PEL SERIES INK JET SYSTEM USER'S MANUAL
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SECTION 1.0: SYSTEM DESCRIPTION

1.1 INTRODUCTION

The Diagraph PEL Series Ink Jet System is a remarkable innovation in product coding and marking. It produces small, precise, non-contact ink jet codes on porous and non-porous surfaces. The PEL Series requires no ink make-up solvents and has almost no solvent emissions. A bulk ink system supplies the ink. Programming is simple with menu-driven firmware. Wherever possible, the firmware will display options available with each command and show prompts and status information to assist you.

The PEL Series Controller will drive up to four PEL printheads. You can transform the printing system into a dual multi-tasking printer with optional components. Each printhead will print fonts from five-dot-high (1/16") to thirty-dot-high (1") characters. The printhead also has the ability to print special characters. Tiny individual drops of ink, fired onto the product from the printhead at precise times form the characters. The energy to eject the ink comes from piezoelectric crystals that turn electrical signals into pressure. Microprocessors change the signals rapidly, altering the printed message almost instantaneously and synchronized with the passing of a product.

This section contains descriptions of the controller and assemblies that make up a Diagraph PEL Series Ink Jet System. Each module or assembly is described in detail by function, relationship and interconnection.

1.2 SYSTEM BREAKDOWN

The diagram below shows the interconnection of major components that make up a PEL Series System.
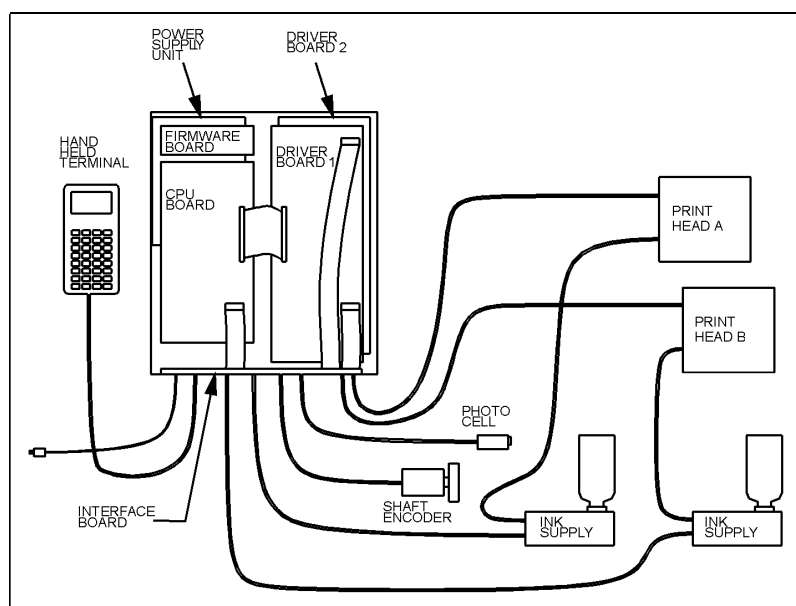
Figure 1-1: Components of the PEL System

1.3 PEL CONTROLLER

The controller is an industrial grade enclosure housing the central processing unit, power supply, driver and interface boards. Access to these electronic boards is through hinged door which can be locked for security. A steel-reinforced flexible umbilical cable connects the controller to the printheads.
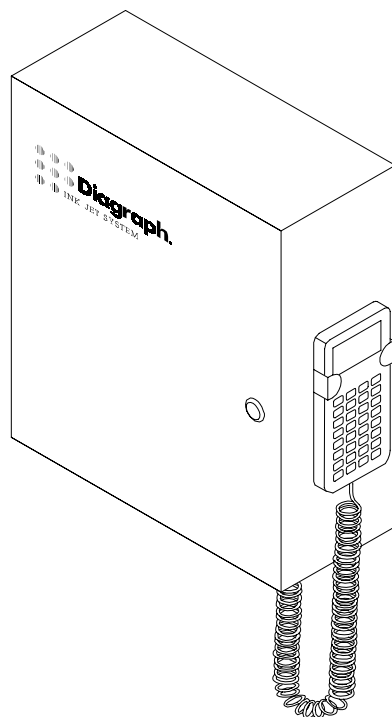
Figure 1-2: PEL Controller

1.3.1 Central Processing Unit (CPU)

The CPU uses 32-bit CMOS microprocessor technology with high performance data manipulation. All input/output signals are opto-isolated and have associated status LED's. You can select system options with jumpers and switches.

1.3.2 Power Supply Unit (PSU)

The PSU is a linear supply that provides all the voltages used in the system.

Supply input voltages:
100V - 130VAC 3A 50/60Hz
200V - 250VAC 1.5A 50/60Hz
(You can select this by changing the power module)

Output voltages:
5VDC   - 3AMPS - used for logic circuits
12VDC   - 2AMPS - used for external peripherals
150VDC - 0.25AMPS - used for printhead driving voltages
30 VAC - 9AMPS - used for printhead heaters

1.3.3 Driver Board

The printhead driver board controls the printhead temperature, monitors the ink level and provides all signals necessary to drive two printheads (A 16 position switch allows the selection of all PEL Series ink types. The driver board accurately controls the temperature of the printhead using a pulse width modulated circuit. All input/output signals have LED's associated with them to facilitate troubleshooting.)

1.3.4 Interface Board

The interface board connects to the CPU board with a single ribbon cable. The board contains all of the D sockets used to connect peripheral devices. Also located on this board is a set of circuit breakers to protect against voltage or current overload from the external peripherals.

1.4 PEL Printhead

The head assembly produces and controls small droplets of ink. This is accomplished by the movement of a piezoelectric ceramic transducer which retracts when voltage is applied. In so doing, the length of the ceramic decreases, creating a void which fills with ink. When voltage is removed, the ceramic expands to its original length and the excess ink is expelled, forming a drop of ink. A fresh drop of ink is expelled "on demand".

1.4.1 Description of Operation

The printhead is a 32-channel array composed of identical channels all sharing a common fluid supply manifold. The array (printhead) is mounted at an angle. This angle is in conjunction with the fixed channel-to-channel spacing determines the vertical resolution of the printhead.

The slant chip on the driver board controls the timing of the droplet ejection allowing the user to input the font as if the printhead was completely vertical.

1.4.2 Filter

A filter area is located at the side of the printhead. The filter itself is a 1" diameter disk of 15-micron sintered stainless steel. Because of its large surface area, the printhead filter does not require replacement.
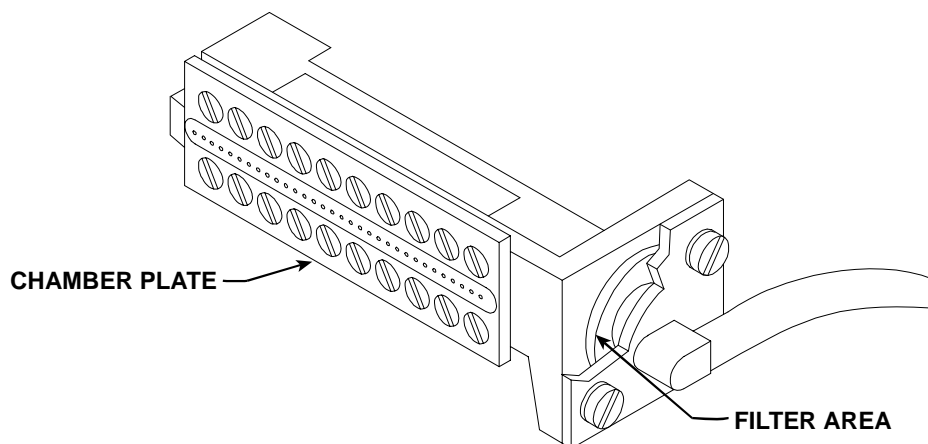
Figure 1-3: PEL Printhead

A piezoelectric transducer and its associated fluidics are located in each of the 32 channels. The transducer, with a foot bonded to it, is coupled directly to the ink in the chamber. When a drive pulse is applied to the transducer, the transducer decreases with length (along its length axis) which is directly in line with the axis of the chamber.

