

# Operations Manual



5760-107  
Revision K

# **IJ3000 Integrated Valve Ink Jet System Operations Manual**

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**5760-107  
Revision K**

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## Warranty:

The IJ3000 system, including all components unless otherwise specified, carries a limited warranty.

The inks and conditioners used with the IJ3000 system carry a limited warranty.

For all warranty terms and conditions, contact Diagraph an ITW Company for a complete copy of the Limited Warranty Statement.

<b>Section 1: Introduction .....</b>	<b>1</b>
<b>Section 2: Safety.....</b>	<b>2</b>
<b>Section 3: System Components .....</b>	<b>3</b>
System and Component Part Numbers.....	4
IJ3000 Controller.....	7
IDS3000-ES Ink Delivery System.....	8
Bracketry .....	9
Print Heads .....	12
Ink Regulator .....	14
Photosensor.....	14
Encoder.....	14
Ink Supply .....	14
<b>Section 4: Installation.....</b>	<b>15</b>
System Overview.....	15
Testing the Electrical Outlet.....	16
Materials Required for Installation.....	16
Installing Controller/IDS Bracketry .....	17
Print Head Bracketry .....	18
Mounting the Print Heads.....	18
Mounting the Photosensor .....	19
The Encoder.....	20
Controller Connections .....	20
Using the Optional Second Interface Board.....	22
Configuring the IDS .....	22
Priming the System.....	26
Checking Ink Pressure.....	27
Setting Ink Pressure.....	28
Print Head Operation.....	29
Operational System Test.....	30
<b>Section 5: Frequently Asked Questions.....</b>	<b>34</b>
<b>Section 6: Maintenance .....</b>	<b>35</b>
System Maintenance.....	35
Print Head Maintenance .....	35
IDS Maintenance .....	37
Ink Regulator Maintenance .....	39
<b>Section 7: Troubleshooting .....</b>	<b>40</b>
Troubleshooting Notes .....	40
Troubleshooting Tests .....	40
Print Quality Troubleshooting.....	43
<b>Appendix A: System Specifications .....</b>	<b>50</b>

IV9 Dot Print Head.....	50
IV18 Dot Print Head.....	51
IDS3000-ES Ink Delivery System.....	52
<b>Appendix B: Theory of Operation .....</b>	<b>53</b>
Functional Description .....	53
Print Head Daisy Chain(s).....	53
Photosensor (5760-383).....	53
Encoder (5760-820-IJ).....	54
IV Print Head Theory of Operation.....	55
IDS3000-ES Ink Delivery System Features .....	56
<b>Appendix C: Interconnect Diagrams.....</b>	<b>59</b>
IDS3000-ES Wiring Diagram for Non-European Countries (115V) .....	59
IV9 Dot or IV18 Dot .....	60
<b>Appendix D: Part Numbers .....</b>	<b>61</b>
Consumables.....	61
Service Parts .....	62
<b>Appendix E: Maximum dpi Calculation for a Given Line Speed.....</b>	<b>69</b>
<b>Appendix F: Font Samples .....</b>	<b>71</b>
<b>Appendix H: Testing an Electrical Outlet.....</b>	<b>79</b>
<b>Appendix I: Electrostatic Discharge (ESD) .....</b>	<b>80</b>
<b>Appendix J: Encoder Functional Testing .....</b>	<b>81</b>

## Section 1: Introduction

This manual covers the installation, operation, and maintenance of the IJ3000 Integrated Valve (I.V.) Ink Jet Printing System. Also included is a troubleshooting and parts list section. The IJ3000 Controller operation is described in a separate manual: 5760-121 IJ3000 Controller Operations Manual.

Your Diagraph IJ3000 Ink Jet System consists of:

- **IJ3000 Controller** - An ink jet controller with color display, touch screen, and full size QWERTY keyboard designed to work with Diagraph I.V. (Integrated Valve) print heads and the IDS3000 Ink Delivery System. (See the IJ3000 Controller Manual, part number 5760-121.)
- **I.V. Print Heads** - Print Heads designed for high-speed printing applications in harsh environments using Diagraph porous and non-porous inks.
- **IDS3000** - An ink delivery system capable of supplying porous and non-porous ink to a maximum of eight (8) IV18 Dot or sixteen (16) IV9 Dot Print Heads.

IJ3000 systems range from a single stand-alone print station to multiple print stations linked together via Ethernet and controlled by a computer. Each print station can control one or two print head daisy chains, with each daisy chain being any combination of IV9 Dot and IV18 Dot print heads totaling 72 dots.



*Scanned sample of ink jet printing.*

## Section 2: Safety

Following is a list of safety symbols and their meanings, which you will find throughout this manual. Pay attention to these symbols where they appear in the manual.



**Wear safety goggles when performing the procedure described!**



**Caution or Warning! Denotes possible personal injury and/or damage to the equipment.**



**Caution or Warning! Denotes possible personal injury and/or equipment damage due to electrical hazard.**



**NOTE:** (Will be followed by a brief comment or explanation.)

Only Diagram trained personnel should operate and service the equipment.



**CAUTION:** The IDS3000 Ink Delivery System contains hazardous voltage (115/230VAC). Turn off the equipment's main power before:

- Performing preventive maintenance.
- Performing any repairs to the unit.
- Servicing the equipment in any manner.

ESD protection should be worn when servicing internal printed circuit boards.

After service to the equipment is completed, replace all protective devices such as grounding cables and covers before operating equipment.



**WARNING:** This equipment contains ink under pressure. Be sure to depressurize the system before servicing.

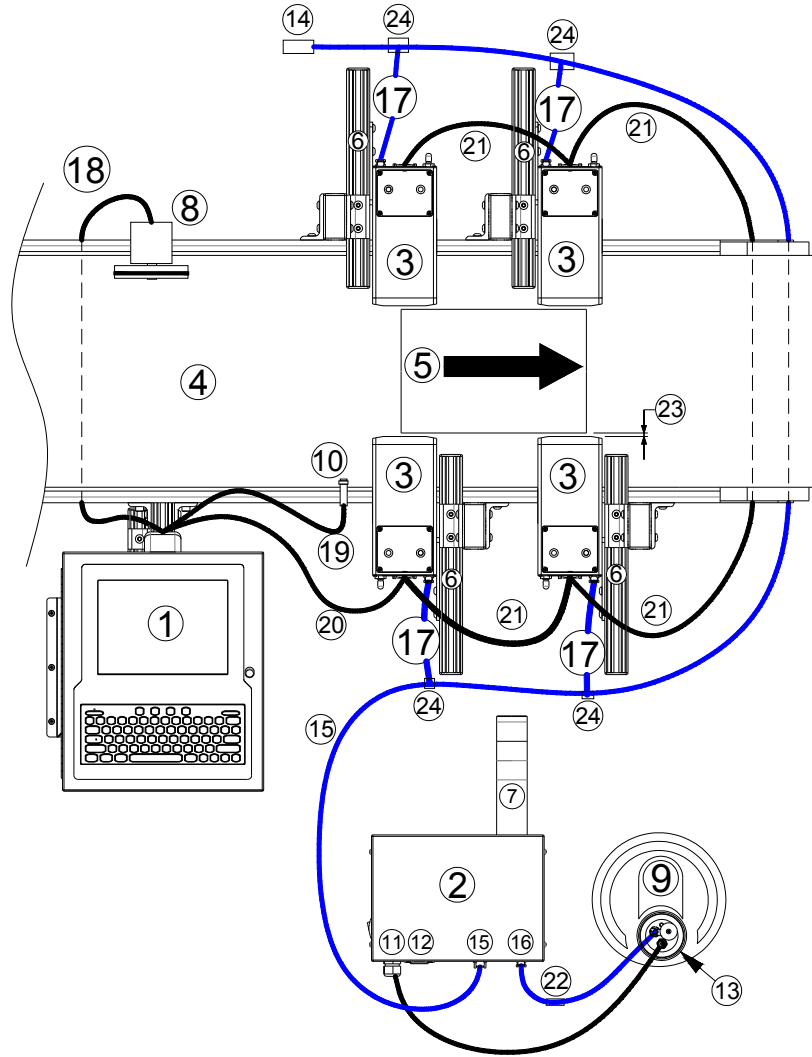
TSO ink contains ethanol and isopropanol. MEK ink contains methyl ethyl ketone. TWP ink contains ethylene glycol. It is extremely important to:

- Clean up all spills with the appropriate conditioners immediately and dispose of all waste according to local and state regulations.
- Wear safety glasses and protective clothing, including gloves, when handling all inks and conditioners.
- Store inks and conditioners under the recommended conditions found on the MSDS (Material Safety Data Sheet).
- TWP (Porous Ink) and TSO (Non-Porous Ink) are not miscible.

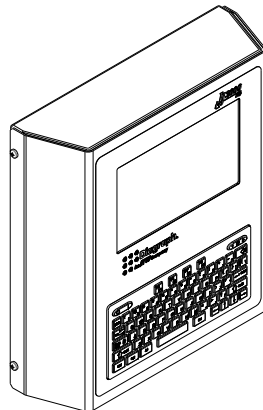


## Section 3: System Components

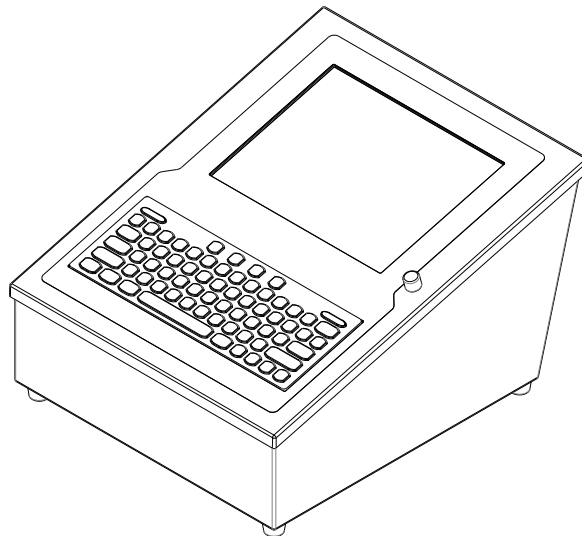
1. IJ3000 Controller
2. IDS3000-ES
3. Print Heads
4. Conveyor
5. Product
6. Print Head Bracketry
7. Ink Status Beacon
8. Encoder
9. Ink Supply Container
10. Photosensor
11. Ink Level Detect
12. Power Cord
13. Ink Supply Cap Assembly
14. Male Quick Disconnect Kit
15. Ink out to Print Heads
16. Ink Supply Tubing
17. Ink Regulator
18. Encoder Cable
19. Photosensor Cable
20. Controller to Print Head Cable
21. Print Head to Print Head Cable
22. Ink Filter
23. Throw Distance
24. Ink T Fitting Kit



IJ3000-ES



IJ3000-XLS





## System and Component Part Numbers

The Diagraph IJ3000 Ink Jet System is available with the following components, options and service kits:

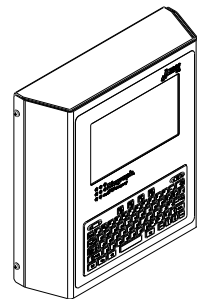
<u>Part Number</u>	<u>Description</u>
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**IJ3000-XLS Controller Assemblies**

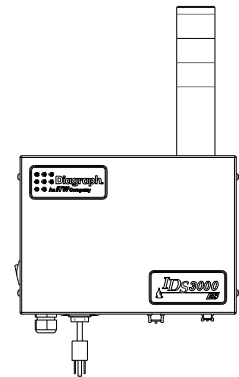
5760-009SV1D	Stainless Enclosure, Single Interface, Domestic
5760-009SV2D	Stainless Enclosure, Dual Interface, Domestic
5760-009SV1E	Stainless Enclosure, Single Interface, European
5760-009SV2E	Stainless Enclosure, Dual Interface, European

**IJ3000-ES Controller Assemblies**

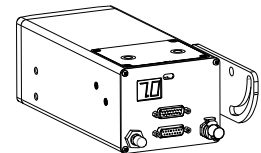
5765-010DV1	Stainless Enclosure, Single IV Interface, Domestic
5765-010DV2	Stainless Enclosure, Dual IV Interface, Domestic
5765-010EV1	Stainless Enclosure, Single IV Interface, European
5765-010EV2	Stainless Enclosure, Dual IV Interface, European

**IDS3000-ES Ink Delivery Assemblies**

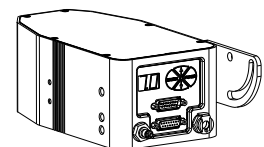
5770-013DP	Stainless Enclosure, Domestic, Porous
5770-013DN	Stainless Enclosure, Domestic, Non-Porous
5770-013EP	Stainless Enclosure, European (220 V), Porous
5770-013EN	Stainless Enclosure, European (220 V), Non-Porous

**Standard Integrated Valve (I.V.) Print Heads**

5770-008P500	1/2", IV9 Dot, Porous
5770-008N500	1/2", IV9 Dot, Non-Porous
5770-008P875	7/8", IV9 Dot, Porous
5770-008N875	7/8", IV9 Dot, Non-Porous



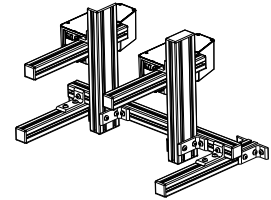
5770-003P1000	1", IV18 Dot, Porous
5770-003N1000	1", IV18 Dot, Non-Porous
5770-003P2000	2", IV18 Dot, Porous
5770-003N2000	2", IV18 Dot, Non-Porous



**Part Number    Description**

**Print Head Bracketry**

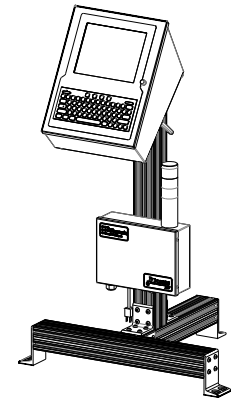
2464-561	X-Y Linear Adjustment Bracket Kit, Tool-Less
5760-354	Multi Print Head Conveyor Mounting Kit (Requires Single Print Head Kits)
5760-355	Print Head Floor Mounting Kit (Requires Single Print Head Kits)
5760-356	Multi Print Head Floor Mounting Kit w/24" Bar (Requires Single Print Head Kits)
5760-357	Multi Print Head Floor Mounting Kit w/44" Bar (Requires Single Print Head Kits)
5760-365	Linear Adjustment Bracket Kit, Single Axis, Tool-Less
5760-821	Single Print Head Conveyor Mounting Kit, IV9 Dot and IV18 Dot



(Also see page 12)

**Controller/IDS Bracketry**

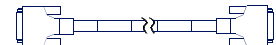
5760-886	Controller/IDS Conveyor Mounting Kit
5760-352	Controller/IDS T-Base Mounting Kit
5760-362	Controller 90° Pivot Bracket Kit
5765-200	IJ3000-ES Conveyor Mounting Kit



(Also see page 11)

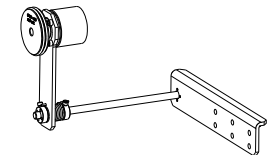
**Print Head Cables (when using IDS3000)**

5700-245-002	Print Head Cable Assembly, 2'
5700-245-010	Print Head Cable Assembly, 10'
5700-245-025	Print Head Cable Assembly, 25'

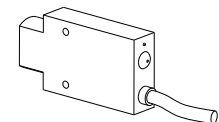


**Encoder and Photosensor**

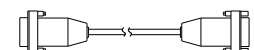
5760-820-IJ	Encoder Assembly w/Mounting Bracket & 25' Cable
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5760-383	Photosensor, Diffuse Type & 20' Cable
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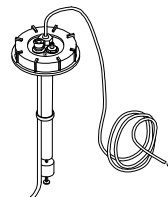
2464182-010	Encoder or Photosensor Extension Cable, 10'
2464182-025	Encoder or Photosensor Extension Cable, 25'



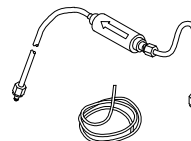
<b><u>Part Number</u></b>	<b><u>Description</u></b>
---------------------------	---------------------------

	<b>Ink Cap Assemblies and Plumbing</b>
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5760-307	5 Gallon Ink Cap Assembly
5760-309	30 Gallon Ink Cap Assembly



5760-310	Inlet Tubing and Filters
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## IJ3000 Controller

The controller gathers and stores all the information required for printing a message. This information can come from the following sources:

1. The user interface, which tells the controller what message to print on the product.
2. The photosensor, which tells the controller when to print.
3. The encoder, which tells the controller how fast to print.

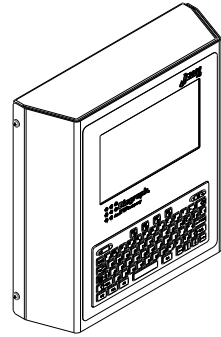
There are two types of encoders:

- A built-in **fixed speed encoder** is used when the conveyor speed does not change.
- An optional, conveyor-mounted **variable speed encoder** is used when the line speed varies or has frequent starts and stops.

With this information, the controller knows exactly when the leading edge of the product will reach the print head and at what rate of speed.

The controller comes in a stainless steel case that makes it splash-proof and resistant to electromagnetic interference.

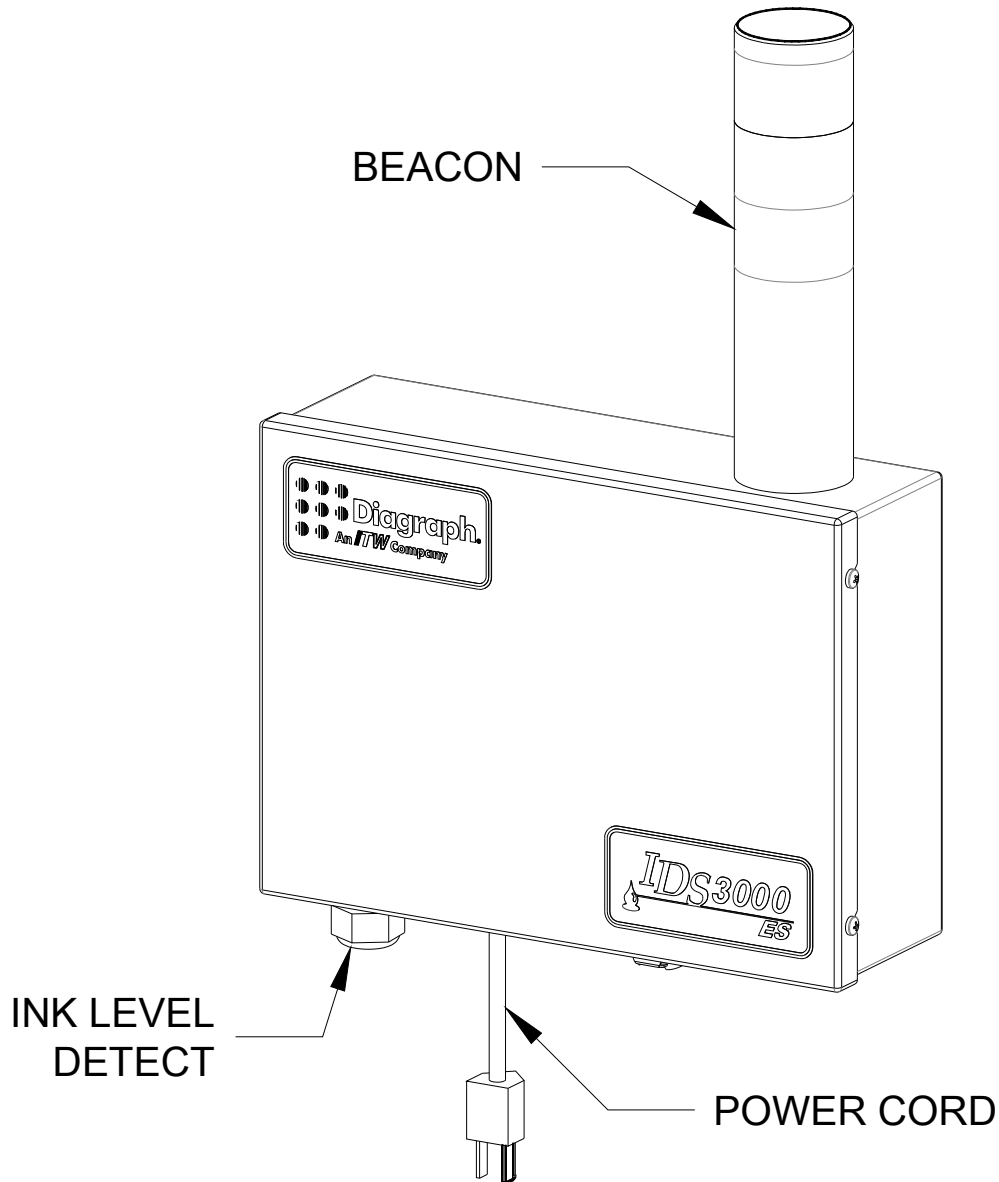
The IJ3000 Integrated Valve Controller can control any combination of IV9 Dot and IV18 Dot print heads totaling 72 dots per interface board.



## IDS3000-ES Ink Delivery System

The IDS3000-ES Ink Delivery System provides pressurized ink to the integrated valve print heads. The system contains an ink pump, fluid capacitor and printed circuit board to control ink supply to the print heads. Ink is pumped into the fluid capacitor to provide a constant ink pressure source.

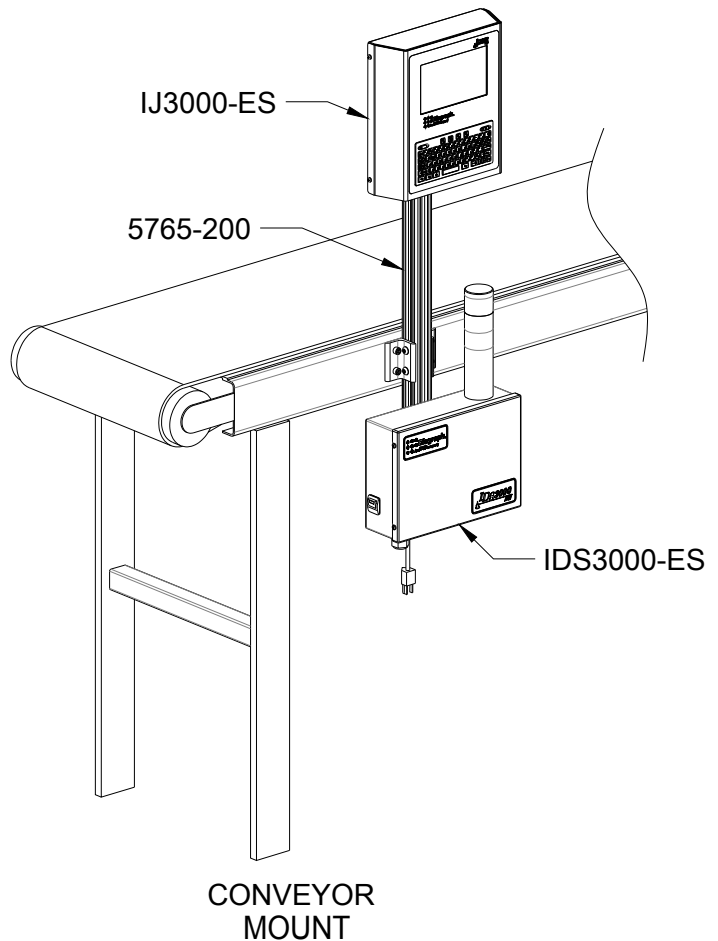
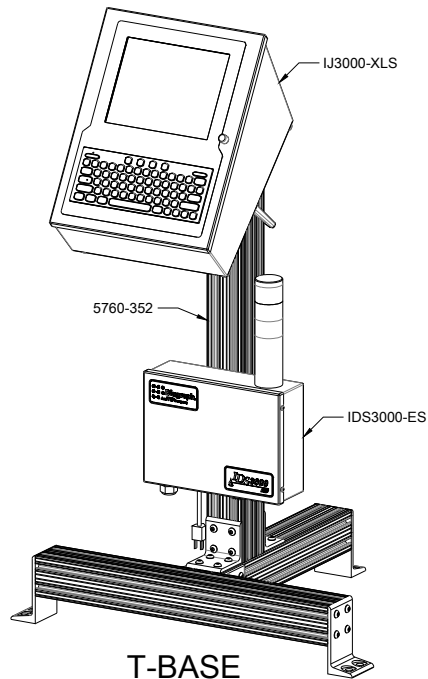
The IDS3000-ES provides connectivity to the float switch in the ink supply tank and a beacon to communicate ink status. See “*IDS3000-ES Ink Delivery System Features*” on page 56 for a complete operational description.



## Bracketry

### Controller/IDS Bracketry

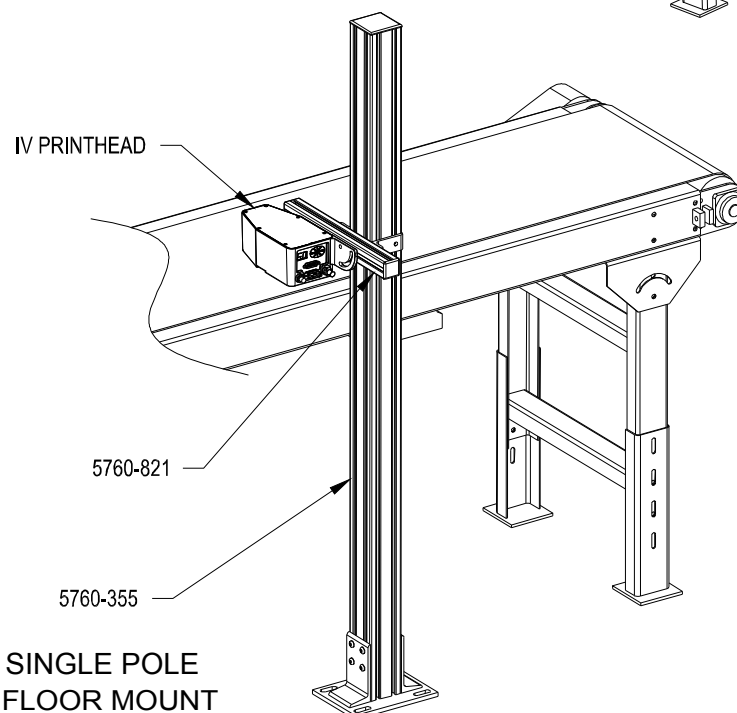
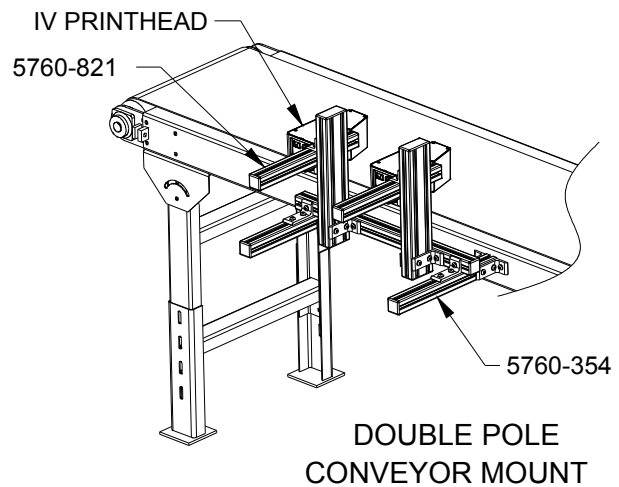
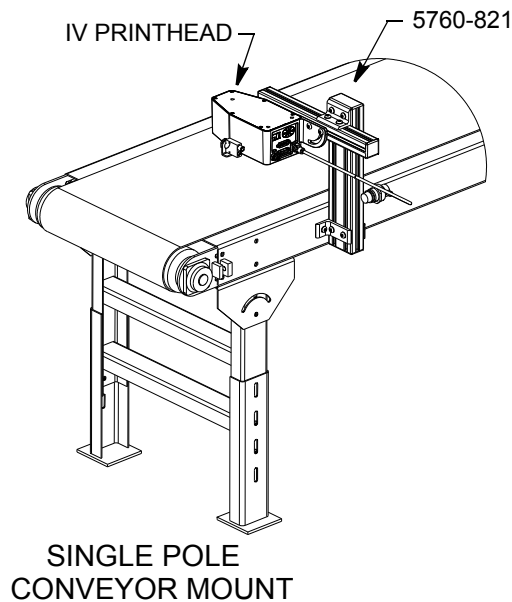
Bracketry is the structure that supports the controller, IDS, print heads, and other accessories. This manual details instructions for mounting all system components to a conveyor. Other mounting options for the controller and IDS include the T-stand and conveyor mount, shown below. Assembly instructions are included with parts kits.

