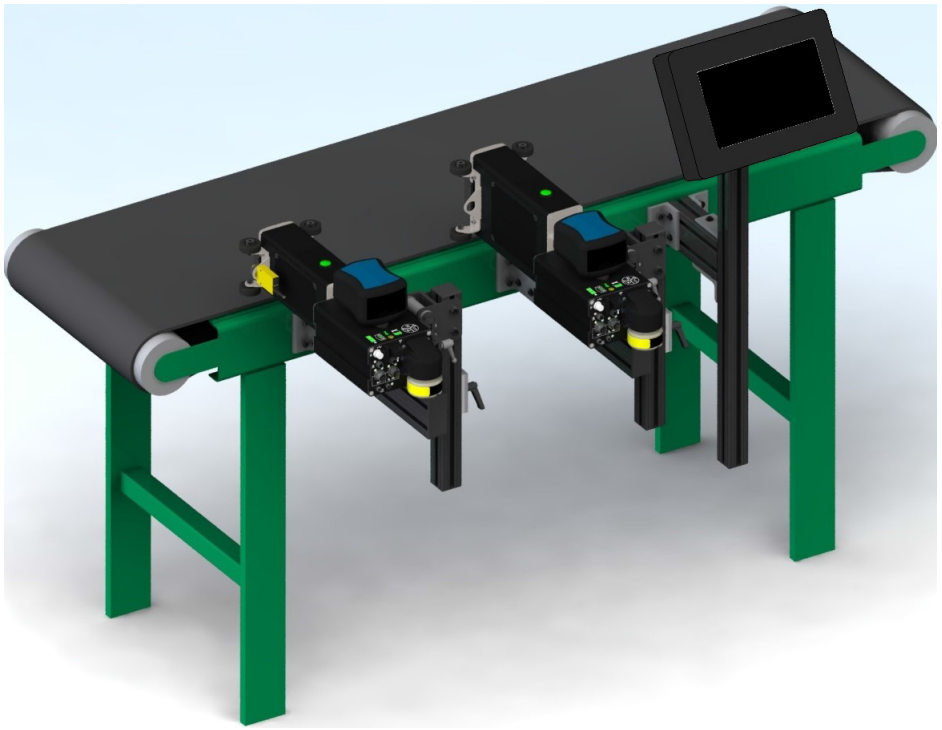
Operations Manual

Piezo InkJet System



400386UB
Revision A

Piezo Inkjet System Operations Manual

400386UB

Piezo InkJet System

Warranty:

This Piezo InkJet system, including all components unless otherwise specified, carries a limited warranty.

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

For all warranty terms and conditions, contact your reseller for a complete copy of the Limited Warranty Statement.

Section 1: Safety and Ink Usage

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! Denotes possible minor or moderate injury and/or damage to the equipment.

Caution! Denotes possible minor or moderate injury and/or equipment damage due to electrical hazard.

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

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.

Service is to be performed by trained personnel only.

It is extremely important to:

- Clean up all spills 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 SDS (Safety Data Sheet).

CAUTION: The Ink Supply Module contains hazardous voltage (90VDC). Disconnect from mains power before:

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

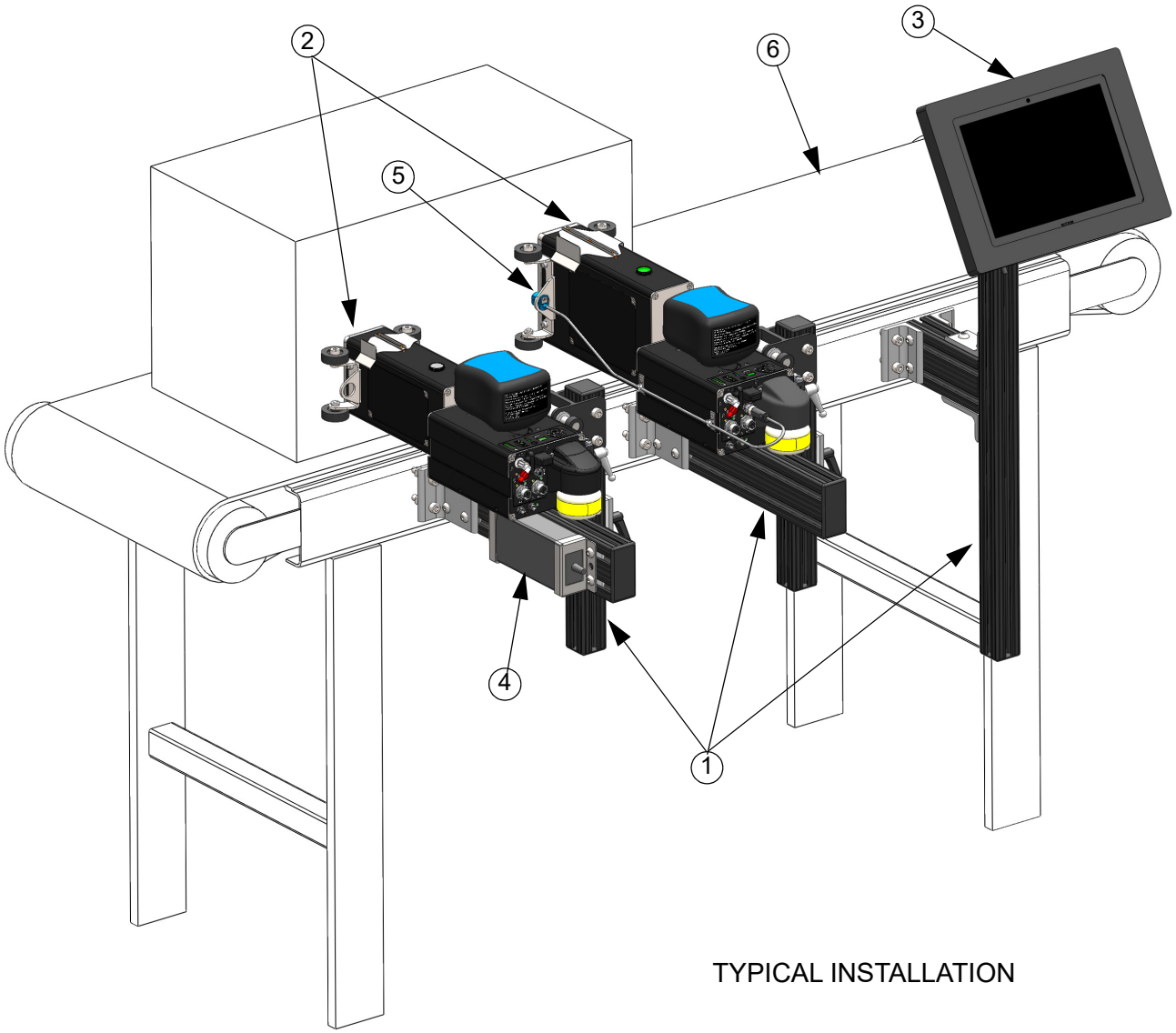
Caution: Denotes possible personal injury due to sharp object.

Section 2: Quick Start

The figure at right illustrates a typical installation.