At this time, the enlarged volume of the chamber allows it to fill with ink. After the chamber has had sufficient time to fill, the drive voltage is rapidly removed from the transducer. The transducer then retracts to its original length, creating a pressure pulse in the chamber. The pressure pulse ejects ink from the nozzles (orifices) at the end of the chamber. Surface tension forms the high-velocity-ejected ink into droplets which resemble spears of ink. This fill-before-fire process is the same for all 32 channels.

FRONT VIEW   **SIDE VIEW**
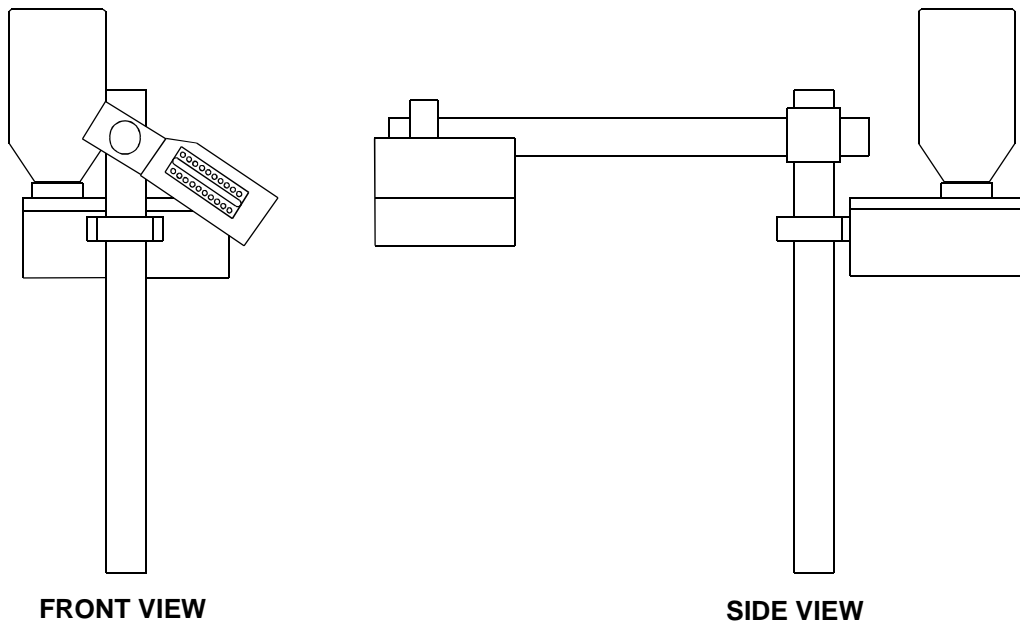
Figure 1-4: Printhead and Ink System Mounting

1.5 PEL Ink System

The Ink System supplies Diagraph PEL Series Ink Jet System with ink.

The Diagraph PEL Series Ink System, designed for use with the PEL Series Printhead, houses the ink reservoir and priming mechanism.

1.5.1 Purge

To prime/purge simply depress the switch labeled "Prime" on the Ink System Unit. The
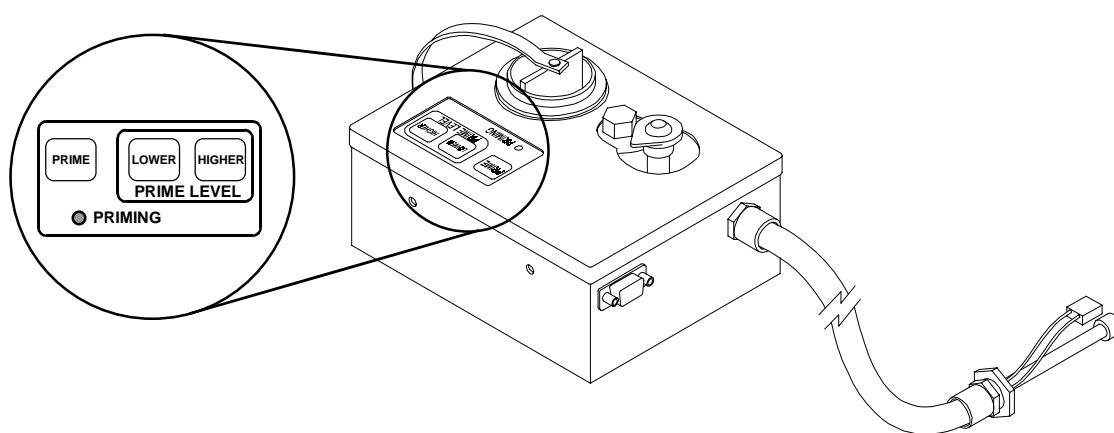
corresponding red LED will light.

Figure 1-6: Ink System

The ink system may be mounted as part of the Printhead assembly or onto a production line conveyor. A standard DB9 interface cable is included with the unit. The ink tubing and ink level detect cable are protected in a steel-reinforced circuit.

To adjust the prime level, click the "Lower" or "Higher" switches until the desired prime level is reached.

NOTE: Prime level can only be adjusted while the "Prime" switch is depressed.

Better priming is obtained by using lower settings. The purge level is saved in memory, even if power is removed from the Ink System.

1.6 Inks

1.6.1 Porous Inks

The PEL Series Inks are supplied in 17 oz. (500ml) bottles. Use them for porous (absorbent) surfaces only. They are available in Black, Blue and Red.

1.6.2 Non-Porous Inks

Not Available at this time.

1.7 PRODUCT DETECTORS

Diagraph supplies four standard types of product detectors: Proximity, Retro-Reflective, Inductive Proximity and Print Registration Photosensors.

1.7.1 Proximity Photosensor

The Proximity Photosensor uses no reflectors but rather detects objects by sensing its own emitted light reflected from the object.

OBJECT
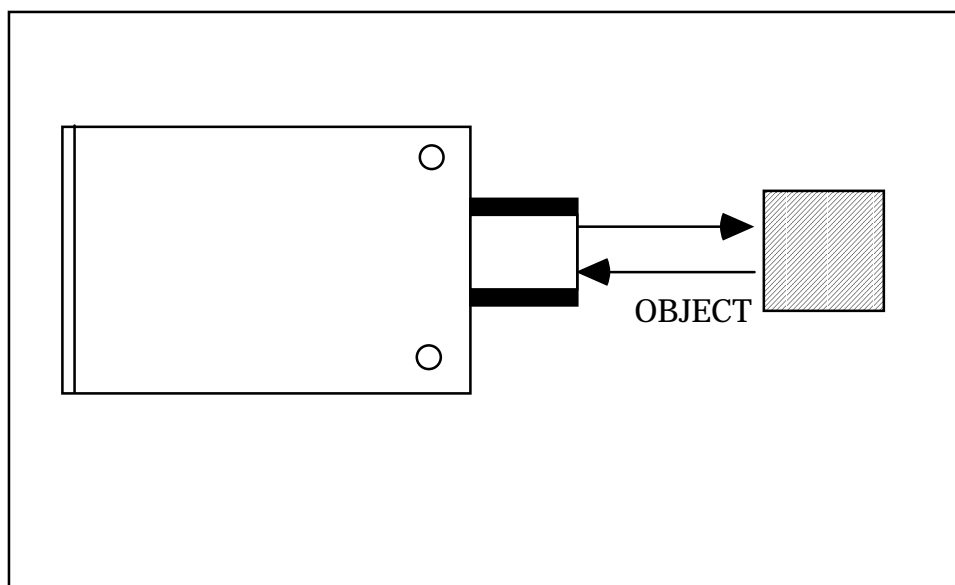
Figure 1-7: The Proximity Photosensor

1.7.2 Retro-Reflective Photosensor

The Retro-Reflective Photosensor consists of a sensor and a reflector. The reflector is mounted directly in front of the sensor. There is a visible red sensing beam for easy alignment. When this beam is broken the photosensor sends the product detect signal.