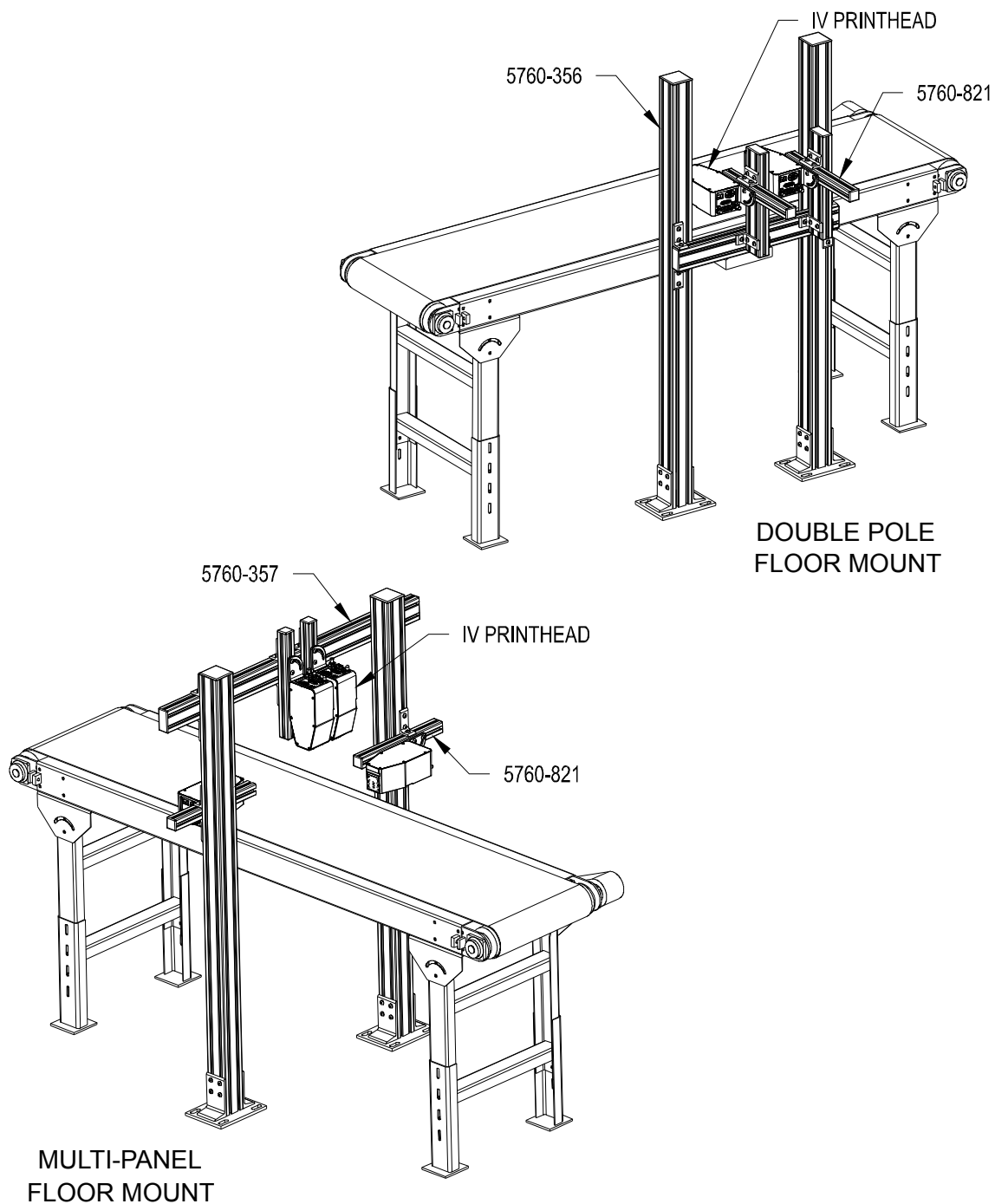


**Print Head Bracketry**

There are numerous options for mounting print heads. Diagram bracketry is modular and can assume several configurations (shown with 18dot print heads):

- Single-pole conveyor mount
- Double-pole conveyor mount
- Single-pole floor mount
- Double-pole floor mount
- Multi-panel floor mount





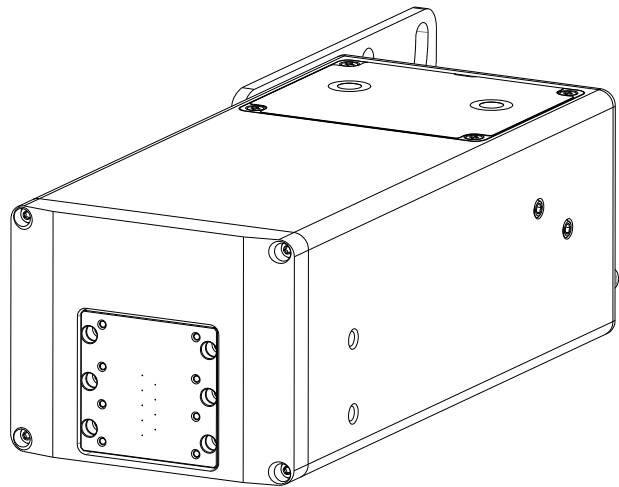


## Print Heads

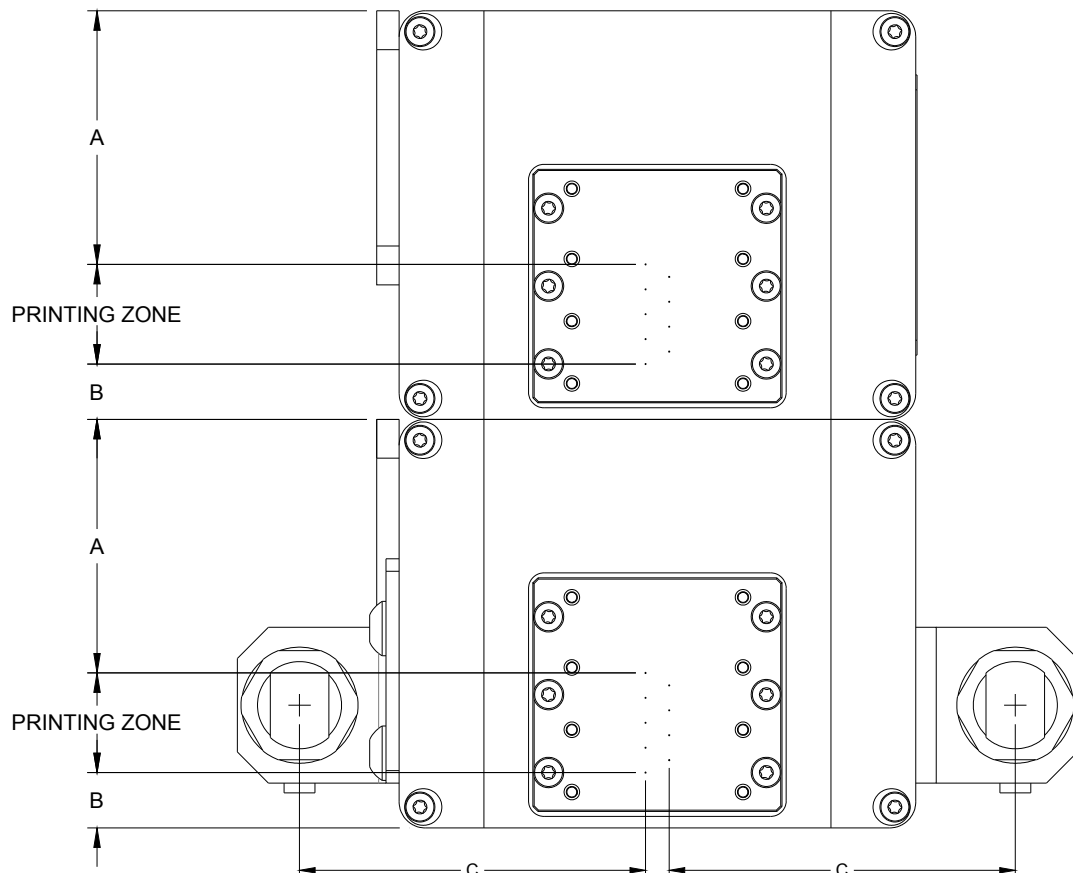
The Diagraph Integrated Valve (I.V.) print head uses a flexible membrane sandwiched between two plates, which propels ink droplets onto moving surfaces by solenoid activation.

This design keeps the ink between the front-plate and membrane, away from the solenoids.

The I.V. print head is capable of printing at very high line speeds with a minimum of required maintenance. It can produce highly legible ¼" to 2" tall alphanumerics, special characters and logos.



Each type of I.V. print head has specific distances above and below the orifices, spaces in which the print head cannot print. These non-printing zones are critical when designing print head layout in multi-head applications. The figure below shows the print and non-print areas obtained when two IV9 Dot print heads are stacked on a vertical bracket, as in the "Single Pole Floor Mount" illustration on a previous page. See the table on the next page for specific non-printing zones for each print head model.



**Print Head Models**

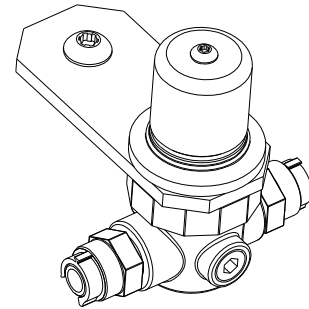
The following table lists the eight models of Diagraph I.V. print heads and their characteristics.

<b>Part Number</b>	<b>Type</b>	<b>Characteristics</b>	<b>Non-Print Base Area (B)</b>	<b>Non-Print Top Area (A)</b>	<b>Total Non-Print Area (A+B)</b>	<b>Photo-cell to First Dot (C)</b>
5770-008P500	1/2" IV9 Dot Porous	Prints 1/4", 5/16" and 1/2" tall characters on porous substrate	.84"	2.04"	2.88"	2.78"
5770-008N500	1/2" IV9 Dot Non-Porous	Prints 1/4", 5/16" and 1/2" tall characters on non-porous substrate.	.84"	2.04"	2.88"	2.78"
5770-008P875	7/8" IV9 Dot Porous	Prints 7/16", 5/8" and 7/8" tall characters on porous substrate.	.44"	2.04"	2.48"	2.78"
5770-008N875	7/8" IV9 Dot Non-Porous	Prints 7/16", 5/8" and 7/8" tall characters on non-porous substrate.	.44"	2.04"	2.48"	2.78"
5770-003P1000	1" IV18 Dot Porous	Prints 1/4", 3/8", 1/2" and 1" tall characters on porous substrate.	1.33"	1.15"	2.48"	3.10"
5770-003N1000	1" IV18 Dot Non-Porous	Prints 1/4", 3/8", 1/2" and 1" tall characters on non-porous substrate.	1.33"	1.15"	2.48"	3.10"
5770-003P2000	2" IV18 Dot Porous	Prints 1/4", 3/8", 1/2", 1" and 2" tall characters on porous substrate	.82"	.64"	1.46"	3.10"
5770-003N2000	2" IV18 Dot Non-Porous	Prints 1/4", 3/8", 1/2", 1" and 2" tall characters on non-porous substrate	.82"	.64"	1.46"	3.10"

## Ink Regulator

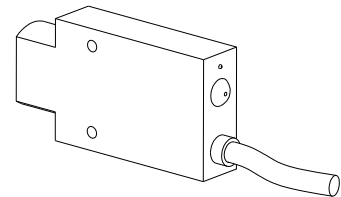
The ink regulator, supplied with the print head, regulates ink pressure to the print head. The regulator is preset at the factory to the correct output pressure.

- Porous Ink Regulator 5701-502
- Non-Porous Ink Regulator 5701-501



## Photosensor

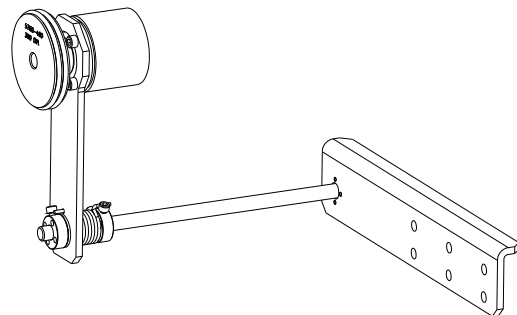
The photosensor (5760-383) is both a light source and a sensor. It emits light and detects the arrival of a product when the product reflects the light source back to the sensor. The sensor then sends a signal to the controller to start the printing cycle.



## Encoder

The variable speed encoder assembly (5760-820-IJ) provides conveyor line speed information to the controller.

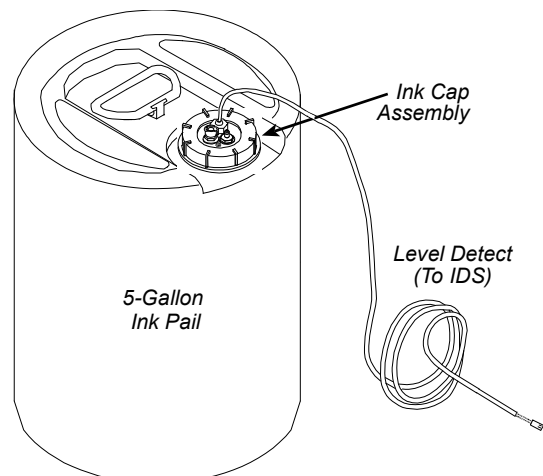
In addition to providing line speed information, an encoder also allows automatic disabling of printing when the line stops.



## Ink Supply

Ink is supplied via 5-gallon or 30-gallon plastic containers. The ink cap assembly contains a float mechanism that detects a low ink condition and sends this information to the ink delivery system.

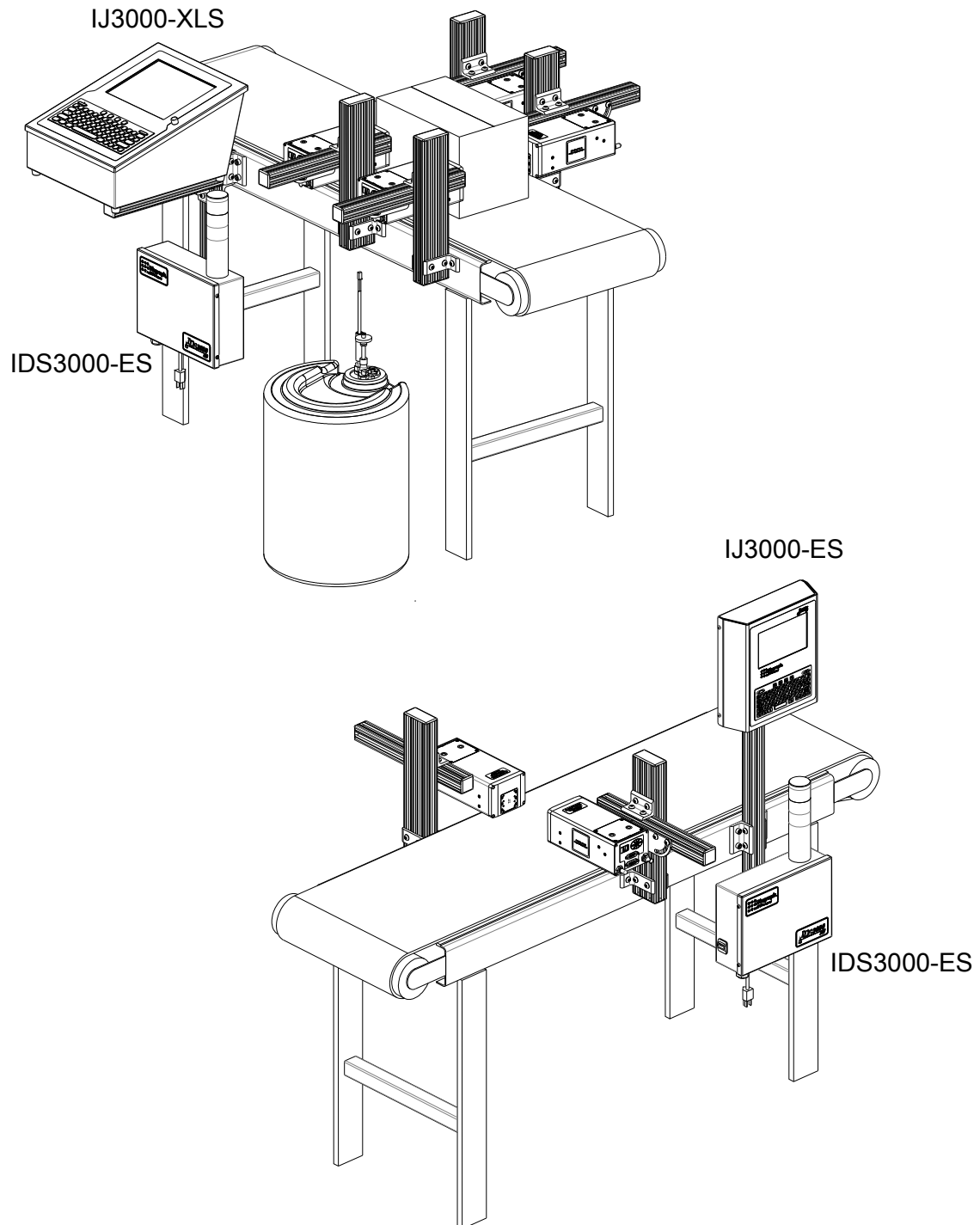
- 5 Gallon Ink Cap Assembly 5760-307
- 30 Gallon Ink Cap Assembly 5760-309



## Section 4: Installation

### System Overview

The figure below illustrates a typical install, with conveyor-mounted controller and print heads. (Cables and ink lines are not shown.)



## Testing the Electrical Outlet



**CAUTION:** The outlet must be installed near the equipment and must be easily accessible.  
**ATTENTION:** On doit installer à côté de l'appareil une prise de courant facilement accessible.

Before installing the IJ3000 system, verify the integrity of the 115VAC sourced power, in accordance with the National Electric Code (NEC) and approved local electrical codes. If using a standard AC outlet, use the following procedure to verify the integrity of your outlet.

1. Place an outlet tester into the socket. (You can purchase an outlet tester at most hardware stores).
2. If the outlet tester indicates that the outlet is wired correctly, proceed with the installation.
3. If the outlet tester indicates that the outlet is wired incorrectly, inform plant maintenance immediately and do not use the outlet until it has been re-wired. See *“Appendix H: Testing an Electrical Outlet”* on page 79 for more information.

### Electrical Line Transients

Transients on the incoming AC power line can be in the form of voltage spikes and transients, over- and under-voltage events, or noise caused by poor grounding or interference. Symptoms of power related problems can be unexplained loss of controller memory (loss of message), garbled print, and unexplained hardware resets.

The best way to eliminate these types of problems is to install the controller on a dedicated line with a line conditioner. A dedicated line refers to an AC line that only the system components are plugged in to. This is most effective when the source is at the building main service entrance.

Good quality line conditioners will provide protection against all AC line problems with the exception of power outages; if power outages are a problem at the installation, an uninterruptible power supply (UPS) should be installed.



**CAUTION:** Not for use in a computer room as defined in the Standard for the Protection of Electronic Computer/Data Processing Equipment, ANSI/NFPA 75.

**ATTENTION:** Ne peut être utilisé dans une salle d'ordinateurs telle que définie dans la norme ANSI/NFPA 75 Standard for Protection of Electronic Computer/Data Processing Equipment.

## Materials Required for Installation

You will need the following items:

- Maintenance Spray (see Appendix D)
- Lint-free wipes
- Ink pressure gauge (5700-743)
- Safety goggles
- Level
- Tape measure
- Effluent bottle (5750-503)

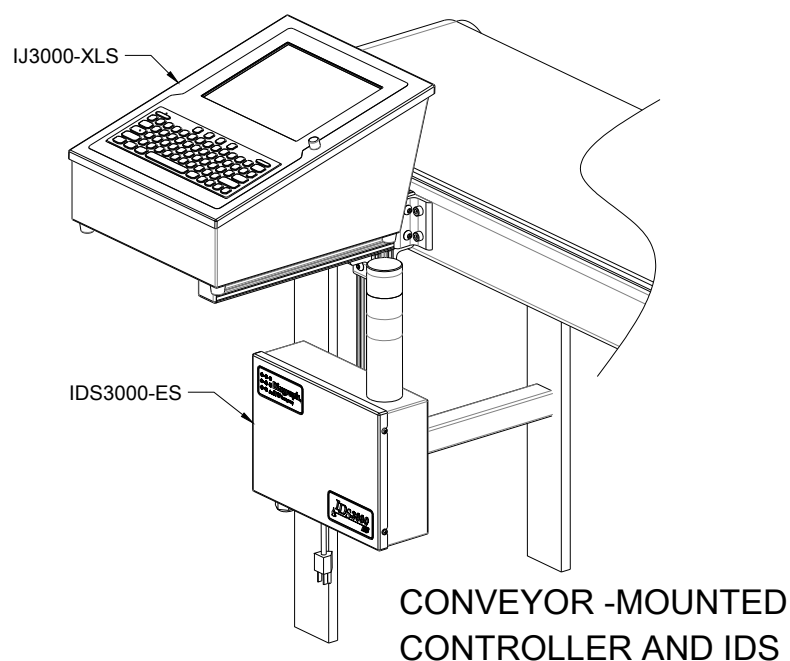
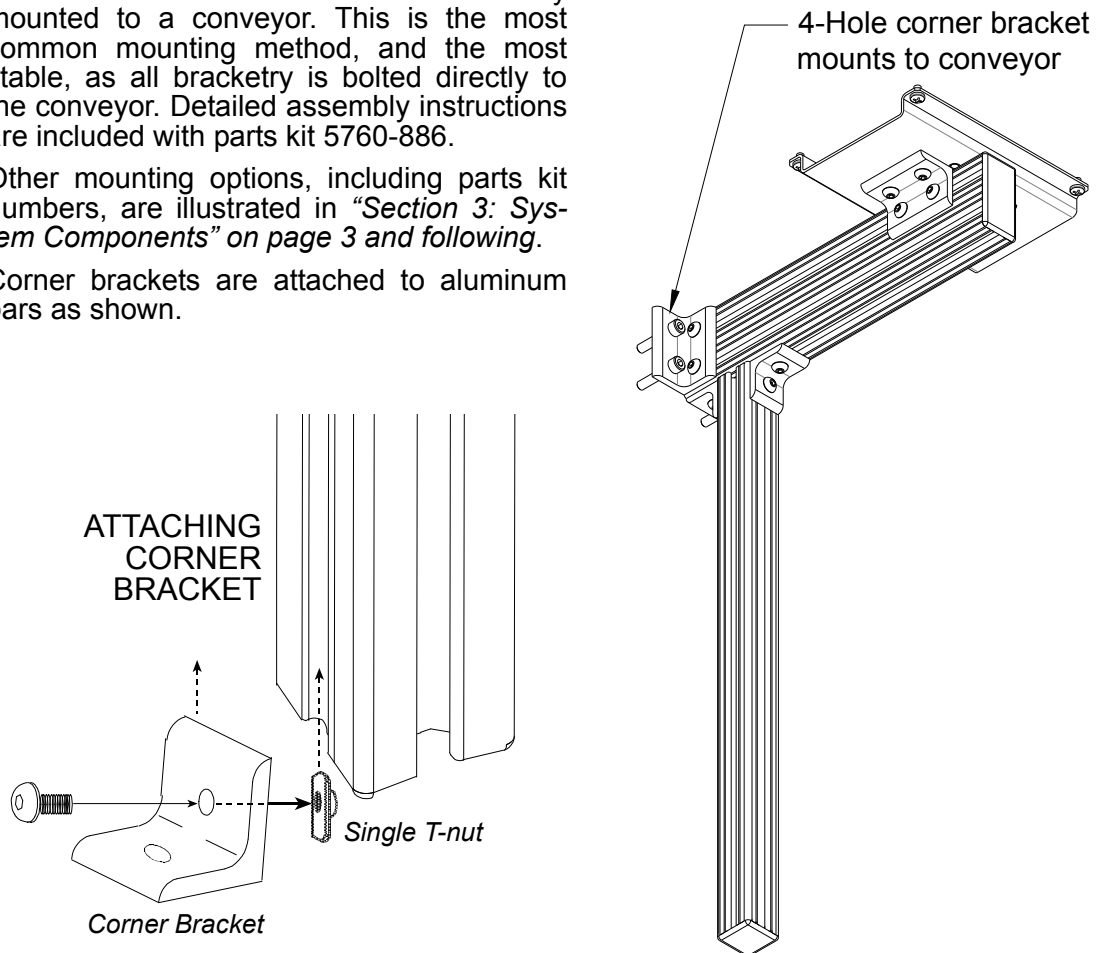
Use appropriate safety equipment and procedures. Leave print heads in their shipping cartons until all bracketry is in place and tightened down.

## Installing Controller/IDS Bracketry

This section shows controller/IDS bracketry mounted to a conveyor. This is the most common mounting method, and the most stable, as all bracketry is bolted directly to the conveyor. Detailed assembly instructions are included with parts kit 5760-886.

Other mounting options, including parts kit numbers, are illustrated in "Section 3: System Components" on page 3 and following.

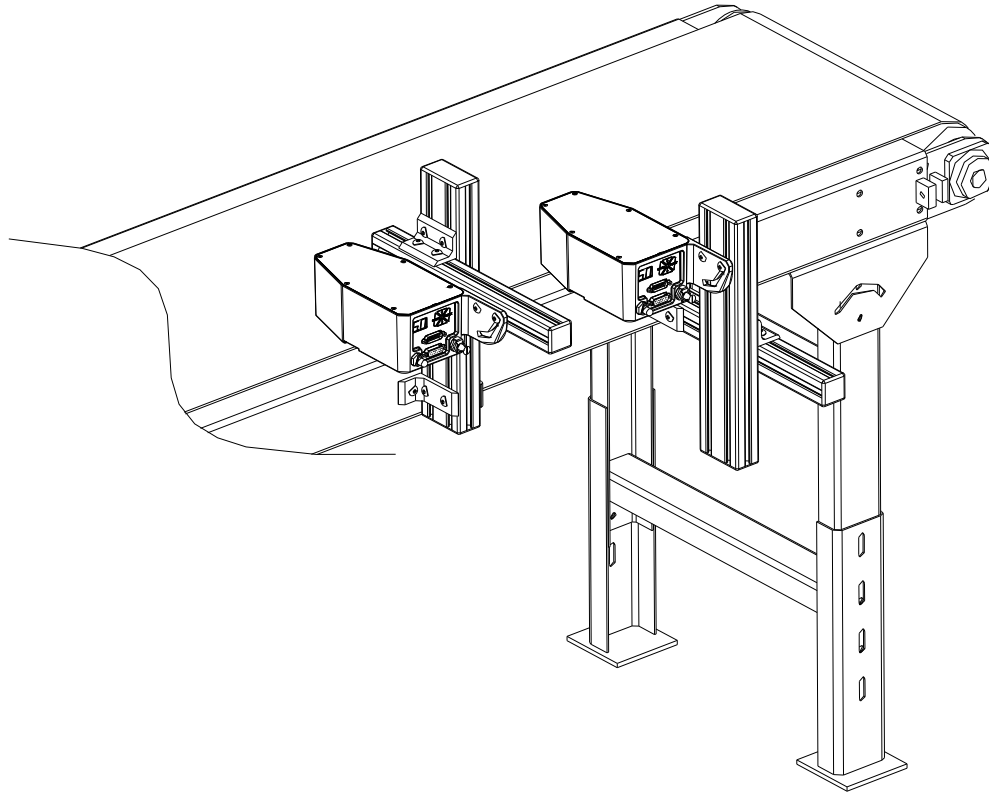
Corner brackets are attached to aluminum bars as shown.



## Print Head Bracketry

This section shows bracketry for conveyor-mounted print heads. The bracketry can be assembled in two different configurations, as shown below. See “*Section 3: System Components*” on page 3 and following for other print head bracketry options.

With all conveyor-mounted options, plant maintenance will need to drill holes in the conveyor for final attachment.



## Mounting the Print Heads

Unpack the print head just before mounting on the bracketry.

Attach the print head to the bracketry with the screws and T-nuts provided in the bracket kit.

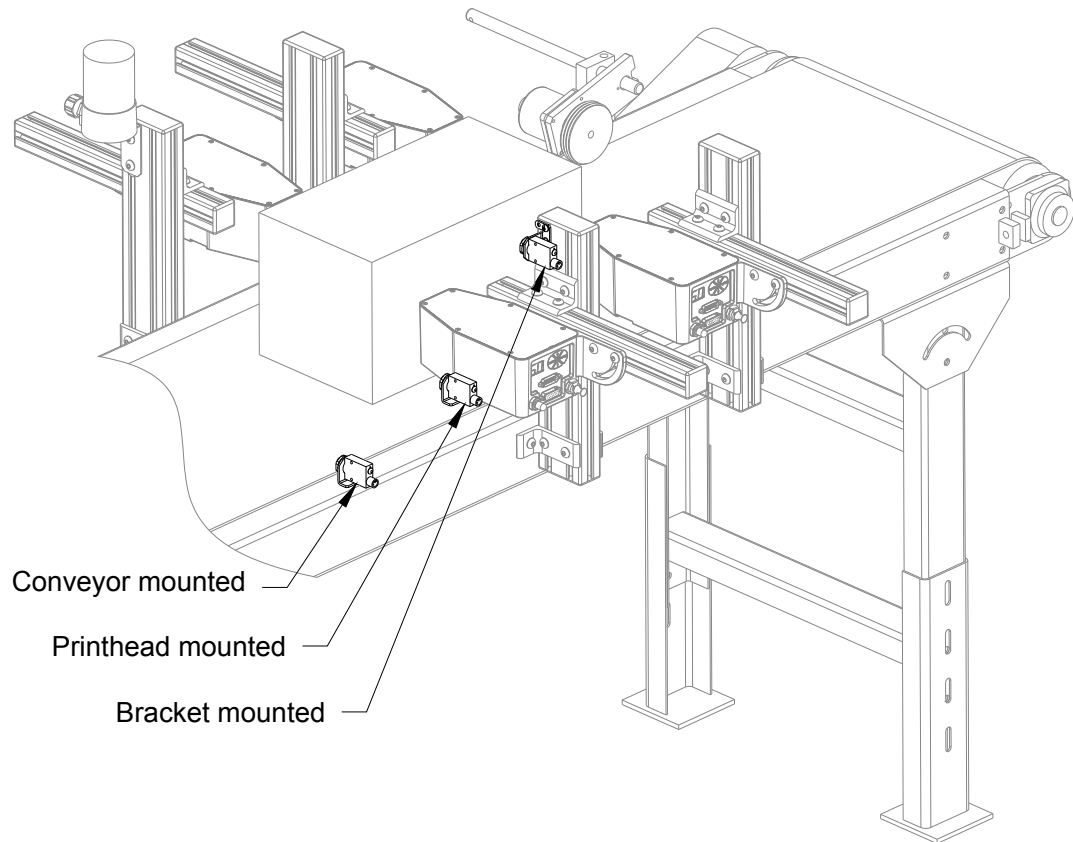
It may be necessary to adjust the vertical location of each print head in order to fine-tune the message placement. This is especially true when using multiple print heads, as message lines will need to be synchronized with each other.



**NOTE:** When adjusting the print head mounting bracket, always support the print head with your hand to keep it from falling onto the conveyor.

## Mounting the Photosensor

1. Position the photosensor (5760-383) upstream from the first print head. The maximum placement distance is 81 inches from the photocell to the print head.
2. The photosensor depth range can be adjusted. Refer to the photosensor manufacturer's instruction sheet for instructions on adjusting the range.
3. The following mounting configurations are standard with the 5760-383 photosensor kit. The mounting bracket is included.



