

# Operations Manual



2466-400  
Revision D



# **WaxJet 192 Ink Jet System Operations Manual**

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**2466-400  
Revision D**

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## Warranty:

### **WaxJet 192**

The WaxJet 192 system, including all components unless otherwise specified, carries a limited warranty.

The inks (wax pellets) used with the WaxJet 192 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.



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## **Section 1: Introduction**

### **IJ3000 WaxJet System Description**

The IJ3000 WaxJet system consists of a Controller, a Print Head Driver Assembly, a Wax Delivery System (WDS), and high resolution, piezoelectric, impulse jet print heads for printing text.

The IJ3000 Controller consists of printing interface electronics, a color display with touch screen and a QWERTY style keypad, in a sealed industrial enclosure. The controller incorporates a Graphical User Interface (GUI) with intuitive, easy to use control software. The controller can be used as a stand-alone device or networked through built-in Ethernet connectivity.

The Wax Delivery System (WDS) melts the solid wax and delivers the melted wax to the print head. The WDS consists of a melt tank, transfer tube, heaters, sensors and thermal control electronics.

The Print Head Driver Assembly houses the electronics which connect the print head to the controller. The driver assembly is also the electronic interface between the controller and WDS.

This manual describes hardware installation for the IJ3000 WaxJet System. The IJ3000 Controller operation is described in a separate manual: 5760-121 IJ3000 Controller Operation Manual.



## Section 2: Safety

Following is a list of safety symbols and their meanings, which are found 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.)



**CAUTION:** The Wax Delivery System contains hazardous voltage (120/230-240VAC). 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 the equipment.



It is extremely important to:

- Wear safety glasses and protective clothing, including gloves, when handling all inks and conditioners.
- Store inks under the recommended conditions found on the MSDS (Material Safety Data Sheet).



### **PRODUCT COMPLIANCE DISCLAIMER NOTE:**

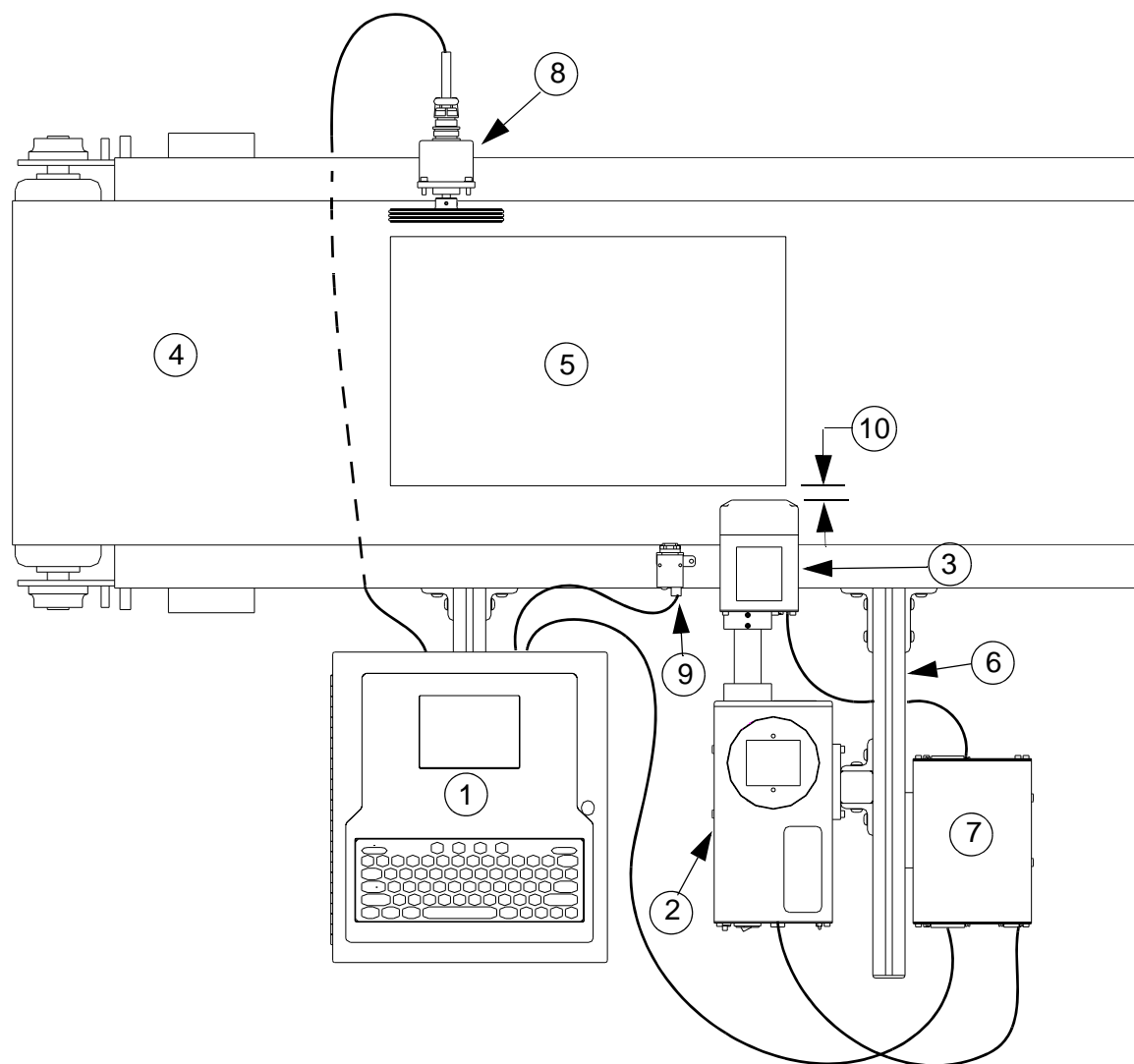
This product meets the requirements of CAN/CSA-22.2 No.60950-00 \*UL 60950 using Diagraph an ITW Company approved items. Units are only tested and qualified with Diagraph an ITW Company approved inks, parts and accessories. Use of other inks, parts or accessories may introduce potential risks for which Diagraph an ITW Company can assume no liability.



## Section 3: System Components

- 1 - IJ3000 Controller
- 2 - Wax Delivery System
- 3 - Print Head
- 4 - Conveyor
- 5 - Product

- 6 - Print Head Bracketry
- 7 - Print Head Driver
- 8 - Encoder
- 9 - Photo Sensor
- 10 - Throw Distance (1/8" Recommended)



The Diagram WaxJet System is available with the following components, options and service kits:

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

	<b>IJ3000 LS Controller Assemblies and Accessories</b>
--	--

5760-001SJ1D	Stainless Enclosure, Single Interface, Domestic
5760-001SJ2D	Stainless Enclosure, Dual Interface, Domestic
5760-392	IJ3000 I/O Board Kit

	<b>IJ3000 ES Controller Assemblies and Accessories</b>
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5760-001DJ	Painted Enclosure, Single Interface, Domestic
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	<b>WaxJet System (Print Head and Ink System)</b>
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2466-001D	WaxJet 192 Print System Assembly, Domestic
2466-001E	WaxJet 192 Print System Assembly, European
2466-002D	WaxJet 192 Modular Print System Assembly, Domestic
2466-002E	WaxJet 192 Modular Print System Assembly, European

	<b>Print Head Bracketry and Accessories</b>
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2464-550	Single Print Head Conveyor Mounting Kit
5760-355	Print Head Floor Mounting Kit (Requires Single Print Head Kits)

	<b>Print Head Cables</b>
--	--------------------------

*2466-300-003	HD-44 Print Head Cable, 2.5'
2466-300-010	HD-44 Print Head Cable, 10'
2466-300-025	HD-44 Print Head Cable, 25'

	<b>IJ3000 LS Controller Bracketry</b>
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5760-350	Controller Conveyor Mounting Kit
5760-351	Controller Pedestal Mounting Kit
5760-352	Controller T-Base Mounting Kit
5760-362	Controller 90° Pivot Bracket Kit

	<b>IJ3000 ES Controller Bracketry</b>
--	---------------------------------------

5765-200	Conveyor Mount Kit
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	<b>Print Head Driver Cables</b>
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5760-614-002	Print Head Driver Cable Assembly, 2'
5760-614-010	Print Head Driver Cable Assembly, 10'
5760-614-015	Print Head Driver Cable Assembly, 15'
5760-614-025	Print Head Driver Cable Assembly, 25'

	<b>WDS Communication Cables</b>
--	---------------------------------

*2464-182-003	Cable, DB9, M/F, 2.5'
2464-182-010	Cable, DB9, M/F, 10'
2464-182-025	Cable, DB9, M/F, 25'

\* Denotes standard component shipped with 2466-001D/E Systems.

**Encoder**

5760-820-IJ	Encoder Assembly w/Mounting Bracket
2464-182-010	Extension Cable, 10'
2464-182-025	Extension Cable, 25'

**Photosensor**

5760-383	Photosensor, Diffuse Type, with 20' Cable
2464-182-010	Extension Cable, 10'
2464-182-025	Extension Cable, 25'

**Warning Tower**

5760-395	Warning Tower (Requires 5760-392)
5760-128	Audible Signal Element

**Ink**

001-0868-01	Ink, SolidMark (Case of 32)
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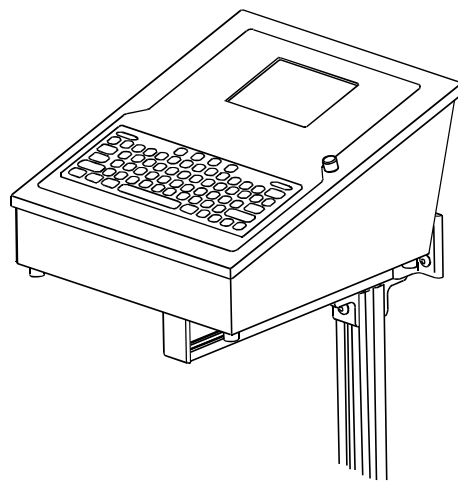
**Carton Cleaning Kits**

5760-018S	Single Side Air-Knife/Brush System Assembly
5760-018D	Dual Side Air-Knife/Brush System Assembly

## 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.

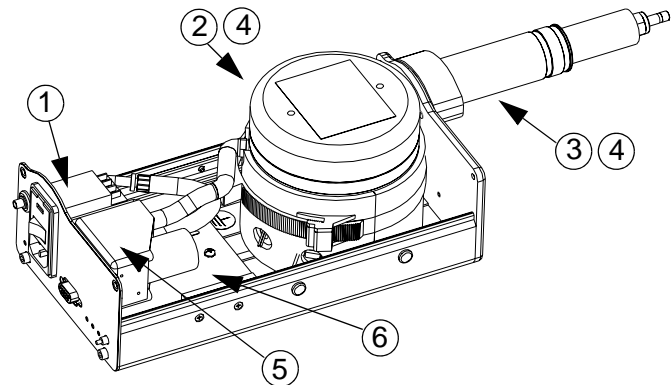
The controller comes in a stainless steel or painted metal case that makes it splash-proof and resistant to electromagnetic interference. A hinged cover provides access to replaceable parts.

The IJ3000 Impulse Jet Controller can control up to two WJ192 print heads per interface board. With the optional second interface board, the system can control up to four heads.

## **Wax Delivery System**

The Wax Delivery System (WDS) melts the solid wax, regulates the temperature of the melted wax, and delivers it to the print head. The WDS has six major components:

1. Power-Entry Module
2. Melt Tank
3. Ink Transfer Tube
4. Heaters and Sensors (Internal to the Melt Tank and Transfer Tube)
5. Prime Pump
6. Thermal Control Board
7. Ink Low Beacon (not shown)



### **Power-Entry Module**

The Power-Entry Module has an ON/Off switch, a fuse holder and an IEC power line connector. Two WDS models are available: 120VAC, 60 Hz @ 3 amps; and 230-240VAC, 50/60 Hz @ 1.5 amps. A unit's operating voltage is specified on its part number label.

### **Melt Tank**

The melt tank melts the solid wax and maintains it in liquid form. Add solid wax to the melt tank when needed by removing its cap and dropping in two pellets, one in each of two cavities. Metal screens at the bottom of the cavities help transfer heat to the solid wax for melting, and serve as filters to keep the wax free of contaminants.

Two 125-watt AC (120V or 230/240V, depending on the model) cartridge heaters supply the heat to melt the wax. A thermistor immersed in the wax provides temperature information to the Thermal Control Board, which turns the heaters on and off to regulate the temperature of the tank at 100°C, +/- 2°C. A thermal fuse mounted to the tank prevents overheating should a system fault occur. These combined components comprise the "Melt Tank" heater zone. This zone (or circuit) is controlled independently by the thermal control board.

A float in the tank tells the Thermal Control Board when the wax level is getting low. At "Ink Low" the Thermal Control Board turns on its **LOW INK** LED, and sends a signal to the IJ3000 controller alerting it to the low ink condition.

The melt tank is vented so pressure does not build inside the tank. The vent is also used to pressurize the tank for print head priming after cold starts.

### **Transfer Tube**

The transfer tube delivers melted wax from the melt tank to the print head, and is the mounting point for the print head.

A 65-watt AC (120V or 230-240V, depending on the model) cartridge heater keeps the wax in the transfer tube melted. A thermistor in the tube provides feedback to the Thermal Control Board, which turns the heater on and off to regulate the temperature at 110°C, +/- 2°C. A thermal fuse attached to the transfer tube prevents overheating should a system fault occur. These combined components comprise the "Transfer Tube" heater zone. This zone (or circuit) is controlled independently by the thermal control board.



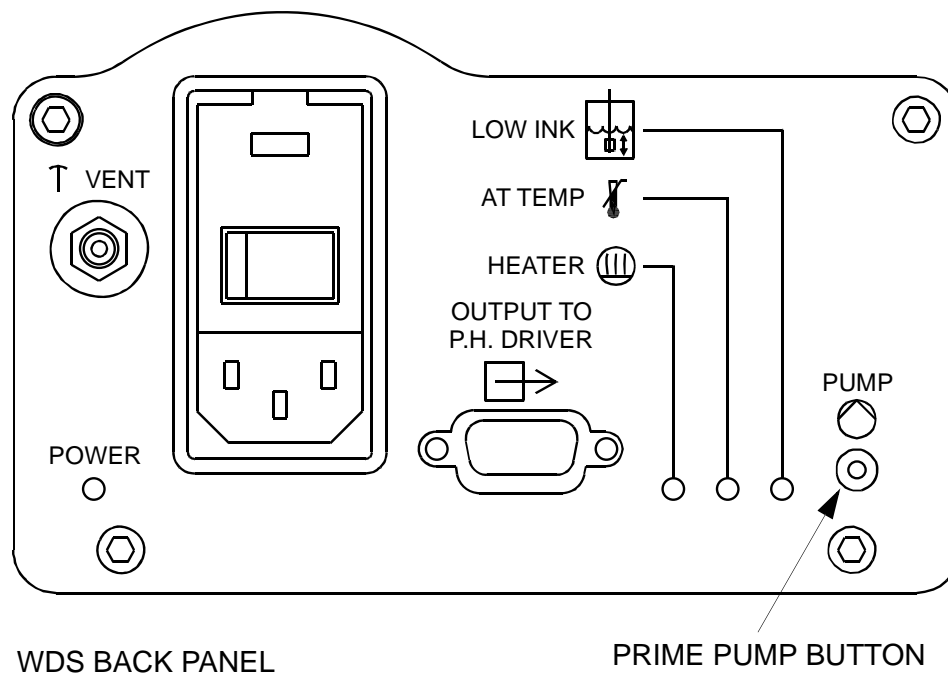
**WARNING:** When the WDS is at operating temperature, an exposed transfer tube is very hot (115°C). Wear proper protective equipment if you must handle a hot transfer tube.



## **Prime Pump**

The prime pump pressurizes the system, forcing wax to flow through the transfer tube and print head, expelling any air from the system, or forcing wax out of the print head to aid in removing contaminants from the orifice plate.

The pump runs on 12VDC and is manually operated by a push button at the lower right corner of the WDS back panel. The pump will not operate unless the WDS is AT TEMP, nor if a LOW INK or INK OUT condition exists.



## **Thermal Control Board**

The Thermal Control Board regulates the temperature of the melt tank and transfer tube, monitors the wax level in the melt tank, controls the prime pump, lights LEDs and sends signals to the IJ3000 Controller indicating the current WDS status.

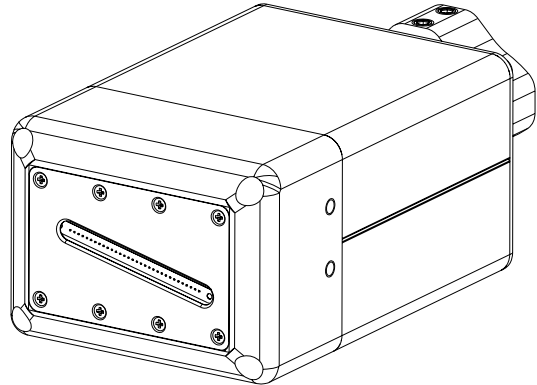
The WDS has two operating modes: **NORMAL** and **SLEEP**. Sleep mode lowers the WDS temperature from 100°C to 90°C during long periods of inactivity, which extends the life of the wax and allows for faster startups. Sleep mode is controlled by a signal from the print head driver assembly. The WDS automatically goes into sleep mode if the cable from the print head driver is disconnected or the IJ3000 is turned off. The **POWER** LED on the WDS back panel blinks to indicate sleep mode.

LEDs visible on the WDS back panel indicate when one of the heaters is on, when the system is at operating temperature, and when the wax supply is low. Other LEDs, internal to the WDS and visible when the top is removed, indicate when the melt tank and transfer tube are heating, and when they are at operating temperature. "At temp" and "low ink" signals are also sent out the 9-pin D-sub connector and through the print head driver assembly to the IJ3000.