RETRO TARGET
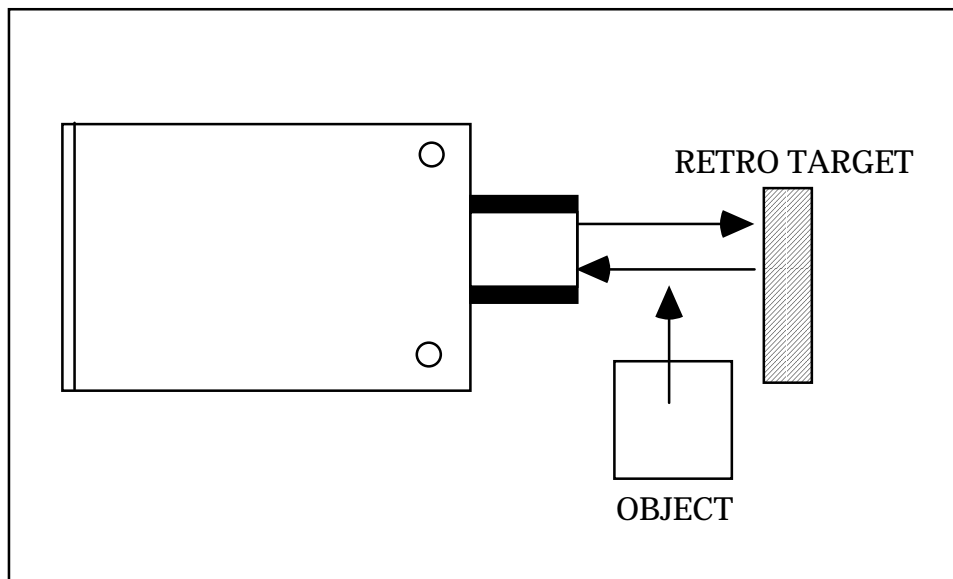
OBJECT

Figure 1-8: The Retro-Reflective Photosensor

1.7.3 Inductive Proximity Sensor

The Inductive Proximity Sensor uses an oscillator and a coil to radiate an electromagnetic field. When a metallic object approaches the sensors surface, the oscillator's energy is dampened. This loss causes a change in the sensor's output, and activates a product detect signal.

METAL
TARGET
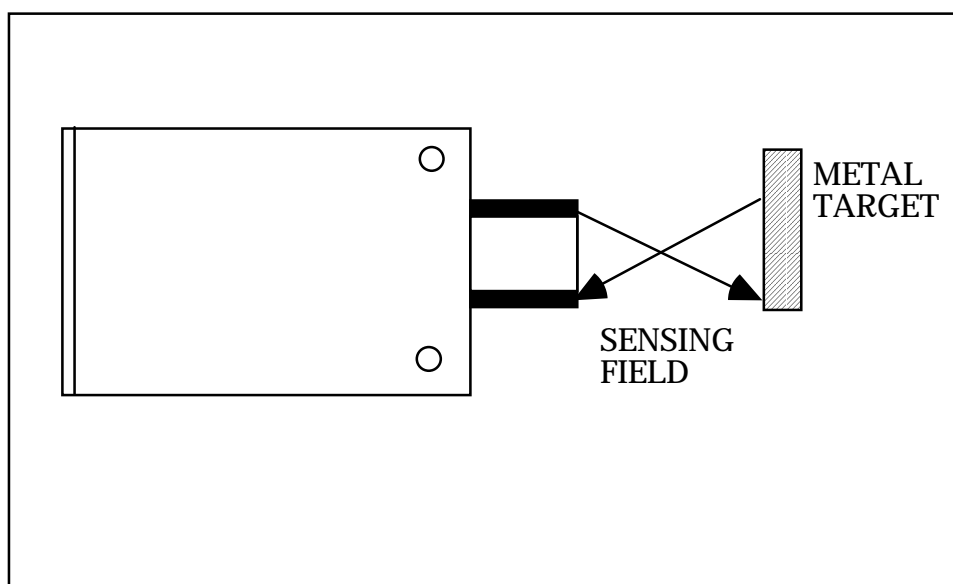
SENSING
FIELD

Figure 1-9: The Inductive Proximity Photosensor

1.7.4 Print Registration Photosensor

The Print Registration Photosensor uses no reflector but rather detects the print registration mark by sensing its own emitted light reflected from the mark. The sensing area is 0.04" in diameter at the focus point.
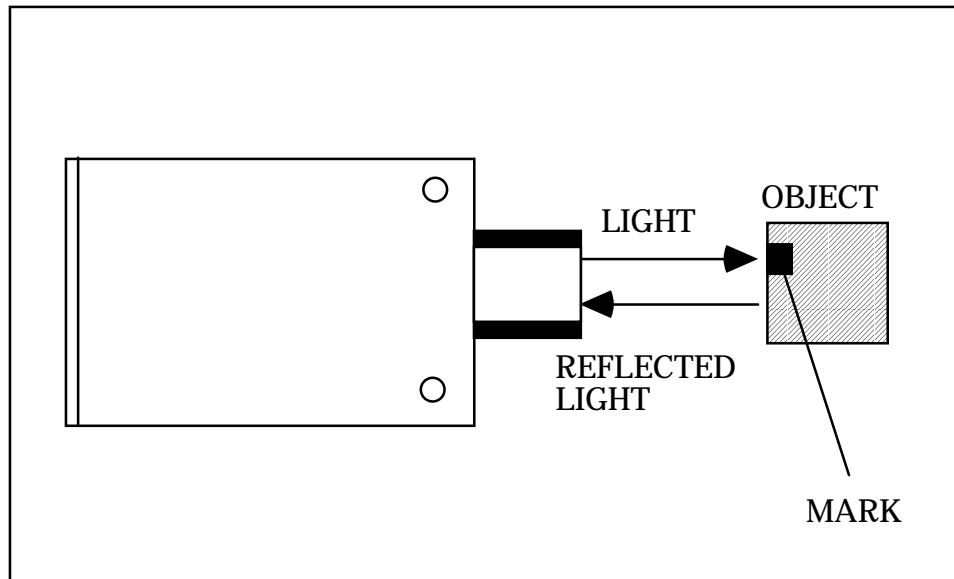
Figure 1-10: The Print Registration Photosensor

1.8 DIAGRAPH HAND-HELD KEYBOARD

The Diagraph Hand-Held Keyboard is designed to allow easy manual data entry. The keyboard is made of a touch sensitive, MEK resistant membrane well suited for the rigors of an industrial environment. It also features a 4 x 16, LCD display enabling 64 characters to be displayed for ease of parameter setting and programming. The keyboard is supplied with a standard DB25 connector and has all protocol settings fully programmed for the PEL Series System printer. It can be detached from the printer to prevent unauthorized programming of the unit.
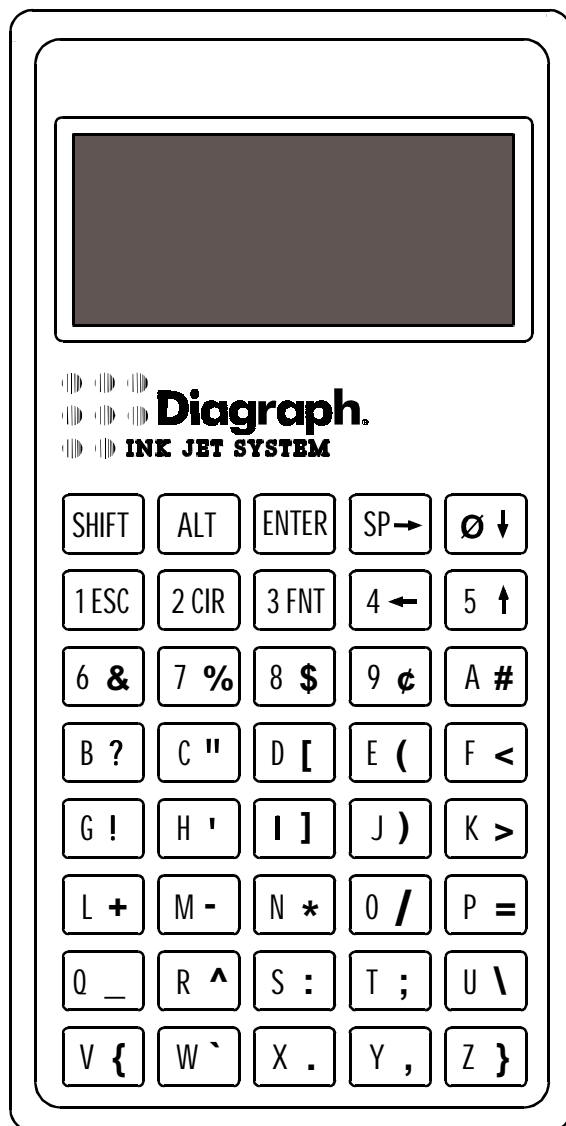
Figure 1-11: Hand-Held Terminal