System Components:

1. Bracketry Kit (Item 1)
2. Printers (Item 2)
3. HMI (Item 3)
4. Power Supply (Item 4)
5. Photosensor (Item 5)
6. Encoder (Item 6)
7. Power Cord (not shown)
8. Ethernet Cable (not shown)
9. Software (not shown)
10. Ink (not included)

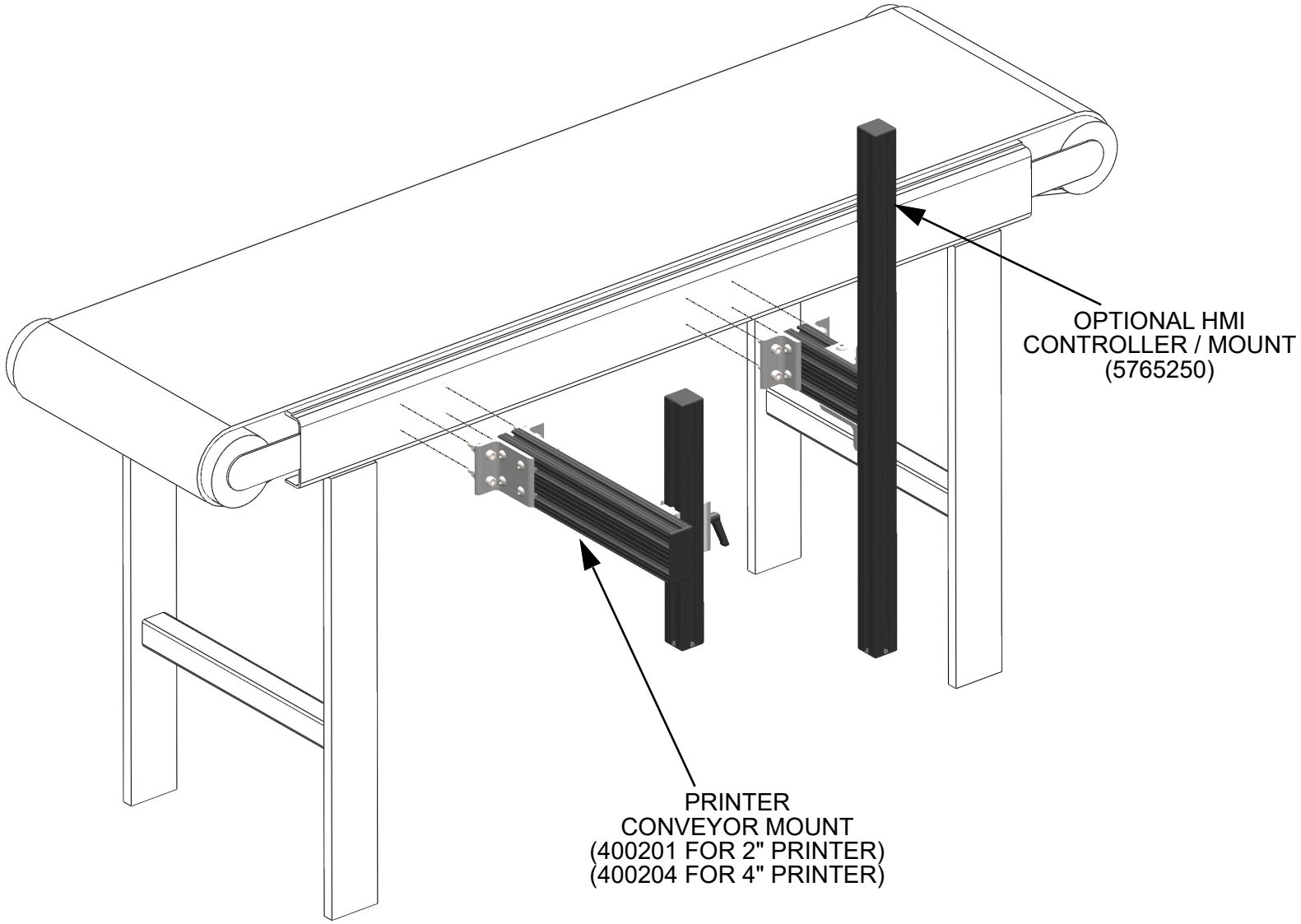


TYPICAL INSTALLATION

Step 1: Assemble Bracketry to Conveyor

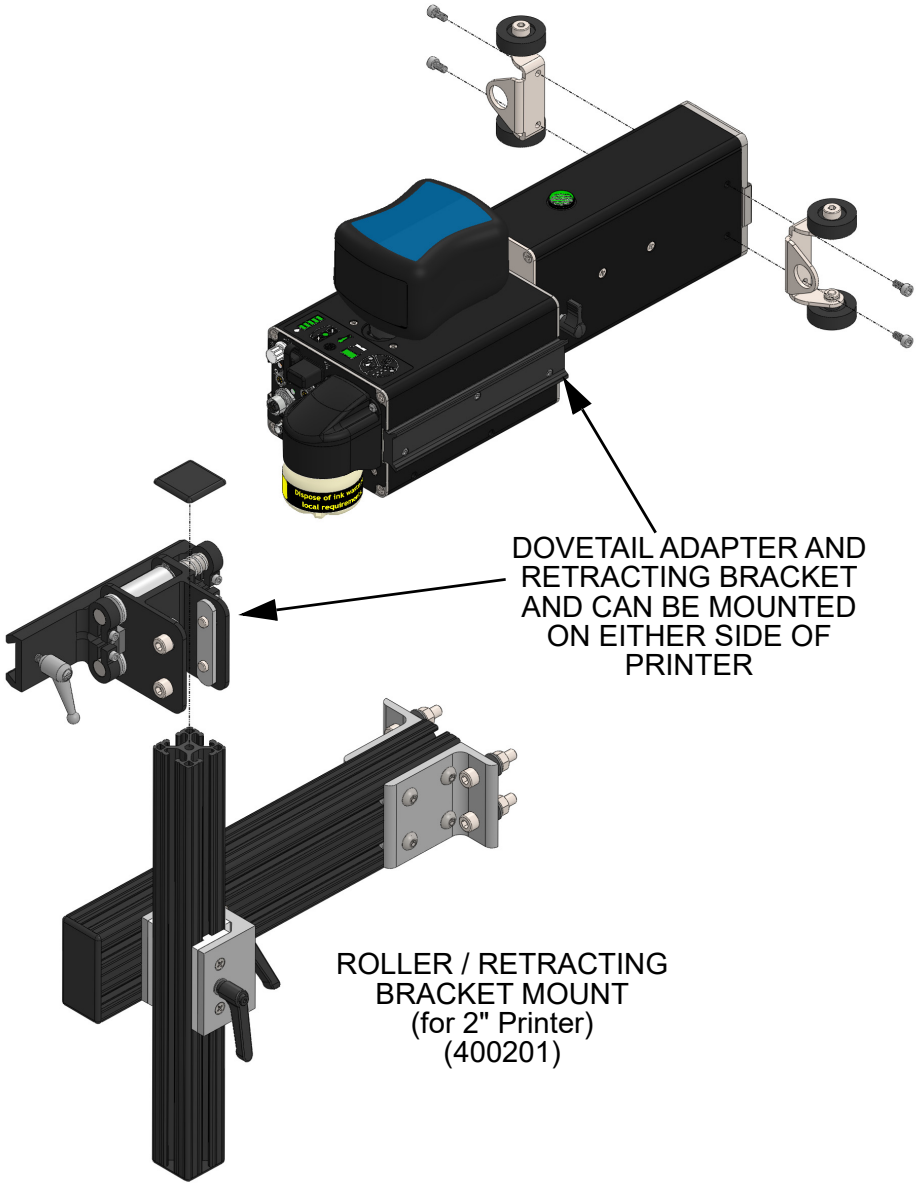
1. Firmly tighten all fasteners.