## WJ192 WaxJet Print Head

The WJ192 print head has 32 addressable channels. Each channel prints through six orifices arranged in a three orifice tall by two orifice wide pattern. Vertical print resolution is 80 dots per inch, producing a maximum print height of 0.4 inches. Maximum print speed is 300 feet per minute.

To maintain the correct relative position between the wax supply and the print head orifices, the head is mounted directly to the WDS. Wax is supplied to the print head via gravity feed and to the orifices by capillary action inside the print engine. The print head and WDS must be level for wax to flow properly from the WDS to the head. Tilt them forward and the print head weeps; tilt them backwards and the head receives insufficient wax.



**WARNING:** The orifice plate at the front of the print head has a normal operating temperature of 110°C. Use caution when cleaning the orifice plate or otherwise working around the print head.

## WJ192 Print Head Driver Assembly

The print head driver has all of the circuits and power supplies needed to drive the WJ192 print head, and to interface the WDS with the IJ3000.

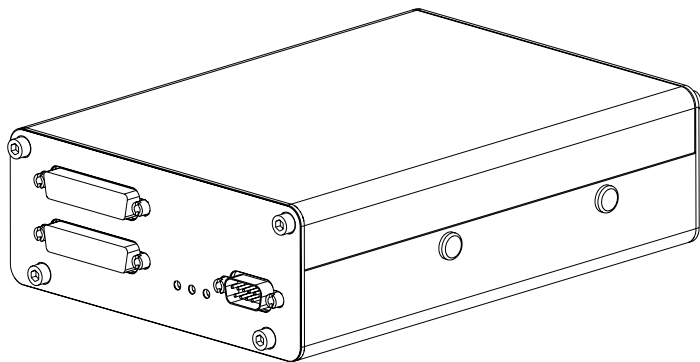
24VDC received from the IJ3000 controller powers the print head driver. A DC to DC converter produces 30V to power the print head's heater, and heater control circuitry maintains the print head's 115°C operating and 90°C sleep mode temperatures.

Another DC to DC converter

generates 50V to power the print head's piezoelectric print engine. Print head driver circuits convert dot data, clock, and latch signals from the IJ3000 controller to the signals needed to drive the print engine's 32 channels. 5VDC and 12VDC power supplies provide power to the logic and analog circuits.

"Low ink" and "at temp" signals from the WDS are passed through to the IJ3000 controller, and "sleep" and "wake up" commands from the controller are relayed to the WDS. The print head driver also monitors the "low ink" signal from the WDS, and during a low ink condition tracks wax consumption. If 5 mL of wax is used before the low ink condition is cleared, an "ink out" signal is sent to the controller.

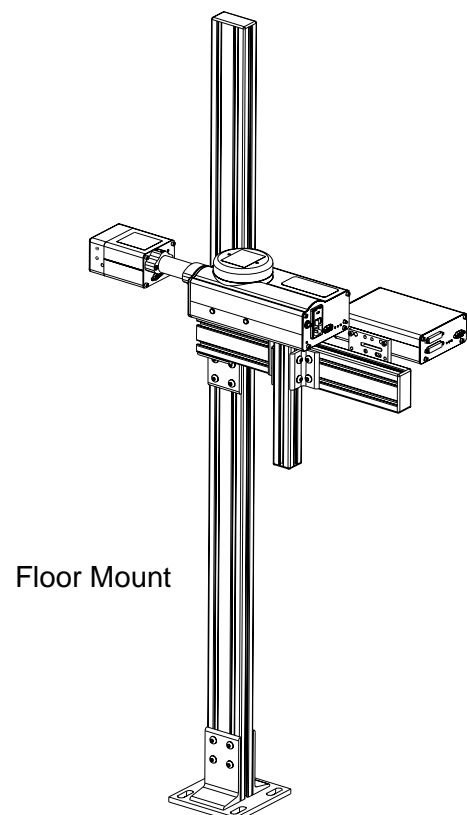
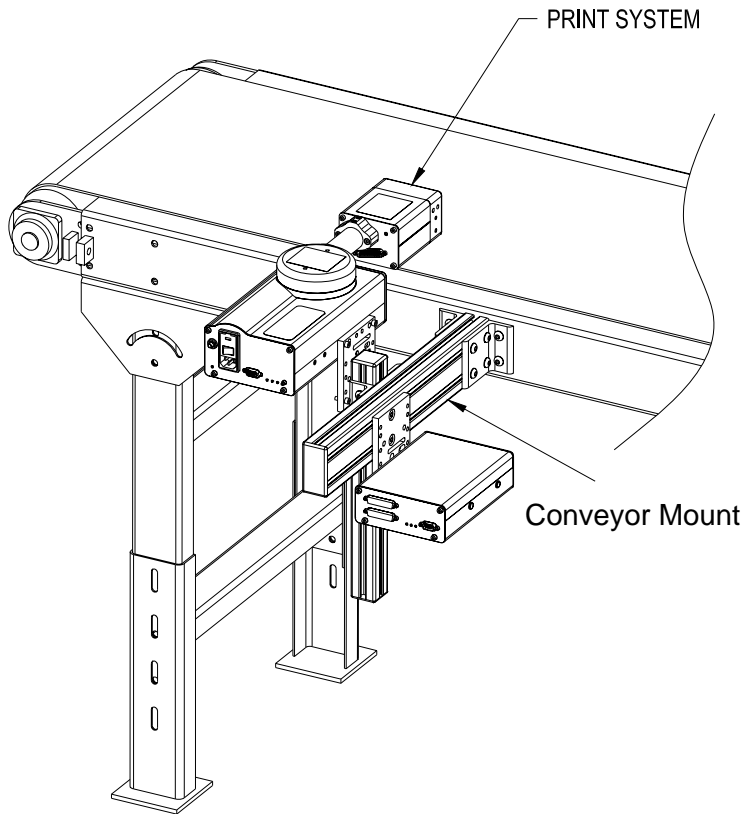
LEDs on the print head driver's back panel light to indicate print head "heater on", print head "at temp", and "ink out".



## Print Head Bracketry

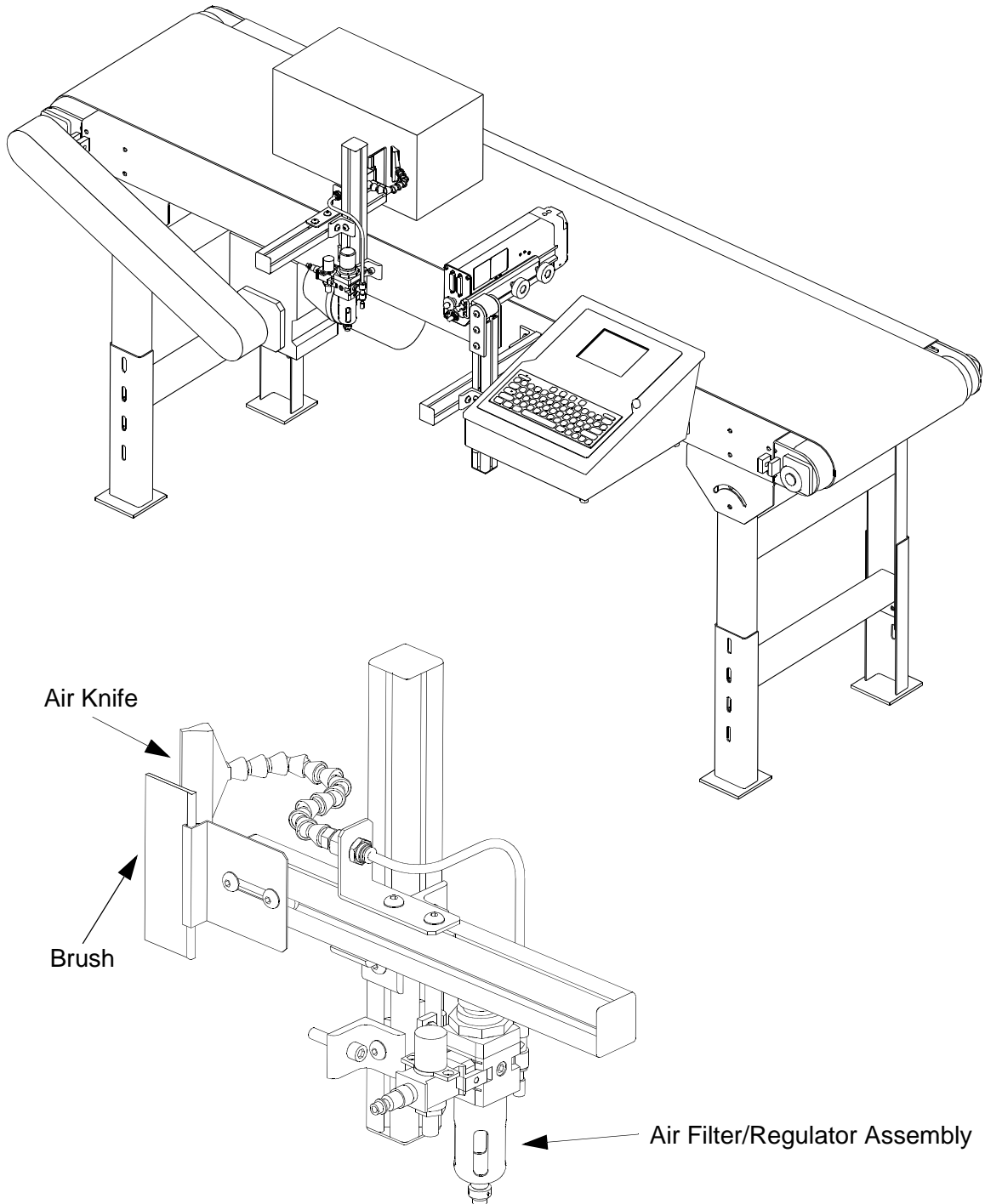
There are several options for mounting print heads. Diagram bracketry is modular and can assume several configurations:

- Single-pole conveyor mount
- Single-pole floor mount



## Carton Cleaning

Diagraph's Air-Knife/Brush System is used to pre-clean cartons. The Brush removes glue strands, while the Air Knife removes carton dust. The Carton Cleaning System is effective in reducing print head cleaning frequency required to maintain consistent print. Shop air is required for the Carton Cleaning System.



Single Side Air-Knife/Brush System (5760-018S)

Dual Side (not shown) (5760-018D)

## 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. A red LED on the back of the sensor illuminates when a reflective object is detected.

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 24VDC and have a current sinking (or open collector) output. The photosensor plugs into the Print Head Interface Board (P2).

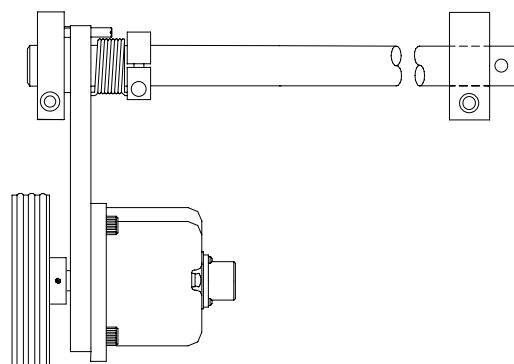
## Encoder

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.

The Impulse Jet System uses a 24VDC, 2400 ppr open collector output encoder. The wheel is sized to provide the correct timing inputs to allow the Impulse Jet heads to print from 100 to 300 dpi.

The encoder plugs into the Print Head Interface Board (J4).



ENCODER ASSEMBLY

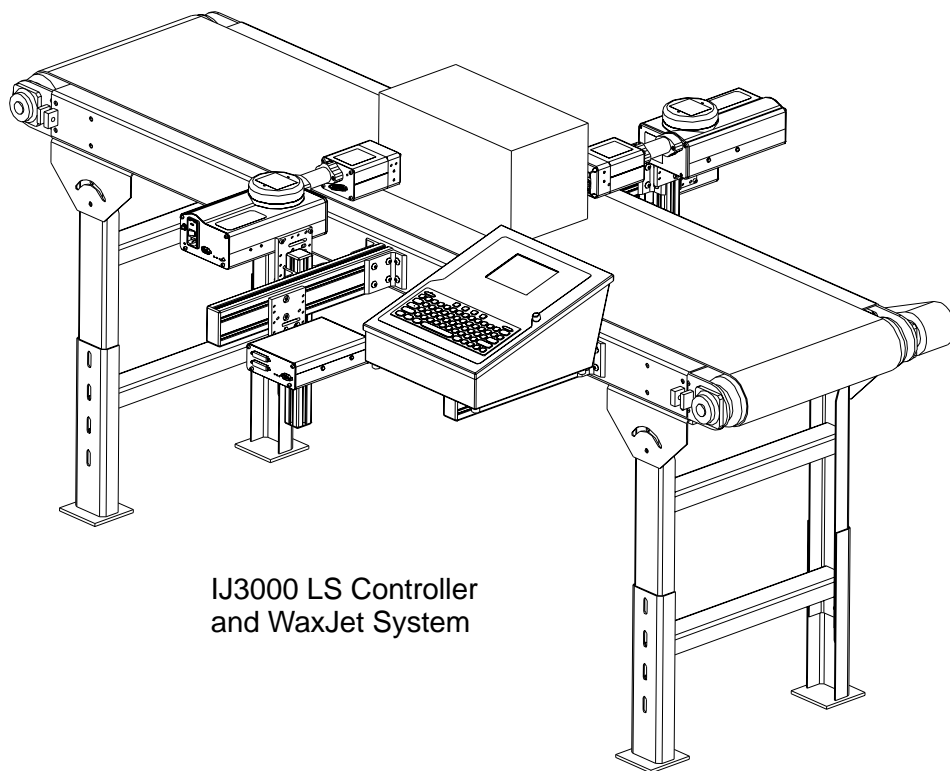
## Solid Ink

The ink is a wax type, dye-based solid ink. Ink is available by the case, with a case containing thirty-two (32) 20mL pellets of solid ink. The solid ink pellets melt into liquid form in the melt tank, allowing ink to be ejected by the head, and then re-solidified on the substrate. The solid ink melts at 60 to 65°C and will re-melt once applied if ambient temperature of the substrate exceeds 60°C.

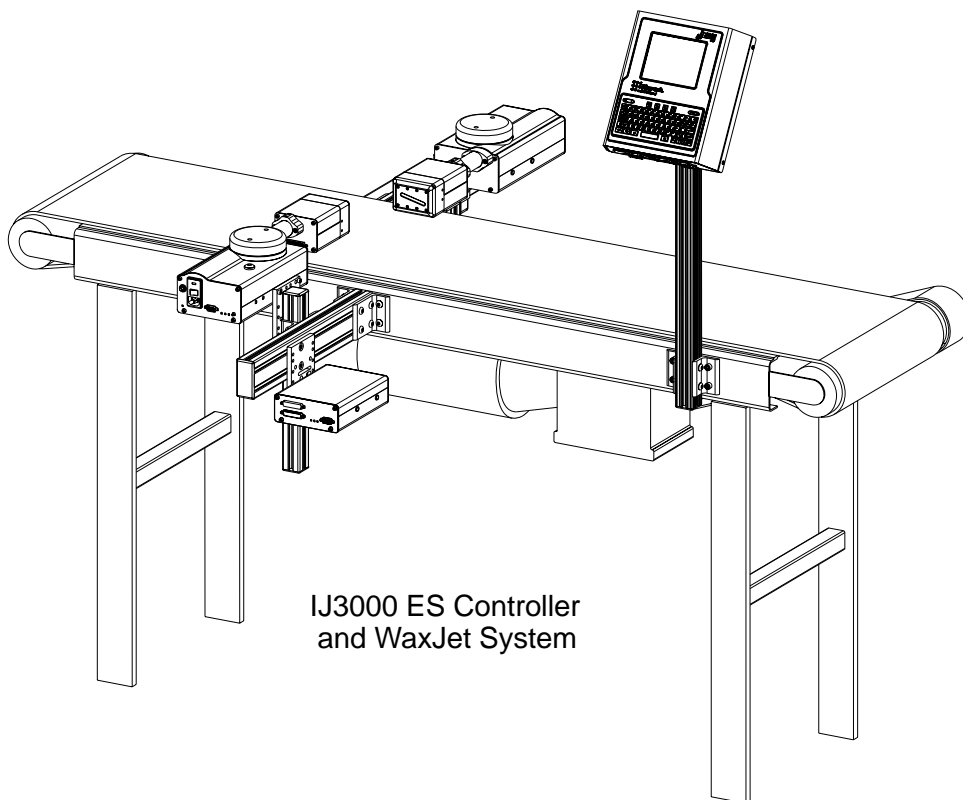


## Section 4: Installation

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



IJ3000 LS Controller  
and WaxJet System



IJ3000 ES Controller  
and WaxJet System

## Materials Required for Installation

- Lint-free wipes
- Level
- Tape measure

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

## System Installation Overview



**NOTE:** The following steps give an overview of the procedure to properly install the IJ3000 Impulse Jet print system. Refer to the appropriate section for details.

1. Carefully plan the mounting location of the equipment. Keep in mind bracketry hardware location and printer equipment size.
2. Remove equipment from packaging.
3. Assemble all bracketry to the floor, conveyor, or other bracketry per bracketry installation section.
4. Mount the IJ3000 to appropriate bracketry. Do not connect to power outlet.
5. Mount the WJ192 System to appropriate bracketry and in the approximate location relative to the carton.
6. Mount the photosensor, optional bracketry, and optional encoder per procedure.
7. Make all appropriate electrical cable connections to the inside of the IJ3000. Connect the print head cables to the print heads.
8. Power the IJ3000 and WJ192 System.
9. Prime the print heads per procedure.
10. System is ready for first print.