1.9 HAND-HELD KEYBOARD HOLDER

There are two types of Hand Held Keyboard Holders, the Controller Holder and Floor Stand Holder. The Controller holder provides a method of storing and protecting the Hand Held Terminal when not in use. It mounts directly to the side of the controller. The Floor Stand Keyboard Holder (NOT SHOWN) provides another method of storing and protecting your Hand Held Terminal.   It mounts directly to the floor stand post and is available through your Diagraph sales representative.
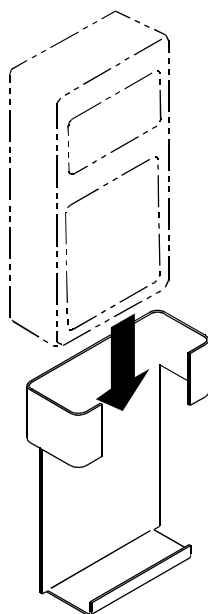
Figure 1-12: Hand-Held Keyboard Holder

1.10 PERIPHERALS

1.10.1 EXTERNAL ALARM BEACON

The External Alarm Beacon indicates ink low situations and system failure. The beacon has two lights, green and red. The red light flashing indicates low ink or a system failure. The green light indicates the system is ready for printing. The beacon is designed to be mounted on top of the floor stand or integrated into a conveyor system. The beacon is supplied with a DB9 connector that plugs directly into the controller.

Figure 1-13: External Alarm Beacon

1.11 SHAFT ENCODERS

The Diagraph Shaft Encoder is designed for heavy duty industrial applications. It converts input shaft rotation into output pulses, which the controller converts into line speed data. The encoder contains high precision hybrid circuitry, along with the latest high resolution chrome and glass rotating disk technology.
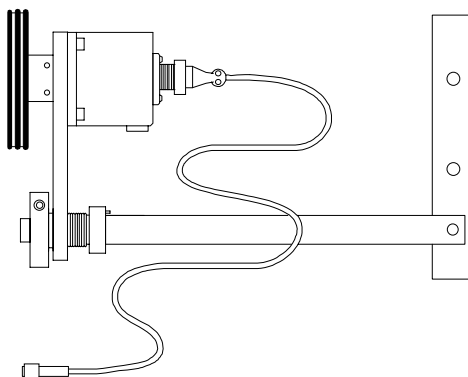
Figure 1-14: Shaft Encoder

1.12 PRINTHEAD BRACKETRY

The printhead bracketry is easily mounted at any angle/orientation for a wide range of printing applications. Each bracket supports one printhead. It can be installed using conveyor mounting brackets. There are two types of mounting bracketry, the Single Head Conveyor Mount and the Multi-Head Conveyor Mount.

1.12.1 Single Head Conveyor Mounting Bracket

The Diagraph Single Head Conveyor Mounting Bracket provides quick installation, and easy maintenance of the printhead.

The printhead/ink supply adjustment consists of a 16" high vertical bar and a 16" long horizontal bar adjustment.

1.12.2 Multi-Head Conveyor Mounting Bracket

The Diagraph Multi-Head Conveyor Mounting Bracket will allow mounting of up to 4 printheads/ink systems.
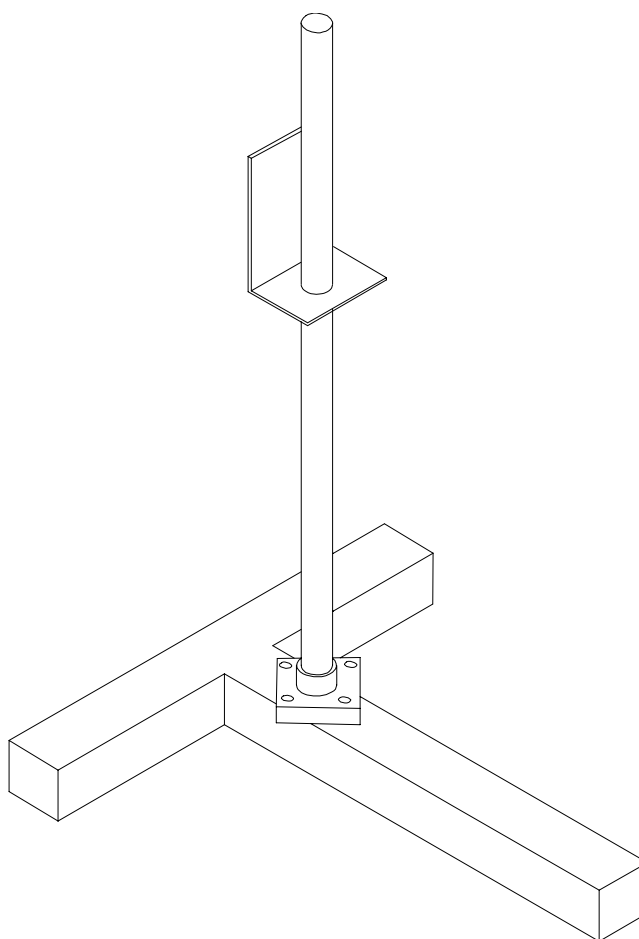
Figure 1-15: PEL Printer Floor Stand

1.12.3 Printer Floor Stand

The Floor Stand is shipped in a 3' high configuration and is supplied complete with bracketry for mounting the controller.

SECTION 2: OPERATION AND PROGRAMMING

2.1 OPERATION

START-UP

A. Turn ON the controller power and wait one minute for the printhead/s to reach operating temperature. This can be observed on the Hand-Held Terminal display by the corresponding head letters A,B,C or D disappearing under the heating status line.

B. Remove nozzle protection clip.

C. Prime the printhead/s and use an absorbent wipe to clean the face of the printhead. Select the "TEST" command, trigger the photosensor to ensure that all nozzles are operating.

NOTE: If a shaft encoder is being used, it will be necessary to rotate the encoder to get all nozzles to print.

SHUT DOWN

A. Turn off the controller power.

B. Clean the face of the printhead using an absorbent wipe and replace the nozzle protection clip.

2.2 PROGRAMMING

For reliable operation of the PEL Series System, it is important that a preventative maintenance program is followed. See Chapter 3: Regular Maintenance for more information on maintaining the system.

The Diagraph PEL Series Ink Jet System can be controlled by a host computer or with a Hand-Held Terminal (front port only). Both ports use Serial RS-232, however the front port has the ability to communicate using RS-485.

The rear communications port can transfer data more quickly because it does not prompt you with command fields.

The front communications port provides terminals with menu driven firmware to assist the operator in setting up and installing the system. The front port is also used for hand-keying data entry applications.