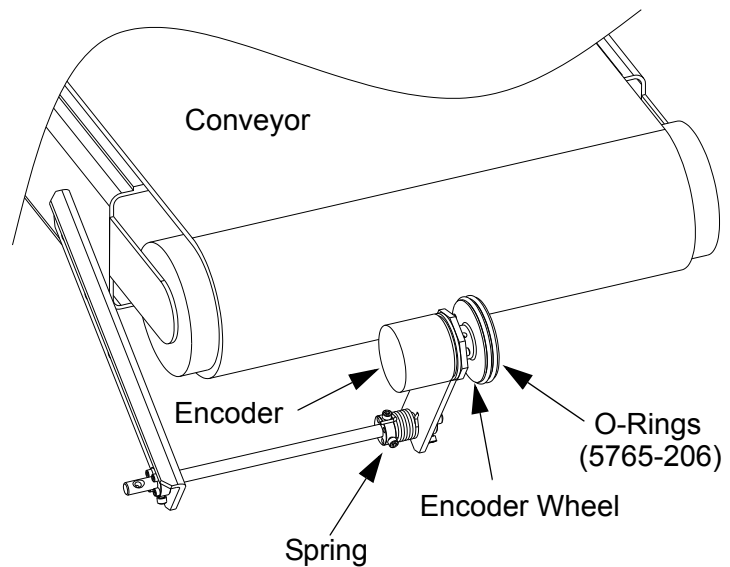


## The Encoder

The encoder (5760-820-IJ) uses a wheel that rolls against the conveyor belt to track the speed. It sends a signal to the controller, which makes adjustments for reported changes in the line speed.

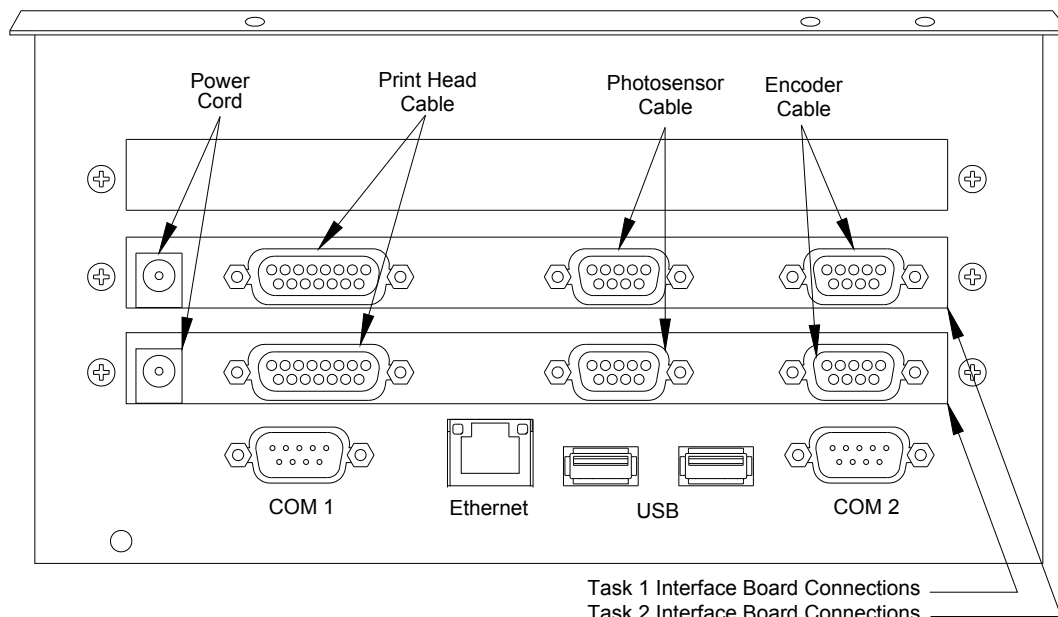
It is not necessary to install the encoder immediately adjacent to the print heads. It is more important to place it where it will accurately measure the speed of the conveyor. Install it in contact with the conveyor, or with a wheel or roller moving the same speed as the conveyor.

The encoder's mounting bracket is spring-loaded. Adjust the spring collar to ensure that the encoder maintains stable contact with the conveyor.



**CAUTION:** Do not excessively load the encoder wheel against the surface of the conveyor. A radial force of over 40 lbs. will reduce the life of the bearings.

## Controller Connections

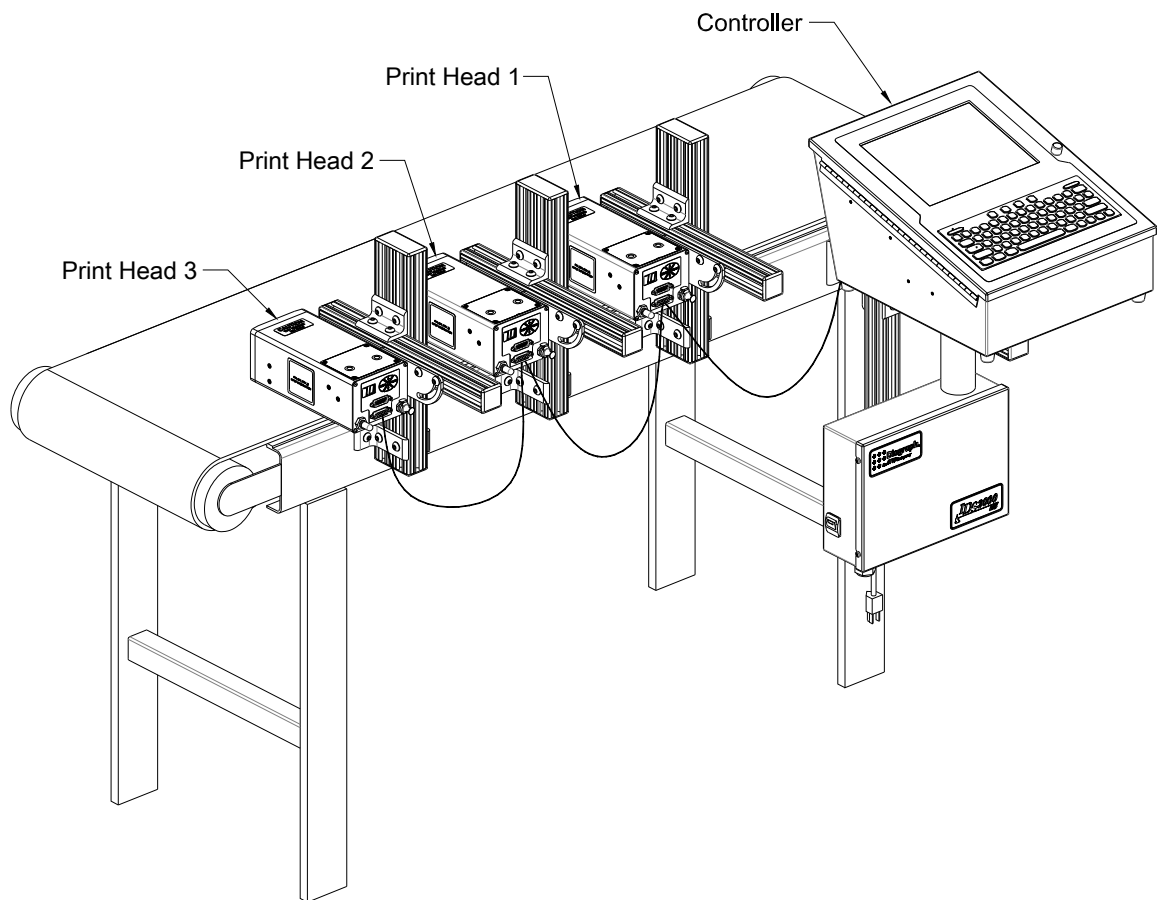
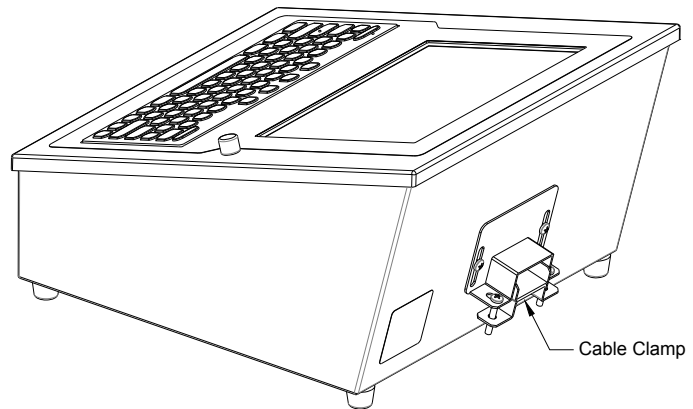


**INTERNAL CIRCUIT BOARD MOUNTING PLATE**

### CPU Connections

All controller cables must be routed through the strain relief cable clamp in the back of the controller (applicable on IJ3000-LS and IJ3000-XLS only).

The controller to print head cable must be connected to the highest vertical head. Print head to print head cables should be connected from the top head down as shown in the following drawing.



## Using the Optional Second Interface Board



**NOTE:** The optional second Interface Board is available for IJ3000-ES and IJ3000-XLS only.

The IJ3000 ships standard with one interface board, capable of printing up to 72 dots on a maximum of eight print heads. A second interface board can be added for capability up to 144 dots.



**NOTE:** A second interface board requires a second power supply to operate.

Print heads connected to the second interface board comprise a separate print station, which will be referred to as Task 2 on the controller's user interface.

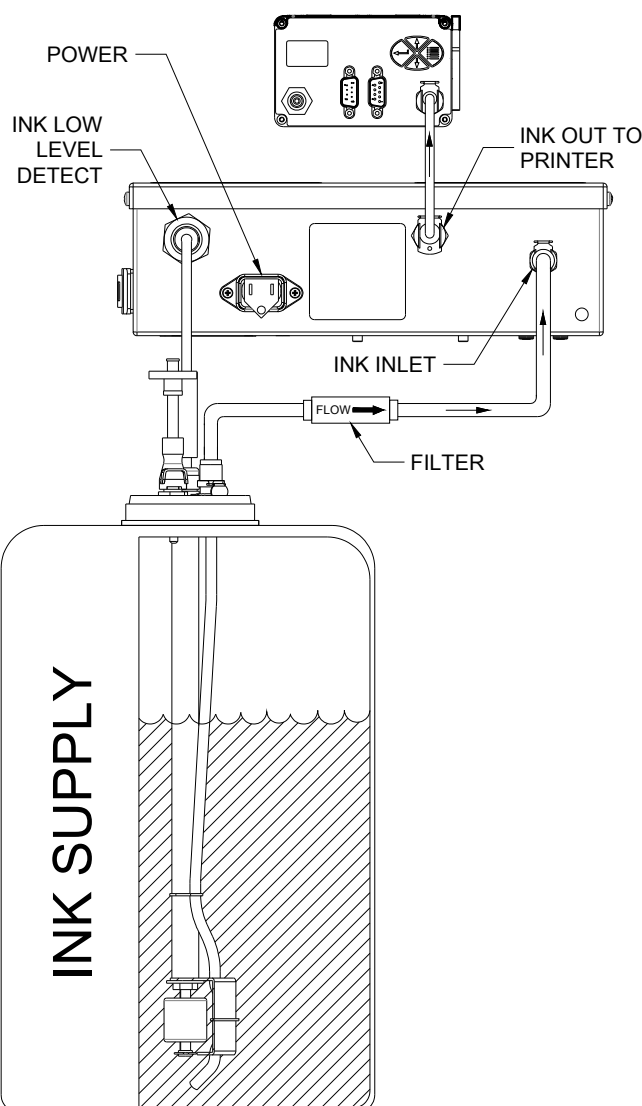
### Sharing an Encoder and/or Photosensor

In many cases, it is possible to use the same encoder and/or photosensor to control both printstations. This is done by connecting the cables to the first interface board and directing Task 2 to share these components with Task 1. (Refer to *Setup Functions, Encoder Setup* in the IJ3000 Controller Manual, part number 5760-121.)

Such sharing may not be possible where the second printstation uses a separate conveyor, or where the distance between printstations is too great to allow triggering from the same photosensor.

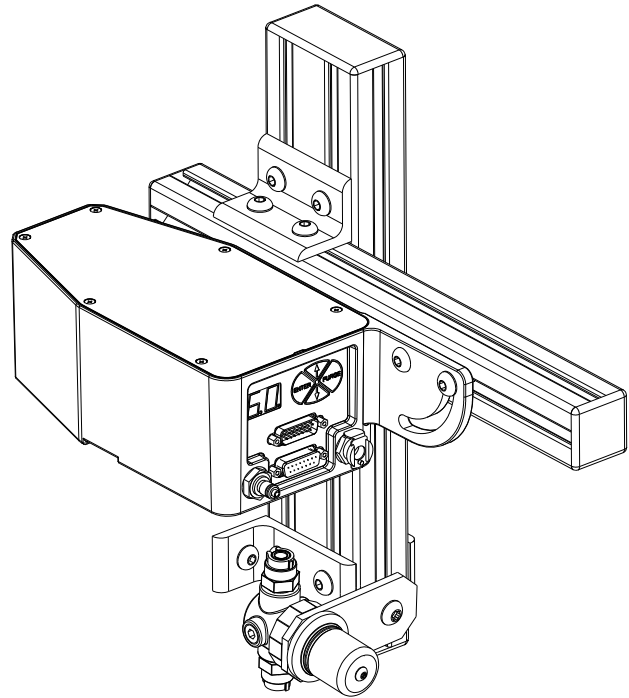
## Configuring the IDS

1. Remove the IDS cover.
2. Install cables through their respective bulkhead fittings, leaving ¼" of the large cable jacket extending outside the bulkhead fitting.
3. Connect the beacon cable to IDS circuit board connector J5 (IDS3000 only). Connect the ink low level detect cable (from ink cap assembly) to J4 for IDS3000 and J6 for IDS3000-ES. (See the wiring diagram in "Appendix C: Interconnect Diagrams" on page 59.) Connect the ethernet cable to the appropriate receptacle (IDS3000 only).
4. Tighten bulkhead fittings by hand, then ½ turn with a wrench, and replace the IDS cover.
5. Place the Ink Status Beacon where it can be seen by plant personnel, and attach it to bracketry with a T-nut (IDS3000 only).



### Attaching Ink Regulators

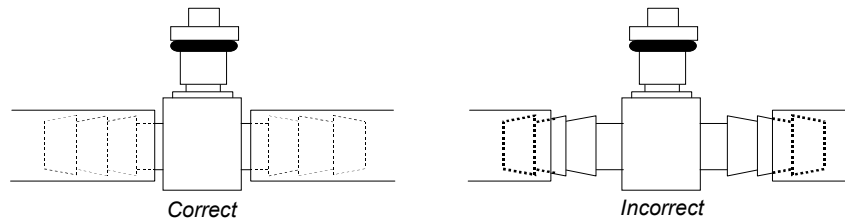
1. Attach a single T-nut loosely to the bottom side of the regulator bracket.
2. Slide the regulator bracket and T-nut into the slotted bar and tighten into place.



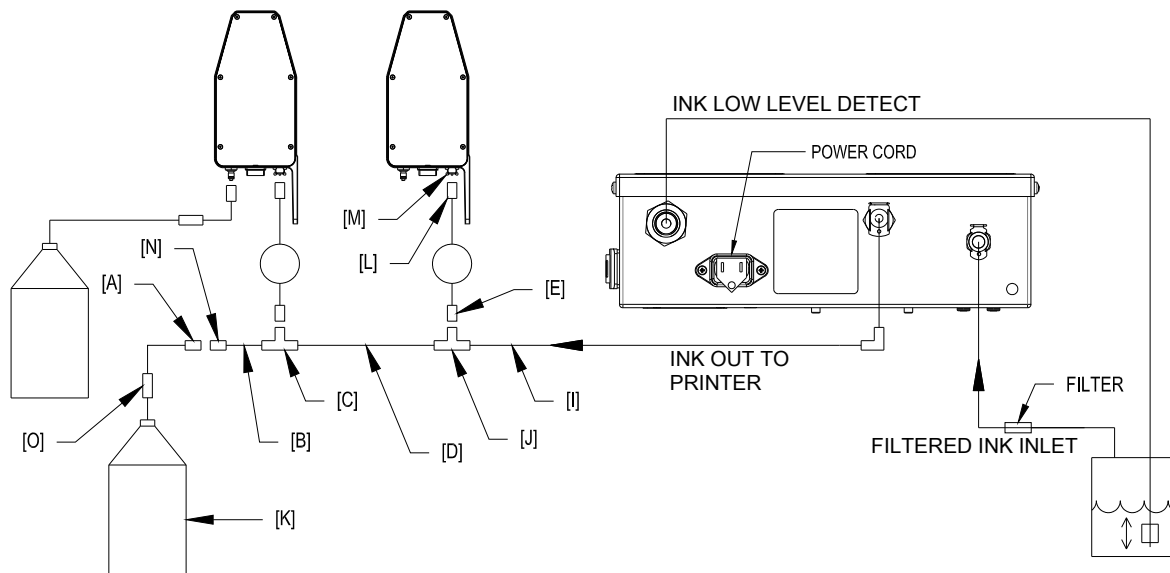
### Plumbing the System

All ink line connections should be as short as possible. Additional ink line can be purchased if necessary. The IDS may be located up to 100 feet from the print heads.

When installing ink line, be sure to slide the tubing completely over the exposed barbs on the fittings to prevent ink line leaks while under pressure.



1. Obtain a suitable length of ink line **[I]** fitted with the elbow connector **[H]**. Attach the elbow connector to the "Ink Out To Printer" quick-disconnect **[F]** on the IDS **[G]**. Cut line to the length desired and insert over the barbed end of a T connector **[J]**.



2. Insert the female connector end **[E]** of the ink regulator tubing assembly over the male fitting on the T connector. Attach the male connector end **[L]** of the ink regulator tubing assembly to the female connector **[M]** ink inlet port of the first print head.

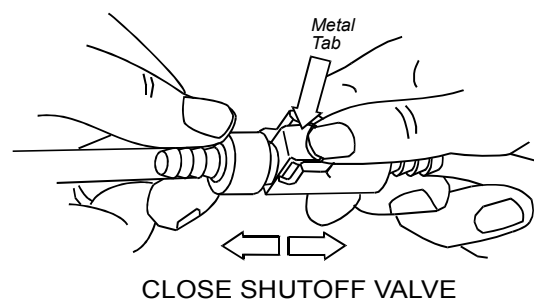


**NOTE:** Listen for a click as you push the quick disconnects together **[A]**. The thumb tab on the female quick disconnect will be in its out position when successfully attached. Test the ink line's security by gently tugging on it.

3. Cut an ink line **[D]** to the desired length and connect one end to the other side of the T connector **[J]**. Add another T connector to this line and attach the second ink regulator and the second print head. Repeat with all remaining print heads.
4. Cut another line of tubing **[B]** to connect to the last T connector on the line **[C]**. Attach a male quick disconnect **[N]** to the other end of the tubing.
5. Attach the effluent bottle assembly **[K]**, with its female quick disconnect **[A]**, at the end of the line.



**NOTE:** Be sure the effluent shutoff valve **[O]** is off at this time. To close the shutoff valve, depress the metal tab on the valve; the connections will pop apart slightly, but not disconnect.



## Connecting the Ink Supply



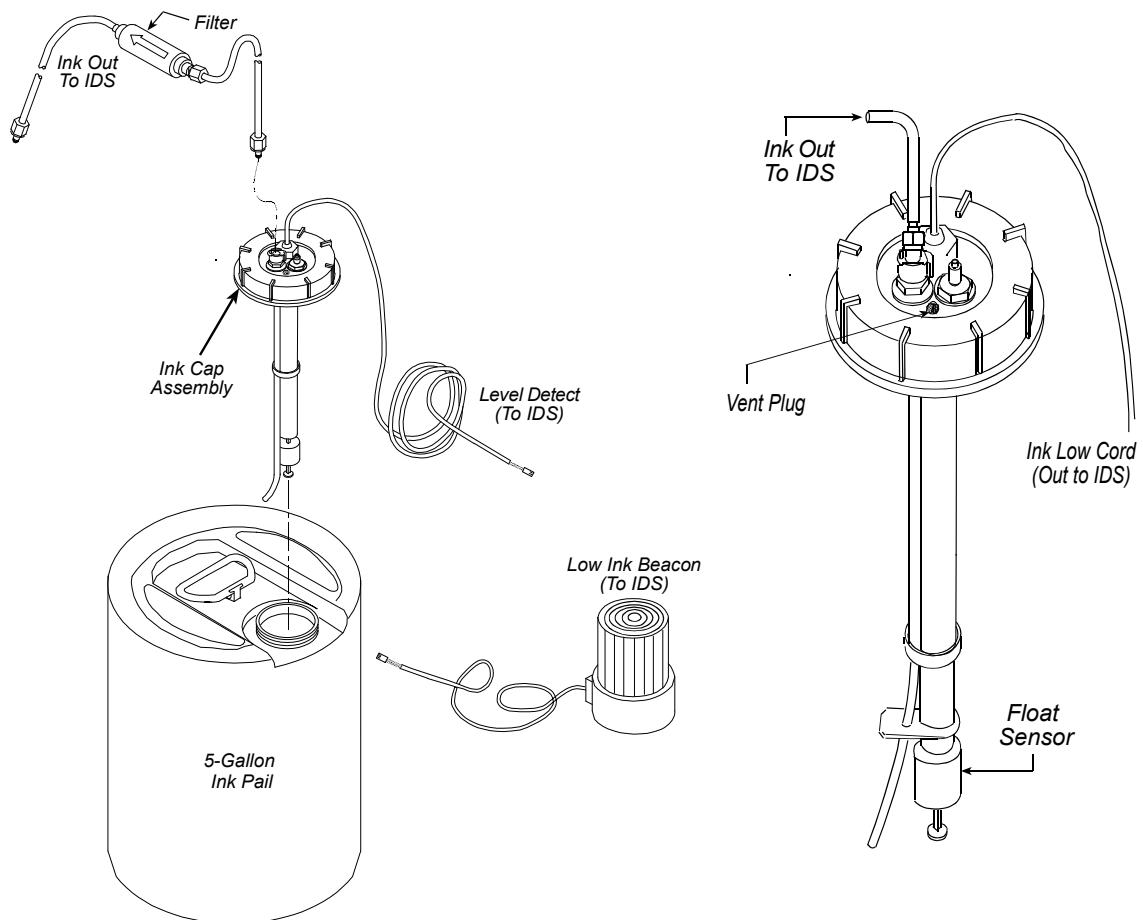
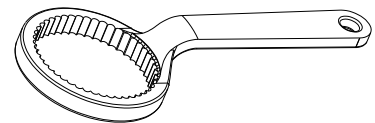
**Wear eye protection and use appropriate safety equipment when working with ink.**

1. Place a pail of Diagraph ink within eight feet of the IDS.
2. Unscrew the shipping cap from the pail. Insert the cap assembly and tighten snugly by hand.
3. Connect the 1/8" ink supply line from the "Filtered Ink Inlet" quick disconnect on the IDS to the female coupling on the ink cap assembly.



**CAUTION:** Porous ink must be used with a porous IDS. Non-porous ink must be used with a non-porous IDS. The IDS can not be flushed to use a different ink type.

Tool required: 5-Gallon Ink Cap Wrench (1301-830).



## Priming the System

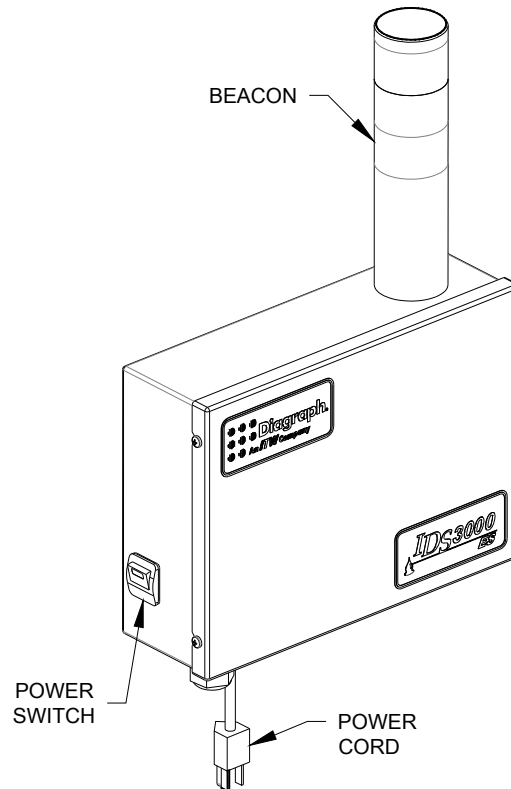
### IDS3000-ES



**WARNING:** Ensure outlet plumbing is capped downstream.

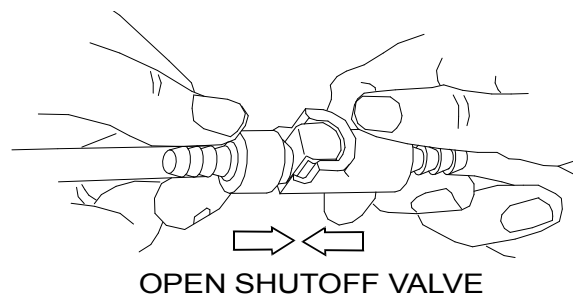
To prime the ink system for the first time after installation, toggle the power switch on the top of the enclosure. The pump will remain on until the ink fluid capacitor reaches its normal operating pressure.

If this is a first-time installation, bleed the downstream lines per operations manual.



### IDS3000-ES

It will still be necessary to bleed the air from the lines. Open the shutoff valve on the effluent bottle assembly by pushing together until the connections snap into place; this will allow air to flow out of the main line. As soon as ink begins flowing into the effluent bottle, close the shutoff valve and disconnect the assembly. Keep a clean wipe handy to clean up any ink drips.



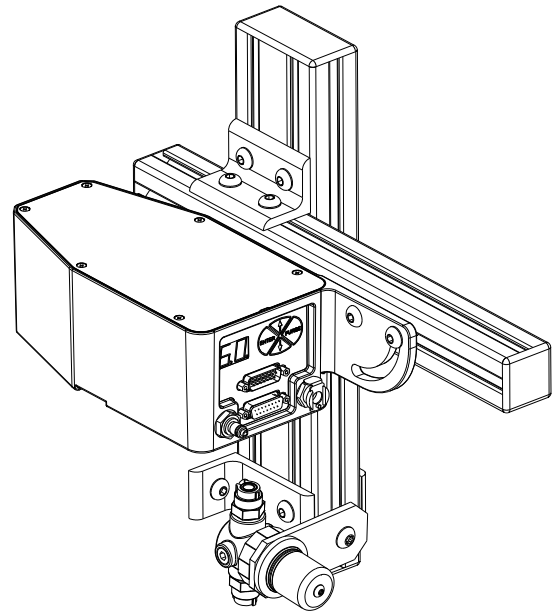
Move the effluent bottle assembly to the first print head in the line and connect it to the ink exit fitting on the head. Repeat Step 2 for each print head to remove all air from the lines.

## Checking Ink Pressure

Variations in ink pressure produce different dot sizes; the higher the pressure, the larger the dot. However, over-pressurizing a print head can result in leakage, or cause ink to shoot across the conveyor. Under-pressurizing can cause ink to drip from the front plate while printing; the print head may also take a long time to print all the dots at morning startup.



**NOTE:** Ink pressure should only be checked when the print head is **NOT** printing. If any of the ink lines have been disconnected and then re-connected, purge the print head.



Use the built-in digital pressure gauge.

Print Head Operating Pressure	PSIG ( $\pm 0.5$ )
IV9 Dot, 1/2"	7
IV9 Dot, 7/8"	7
IV18 Dot, 1"	7
IV18 Dot, 2"	7

If the ink pressure at the print head is not correct, follow the steps on the next page (*Setting Ink Pressure*).



## Setting Ink Pressure



**NOTE:** The pressure regulator shipped with the print head is pre-set at the factory and should **NOT** require adjustment. Bleed all air from regulator before adjusting set pressure.

Tools and materials required:

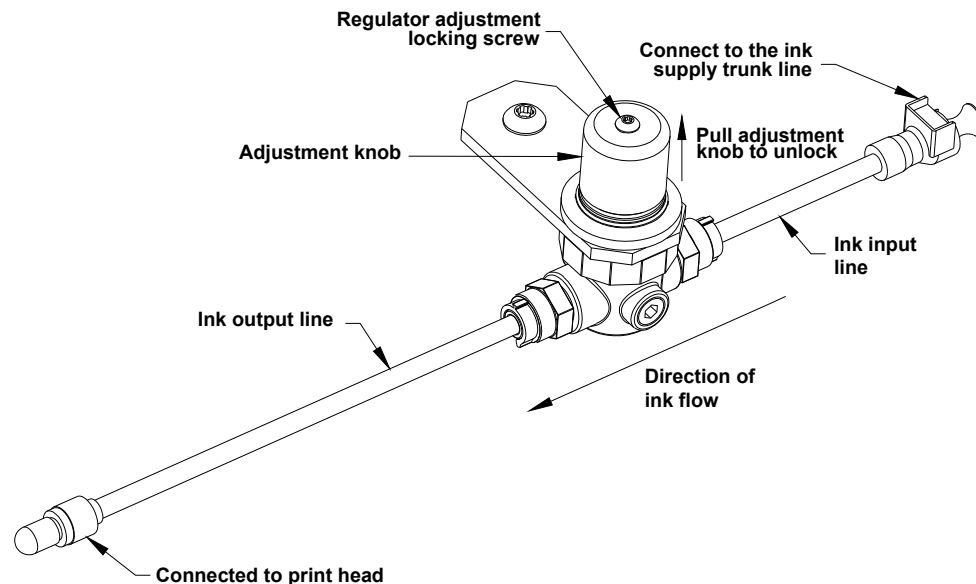
- T20 Torx driver



**CAUTION:** Wear safety goggles when working with industrial inks or solutions!



**NOTE:** All efforts should be taken to prevent air from entering the regulator. If present, air can become trapped and cause false readings, pressure fluctuations, and print head leakage. Ensure the trunk line has been purged of any air. If any of these anomalies are observed during installation, refer to *"Ink Regulator Maintenance"* on page 39.



1. Monitor the ink pressure via the LED at the rear of the print head.
2. Remove or loosen the regulator adjustment locking screw and pull the adjustment knob up into the unlocked position (see illustration above).
3. Adjust the regulator clockwise to increase pressure or counter-clockwise to decrease pressure.
4. After any adjustment to the regulator, purge ink through the front orifice plate either from the control on the rear of the print head or from the controller (depending on head type).
5. The regulator is properly adjusted when the print head pressure is within  $\pm .5$  psig of the operating pressure and stable after 30 seconds of a purge. If the ink regulator pressure is not stable, refer to *"Ink Regulator Maintenance"* on page 39.
6. Depress the ink regulator adjustment knob to the locked position and install or tighten the regulator adjustment locking screw.