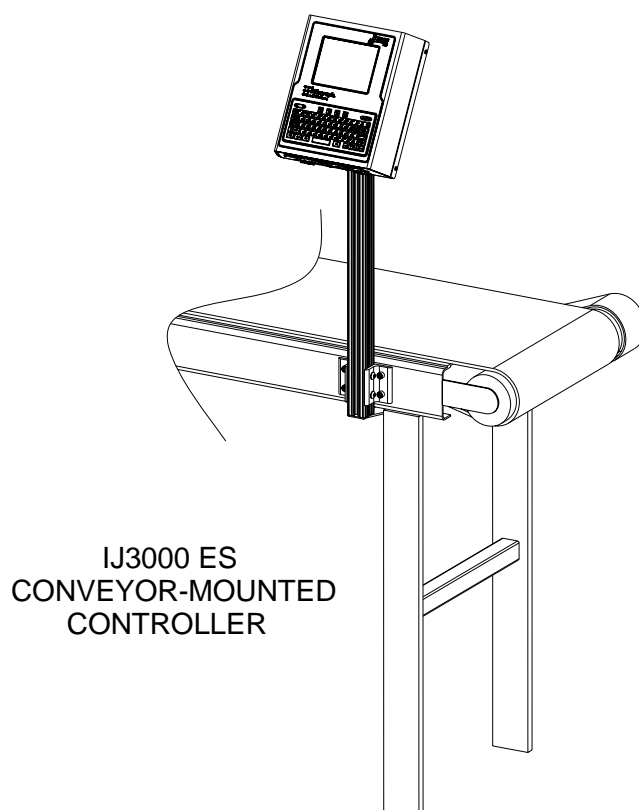
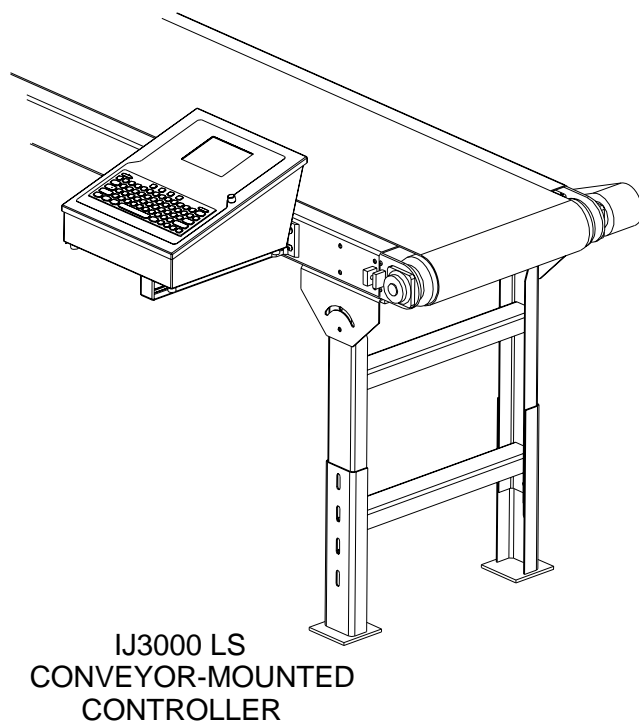


## Installing Controller Bracketry

This section shows controller 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 5760-350.

Other mounting options, including parts kit numbers, are illustrated in *Section 3, System Components*.

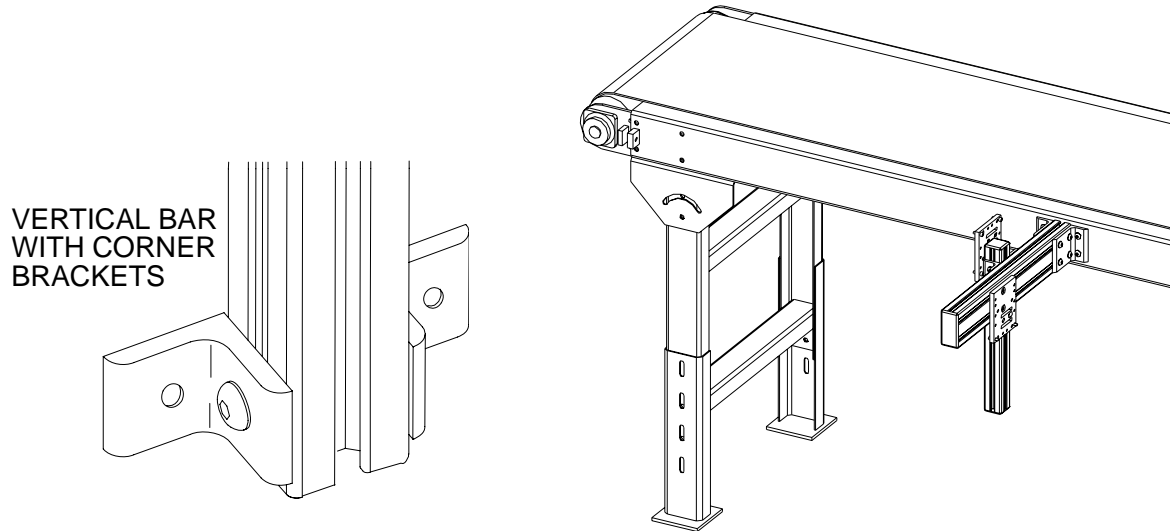
Corner brackets are attached to aluminum bars.



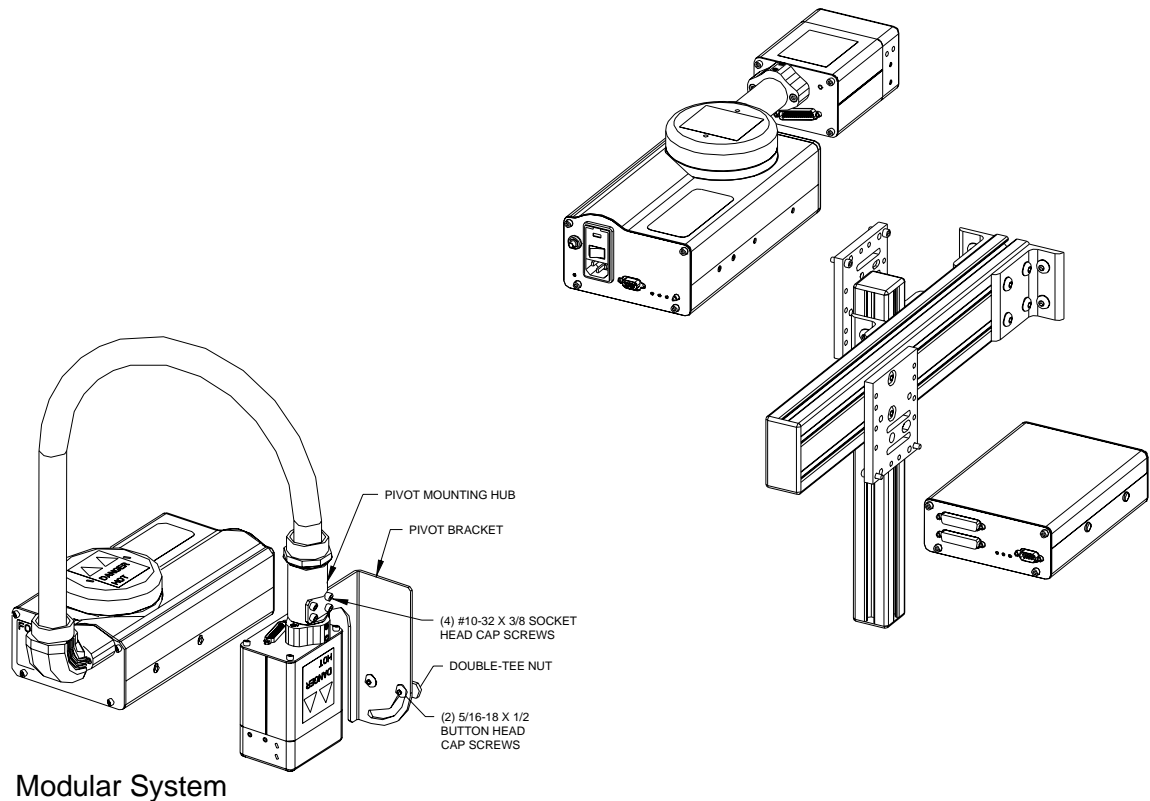
## Print Head Bracketry

This section shows bracketry for a single, conveyor-mounted print head. See *Section 3, System Components*, 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 WJ192 print head to the bracketry with a print head mounting bracket as shown.

The print head must be mounted in close proximity to the product. To maintain consistent print, the head should be mounted 1/8" from the substrate. The WJ192 print head is typically mounted to a conveyor using a mounting bracket, as shown.

Remove the melt tank cap. Place a level on the top of the melt tank and level the WJ192 Print System front to back and side to side.

It may be necessary to vertically adjust each bracket's horizontal bar later to fine-tune message placement. This is especially true when using multiple print heads, as message lines will need to be synchronized with each other.

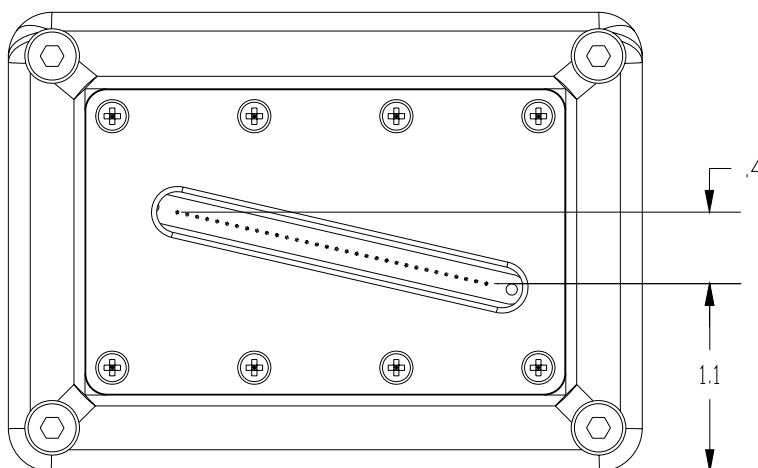


**NOTE:** When adjusting the horizontal bar or print head mounting bracket, always support the print head with your hand to keep it from falling forward onto the conveyor.

Remove the Kapton tape from the print head orifice plate.



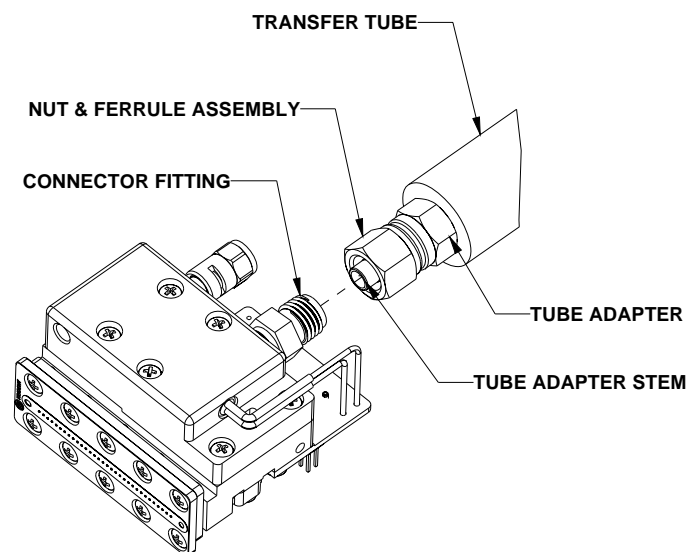
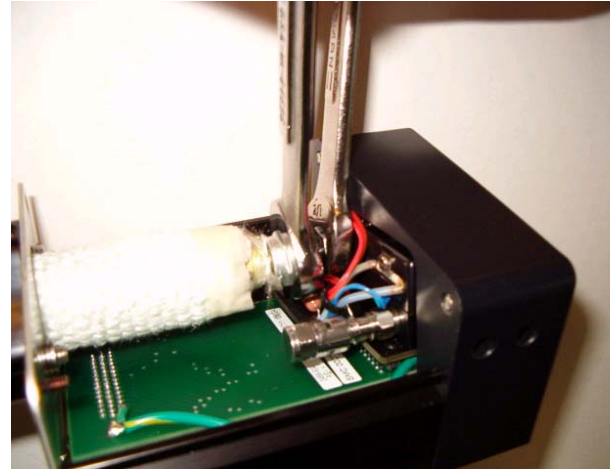
**NOTE:** The WJ192 heads work on gravity and capillary ink feed. The head must be mounted in a level position from front to back or the head will leak.



## Inclined Conveyor Mounting

The WDS system must be mounted level. If the system is mounted to an inclined conveyor, the head can be rotated. To rotate the head:

1. Remove the print head cover.
2. Loosen the transfer tube to the print head connection (nut and ferrule assembly) using 9/16" and 1/2" wrenches. The tube connection must be loosened to rotate the head.



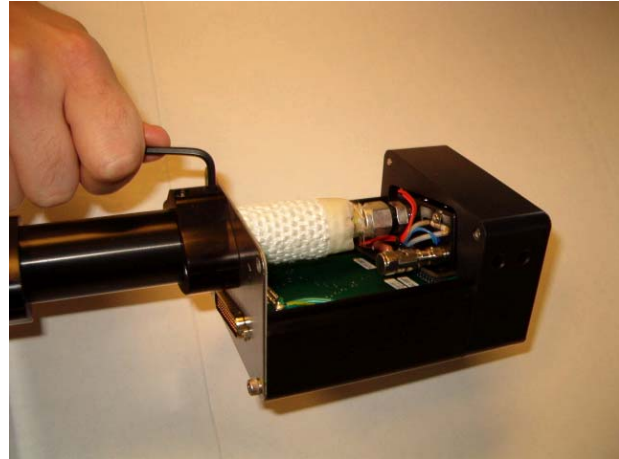
3. Loosen the set screws in the print head mounting bracket.
4. Rotate head to the required print angle and re-tighten the set screws in the print head mounting bracket. Tighten the nut and ferrule assembly until resistance is felt. The fitting should be tightened 1/8 to 1/4 turn past this point.



**CAUTION:** Over-tightening the nut and ferrule assembly may damage the tube adapter and cause the transfer tube to leak. Over-tightening may also cause the tube adapter (front or rear) to disengage and start to un-thread from the transfer tube, causing the transfer tube to leak and the engine to de-prime.

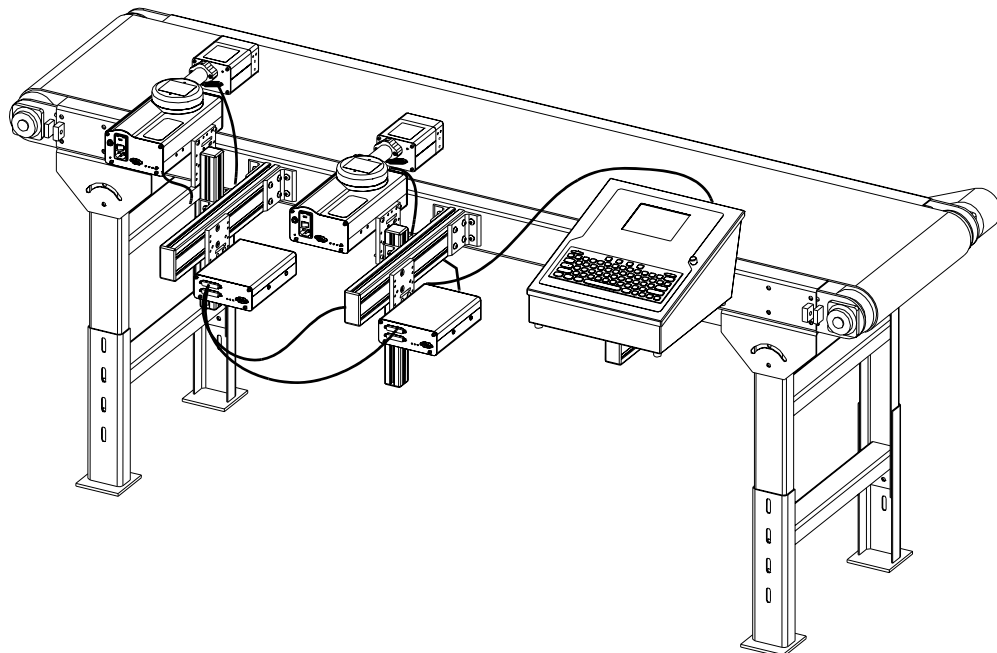


**NOTE:** After the system (WDS and Print Engine) has been turned on and has reached operating temperature, the connection (Transfer Tube to Print Head) should be checked to ensure that the connection is tight and not leaking. (Wax build-up in the connector fitting may prevent the nut and ferrule assembly from being fully tightened while at room temperature.)



5. Replace the print head cover.

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. (This diagram is for reference only.)

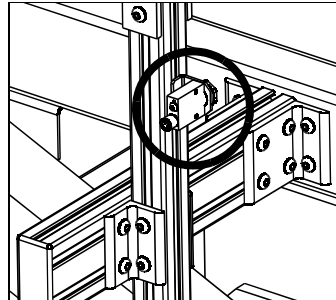


## Mounting the Photosensor

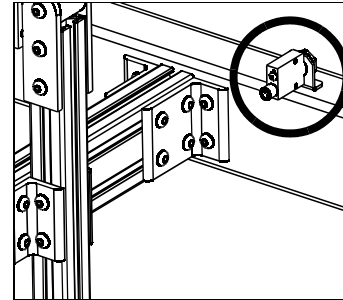
Position the photosensor upstream from the first print head. The maximum distance from the photosensor to the print head is 54 inches.