2.3 COMMAND SUMMARY

The commands listed below are used for the Front and Rear Communications Ports. Each command is selected by the first two letters of the command for both ports.

ACknowledge	Sends an ASCII character when current message is finished printing.
BOld	Sets the bold value of the text.
CAll	Recalls a group of parameter settings to print.
CLear Map	Clears the input and print buffers.
COunters	Visual display of numbers command in process.
DAte	Sets or displays the current date.
DElay	Controls the time the product is printed.
DIsplay	Selects the terminal for the front port.
EDit	Allows the entry of a message and font selection.
ENcoder	Specifies the use of a shaft encoder.
EXp Date	Allows setup for expiration date.
GAp	Sets the spacing between characters.
HEad	Specifies which printhead is being affected by changes.
INvert	Turns message upside down.
LOngbar	Sets Bar Code Height.
NUmbers	Setup of Product Counters.
POsition	Adjusts vertical position of printed message.
REverse	Reverses the message.
SAve	Saves group of parameter settings for message.
SElect	Selects a message to be printed.
SHift	Allows setup for shift times.
SLant	Controls the slant of the printed characters.
STatus	Displays the status of the printer.
TEst	Test fires all 32 nozzles.
TIme	Sets or displays the current time.
TRigger Edge	Selects type of product detector.
WIdth	Controls the width of print.
ZAp	Resets all parameters to factory default settings.

2.4 FRONT COMMUNICATION PORT

The Front Communications Port communicates with the Hand-Held Terminal.

2.4.1 Terminal Control

The terminal protocol is: selectable baud rate, selected (on the CPU board) by SW1, 8 data bits, 1 stop bit, no parity.

NOTE: No handshaking is used in terminal control.

The correct terminal type must be selected in the firmware for correct communications. If the wrong terminal type is specified in the firmware, the terminal being used will display scrambled commands. For this case, you must know the exact keystrokes to select the correct terminal type.

The exact keystrokes will follow to select each terminal type:

> VT-100 Terminal **DI 1** [ENTER]
>
> Wyse Terminal **DI 2** [ENTER]
>
> Hand-Held Terminal **DI 3** [ENTER]

2.4.2 Command Prompt

The Command Prompt is the first screen seen on the display of the terminal. The screen will display the status of the printer, along with the model number and the printhead that is being affected by changes.

The Command Screen:

Diagraph PEL
INK LOW *   *
HEATING *   *
COMMAND(A) :

The first line of this screen displays the model of printer. The second line displays the status of ink on each printhead, e.g., "A" will display between the asterisks if ink is low on head A. The third line displays the status of the printhead/s as they are heating, e.g., "A" will display between the asterisks if printhead/s A is being heated. (Heating will only show if the temperature of the ink is below 55⁰.) The fourth line displays "command" along with which head the next command will affect. "Command" is asking for the next command to be entered.

2.4.3 Command Selection

When at the Command prompt, the printer is ready for a new command. A command is selected by the first two letters of the name of the command you want (in the Command Summary, the capital letter in the command names show the characters that have to be entered to select the command).

2.4.4 Options

Wherever possible, the Firmware will try and help you remember what input is expected and acceptable by displaying the Options in [ ] brackets. For example, if the System is expecting a Yes or No response [Y/N] will be displayed. Some messages will allow the use of the left and right arrows to change only part of the command. For example, in the date command, the month can be edited while leaving the year and day unchanged.

2.4.5 Message Capability

The controller can store as many as 100 messages. Each message can be up to 100 characters long.

2.4.6 Saving Changes

After entering the changes to a specific command, you can save this parameter or abort the changes. ENTER will save the changes and Escape (ESC) will abort them.

2.4.7 Commands

The chart that follows shows every command, its purpose, the keystrokes to select it, what the display screen shows and how to enter a new value of text.

Under data entry there will be keystrokes to show how to enter the new values, the small "n" in the box represents a variable. This variable might be an alpha character or a numeric character. The Hand Held Terminal does not require you to enter any "place holder" characters.

Command	Purpose	Key-strokes	Display	Data Entry
ACknowledge	Enables ACK for each head indicating a message has been downloaded to the print buffer and the controller is now ready to receive the next message for that head.	AC	ACK ENABLE [Y/N} *ABCD* :N	n ENTER

BOld	Sets the default bold value. This is the number of times each column in a character is repeated. The more times each column is repeated, the bolder the character appears.	BO	BOLD[0-9] *A * : 0 Def = 0	*n* ENTER

Command	Purpose	Key-strokes	Display	Data Entry
CAll	Allows 32 different parameter groups to be called from storage. Can also call a clean allocation to start new with default values when setting up a parameter group	CA	CALL GRP [0-31] *A * : 0	*n n* ENTER
CLear Map	Clears the print buffers so that when a message is no longer valid, the PC can download the string and prevent message errors	CL	CLEAR MAP [Y/N] *A * : N	*n* ENTER
COunters	Lets you see what is happening in the command "NUMBERS"	CO	COUNTERS *A * UPPER : 00000000 LOWER 99999999 REP: 000 INC: 001	NONE
DAte	Displays the current date or allows the date to be set.	DA	DATEMM-DD-YY *ABCD* 03-06-93	*MM DD YY* ENTER

| DElay | Controls the delay between the product detection and the start of printing. This allows the position of the message to be arranged without having to move either the printhead/s or product detector. | DE | DELAY   [0-9999]

*A   * :   440

Del = 0 | *n n n n*
[ENTER] |

Command	Purpose	Key-strokes	Display	Data Entry
DIsplay	Selects the terminal type	DI	DISPLAY[1-4] :3	*1=VT-100* *2=Wyse* *3=Hand-Held* *n* [ENTER]
EDit	To enter and amend text and change font if desired.	ED	EDITMSG [0-2] *A * : 1 HA M1 L1 F (5,7,9,16,32) DIAGRAPH, INC. 3401 RIDER TRAIL SOUTH EARTH CITY, MO.	*n* [ENTER] ALT FNT (5)
ENcoder	Selects the use of and/or discontinues use of shaft encoder. (*Switch #4 on SW2))	EN	ENCODER [Y/N] *AB * : Y	*n* [ENTER]
EXp. Date	Allows setup of expiration date	EX	EXP DATE [0 - 999] *A * : 0	*n n n* [ENTER]
GAp	Controls the spacing between characters.	GA	GAP [0-9] *A * : 5 Def= 0	*n n* [ENTER]
HEad	Selects the printhead that will be affected by the changes.	HE	HEAD [A-D] :A	*n* [ENTER]
INvert	Turns the characters upside down.	IN	INVERT [Y/N] *A * : N	*n* [ENTER]

Command	Purpose	Key-strokes	Display	Data Entry
LOngbar	Set vertical height of bar codes	LO	LONG BAR [1-32] *A * :nn	*nn* [ENTER]
NUmbers	Sets up product and batch counters, these counters will have the ability to count positively or negatively, increment by multiplier, repeat by a multiplier or simply be set up as a simple count routine	NU	NUMBERS *A * UPPER:99999999 LOWER:00000000 REP: 000 INC: 001	Use the arrow keys to move the cursor over the area that is to be changed and enter the new value.
POsition	Adjusts the vertical position of printed message.	PO	POSITION[0-32] *A * : 0	*n n* [ENTER]
REverse	Reverses the direction of printing to allow for products to pass the printhead/s from left to right or right to left.	RE	REVERSE[Y/N] *A * : N	*n* [ENTER]
SAve	Assigns parameter groups specific file numbers which allow the saved files to be pulled back for future printing	SA	SAVE GRP[0 - 31] *A * : 0	*n n* [ENTER]

SElect	Selects the message(s) to be printed from those available in the message library.	SE	SELECT
			*A *
			MSGS : 01
			                  02
			                  03
				N N
				[ENTER]

Command	Purpose	Key-strokes	Display	Data Entry
SHift	Set Shift times	SH	SHIFT SET [1-3] *ABCD* :N	n ENTER
STatus	Displays status of the printer	ST	HEATING INK LOW * ABCD * * ABCD *	NONE
SUb Pulsing	Vibrates the nozzles to prevent Non Porous inks from drying on printhead/s.	SU	SUB PULSING[0-99] : N Def = 6	6 ENTER NOTE: Must set frequency if using subpulse.
TEst Pattern	Test fires all of the nozzles for diagnostic purposes.	TE	TEST PATTERN *A *	ESC
TIme	Displays the current time or allows the time to be set.	TI	TIMEHH:MM:SS *ABCD*02:26:08	$n n n n n$ ENTER
TRigger Edge	Selects the positive or negative transitions of the product detector signal as the print-go signal.	TR	TRIG EDGE[R/F] *AB * F	n ENTER
WIdth	Makes the printed message longer or shorter to enable it to fit correctly on the product.	WI	WIDTH[1-255] *A * : 1 Def = 30	$n n n$ ENTER
ZAp	REsets all parameters and messages to factory default settings.	ZA Power Off	ZAP[Y/N] :N	n ENTER

Three standard fonts can be selected. The following chart will assist in choosing the correct font for your application.