## Print Head Operation

**Initial Startup and Power Save:** When the print head is connected to the electronic cable, the display shows the center decimal point to signify there is power. This is the Power Save mode. This mode saves energy by not powering all the LED display segments. The print head has full functionality in Power Save mode. Any of the four push buttons on the membrane switch will illuminate (wake up) the display. When awake, the display will always start in the Home Screen.

**Inactivity:** After 30 seconds of inactivity in the Home Screen, the display will change to Power Save mode. If the LED display is in any other mode such as Purge or Pulse Width Adjustment, the LED display will default to the Home Screen after 30 seconds of inactivity, then Power Save mode (an additional 30 seconds).

**Home Screen:** The LED state after waking up the print head display or the default after 30 seconds of inactivity. It displays the print head pressure in psi (pounds per square inch).

**PURGE Button:** The PURGE button can be used in two different ways, one, to PURGE all channels at once, or two, to PURGE one channel at a time. From the Home Screen, press and hold the PURGE button on the rear membrane switch for one second. All of the channels will fire/eject ink for two seconds. If you continue to hold the PURGE button, then the print head will purge ink until you release the button. To purge individual channels, press the ENTER button once then the up and down arrows to select the desired channel (e.g. 1 through 9). Again, press and hold the PURGE button for one second. Ink will eject from the selected channel for two seconds. To return to the home screen, press the down arrow button until "Pr" is selected, and then press ENTER. Otherwise, the print head will automatically return to the home screen after 30 seconds of inactivity.

**Pulse Width Adjustment:** Hold down the up and down arrows simultaneously. The last channel to be accessed will be displayed. Press the ENTER button. The pulse width setting will be displayed. This value is relative and can range between 15 and 65. The higher the value, the larger the dot size, and vice versa. Generally, pulse width adjustment on a new print head is not recommended. These values are factory set. However, it may be necessary to increase pulse widths if there are long print head cable lengths in the daisy chain. Decreasing the pulse widths will likely result in missed dots at first start-up. If a pulse width is changed, the ENTER button must be pressed to save the new value(s). Again, press the down arrow until "Pr" is displayed. Press ENTER to exit to the Home Screen.

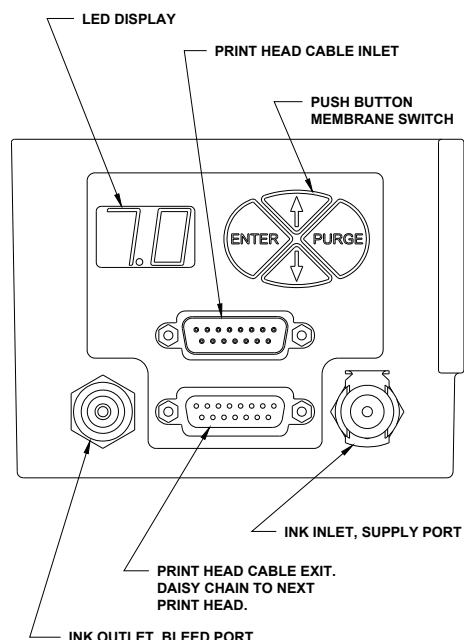


**NOTE:** If the ENTER button is not pressed, the display will revert to the home screen after 30 seconds and the pulse width value will not be saved.

**ENTER Button:** This button is used to move from one function to the next or saving pulse width adjustments.

**Up and Down Arrows:** These buttons are used to select channels, enter Pulse Width Adjustment mode, and to adjust the pulse width values up or down.

**"Er" Display Code:** If the display on the rear of the print head shows a flashing decimal, this means the print head has been driven in excess of its normal printing range and is now in overdrive protection. Pressing any of the four buttons on the rear of the print head will reveal the "Er" code. Consult the factory. To clear the code, press the ENTER button on the rear of the print head. Note that this code will only clear when the print head is not being over-driven.



## Operational System Test

After the equipment installation is complete (including all ink line and electrical connections), a print head purge should be performed. Power On both the IJ3000 Controller and the IDS3000 Ink Delivery System. Prior to purging the print heads, the Print Station Configuration needs to be set up on the IJ3000 Controller, per the following instructions.

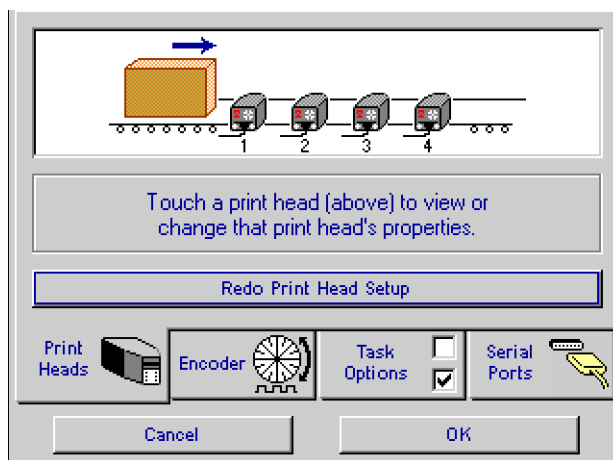
### Configuring the Print Station

#### Print Head Setup Screen

On the **Home Screen**, touch **Show Menu, Control Panels**, then **System Setup**.

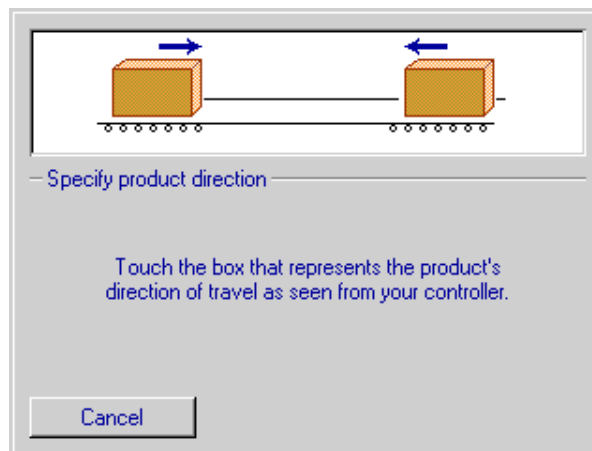
Screen prompts guide you through the step by step print head setup procedure. Once begun, the procedure may be aborted (by pressing Cancel or the Escape key) at any time without changing the current print head setup.

To begin the print head setup procedure, touch the **Redo Print Head Setup** button. The next screen prompts you to specify product direction.



#### Specifying Product Direction

Touch the box that represents the direction your product will move on the conveyor. The next screen will appear automatically.



### Specifying Number of Print Heads

Touch the up/down arrows to set the number of print heads on each side of the conveyor. The illustration at the top of the screen will automatically change to reflect your choices. In the example at right, four print heads have been specified on the near side and two on the far side of the conveyor. Touch the **Next>** button.

### Setting Daisy Chain Order

All six print heads are displayed, and you are prompted to indicate the first print head in the daisy chain by touching it. The "grayed-out" heads are not eligible as they are in the middle of the chain. (If there is only a single print head, this step is bypassed.)

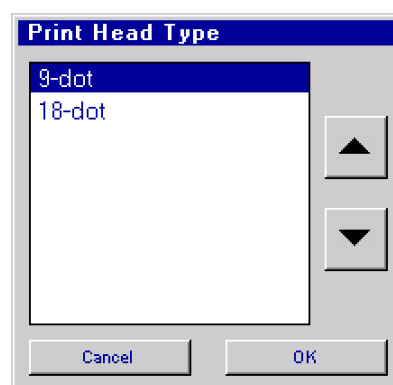
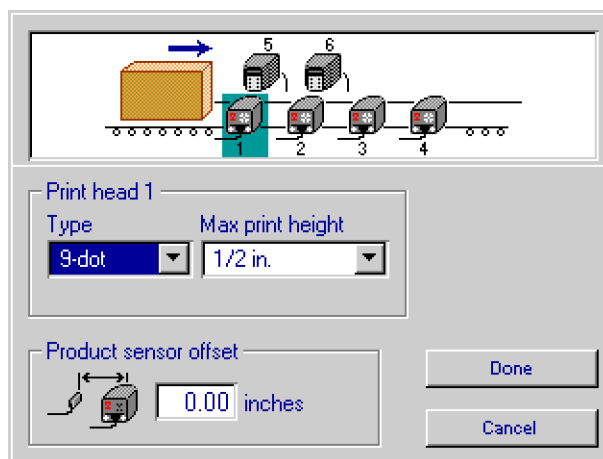
In the example at right, you have chosen the far left print head on the near side as the first in your daisy chain. The rest of the print heads on this side have been assigned numbers automatically, and you are now prompted to indicate which of the print heads on the far side is the last in the chain. (Depending on the configuration, this step may be bypassed.) Once this is done, the **Print Head Properties** screen appears.

### Defining Print Head Properties

The final step in print head configuration is defining the properties of the individual print heads.

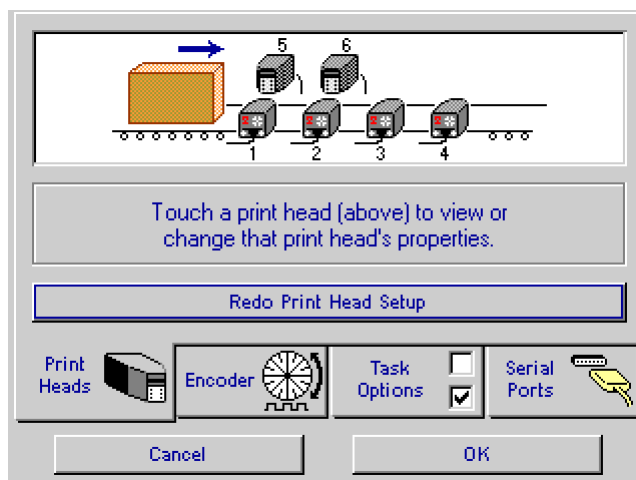
Beginning with print head number one and working in numerical order, you will need to define the following:

- **Print head type:** A list box shows the types available, including IV9 Dot and 18 Dot. Select Print Head type and then select Max print head height of 1/2", 7/8", 1", or 2" to match Print head installed.
- **Product sensor offset:** Enter the distance between the center of the photosensor and the center of the print head, in inches. This may need to be fine-tuned after print setup. The maximum sensor offset is 81".



After a print head's properties are defined, touch the **Next Head** button to move to the next one; or just touch a print head on the display to highlight it. Repeat this process for each print head in your daisy chain until all heads have been defined.

After the last print head is defined, touch the **Done** button to display the following screen. Print Head setup is now complete.



Touch any print head on the display to review or change the properties for that head. Touch the **Redo Print Head Setup** button to repeat the setup procedure using the new setup as the default. Touch **OK** to return to the **Home Screen**.

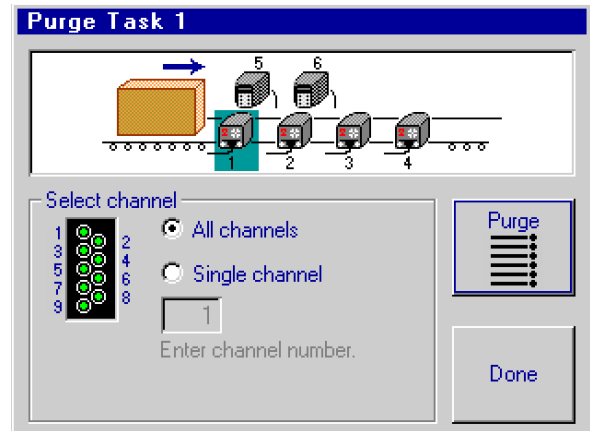
## Purging Print Heads

Purge all heads with ink as follows:

1. On the **Home Screen** menu, select **Print**.
2. On the **Print** menu, select **Purge**.
3. Touch the head you wish to purge first.
4. Hold a lint-free wipe in front of the print head.
5. Touch the radio button labeled **All**. Press the **Purge** symbol. Ink should eject for a few seconds from the print head orifices.



6. To check for proper purging, swipe a sheet of cardboard or other material across the front of the print head at about the normal printing distance as the print head purges. If all orifices are purging, the result should be a solid band of ink across the material. It is not uncommon for the first purge to show streaks where some of the orifices are not purging properly. Purge the head a few more times until all orifices are purging. Repeat the process with all the heads in the daisy chain.



## Section 5: Frequently Asked Questions

**Q:** *How do I fine-tune my print so all the message lines are aligned flush left?*

**A:** Adjust the **Product Sensor Offset**. This is the distance in inches between the center of the photosensor and the center of the print head. (Refer to “*Defining Print Head Properties*” on page 32.) When you have printed a sample product, the offset can be adjusted down to the hundredth of an inch.

On the **Home Screen**, touch **Control Panels**, then **System Setup**. Touch the icon for the print head that is printing out of alignment, and adjust the offset up or down to change the positioning of the printed message.



**NOTE:** It is easiest to identify one print head that is printing in the correct position, and align the rest of the heads to it.

**Q:** *Will changing the print resolution change the positioning of the print on the product?*

**A:** Yes. An increase in resolution moves the dots, and thus the characters, closer together, increasing the rate at which the message downloads to the print head, and thus starting the print cycle earlier. A decrease in resolution has the opposite effect.

In addition, the point at which the print head begins printing can be affected by the number and types of autocodes (which also affect download time) and conveyor speed.

**Q:** *Can I print an IV18 Dot font with two IV9 Dot print heads?*

**A:** Yes. When entered as an 18-dot font, the data will span two message lines on the display, and will be printed by both IV9 Dot print heads.



**NOTE:** Printing an 18-dot font with two IV9 Dot print heads requires precise alignment of the heads. You will need to fine-tune both the vertical placement of the print heads on bracketry (see “*Mounting the Print Heads*” on page 18) and the **Product Sensor Offset** (Refer to “*Defining Print Head Properties*” on page 32.)

## Section 6: Maintenance

The following are the recommended maintenance procedures to keep the IJ3000 ink jet system printing cleanly and efficiently.

### System Maintenance

#### **Intermittent (as required):**

1. Be sure the photosensor is clean and free of debris.
2. Be sure the O-rings on the encoder wheel are present and not worn (cracked and/or chipped).
3. Be sure the nuts and bolts holding the bracketry in place remain tight.
4. Equipment may be cleaned utilizing the appropriate conditioner for the ink in use.



**CAUTION:** Do not spray conditioner on, or wipe off, exposed electrical connections.

#### **Annually:**

1. Replace encoder O-rings (5765-206).
2. Recalibrate Touch Screen.

### Print Head Maintenance

#### **Daily Startup**



**Wear safety goggles when working with industrial inks or solutions!**

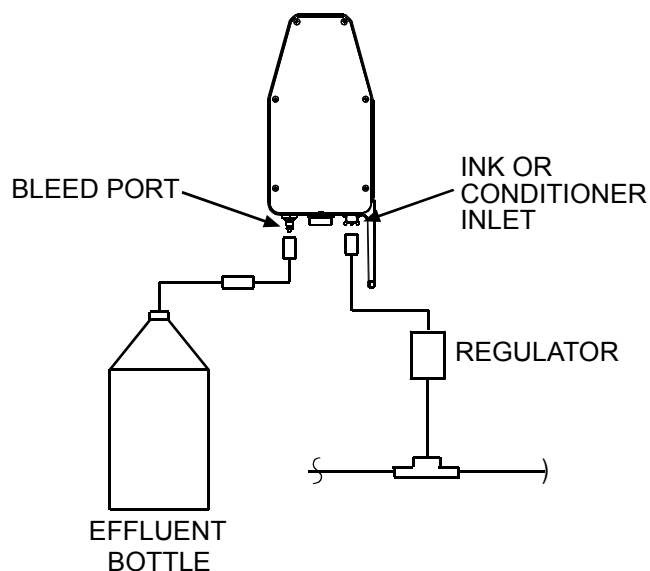
1. Clean print head faceplates with the appropriate conditioner for your ink system. Spray conditioner on a lint-free wipe and wipe the faceplate in a circular motion to remove ink from the orifices. Diagraph maintenance sprays are conveniently packaged in pressurized cans:  
Porous Maintenance Spray (TWP): 5750-249  
Non-Porous Maintenance Spray (TSO): 5750-657
2. Inspect lines and connections for leaks. Make repairs if needed.
3. Inspect all electrical connections and cabling for damage, and replace as necessary.



### Shutdowns of Seven Days or Longer

For extended shut down periods, it is recommended that the print head(s), regulator(s) and IDS3000 Ink Delivery System be thoroughly flushed with appropriate conditioner. In order to perform this procedure, an adequate supply of conditioner and an additional cap assembly (5760-307 5-Gallon Cap Assembly, or 5760-309 30 Gallon Cap Assembly) are required.

1. Insert the cap assembly into conditioner.
2. Disconnect the IDS3000 liquid supply line from the ink supply cap assembly and insert into the conditioner cap assembly.
3. Hold down the Prime switch on the IDS3000 while toggling the power switch (Broken Line Override).
4. Ensure the effluent system is closed and connect it to the end of the ink trunk line.
5. Open the flow of liquid to the effluent system. The IDS3000 will turn on and draw in conditioner and pump it through the trunk line.
6. Occasionally close the effluent system to build liquid pressure.
7. Flush system until the trunk line and IDS3000 are clear.
8. Connect the effluent system to any of the print head bleed ports (male quick disconnect fitting).
9. Open the effluent system to allow conditioner to flow through the regulator and print head.
10. Close the effluent system after the print head has been flushed.
11. Repeat steps 8 through 10 for all print heads.
12. Hold an absorbent cloth at the front of the print head and hold the Purge button until the print head runs clear through the orifices.



**NOTE:** To run print again, repeat the above procedure, except plug the IDS3000 liquid lines into the ink supply.

### Preventative Maintenance at 2000 Hours

- Thorough cleaning of print head
- Lubrication of solenoid wires
- Solenoid and pulse-width adjustment for optimal dot size

## IDS Maintenance

### Changing Ink Containers



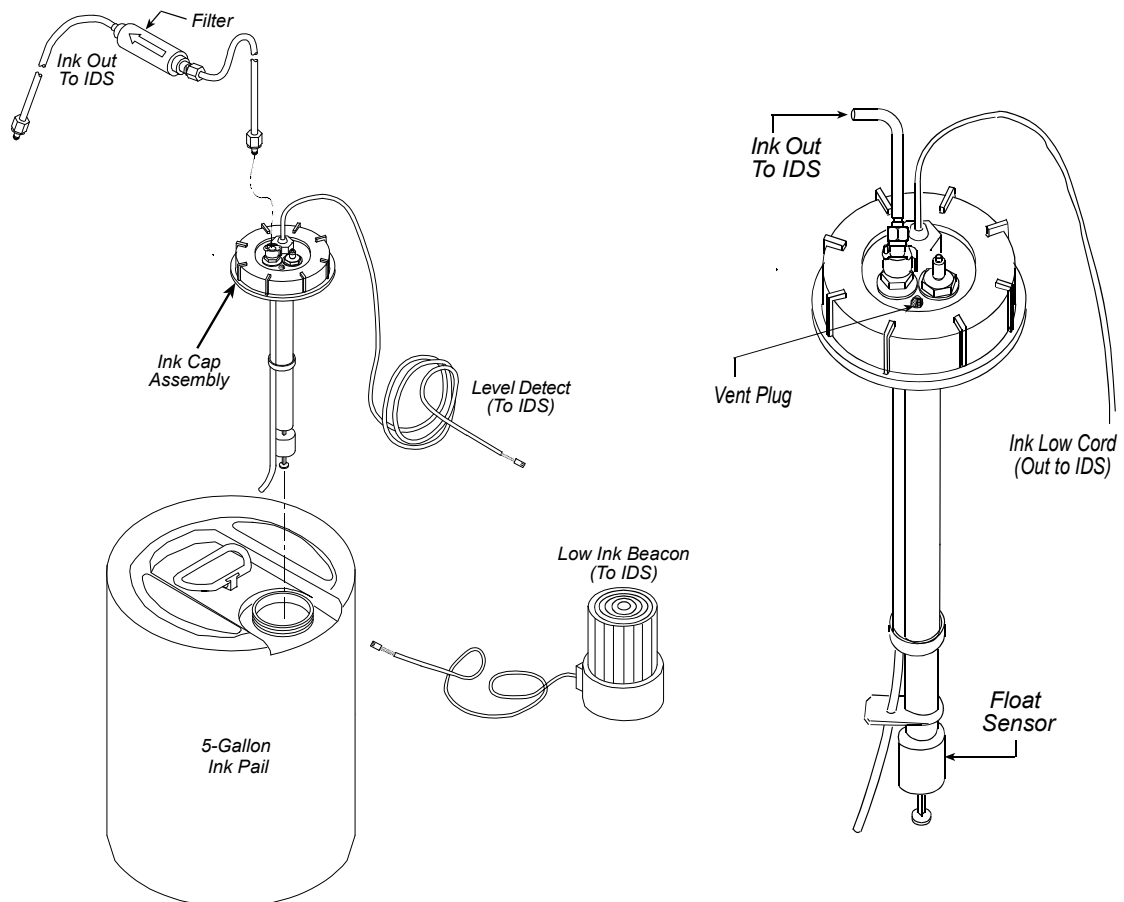
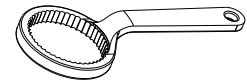
**CAUTION:** Porous ink must be used with a porous IDS. Non-porous ink must be used with a non-porous IDS. The IDS can not be flushed to use a different ink type.

Ink Status	Beacon Status & Actions
	IDS3000-ES
Ink and Float Switch High	OFF
Ink and Float Switch Low	ON STEADY / Replace ink container
Container Near Empty	N/A
Notes	Pump no longer active during steady beacon



**NOTE:** Any ink remaining in the bottom of the pail should be carefully poured into the new pail or disposed of in accordance with state and local regulations.

Tool required: 5-Gallon Ink Cap Wrench (1301-830).



The following procedure explains how to change ink while the system continues to print. Determine whether the system is using porous (TWP) or non-porous (TSO) ink, and replace with the same type of ink.

Changing ink colors is a two step process: first flush the system with the appropriate conditioner for your ink type, then change ink colors - making sure to use the same ink type. Changing ink colors without first flushing the system with conditioner may damage the system.



**NEVER USE PIGMENTED INK IN THE IDS3000.** This system is not designed to operate with pigment particles. Use of pigmented ink will permanently clog the IDS.



**Wear eye protection and use appropriate safety equipment when changing pails of ink.**

1. Disconnect the 1/8" supply line from the female quick-disconnect in the ink pail cap, and set the empty pail aside.
2. Set the new pail in place and remove the cap.
3. Remove the cap assembly from the empty pail and insert it into the new pail. Tighten snugly by hand.
4. Connect the 1/8" ink supply line from the IDS to the female quick-disconnect on the ink cap. Make sure the couplings snap into place.
5. Press the Prime button on the IDS momentarily to prime the system. The beacon should turn off.

### **Daily Startup**

Be sure all ink lines are undamaged. Damaged ink lines can rupture and cause a high pressure liquid hazard.

### **Intermittent (as required)**

When disconnecting ink lines, spray the quick disconnects with the appropriate ink conditioner to prevent them from sticking open.

### **Annually**

Replace the filter assembly as follows:

1. Disconnect the old filter assembly via the quick disconnects at the rear of the IDS and at the ink supply container.
2. Connect the new filter assembly (5760-319) by snapping the ends into the quick disconnects. Be sure the arrow on the filter is facing toward the IDS.
3. Discard the old filter in accordance with local regulations.



**CAUTION:** Ink is under pressure within the IDS and ink lines. Be sure to bleed pressure from the system prior to removing any components.

## Ink Regulator Maintenance

The following maintenance procedure can remove obstructions from the valve seat area of the ink regulator, restoring normal operation:

1. Unplug the ink regulator from the print head. (Ink may be used, but conditioner is preferred for this procedure).
2. Plug the ink regulator output into the effluent bottle.
3. Rotate the pressure adjustment clockwise until it stops, then counter-clockwise until it stops. Repeat six to twelve times.



**NOTE:** Monitor the fluid level in the effluent bottle to ensure that it does not overflow during this procedure.

4. Turn the ink regulator off (completely counter-clockwise), and connect it to the print head.
5. Connect the ink pressure gauge to the print head ink exit port (IV18 Dot print heads only).
6. Increase ink regulator to desired operating pressure (see table under “*Checking Ink Pressure*” on page 27).
7. Purge the print head after any regulator adjustment.
8. Repeat steps 6 and 7 until correct operating pressure is achieved.
9. Monitor ink pressure while printing. Note that the pressure drops by as much as 0.75 PSIG (usually less) during the print cycle.
10. Check pressure 15 minutes after setting it. The pressure should be within the same range +/- 0.5 PSIG. If not, repeat the procedure. If the regulator exhibits pressure changes after performing the procedure two times, the regulator should be replaced.

## Section 7: Troubleshooting

The IJ3000 ink jet system incorporates advanced designs, both in hardware and in software. However, if the system ever fails to perform properly, some built-in indicators will help in troubleshooting. This section will help minimize system downtime and explain some of the diagnostic features built into the system.

### Troubleshooting Notes

#### Ink Delivery System

Most ink system problems involve an empty ink container, kinked or crushed ink lines, or leaks (internal or external). If there are no apparent leaks, the ink supply container is not empty, and the ink system will not supply sufficient pressure at the output, poor or no pumping is the most likely suspect. All other suspect components should be checked first. Check the power fuse (F1) and the TCO (Thermal CutOff). (See *“IDS3000-ES Ink Delivery System Features”* on page 56 for more information.) The normal output pressure should be 20-25 psi.

#### Print Heads

Many issues pertain to regulator anomalies (see *“Checking Ink Pressure”* on page 27 for more information). Additional problems generally show up as leakage or print quality issues, but distance from the substrate and solenoid pulse width will also effect overall print quality.

### Troubleshooting Tests

#### Purge Test

This test will determine if the print heads are functional.

1. Place cloth in front of print head front plate.
2. Press and hold the Purge button on the rear of the print head.
3. Listen for solenoid buzz.
4. Check for ink on cloth.



**NOTE:** An encoder signal is not required for the purge function.

If solenoids buzz and ink dots appear on cloth, the print head is functional.

If solenoids buzz but no ink dots appear on cloth, the print head is clogged or there is an ink supply problem.

If solenoids do not buzz, there may be a cable, print head or electronics failure.

### **Print Test**

This test will determine if the print heads are printing.

1. Place cloth in front of print head front plate.
2. Initiate print cycle by tripping photocell.
3. Encoder must be spinning if using an external device.
4. Check for ink on cloth.

Printed dots on cloth indicate that the system is printing; delay may be set incorrectly, or photocell is not sensing product correctly.

No ink on cloth indicates that the system is not printing.

### **Photosensor Test**

This test will determine if the photosensor sensitivity is adjusted correctly for the application.

1. Place an object in front of the photosensor at approximately the same location as the product; the photosensor should sense the object.
2. Place object near the center of the guide rails; the photosensor should sense the object.
3. Place object on far guide rail; the photosensor should not sense the object.
4. Check that objects on the far side of the conveyor do not trip the photosensor.
5. Check that color differences in product do not cause multiple photosensor trips at the farthest sensing distance.



**NOTE:** The test object should be a sample of the actual product. For photosensor sensitivity adjustment, refer to the manufacturer's instructions.



**NOTE:** If the LED on the photosensor fails to illuminate when an object is placed in front of (but not touching) the photosensor, it is an indication that the photosensor is disconnected or has malfunctioned.

### **Print Head Ink Pressure Test**

This test will determine if the print head pressure is correct.

1. Ensure the print head is not printing or purging.
2. Observe the display home screen. If the head is in power save mode, press any of the four buttons on the rear membrane switch once.
3. Perform a channel purge on the print head to stabilize pressure.
4. The pressure should be 7 +/- .5 psig.
5. If pressure is not correct, see *"Setting Ink Pressure"* on page 28.

**Ink Regulator Input Pressure Test**

This test will determine if the regulator input pressure is within operational range.

1. Connect a pressure gauge to the end of ink trunk line where the effluent bottle is normally attached.
2. Check that the pressure is 10 psig minimum at any time. Normal operation of the IDS is 17 to 30 psig. Normal operation of the P.I.C. IDS is 15 psig.

**Encoder**

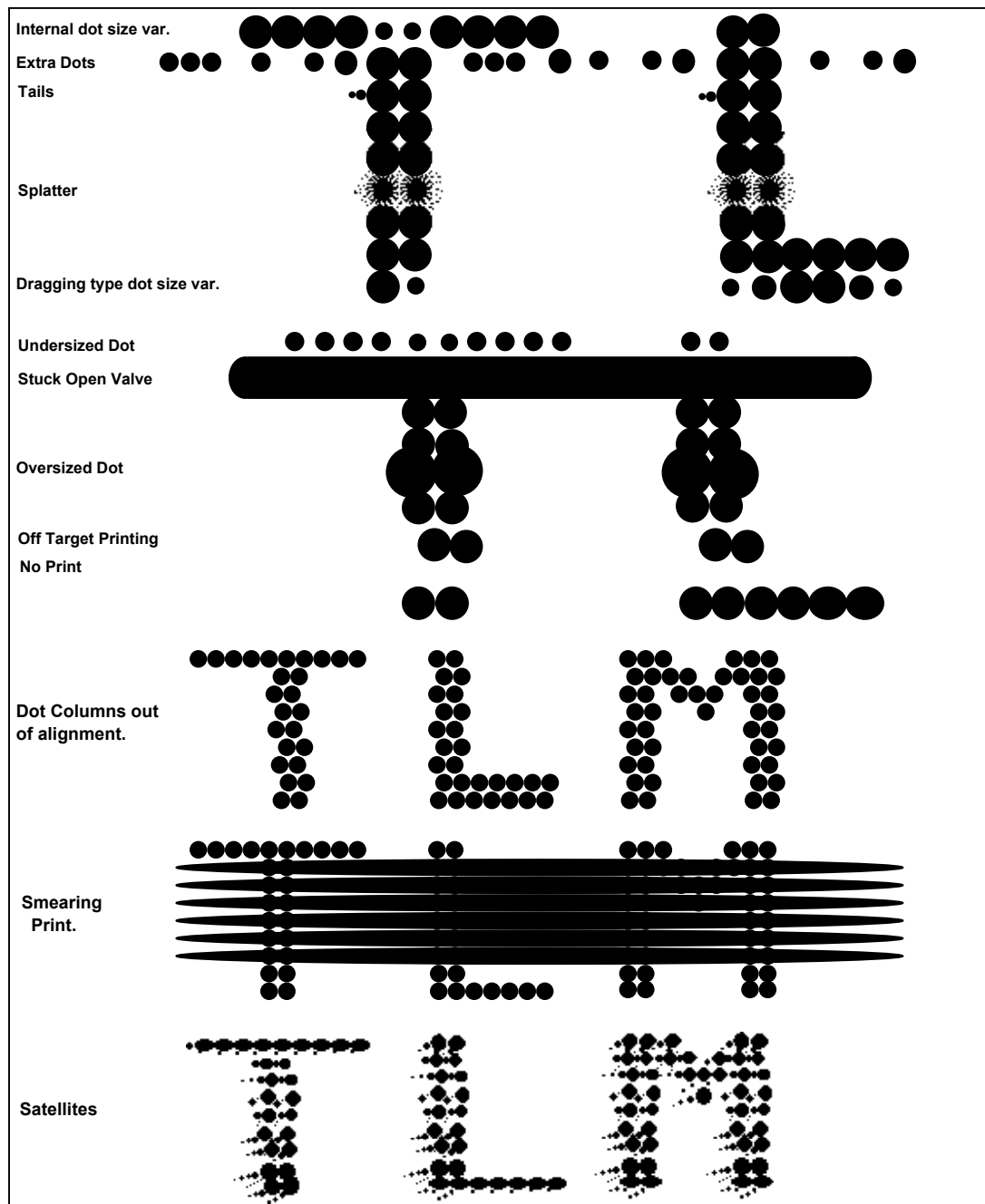
Navigate the IJ3000 to the status screen. If the line speed displays a value comparable to the known line speed, then the encoder is functioning correctly. If the line speed displays "0", then check electrical connections to the encoder and IJ3000 PCB. For Encoder functional testing, refer to *"Appendix J: Encoder Functional Testing"* on page 81.