Print Head Mount



Bracketry Mount



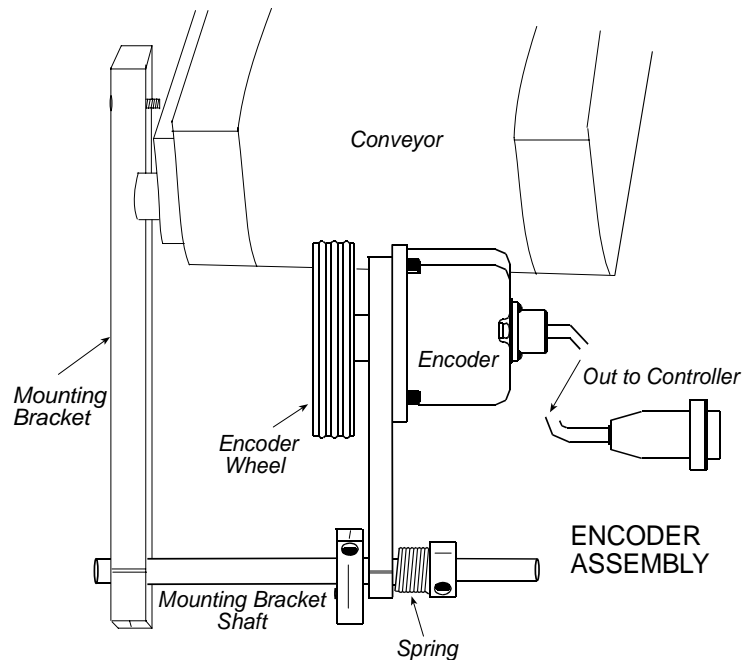
Conveyor Mount

## The Encoder

The encoder (5760-820-IJ) uses a wheel that rolls against the conveyor line 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.

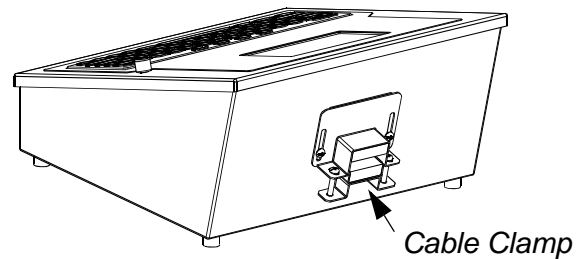
The encoder's mounting bracket is spring-loaded. Adjust the spring collar to ensure that the encoder maintains stable contact with the conveyor.



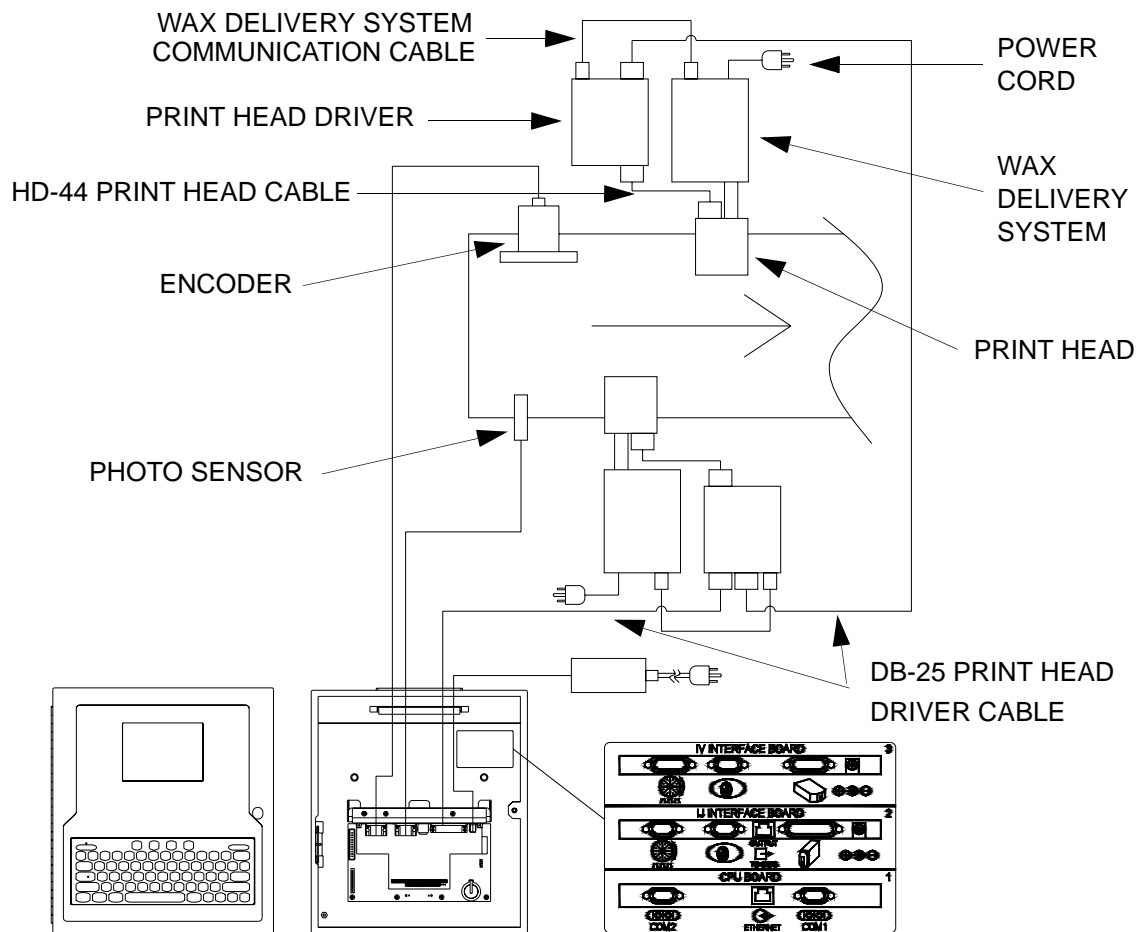
**CAUTION:** Do not jam the encoder wheel against the surface of the conveyor. A radial force of over 40 lbs. will reduce the life of the bearings.

## Electrical Cable Connections

All controller cables must be routed through the strain relief cable clamp in the back of the controller.



1. Refer to the diagram below for typical electrical cable installation and routing.



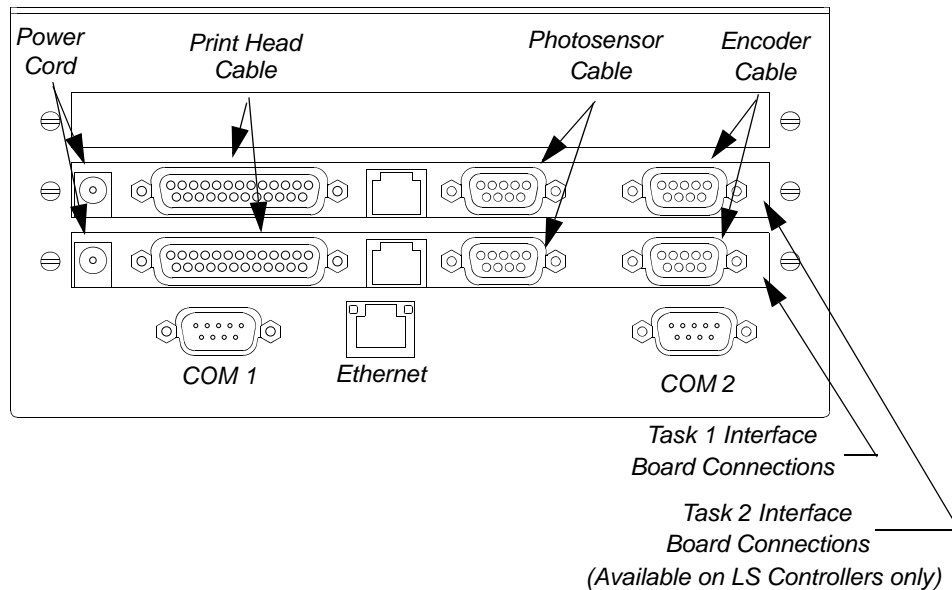
2. Connect the power cord(s), photosensor(s), and encoder(s) to their appropriate sockets.



**NOTE:** To meet CE compliance, each power supply must have a separate, dedicated power line.

3. Connect the print head cable(s) to the appropriate interface board sockets. Route print head cable(s) under the conveyor for connection to the print head(s).
4. Plug both the WDS and IJ3000 power supplies into appropriate outlets.

### **Internal Circuit Board Mounting Plate**



## **Using the Optional Second Interface Board**

The IJ3000 LS ships standard with one or two interface boards. A second interface requires a second power supply to operate. The second interface is only available on the LS Controller.

Print heads connected to the second interface board comprise a separate print station, which is 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 print stations. This is done by connecting the encoder/photosensor to the Task 1 Interface Board and directing Task 2 to share these components with Task 1.

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



## System Startup

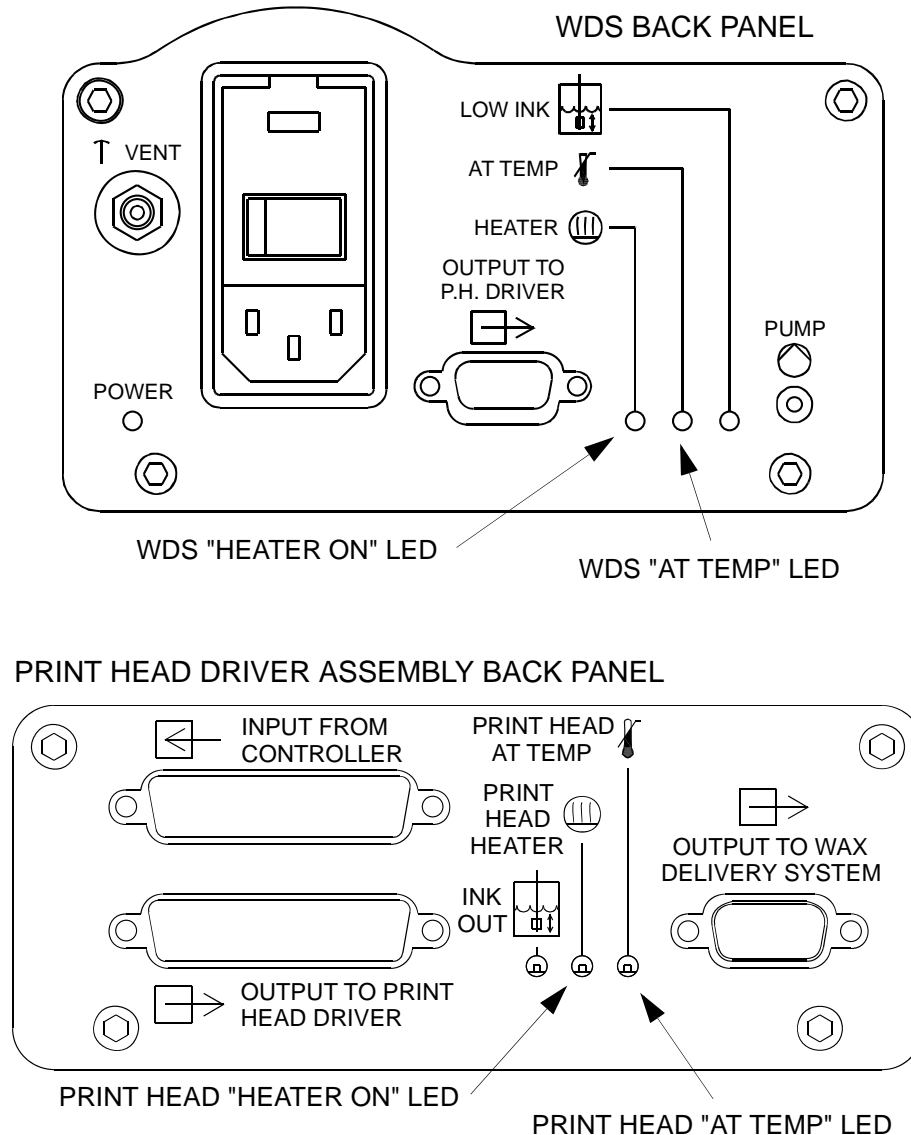
All cable connections should be completed and the print engine shipping caps removed from the print heads prior to turning on the system. Turn on the WDS by placing its power switch in the ON position. The **POWER** LED to the lower left of the power switch lights to indicate power on. The **HEATER** LED also lights indicating the melt tank and transfer tube are heating. See the illustrations below for the location of all LEDs.



**NOTE:** The WDS controls melt tank and transfer tube heating only. The Print Head Driver Assembly controls print head heating.

Turn on the IJ3000 controller by plugging its power cord into an outlet and pushing the **On** button on the keypad. The **PRINT HEAD HEATER** LED on the Print Head Driver Assembly lights indicating the print head is heating.

The system should reach operating temperature within 15 minutes of power on. LEDs on the WDS and Print Head Driver Assembly indicate when the WDS and print head, respectively, are "at temp". After the system reaches operating temperature the **HEATER** LEDs will periodically blink on and off as the heaters turn on and off to maintain system temperatures.



## Adding Wax Refills

Wax needs to be added to the melt tank when the **LOW INK** indicator on the top cover and **LOW INK** LED on the WDS back panel light. Unscrew the melt tank cap, drop in two wax pellets (one in each cavity), and replace the cap, securing it tightly. The **LOW INK** indicators should go out five to seven minutes after wax is added.



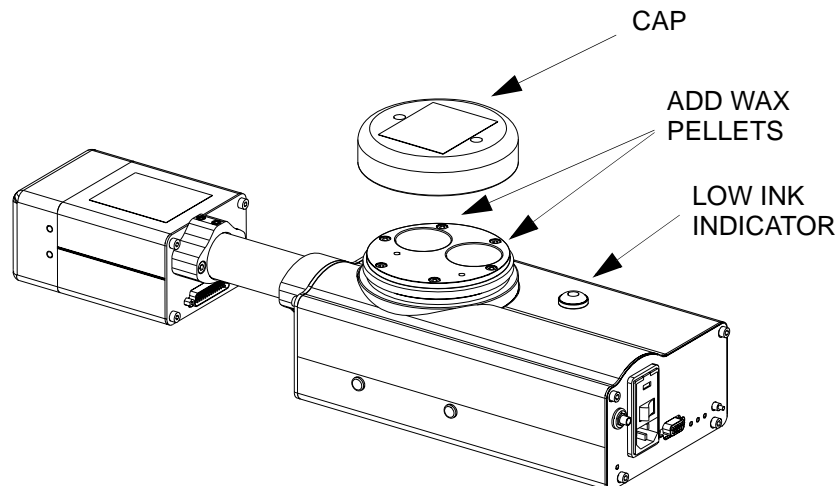
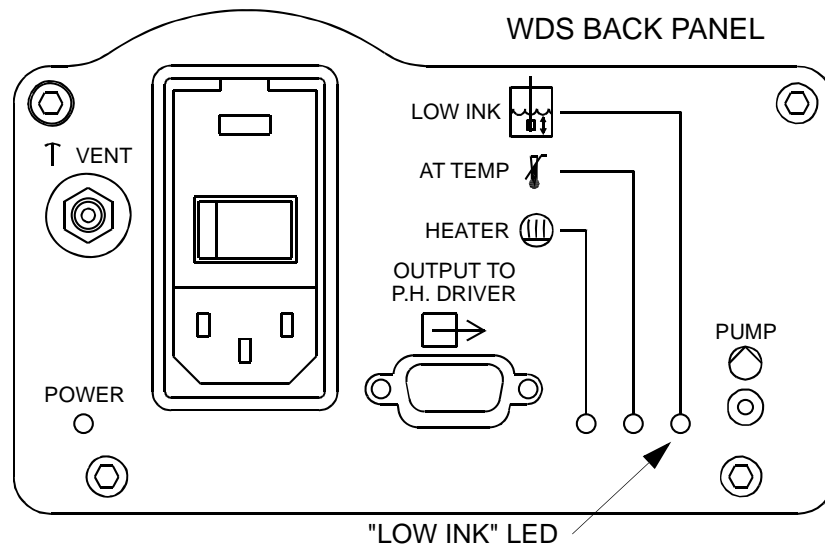
**CAUTION:** The temperature in the melt tank is very hot (100°C). Avoid touching any objects or surfaces, including melted wax, inside the melt tank or its two cavities.



**CAUTION:** Refill the melt tank only when the **LOW INK** indicators come on. Adding wax to the melt tank prior to a LOW INK condition will overfill the tank and cause the print head to weep.



**NOTE:** If the melt tank cap is not sufficiently tight, the print head can not be properly primed.



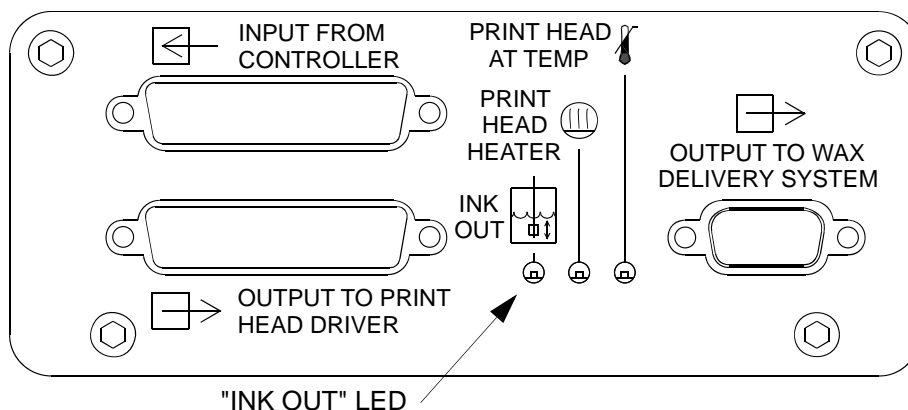
## Ink Out



**NOTE:** An "Ink Out" condition occurs, and printing stops, when wax consumption exceeds 5 mL while printing in an "Ink Low" state. The "Ink Low" to "Ink Out" time is determined by print message size and print rate. Larger print messages and higher print rates produce shorter "Ink Low" to "Ink Out" periods. When printing during "Ink Low", the estimated number of prints remaining until "Ink Out" is displayed on the IJ3000's Status Screen.