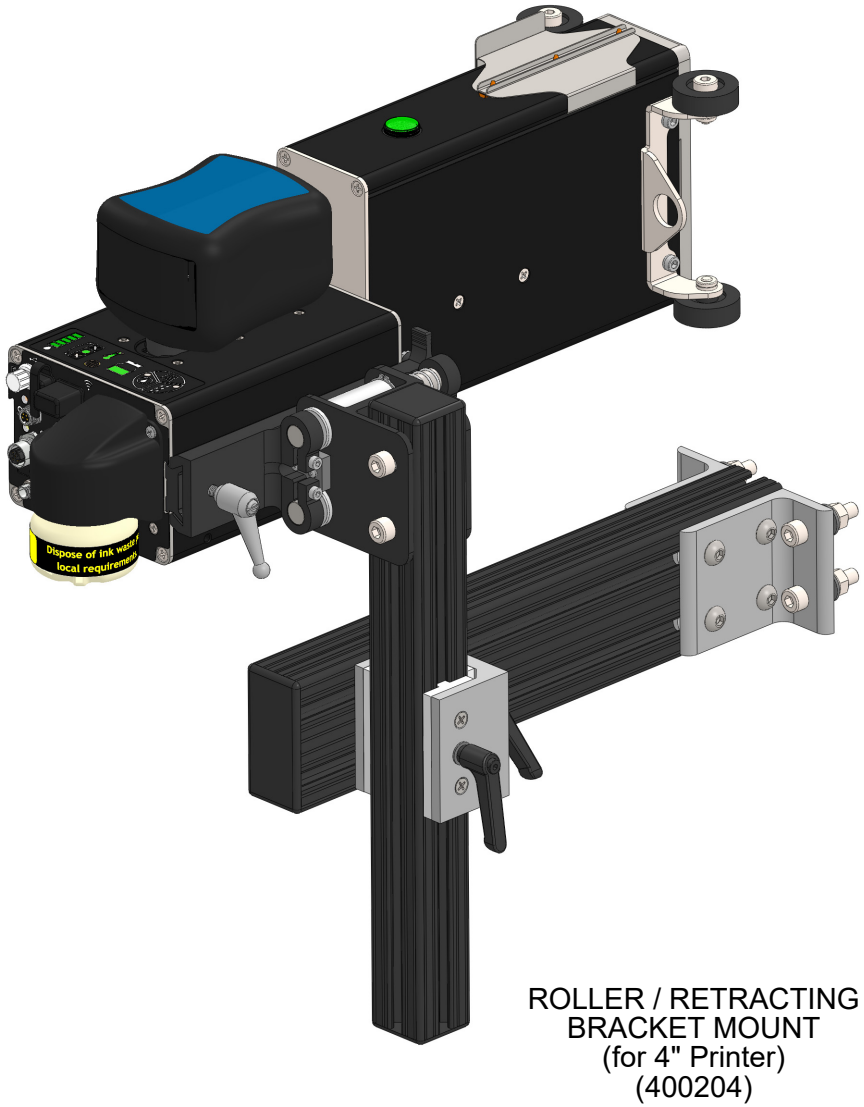
NOTE: Ensure bracketry is square and level.



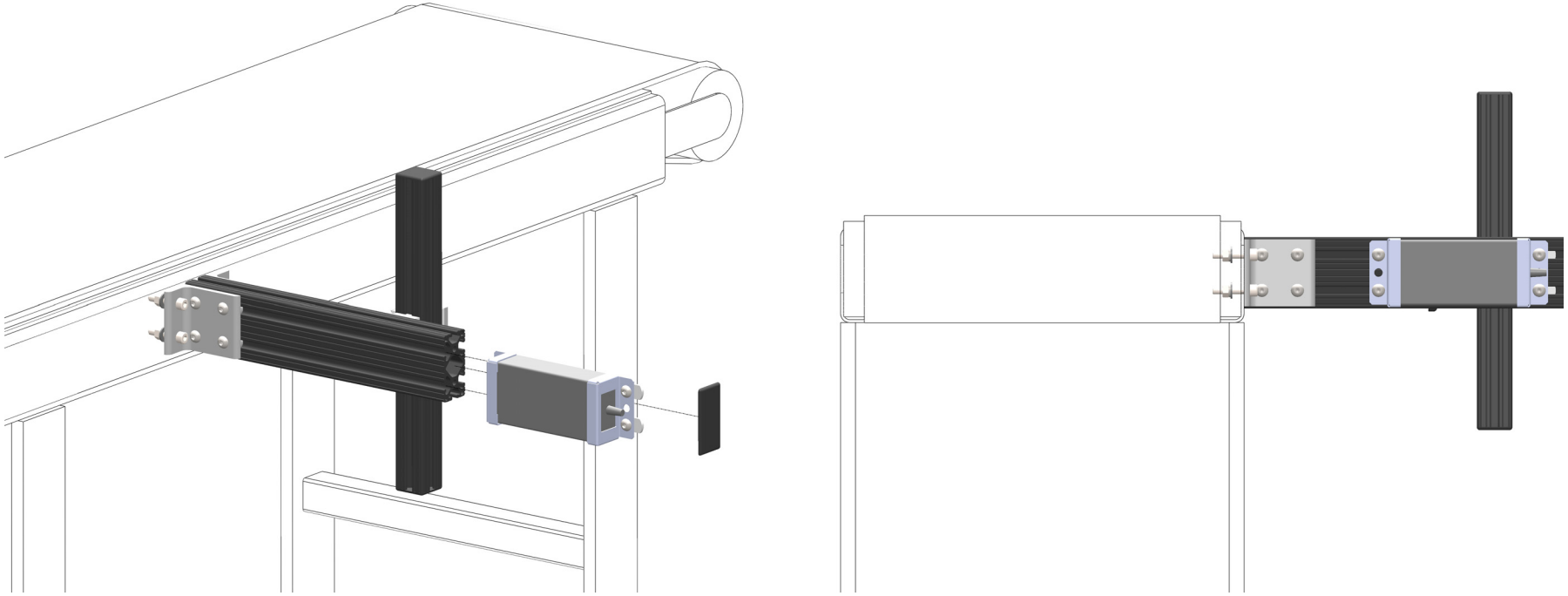
Step 2: Assemble Printer onto Bracketry

NOTE: The dovetail adapter and mounting bracketry can be mounted on either side of the Printer.





Step 3: Mount and Connect Power Supply



1. Install power supply with power cord mains facing the conveyor and DC output facing out towards the rear of the Printer.
2. Firmly tighten fasteners to bracketry or convenient location.

NOTE: One power supply pack can power up to two Printers in any combination of 2" or 4".

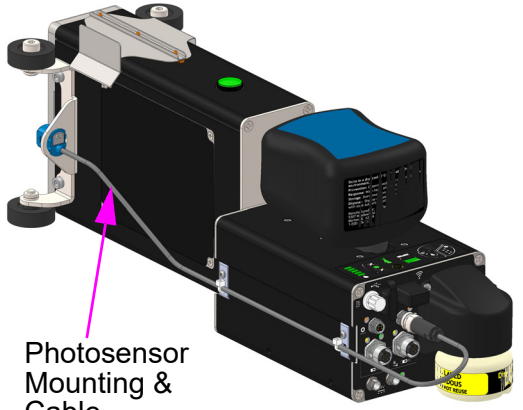
Step 4: Mount Photosensor and Encoder

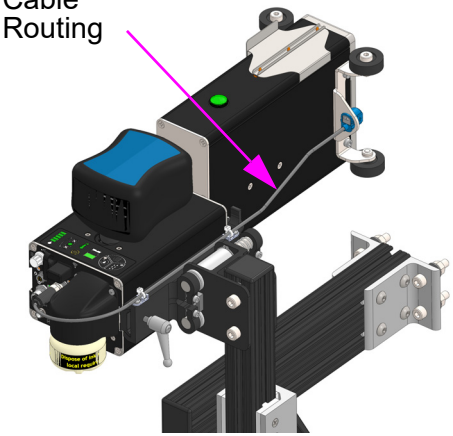
Photosensor

1. Mount the photosensor (kit 400203) in the roller bracket attached to the Primary Printer Module and route the cable as shown in one of the two shown configurations depending on the application.

NOTE: When viewing from the rear for the Printer, mount on the left side for left to right moving cartons, and vice versa on right to left.

2. Insert the photosensor cable connector into the appropriate connector on the rear of the Primary Printer Ink Supply Module.





Encoder

1. Install the encoder (kit 400206) in a location where it will accurately measure the speed of the conveyor.
2. Install it in contact with the conveyor belt or with a roller moving the same speed as the conveyor.
3. Insert the encoder cable into the Primary Printer Ink Supply Module.**CAUTION:** Do not excessively pre-load the encoder wheel. A radial force of over 18,14 kg [40 lbs] will reduce the life of the bearings.

