fuse(s) is installed and in working condition.

Fan On and Power Light Off

Caution: When the right end covers or bottom cover is removed, high voltage wiring is exposed. Only qualified service technicians should work on exposed electrical components when the plotter is turned on:

1. Remove the bottom cover.
2. Check all cable connections.
3. Check the DC voltages measured on the 7-wire power supply cable at the logic board. Reading from the center of the plotter toward the right end plate:

+33 V GND N/C +14.5V -12V +12V GND +5V

The Plotter Won't Respond To the Host Computer

1. Verify that the plotter is properly connected to the host computer Communications port.
2. Verify that the data cable from the host computer is connected to the port labeled "HOST/MODEM" on the plotter.
3. Verify that the plotter is On Line.
4. See that there are no error lights lit on the keypad.
5. Run "Diagnostics Program."

Media Creep or Poor Registration

Determine whether the shift observed is due to a gradual, continuous process called creep (the paper is slipping slowly on the grit shaft) or a sudden shift (lines plotted prior to the shift look correct relative to the original origin and lines plotted after the shift look correct relative to some new shifted origin).

Paper fibers (or plot media integrity) may break down while plotting, depending on paper quality, plot duration, plot size and plotter acceleration. Large charts, long plots and high acceleration place more demand on the paper and grit drive (rack and pinion) process. Once paper begins to slip, the grit pattern will be replicated many times, creating rows of images (scratches) instead of one clean, crisp track.

Creep is usually the result of paper stretch due to wrinkles or non-flat paper, damaged chart wheels, or a breakdown of the paper fibers from plot duration or plotter acceleration. Reduce the acceleration.

Large plots stretch more than small plots because the distance between the chart hold wheels is greater and the loads are increased. Use high quality (stiff, flat and stable) media such as vellum or double matte mylar for such plots. Allow the media to stabilize (temperature and humidity) prior to plotting. Use care supporting the media.

By providing temporary support (table) in front of and behind the plotter, extra long charts can coil rather than hang on the floor. The load on the paper is thereby reduced, extending the plot duration limits.

A sudden shift of plotted data may be the result of changing to (or from) a pen which is not concentric with the pen holder. Verify that the pen is installed correctly in the pen flange adapter. Check the pen point for damage.

The Line Quality Is Poor

1. Check the pen to see that the ink has not dried since it was last used.

2. Check the pen pressure setting (See Chapter 9).
3. Check the pen height adjustment (See Chapter 9).
4. Adjust the pen dashpot (See Chapter 9).
5. Reduce pen speed and/or acceleration
6. Set pen up/down delay (liquid ink pens)

Keypad Entry Errors

When the plotter is off line, the red error light indicates that an erroneous keypad entry has been made. Correct the entry to reset the light.

If you are trying to take the plotter on line and the *Error* and *Size* lights begin to flash, the following keys have not been properly entered.

[ ], [ ] or [ ] keys

Correct the condition to continue.

Errors While Plotting

This indicator reflects several types of plotting errors. A steady error light indicates that the plot may continue. A blinking error light indicates that the plot must be terminated. See Fig 6-1 for specific error codes.

Window or Viewport Error

An error results if a viewport is set exceeding the paper size, or if the window/viewport parameters are invalid.

To reset the window/viewport size, reenter the window/viewport parameters or reset the paper size.

Communication Errors

Buffer Overflow Error

This is a fatal error condition. The current plot stops automatically and won't continue until you reset the plotter. This error suggests a problem with the interface cabling or handshaking (communications with the host). Check the plotter to computer interface.

Framing Error

This is a fatal error condition. The current plot stops automatically and won't continue until you reset the plotter. This error suggests a compatibility problem between the host and plotter serial ports or electrical noise affecting this interface. Check the plotter to computer interface.

Parity Error

This is a fatal error condition. The current plot stops automatically and won't continue until you reset the plotter. This error suggests a compatibility problem between the host and plotter serial ports or electrical noise affecting this interface. Check the plotter to computer interface.

Overrun Error

This is a fatal error condition. The current plot stops automatically and won't continue until you reset the plotter. Try a lower baud rate.

Pen Changer Errors

Gear Motor Stall

This is a fatal error. The current plot stops automatically and will not continue until the plotter in reset. Any plots stacked in the hyperBUFFER are also lost. The error suggests a problem with the pen change gear motor assembly: The mechanical linkage is binding, the motor is not being powered, the motor has failed, etc.

Pen Changer Travel

The plot can proceed. The link on the pen change gear motor cam has flexed during a balked pen exchange; the exchange may not have occured. To proceed, press the pen up or pen down key to indicate the location of the pen immediately after the balked exchange:

Press [PEN UP] if the pen is in the pen changer stall.

Press [PEN DOWN] if the pen is in the plotter pen holder.

After the plot is complete, check the motion of the pen changer. Roughness during an exchange may be due to poor alignment between the pen changer stall and the plotter pen holder. The pen holder pre-lift (for exchange) is set by turning the pre-lift adjusting screw under the pen lift solenoid.

Other Errors

Incorrect Non-volatile Memory EEPROM Version

This as not a fatal error. Press

[ON LINE]

to transfer the original factory constants (grit shaft circumference and pen stall locations) to the new non-volatile memory keypad.

Input Syntax Error

The code sent from the host to the plotter is not recognizable. Verify that the command set used by the software/driver package is a subset of the plotter command set listed in the plottter manual. The plot continues and the code in question is printed on the drawing to assist in understanding the cause of the problem.

Error:	View	On Line	Speed	Size	Scale	ALT	Error
hyperBUFFER							
Buffer overflow	■				■		Steady
Framing		■			■		Steady
Parity	■	■			■		Steady
Overrun			■		■		Steady
Unknown serial	■	■	■		■		Steady
Input syntax		■		■	■		Steady
Plotter							
Buffer overflow	■					■	Blinks
Framing		■				■	Blinks
Parity	■	■				■	Blinks
Overrun			■			■	Blinks
Pen Changer							
Gear motor stall	■		■			■	Blinks
Pen changer travel		■	■			■	Steady
Other							
Wroog EEPROM	■	■	■			■	Steady
Input syntax		■		■		■	Steady
Window/Viewport	■	■			■	■	Steady

Key:

■	Yellow indicator light on
Error	Red indicator light on
Blinks	Plot must be terminated
Steady	Plot may continue

Figure 6-1. Errors indicated on the keypad.

7 The hyperBUFFER Option

The IOLINE hyperBUFFER is a large memory capacity device capable of holding (or spooling) several large plots simultaneously. When you use the hyperBUFFER, the plotter's performance improves significantly by sorting pen requests and reordering the sequence of plot commands.

The performance improvements vary depending upon the plot size, original command sequence, and the effective data transmission rate of the host computer. The best performance occurs when the physical size of the plot is large and the host data rate is high.

The hyperBUFFER data compression technique permits storage of plot files that exceed the hyperBUFFER's 512K memory size. In some cases the hyperBUFFER can hold files that are more than double the physical memory. Because of this extremely large effective capacity your computer becomes available earlier in the plot cycle for other tasks.

The hyperBUFFER is easily installed in the plotter chassis and once installed, the hyperBUFFER ROM Revision number is then plotted in the Self Test Plot.

The hyperBUFFER accepts data before the plotter is placed on line. Performance of the hyperBUFFER can be improved by initiating data transfer before the plotter is placed on line.

Here's how to operate the hyperBUFFER:

1. Send the drawing. Several plots may be stored in the hyperBUFFER simultaneously. This provides the hyperBUFFER a selection of plotting operations with which to begin optimizing.
2. Press the [ON LINE] key. The plotter will begin the first drawing.
3. When the first plot is complete, press [ON LINE] to toggle the plotter off line.
4. Change the paper and plot parameters via the keypad as required for plot #2.
5. Press [ON LINE] to begin the second plot.
6. Repeat steps 3-5 until all plots are complete.