The **INK OUT** LED on the back panel of the Print Head Driver Assembly lights to indicate "Ink Out".

**PRINT HEAD DRIVER ASSEMBLY BACK PANEL**



A Warning Tower (5760-395) may be added to the system to provide system status to workers on the production line. The standard warning tower has four lights: green, yellow, red and blue, and is capable of driving an optional Audible Alarm Module (5760-128). The warning tower must be used in conjunction with the IJ3000 I/O Board Kit (5760-392).

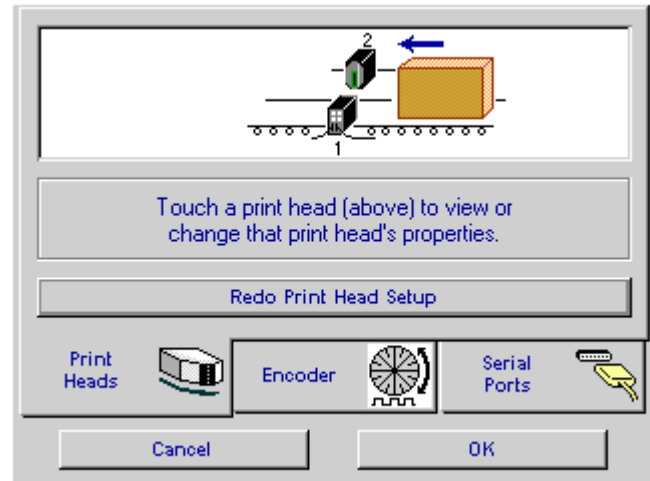
## Configuring the Print Station

### Print Head Setup Screen

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

Screen prompts guide the user 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.

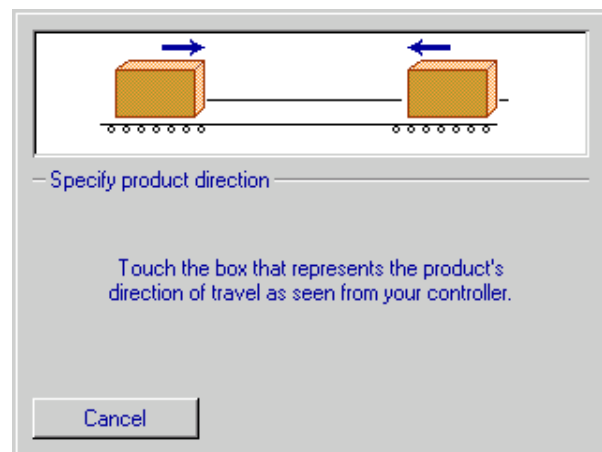
To begin the print head setup procedure, touch the **Redo Print Head Setup** button. The next screen prompts the user to specify product direction.



**NOTE:** The Print Head Setup cannot be redone unless the print buffer is empty, that is, the **Home Screen** message window header indicates "None." A Message Box with the message: "Can not change print head configuration while printing. Please cancel print." is displayed when the **Redo Print Head Setup** button is pressed and the print buffer is not empty.

### Specifying Product Direction

Touch the box that represents the direction the 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 the choices. In the example, one print head has been specified on the near side and one on the far side of the conveyor. Touch the **Next>** button.

## Setting Daisy Chain Order

Both print heads are displayed, and the user is prompted to indicate the first print head in the daisy chain by touching it. (If there is only one print head, this step is bypassed.) Once this is done, the **Print Head Properties** screen appears.



**NOTE:** The first print head in the daisy chain should be the top print head in the system, as this one will be printing the top line of data and will be the first one prompted to enter data.

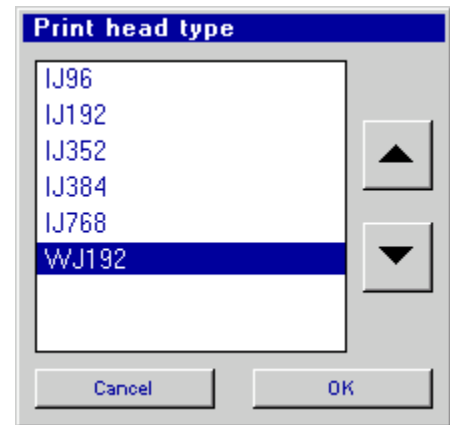
## Defining Print Head Properties

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, the following will need to be defined:

- **Print head types:**

For WaxJet applications, select the WJ192 Print Head.



- **Auto clean:**

Touch the **With auto clean** check box if the print head has the auto clean option. The auto clean option is not available in the WJ192 print head and this control is "grayed out" and non-operational when WJ192 is selected.



- **Maximum print height:**

The WJ192 print head has only one maximum print height selection: 0.4 inches.

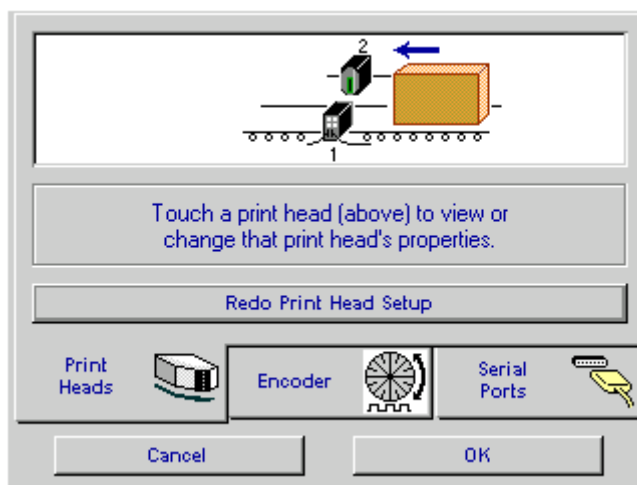


- **Product sensor offset:**

Enter the distance between the photosensor and the print head, in inches. This may need to be fine-tuned after print setup. The maximum offset is 52.74 inches.



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 save the changes and return to the **Home Screen**.

## **Priming the WJ192 Print Head**

Make sure the Kapton tape has been removed from the print head orifice plate.

Power on both the WDS and IJ3000 Controller.

Allow the system to heat to operating temperature as indicated by the **AT TEMP** LEDs located on the WDS and Print Head Driver assembly. Temperature status can also be reviewed on the IJ3000 controller status screen. Check to ensure the system is not low on ink. If the **LOW INK** LED is on, add wax pellets to the WDS. Check to ensure the WDS tank lid has been securely screwed onto the tank.



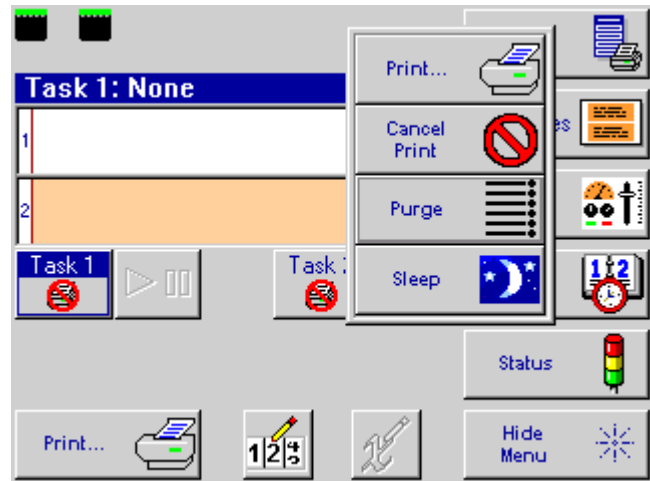
**NOTE:** The print station configuration must be set up on the IJ3000 Controller prior to priming the print heads.



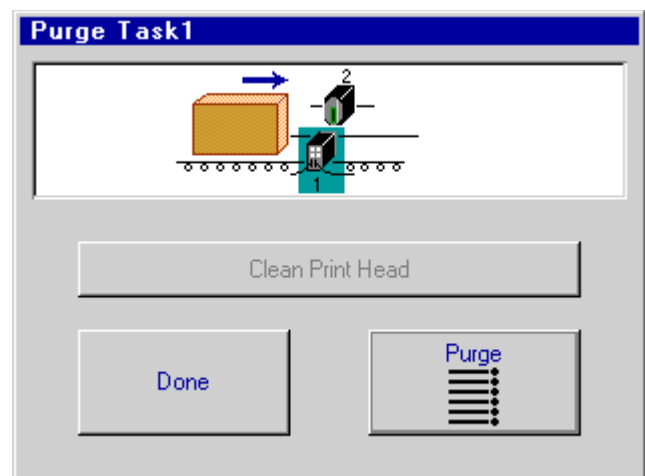
**CAUTION:** The front plate of the print head and the wax are very hot (110 °C). Caution must be used while priming the head.

Wipe the front of the print head with a lint-free wipe. Swipe a print sample while running the print/purge option from the IJ3000 controller:

1. Touch **Print** on the home screen followed by **Purge**.



2. Touch the head to be print tested.



3. Place a lint-free wipe in front of the orifice plate. Touch the **Purge** button while swiping the lint-free wipe vertically in front of the print head. Inspect the print for 32 printed lines. If all 32 channels did not print, system priming is required.





4. Place a lint-free wipe under the head and push the **PUMP** button on the back of the WDS for three to four seconds. Ink will flow from the orifice plate



5. Wipe the excess ink from the front plate with a lint-free wipe. Run another test print using the print/purge feature while swiping a lint-free cloth vertically in front of the head. Inspect for all 32 channels printing. Repeat the priming process and test printing until all 32 channels print.



If all 32 channels will not print after five or more priming cycles, the system may need to be primed using external shop air input. Clean, dry shop air can be applied to the vent port to pressurize the tank and expel air and ink out the orifice plate.

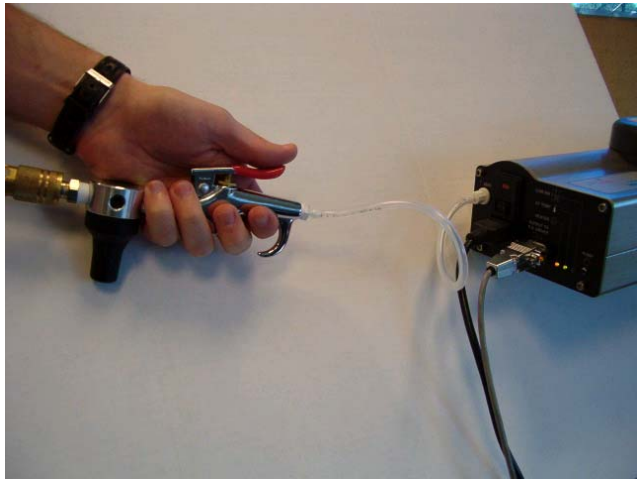


**CAUTION:** Input air must not exceed 15 psi or damage to the print head will occur.



**CAUTION:** Hot ink will likely stream from the orifice plate when using shop air to prime the print head. Use a cloth or paper towels to catch the ink. Avoid spraying ink on yourself or others.

1. The External Air Priming Tool (2466-522) should be used to apply regulated shop air to the system. The air input tool regulates shop air to 15 psi, and incorporates a lever-actuated air switch to apply air pressure to the WDS vent. The output of the priming tool should be connected to the vent fitting with clean, dry shop air connected to the quick disconnect input fitting. Apply three to five second pulses of air to the system.



2. A lint-free wipe must be placed in front of the orifice plate to collect the ink expelled from the front plate.

**Note:** Orifices will likely stream when pressure is applied and a wipe must be in front of the head to collect the ink.



3. Wipe the excess ink from the front plate with a lint-free wipe. Run another test print using the print/purge feature while swiping a lint-free cloth vertically in front of the head. Inspect for all 32 channels printing. Repeat the priming process and test printing until all 32 channels print.

## Controller Operation

This manual covers the IJ3000 System hardware installation. For detailed instructions on the operation of the IJ3000 Controller, refer to the IJ3000 Controller Operations Manual, part number 5760-121. When all heads have been successfully purge tested, the system is ready for programming and printing.

## Section 5: Maintenance

Performing the following recommended maintenance procedures will keep the IJ3000 WaxJet system printing cleanly and efficiently.

### System Maintenance

#### **Filter Replacement and Head Cleaning Required Every 2000 Hours**

The print head filter and orifice plate will require servicing every 2000 hours of operation. The system controller will monitor operation time and notify operator when 2000 hour maintenance is required. The operation time can be seen by reviewing the system status screen on the controller.

Every 2000 hours of operation, the print head filter must be replaced and the orifice plate must be cleaned to ensure satisfactory print. Filter replacement and orifice cleaning are not field service actions. The head must be returned to the OEM for filter replacement and cleaning.

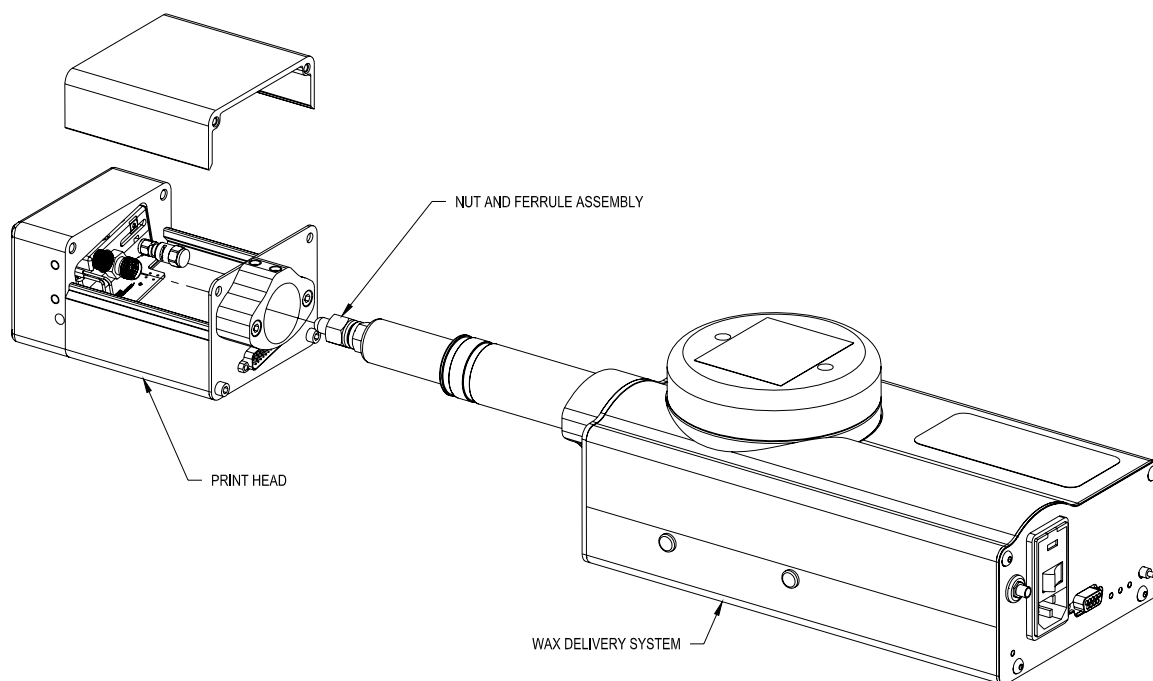
It is recommended that a spare print head assembly be purchased and utilized to minimize system down time during filter replacement. The spare print head assembly is identified as part number 2466-500.



**Always disconnect power when servicing equipment!**



**Let print system cool before servicing!**



- Remove four enclosure screws and cover from print head.
- Loosen the set screws in the print head mounting bracket.
- Loosen the nut and ferrule assembly located directly behind the print head engine connector fitting. (the print head will pull away from the wax delivery system).
- Install the new wax delivery system or print head by reversing the above process.

**Notes:**

1. Insert the tube adapter stem into the print head engine connector fitting. Tighten the nut and ferrule assembly until resistance is felt. The nut and ferrule assembly should be tightened 1/8 to 1/4 turn past this point.
2. Refer to *“Inclined Conveyor Mounting”* on page 20 for print head rotation and *“Priming the WJ192 Print Head”* on page 31 for priming instructions. Refer to the Controller Operations Manual (part number 5760-121) for printing instructions.

**Intermittent (as required):**

- Be sure the photosensor is clean and free of debris.
- Be sure the O-rings (5760-492) on the encoder wheel are present and not worn.
- Be sure the nuts and bolts holding the bracketry in place remain tight.
- Clean melt tank cap seal (using alcohol and a lint-free wipe).
- Ensure melt tank top surface is clean and free of debris.

**Annually:**

- Replace encoder O-rings (5760-492).
- Recalibrate Touch Screen.
- Replace melt tank filter screens (2466-509)

## **Print Head Maintenance**

### **Daily Maintenance**



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

The print head should be cleaned daily. Place a lint free wipe in front of the orifice plate and press the **PUMP** button on the back of the WDS. Wax will flow from the orifice and should be wiped clean. This will keep the orifice plate clean from carton dust and debris, and ensure good print quality.



**Caution:** The orifice plate and wax are very HOT (110°C). Use caution when cleaning the head.

### **Day to Day Operation**

The system should remain powered on for normal day to day operation.

### **Short Term Shut Down**

If the WaxJet system will be idle for one to seven days, it should remain on but be put into the sleep mode. Sleep mode lowers the temperature of the print head and WDS to 90°C, which maintains the viability of the wax and reduces the start up time when printing resumes.

When the system is idle for long periods at operating temperature solvents in the wax evaporate, clogging the orifices in the print head. Sleep mode lowers the temperature to a point at which the wax remains liquid but solvent loss is minimized. A system can remain in sleep mode for up to seven days. Sleep mode is controlled through the Print Menu on the Home Screen.

### **Long Term Shut Down**

If the WaxJet system will be idle for longer than seven days, both the IJ3000 controller and the WDS should be turned off. Power should be removed from the IJ3000 controller.