## Print Quality Troubleshooting

### Diagnosis

HOW TO USE THIS SECTION:

1. Look at the problem characters on your substrate and compare them with the figure below to diagnose the exact name for the problem.
2. Look at the next segment entitled "Print Quality Definitions" to verify that you classified the problem correctly.
3. Look at the table on the following page to identify possible causes for your printing problem.
4. See subsequent pages for solutions to various print quality problems.





**Print Quality Definitions**

<b>[1] Internal Dot Size Variation</b>	The system prints dots that are different in size.
<b>[2] Extra Dots</b>	The system continues to print dots outside the designated dot columns.
<b>[3] Tails</b>	The system prints dots with small trails of ink.
<b>[4] Splatter</b>	The system prints shapeless dots surrounded by tiny "aerosol" dots.
<b>[5] Dragging type dot size variation</b>	The system prints different size dots.
<b>[6] Undersized Dot</b>	The system prints dots that are smaller than normal.
<b>[7] Stuck Open Valve</b>	The system prints a solid row of ink ejecting from an orifice.
<b>[8] Oversized Dot</b>	The system prints dots that are larger than normal.
<b>[9] Off Target Printing</b>	The individual dots do not line up exactly.
<b>[10] No Print</b>	The system prints nothing.
<b>[11] Dot Columns Out of Alignment</b>	The dot columns do not exactly line up.
<b>[12] Smearing Print</b>	The system prints individual dot columns that run together giving a "dirty" look to the printed message.
<b>[13] Satellites</b>	Any extraneous ink particles found near the printed dots.
<b>[14] Message Broken</b>	Incomplete printing or gaps in printed message.
<b>[15] Dynamic Seepage</b>	Seepage from orifices during print.
<b>[16] Static Seepage</b>	Seepage from orifice when system is not printing.
<b>[17] Missing Dots</b>	Individual print head dots not printing.



**NOTE:** Seepage is defined as ink running down the front plate from one orifice far enough to connect to an adjacent orifice.

PRINT QUALITY PROBLEM	POSSIBLE CAUSE
Internal Dot Size Variation	<ul style="list-style-type: none"> <li>• Low ink pressure</li> </ul>
Extra Dots	<ul style="list-style-type: none"> <li>• High ink pressure</li> <li>• Pulse width set too high</li> <li>• Incorrect pre-load</li> </ul>
Tails	<ul style="list-style-type: none"> <li>• Print head too far from the target</li> <li>• Pulse width set too high</li> <li>• Incorrect pre-load</li> </ul>
Splatter	<ul style="list-style-type: none"> <li>• Print head too far from the target</li> <li>• Pulse width set too high</li> <li>• Incorrect pre-load</li> </ul>
Undersized Dot	<ul style="list-style-type: none"> <li>• Low ink pressure</li> <li>• Pulse width set too low</li> <li>• Incorrect pre-load</li> </ul>
Stuck Open Valve	<ul style="list-style-type: none"> <li>• High ink pressure</li> <li>• Pulse width set too high</li> <li>• Incorrect pre-load</li> </ul>
Oversized Dot	<ul style="list-style-type: none"> <li>• High ink pressure</li> </ul>
Off Target Printing	<ul style="list-style-type: none"> <li>• Print head too far from target</li> <li>• Low ink pressure</li> </ul>
No Print	<ul style="list-style-type: none"> <li>• Low ink pressure</li> <li>• Pulse width set too low</li> <li>• Print head failure</li> <li>• Controller or cabling failure</li> </ul>
Dot Columns Out of Alignment	<ul style="list-style-type: none"> <li>• Internal line speed turned on</li> <li>• Incorrect direction selected in software</li> </ul>
Smearing Print	<ul style="list-style-type: none"> <li>• Print head too close to target</li> <li>• Incorrect ink usage for your application</li> </ul>
Satellites	<ul style="list-style-type: none"> <li>• Print head too far from target</li> </ul>
Message is Broken	<ul style="list-style-type: none"> <li>• Photocell is triggering multiple times per box</li> <li>• Loose cable connections</li> </ul>
Garbled Printing	<ul style="list-style-type: none"> <li>• System improperly grounded</li> <li>• Excessive line noise</li> </ul>
Dynamic Seepage	<ul style="list-style-type: none"> <li>• Pulse width set too low</li> <li>• Low ink pressure</li> <li>• Incorrect pre-load</li> </ul>
Static Seepage	<ul style="list-style-type: none"> <li>• High ink pressure</li> <li>• Incorrect pre-load</li> </ul>
Missing Dots	<ul style="list-style-type: none"> <li>• Pulse width set too low</li> <li>• Clogged orifice</li> </ul>



**NOTE:** Pre-load adjustment should be performed after all other causes are eliminated.

## Ink Regulator

If print **dot size is fluctuating**, check the print head pressure. If the dot size fluctuations can be correlated to changes in ink pressure, the ink regulator may be in need of service. Dot diameters will decrease if the regulator input pressure is less than 10 PSIG. Check the ink regulator input pressure per *"Ink Regulator Input Pressure Test" on page 42*.

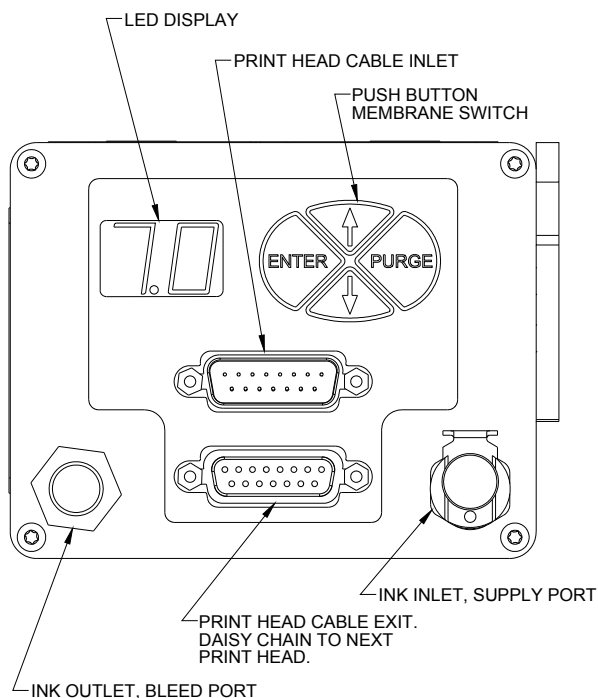
Decreases in pressure can also be caused by obstructions in the valve seat of the ink regulator. Obstructions in the valve seat may cause the pressure to creep up over a 15-minute time period. (For example, the pressure is set at 7 PSIG, and fifteen minutes later it has increased to 8 PSIG.) (Refer to *"Ink Regulator Maintenance" on page 39*.)

## Print Head Pulse Width Adjustment

If printed dots are over- or under-sized, pulse width adjustment may be required. Hold down the **Up** and **Down Arrows** simultaneously. The last channel to be accessed will be displayed. Press the **ENTER** button. The pulse width setting will be displayed. This value is relative and can range between 30 and 80. The higher the value, the larger the dot size, and vice versa. **Pulse width is set at the factory to ideal performance. Caution should be used when changing pulse width; if it is set too low it can affect startup, if it is set too high it can cause premature internal failures.** If a pulse width is changed, the ENTER button must be pressed to save the new value(s). Press the **Down Arrow** until "Pr" is displayed. Press **ENTER** to exit to the Home Screen.



**NOTE:** If the ENTER button is not pressed, the display will revert to the Home Screen after 30 seconds and the pulse width value will **not** be saved.



## Cleaning the Front Plate of a Clogged Print Head

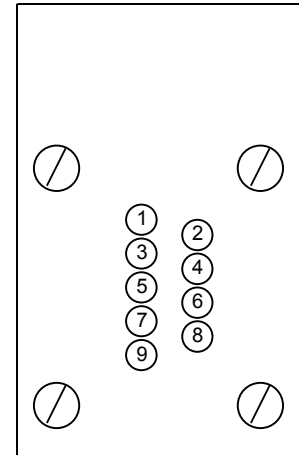
If dots are missing from the print, the print head front plate may have dried ink or debris covering the orifices. To clean the front plate:

1. Wipe the front plate with a conditioner-wetted towel (towel should be very wet).



**NOTE:** Pressurized conditioner can be used to flush the front plate if an IV9 Dot Print Head. Caution should be used with an IV18 Dot Print Head.

2. Purge the print head; check if missing dots are purging.
3. Wipe the front plate with a conditioner-wetted towel and inspect front plate. (There should be no dried ink or debris on front plate).
4. Repeat steps 1 through 3 until front plate is clean. If cleaning the front plate and purging do not clear the clogged orifice, follow the orifice broaching procedure.



**Printhead front plate orifices (NOT TO SCALE)**

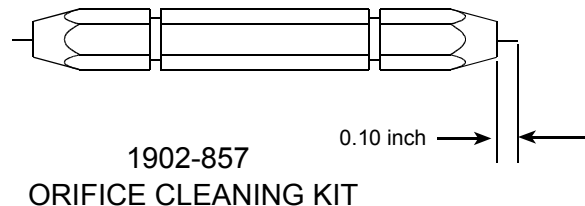
## Broaching the Orifice

If a print head orifice is clogged or obstructed and wiping the front plate and purging will not clear it, the appropriate orifice should be broached.



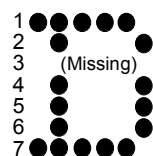
**CAUTION:** Failure to follow the broaching instructions can result in damage to the print head.

1. Wipe the front plate with a conditioner-wetted towel.
2. Make sure the broach pin does not extend out of the handle more than 0.10 inch. This will ensure that the broach pin will not poke a hole in the membrane and cause internal leaking. (Internal leaking will show up as a no print failure several weeks later.)



3. Identify the clogged orifice by identifying the missing dot(s) from a print sample.
4. Count the orifices on the front plate up or down to locate the clogged orifice. A flashlight may be necessary as the orifices are very small.
5. Carefully insert the broach pin into the orifice until the handle touches the front plate. Remove the pin and create a print sample.
6. If the print sample shows that the orifice is still clogged, purge the print head and make a second print sample.
7. If still clogged, count the orifices again to make sure you are broaching the correct orifice, and repeat steps 5 and 6.

**Channels**



**CAUTION:** Avoid broaching repeatedly. The broach pin is like a microscopic file that will enlarge the orifice with repeated insertions. The enlarged orifice will seep ink, print off target or produce other print anomalies.

## Print Head Pre-Load Adjustment

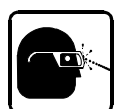
Pre-load adjustment is sometimes required, as print head components wear over time.

Pre-load adjustment may be required under the following conditions:

- Excessive or constant **ink leakage**.
- Poor print quality in the form of **tails, extra dots, splattering**, or a stuck open valve.
- **Undersized dots** (not correctable by pulse width adjustment) and purge die out (rarely) are indications of over pre-loading.



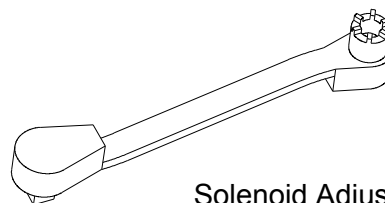
**NOTE:** If a valve is under pre-loaded, increasing the pre-load can correct the print problem. If the valve is over pre-loaded, the membrane or solenoid wire may be damaged to the point where the print head will have to be replaced. Diagram is not responsible for damage caused by over adjustment of the pre-load.



**CAUTION:** Wear safety goggles when servicing the print system.

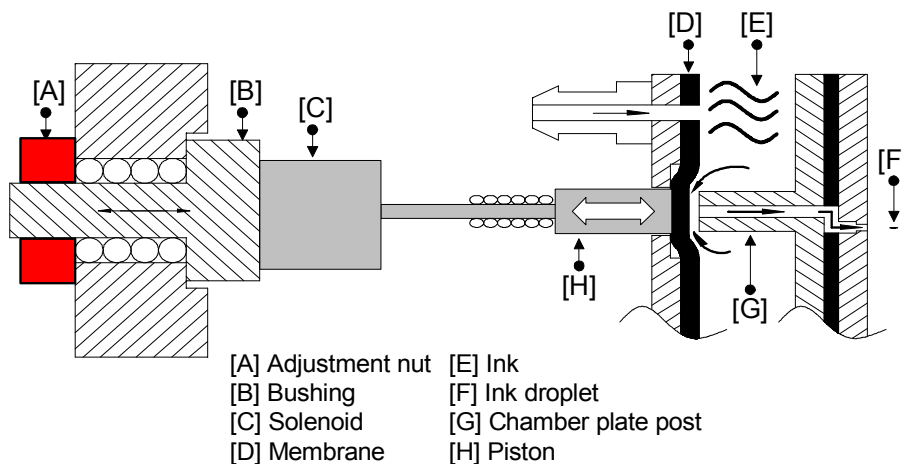
### IV9 Dot and IV18 Dot Print Head Pre-Load Adjustment

If a print head is leaking when not printing (static leakage), it requires solenoid preload adjustment. Pre-load is the amount of force a piston [H] (see figure below) applies to the membrane in the print head [D] to prevent ink [E] from leaking when the print head is idle or not printing. The Preload Pressure is 9 psig, and the Operating Pressure is 7 psig.

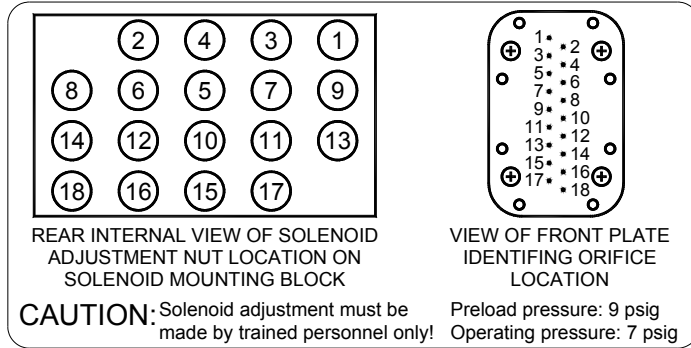


Solenoid Adjustment Tool  
(5770-201)

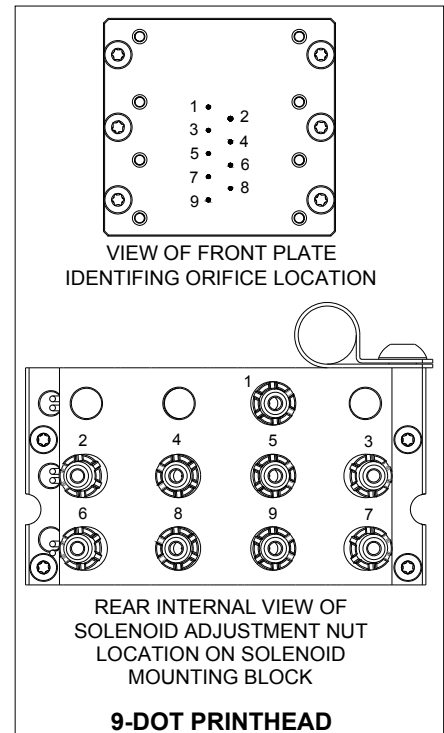
1. Adjust the regulator to the preload pressure.
2. Clean the front plate with a clean cloth and maintenance spray.
3. Remove the print head enclosure cover.
4. Channel Purge the print head.
5. Clean the front plate with a clean cloth and maintenance spray.



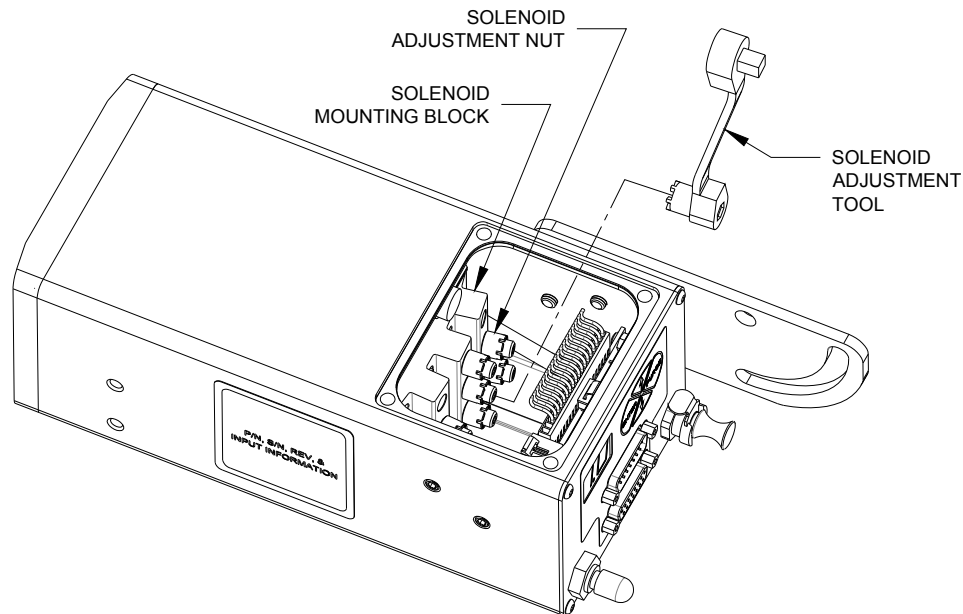
6. Identify the orifice that is leaking from the diagrams at right and below.
7. Use the diagrams at right and below to locate the adjustment nut that controls the leaking orifice.
8. Using the solenoid adjustment tool, **SLOWLY AND CAREFULLY** turn the adjustment nut counter-clockwise approximately 1/8 turn to add additional pressure to the piston.



**18-DOT PRINTHEAD**



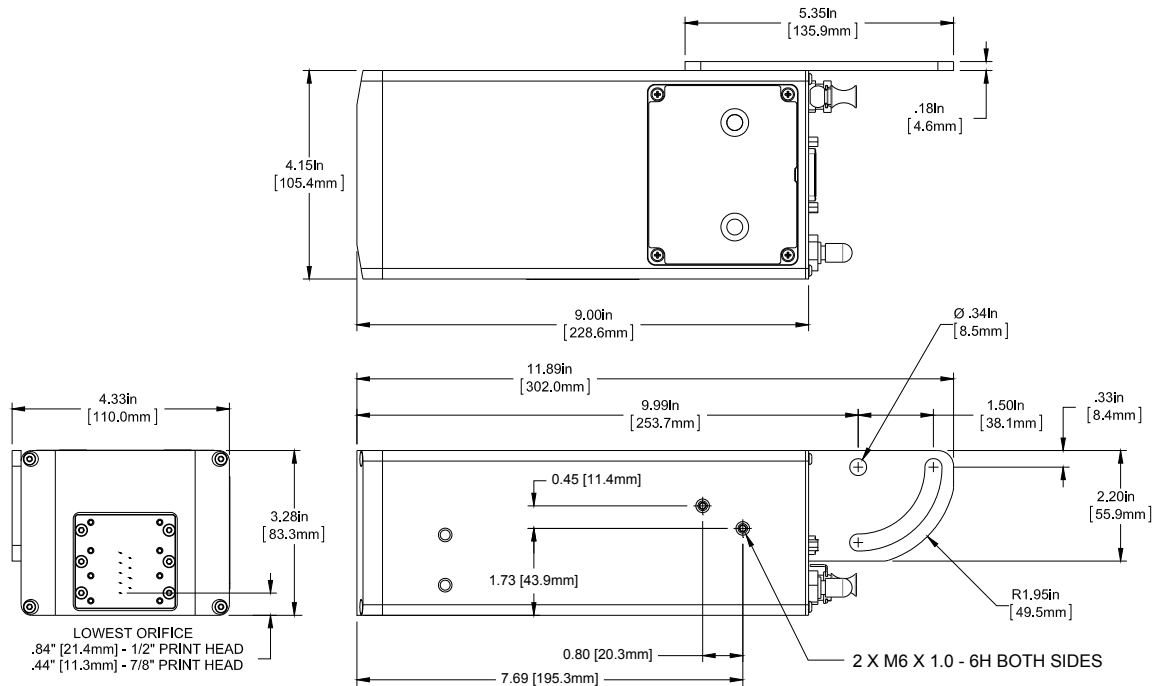
**CAUTION:** Excessive preload will damage the print head.



9. Channel Purge the print head again.
10. Clean the front plate again with a clean wipe and maintenance spray.
11. If no static leakage is observed after 1 minute, then replace the print head enclosure cover. If static leakage continues, then repeat the pre-load adjustment procedure until static leakage stops.
12. Adjust regulator pressure to operating pressure.

## Appendix A: System Specifications

### IV9 Dot Print Head



#### **Weight**

4.5 lbs [2.0 kg]

#### **Enclosure**

Paint over anodized Aluminum

#### **Electrical**

15 VDC input from controller

#### **Ink Filtration**

25 micron in-line

#### **Print Speed**

Up to 650 ft/min (Print Resolution Dependent)

#### **Ink Type**

Porous (Water Based)

Non-Porous (Alcohol or MEK Based)

#### **Operating Pressure**

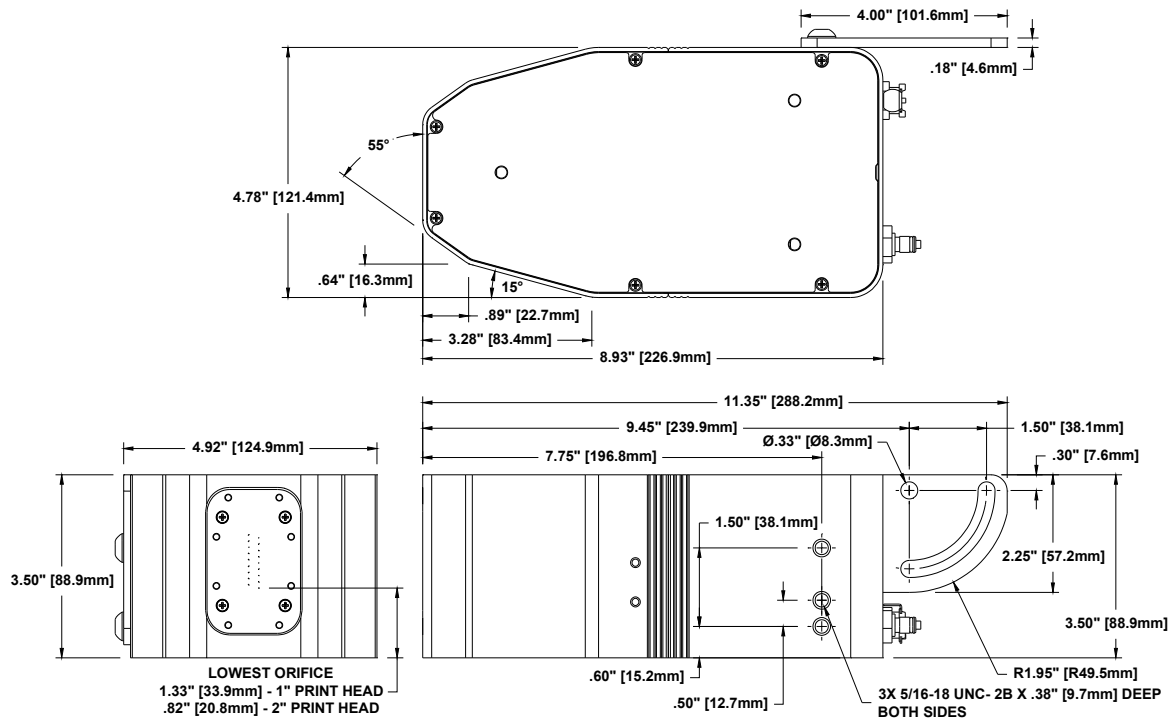
7 psig ink input

#### **Environment**

Ambient operation temperature: 40°F to 104°F (10°C to 40°C)

Operating humidity: 10 - 90% non-condensing

## IV18 Dot Print Head



### **Weight**

6.2 lbs [2.8 kg]

### **Enclosure**

Anodized Aluminum

### **Electrical**

15 VDC input from controller

### **Ink Filtration**

25 micron in-line

### **Print Speed**

Up to 650 ft/min (Print Resolution Dependent)

### **Ink Type**

Porous (Water Based)

Non-Porous (Alcohol or MEK Based)

### **Operating Pressure**

7 psig ink input

### **Environment**

Ambient operation temperature: 40°F to 104°F (10°C to 40°C)

Operating humidity: 10 - 90% non-condensing



## IDS3000-ES Ink Delivery System

### Size

Height: 15.89" (404mm)

Width: 11.2" (284)

Depth: 3.6" (91mm)

Weight: 10.7 lb (4.9 kg)

Cable and Plumbing Clearance: 3" from the bottom of the IDS

### Enclosure

Stainless Steel

### Mounting

Modular brackets included

### Ink Filtration

100 micron absolute (5760-319 Kit, Ink Filter Assembly)

### Electrical

2.3 A max @ 115 VAC

1.35 A max @ 230 VAC

### Normal Operating Pressure Range

18 psi to 26 psi (approximately)

### Cable Ports

Ink low level

Power cord

### Plumbing Ports

Filtered ink inlet

Pressurized out port to print heads

### Environment

Ambient operating temperature: 40°F to 104°F

Operating humidity: 10-90%, non-condensing

### Tubing Limitations

Maximum horizontal tube length = 100 ft

Maximum vertical tube length (bottom of IDS to bottom of highest print head) = 20 ft

### Ink Supply Limitations

Maximum height above IDS (top of ink supply to bottom of IDS) = 8 ft

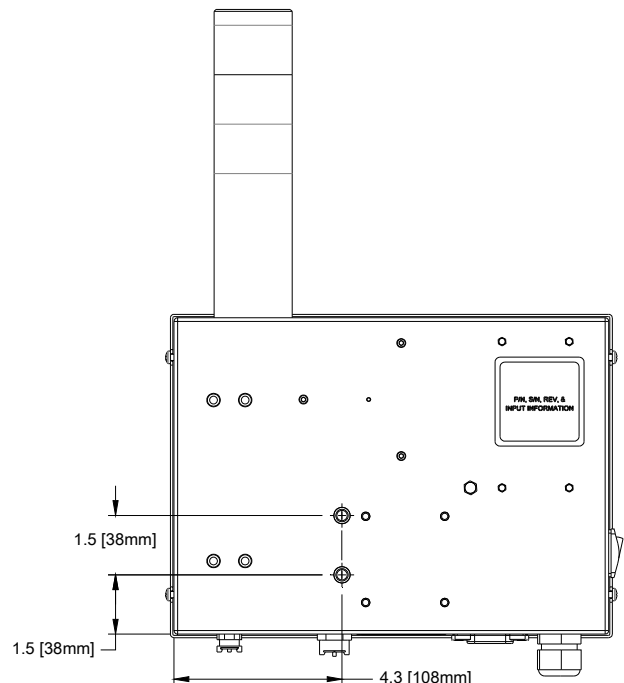
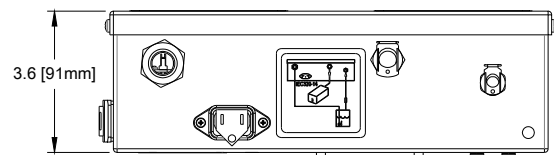
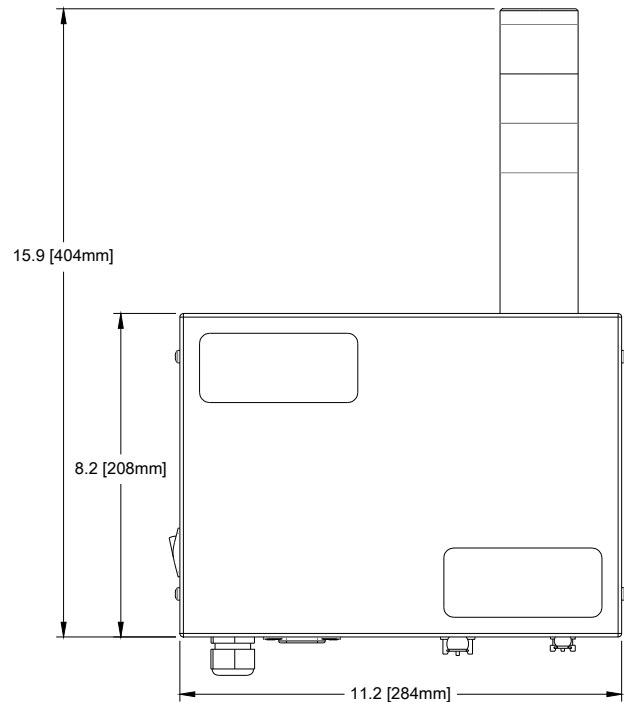
Maximum distance below IDS (top of ink supply to bottom of IDS) = 8 ft

Maximum horizontal distance between top of IDS and bottom of supply = 8 ft

### Print Head Limitations

Up to 8 - 9 DOT or 4 - 18 DOT

Any combination totaling 72 dots



## **Appendix B: Theory of Operation**

### **Functional Description**

The IJ3000 ink jet system prints text, autocodes (such as product counts or time and date stamps) and/or graphics onto products as they travel by conveyor past stationary print heads. Print can be on any one of, or a combination of, the product's sides, top, or bottom. The conveyor speed is monitored using a variable speed encoder or a built-in fixed speed encoder. Products are detected using a photosensor. The information to be printed is defined as a message and is programmed into the controller via a user interface.