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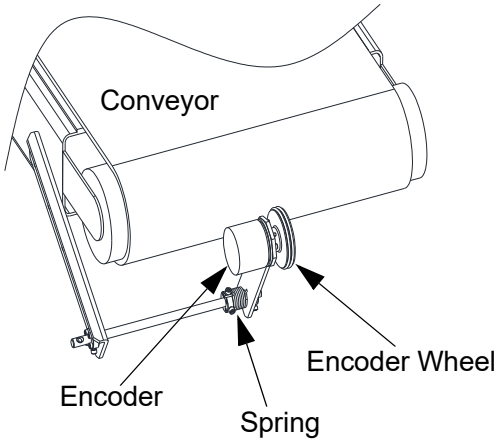
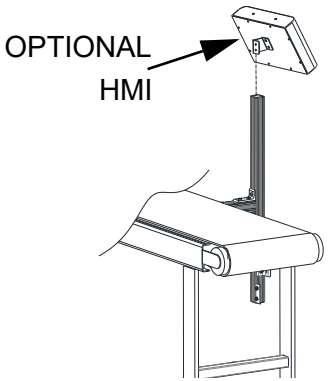


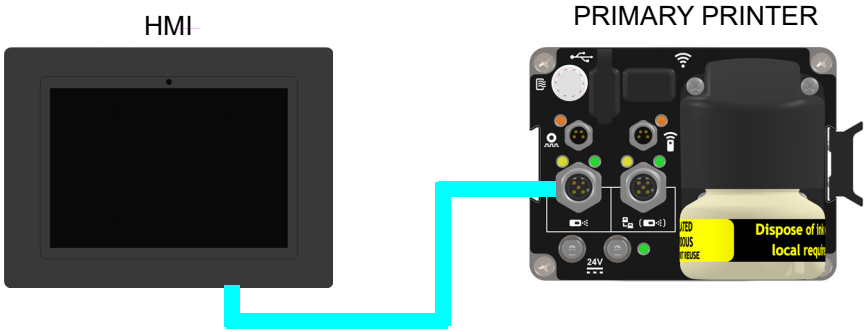
Step 5: Daisy-Chain Printers, HMI, and/or Customer Network

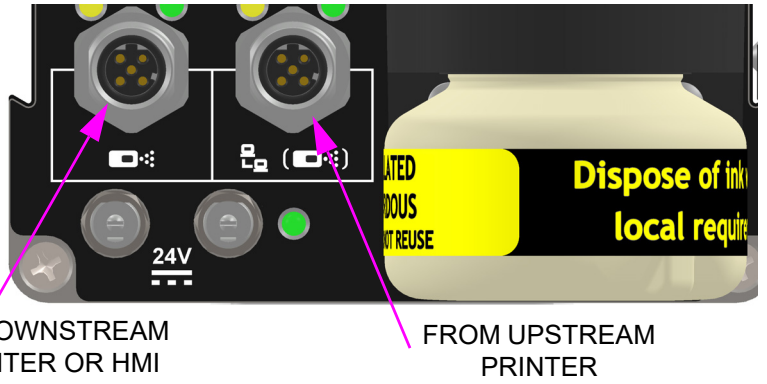


1. Install secondary Printers as shown in the previous steps.
2. Secondary Printers should be connected between the upstream Printer Ethernet out port to the input port on its Printer as shown as shown in the diagrams below. Up to eight Printers can be daisy chained together.
3. Install the HMI / Controller on appropriate bracketry.
4. Connect the HMI or Laptop / PC via Ethernet cable (400374-2.0) as shown in the below diagrams.

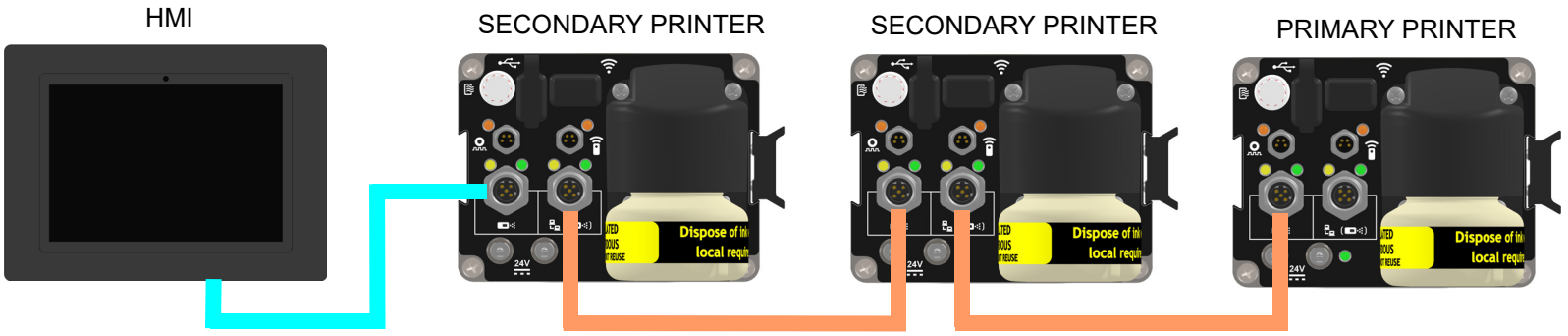
NOTE: Alternatively, the Primary Printer can be connected to the HMI via wireless. Consult the create and control manual (400463).