Buffering Multiple Plots

Each plot intended to be stacked or optimized must begin with a Plotter Select (:) and be terminated by a Plotter Deselect (@). When the hyperBUFFER is enabled, it automatically inserts an H (Home) before passing the @ to the plotter.

If the next plot occurs without pausing, it may be that the host software did not send an @ at the end of each plot. One may be manually inserted from the plotter keypad. The plotter may be either on or off line. After the host computer is finished sending the plot file:

Press [ORIGIN].

If the plotter is placed off line during a plot, the hyperBUFFER purges only the current plot file. The next stacked plot will be output after a normal plot initialization sequence.

If the plotter is reset, the hyperBUFFER is purged of all current contents and the default mode is set to n = 3 (full optimization).

Modes of Operation

The keypad sequences shown below set the hyperBUFFER optimization level:

Press [ALT] [0 BLOW] *n*

where *n* is one of the following:

n = 0	Disable the hyperBUFFER. No optimization, pass through (like a wire).
n = 1	Enable the hyperBUFFER. No optimization.
n = 2	Optimization: pen number sorting only.
n = 3	Full optimization techniques. (default mode)

8 Using the Multi-Pen Changer Option

The Multi-pen Changer can support up to 20 pens in groups of 4. Each 4-pen group occupies a pen *tray*. Up to 5 pen trays can be mounted on a removable *pen tray carrier* which can be stored on the plotter dust cover. Each pen stall is shipped with a pen flange adapter. Standard plotter pens may be used.

To install the pen trays and pen tray carrier:

1. Remove two screws (painted 3/8 inch flat head phillips) which secure the dust cover to the plotter chassis. Do not remove the dust cover from the plotter. (See Figure 8-1.)

2. Place the storage brackets in position with support studs oriented toward the center of the plotter and attach with the screws provided (two longer screws, painted 1/2 inch flat head phillips screws).

3. Place the pen tray carrier on the storage brackets.

4. Fasten the prepared tray(s) to the pen tray carrier. Pen positions are numbered from right to left, 1 through 20.

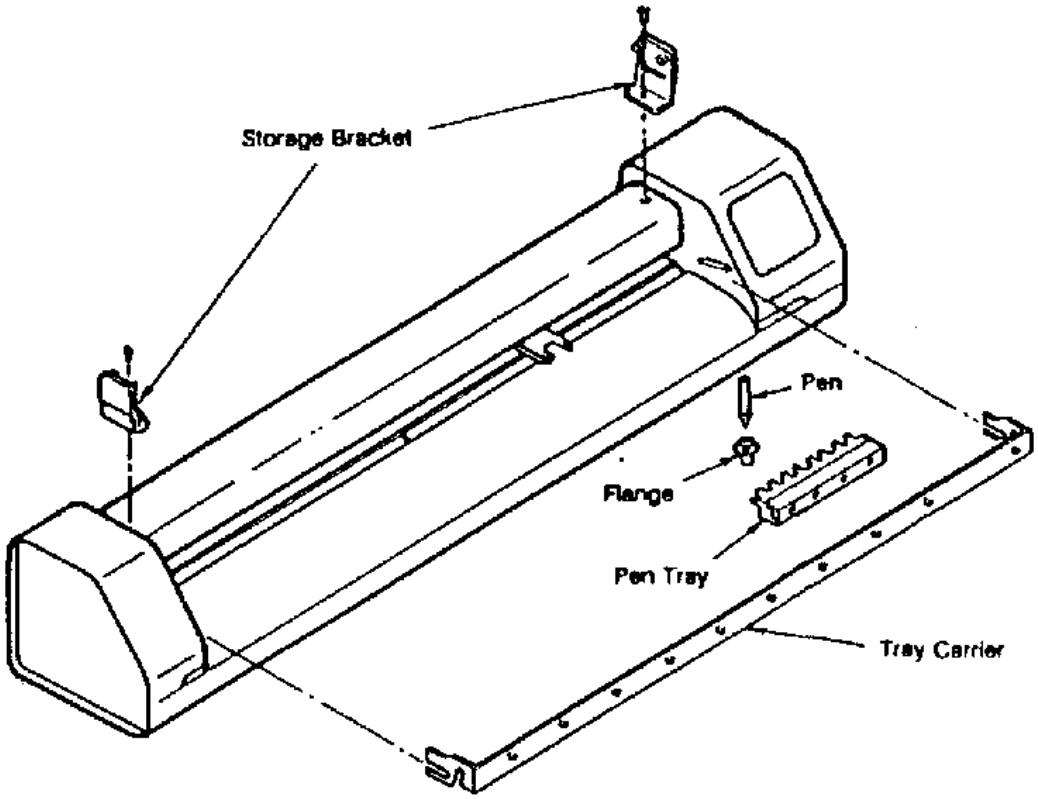


Figure 8-1. Multi-Pen Changer.

9 Plotter Maintenance

Your plotter should be routinely inspected and cleaned every 300 hours of operation, or more frequently if its operating environment is particularly dusty. The two traverse rods which support the pen carriage assembly should be kept clean and dry.

Cleaning the Traverse Rods

NOTE: Clean plastic and metal parts with alcohol. Lubricate rotating and sliding parts with a small amount of 3M Silicone Spray Lub (#62-4613-4935-9).

To clean the traverse rods, perform the following steps:

> *CAUTION: The pen carriage assembly has two spring loaded damper wheels which contact the dust cover. When removing or replacing the cover use caution to move the cover slowly in the vertical direction, rocking gently to engage or disengage the two damper wheels. (See Figure 9-2.)*

1. Remove the two painted screws at the end of the dust cover with a medium Phillips screwdriver.

2. Remove the dust cover (top center cover) which spans the width of the plotter.

3. Using the pen move keys, drive the pen carriage to one side of the plotter. Clean the two traverse rods with a soft cloth moistened with isopropyl alcohol. Move the pen carriage and finish cleaning the traverse rods. *Note: Adjust the pen height, if necessary (Described below).*

4. Replace the dust cover. Use care to engage the carriage damper wheels one at a time when lowering the cover into position. Replace and tighten the two mounting screws.

Pen Height Adjustment

Adjust the pen height using the fine adjustment procedure outlined below. Large changes in pen height should only be required if the pen lift belt has been forced past a tooth on the lift sprocket assembly. (See Figure 9-3)

Fine Adjustment

Fine adjustments in pen height can be made to correct for plot defects such as: leaders at the beginning of lines; trails at the end of lines; lines made while the pen is up; or lines missed while the pen is down.

1. Following the procedure described above for cleaning the traverse rods, carefully remove the dust cover.

2. Turn the plotter power switch *on*.

3. Press [6-] to move the pen to the right hand limit.

4. With pen and paper installed, press [PEN DOWN] to lower the pen.

   Notice the clearance between the vertical pen holder arm and the lift sprocket assembly (where contact is made when the pen is raised by the actuator). The desired clearance is approximately .01 inch, or the thickness of a business card, which insures that the pen lift sprocket assembly is completely clear of the pen holder arm when the pen is down. (See Figure 9-3.)

5. Raise the pen by pressing the [PEN UP] key.

6. Repeat steps 4 and 5 at several locations across the plotter, noting the pen location which produced the smallest clearance. Move the pen to this location.

7. The pen height adjustment screw is a socket head screw located on the right hand end plate, behind the rear traverse rod (see Figure 9-2). By turning the adjustment screw clockwise, the clearance decreases, and the pen height setting increases. With the pen down and by turning this screw, set the clearance to approximately .01 inch.