### **Print Head Daisy Chain(s)**

Print heads attach to the IJ3000 in a daisy chain configuration. The first print head plugs into a Print Head Interface Board (P1), the second print head plugs into the first, the third plugs into the second, etc. A daisy chain can be up to 72 dots long (eight IV9 Dot heads, four IV18 Dot heads, or a combination of IV9 Dot and IV18 Dot heads totaling no more than 72 dots), and an IJ3000 can have one or two daisy chains (one for each Print Head Interface Board).

Electrically, a print head daisy chain is a shift register. A shift register moves bits of information along a line one bit at a time in step with a clocking signal. It works like this: A bit is placed at the entrance to the line of bits and waits for the clock (step) signal. When the clock signal is given, the bit steps into the first spot on the line. The bit that occupied the first spot in line steps to the second, the second steps to the third, the third to the fourth, and so on until the last bit in line steps off the end of the line and is lost. Repeat the process enough times and all of the information in the shift register is replaced. Repeat the process 72 times and you've output a column of print data. A latch (print) signal, sent after the 72 dots have been shifted, prints the column.

The IJ3000 always sends 72 dots of print data per column regardless of the number of print heads on a daisy chain. On a daisy chain with less than 72 dots the first dots shifted out are lost, not printed. For example, a daisy chain with two IV18 Dot heads prints the last 36 dots sent; the first 36 dots are lost.

All daisy chain signals - DATA, CLOCK and LATCH - are generated and controlled by circuitry in the FPGA (Field Programmable Gate Array, used as a print head driver chip) on the Print Head Interface Board.

Please note that power is applied to the print heads even when the IJ3000 is "turned off." The only way to remove power from the print heads is to pull the plug.

### **Photosensor (5760-383)**

The photosensor detects when a product is about to pass by the print heads and signals the IJ3000 controller to start a print cycle. The photosensor signal is active low, and it must remain low for at least one encoder pulse. Once a print cycle starts it continues to completion regardless of what the photosensor signal does.

The IJ3000 is compatible with through-beam, retro-reflective, and diffused photosensors that work at 15VDC and have a current sinking (or open collector) output. The photosensor plugs into the Print Head Interface Board (P2).

## Encoder (5760-820-IJ)

The encoder determines the time period between the printing of individual columns, or the print speed. As a product's speed increases, the time period between columns must decrease, that is, the print speed must increase, to maintain consistent column-to-column spacing. The IJ3000 has two encoder options, external and internal. Use the external encoder where the conveyor speed fluctuates. You can use the internal encoder when the conveyor speed is constant.

The **external encoder** is a 5VDC optical encoder. The encoder's wheel is sized such that the encoder outputs 300 pulses per inch of product travel. The external encoder plugs into the Print Head Interface Board (J4), and its signal goes to the FPGA where it is used to time the sending of column data to the print head.

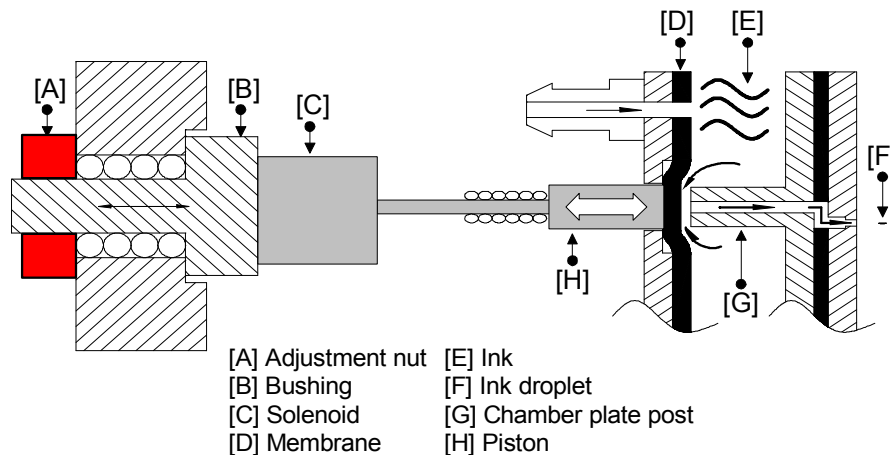
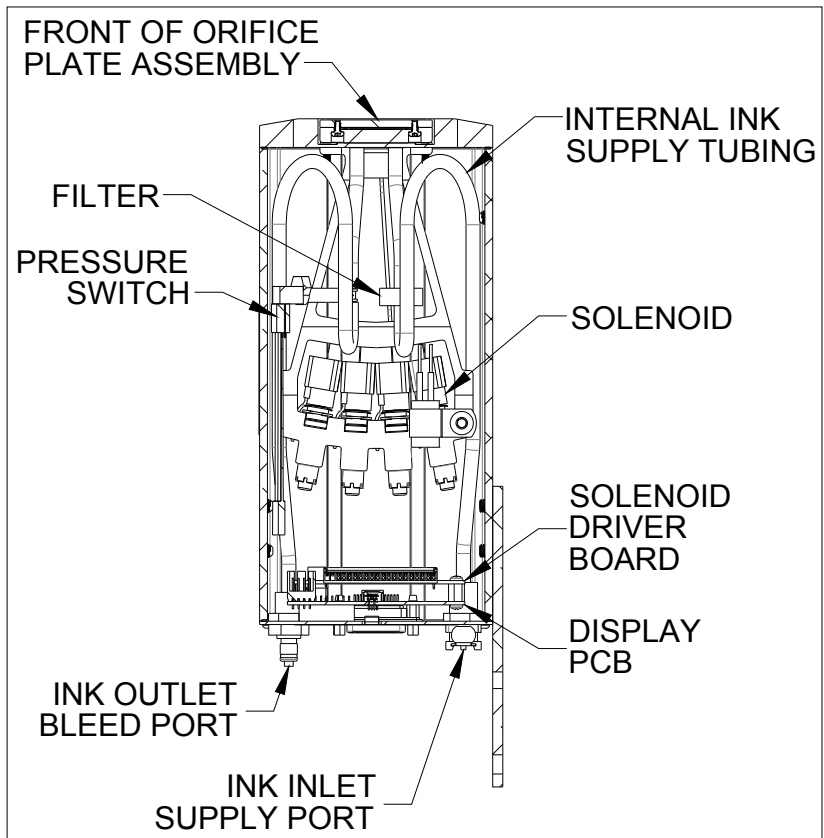
The **internal encoder** signal is a constant frequency pulse stream generated on the Print Head Interface Board. A programmable counter circuit in the FPGA divides the board's 16 MHz clock by a value calculated from a line speed entered during system setup. When the user selects the internal encoder, a switch in the FPGA disconnects the external encoder signal from the print timing circuits and connects the output from the counter circuit.

## IV Print Head Theory of Operation

Integrated Valve inkjet technology utilizes electronically controlled solenoid valves to open and close the flow of pressurized ink through a series of holes, channels, and small orifices. Regulated ink pressure is supplied to the rear of the print head. While the print head is printing or purging, ink is flowing through the inlet port, tubing, filter, and finally into the valve control mechanism. When the print head printed circuit board receives data signals from the controller via the print head cable, a micro-controller on the pcb generates pulses to the appropriate solenoids. These solenoids in turn, connect directly to a sealing piston. The sealing piston presses against a membrane that seals off the flow of ink to the appropriate orifice(s).

When the solenoid is energized the piston pulls away from the sealing membrane and ink pressure allows flow of ink through that channel and out the orifice. The time that the solenoid is powered on is called the pulse width; therefore, if the pulse width is increased, the valve is allowed to flow more ink (bigger dot).

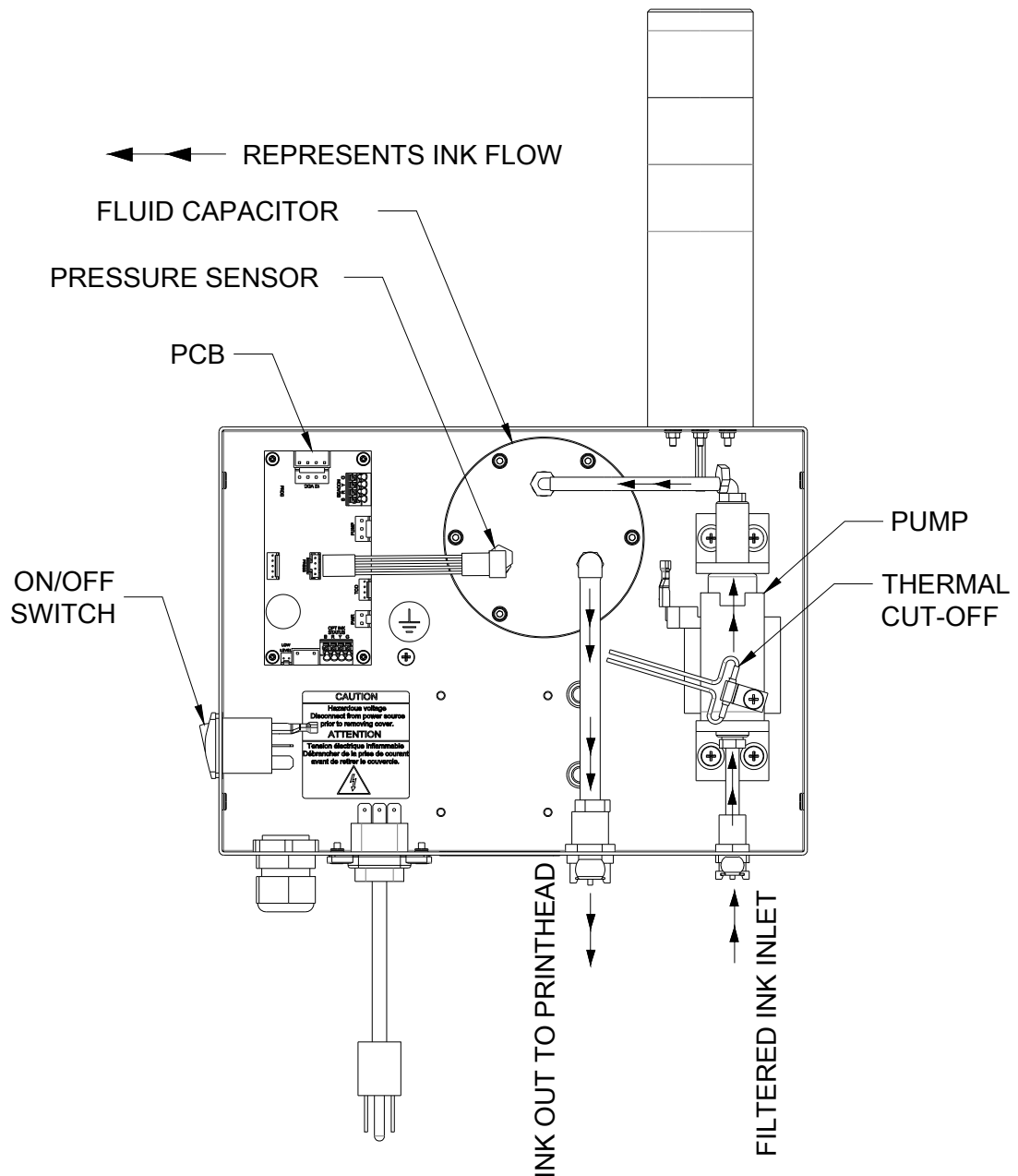
Pressure is monitored via a sensor that is teed into the print head bleed tubing. The sensor sends voltage signals to the display board that are scaled and displayed as gage pressure on the rear of the print head.



## IDS3000-ES Ink Delivery System Features

The IDS3000-ES Ink Delivery System provides ink to the print heads. In addition to pumping ink from the supply container, the IDS3000-ES is programmed with the following features:

1. *Continuous monitoring and maintenance of ink line pressure.* Whenever the pressure drops to a level of 18 psi, the IDS3000-ES pump turns on until the pressure reaches 26 psi.
2. *Ink supply "low" detection.* A float sensor mounted to the end of the ink cap assembly in the ink container informs the IDS3000-ES when the container is almost empty. The IDS3000-ES then alerts the operator by turning on the beacon light.



## **Operation**

After the appropriate fluid lines are plumbed to the inlet and outlet ports and all electrical connections are made, the IDS3000-ES can be turned ON. Depressing the ON/OFF switch starts the process of automatically flushing the IDS3000-ES with the supply fluid. Ink is sucked from the supply tube in the tank, through the filter, and into the IDS3000-ES pump.

During normal operation, fluid is pumped into the fluid capacitor until the system reaches a pressure of 26 psi.

The print head(s) drains the accumulator until a line pressure of 18 psi is detected by the pressure sensor circuitry. At this point, the pump turns on until the system reaches the target pressure. This operation continues until the ink supply is depleted.

## **Features**

### **Ink Low Detection**

At a point prior to supply depletion, the low level detect sensor sends a closed signal back to the IDS3000-ES. The sensor is mounted on the end of a rod connected to the supply cap assembly and immersed in the ink supply. The float sensor acts as a reed switch that closes a contact and completes the signal detection circuit to the IDS3000-ES. This conditional information is then passed on to the user via a fixed "on" beacon light. At this point, further pumping is disallowed.



**NOTE:** If there is no ink supply float switch connected and the tank empties, then the pump will turn OFF after 15 seconds of continuous pumping, and the beacon will flash rapidly.

### **Ink Supply Replenishment**

After the ink supply container is replaced, the IDS3000-ES will immediately resume pumping. Depending on the length of time of the changeover and the ink consumption by the print heads, the fluid capacitor may have dropped below 18 psi.

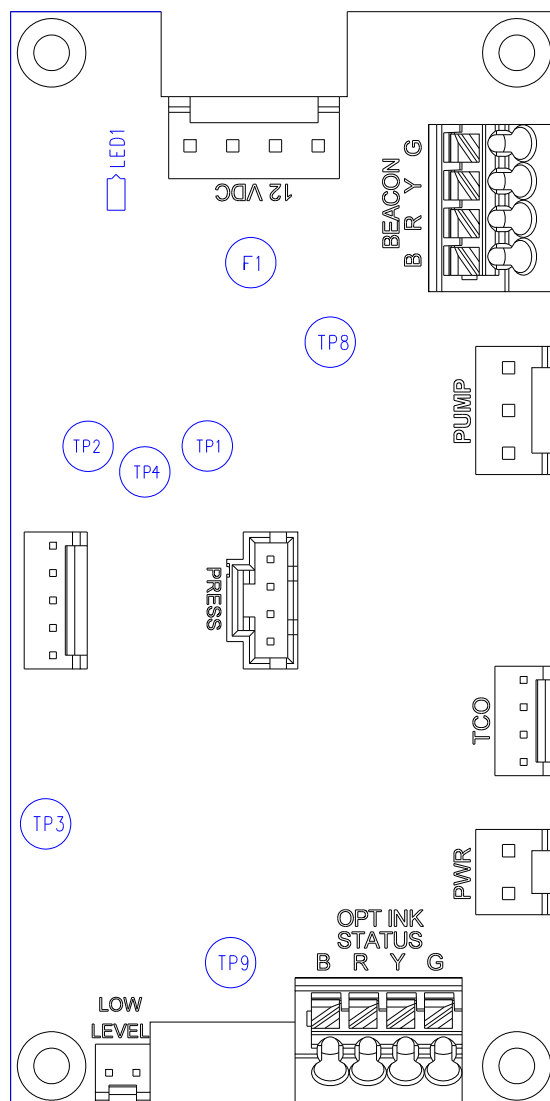
### **Overheating Protection**

If the pump becomes clogged for any reason and the circuitry does not shut it down, the pump will become very hot. A thermal cut-off (TCO) device rigidly attached to the top of the pump acts as a thermal fuse by creating an "open" in the pump power circuit when excess temperature is encountered, shutting down the IDS.

### **Power Outage**

A power outage will behave exactly the same as toggling the power switch.

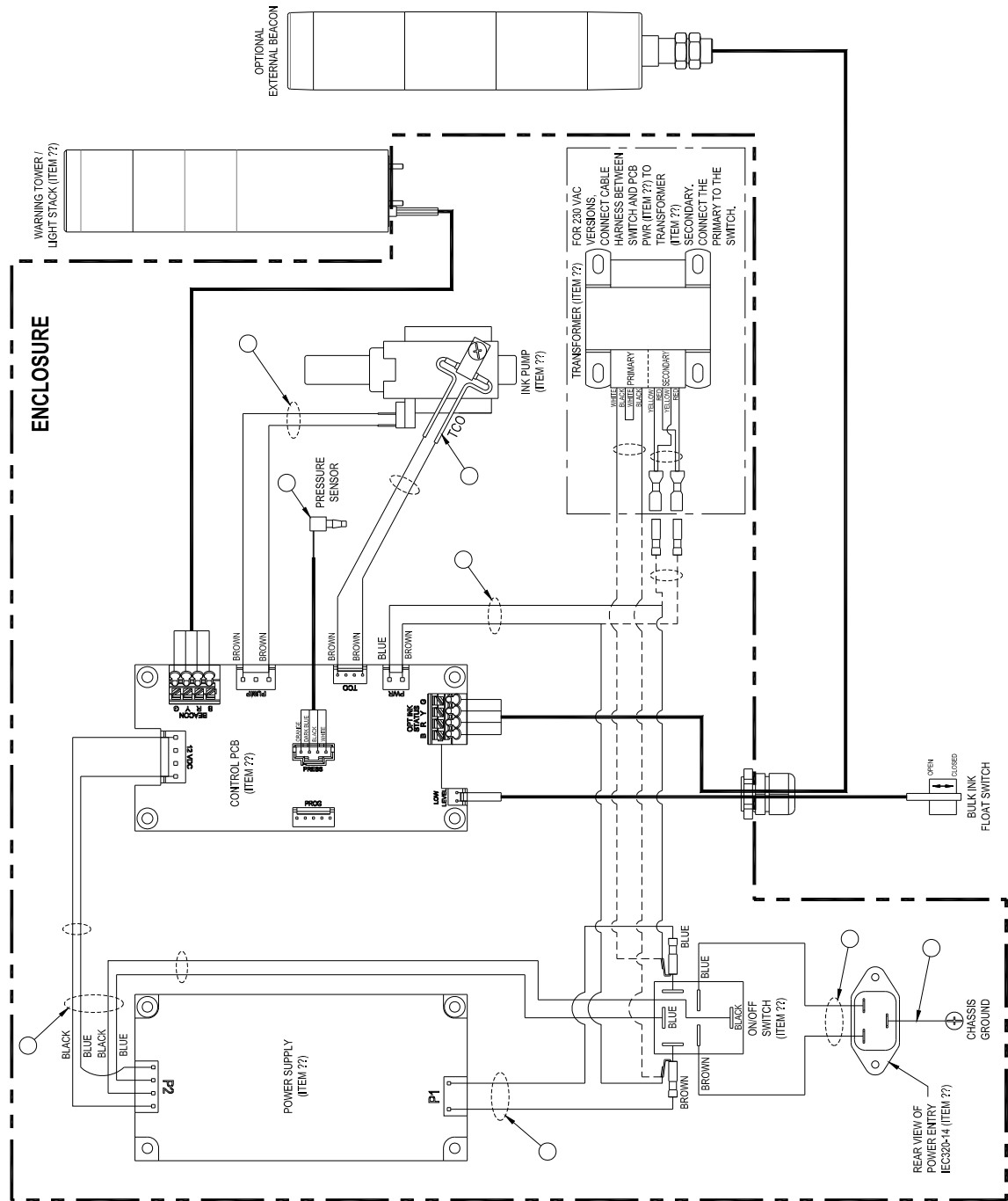
## IDS3000-ES Board Test Points



Test Points:	TP1, TP4:	(TP4 - TP5) = 1.2mV/PSI at the pressure sensor
	TP2:	0.1V/PSI of pressure
	TP3:	Toggles at the end of a pressure sampling period
	TP8:	12VDC
	TP9:	5VDC
LEDs:	LED1:	Yellow; indicates the pump is running
Fuses:		
	F1:	Beacon fuse, 125V, 1A

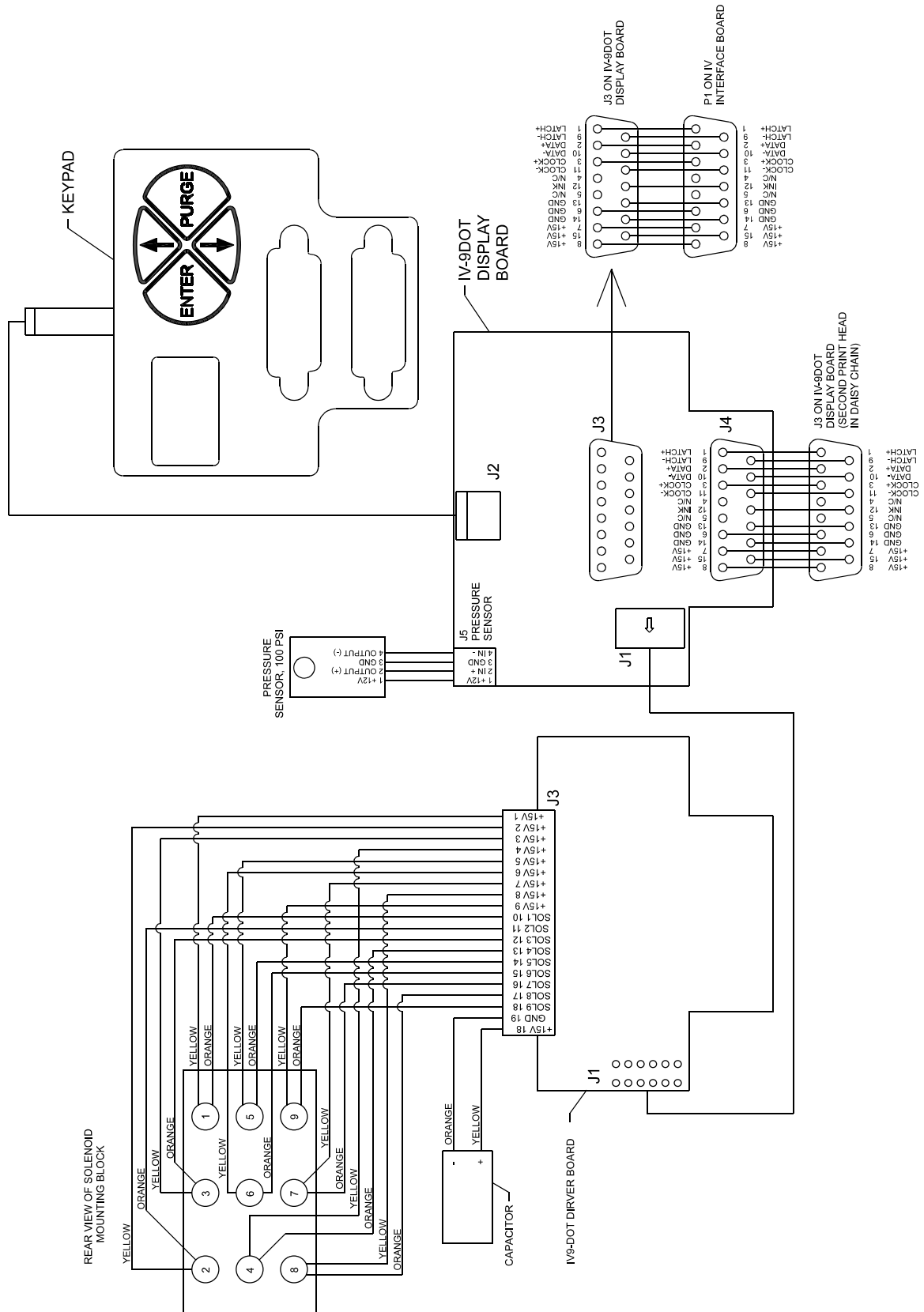
## Appendix C: Interconnect Diagrams

### IDS3000-ES Wiring Diagram for Non-European Countries (115V)





**IV9 Dot or IV18 Dot**



## Appendix D: Part Numbers

### Consumables

#### Inks, Conditioners and Maintenance Sprays

The following is a partial list of inks offered by Diagraph. Your sales representative can advise you on the proper ink for your application.

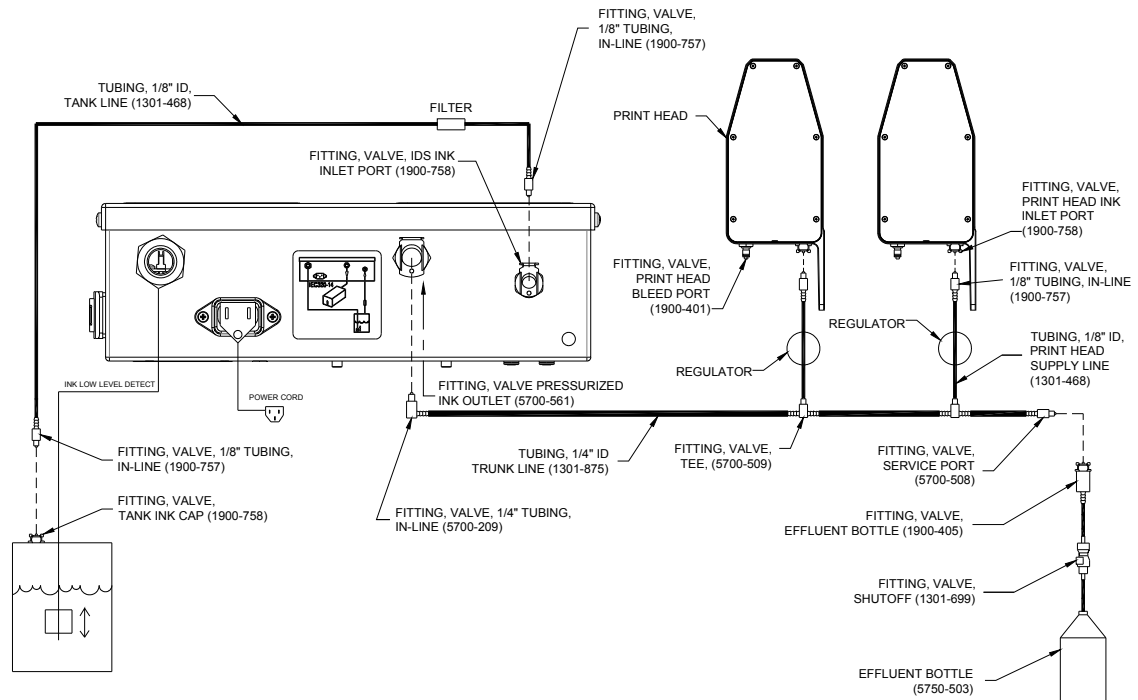
Part Number	Description	Package
<b><u>Porous Inks for IDS3000</u></b>		
2600928	Conditioner, TWP (Water-Based)	5 Gallon
2601016	Ink, TWP-1 Black, Porous (Water-Based)	5 Gallon
2601017	Ink, TWP-1 Black, Porous (Water-Based)	30 Gallon
2601021	Ink, TWP-101 Black, Porous (Water-Based)	5 Gallon
2600947SC	Ink, TWP GB-SC Black, Porous (Water-Based)	5 Gallon
2600323SC	Ink, TWP GB-SC Black, Porous (Water-Based)	30 Gallon
5750249	Maintenance Spray, TWP, Cans	2/case
<b><u>Non-Porous Inks for IDS3000</u></b>		
2600199	Conditioner, TSO Non-Porous (Alcohol-Based)	5 Gallon
2600201	Ink, TSO-1 Black, Non-Porous (Alcohol-Based)	5 Gallon
2600214	Ink, TSO-1 Black, Non-Porous (Alcohol-Based)	30 Gallon
2600227	Ink, TSO-101 Black, Non-Porous (Alcohol-Based)	5 Gallon
2600970	Ink, TSO-3100 Black, Non-Porous Fast Dry (Alcohol-Based)	5 Gallon
2600981	Conditioner, TSO-4000, Non-Porous (MEK)	5 Gallon
2600986	Ink, TSO-4400 Black, Non-Porous (MEK)	5 Gallon
5750657	Maintenance Spray, TSO-NP, Cans	2/case

Part Number	Description	Package
<b><u>Porous (Water-based) for Pressurized Ink Can IDS</u></b>		
5750-242	Conditioner, TWP, Cans	2/case
5750-243	Ink, TWP-101 Black, Cans	6/case
5750-246	Ink, TWP-3 Green, Cans	6/case
5750-244	Ink, TWP-2 Red, Can	6/case
5750-249	Maintenance Spray, TWP, Can	2/case
<b><u>Non-Porous (Alcohol-based) for Pressurized Ink Can IDS</u></b>		
5750-650	Conditioner, TSO-SC, Can	2/case
5750-651	Ink, TSO-3100 Black, Can	6/case
5750-652	Ink, TSO-2 Red, Can	6/case
5750-657	Maintenance Spray, TSO, Can	2/case



**NOTE:** Porous and Non-Porous Inks are not miscible.

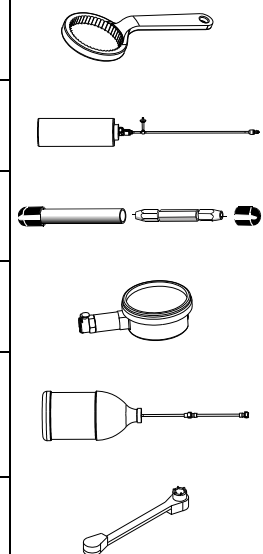
## Service Parts



Unless otherwise noted, kits contain only one device or part.