Standalone System with HMI - One Printer

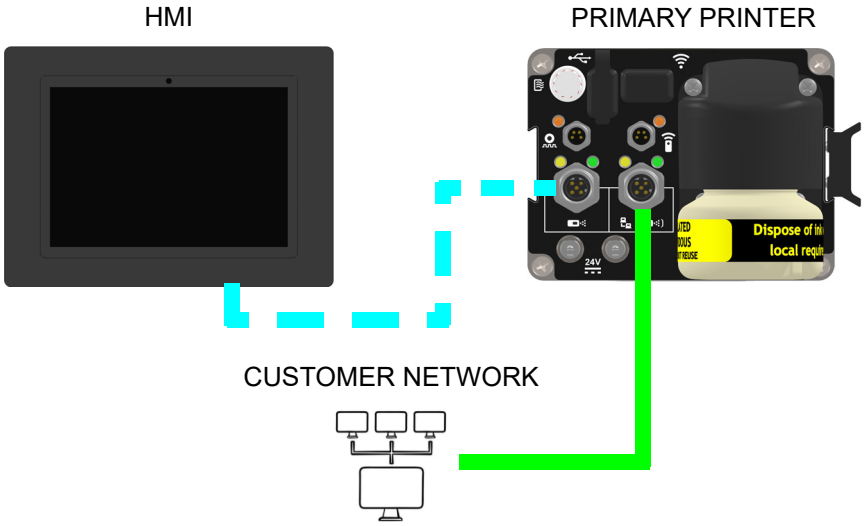


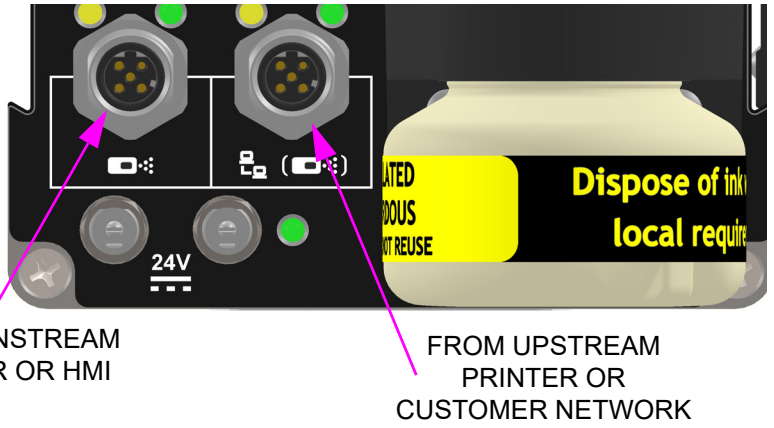


Standalone System with HMI - Two or More Printers

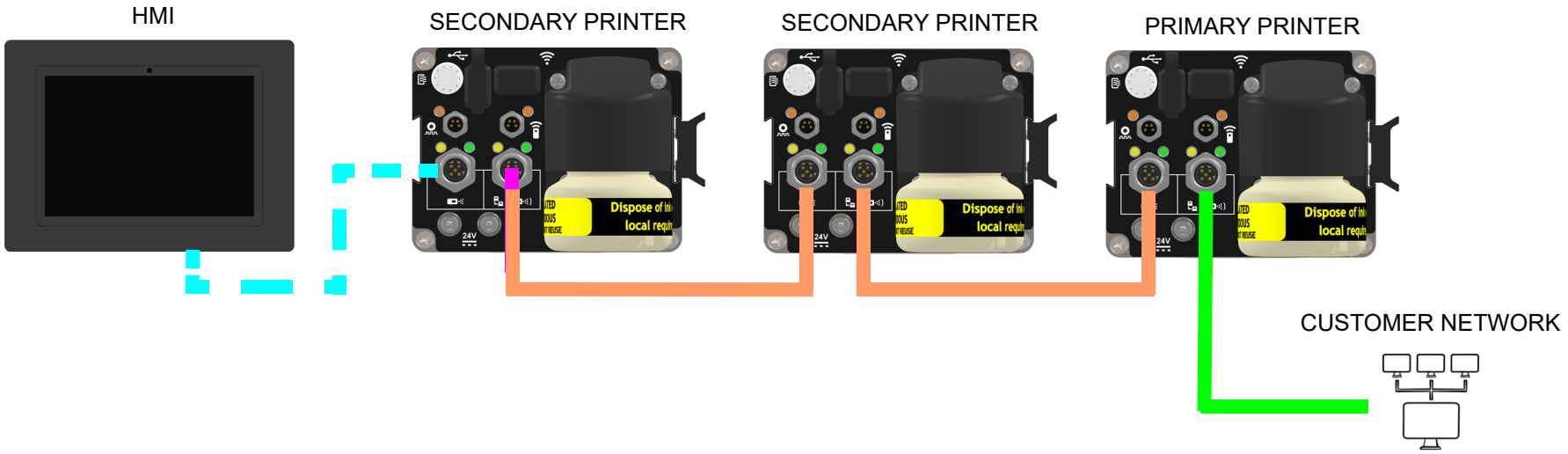


Networked System with Optional HMI - One Printer





Networked System with Optional HMI - Two or More Printers



Step 6: Powering up the Printers

5. Install the power cord into the first Printer in the system (from now on called the Primary Printer).

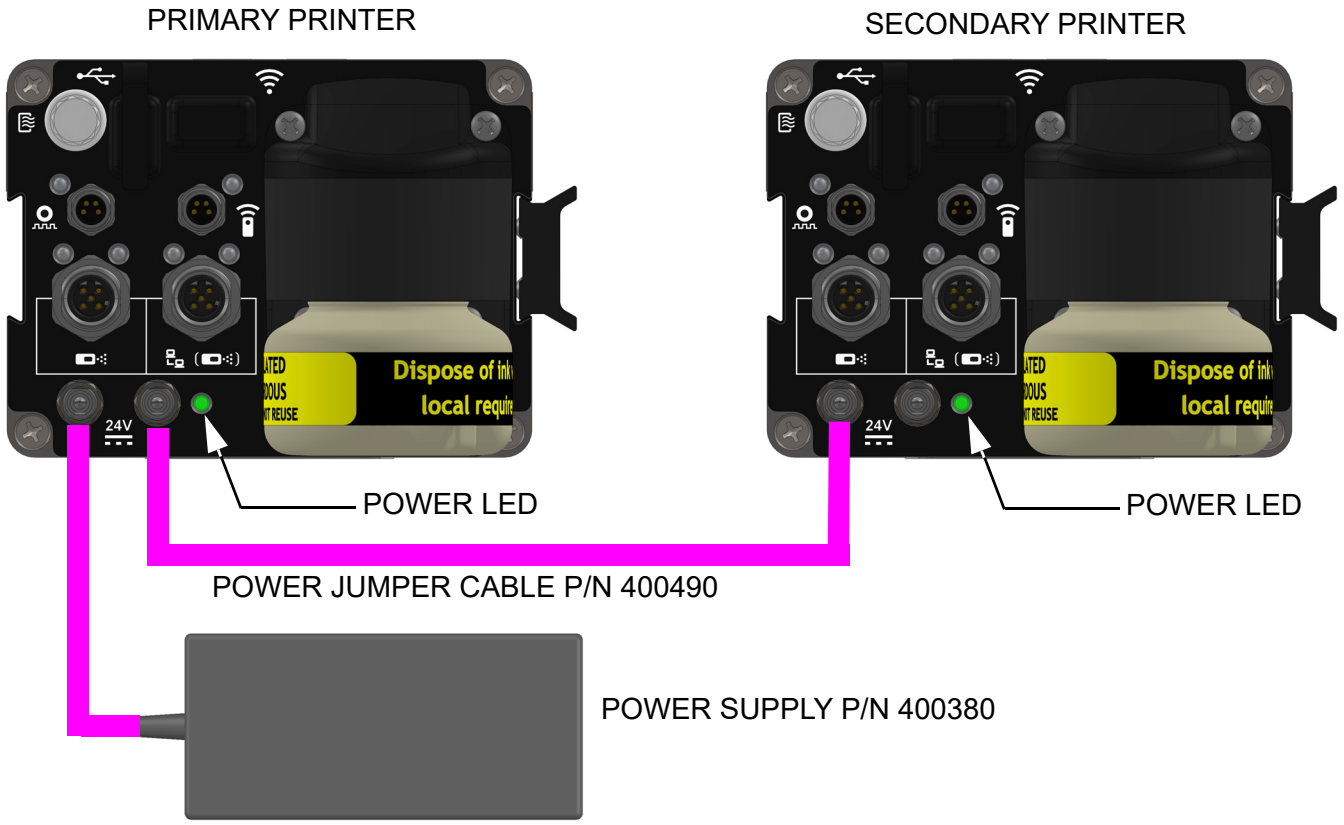
The power supply cable or jumper cable can be plugged into either power port.

Do not over-tighten with pliers.

6. If there is more than one Printer, the Primary should be the Printer to have product pass by it first; therefore, it should have the photocell mounted to it on the leading edge.
7. Ensure the power connector is fully inserted and the threaded barrel is finger tight.
8. Connect any downstream Printers from the Primary. These are considered Secondary.
9. Only one Secondary Printer can be powered by an upstream Printer. An additional power supply will be required for every two Printers on a daisy chain, regardless of Printer type / size.
10. Plug the A/C cord into the mains.

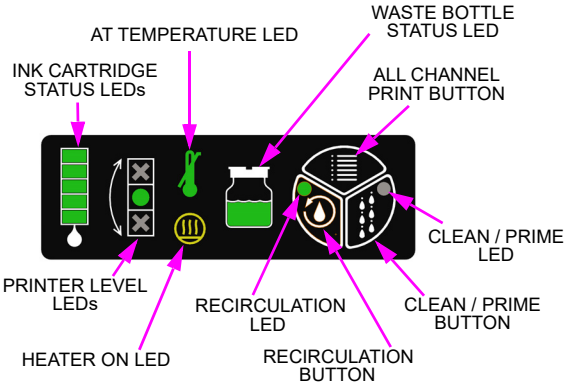
Best practices are to plug power into the Printers first before the A/C mains.