8. With the pen in the raised position, check the height of the pen above the paper at the right, center and left hand locations across the plotter. The pen should lift at least .05 inches.

9. Replace the dust cover as described in "Cleaning the Traverse Rods", above.

Coarse Adjustment

When the pen is up, the lift sprocket assembly should be approximately square with the pen carriage (Figure 9-3). The pen lift solenoid should also be approximately parallel to the plotter right end plate (Figure 9-1). A dragging pen may indicate that a pen lift belt has been forced over one tooth on a lift sprocket.

Turn the pen height adjust screw (Figure 9-2) until the pen lift solenoid is parallel to the right end plate. Remove a security clip on one of the damper wheels (Figure 9-3), lift the wheel and reposition the lift sprocket assembly to be square with the pen carriage. Engage the belt with the sprocket, lower the damper wheel and replace the clip. Now, adjust the pen height following steps 1 through 9 above.

Adjusting the Pen Force

The force the pen exerts on the plotting media may be varied by adjusting the "pen down" spring tension. Five settings provide pen forces from approximately 20 to 60 grams. The optimal pen force setting depends on the weight and type of the pen you use. To adjust the pen force:

1. Find the pen force adjustment lever under the dust cover on the rear of the pen holder arm. See Figure 9-3.

2. Push the pen force adjustment up or down to decrease or increase the pen writing force. Each new downward position of the lever increases the pen force by approximately 10 grams; the range of adjustment is 20 to 60 grams.

Adjusting the Pen Damper

Pen "up and down" motion is adjusted (or damped) by an adjustable air dashpot located next to the pen solenoid. Here's how to adjust the pen damper:

1. Remove the top right cover (4 tan screws). See Figure 9-1 and Figure 9-2.

2. Turn the plotter power switch on.

   WARNING: Do Not touch electrical connections. Line voltage is present.

3. Verify that the pen height is set correctly.

4. Use a long, fine pitch, dashed line as a test plot to adjust the pen damper. Such a dashed line is available by pressing ALT / 8. Use E size paper or, if smaller paper is used, leave the chart wheels up and move the paper under the pen as desired. Set the damper adjusting screw (Figure 9-1) to the maximum damping (clockwise) position which will still permit full pen lift solenoid travel. Too much damping is indicated by missing ink at the start of lines. Too

little damping (and too much pen force) causes pen impact at line starts.

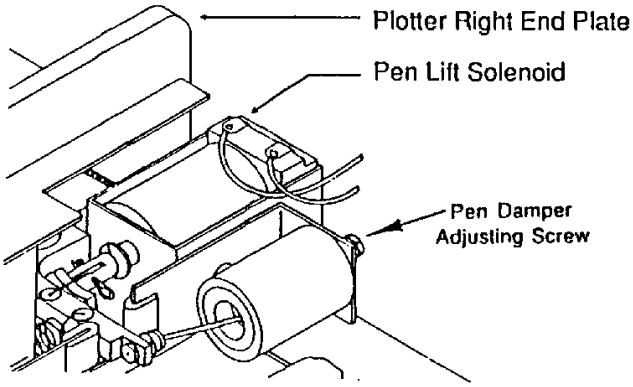


Figure 9-1. Pen Dash Pot.

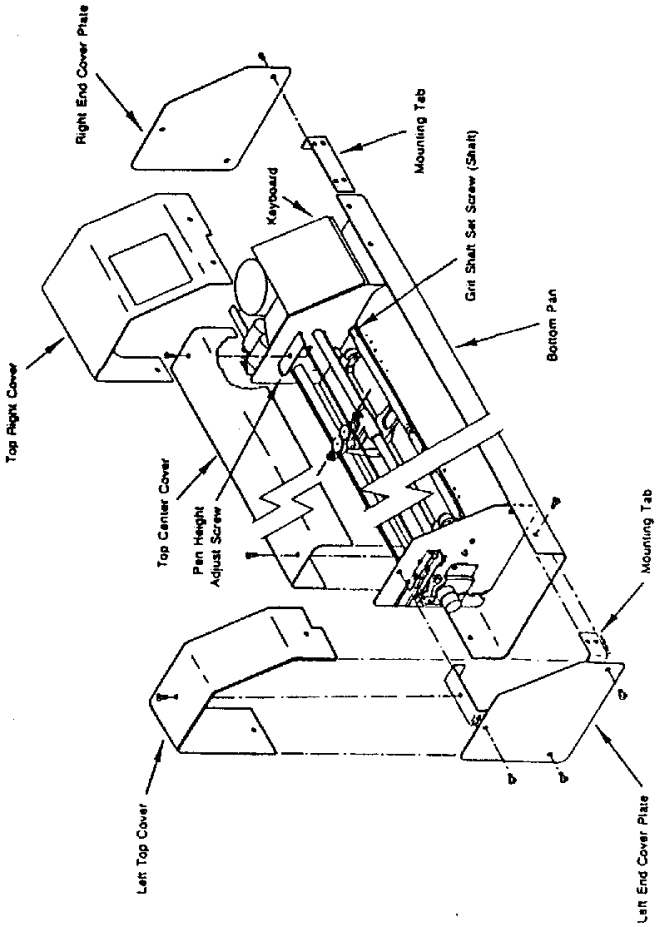


Figure 9-2. LP4000 Plotter.

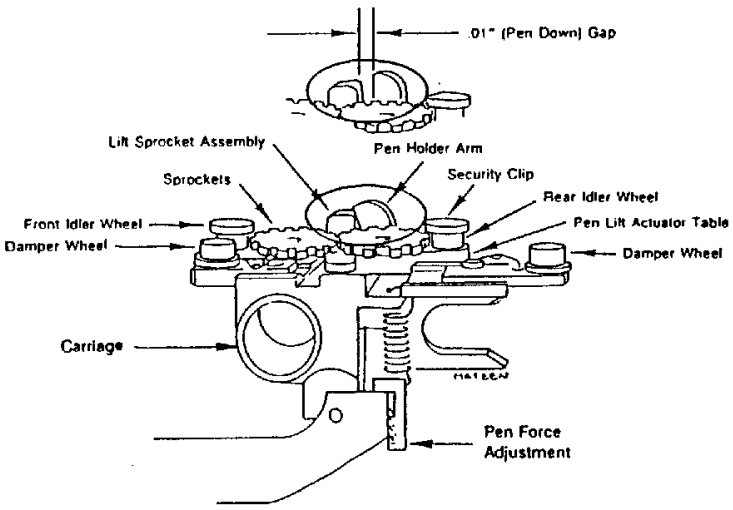


Figure 9-3. Pen Carriage.

A DM/PL Commands

Summary (Alphabetic Listing)

This listing shows the Plotter Host commands in alphabetical order. It is followed by a more detailed listing which is also displayed in alphabetical order. Throughout these lists, you will see references to such characters as: *n, m, y, x, d, r, mm,* etc. These characters refer to the actual numbers or other data you will choose to use with these commands. In each case, these characters will be shown in *italics* in order to set them apart from the actual alphabet characters featured in the lists.

ASCII Command	Description
::	Plotter Select (Mode One)
::I*pc d* or ::I(*nn nn nn nn*)*pc d*	Plotter Select (Mode Two) pc = single ASCII character represented by two-digit hexadecimal number (both digits must be entered). *d* = numeric delay time.
@	Plotter Deselect

#*n,m* Set Pen Delays
pen up delay set to *n* milliseconds
pen down delay set to *m* milliseconds

A Absolute Pen Positioning (all coordinates that follow are relative to Origin)

CA*x,y,d* Arc

x,y = center point *x,y* coordinates
d = arc angle in degrees (+CCW, -CW)

CC*x,y,r* Circle

x,y = center point *x,y* coordinates
r = radius

D Pen Down

EB*nn* (Mode Two) Prompt Enable

n = two-digit hexadecimal value
(Caret 5E hex or 94 decimal default)

EC*n* Set Coordinate Resolution

n = 1 = .001 inch
2 = .0025 inch (default)
5 = .005 inch
M = .1 mm
N = .025 mm

ED Digitize

EF Large Chart

EH Small Chart

EL Plot Pause

ER Report

ET*nn* Redefine End of Text character
nn = ASCII character represented by a two digit hexadecimal number (both digits must be entered)

F Frame Advance

H Resets origin to lower left and moves pen to the Home position.