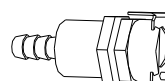
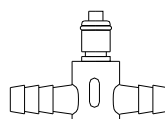
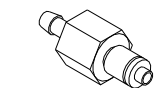
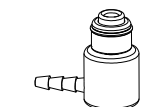
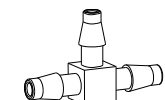
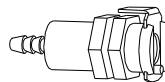
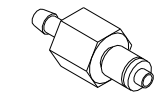
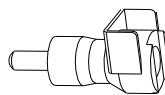
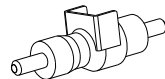
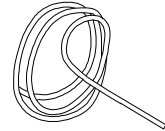
## Tools

KIT NO.	DESCRIPTION	PURPOSE
1301-830	Ink Cap Wrench	Assists removal of cap from 5 gal-lon pail
1902-964	Flush Bottle Kit	Assists flushing print head via the rear intake port
1902-857	Print Head Broach Kit	Assists cleaning of orifice plate holes
5700-743	Pressure Gauge	Measures ink pressure
5750-503	Effluent Bottle Kit	Assists in bleeding ink or flushing conditioner through the trunk line and the print head(s)
5770-201	Solenoid Adjust-ment Kit	Assists in adjusting print head valve preload via the solenoid nut



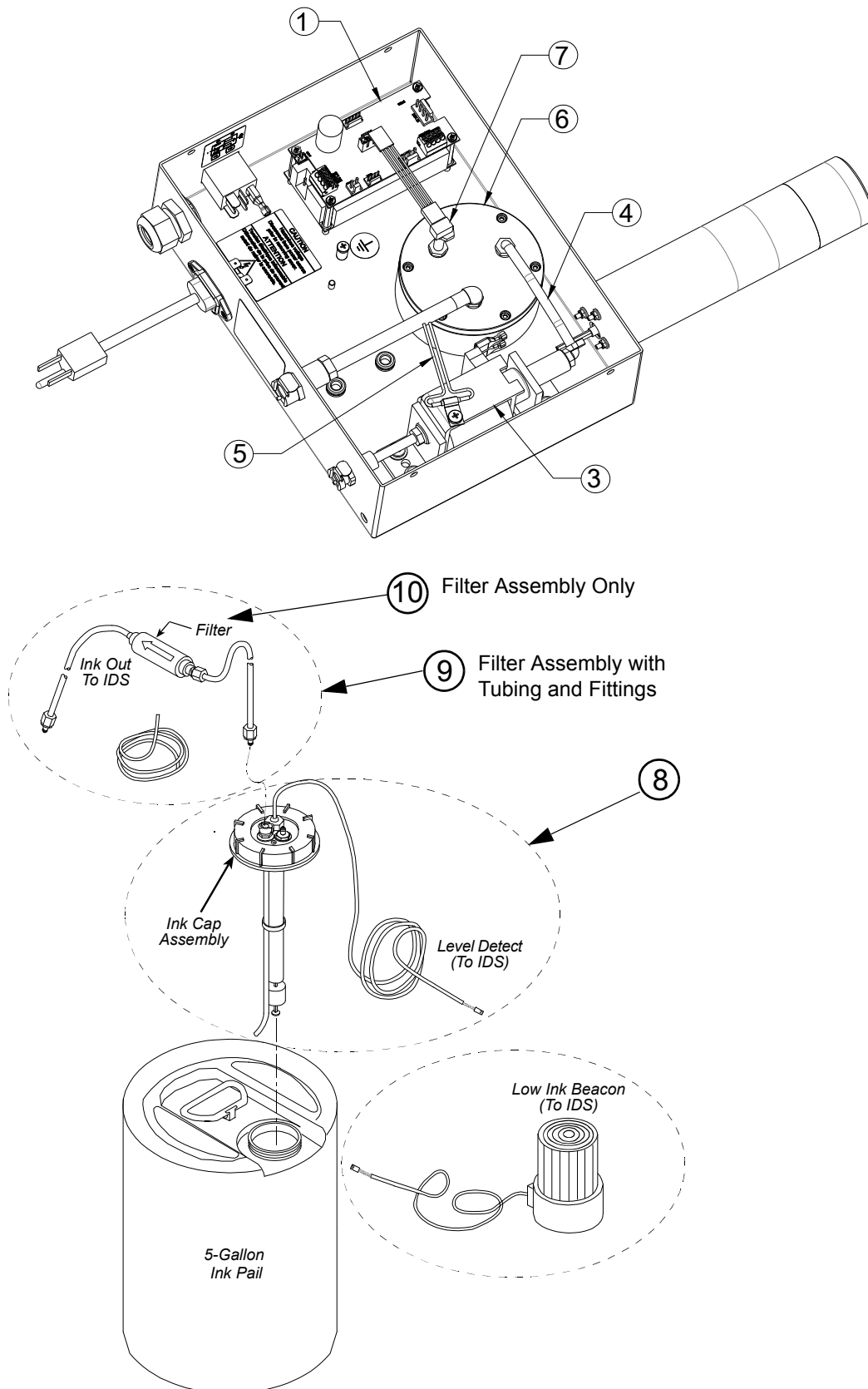
**Fittings and Tubing**

KIT NO.	DESCRIPTION	CON- TENTS	WHERE USED
1301-468	Tubing, 1/8" ID x 1/4" OD	50 foot roll	Plumbing line between trunk line and print head
1301-875	Tubing, 1/4" ID x 3/8" OD	50 foot roll	Plumbing trunk line from ink delivery system
5770-224	Fitting 1301-699, 1/8 Barb x 1/8 Barb In-Line Shutoff Valve	5 fittings per kit	Effluent bottle
5770-225	Fitting 1900-401, 1/8 Barb x 1/8 Flow Bulk-head Male Valve	5 fittings per kit	Bleed port on rear of print head
5770-226	Fitting 1900-405, 1/8 Barb x 1/8 Flow In-Line Female Valve	5 fittings per kit	Connects tubing to print head rear bleed port or any male fitting
5770-227	Fitting 1900-757, 1/8 Barb x 1/8 Flow In-Line Male Valve	5 fittings per kit	Connects tubing to print head rear ink supply port or any female fitting
5770-228	Fitting 1900-758, 1/8 Barb x 1/8 Flow Bulk-head Female Valve	5 fittings per kit	Ink supply port on rear of print head or IDS
5770-229	Fitting 5361-331, 1/4 Barbed Tee	5 fittings per kit	IDS Flushing System
5770-230	Fitting 5700-209, 1/4 Barb x 1/4 Flow Elbow Valve	5 fittings per kit	Connects ink supply trunk line to rear pressure port on IDS
5770-231	Fitting 5700-508, 1/4 Barb x 1/8 Flow In-Line Male Valve	5 fittings per kit	Bleed fitting on the end of ink supply trunk line
5770-232	Fitting 5700-509, 1/4 Barb x 1/4 Flow Tee Valve	5 fittings per kit	Connection between ink supply trunk line and print head regulator
5770-233	Fitting 5700-561, 1/4 Barb x 1/4 Flow Bulk-head Female Valve	5 fittings per kit	Rear pressure port on IDS



## IDS3000-ES Assembly Kits

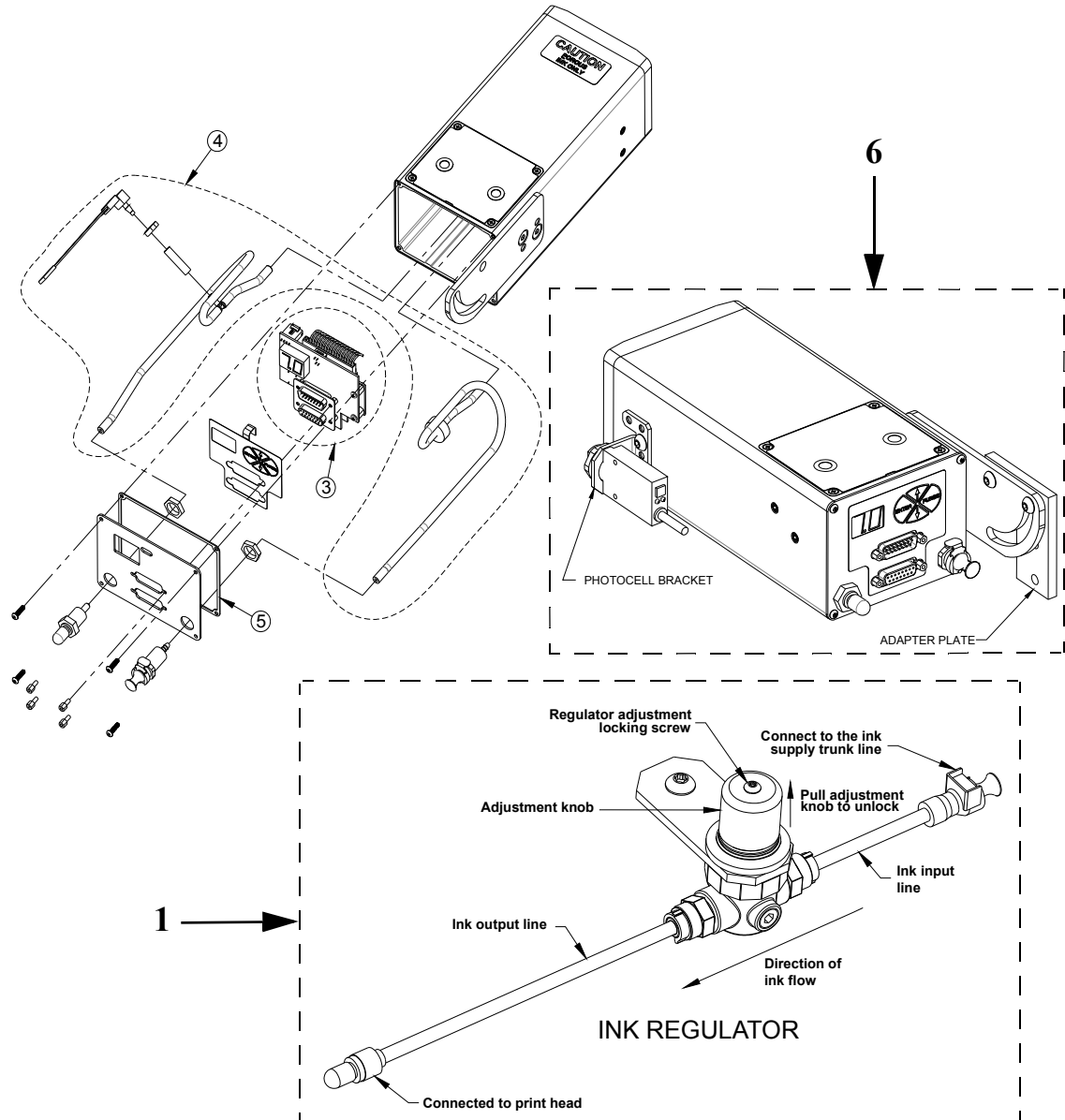
See item list on next page.



### IDS3000-ES Assembly Kits

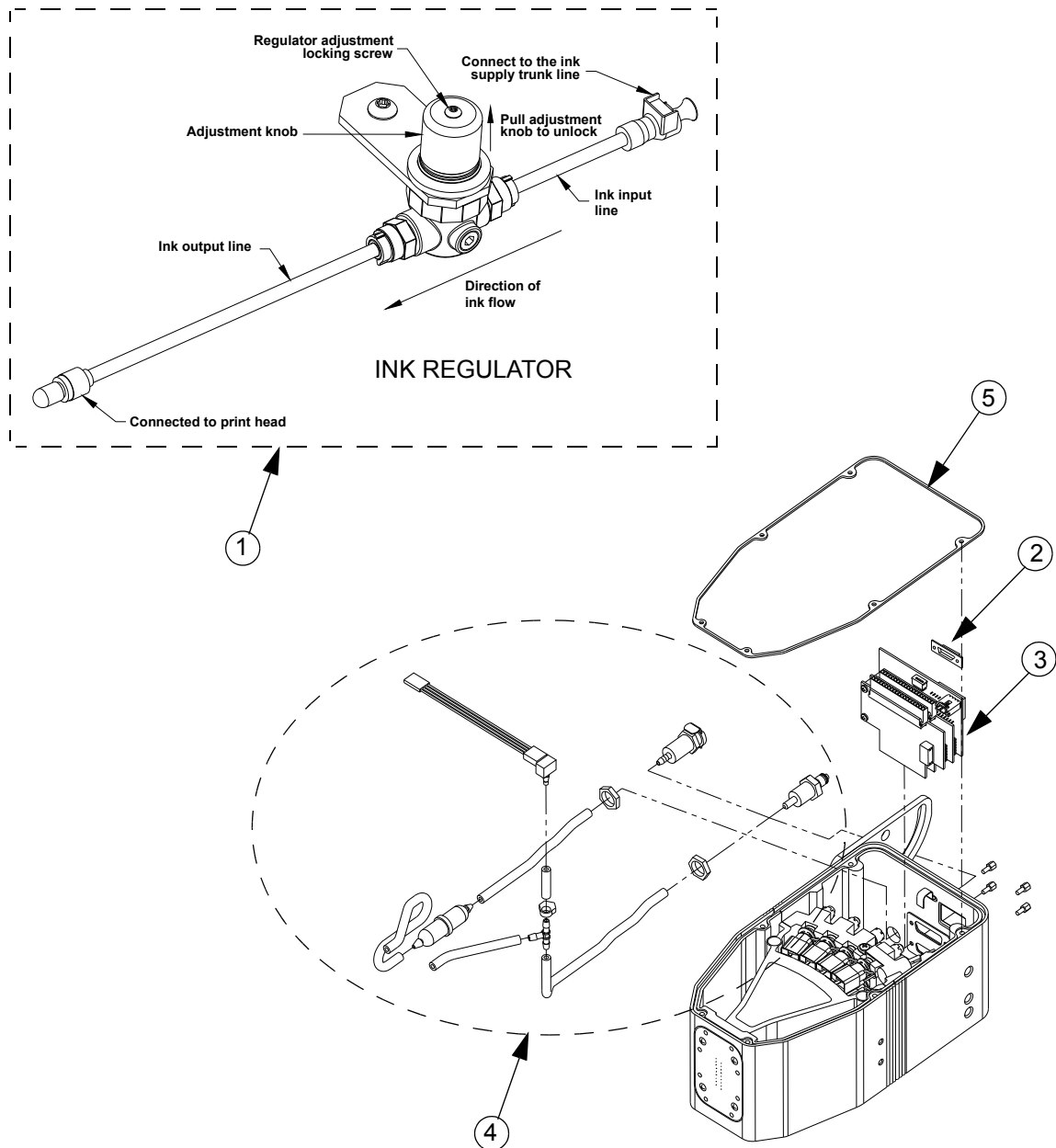
ITEM	KIT NO.	DESCRIPTION	CONTENTS - QUANTITY
not shown	5760-248	Fuse Kit	Light Fuse - 2
1	5770-246	PCB Replacement Kit	PCB - 1
2			
3	5760-315	Pump Replacement Kit, 115VAC	Pump - 1
4	5770-247	Internal Tubing and Fittings Kit	Fitting 5700561 - 1; Fitting 1900758 - 1; Fitting 5700889 - 2; Fitting 5361310 - 2; Fitting 6105149 - 1; Clamp, 1/4" OD Tube 5760276 - 2; Tubing, 1/4" 1303561 - 5-3/4"; Tubing, 3/8" OD 1303562 - 4-3/8"; Clamp, 3/8" OD Tube 5760277 - 1
5	5760-389	Thermal Cutoff Kit	TCO Assembly - 1
6	5770-234P	Fluid Capacitor Replacement Kit, Porous	Fluid Capacitor Assembly - 1
	5770-234NP	Fluid Capacitor Replacement Kit, Non-Porous	
7	5760-808	Pressure Sensor Kit, 100 psi	Pressure Sensor Assembly - 1
8	5760-307	5 Gallon Ink Cap Assembly	Cap Assembly - 1
	5760-309	30 Gallon Ink Cap Assembly	
9	5760-310	Inlet-Outlet Tubing and Filter Kit	Tubing Filter Assembly, Tank to IDS 5700026 - (1) 8' Assembly; Tubing, Trunk Line 1301875 - 25'; Fitting 5700508 - 1; Fitting 5361315 - 3; Cable Tie 6105393 - 6
10	5760-319	Ink Filter Kit, Ink Supply	Tubing Filter Assembly, Tank to IDS 5700026 - (2) 8' Assemblies

## IV9 Dot Print Head Replacement Part Kits



ITEM	KIT NO.	DESCRIPTION	CONTENTS - QUANTITY
1	5701-501	Ink Regulator (Non-Porous)	Ink Regulator Assembly with Tubing and Bracket
	5701-502	Ink Regulator (Porous)	
2	5770-200	Sealed DB Caps	Sealed Caps - 2
3	5770-203	PCB Stack	PCB Stack Assembly - 1
4	5770-205	Internal Tubing and Fittings	Pressure Sensor Assembly 5765432 - 1; Pre-Formed Tube 5770444- 2; Hi-Temp Tubing 1303561 - 6"; Filter 5760629 - 1; Fitting 1900758 - 1; Fitting 1900401 - 1; Fitting 2460120 - 1; Clamp 5760276 - 1
5	5770-217	Enclosure Cover Gasket	Gasket - 1
6	5770-219	Adapter Mounting Plate Kit, IV9 Dot Print Head to Round Bracket	Adapter Plate 5770369 - 1; Photocell Bracket 5760434 - 1; Screw 5082001 - 4; Screw 5101511 - 2

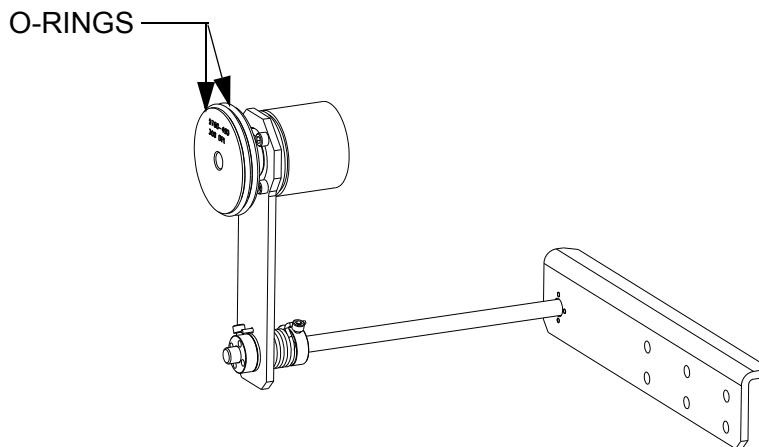
## IV18 Dot Print Head Replacement Part Kits



ITEM	KIT NO.	DESCRIPTION	CONTENTS - QUANTITY
1	5701-501	Ink Regulator (Non-Porous)	Ink Regulator Assembly with Tubing and Bracket
	5701-502	Ink Regulator (Porous)	
2	5770-200	Sealed DB Caps	Sealed Caps - 2
3	5770-220	PCB Stack	PCB Stack Assembly - 1
4	5770-221	Internal Tubing and Fittings	Pressure Sensor Assembly 5765432 - 1; Hi-Temp Tubing 1303561 - 27.5"; Filter 5700835 - 1; Fitting 1900758 - 1; Fitting 1900401 - 1; Fitting 2460120 - 1; Clamp 5760276 - 1; Cover Screws 5101710 - 6
5	5770-222	Enclosure Cover Gasket	Gasket - 1



**Encoder Replacement Part Kit**



KIT NO.	DESCRIPTION	CONTENTS - QUANTITY
5765-206	Encoder O-Ring Replacement Kit	O-Ring, 2-7/8 ID x 3-1/8 OD x 1/8 - 3; O-Ring, 4-7/8 ID x 1/8 W - 3; O-Ring, 2.175 ID x .103 W - 2

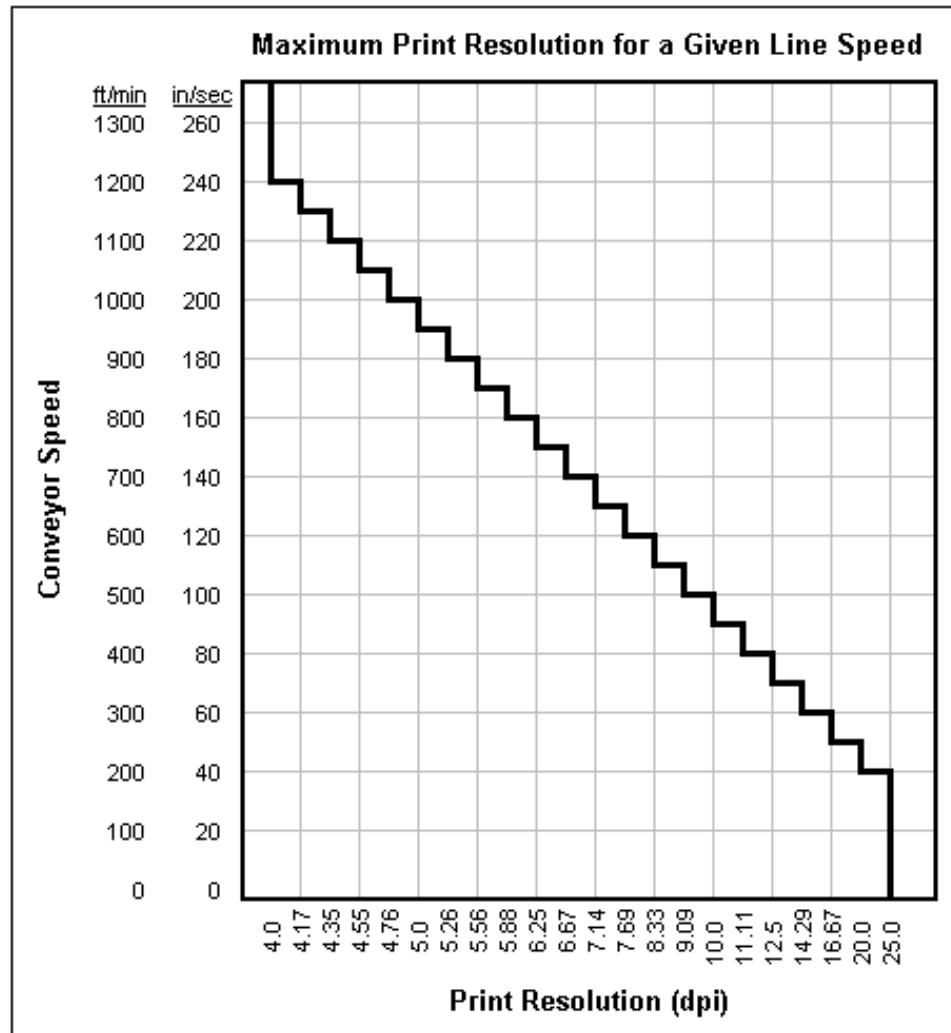
## Appendix E: Maximum dpi Calculation for a Given Line Speed

The maximum line speed of an I.V. print head is limited by the maximum frequency of the solenoid, which is 1000 Hz. The following steps will determine the operating frequency of the solenoids in the application. The graph on the following page can also be used to determine the maximum print resolution for a given line speed.

1. Determine the values for:
  - Line speed in feet per minute: If a tachometer is not available, the line speed can be estimated by measuring the conveyor belt and using a stop watch to time one complete revolution of the belt. For example, a 20-foot, 7-inch conveyor belt takes 34 seconds to make a complete revolution. Divide 60 seconds by the number of seconds per revolution (34 in this case). Multiply the resulting number by the length of the belt (21 feet in this example; always round up to the next foot for this calculation). The answer is 37 feet per minute ( $60/34 \times 21 = 37$ ).
  - Print resolution in dots per inch (dpi): Print resolution is selected through the software. This setting is measured in dots per inch; a setting of 4 denotes 4 dots, or print columns, per inch. Resolution can be set from 4 to 25 dpi.
2. The operating frequency of the solenoids can be determined with these two parameters by following the next two steps:
  - Determine the line speed in inches per second. Divide the line speed in feet per minute by 5 to get inches per second. A line speed of 200 feet per minute is equal to 40 inches per second ( $200/5 = 40$ ).
  - Multiply the number of inches per second by the dpi setting to determine the solenoid operating frequency in Hz (cycles per second). Printing at 25 dpi, at a line speed of 40 inches per second, would result in a frequency of 1000 Hz ( $40 \times 25 = 1000$ ).

The operating frequency of an I.V. print head must be less than or equal to 1000 Hz. If it exceeds 1000 Hz, the print head will have reliability and print quality problems. In such a case, the best solution is to decrease the print resolution, which will decrease the operating frequency.

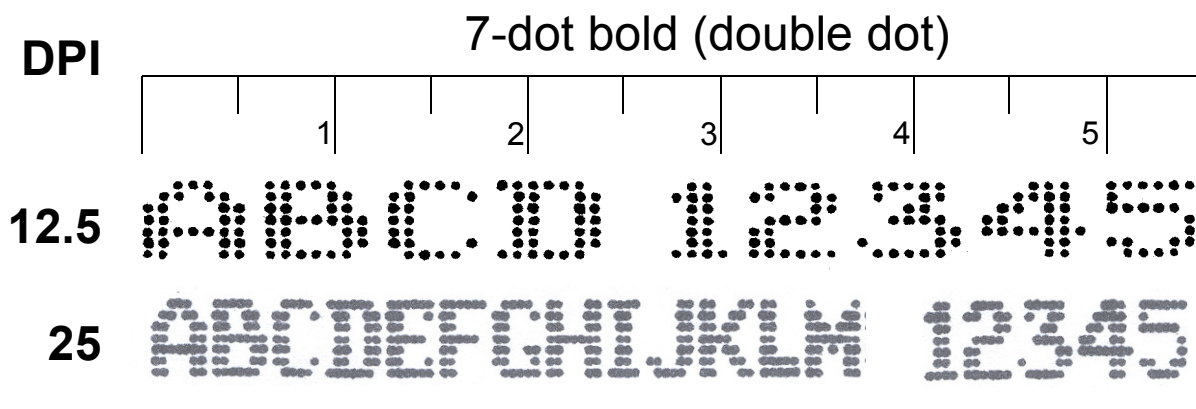
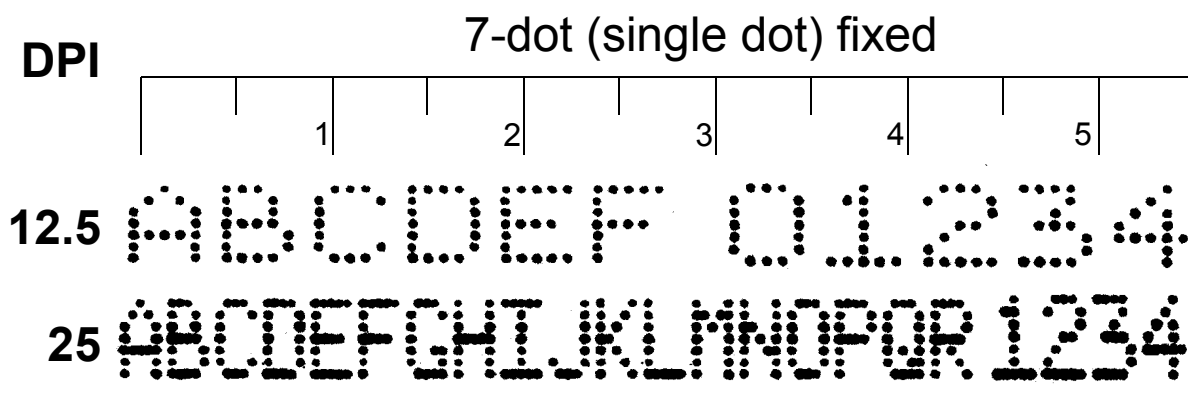
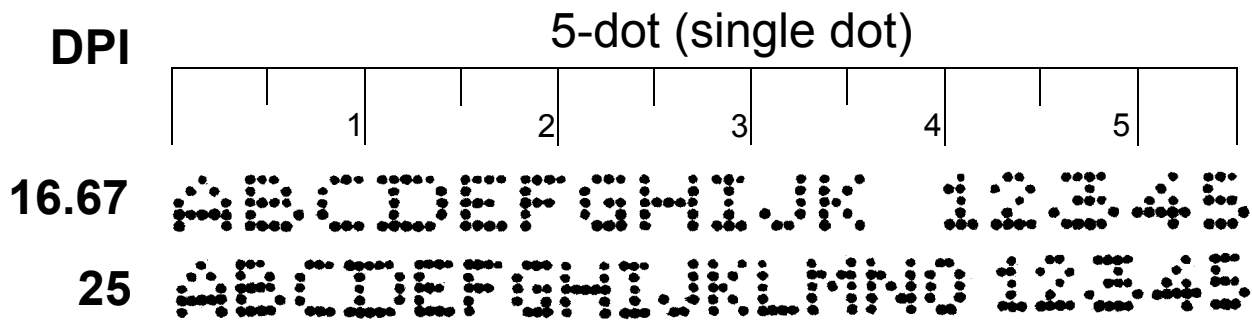
To determine the maximum print resolution for a given conveyor, divide 1000 by the conveyor speed in inches per second. Using the previous example, 1000 divided by 40 inches per second equals 25 dpi maximum print resolution. Even if a higher resolution is desired, the I.V. print head is not capable of it without encountering performance and reliability problems.



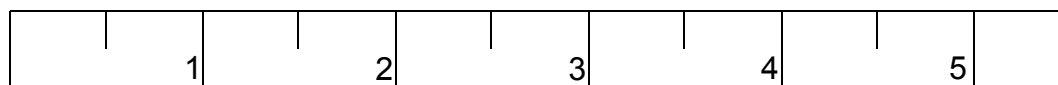
## Appendix F: Font Samples

Character appearance is affected by weight and dots per inch (dpi). Character weights available are single dot and bold (double dot). The term "fixed" means the space allotted per character is the same regardless of the character. (An "I" occupies the same space as a "W".)