TYPICAL INSTALLATION

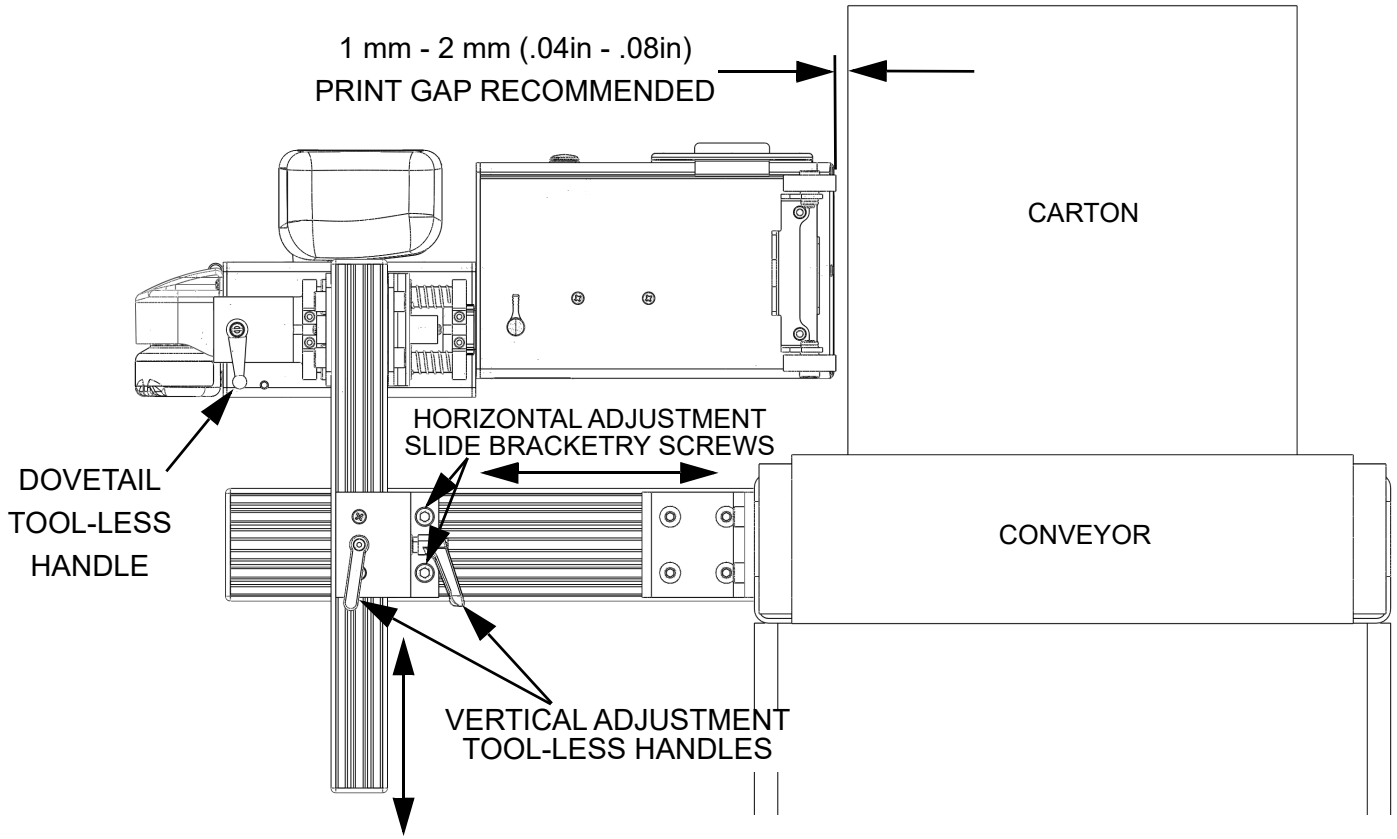


Step 7: Adjust Printer to Substrate

1. Tighten bracketry to conveyor such that the Printer is perpendicular to the carton; however, ensuring that the Printer is level from front to back. See "Step 8: Printer Level and Tilt" on page 16.
2. Use vertical tool-less handles to adjust Printer to approximate printing height position. Tighten handles.
3. While horizontal adjustment slide bracketry screws are loose, adjust vertical bracket with Printer horizontally to within 6 mm (1/4 in) of the carton.
4. Use the dovetail tool-less handle to make fine adjustments between the Printer rollers and carton to within 1 mm - 2 mm (.04in - .08 in).



NOTE: Printer print gap can be adjusted to be larger in heavy debris environment but must be balanced with print quality.



Step 8: Printer Level and Tilt

Printer Level

1. Slightly loosen the Slide Bracketry Screws shown in the diagram in "Step 7: Adjust Printer to Substrate" on page 15.
2. When the Printer is perpendicular to the substrate, tighten the Slide Bracketry Screws.
3. Observe the LED indicators on the rear top of the Printer on the ink supply. The green LED should be illuminated, and if not, adjust the bracketry up or down as needed.
4. The Printer is calibrated to within +/-1.5°

Printer Level

Printer Not Level

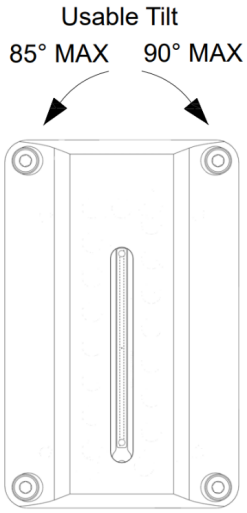
Printer Tilt

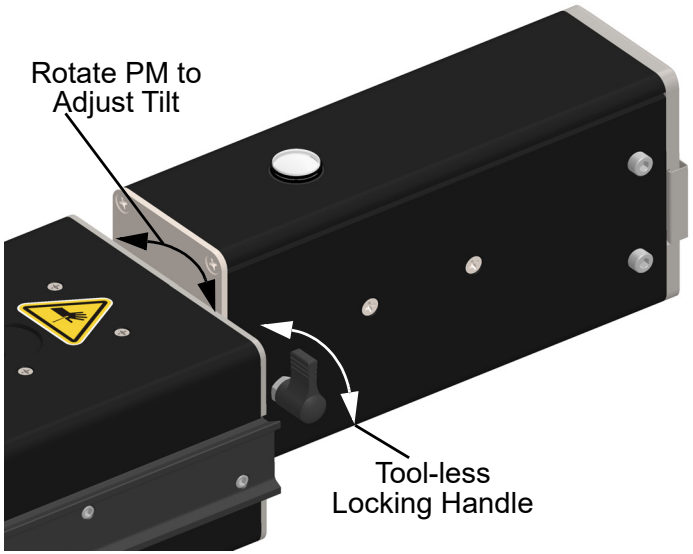
1. Loosen the tool-less handle on the side of the Printer Module.
2. Rotate the Printer Module to an angle that creates perpendicular print on the product.
3. Tighten the tool-less handle.

Maximum Printer Tilt from Vertical When Viewed from the Rear of the Printer:

- Clockwise Tilt: 85° (Printer Module disengages from the Ink Supply Module at 90°)
- Counterclockwise Tilt: 90°

Cleaning and priming features are effective up to ±15°





Step 9: Install Ink Cartridge

1. Remove the shipping plugs from the rear and top of the Ink Supply Module. Retain plugs for potential later use.
2. Install the ink cartridge and vent filter as shown.

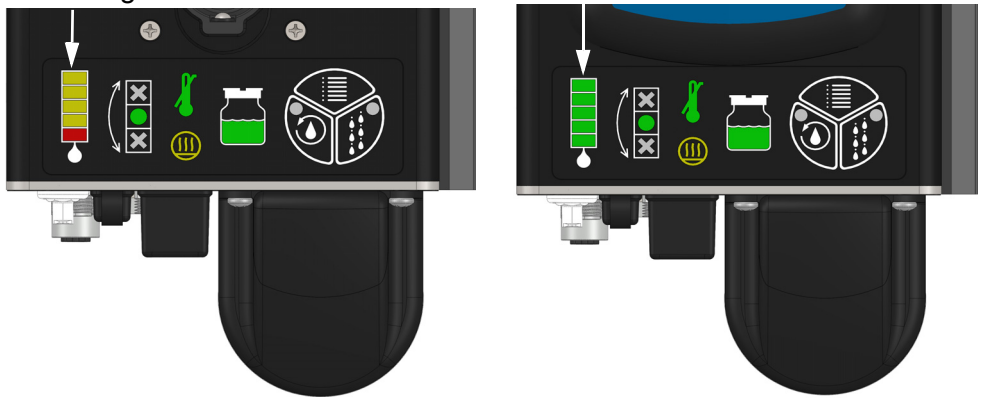
Warning! Opening the cartridge door exposes sharp needles used to puncture the cartridge rubber seal. Extreme caution should be used during the cartridge insertion.