L*nn* Select Line Type

nn = 0 through 9 or :

M*hhm* Plot Marker

hh = marker height specified as:
1, 1+, 2, 2+, 3, 3+, 4, 4+, 5
m = marker type:
0,1 2, 3, 4, 5

M(S*n*)*m* Extended Marker

n = marker height = 1 through 255
m = marker type = 0 through 5

O Set Plot Origin

P*n* Select Pen

n = pen number; *n* = 1 through 20

Q Query

R Relative Pen Positioning (all coordinates that follow are relative to previous pen position)

Srhh[string]_ Plot Simple Text

r = 1 = 0 degrees rotation
2 = 90 degrees rotation (clockwise)
3 = 180 degrees rotation
4 = 270 degrees rotation

hh = character height. See "Simple Text" under "Command Descriptions" in the next section.

[string]= ASCII character string
_ = End of Text terminator (see ET*n* above)

S(S*n*,W*n*,I/NI,G*n*,X*n*,Y*n*)
Extended Text

T Plotter Test

U Pen Up

V*n* Set Velocity

n = 1 to 20: 1 to 20 inches per second

W Set Window, Viewport Limits

X Serial Port Pass Through Enable

Z Plotter Reset

x,y Move to specified *x,y* coordinate

p +*y* incremental move

q +*x*,+*y* incremental move

r +*x* incremental move

s +*x*,-*y* incremental move

t -*y* incremental move

u -*x*,-*y* incremental move

v -*x* incremental move

w -*x*,+*y* incremental move

y pen up

z pen down

Command Description

ASCII Command	Description
::	**Plotter Select.** This command enables the plotter to interpret plot commands. Interpretation ceases when either an "@" (deselect) or "Z" (reset) command is received. Prior to receiving a "::", input is passed through to the Terminal Port. *Note: The plotter must be put on line from the keyboard before this command is accepted.*
::I*pc d* or ::I(*nn nn nn nn*)*pc d*	**Plotter Select (Mode Two).** Use to verify available space for data transmission from the host to the plotter. *pc* is an ASCII character prompt code in hexadecimal. *d* is the time in hundredths of a second being requested that the plotter delay between receiving the prompt code and checking to see if there is space available to receive data from the host. *d* must be an integer number in the range of 0-255. Unless specified, *pc* defaults to 0D hex and *d* defaults to 255.

(*nn nn nn nn*) are optional plotter response codes which may be as many as four ASCII characters, expressed in hexadecimal, used in lieu of the default carriage return.

When prompted, the plotter waits the specified delay time and then checks its data buffer status. If there is room for at least 256 more characters, it sends the specified response codes the computer.

@ **Plotter Deselect.** This command causes the plotter to process all data currently in the buffer. No new data is accepted until the plotter is selected again. The pass through function is reenabled and the plotter appears transparent to the computer. All parameters, such as pen velocity, are retained.

Note: The hyperBUFFER uses this command to separate spooled plots.

#*n,m* **Set Pen Delay.** This command allows software control of the delays necessary between a pen up or down action and any pen or paper motion. It may be sent from the host only if the hyperBUFFER is disabled.

The pen up delay allows the pen to be completely clear of the paper before a pen up move is initiated. The pen down delay allows the pen to reach the paper before the start of a pen down move. Generally, the longer these delays are made, the higher the plot quality.

Plot time may, however, be substantially improved (particularly for plots containing large amounts of text) by reducing these numbers. *n* and *m* are expressed in milliseconds, and the default values are 16 and 50, respectively. The range for *n* and *m* is 1 to 255; however, the practical minimum is for *m* is 40.

x,y **Vector Move.** Moves to specified coordinate.

A **Set Absolute Pen Positioning.** This command causes all coordinate information that follows to be relative to the most recently established Origin.

CA*x,y,d* **Plot Arc.**

x,y = center point coordinates (integers)
d = arc angle in degrees (+CCW, –CW)

This command draws an arc for *d* degrees centered at *x,y* if *absolute positioning* has been specified, or at *x,y* relative to the current pen position if *relative positioning* has been specified. If *d* is positive the arc is drawn in the counterclockwise direction. If *d* is negative the arc is drawn in the clockwise direction.

Note: A relative vector following an Arc *command is relative to the arc starting point, not the final position of the pen.*

CC*x,y,r* **Plot Circle.**

x,y = center coordinates (integers)
r = radius (positive integer)

This command raises the pen and moves it to the 3 o'clock position of a circle of radius *r*, centered at *x,y* if *absolute positioning* has been specified, or at *x,y* relative to the current pen position if *relative positioning* has been specified. The circle is drawn in the counterclockwise direction until the 3 o'clock position of the circle is reached again, when the pen is raised.

Note: A relative vector following a Circle *command is relative to the center of the circle, not the actual position of the pen.*

D — **Pen Down.** This command causes the pen to be lowered to the plotting surface. It remains lowered until a Pen Up (U), Home (H), Plotter Deselect (@), Plotter Reset (Z), Arc (CA), or Circle (CC) command is received. Also, to prevent pen bleeding, the pen automatically raises after several seconds of no movement. It is lowered again when additional plotting commands are received.

EB*nn* — **Prompt Enable.** This command defines the Mode Two prompt code to be used within a Simple or Extended Text string. The default prompt enable character is a caret (5E hex). Any other character can be used by using the EB command. *Note: The EB command must be used immediately following the Mode Two command. Do not use these characters as an EB indicator: Mode Two prompt code, Deselect (@), or End of Text (ET).*

EC*n* — **Coordinate Addressing.** Set Coordinate Resolution as follows:

n =
- 1 = .001 inches per unit
- 2 = .0025 inches (default)
- 5 = .005 inches
- M = .1 mm
- N = .025 mm

This command sets the distance unit for pen motions. All pen motion commands requiring distance parameters use the resolution for one unit of motion.

ED — **Digitize.** This command enables the plotter digitize mode while plotting On Line. At the time the ED command is processed, the plotter goes Off Line and the user can move the pen to a desired location (using the arrow keys). When the Digitize (DIGIT) key is pressed, the plotter sends the current pen location to the host. The plotter then goes back On Line.

The form of the pen coordinates sent to the host is:

(*s*xxxxx,*s*yyyyy) <CR> where *s* is a sign

Note: The sign is included only if it is negative; otherwise, a blank precedes the coordinates as follows: (xxxxx, yyyyy)<CR>

Example: (32767, 522)

Note: The current pen location (coordinates sent to host) is expressed in Absolute relative to Home (LL), and each unit equals one Host Unit (as specified with EC1, EC2 ECM, ECN or EC5 from the host computer). The hyperBUFFER must be placed in the Disabled mode, if it is installed, before Digitize can be used.

EF — **Large Chart.** Used to prepare the plotter to use the large chart-size format (no action occurs).

EH — **Small Chart.** Used to prepare the plotter to use the small chart-size format (no action occurs).

EL — **Plot Pause.** When the plotter receives this command, the current plot pauses (while still on line), the pen moves to the Home position (lower left corner, 0,0 regardless of the Origin position). The CHART HOLD key is enabled so that the paper may be changed.