**NOTE:** When the controller is turned off, power is not removed to the print head. Power to the IJ3000 controller must be disconnected to remove power to the print head.

It takes about 15 minutes for the system to reach operating temperature from a cold start, and the print heads may need to be purged and/or primed as described in *Section 4*.



## Section 6: Troubleshooting

If the IJ3000 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 Tests

#### Purge Test

This test will determine if the print heads are functional.

1. Place a piece of cardboard in front of the print head front plate.
2. Purge the print head according to the Priming Procedure in *Section 4, Installation*.
3. Move the cardboard vertically in front of the print head while channels fire. Inspect printed pattern to determine if all channels are firing correctly.



**NOTE:** Encoder and photocell signals are not required for purging.

4. Purge each head separately to verify each is ready to print.

#### 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 turning on conveyor and tripping photocell.
3. Check for ink on cloth.

Printed dots on cloth indicate that the system is printing. If there is ink on the cloth, but no print on the product, the system may be printing before or after the product passes the print head. Check the product sensor offset settings, product length, or product margins.

No ink on the cloth indicates that the system is not printing. Review system status to determine other possible causes of system not printing, including a test of the photosensor and encoder to ensure operation.

## **Print Quality Troubleshooting**

This section shows examples of various print problems and actions which should be taken to improve the print.

**Problem: Minor fractures in print channels.**

**Possible Cause:** Debris on front plate, air in channel.

**Action:** Purge and wipe orifice plate. Add brushes and positive air flow to minimize debris build-up.



WAXJET 192

**Problem: Missing Channels and Channel fractures in print channels.**

**Possible Cause:** Excessive debris on front plate, air in channel.

**Action:** Purge and wipe front plate. Prime air from head as described in *Section 4*. Add brushes and positive air flow to minimize debris build-up.



WAXJET 192

**Problem: Missing bottom print channels.**

**Possible Cause:** Ink build-up on lower orifices.

**Action:** Wipe front plate.



WAXJET 192

**Problem: Fuzzy Print.**

**Possible Cause:** Print head too far away from substrate.

**Action:** Move print head to within 1/8" from product.



WAXJET 192



**Problem: Occasional mis-aligned print pattern.**

**Possible Cause:** Encoder slipping or bouncing on belt.

**Action:** Tighten encoder on belt; replace encoder o-rings, if required; replace conveyor belt with smooth seamless type belt.

**WAXJET 192**

**Problem: Stretched out, light print, slanted print.**

**Possible Cause:** Incorrect encoder, or incorrect line speed (set too low) if using internal encoder.

**Action:** Check for correct encoder (must use Diagraph Encoder, part number 5760-331).

**WAXJET 192**

**Problem: Short image, dark print, slanted print.**

**Possible Cause:** Incorrect encoder or wheel size, or incorrect line speed (set too high) if using internal encoder.

**Action:** Check for correct encoder (must use Diagraph Encoder, part number 5760-331).

**WAXJET 192**

**Problem: Backwards print or print severely slanted.**

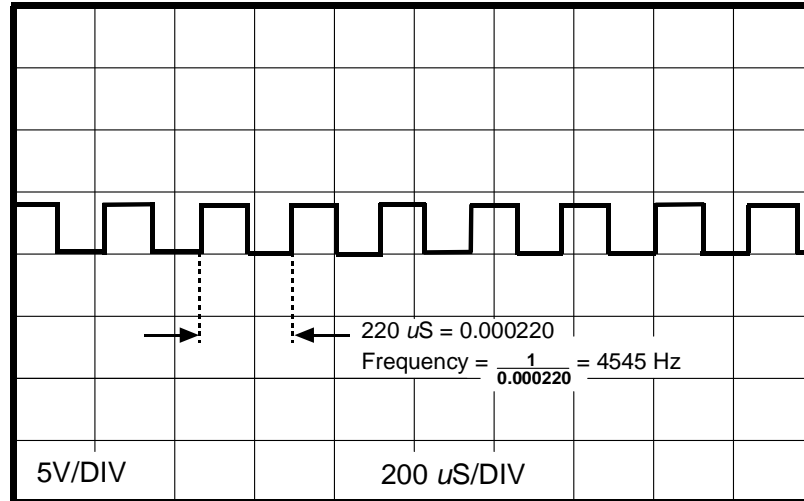
**Possible Cause:** Incorrect print direction specified in set-up.

**Action:** Re-do print head set-up to specify correct direction.

**WAXJET 192**

## Encoder Functional Testing

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



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 5760-331 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 and compare it to the expected value.

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

Connect a scope ground to TP4 on the interface board. Connect the voltage probe to TP23. The 5760-331 encoder has a resolution of 300 dots per inch. Set the vertical resolution of the scope to 5 volts per division and set the horizontal resolution to 1 millisecond.

Evaluate the waveform as follows:

Review the 5-volt square waves, as in the illustration above. These waves generally compress and expand across the width of the display at regular, rhythmic intervals. If they 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 there is a question on the difference between rhythmic and intermittent sporadic appearance of the 5-volt square waves, and the 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.

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 encoder 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 calculated.

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.

## Photosensor Sensitivity Test

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

1. Place object approximately ¼ inch in front of photosensor; photosensor should sense object.
2. Place object near the center of the guide rails; photosensor should sense object.
3. Place object on far guide rail; photosensor should not sense object.
4. Check that objects on the far side of 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 procedure, see *Section 4, Installation*.



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

## Wax Delivery System Troubleshooting

### WDS System Diagnostics Overview

To ensure that the WDS is functioning properly, a system integrity test is performed every time the Wax Delivery System (WDS) is turned on. This test checks for and detects open thermistors, cross-connected thermistors and failed heating elements, and may take several minutes to complete.

The test first checks the temperature of the melt tank and transfer tube. If either is above 50°C, the rest of the test is skipped and normal operation begins. (Such a system is assumed to have been recently operating, and to have successfully passed the test on a previous power-up.) Otherwise the test continues as follows:

1. Melt tank heater verification (checks for proper heater operation).
2. Melt tank thermistor verification (checks for open thermistor, and thermistor cross-wired with the transfer tube thermistor).
3. Transfer tube heater verification (checks for proper heater operation).
4. Transfer tube thermistor verification (checks for open thermistor).

During the test, the **POWER** LED is on steady and the **HEATER** LED flashes at a once per second rate. When all checks are successfully completed, normal operation begins: the **POWER** LED remains on, and the **HEATER** LED turns on steady until operating temperature is reached, at which time it cycles on and off with the heaters. Also during normal operation an open thermistor check is performed every two seconds.

If a fault is detected either during the power-up test, or later while the WDS is operating, the **POWER** LED goes out, the **HEATER** LED turns on steady, and all heaters are shut down. The WDS will remain in this state until it is turned off.



**NOTES:**

1. Refer to *Section 3* of this manual for detailed information on the configuration of the Wax Delivery System, its components, and how they are controlled.
2. If a Heating Zone has a blown thermal fuse, the Diagnostics Program will see this as a failed heating element and enter into a fault condition.
3. Dipswitch #1 (SW1) on the Thermal Control Board Must Always Be Set To "On". If it is set to the "Off" position, the diagnostics program will report a fault that is non-existent.

Top Level Problem	Possible Component Failure	Replacement Kit Part Number
<b>IJ3000 Controller</b>	24VDC Power Supply	5760-333
	Touch Screen / Display Assembly, 5.7"	5760-305
	Touch Screen / Display Assembly, 10.4"	5760-836
	Keypad Assembly, IJ3000 LS	5760-301
	Keypad Assembly, IJ3000 ES	5765-201
	Impulse Jet Interface Board	5760-332
	CPU Board	5760-303
	CPU to Display PCB Cable, 30 Conductor	5760-713
	CPU to Display PCB Cable, 40 Conductor	5760-746
<b>Wax Delivery System</b>	Prime Pump	2466-521
	Thermal Control Board	2466-520
	120VAC Melt Tank Cartridge Heater	2466-514
	230-240VAC Melt Tank Cartridge Heater	2466-515
	120VAC Transfer Tube Cartridge Heater	2466-516
	230-240VAC Transfer Tube Cartridge Heater	2466-517
	Melt Tank Thermal Fuse Cable Assembly	2466-518
	Transfer Tube Thermal Fuse Cable Assembly	2466-519
	Filter Screens	2466-509
	Wax Low Indicator	2466-532
<b>Print Head Driver Assembly</b>	Print Head Driver Board	2466-510
<b>WaxJet Print Head</b>	Trident Print Engine, WaxJet 192/32, SolidJet	2466-508
	Interconnect Board, WaxJet Print Head	2466-503

## Wax Delivery System

System Symptom	Possible Cause	Operational Test Method
Wax Delivery System Will Not Turn On	Power Cable	Ensure that the WDS Power Cable is connected to the power input module and is not damaged. Ensure that the WDS Power Cable is connected to an electrical outlet and that the outlet is supplying the proper voltage.
	Fuse	Disconnect the power cable from the power input module, remove and inspect the fuses, replace if necessary. If the fuse blows repeatedly, turn off the WDS and remove the power cord. Remove the top from the WDS and locate and unplug the cables connected to J6 and J7 on the Thermal Control Board. (See <i>Appendix A: System Specifications</i> for a diagram of the Thermal Control Board.) Check the system's heaters by using an ohmmeter to measure the resistance between the pins of the cable connectors (not the connectors on the board) as listed in the table below. A resistance reading substantially lower than listed in the table indicates a bad cartridge heater. Pins 3 & 4 of J6, and 5 & 6 of J7 are wired to thermal fuses and will normally give a reading of two ohms or less. If the heaters test good, measure the resistance between each of the cable connector pins and ground pin of the AC input connector. Any reading other than "open" indicates a problem with the heater harness.

Connector & Pins	Heater Location	Resistance
J6, Pin 1 & Pin 2	Transfer Tube	220 ohms, 120 volt systems 880 ohms, 240 volt systems
J7, Pin 1 & Pin 2	Melt Tank	111 ohms, 120 volt systems 470 ohms, 240 volt systems
J7, Pin 3 & Pin 4	Melt Tank	111 ohms, 120 volt systems 470 ohms, 240 volt systems

<b>System Symptom</b>	<b>Possible Cause</b>	<b>Operational Test Method</b>
Wax Delivery System Will Not Turn On (continued)	Internal AC Power Cable	Turn the WDS off and remove the power cord. Take the top off the WDS and locate and inspect the cable that runs from the Power Entry Module to the Thermal Control Board. Replace the cable (Part No. 2466-129 for 120V systems or 2466-177 for 230V systems) if there are broken or loose crimp connections on any of the cable's wires.
	Thermal Control Board	If above tests have been successfully completed, and the WDS still does not turn on, the Thermal Control Board should be replaced.
After Turning the WDS On, the Power LED Turns Off, but System Heating LED Remains Lit	Thermal Control Board CPU Setting	Verify that Dipswitch #1 (SW1) on the Thermal Control Board is set to "On". If it is set to the "Off" position, the WDS System Diagnostics Program will report a fault that is non-existent.
	Melt Tank Heater(s)	<b>(CAUTION: Exposed High Voltage - Use Extreme Caution. This procedure should only be performed by a trained technician).</b> Review The WDS System Diagnostics Overview Above. Identify LED1 through LED6 on the Thermal Control Board (see <i>Appendix A: System Specifications</i> for a diagram of the Thermal Control Board). Connect the power cable to the power input module and turn the WDS on. The Diagnostics program will check the system integrity as stated above, starting with the Melt Tank Heater Zone. As the test progresses, LED1 and LED2 will be lit. If the system goes into a fault condition, the Power LED will go out and the System Heating LED will turn On solid. This denotes that the fault lies in the Melt Tank Zone. If LED3 and LED4 turn on (denotes that the Melt Tank Zone Passed Diagnostics Testing) and the fault condition occurs, the fault is in the Transfer Tube Heating Zone.
	Melt Tank Thermal Fuse	
	Transfer Tube Heater	
	Transfer Tube Thermal Fuse	
	Melt Tank Thermistor	
	Transfer Tube Thermistor	Turn the WDS off and remove the power cable from the power input module. Locate J6 and J7 on the Thermal Control Board. Disconnect the wiring harness of the failed heater zone. Using a Multimeter, check continuity of the heater(s) and the thermal fuse. An open condition on any component denotes a failed component. If all components check "OK", locate J9 and J10 on the Thermal Control Board. Carefully disconnect the wiring harness from the failed Heater Zone. Using a Multimeter, check continuity of the Thermistor. An open condition denotes a failed component. If the Thermistors do not show any failures, trace the component wiring back to the Melt Tank / Transfer Tube. If the components were cross-wired, the diagnostics program will detect it and enter a "Fault" condition.

System Symptom	Possible Cause	Operational Test Method
Wax Delivery System Will Not Heat (Controller Reports WDS as "Not at Temperature")	Controller Setting	Ensure that the Print System is not in "Sleep Mode" (Power LED blinks In Sleep Mode). If the system is in "Sleep Mode", wake the system up via the IJ3000 controller and wait until the system reaches operating temperature (approximately five minutes).
	Communications Cable	If the controller shows that the system is not in sleep mode, but the Power LED is blinking, check the communications cable (DB9) located at the back of the WDS. If the cable is unplugged at the WDS or at the IJ3000 Controller, the WDS will enter "Sleep Mode." Reconnect the cable and wait until the system reaches operating temperature (approximately five minutes).
Cannot Prime System	System Temperature	Ensure that the WDS is "At-Temperature" and not in "Sleep-Mode," as the System Priming is disabled until the Print System reaches operating temperature.
	Ink Level	Ensure that the system is not in a "Low-Ink" or "Ink-Out" condition. System Priming is disabled if the system is in either of these conditions.
	Melt Tank Cap	Verify that the Melt Tank Cap is securely fastened. WDS Priming is achieved by pressurizing the Melt Tank. If the Melt Tank Cap is not on or secured, the system will not be able to pressurize the melt tank.
	Melt Tank Cap Seal	Remove the Melt Tank Lid and inspect the seal located inside the cap. The seal should be clean and free from debris. If debris is noted, remove the seal and clean it and the surfaces inside the cap where the seal is retained with alcohol and a lint-free wipe.
	Purge Melt Tank Sealing Surface	Inspect the top of the Melt Tank. The seal inside the Cap compresses against this surface to form a seal. If any wax build-up or debris is noted, clean the surface with alcohol and a lint-free wipe.
	Vent Port(s)	There are two small (1/4" diameter) ports located in the top of the Melt tank. If any wax build-up or debris blocks these ports, the system will be unable to fully pressurize the Melt Tank, and priming / purging will be impacted. Clean the surface with alcohol and a lint-free wipe.

<b>System Symptom</b>	<b>Possible Cause</b>	<b>Operational Test Method</b>
Ink Low Indicator Will Not Turn Off (After Adding Wax Pellets)	Vent Port(s)	There are two small (1/4" diameter) ports located in the top of the Melt Tank. If any wax build-up or debris blocks these ports, a pressure bubble may form inside the Melt Tank reservoir area. Clean the surface with alcohol and a lint-free wipe.
Ink Low Indicator Will Not Turn Off (After Adding Wax Pellets) (continued)	Thermal Control Board	Locate the Thermal Control Board inside the Wax Delivery System. Identify J4 (Cap Off) on the Thermal Control Board (see <i>Appendix A: System Specifications</i> for a diagram of the Thermal Control Board). This header has a jumper installed on it. If the Jumper has been accidentally removed for any reason, the WDS will report a false "Low-Ink" condition.
Message Degrades / Fades Away (Loss of Print Channels)	Vent Port(s)	Remove the Melt Tank Lid and inspect the top of the Melt Tank. There are two small (1/4" diameter) ports located in the top of the tank. If any wax build-up or debris blocks these ports, the print head print quality will be degraded, and may cause loss of print channels (Starvation). Clean the surface with alcohol and a lint-free wipe.
	System Vent	Locate the "Vent" Luer Fitting on the back panel of the WDS. If a Luer Cap has been placed onto the fitting, remove it and/or clear any obstruction.



## Print Head

System Symptom	Possible Cause	Operational Test Method
Print Head Will Not Reach Operating Temperature	Print Head Cable	Check the Print Head Driver Cable and the HD-44 Print Head Cable and ensure connections to the Print Head Driver Assembly and IJ/3000 Controller. See <i>Section 4</i> for I/O Cable and Print Head Cable connections.
	Print Head Driver Assembly	Remove cover and check voltage at TP-8; it should be 30 - 36VDC.
	Trident Print Engine	The WaxJet Print Head operates at 115° Celsius. The Head should be extremely hot, and care should be exercised when troubleshooting. Check the Print Head thermal fuse and cartridge heater. The thermal fuse resistance should be <1 ohms and the cartridge heater should be 25 - 28 ohms.
One or More Channels Will Not Fire After Multiple Prime Cycles	Air in Print Head	Air in the Print Head is the most likely cause of missing channels. Refer to <i>Section 4</i> for priming procedures.
	Debris in Print Head	Debris on the Print Head Front Plate can cause missing channels. Refer to <i>Section 4</i> for priming procedures.
Print is extremely faint with small, widely spaced dots - or - Print has diagonal light and dark stripes	Print Head Driver Board lost its programming.	Reset the IJ3000 Controller by simultaneously pressing the <b>Ctrl</b> , <b>Alt</b> and   (power on) keys. If that doesn't restore normal print, replace the Print Head Driver Board.