2.5 FONT CHART

NOTE: Font can only be changed under the edit command.

FONT SELECTION	DESCRIPTION	TEXT OUTPUT
1	Micro-Spacing, only allows spaces (no characters)	Spaces
2	UPC Shipping Container Bar code 100% (Top)	Bar code
3	UPC Shipping Container Bar code 100% (bottom)	Bar code
5	5 x 5 Dot Matrix, Block Character	5 lines
7	7 x 5 Dot Matrix, Block Character	4 lines
8	8 x 6 Dot Matrix, Block Character	4 lines
9	9 x 7 Dot Matrix, Block Character	3 lines
15	12 x 6 Dot Matrix, Block Character	2 lines
16	14 x 8 Dot Matrix, Block Character	1 line
31	32 x 20 Dot Matrix, OCR-B Characters (Numerics Only)	1 line
32	28 x 20 Dot Matrix, OCR-B Characters (Numerics Only)	1 line
33	24 x 15 Dot Matrix, OCR-B Characters (Numerics Only)	1 line
34	32 x 21 Dot Matrix, OCR-B Characters (Numerics Only)	1 line

(Continued on the next page)

FONT SELECTION	DESCRIPTION	TEXT OUTPUT
35	23 x 13 Dot Matrix, OCR-B Characters (Numerics Only)	1 line
36	23 x 13 Dot Matrix, OCR-B Characters (Numerics Only)	1 line
40	EAN 13 Bar Code	Bar code
41	EAN 8 Bar code (w/HR)	Bar code
42	Code 39 Bar code (w/HR)	Bar code
43	Code 128 Bar code (w/HR)	Bar code
90	Postnet Bar code	Bar code
91	Canadian Bar-no-Bar Postal Code	Bar code
92	Interleaved 2 of 5 Bar code	Bar code
93	Code 39 Bar code	Bar code
94	UPC Shipping Container Bar code 62.5% (w/HR)	Bar code
95	5 x 5 Dot Matrix Postnet Bar code	Text/ Bar code
96	UPC Shipping Container Bar Code 70% (w/HR)	Bar code
97	Code 128 Bar code	Bar code
98	UPC A Bar code	Bar code
99	UPC E Bar code	Bar code

NOTE: When a font is selected that is not current, the font number will go back to the original.

Enter the numeric value for the font needed for the application.

Keystroke -   n   n   n   [ENTER]

After selecting the font, the message can be entered.

Keystroke -   n   n   n, etc.   [ENTER]

The edit command allows many useful tools to help in editing a message, the following will describe each.

ALT ←   Moves the cursor left one character.

ALT →   Moves the cursor right one character.

ALT, SHIFT C   Clears all the text on all the lines.

ALT, CLR   Deletes the character behind the cursor position.

ALT ↓   Moves to the next line down.
ALT FNT   Selects Font for that message.
ALT ↑   Moves to the next line up.
SHIFT   Toggles between lower and upper case characters (Hand-Held only).
ENTER   Quits the Edit command and saves all changes.
ESC   Quits the Edit command and aborts all changes.

2.5.1 Bold Fonts

When the font or logo is selected it can be made bold by the numeric value that is added to the font or logo value. Use the following chart for making the font or logo **bold**.

FONT/LOGO BOLD CHART

Bold Level	Add
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800
9	900

2.6 AUTOCODES

An auto code is a one or two letter command which tells the Diagraph PEL Series Ink Jet
System to print information which changes regularly such as the time, date, Julian Day, etc.
The following is a list of auto codes for the Diagraph PEL Series Ink Jet System.

EXPIRATION AUTOCODES

{EC}	DATE (xx/xx/xx)
{ED}	DAY
{EJ}	JULIAN DATE
{EM}	MONTH
{EW}	DAY OF WEEK
{EY}	YEAR
{EL}	LAST DIGIT YEAR

DATE AUTOCODES

{DA}	DAY
{DT}	DATE (xx/xx/xx)
{MO}	MONTH
{AD}	ALPHABETIC DAY OF THE WEEK
{AM}	ALPHABETIC MONTH
{YE}	YEAR
{YL}	LAST DIGIT OF YEAR
{JD}	JULIAN DATE
{MF}	FIRST NUMERIC CHARACTER OF THE MONTH
{MS}	SECOND NUMERIC CHARACTER OF THE MONTH

TIME AUTOCODES

{HO}	HOUR
{MI}	MINUTE
{SE}	SECONDS
{TI}	TIME (HH/MM/SS)

NOTE: The time and date are updated at the end of each print cycle.

COUNTER AUTOCODES

{NL}	DOWN COUNTER - PRINTS ALL 8 DIGITS
{Ld}	DOWN COUNTER - PRINTS SPECIFIED DIGIT
{Wd}	DOWN COUNTER ZERO SUPRESSION - PRINTS SPECIFIED DIGIT
{NU}	UP COUNTER - PRINTS ALL 8 DIGITS
{Ud}	UP COUNTER - PRINTS SPECIFIED DIGITS
{Vd}	UP COUNTER ZERO SUPPRESSION - PRINTS SPECIFIED DIGITS

ROLLOVER AUTOCODES

{RM}	ROLLOVER MONTH
{RD}	ROLLOVER DAY
{RY}	ROLLOVER YEAR
{RC}	ROLLOVER DATE (xx/xx/xx)
{RL}	ROLLOVER - LAST DIGIT OF YEAR
{JR}	ROLLOVER JULIAN DATE

MISCELLANEOUS AUTOCODES

{SH}	SHIFT ROLLOVER

2.7 FREQUENTLY USED COMMANDS

CALL

First Line: CALL GRP is the command name, GRP stands for Group. [0-31] represents the groups that can be called.

Second Line: N/A

Third Line: N/A

Fourth Line: *A   * represents the printheads being affected when this command is changed. The bottom right hand portion of the screen is where the group number is entered that is to be called.

There are 32 different groups that can be called at this point, however there are really only 2 choices. They are:

Calling a clean parameter group: Enter a group location that has not had a parameter group saved to it. This will pull the saved parameter group and will allow it to be printed.

Calling a saved parameter group: Enter a group location that has had a parameter group saved to it. This will pull the saved parameter group and will allow it to be printed.

A parameter group consists of the following commands saved to a group: BOLD, GAP , WIDTH, DELAY, REVERSE, INVERT, SELECT, EXP. DATE.

COUNTERS

First Line: COUNTERS is the command name. *A   * represents which printheads are being monitored.

Second Line: UPPER: 00000000 represents the count sequence as it is to be printed if using the up counter.

Third Line: LOWER: 99999999 represents the count sequence as it is to be printed if using the down counter.

Fourth Line: REP: 000 represents the value at which the repeat is set to. INC: 001 represents the value the increment is set to.