During a plot pause, the *Alt* light is turned on. The ALT key must be pressed to continue plotting. The plot resumes at the last pen position.

ER — **Report.** Sends the following plotter status to the host:
- Pen number last selected
- Pen status (up/down)
- Inside/Outside current window limits on plotting surface status code

- Chart format (large/small)
- Pen position
- Window limits coordinates
- Viewport limits coordinates

ET*nn* **Set End of Text Character.**

nn = ASCII character represented by a two digit hexadecimal number.

This command redefines the character that signifies the end of a text string. The default is 5F hex (an underscore).

A redefined end of text character stays in memory until the plotter is given a new ET*n* command, or until the plotter is reset or turned off.

F*n* **Frame Advance.** Used with rolled paper to move paper between plots. Establishes a new home position.

n = Steps in current resolution required to move from current home to new home.

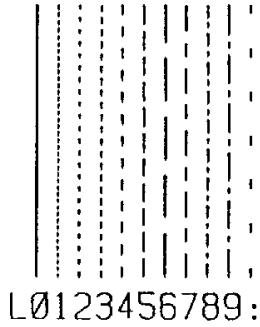
H **Go To Home Position.** This command causes the pen to be raised and returned to the Home position. All other parameters that have been set are retained.

L*n* **Select Line Type.**

n = 0 to 9 or :

The Select Line Type command allows the selection of either solid (default) or one of 10 styles of dashed lines for pen-down vectors. The plotter self test displays a sample of each line style. Line types do not change scale with plot scaling. The following actual scale table indicates each line type.

Line Types



M*hhm* **Marker.** Marker symbol dawn by the plotter at the center of a specified size.

hh = marker height:
1, 1+, 2, 2+, 3, 3+, 4, 4+, 5 (see table below)

m = marker type:
0, 1, 2, 3, 4, 5 (see table below)

Note: Do not follow hh with a space character.

The following tables provide the symbols and sizes for Markers.

Marker Types

Type (*m*)	Marker Symbol
0	
1	
2	
3	
4	
5	

Combined Unit Marker Sizes

hh Specifier	EC1 .001 inch (inches)	EC2 .0025 inch (inches)	EC5 .005 inch (inches)	ECM .1 mm (mm)	ECN .025 mm (mm)
1	0.008	0.02	0.04	0.8	0.2
1+	0.012	0.03	0.06	1.2	0.3
2	0.016	0.04	0.08	1.6	0.4
2+	0.024	0.06	0.12	2.4	0.6
3	0.032	0.08	0.16	3.2	0.8
3+	0.048	0.12	0.24	4.8	1.2
4	0.064	0.16	0.32	6.4	1.6
4+	0.096	0.24	0.48	9.6	2.4
5	0.128	0.32	0.64	12.8	3.2

M(S*n*)*m* **Extended Marker.** Plots markers in a variety of sizes. *n* is a number between 1 and 255. *n* represents the marker height specified as 8 times *n* times the current addressable resolution.

For example: M(S50)2 plots a rectangle marker .4 inches high on a plot while .001 inch resolution (EC1) is in effect.

If the size parameter is omitted from the command format all marker symbols are drawn at the size of the last-drawn marker.

O **Set Origin.** This command sets the current pen position as the origin of the coordinate system. All further Absolute position commands are relative to this point. This origin is retained until another Set Origin (O), Home (H), Window (W), or Reset (Z) command is received. A Home command resets the origin to its position when the plotter was put on line.

Note: Several commands imply a Home command: PO, ECn.

P*n* **Select New Pen.** Format: *n* is a pen number selected (1 through 20) Alternatively, pen numbers 8 through 16 can be selected as follows:

n = 1+ = pen 8
2+ = pen 9
3+ = pen 10
4+ = pen 11
5+ = pen 12
6+ = pen 13
7+ = pen 14
8+ = pen 15
9+ = pen 16

This command causes the plotter to complete all commands in its buffer, and then stop with the pen up. The red Pen LED on the plotter's front panel is lit and the pen number parameter, n, is displayed in binary, lowest order bit at the top, on the yellow front panel LEDs.

When the operator has changed pens and pressed the [ALT] key plotting resumes. Input arriving after the Pen command is buffered (until the buffer is full) while the operator is making the pen change.

A Pen command requesting pen 0 (zero) also executes a Home operation.

Q

Query. The query command causes information about the IOLINE plotter to be sent to the host computer. This information is sent in ASCII format and contains the plotter model number and ROM version number. For example:

(LP4000 V01.14) <carriage return>

R

Set Relative Pen Positioning. This command causes all coordinate information that follows to be relative to the previous pen position when the coordinates are received. This is the default state on power up or reset.

S*rhh*[string]_

Simple Text.

r = 1, 2, 3 or 4
hh = 1, 1+, 2, 2+, 3, 3+, 4, 4+, or 5
[string]= ASCII character string
_ = (underscore) end simple text (see ET command)

This command causes the ASCII text resident in the plotter to be plotted with a rotation specified by r, and size specified by hh. Rotation is specified by:

r = 1 = 0 degrees (parallel to x axis)
2 = 90 degrees (clockwise)
3 = 180 degrees
4 = 270 degrees

Text height is specified by:

hh = text height:
1, 1+, 2, 2+, 3, 3+, 4, 4+, 5 (see table below)

Character Heights

hh Specifier	EC1 .001 inch (inches)	EC2 .0025 inch (inches)	EC5 .005 inch (inches)	ECM .1 mm (mm)	ECN .025 mm (mm)
1	0.014	0.035	0.07	1.4	0.35
1+	0.021	0.0525	0.105	2.1	0.525
2	0.028	0.0700	0.14	2.8	0.70
2+	0.042	0.1050	0.21	4.2	1.05
3	0.056	0.1400	0.28	5.6	1.4
3+	0.084	0.2100	0.42	8.4	2.1
4	0.112	0.2800	0.56	11.2	2.8
4+	0.168	0.4200	0.84	16.8	4.2
5	0.224	0.5600	1.12	22.4	5.6

Carriage returns and line feeds act independently within text strings. *hh* is two characters – either digit with + or digit with space.

S(S*n*,W*n*,I/NI,G*n*,X*n*,Y*n*)

Extended Text. Extended text mode is started with an S, which must be followed immediately (no

intervening characters such as space or comma) by the text specifiers enclosed in parentheses. *Note: Only those text parameters you wish to change need be specified. The same height, width, italics, and character set parameter specifications apply to Simple Text as in Extended Text. The trailing commas are optional except between parameter specifiers.*

Sn, = Character height and width. *n* is a numeric expression between 1-255. The standard character width to height ratio (aspect ratio) is 6/7. The height is:
n times .007" at .001" resolution,
n times .035" at .005" resolution,
n times .7 mm at .1 mm resolution
n times .0175 mm at .025 mm resolution.

Wn = Width of character for other than a standard aspect ratio. *n* may be specified as a numeric expression between 1-255.

I = Italicized text follows.
NI = Non-italicized text follows.

Gn = One of two different character sets selected may be selected, where:
n = 0 for the standard ASCII character set (def)
n = 1 for the mathematics character set.

Xn,Yn = Slope line for drawing text, specified as the coordinate through which the text angle will pass starting from the current pen position.

T **Plotter Test.** This command causes the plotter to discard any other commands pending in its buffer and to produce its self-test plot. All programmed or manually input parameters are lost.

U **Pen Up.** This command causes the pen to be raised from the plotting surface until the next Pen Down (D) or other plot command (such as Circle or Text) is received.

Vn **Set Velocity.** This command is used to limit the maximum velocity of the pen over the paper. This is sometimes necessary to produce optimum quality plots, particularly with some liquid ink pen and media combinations. n must be an integer within the range of 1 to 20, and specifies inches per second. Velocities specified larger than 20 are set to 20.