## Appendix A: System Specifications

### Print Head and Wax Delivery System

#### Size

L: 19.57 " (497.1mm)

W: 5.5" (139.7mm)

H: 4.37" (111.0mm)

Weight: 10.7 lb. (4.9kg)

#### Operating Temperature:

Print Head: 110°C

Transfer Tube: 110°C

Melt Tank: 100°C

#### Enclosure

Anodized aluminum

#### Electrical

##### Input Power

Domestic: 120VAC, 3A, 60Hz

European: 230/240VAC, 1.5A, 50/60Hz

##### Input Module

On/Off switch with EMI filter

UL/CE recognized

##### I/O Port

DB-9 female connector

#### Print Speed

Up to 300 fpm, depending on printed message and horizontal resolution

Up to five images/second

#### Print Resolution

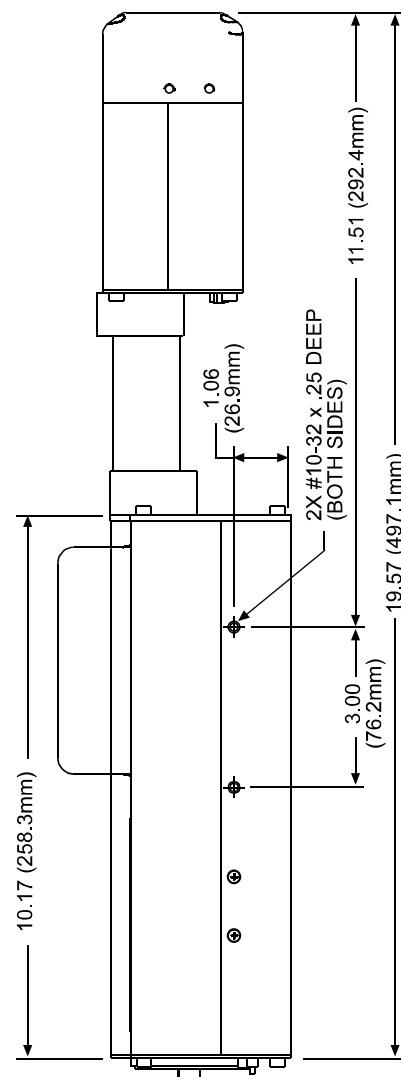
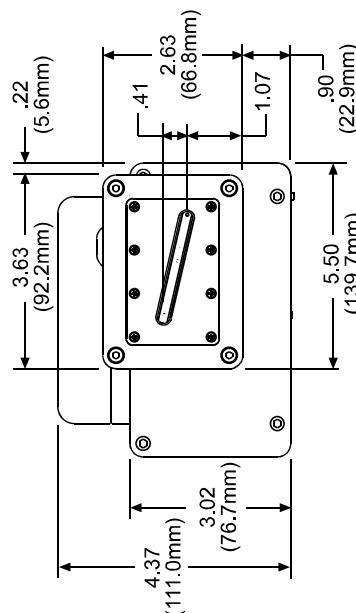
WJ192 Head: 32 addressable channels, 0.4" solid print height

#### Throw Distance

Up to 1/2" (1/8" recommended for consistent print quality)

#### Ink Type

Wax Based, solid ink. Melt temperature of 60 to 65°C



**Preventative Maintenance**

Print Head Filter Replacement is required every 2000 hours of operation

**Environment**

Ambient operating temperature: 40°F to 104°F (5°C to 40°C)

Operating humidity: 5 to 90%, non-condensing

**Certifications**

Meets UL/CE/CSA standards

**I/O Port**

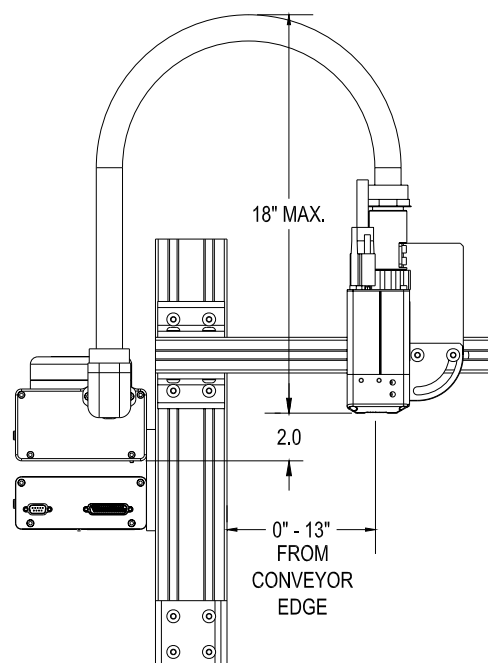
Wax Melt System 9-Pin D-Sub Connector Pin-Out

**Pin # Signal - Description**

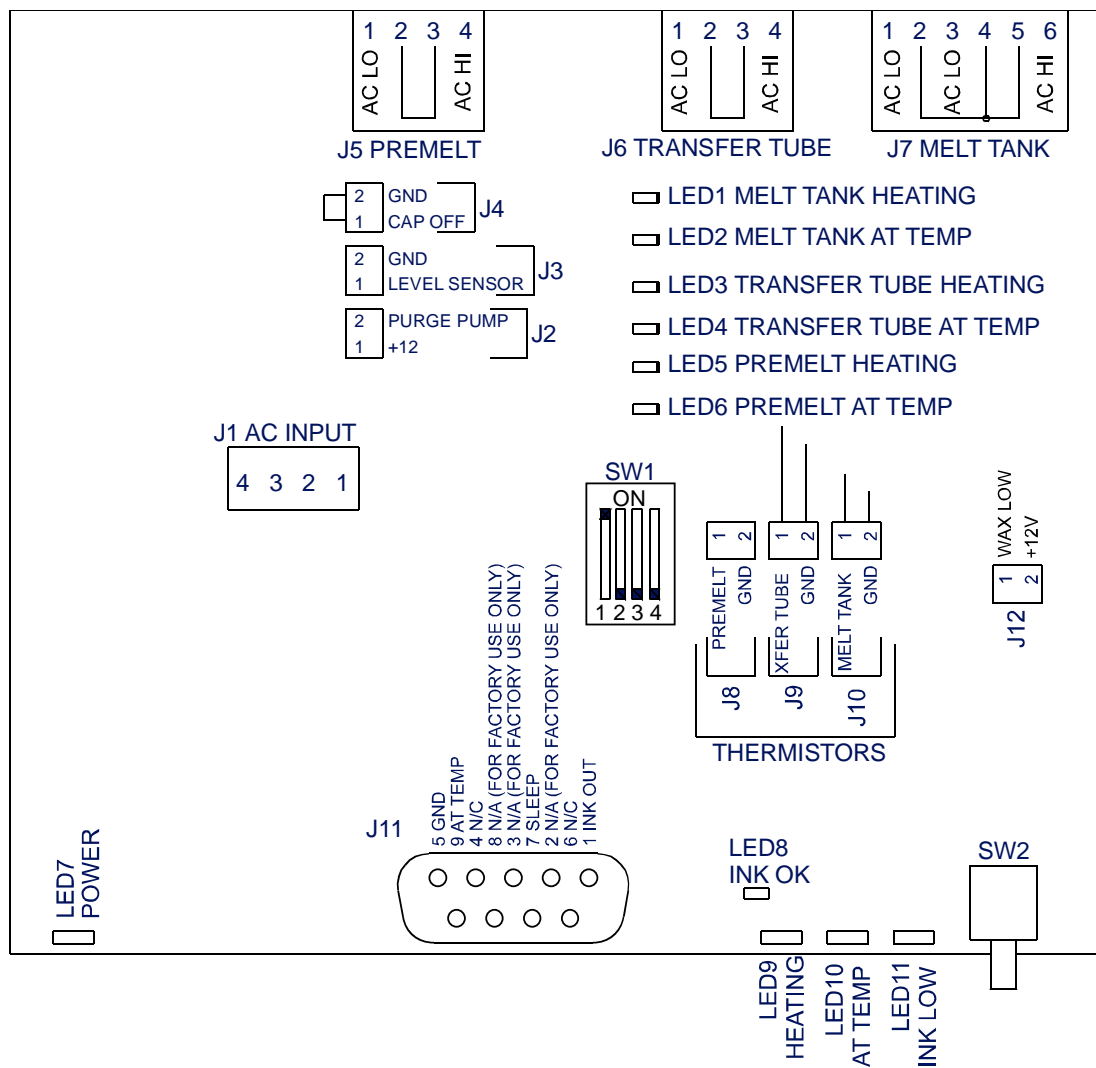
- |    |   |
|----|---|
| 1  | Ink Low - Opto-isolated open collector output; HIGH = wax level low, LOW = wax OK. There is a 100-ohm series resistor on this signal line in the wax melt system. |
| 2  | N/A - RS-232 level output; make no connection.  |
| 3  | N/A - RS-232 level input; make no connection.   |
| 4  | No connection.  |
| 5  | GND   |
| 6  | No connection.  |
| 7* | Sleep Mode - RS-232 level input; HIGH (> 3V) = Operate, LOW (0V) = Sleep Mode.  |
| 8* | N/A - RS-232 level output; make no connection.  |
| 9  | At Temp - Opto-isolated open collector output; HIGH = not at temp, LOW = at temp. There is a 100-ohm series resistor on this signal line in the wax melt system.  |