### PRINT SAMPLES FOR A ½" IV9 DOT PRINT HEAD (CAN ALSO BE PRINTED WITH A 1" IV18 DOT PRINT HEAD)



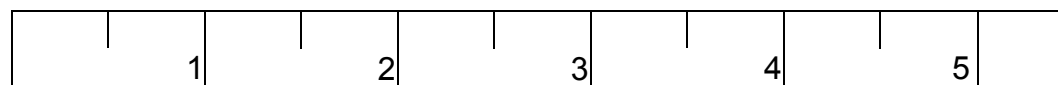
**DPI** 9-dot (single dot)



12.5 A B C D 0 1 2 3

25 A B C D E F G H I J K 1 2 3 4 5 6

**DPI** 9-dot bold (double dot) fixed

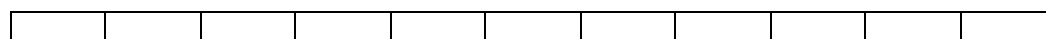


12.5 A B C 1 2

25 A B C D E F 0 1 2 3

PRINT SAMPLES FOR A 1" IV18 DOT PRINT HEAD

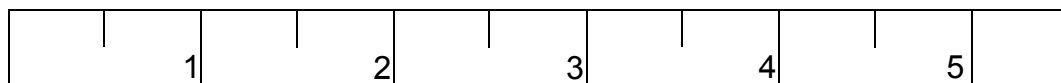
**DPI** 18-dot bold (double dot)



10 A B 1 2

25 A B C D E F 1 2 3

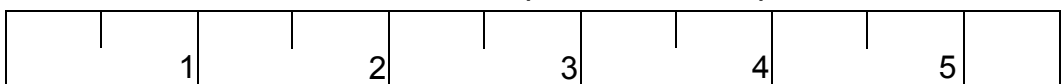
**DPI** 3 x 5-dot (single dot)



16.67

A B C D E F G H 1 2 3 4 5 6 7 8  
A B C D E F G H 1 2 3 4 5 6 7 8  
A B C D E F G H 1 2 3 4 5 6 7 8

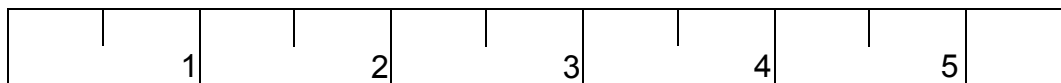
**DPI** 9-dot (single dot),  
9-dot bold (double dot)



16.67

A B C D E F 1 2 3 4 5  
A B C D E F 1 2 3 4 5

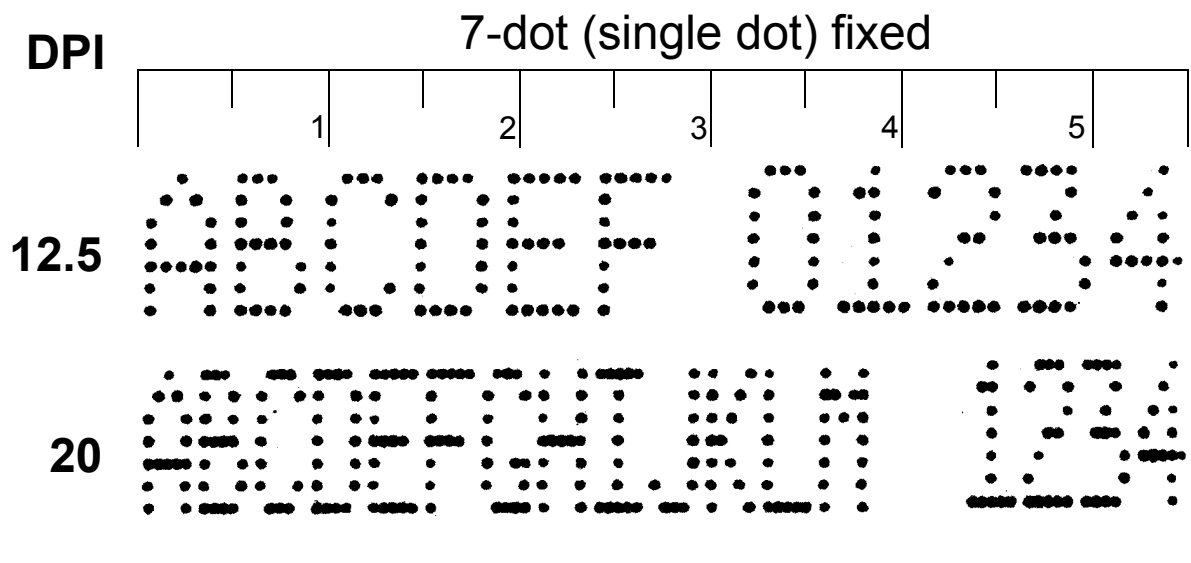
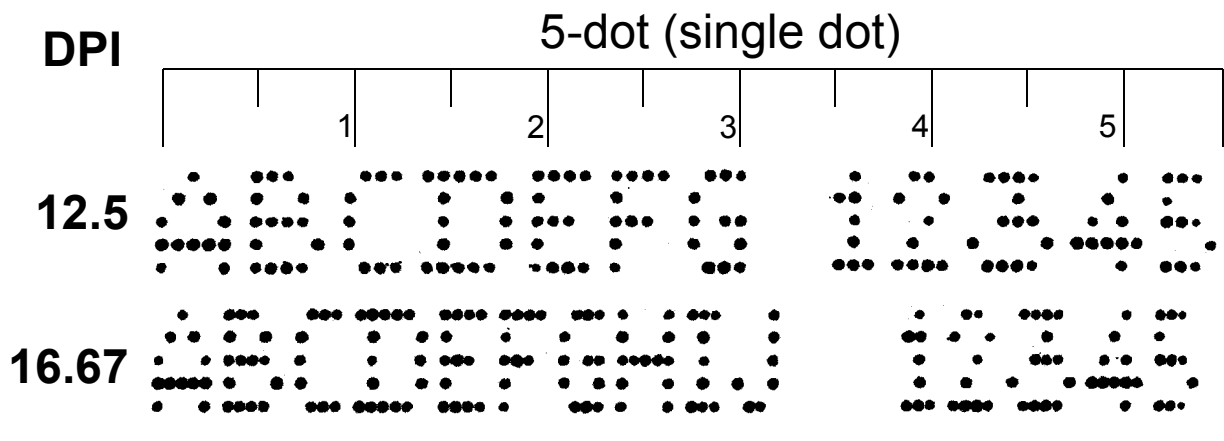
**DPI** 5-dot (single dot),  
9-dot (single dot)

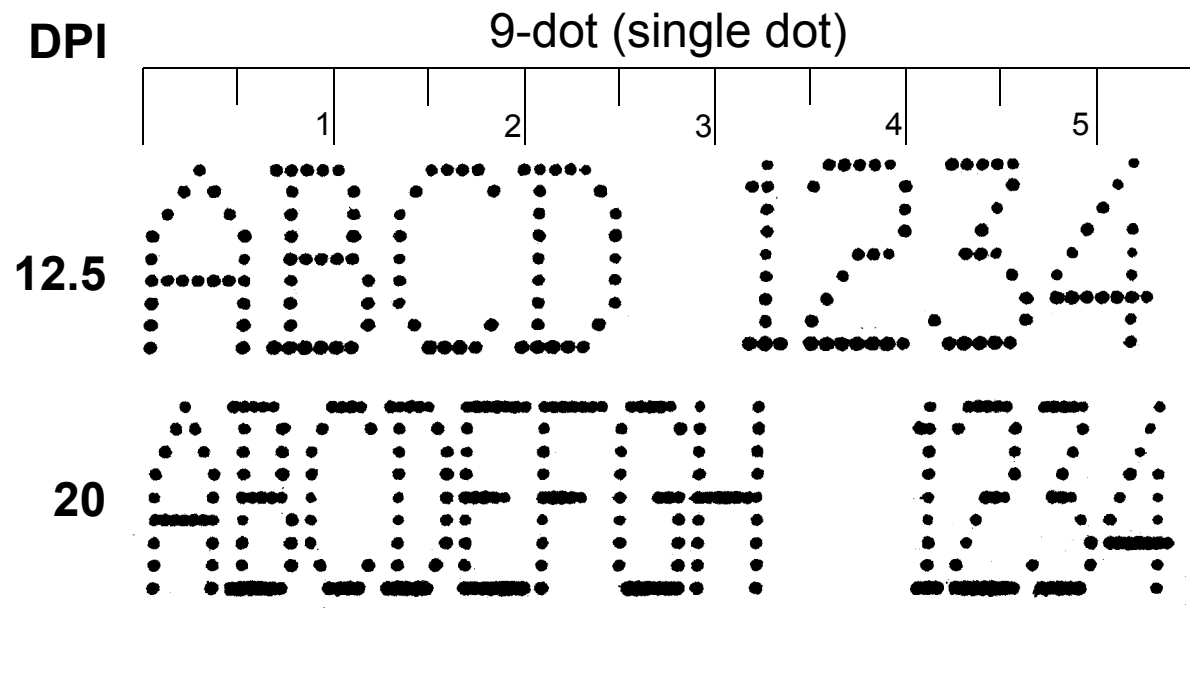
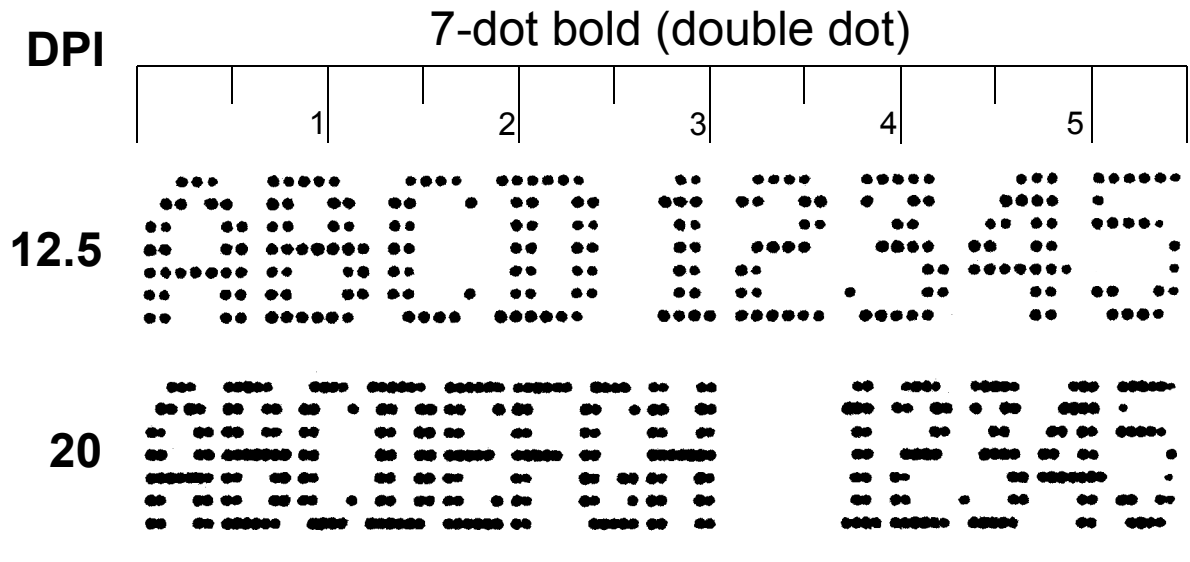


16.67

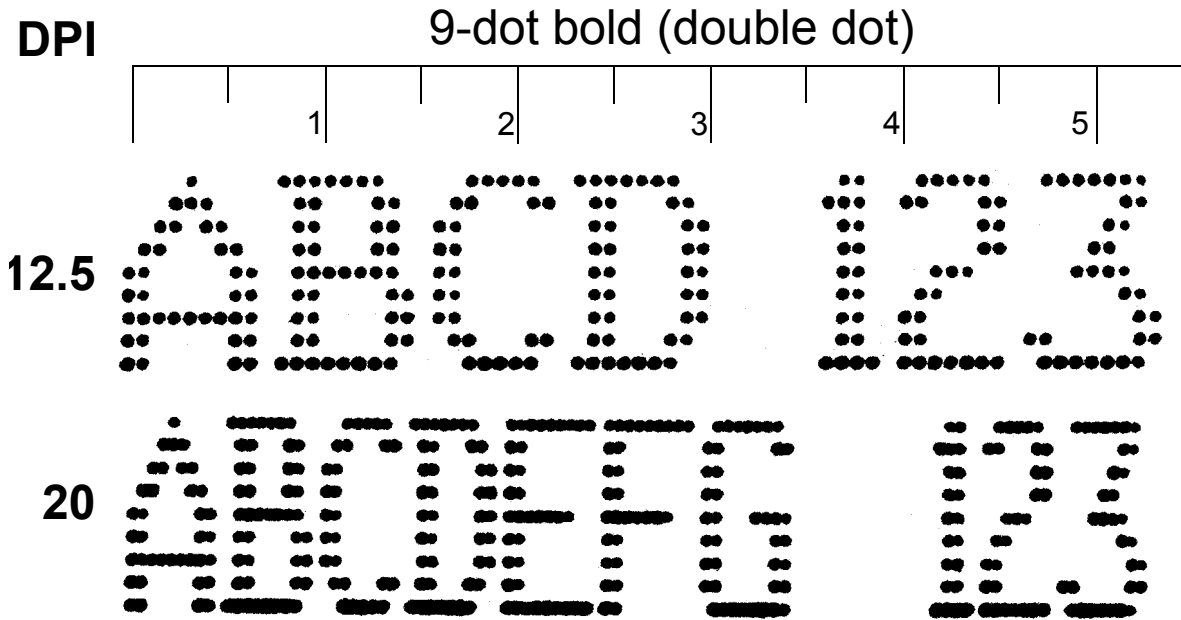
A B C D E F G H 1 2 3 4 5 6 7 8  
A B C D E F 1 2 3 4 5

**PRINT SAMPLES FOR A 7/8" IV9 DOT PRINT HEAD  
(CAN ALSO BE PRINTED WITH A 2" IV18 DOT PRINT HEAD)**



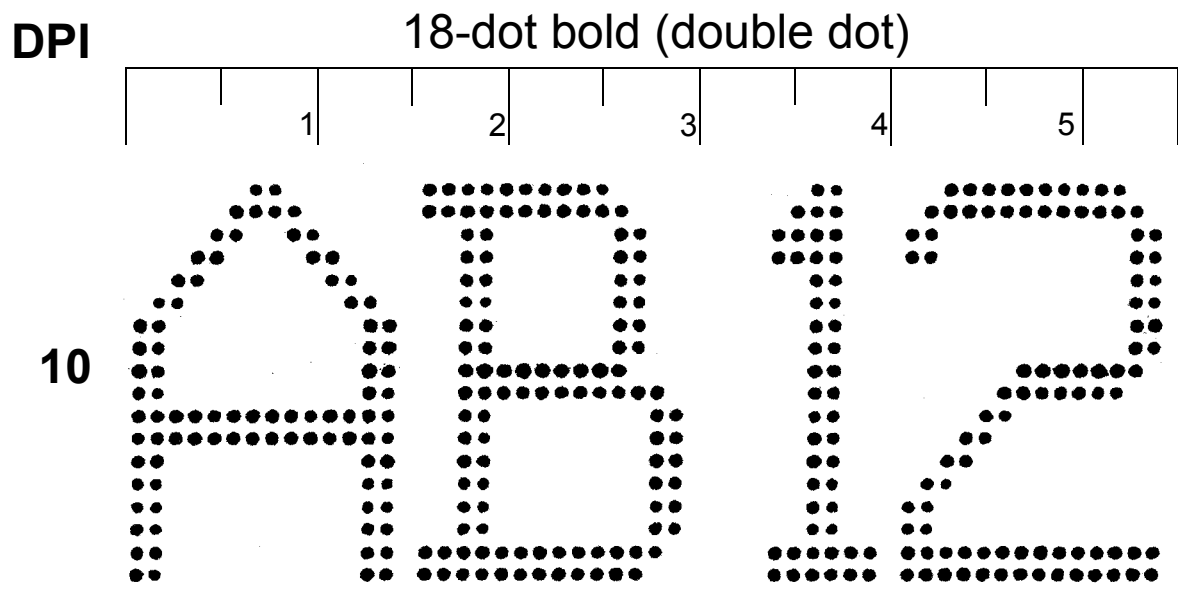


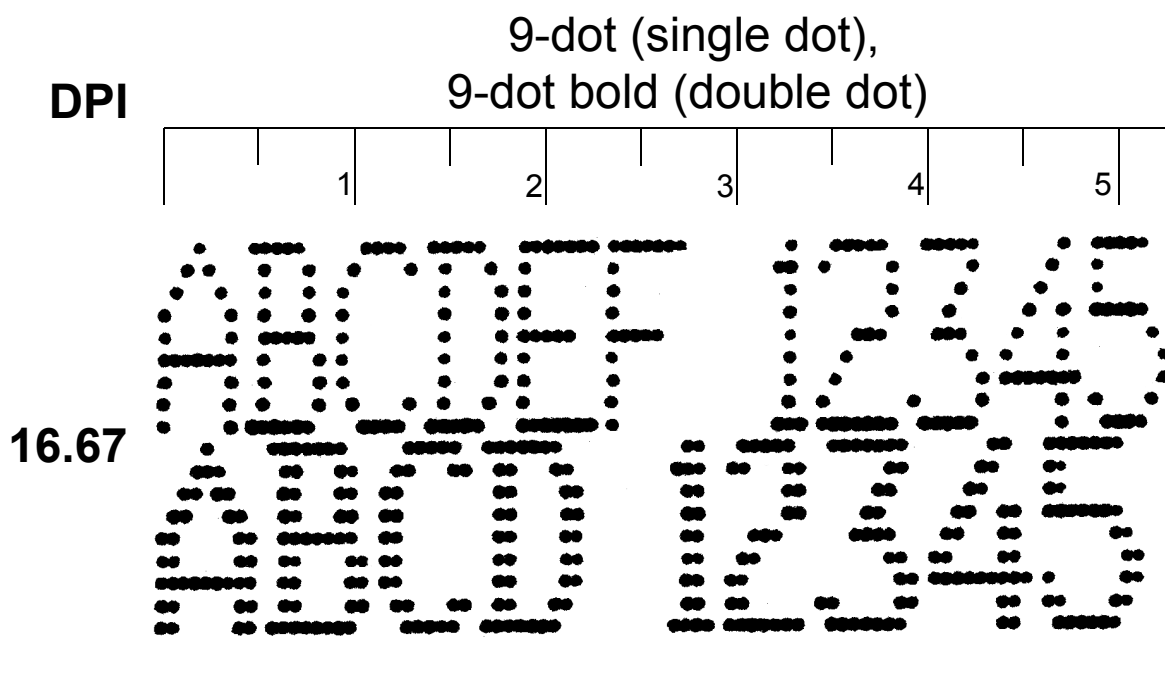
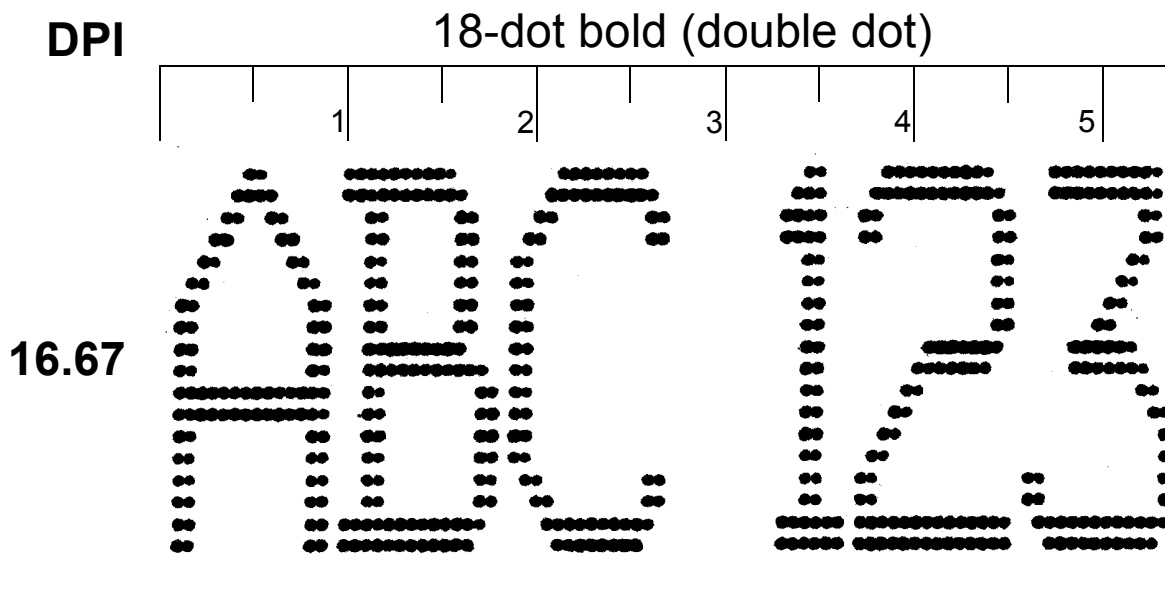





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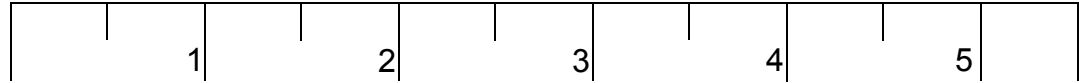
PRINT SAMPLES FOR A 2" IV18 DOT PRINT HEAD





**DPI**

5-dot (single dot),  
9-dot (single dot)



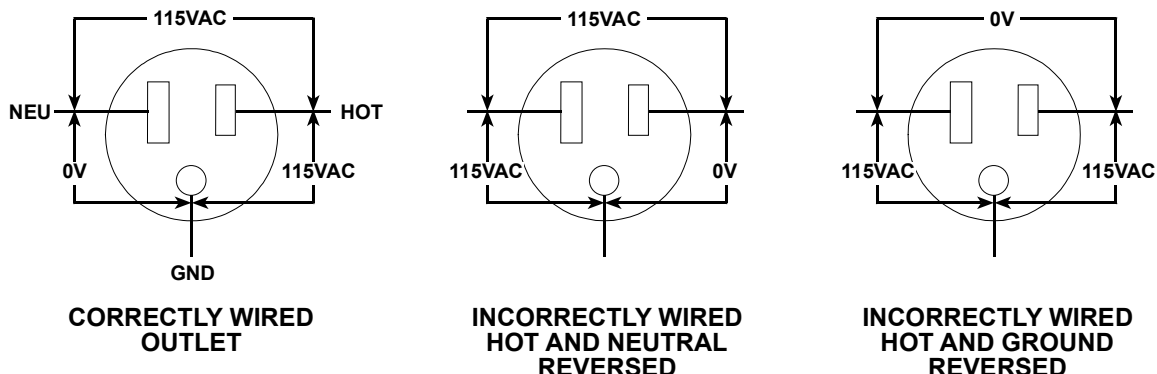
**16.67**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

## Appendix H: Testing an Electrical Outlet

An outlet tester is the preferred method of checking an electrical outlet, although a voltmeter can also be used.



### BACKGROUND INFORMATION ABOUT AC WIRING

Equipment running at 115VAC must have one hot wire and one neutral wire. Additionally, a separate ground wire runs to non-current carrying parts of most loads.

### THE WIRES IN AN AC OUTLET (115VAC)

WIRE	DESCRIPTION	FUNCTION
LINE	Usually black. Cannot be white or green.	Carries the live voltage and current to the equipment.
NEUTRAL	White or natural gray.	Grounded at the service equipment* only. Serves as the return for 115 volts.
GROUND	Bare, green, or green with yellow stripes. May be metal armor or metal conduit.	Grounded at the service equipment* and every metal box or cabinet. Runs to non-current, carrying parts of most loads.

\*The service equipment is defined as "the equipment used to disconnect the entire building and overcurrent device to protect the entire installation, but not the branch circuits individually."

At the service equipment, a single ground wire connects both the neutral and ground to earth. The NEC calls this wire the "ground electrode conductor."

## **Appendix I: Electrostatic Discharge (ESD)**

### **What is ESD?**

Electrostatic Discharge (ESD) is a triboelectric charge generated by separating or rubbing together two non-conductive materials.

### **What causes ESD?**

Friction can cause ESD. Friction can be generated by walking across a floor, removing tape from a tape dispenser, pulling a work order from a plastic work order holder, rolling the wheels of a push-cart across the floor, sitting on a foam cushion such as a stool or blowing air across a nonconductive surface.

<b>Source</b>	<b>70-90% Relative Humidity Volts</b>	<b>10-20% Relative Humidity Volts</b>
Walking across a carpet	1,500	35,000
Working at a bench	100	12,000
Sitting on a foam cushion	600	20,000
Removing plastic bag from bench	12,000	20,000
Removing work-order from plastic pouch	600	7,000

ESD at the print station can be caused by the product rubbing against ungrounded guide rails, conveyor belt static voltage build-up, or a residual static charge on the product from earlier processing.

Generally, ESD problems are more prevalent in the winter months. Heated air has a much lower relative humidity than the cold air had prior to heating. In many instances ESD problems appear in the fall when the outside temperature drops, and go away in the spring when the outside temperature begins to rise.

### **What are the effects of ESD?**

Unexplainable system resets, controller lockups, and multiple prints on the product can be signs of static discharge to the system. When static electricity is discharged to an electronic circuit (components or printed circuit boards), permanent damage may also occur. This damage may be in the form of reduced functionality, reduced life, or complete non-functionality.

The static charge does not have to be noticeable to the human touch in order to cause problems in an electronic system. A human being does not start to feel the effects of static electricity until the voltage reaches or exceeds 4000 volts. Voltage as small as 100 volts can cause problems with some sensitive electronic components.

### **What prevents ESD?**

Prevention begins with training and knowledge. The use of wrist straps, heel straps, work-bench mats, floor mats, and monitoring systems for electronic devices will drastically reduce the ill effects of ESD when handling circuit boards. Anytime you handle electronic components or printed circuit boards, ESD wrist straps should be used.

If static discharge is suspected of causing controller problems at the print station, check the grounding of the conveyor and print station components. Nonconductive or ungrounded guide rails are the most common cause of static discharge. Ionized air blowers and static dissipating material have proven effective in eliminating many static problems.

## Appendix J: Encoder Functional Testing

In the event of print quality problems that point to variations in encoder performance or location with an IJ3000 Ink Jet System, this procedure will help to verify proper encoder function.

Tools:

- Tachometer or tape measure and stop watch
- Oscilloscope

All measurements depend on an accurate measurement of the line speed.

If a tachometer is not available, line speed can be determined with a stopwatch and tape measure. Measure a known length (the longer the better) and place a mark at the beginning and at the end of the measurement. Then use the stopwatch to time the passage of the leading edge of the product from the first to last mark. Take three readings to get an average.

For example: You measure a 25 foot distance that passes from the leading edge mark to end mark in 33 seconds = 25ft./33 sec. = 0.76 ft./sec.

Multiply by 12 to convert to in./sec. = 0.76ft./sec. x 12 = 9.09 inches per second.

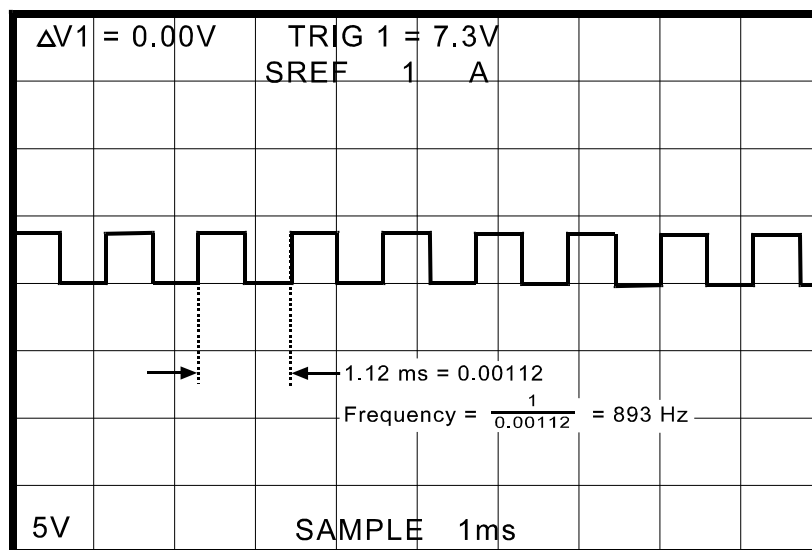
Remember this number. Now you'll need to get out your oscilloscope and make some measurements on the system you wish to test. Set the vertical resolution of the scope to 5 volts per division and set the horizontal resolution to 1 millisecond.

### MEASUREMENTS

Connect the scope ground to TP11 on the interface board. Connect the voltage probe to TP10. The 5760-820-IJ encoder has a resolution of 300 dots per inch.

Evaluate your waveform as follows:

You will see 5-volt square waves, as in the illustration on the next page. These waves generally compress and expand across the width of the display at regular, rhythmic intervals. If you see them compress sporadically, the encoder is not tracking consistently. For example, when it "bumps" over a seam in the conveyor belt, a momentary compression of the waveform on the display will occur. If you question the difference between rhythmic and intermittent sporadic appearance of the 5-volt square waves, and your conveyor has no seam, tape a small object, such as a washer or nut, onto the conveyor belt such that it will be hit by the encoder wheel and observe the difference it makes in the waveform appearance.



When you're satisfied that the encoder is tracking normally, you can calculate the encoder frequency as follows:

Measure the time from the leading edge of one of the 5-volt square waves to the leading edge of the one next to it.

Divide 1 by the time you measured. for example, if you had one square between the leading edge of the 5 volt square waves, and your horizontal sweep is set to 1.0 milliseconds,  $1/0.001 = 1000\text{HZ}$ .

In keeping with previous example, we know we're moving at 9.09 inches per second, using a 100 dpi encoder. multiplying the 9.09 by the 100 dpi expected; we get 909.09HZ.

Referring to the scope screen, since we're set to a 1.0-millisecond horizontal sweep, we measure 1.12 square between the leading edges of the volt square waves. Our calculation is as follows:  $1/0.00112 = 893\text{HZ}$ .

To sum up the process for checking encoder accuracy:

Determine the line speed in inches per second (accomplished by dividing speed in feet per minute by 5 or multiplying feet per second by 12).

Determine encoder resolution (300 dpi for the 5760-820-IJ encoder).

Multiply the encoder resolution by the line speed in inches per second to determine what the frequency should be.

Measure the actual frequency with a scope to compare it to the expected value.

These two numbers will not agree exactly, but should be within plus or minus 1%.

Most of the time, encoder tracking problems are due to tracking on irregular surfaces. these problems are characterized by rapid, inconsistent, jerking movements of the 5-volt square waves on the scope. The remainder of encoding tracking problems are usually due to the wheel contacting a drive wheel or other surface and not the belt. In these cases, the 5-volt square wave motion may be uniform, but the measured frequency will not agree with the expected value you calculate.

A failed disk within the encoder will generally appear as large and erratic pulse width differences from one encoder pulse to the next, or no output from the encoder.