3. Install the cartridge in the orientation shown with safety information label facing towards the rear of the Printer.

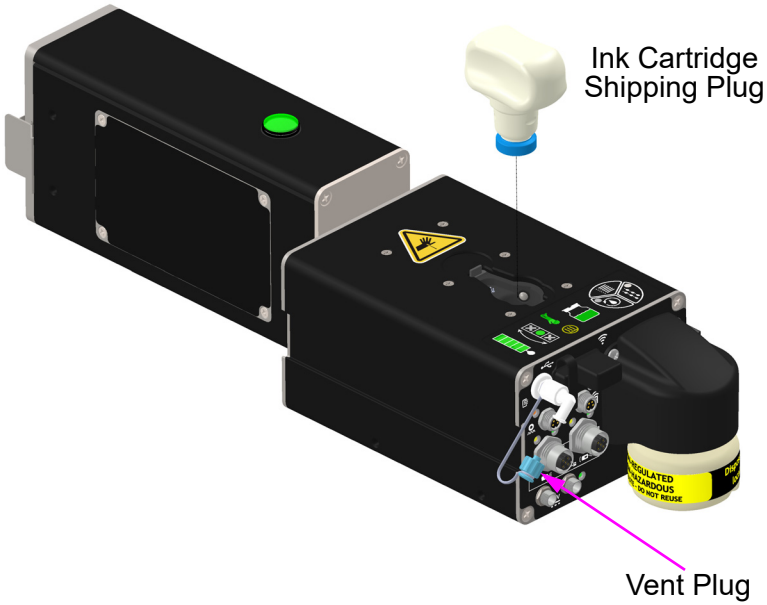
Note: The cartridge is equipped with smart chip technology that will detect the presence of the cartridge. The cartridge can only be installed in one orientation as it is keyed to the Ink Supply receiver which will guarantee connection to the smart chip.

When the cartridge is installed, the state of the ink gauge LED indicators on the top of the Ink Supply and the LED on the top of the Printer Module will change from flashing to solid green as shown below.

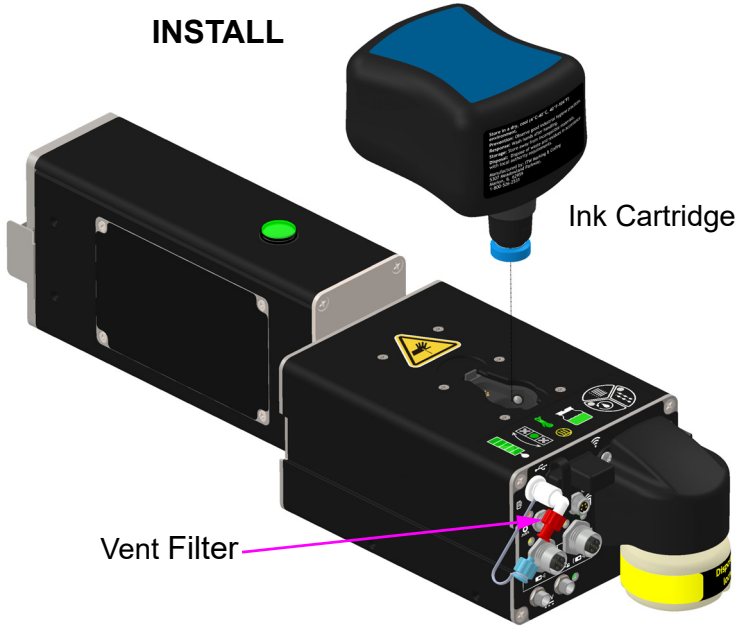
For a full description of the LED / Button panel on the top of the of Ink Supply Module see "Ink States" on page 40.



REMOVE



INSTALL



Step 10: Priming the Printer and Testing Print Quality

1. Ensure all Printers are at operating temperature.
2. Ensure that the shipping cap is installed for Recirculation, otherwise ink may overflow.

NOTE: Print is disabled until the Printer is fully heated. Wait until the "AT-TEMPERATURE" LED is illuminated green on the rear of the Printer prior to any print sampling.

3. Press and hold the **Recirculation** button (10 seconds) on the rear top of the ISM until its LED turns on. The ink gauge will count up during this time.
4. Allow the Printer to recirculate for at least 2 minutes. To turn off the recirculation feature, press the **Recirculation** button once, and the LED will turn off.
5. Wait three seconds and remove the ship cap.
6. Press and hold the **Clean / Prime** button for 5 seconds.
7. Reinstall the shipping cap and run **Recirculation** again for 15 minutes. After 15 minutes, the recirculation feature will automatically turn off.
8. Remove the shipping cap, and store on the top of the Printer.

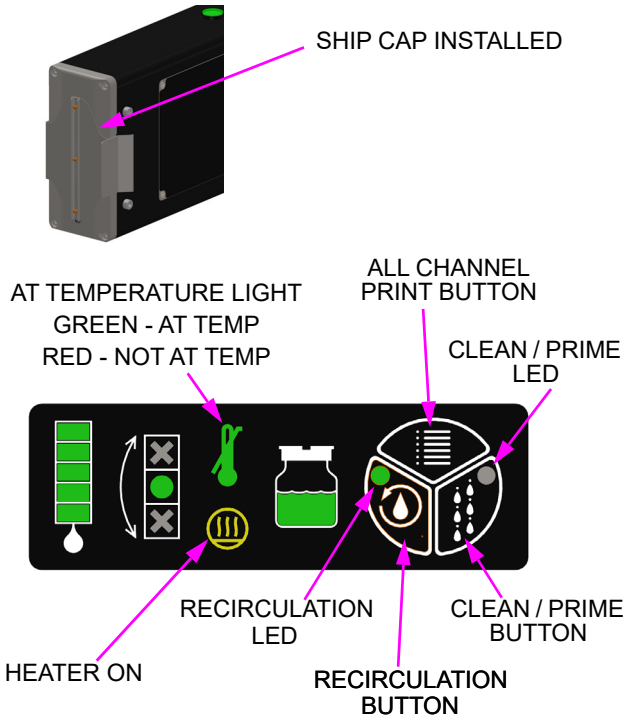
NOTE: Do not use common wipes in the print channel; use foam swabs instead.

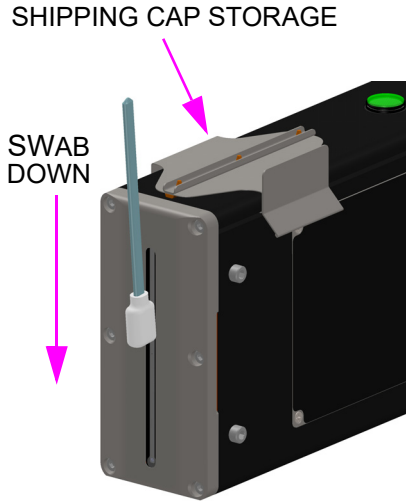
9. Use a foam swab to **lightly** wipe the orifice plate in a vertical downward motion. Prime the Printer by pressing and holding the **Clean / Prime** button up to 5 seconds (Prime). The Clean / Prime button LED will illuminate during this time and print will be disabled. After an additional 15 seconds, the LED will turn off and print will be re-enabled.
10. Print can be tested by slowly passing a sheet of paper in front of the Printer after pressing the **All Channel Print** button. A solid image will print for approximately 3 seconds.
11. If the 2" Printer sample is 50,8 mm (2 in) tall with no gaps, the Printer is ready.

    If the 4" Printer sample is 101,6 mm (4 in) tall with no gaps, the Printer is ready.

Missing Print

1. Press and hold the **Clean / Prime** button for five (5) seconds (Prime).
2. Inspect for very small air bubbles flowing out of the top of the orifice plate. If bubbles are evident, repeat the previous step one more time.
3. Press the **All Channel Print** button.
4. If any print is still missing after all air bubbles are purged, repeat steps 7. - 9., in "Step 10: Priming the Printer and Testing Print Quality" on page 18, up to three more times as necessary.





Step 11: Cap Unused Ports

After the installation is complete, it is recommended that all unused ports be capped to prevent accidental electrostatic discharge into a connector.

The Primary Printer should have all ports populated with a cable.