**\*NOTE:** Shorting Pins 7 & 8 will disable "Sleep Mode" functionality.

**Modular System**

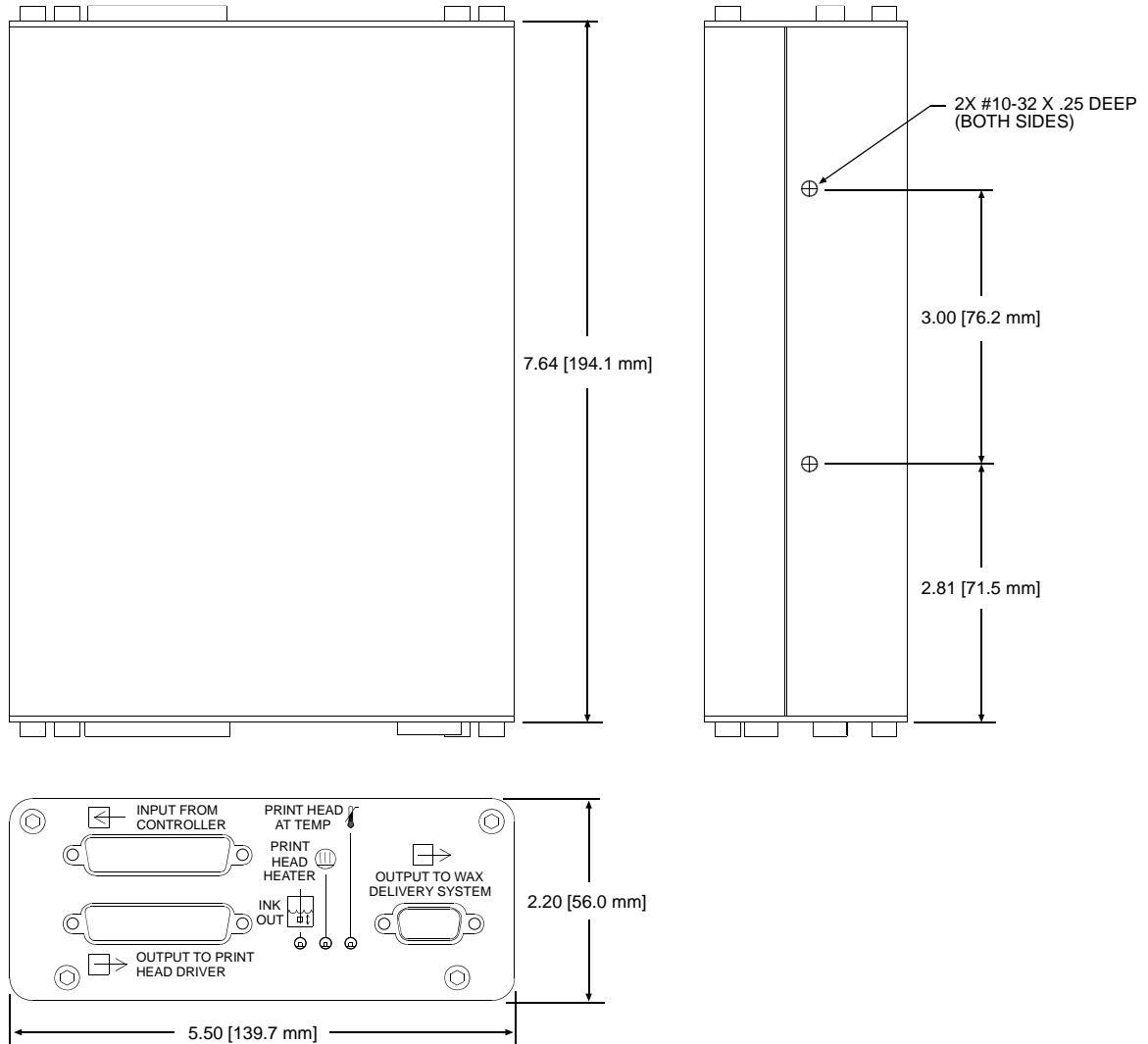
## WDS Thermal Control Board





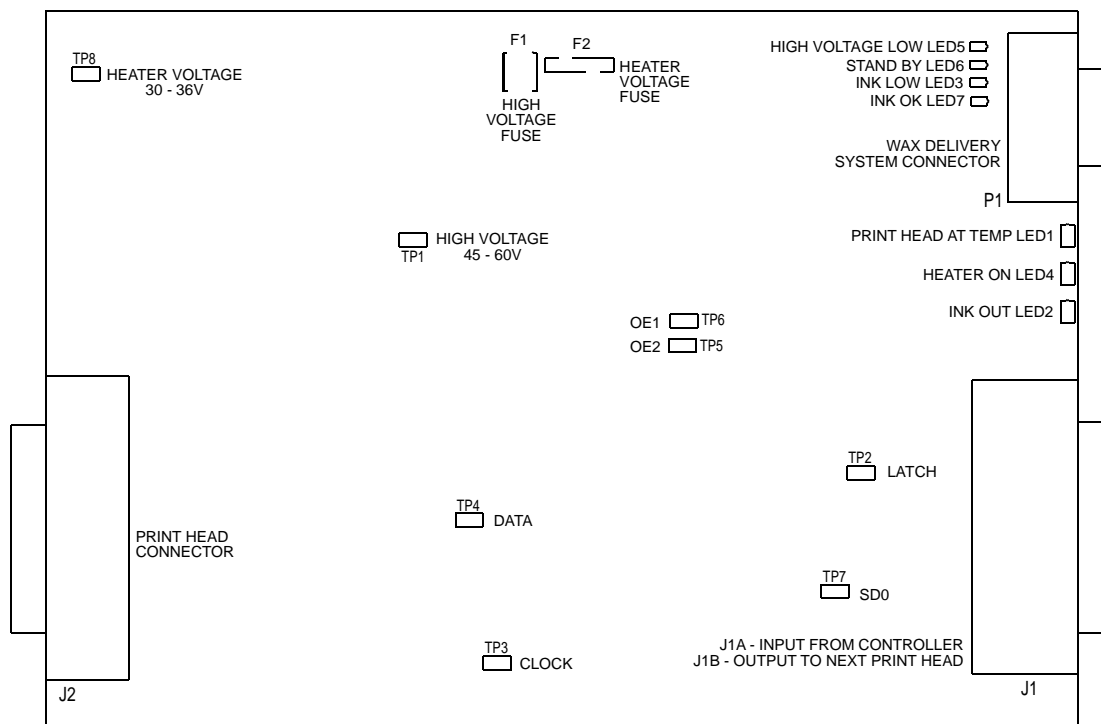


## WJ192 Print Head Driver Assembly

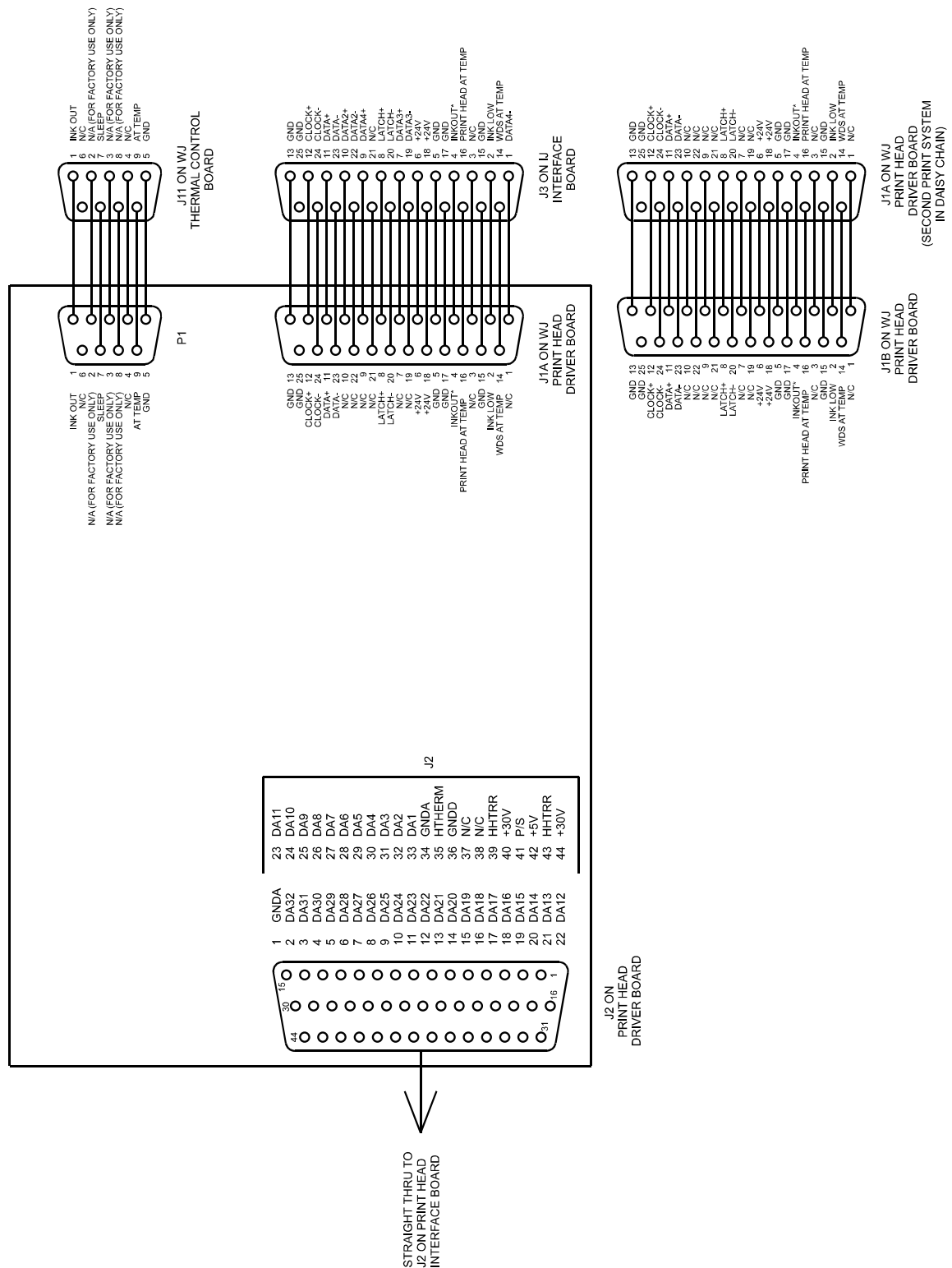




## Print Head Driver Board



## WJ192 Print Head Driver Board Diagram



## Appendix B: Parts and Supplies

### Consumables

#### Solid Ink

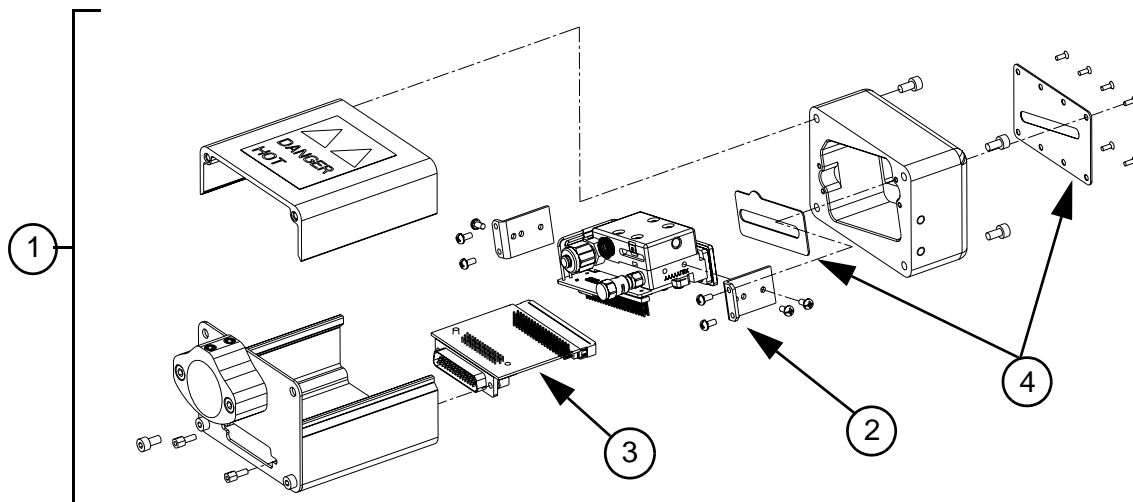
The following ink is currently offered by Diagraph. A Diagraph sales representative can advise the proper ink for a particular application.

Part No.	Description	Type	Color	Size
001-0868-01	Ink, SolidMark	Wax Based, Dye	Black	(32) 20 mL Pellets

### Parts in Kits

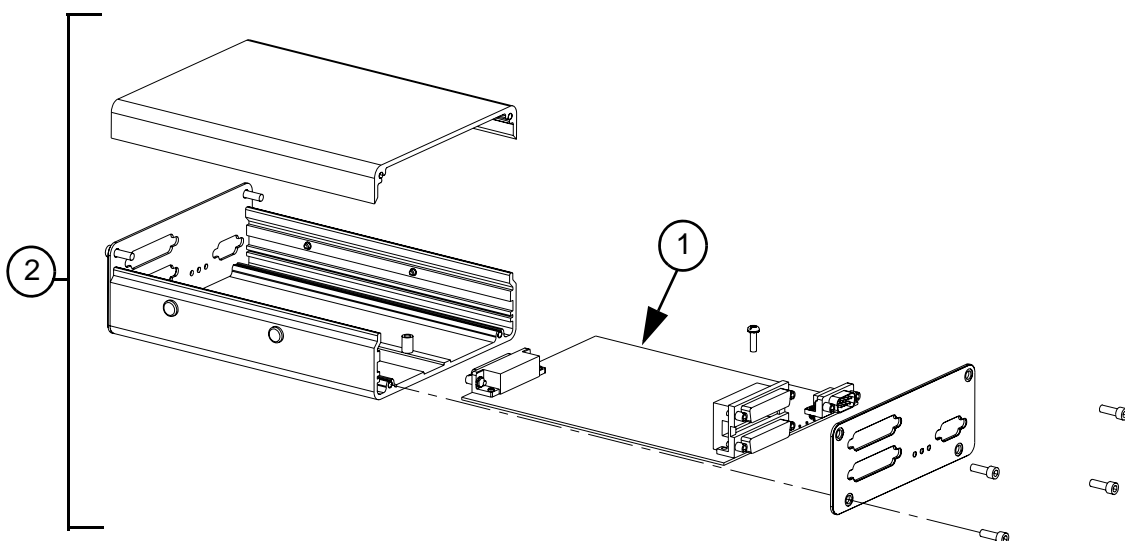
Part #	Description
5760-301	Keypad Kit
5760-303	CPU PCB Replacement Kit
5760-305	Color Display Replacement Kit
5760-332	Impulse Jet Interface Board Replacement Kit
5760-333	24 VDC Power Supply Kit
5760-334D	Impulse Jet Interface Board Upgrade Kit (Domestic)
2466-500	Kit, Replacement, Print Head, WaxJet
2466-501	Print Head Driver Board
2466-503	Kit, Replacement, Interconnect PCB and Cable
2466-504	Kit, Melt Tank Replacement, 115V
2466-505	Kit, Melt Tank Replacement, 230V
2466-506	Kit, Transfer Tube Replacement, 115V
2466-507	Kit, Transfer Tube Replacement, 230V
2466-508	Kit, Print Engine Replacement, WJ192
2466-509	Kit, Filter Screen Replacement
2466-510	Print Head Driver Assembly
2466-512	Kit, Wax Delivery System Replacement, 115V
2466-513	Kit, Wax Delivery System Replacement, 230V
2466-514	Kit, Heater, Melt Tank Replacement, 115V
2466-515	Kit, Heater, Melt Tank Replacement, 230V
2466-516	Kit, Heater, Transfer Tube Replacement, 115V
2466-517	Kit, Heater, Transfer Tube Replacement, 230V
2466-518	Kit, Thermal Fuse, Melt Tank Replacement
2466-519	Kit, Thermal Fuse, Transfer Tube Replacement
2466-520	Kit, Thermal Control Board Replacement
2466-521	Kit, Prime Pump Replacement
2466-522	Kit, Maintenance, External Prime Tool & Spanner Wrench
2466-526	Kit, Fuse Replacement, 120VAC Systems
2466-527	Kit, Fuse Replacement, 230-240VAC Systems
2466-531	Kit, Replacement, Print Head, Seal Plate and Gasket
2466-532	Kit, Wax Low Indicator

## Print Head Assembly Kits



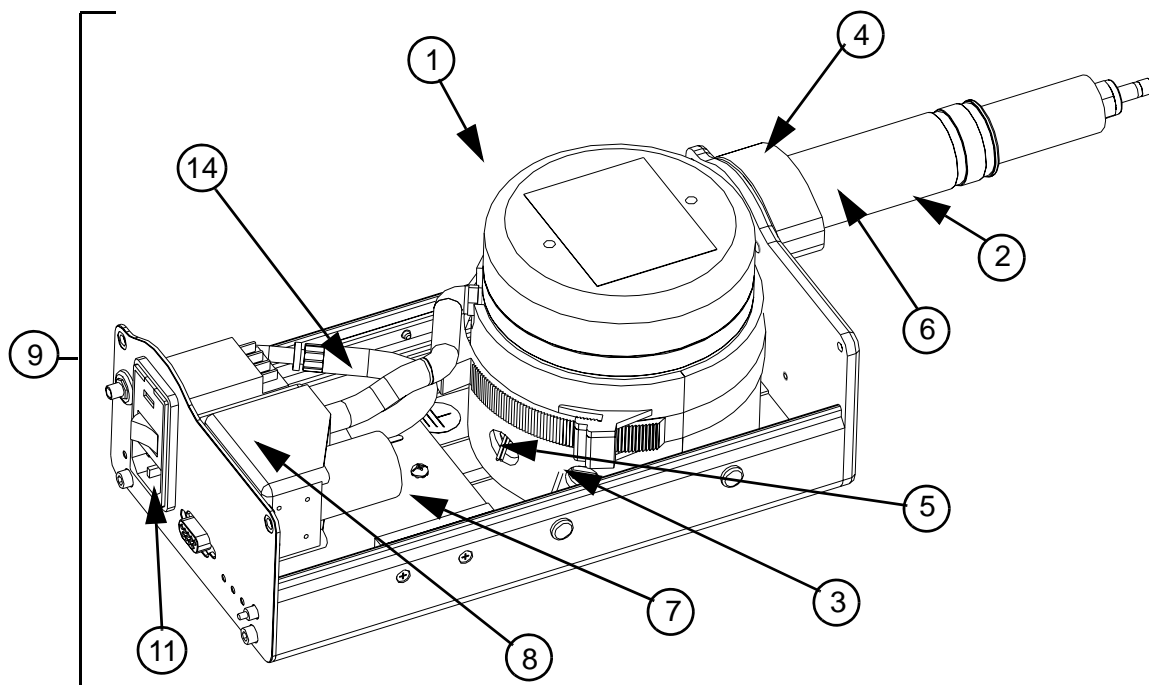
ITEM	PART NO.	DESCRIPTION
1	2466-500	Kit, Replacement, Print Head, WaxJet
2	2466-508	Kit, Print Engine Replacement, WJ192
3	2466-503	Kit, Replacement, Interconnect PCB and Cable
4	2466-531	Kit, Replacement, Print Head, Seal Plate and Gasket

## Print Head Driver Assembly Kits



ITEM	PART NO.	DESCRIPTION
1	2466-501	Print Head Driver Board
2	2466-510	Print Head Driver Assembly

## WDS Assembly Kits



ITEM	PART NO.	DESCRIPTION
1	2466-504	Kit, Melt Tank Replacement, 120V
	2466-505	Kit, Melt Tank Replacement, 230-240V
2	2466-506	Kit, Transfer Tube Replacement, 120V
	2466-507	Kit, Transfer Tube Replacement, 230-240V
3	2466-514	Kit, Heater, Melt Tank Replacement, 120V
	2466-515	Kit, Heater, Melt Tank Replacement, 230-240V
4	2466-516	Kit, Heater, Transfer Tube Replacement, 120V
	2466-517	Kit, Heater, Transfer Tube Replacement, 230-240V
5	2466-518	Kit, Thermal Fuse, Melt Tank Replacement
6	2466-519	Kit, Thermal Fuse, Transfer Tube Replacement
7	2466-520	Kit, Thermal Control Board Replacement
8	2466-521	Kit, Prime Pump Replacement
9	2466-512	Kit, Replacement, Wax Delivery System, 120V
	2466-513	Kit, Replacement, Wax Delivery System, 230-240V
10	2466-509	Kit, Filter Screen Replacement (not shown)
11	2466-526	Kit, Fuse Replacement, 120VAC Systems
	2466-527	Kit, Fuse Replacement, 230-240VAC Systems
12	2466-529	Kit, Transfer Tube Replacement, Modular, 115V (not shown)
	2466-530	Kit, Transfer Tube Replacement, Modular, 230V (not shown)
13	2466-532	Kit, Wax Low Indicator (not shown)
14	2466-534	Kit, Internal Tubing



## Appendix C: Font Samples

Character appearance is affected by weight and dots per inch (dpi). Character weights available are single dot and bold.

### Fonts at 200 dpi:

Arial 32 Bold:

**AaBbCcDd 123**

Arial 32:

**AaBbCcDd 1234**

Arial 24 Bold:

**AaBbCcDdEe 12345**

Arial 24:

**AaBbCcDdEe 12345**

Arial 15 Bold:

**AaBbCcDdEeFfGg 1234567**

Arial 15:

**AaBbCcDdEeFfGg 1234567890**

Arial 9 Bold:

**AaBbCcDdEeFfGgHhIiJjKkLlMmNn 1234567890**

Arial 9:

**AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRr 1234567890**

Arial 7 Bold:

**AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRr 1234567890**

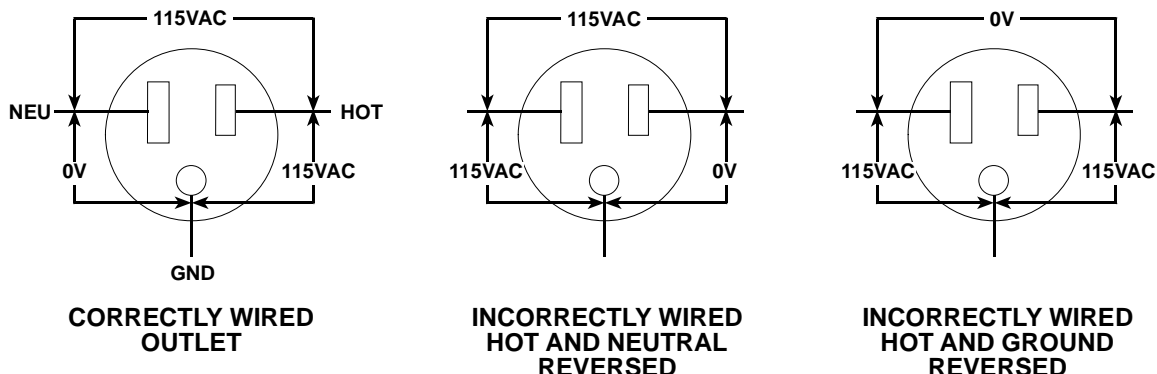
Arial 7:

**AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVv 1234567890**



## Appendix D: 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 E: 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. ESD wrist straps should be used when handling electronic components or printed circuit boards.

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 F: Glossary of Terms

**Bracketry** - Mounting hardware for ink jet system components.

**COM** - Abbreviation for a serial communications port on a computer. Usually expressed as "COM port" or associated with a number, "COM 1" or "COM 2."

**Controller** - The heart of the inkjet system, this unit gathers information from the computer, the photosensor, and the encoder, and facilitates the printing of messages by the print heads.

**Daisy Chain** - A series of print heads connected to one interface board. The IJ3000 can control one or two daisy chains.

**Debris** - Small, solid material particles which collect on the orifice plate, causing orifice blockage.

**dpi** - Dots Per Inch.

**Encoder** - This device gathers line speed information via a wheel rolling against a conveyor belt. The controller uses this information to determine when to send print signals to the print heads.

**ESD** - Electrostatic Discharge is a charge generated by separating or rubbing together two non-conductive materials. ESD can result in print problems or even damage to the ink jet system.

**ESD Protection** - Wrist straps, floor mats, and other devices used when handling electronic components to minimize ESD.

**Font** - A complete set of characters - alphabetic, numeric, and punctuation - in one typeface. The font used in this glossary is Arial.

**fpm** - Feet Per Minute.

**GUI** - Graphic User Interface.

**Impulse Jet** - The branch of ink jet technology where droplets are produced by a rapid pressure pulse created in an ink chamber causing the expulsion of an ink droplet through the orifice plate. In piezo-based impulse ink jet systems, this disturbance is caused by a rapid small change in the volume of the ink chamber behind the orifice plate. (Sometimes also erroneously referred to as drop-on demand type of ink jet printing.)

**Interface Board** - The power entry point for the IJ3000, and connection point for the print head daisy chain, photosensor, and encoder. A second interface board is optional.

**Jumper** - A small plug or wire that alters a hardware configuration by connecting different points in an electronic circuit.

**LED** - Light Emitting Diode. There are several LEDs in the IJ3000 system, and they either illuminate or extinguish to indicate various operating conditions.

**MSDS** - A Material Safety Data Sheet contains federally mandated safety, environmental and disposal information about an ink or other potentially hazardous material.

**Photosensor** - A device that emits a beam of light, and sends a print signal to the controller when light is reflected back to it by a product passing on a conveyor.

**Piezoelectric** - A physical phenomenon exhibited by certain crystals which change their dimensions when subject to an E-field (has an electrical field impressed across it). Conversely, when subjected to mechanical stress, it creates an electrical signal. This type of transducer is the driving element in a piezoelectric impulse system and frequently is the "stimulator" in a continuous ink jet system.

**ppr** - Pulses Per Revolution.

**Prime** - The art of pushing ink into a system to expel air.

**Print Head** - A solenoid-activated mechanism that propels ink droplets onto a moving surface.

**Print Station** - One or more print heads set up to mark a given product in a specified location.

**psi** - Pounds per Square Inch, a measure of pressure.

**Pulse Width** - The amount of time a print head solenoid is on, one of the factors controlling the size of a printed dot.

**Purge** - The art of pushing ink into a system to expel air. This term is used to define the firing of all channels to verify that air has been expelled from the print heads.

**QWERTY** - The universal computer keyboard character arrangement, named for the first six letters in the top alphabet row.

**RS-232** - Serial communication standard employed by personal computers. It defines three types of connection (electrical, functional, and mechanical) usually used with 25-pin D-shaped connectors.