If a Set Velocity command is received from either the keypad or the serial interface the actual pen velocity is constrained to the lower number set (by keypad or host). If, however, the default value of pen velocity is not changed, only the axis component is constrained to that velocity, and a 45 degree vector would actually be plotted at about 1.4 times the axial velocity.

W *wxll,wyll,wxur,wyur,vpxll,vpyll,vpxur,vpyur*

Window, Viewport Limits. Used to change the plot window and the plotter's viewport limit from the host computer. Default is the user-selected paper size.

Window Limit Coordinates:

wxll,wyll - lower left window
wxur,wyur - upper right window

Defines the LL and UR corners of the area within a plot file to be plotted. Any area outside this rectangle will be ignored by the plotter. The size of the window may be larger than the maximum paper size or viewport. Default is the maximum plot area for the current paper size.

Viewport Limit Coordinates:

vpxll,vpyll - lower left viewport
vpxur,vpyur - upper right viewport

Defines the area on the paper where the plotter will draw the area of the plot file as currently defined with the window specification. This may be visualized as a method of scaling (larger or smaller) the plot data (window area) into the desired area on the paper (viewport area).

If the aspect ratio of the window matches that of the viewport, the scale for the *x* and *y* axes will be the same. If they are different, the aspect ratio of the plot will be changed.

Default viewport is the maximum user-specified paper size. A viewport larger than the user-specified paper size may not be selected.

X

Serial Port Pass Through Enable. This command causes further input to be passed through to the second serial port as well as to be processed by the plotter. The second serial port allows the plotter to share a serial interface with a CRT. The plotter will be between the CRT and the host port.

Normally the plotter passes on all received characters to the CRT until a Plotter Select (;:) sequence is received. Then all further input is consumed in the plotter until a Deselect command (@) or Reset command (Z) is received, when pass through resumes. Characters arriving from the CRT are always passed through to the host.

Note: The plotter also sends XON (ctl Q) and XOFF (ctl S) characters to the host as its buffer fills and empties.

Z

Plotter Reset. This command has the same effect as a manual reset from the keypad. Since all programmed or manually input parameters are reset to their default states, and origin and paper size must be reestablished, this command is normally not used.

Note: The hyperBUFFER ignores this command, but passes it through to the plotter for interpretation.

a

Incremental Move.

a = lower case command letter (alpha), where:

a = p = +y incremental move
q = +x,+y
r = +x
s = +x,-y
t = -y
u = -x,-y
v = -x
w = -x,+y
y = pen up
z = pen down

Each incremental move host command must be a lower case alphabetical letter. The increment addressed is defined by the current EC command.

x,y

Pen Motion Command. This command causes the pen to move to the coordinates *x,y* if absolute positioning has been specified (A) or *PreviousX + x, PreviousY + y* if relative positioning (R) has been specified.

Note: Consecutive pen up moves are combined by the plotter into the most efficient single move.

B *HP-GL Commands*

The LP4000 can be configured to respond to the Hewlett Packard Graphics Language (HP-GL). No hardware modification is needed to accomplish this. To do this, use an HP 758X driver. There are three ways to configure the LP4000 to respond to HP-GL:

1. Temporarily, select HP-GL by setting the plotter paper size as usual and by placing the plotter online with:

   The plotter language will change back to the default DM/PL after being taken offline.

2. Use the language select option in the non-volatile memory to select HP-GL under User *#n* (see Chapter 5). Then, manually select User #n each time the HP-GL is desired.

3. Use the plotter non-volatile memory to: 1. Program User #n to select HP-GL and, 2. Program the Boot User variable to automatically boot as User #n on power up. Each time the plotter is turned on, it will load parameters for User #n.

After selecting HP-GL, the LP4000 will automatically switch to DM/PL if it receives a DM/PL plot file. It will not, however, automatically switch from DM/PL to HP-GL. The default language is DM/PL.

Summary of HP-GL Commands:

Basic Commands

DF	Default instruction
IN	Initialize instruction
NR	Not Ready instruction
IP	Input P1 and P2 scaling points.
OP	Output P1 and P2 instruction
OH	Output Hard clip limits
SC	Scale instruction
IW	Input Window instruction
OW	Output Window instruction
RO	Rotate coordinate system
SP	Select Pen instruction
PU	Pen Up instruction
PD	Pen Down instruction
PA	Plot Absolute instruction
PR	Plot Relative instruction
AS	Acceleration Select instruction
VS	Velocity Select instruction

Circle & Arcs

CT	Chord Tolerance instruction
CI	Circle Instruction
AA	Arc Absolute instruction
AR	Arc Relative instruction

Miscellaneous

XT	Plot X Tick mark instruction
YT	Plot Y Tick mark instruction
TL	Tick Length instruction
SM	Symbol mode instruction
LT	Line Type instruction
BP	Beep instruction

Text

LB	Label instruction
DT	Define Text terminator instruction
DI	Absolute label Direction Instruction
DR	Relative label Direction instruction
SI	Set absolute character Size Instruction
SR	Set relative character Size Instruction
SL	Set character Slant instruction
BL	Save label in Label Buffer
OL	Output buffered Label length
PB	Print Buffered label instruction
LO	Label Origin instruction
CP	Character Plot instruction
ES	Extra Spacing

Reports

OA	Output Actual position and pen status instruction
OC	Output Commanded position instruction
OE	Output Error status instruction
OF	Output Plotter units / millimeter
OI	Output ID message instruction
OO	Output Options instruction
OS	Output Status instruction
OT	Output carousel Type instruction

Frame Advance

AF	Advance Full page instruction
PG	Advance full Page instruction
FR	Advance Full page instruction
AH	Advance Half a page instruction

Basic Commands

DF — Default Instruction

Syntax: DF *term*

Description: Sets the following commands to their default conditions:

CT;	Arc chord tolerance to 5 deg.
DR1,0;	Horizontal characters
DT *03hex*	Text terminator set to ^C
IW;	Input Window set to paper size
LT;	Line Type set to solid line
PA;	Absolute Coordinate addressing mode
SC;	Scale set to plotter units
SL;	Character slant set to 0 degrees
SM;	Symbol mode off
SR;	Set normal character Width and Height (0.285,0.375) cm
TL.5,.5;	Tick length set to .5% of each axis
DI1,0;	Character Direction Horizontal
SI;	Normal Character width

IN — Initialize Instruction

Syntax: IN *term*

Description: Sets all commands to their default conditions.

NR — Not Ready Instruction

Syntax: NR *term*

Description: Pauses the plot and waits for the "ALT" Key to be pressed. At this time the Chart Hold key becomes active to allow the paper to be changed.

Scaling, Windowing and Rotation

IP — Input P1 and P2 scaling points.

Syntax: IP P1x,P1y(,P2x,P2y) *term*
or IP *term*

Description: The default location (IP *term*) of the two scaling points is P1 at the Lower Left corner of the paper and P2 at the Upper Right corner.

If values are included for P1 and P2 they are set at those coordinates. The values are assumed to be plotter units and are relative to the center of the paper.

If only P1 is specified then P2 will move relative to P1.

OP — Output P1 and P2 Instruction
OH — Output Hard Clip Limits

Syntax: OP *term*
OH *term*

Description: Both these commands currently output the same values. The current values of P1 and P2 are output to the host in plotter units having the form:

P1x,P1y,P2x,P2y *ret*

SC — Scale Instruction

Syntax: SC Xmin,Xmax,Ymin,Ymax *term*
or SC *term*

Description: The user values are set for each of the 2 scaling points. A Scale Instruction with no parameters (SC *term*) will turn off the scale mode and revert back to plotter units.