Use this command for monitoring the "NUMBERS" command.

NOTE: When connected to the rear port, the counters command returns the numbers data in the following format:

U00000000L99999999

"U" followed by 8 digits of the up count value, then "L" and the down count value.

EDIT

First Line   EDIT MSG is the command name, MSG stands for Message. [0-99] represents the 100 different message allocations that can be edited.

Second Line   N/A

Third Line   N/A

Fourth Line   *A   *represents what printhead is being affected. The bottom right portion of the screen displays what message is to be edited or the message to be edited can be entered here.

EXP. DATE

First Line   EXP. DATE is the command name. [0-999] represents the values of the expiration date that can be entered.

Second Line   N/A

Third Line   N/A

Fourth Line   *A   * represents the printheads that are affected when this command is changed. The bottom right hand portion of the screen is where the users choice is entered.

NUMBERS

First Line   NUMBERS is the command name. *A   * represents the printhead that is being affected by the changes.

Second Line   UPPER: 99999999 represents the upper limit for the count sequence.

Third Line   LOWER: 00000000 represents the lower limit for the count sequence.

Fourth Line   REP: 000 represents the number of times a count is going to repeat.INC: 001 represents the value by which the count is going to increment.

2.8 REAR COMMUNICATIONS PORT

The Rear Communications Port communicates through the Rear RS232 port. This port will allow any host computer capable of communicating serial RS232, to download the ASCII strings to control the printer.

The rear port allows data to be downloaded to the print buffers at high speed. A special high speed version of the editing command has been implemented. The edit command through the rear port does not allow any editing of a message, it assumes the downloaded text has been checked for corrections.

2.8.1 Host Computer Control

The host computer protocol is: Selectable baud rate, selected by SW1, 8 data bits, no parity, 1 stop bit (refer to CPU Configuration for baud rate selection).

NOTE: No handshaking is used in host computer control.

2.8.2 Commands

The rear port expects all parameters and text to be downloaded in ASCII strings. A command is selected by the first two letters of the name of the command and each command is listed in the Command Summary. The capital letters in the command name, show the characters that have to be entered.

2.8.3 Saving Changes

After each command has been changed, you can save this parameter or abort the changes. ENTER will save the change and Escape (ESC) will abort the changes. Form Feed (FF) will auto delete the command.

2.8.4 Editing

The rear port editing command expects to see the parameter indicators and text sent down in ASCII strings. The high speed editing command provides an input buffer and a print buffer. The input buffer is where the bitmap is created for the printed text. After the bit map is created it is sent to the print buffer where it awaits the print-go signal. When the message enters the print buffer, the printer requests new data to be sent to the input buffer. The printer gives one of these four acknowledgments when it is ready to receive new data for that printhead.

(A) = Printhead A is requesting new data.
(B) = Printhead B is requesting new data
(C) = Printhead C is requesting new data
(D) = Printhead D is requesting new data

The editing command provides a few necessary keystrokes for editing:

ENTER   for saving a text string, for continuous print the same message
FF   for auto deleting a text string, for a one time print
LF   for moving down a line, for multiple line editing
ESC   to abort the editing process

2.8.5 Message Capability

The controller has up to 100 messages and each message may be up to 100 characters in length.

2.8.6 Changing Fonts

The font is changed by entering ALT 3 (FNT) , out of the editing command. After ALT FNT is entered, the value representing the font is entered followed by ENTER to save the change.

2.8.7 Entering a Text Message

A text message must be preceded by the printhead to be edited, the message for that printhead, and the entry of the edit command.

Example of Command sequence:

HE A ENTER

ED 1 (edited text) ENTER

SE 1 ENTER

The HE A ENTER will select which printhead is to be edited, ED 1 ENTER will select which message is to be edited and SE 1 ENTER will select which message is to be printed.

2.8.8 Programming Examples

Downloading a specific command:

① Select printhead to be edited   H   E   A   ENTER

② Select message to be edited   E   D   1   D I A G R A P H , I N C.   ENTER

③ Select message to be printed   S   E   1   ENTER

SUMMARY

The **first** line selects which Head is to be edited, the **second** line selects the edit command along with which message is being edited. The **third** line selects which message is to be printed.

2.9 PEL and PROCOMM

Load PROCOMM on the PC. Set the baud rate to 9600,N,8,1 by pressing ALT-P, for the serial port. Also, set the terminal emulation for VT-100 and use Full Duplex.

OPERATION	OYSTER KEY	PC KEY	HEX
CLEAR	ALT-SHIFT-C	CTRL-C	03
FONT	ALT-FNT	CTRL-F	06
LEFT CURSOR	ALT-4	CTRL-G	08
RT. CURSOR	ALT-SP	CTRL-I	09
DWN CURSOR	ALT-0	CTRL-J	0A
UP CURSOR	ALT-5	CRTL-K	0B
ESCAPE	ALT-1	CTRL-[	1B
ENTER	ENTER	CTRL-M	0D

All other alphanumeric and special character keys work as they are marked on the keyboard.

The PEL is connected to a 25-pin PC serial port by a straight pin for pin cable. This can also be a 9-pin PC serial port with a null-modem cable (2-3 crossed).

When you use a PC and PROCOMM to operate a PEL you will get a screen that looks like the screen of the Diagraph Portable Terminal.

CHAPTER 3: GENERAL MAINTENANCE

3.1 PREVENTIVE MAINTENANCE

Procedure	Daily	Weekly	Monthly	Quarterly
Clean & Prime Printhead	●			
Clean Outside of Ink Reservoir (prevent contaminants from getting into ink)		●		
Clean Outside of Printhead thoroughly		●		
Blow Out Inside of Control Cabinet (use air line)			●	
Clean Photosensor Lens			●	
Check Mounting Hardware is Secure			●	
Check all Electrical Connections are secure			●	
Check Ink Tube fittings are secure				●

3.2 REPLACING INK

A low ink status can be observed on the host computer or the hand-held terminal.
It is imperative that you change the ink container as soon as a low ink condition is sensed.

3.2.1 Replacement of the Ink Container

Remove the old container by turning it counter-clockwise and pulling. Press the new container into place and turn clockwise, making sure that it latches into position. The system will require priming after an ink container replacement

CHAPTER 4: PART NUMBERS

Part Description	Diagraph Part No.
INKS	
Ink, PEL Black Porous - 500ml	5200-026
Ink, PEL Blue Porous - 500ml	5200-027
Ink, PEL Red Porous - 500ml	5200-028
CONTROLLERS	
Controller, PEL Single Head - 110V	6600-100
Controller, PEL Dual Head - 110V	6600-101
Controller, PEL Triple Head - 110V	6600-102
Controller, PEL Quad Head - 110V	6600-103
Controller, PEL Dual Head Multi-Task 110V	6600-104
Controller, PEL Quad Head Multi-Task 110V	6600-105
Controller, PEL Single Head - 220V	6600-106
Controller, PEL Dual Head - 220V	6600-107
Controller, Tri Head - 220V	6600-108
Controller, PEL Quad Head - 220V	6600-109
Controller, PEL Dual Head Multi-Task 220V	6600-110
Controller, PEL Quad Head Multi-Task 220V	6600-111
Controller, PEL Single Head NEMA 4X-110V	6600-112
Controller, PEL Dual Head NEMA 4X-110V	6600-113
Controller, PEL Tri Head NEMA 4X-110V	6600-114
Controller, PEL Quad Head NEMA 4X-110V	6600-115
Controller, PEL 2 Head M-T NEMA 4X-110V	6600-116
Controller, PEL 4 Head M-T NEMA 4X-110V	6600-117
Controller, PEL Single Head NEMA 4X-220V	6600-118
Controller, PEL Dual Head NEMA 4X-220V	6600-119
Controller, PEL Tri Head NEMA 4X-220V	6600-120
Controller, PEL Quad Head NEMA 4X-220V	6600-121
Controller, PEL 2 Head M-T NEMA 4X-220V	6600-122
Controller, PEL 4 Head M-T NEMA 4X-220V	6600-123
PCB, Power Supply (NS)	6600-124
Transformer, PC621 Power Supply	6600-125
PCB, CPU (NS)	6600-126
PCB, Interface (NS)	6600-127
PCB, Assembly, 7400 Single P/H Driver	6600-128
Upgrade Kit, 7400 Single P/H Driver	6600-129
PCB, 7400 Dual Printhead Driver	6600-130
Holder, Power Entry Module Fuse	6600-131
Fuse, 1.5A 250V Power Entry Module	6600-132
Fuse, 3A 250V Power Entry Module	6600-133
Bottle, Wash	6600-134
Cord, Power	6600-135

Part Description	Diagraph Part No.
Enclosure, 14-12-5 (NS)	6600-136
Plate, Enclosure Bottom Connector	6600-137
Lock, Enclosure	6600-138
Key, Enclosure Lock	6600-139
Power Harness, PSU/Driver	6600-140
Power Harness, PSU/CPU	6600-141
Ribbon Cable Assy 60 Pin	6600-142
Ribbon Cable Assy, Split 60 Pin	6600-143
Ribbon Cable Assy, 34 Pin	6600-144
Plug, Enclosure Bottom Conn.	6600-145
Plate Umbilical	6600-146
Clip, Grounding Spring	6600-147
Terminator Sub-Assy Driver PCB	6600-148
Core, Ferrite	6600-149
Clamp, Ferrite	6600-150
PRINTHEAD	
PEL/9600 (1/2") Printhead	6600-206
PEL/1920 (1") Printhead	6600-207
Clip, Nozzle Protection (3/PK)	6600-208
Shipping Cap, Nozzle	6600-209
Connecting Tubing, Ink	6600-210
Cap, SM Black Dust (10/pk)	6600-211
Cap, SM Red Dust (10/pk)	6600-212
Cap, Lrg Black Dust (10/pk)	6600-213
Cap, Lrg Red Dust (10/pk)	6600-214
Fuse, Printhead Thermal	6600-215
Clip, 7400 Printhead Fuse	6600-216
PRINTHEAD CABLES	
5' Printhead Cable	6600-202
10' Printhead Cable	6600-203
20' Printhead Cable	6600-204
40' Printhead Cable	6600-205
INK SYSTEMS	
Ink System w/6'Cable	6600-300
Switch, Prime	6600-301
PCB Assembly Priming Control	6600-302
Lens, Red Prime Switch	6600-303
Enclosure/Lid Manual Prime Module	6600-305
Reservoir, PEL ink	6600-306
Cap, Ink Reservoir Shipping	6600-307
Pump, Prime Module	6600-308
Seal, EPDM Pump Lip	6600-309

Connecting Tubing Ink	6600-310

Part Description	Diagraph Part No.
BRACKETRY	
T-Base, Floor Stand	6600-401
Post Clamp, Floor Stand	6600-402
Mounting Bracket PEL Printhead	6600-154
Mounting Bracket Ink System	6600-155
Crossbar, 1.25 Dia x 10" Lg	6600-158
Mounting Base Assy 1.25 OD	5700-039
Cross Clamp Assy 1.25 x 1.25	5700-040
Hole Plug, Plastic 1-1/4 O.D.	5700-021
Tubing SS 1.25 O.D. x 16" Lg.	5700-020
Tubing SS 1.25 O.D. x 24" Lg.	5700-018
Tubing SS 1.25 O.D. x 60" Lg.	5700-017
Tubing SS 1.25 O.D. x 44" Lg.	5700-019
Handle, Adj Blk 5/16 - 18 x 1.57	5700-022
U-Bracket, Floor Stand	6600-410
Controller Bracket, Floor Stand	6600-411
Plate, Keyboard Mounting	6600-412
Post, 2" X 3' Floor Stand	6600-413
Post, 2" X 6' Floor Stand	6600-414
Cap, Post Dust	6600-415
Clamp, Photosensor Bracket "T"	6600-416
Crossblock, Photosensor Mtg Brkt Mini	6600-417
Tube/Caps. Photosensor Bracket	6600-418
Clamp, Photosensor Bracket Sensor	6600-419
Clamp, Photosensor Bracket Reflector	6600-420
Leveler Foot, T-Base	6600-421
ENCODERS	
Shaft Encoder	6600-600
O-Ring 5.50 x 5.25 x 1.25	6600-153
Encoder Wheel 5.50	6600-151
EXTENSION CABLES	
6' Extension Cable	6600-601
FIRMWARE	
Firmware Module, Standard	6600-700
PERIPHERALS	
Connector, 9 Pin Male DB	6600-800
Cover, Straight DB9 Connector	6600-801
Pedestal, Alarm Beacon Light Mntg	6600-802
Light, Alarm Beacon (Red/Green)	6600-803
Relay Module, Alarm Beacon	6600-804

| Housing, Alarm Beacon | 6600-805 |
| Reflector, 3' Photosensor | 6600-806 |

CHAPTER 5: TROUBLESHOOTING

5.1 CONTROLLER

SYMPTOM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
No Print	No Photosensor signal	Observe diagnostic LED's for PC1 or PC2. If there is no signal, refer to Corrective Maintenance.
	No Shaft Encoder signal	Observe diagnostic LED's for SE1 or SE2. If there is no signal, refer to Corrective Maintenance. *If machine is working off of internal, check the correct Jumper configuration or JMP7, and ensure that the encoder command has "no" selected.
	No Data for Printhead to Print	Check connections to the printhead. Make sure there is a message in the edit command, have the correct message selected. Check ink and prime.
	Out of ink	
Ink Low Signal Does Not Work	Shorted Signal Wires	Check breaker. (Refer to Corrective Maintenance).

5.2 TERMINAL

SYMPTOM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
No Command Prompt on Display Screen	Incorrect settings for communications	Check SW1 on CPU. (Refer to CPU Board Configuration).
	Bad Connections	Check connections between terminal and printer.
Terminal display Commands are Scrambled	Incorrect display type selected	Using "Display" Command select the correct terminal type. (Refer to Programming).

5.3 PRINTHEAD

SYMPTOM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
No channels will fire	Ink dried on nozzle plate	Spray nozzle plate with Diagraph Cleaning Solution and prime.
	Air in channels	Reprime and observe the flow of ink from nozzles.
	No ink flow during reprime attempts.	NP INKS ONLY Follow NP start up procedure.
Few Channels will not print	Clogged nozzles	Reprime
Nozzles Print but Appear Weak	Low drive voltage	Increase the printhead drive voltage

APPENDIX

TECHNICAL SPECIFICATIONS

PRINT FEATURES	5 Dot to 32 Dot High Character Fonts Detector User-Selectable Character Heights Inverted and Reversed Print Pallet/Batch Counters Real Time Clock Julian/Gregorian Month, Day, Week Bar Codes Logos/Special Characters 100 Message Library 100 + Characters/Line Product Count
CONTROLLER FEATURES	Up to 1 MB Battery-Backed Memory Opto-Isolated I/O's Front RS232 (DB25 connector) Port for Terminal/PC Up to 19.2K Baud Multiple Terminal Drivers supporting VT100/ANSI, Wyse, Hand Held Diagnostic LED Indicators
PRINT SPEED	Up to 400 feet/minute
PERIPHERAL INTERFACES	Product Detector DB9 Connector Open Collector Power provided 12V DC Shaft Encoder DB9 Connector Open Collector Power provided 12V DC External Alarms DB9 Connector Open Collector Power provided 12V DC
ELECTRICAL	100V-130VAC 3A 50/60Hz 200V-250VAC 1.5A 50/60Hz
ENVIRONMENT	Temperature 50 F-95 F (10-35 C) Operating Humidity 10-90% RH (non-condensing)
WEIGHT	25 pounds 11 kilograms