IW Input Window Instruction

Syntax: IW X1,Y1,X2,Y2 *term*
or IW *term*

Description: The input window instruction is assumed to be plotter units and will limit any plotting to the window specified by the window made up of X1,Y1 for lower left corner and X2,Y2 for the upper right corner.

OW Output Window Instruction

Syntax: OW *term*

Description: The current window setting in plotter units is output to the host in the form of: X1,Y1,X2,Y2 *ret*

RO Rotate Coordinate System

Syntax: RO90 *term*
or RO *term*
or RO 0 *term*

Description: Rotate the plotter coordinate system 90 degrees. If no parameter is specified or the parameter is zero then the rotation is canceled. When rotation is selected positive X coordinates become negative Y values and positive Y coordinates are plotted as positive X values.

Pen Control and Plotting

SP Select Pen Instruction

Syntax: SP n *term*
or SP *term*

Description: The plotter will pick up the specified (n) pen. The legal range for our plotter is 0-20. If pen zero is specified or no parameter (SP *term*) then the current pen is put away.

PU Pen Up Instruction
PD Pen Down Instruction

Syntax: PU *term*
or PU Xcoordinate, Ycoordinate(,...) *term*
and PD *term*
or PD X,Y(,...) *term*

Description: The Pen Up Instruction will cause the pen to be raised from the paper. Likewise the Pen Down instruction will cause the pen to be lowered to the down position. This action takes place at the current pen position. The optional coordinates that follow specify the absolute or relative location to move to. Up moves are optimized out and no up moves are made until a Pen Down instruction is received.

PA Plot Absolute Instruction
PR Plot Relative Instruction

Syntax: PA *term*
or PA Xcoordinate,Ycoordinate(,...) *term*
and PR *term*
or PR X,Y(,...) *term*

Description: Plot Absolute sets the coordinate addressing mode to be referenced to the Origin (Center of the Paper). Plot Relative sets the addressing mode of the next move to be referenced to the current pen position.

AS — Acceleration Select Instruction

Syntax: AS n.n *term*
AS *term*

Description: Acceleration is set in G's and has a range of .1 to 2.0. The Default is used if no parameters are specified and has a value of 1G.

VS — Velocity Select Instruction

Syntax: VS n *term*
or VS *term*

Description: Velocity is in cm/sec. and has a range of 1 to 50. Velocity Set through this command from the host only sets the Speed with the pen in the Down position. Any pen up Speeds may be entered through the keypad and are then entered in inches/second.

Circles and Arcs

CT — Chord Tolerance Instruction

Syntax: CT n *term*

Description: The CT instruction determines whether Circles and Arcs that specify a chord tolerance are using degrees or deviation mode (the greatest distance between the arc segment and the drawn chord). A parameter of zero is the same as no parameter and selects degree mode. A parameter of 1 selects deviation mode.

CI — Circle Instruction

Syntax: CI radius(,chord tolerance) *term*

Description: Circles are drawn using the current pen position as the center of the circle. The start of the

circle is at the largest positive X position. Chord Tolerance determines the number of degrees/chord or the length of the chord, whichever is selected with the CT instruction. Specifying a chord tolerance of 120 degrees will cause a triangle to be drawn. Circles drawn with scaling in effect will appear as an ellipse if the P1, P2 scaling points do not define a square. The circle instruction implies a pen down at the start of the circle and returns the pen to its previous state at the end of the circle.

AA — Arc Absolute Instruction
AR — Arc Relative Instruction

Syntax: AA X coordinate,Y coordinate,arc angle (,chord tolerance) *term*

AR X coordinate,Y coordinate,arc angle (,chord tolerance) *term*

Description: The Arc Instructions are similar to the circle command in that the chord tolerance may be specified in degrees or deviation distance. The start of the arc is the current pen position. And the center of the arc is given by the first and second parameter (X and Y coordinate). The arc angle indicates the number of degrees to rotate through. A positive value for the angle causes a CCW rotation and a negative angle causes a CW rotation. If scaling is in effect ellipses may be drawn due to the aspect ratio of the P1, P2 scaling points. The arc instruction does not imply a pen down like the circle command. If the pen was up prior to starting the arc, no arc is drawn but the new location is at the end of the arc.

Miscellaneous Instructions

XT Plot X Tick Mark Instruction
YT Plot Y Tick Mark Instruction

Syntax: XT *term*
YT *term*

Description: The X and Y tick instruction draws a tick mark at the current pen position. The pen does an implied down at the start of the tick mark and returns the pen to its previous state when the instruction completes. The XT instruction draws a vertical (Y direction) X tick and likewise the YT instruction draws a horizontal (X direction) Y tick.

TL Tick Length Instruction

Syntax: TL pos(,neg) *term*
or TL *term*

Description: The tick length has a positive and negative portion and each part may specify a positive or negative percentage of the horizontal or vertical axis.

SM Symbol mode Instruction

Syntax: SM character *term*
or SM *term*

Description: Symbol mode is activated by a character as its parameter. When activated the specified character will be plotted at the end of every PA,PR,PU,PD X,Y vector. Symbol mode can be canceled by using the SM instruction without any parameters.

LT Line Type Instruction

Syntax: LT n *term*
or LT *term*

Description: Line type selection is available for a variety of line types with a range of 0 to 9. Line type 0 plots a dot at each end of the line. Line type *term* (no parameter) changes to the default, solid line.

BP Beep Instruction

Syntax: BP *term*

Description: The Beep Instruction is used to sound the beeper in the plotter. There are no parameters and the beep has a duration of one second.

Labelling

LB Label Instruction

Syntax: LB c...c *text terminator term*

Description: The Label Instruction causes all characters following the LB instruction and up to the Defined Text Terminator to be printed on paper at the current pen position using the current size (SI or SR) and direction (DI or SR). The text terminator is also printed if it is a printable character. The first 150 characters of this instruction are saved in a label buffer. The contents of this buffer may be plotted again (with a possible change in size or direction) using the PB Instruction. The length of the buffered label can be requested using the OL instruction.

DT — Define Text Terminator Instruction

Syntax: DT t *term*
or DT *term*

Description: The terminator (t) may be defined using this Instruction. Any character (except the terminator characters) may be used. The default terminator is the binary number 3 (control C).

DI — Absolute Label Direction Instruction
DR — Relative Label Direction Instruction

Syntax: DI run,rise *term*
or DI *term*
DR run,rise *term*
or DR *term*

Description: Direction of labels is specified using the DI or DR Instruction. If DI is used then plotter units are used to determine the slope and changing the location of the P1, P2 scaling points has no effect on the direction of the labels. If DR is used then user units are used and the slope and sign of the slope of the line the label will be written on is affected by the movement of the P1, P2 scaling points. A DI Instruction with no parameters will draw all labels in a positive X direction. A DR instruction with no parameters will print all labels in the direction of the P2 X coordinate. Changing the locations of P1 and P2 may cause the text to mirror.

SI — Set Absolute Character Size Instruction
SR — Set Relative Character Size Instruction

Syntax: SI width,height *term*
SI *term*
SR width,height *term*
SR *term*

Description: Character Size may be set either in centimeters of height, or in percentage of the paper width and height. The default width is .285 cm and .375 cm for height. Negative values may be specified for each and will cause the text to be mirrored across the respective axis.

SL — Set Character Slant Instruction

Syntax: SL *tan angle term*
SL *term*

Description: Character Slant may be used for italicizing text and is specified by sending the tangent of the angle of 'lean' that you request.

BL — Save Label in Label Buffer

Syntax: BL c...c *text terminator term*
BL *text terminator term*

Description: This instruction loads the following characters including the *text terminator* into the label buffer for later plotting. The maximum number of characters that will fit in the buffer is 150.

OL — Output Buffered Label Length

Syntax: OL *term*

Description: Output the number of characters in the label buffer to the host computer.

PB — Print Buffered Label Instruction

Syntax: PB *term*

Description: This instruction causes the currently buffered label to be printed at the current pen position using the current size and direction settings. This instruction is identical to the LB instruction except that the characters printed must be previously loaded using the BL or LB instruction.

LO — Label Origin Instruction

Syntax: LOn *term*

Description: This instruction sets the label origin. Text may be centered, right or left justified or positioned above or below the line with this instruction. The default (with n omitted) is LO1. A sample of the origin locations is shown in the back of this manual.

CP — Character Plot Instruction

Syntax: CP spaces, lines *term*

Description: This command is useful to move a whole or fractional number of spaces or line feeds. Negative numbers are valid to allow backspacing or reverse line feeds. A CP command without parameters will execute a carriage return, line feed.

ES — Extra Spacing Instruction

Syntax: ES spaces, lines *term*

Description: This command is useful in adding spaces between characters and lines or subtracting spaces between characters or lines to make condensed text. Negative values are legal and can be used to make characters print in a backwards direction or have reverse line feeds (scroll up the page).

Output Commands

OA — Output Actual Position and pen Status Instruction

OC — Output Commanded Position Instruction

Syntax: OA *term*
OC *term*

Description: The actual position in user units is output to the host when this instruction is received. The pen state (up or down) is also output. The commanded and actual positions both output the same information at this time.

OE — Output Error Status Instruction

Syntax: OE *term*

Description: The error code output from the plotter is always zero (no error).

OF — Output Plotter Units / Millimeter

Syntax: OF *term*

Description: The number of plotter units/millimeter is output to the host in response to this instruction. The response is: 40,40 *cr*

OI — Output ID message Instruction

Syntax: OI *term*

Description: The ID message currently output from an Ioline plotter is LP4000 or LP4000 for stepper or servo model respectively.

OO — Output Options Instruction

Syntax: OO *term*

Description: The Options we output are:

Clean paper/paper advance options	none
Pen Select Capability	yes
Arc and Circle instructions	yes
Polygon fill instructions	none
User definable RAM	none

The response sent to the host is:
0,1,0,0,1,0,0,0 *cr*

OS — Output Status Instruction

Syntax: OS *term*

Description: The status we output is always 16 (ready for data)

OT — Output Carousel Type Instruction

Syntax: OT *term*

Description: Carousel type is output as -1 for type (unknown type) and 255 for map (a pen in all pen positions 1-8).

The response sent to the host is: -1,255 *cr*

Roll Paper Feed Instructions

AF — Advance Full Page Instruction
PG — Advance Full Page Instruction
FR — Advance Full Page Instruction

Syntax: AF *term*
PG *term*
FR *term*

Description: These three instructions cause the plotter to advance the paper to the next frame (lower right becomes lower left). This is used when using roll feed paper to eject the current plot and set a new lower left and upper right identical to the last on fresh paper.

AH — Advance Half a page Instruction

Syntax: AH *term*

Description: This instruction is identical to the AF instruction with the exception of advancing half a page rather than a full page.

Note: The Symbol *term* used throughout this manual indicates the Instruction Terminator character. This character may be either a Carriage Return, Line Feed or Semicolon.

Commands Which Are Understood But Ignored

Character Sets

CC	Set Character Chord Angle
CM	Character Select Mode
CS	Designate Character Set
CA	Select Alternate Character Set
SS	Select Standard Character Set
SA	Select Alternate Character Set
DS	Designate Character Set
UC	User Defined Character
DL	Down Loadable Character

Digitize Functions

OD	Output Digitized Point
DC	Clear Digitized Point
DP	Digitize Point

Miscellaneous

AP	Automatic Pen Operations
FS	Pen Force Adjust
GP	Group Pen Define
SG	Select Pen Group
IM	Input Mask
EC	Enable Cut Line Instruction

Instructions Not Recognized

Polygon fills

FT	Fill Type Instruction
UF	User Defined Fill Instruction
PT	Pen Thickness
WG	Fill Wedge Instruction

EW	Edge Wedge Instruction
RA	Fill Rectangle Absolute Instruction
RR	Fill Rectangle Relative Instruction
EA	Edge Rectangle Absolute Instruction
ER	Edge Rectangle Relative Instruction
PM	Polygon mode Instruction
EP	Edge Polygon Instruction
FP	Fill Polygon instruction

Escape Sequences

.(OR .Y	Plotter On Instruction. Causes the plotter to exit the 'Sleep' mode started with the Plotter Off Instruction.
.) OR .Z	Plotter Off Instruction. Causes the plotter to Enter a 'Sleep' mode ended only with an offline on the keypad. or a Plotter On Instruction.
.B	Output Buffer Space Instruction. Causes the plotter to Output the remaining buffer space available.

All the following escape sequences are Understood and Ignored.

.@
.A
.E
.H
.I
.J
.K
.L
.M
.N
.O
.P
.Q
.R
.S
.T

C *Service Information*

The LP4000 contains no user serviceable parts and must be serviced only by your dealer, or the factory.

Any LP4000, whether purchased from a Dealer or from the factory, may be serviced at the factory by following this procedure.

1. Call the IOLINE customer service department (206) 821-2140 to ask for a Return Material Authorization (RMA) number.

2. Fill out a copy of the Service Form included in the following pages of the manual. Be sure to fill in all of the blanks. Include the Service Form with the plotter.

3. Carefully package the plotter in either its original or other suitably protective container. The carriage should be moved to the right endplate and blocked from moving up and down with a piece of foam. Any accessories commonly used with the plotter, such as data cable, cable adapter (if any), pen flanges, pen tray carrier and pen trays (if the plotter is a multipen model) should be sent in with the plotter to aid in diagnosis and adjustment. It is also helpful to send samples of commonly used pens and media. All items sent in with the plotter are carefully noted, and will be returned to you with your plotter, or if defective, replaced after notifying you. All items packed with the plotter should be carefully wrapped and secured to prevent damage to the plotter during shipment.

4. Label the carton as follows:

   RMA # _____

   IOLINE CORPORATION
   12020 113th Avenue N.E.
   Suite 250
   Kirkland, WA 98034

   ATTN: Customer Service

IOLINE will accept no machine returned to it freight collect.

If your machine is under warranty, and you have returned your registration form, that fact should be established at the time you receive your RMA number. Warranty machines will be returned freight prepaid via UPS. If you want a different method of shipment, specify on the service form, and the machine will be returned freight collect via that method. There is no charge for warranty service.

There is a standard charge for out-of-warranty service. Your repaired equipment will be returned collect for the repair charge and freight charge via your specified method. You may prepay the service charge to avoid carrier surcharge on collect shipments.

Any machine, whether in or out of warranty, that has been dropped, plugged in to the wrong voltage, or been otherwise abused will be fixed at time and materials rate. Be sure that you have included your telephone number, since no work will be done without first advising you of the probable charge.

There will be a charge for "no trouble found" machines to cover test time and handling.

All repair work carries a 90 day warranty.

IOLINE Service Request Form

RMA# _____ Unit Serial # _____

Date Returned _____ Model # _____

Name _____

Company _____

Address _____

City _____ State ____ Zip _____

Phone _____

SHIPPING INSTRUCTIONS:

UPS Ground ____ PO# _____
UPS Blue ____ Check Enclosed ____
EMERY ____ FEDERAL EXPRESS ____
Other _____

BRIEF DESCRIPTION OF PROBLEM:

_____

_____

_____

Ship to:
IOLINE CORPORATION
12020 113th Avenue N.E.
Suite 250
Kirkland, WA 98034
(206) 821-2140