Exceptions:

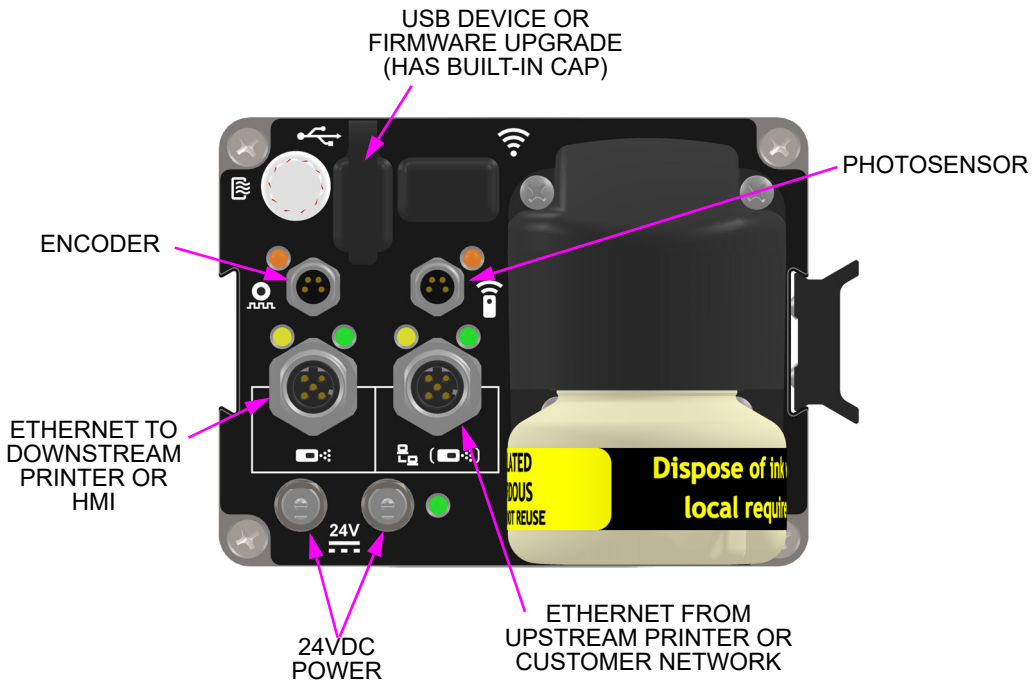
- Only one head in the daisy chain - cap Ethernet and one power port.
- No encoder - cap encoder port.
- Wireless communication - cap Ethernet ports.
- No HMI - cap Ethernet port.

Secondary Printers will have most ports capped excluding one power port.

Exceptions:

- Wired Ethernet port - cap other Ethernet port.
- Second power port is connected to HMI.

See "Service Parts and Optional Equipment" on page 49 for plug and cap kits.



Step 12: Create a Message and Control the Printer

Reference manual **Create & Control 400463**.

Section 3: Maintenance and Shutdowns

Following are the recommended maintenance procedures to keep the Printer printing cleanly and efficiently.

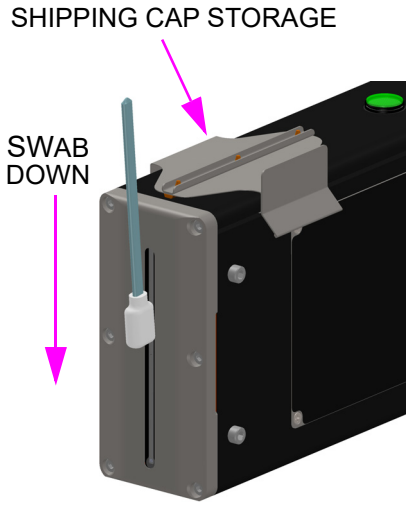
System Maintenance

Intermittent (as required):

1. Be sure the photosensor is clean and free of debris.
2. Be sure the nuts and bolts holding the bracketry in place remain tight.
3. Ensure all cable connections are secure but not overtightened.
4. Adjust Printer Module level and throw distance as necessary.

Annually:

Clean the encoder and review the wheel for excess wear.



Printer Module Maintenance

Daily / Shift Startup / Periodic

Wear safety goggles when working with industrial inks or solutions!

The majority of print quality degradation is due to excessive debris deposits on the Printer orifice plate that disrupt the ink droplet path. For best preventative maintenance practices, do the following:

1. Remove excessive debris build-up (corrugate dust, glue strands, and the like) on and around the front of the Printer by using maintenance spray (5760695) on a clean lint-free cloth (6600171) and wiping the front plate and enclosure. If debris build-up is noted on the enclosure and rear of the Printer, then wipe those clean too.

NOTE: DO NOT SPRAY MAINTENANCE SPRAY DIRECTLY ON THE PRINTER MODULE OR ANYWHERE NEAR THE ORIFICE PLATE.

2. Press and release the **Clean / Prime** button (Clean), and using a sponge swab (5760832), rub the orifice plate **lightly** from top down in a vertical direction while ink is flowing during a clean cycle. The **Clean / Prime** button is located on the rear of the Printer. DO NOT USE n-Propanol directly on the orifice plate.
3. Press the **Clean / Prime** button one more time (Clean) to ensure channel priming, but do not swab this time.
4. Wipe the front plate with a clean lint-free cloth to remove any excess ink.

Ink Supply Module Maintenance

Daily / Shift Startup / Periodic

1. Do not remove the ink cartridge. Use a low pressure air nozzle (5psi) and / or maintenance spray and a lint free cloth to remove debris buildup on and around the Ink Supply Module.
2. Remove the cartridge from the Ink Supply Module and carefully use a foam swab to wipe out the receiver / needle area to remove any debris or ink residue.

NOTE: Do not use Maintenance Spray directly in this area.

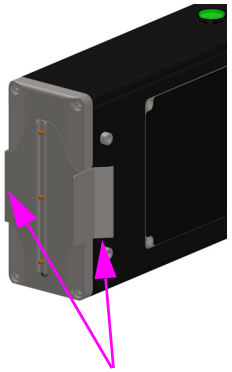
Printer Shutdown

Shutdowns of 1 Week or More

1. Repeat the steps in “Printer Module Maintenance” on page 20.
2. Install shipping cap onto the front of the PM and the shipping plugs into the cartridge receiver and vent on the ISM.
3. Disconnect power from the mains power cord.

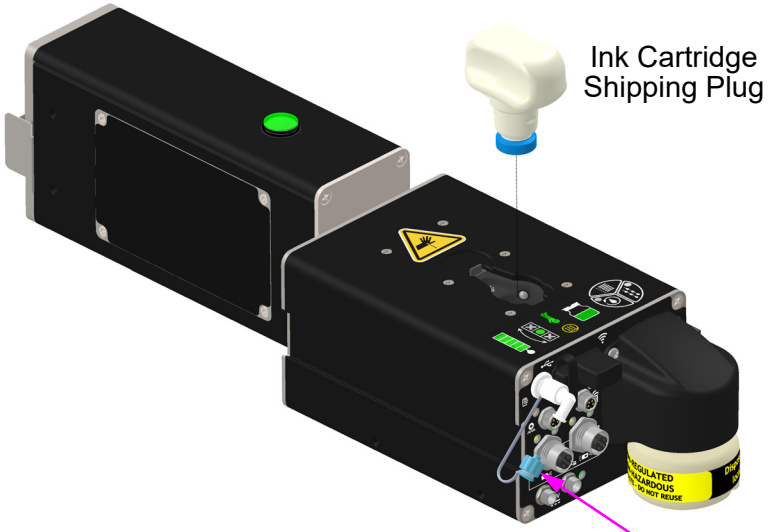
Startup:

Follow instructions in “Step 10: Priming the Printer and Testing Print Quality” on page 18.



Shipping Cap -
Ensure Tabs Are Fully Seated In Slots

INSTALL



Cleaning Maintenance System

The cleaning system is an invaluable maintenance tool for routine cleaning of loose debris from the print engine orifice plate. The images below demonstrate print before and after the cleaning.

BEFORE

AFTER

Functional Description: When activated, the Cleaning System initiates with a vacuum pump, and within 2 seconds, an ink pump turns ON and flushes ink out of the orifice plate nozzles. The flow of ink captures debris on the orifice plate and flushes it down to a vacuum channel. The debris and ink mix (waste ink) is pulled back through a vacuum line into a waste bottle.

NOTE: If the LED on the top of the Printer is flashing, or the Waste Full LED is red, then the cleaning system will not activate. Make sure all ink faults are corrected before attempting a cleaning cycle.

1. The cleaning feature can be accomplished by two methods.

   Manually: From the rear of the Printer: Press the **Clean / Prime** button. The cleaning cycle will initiate.

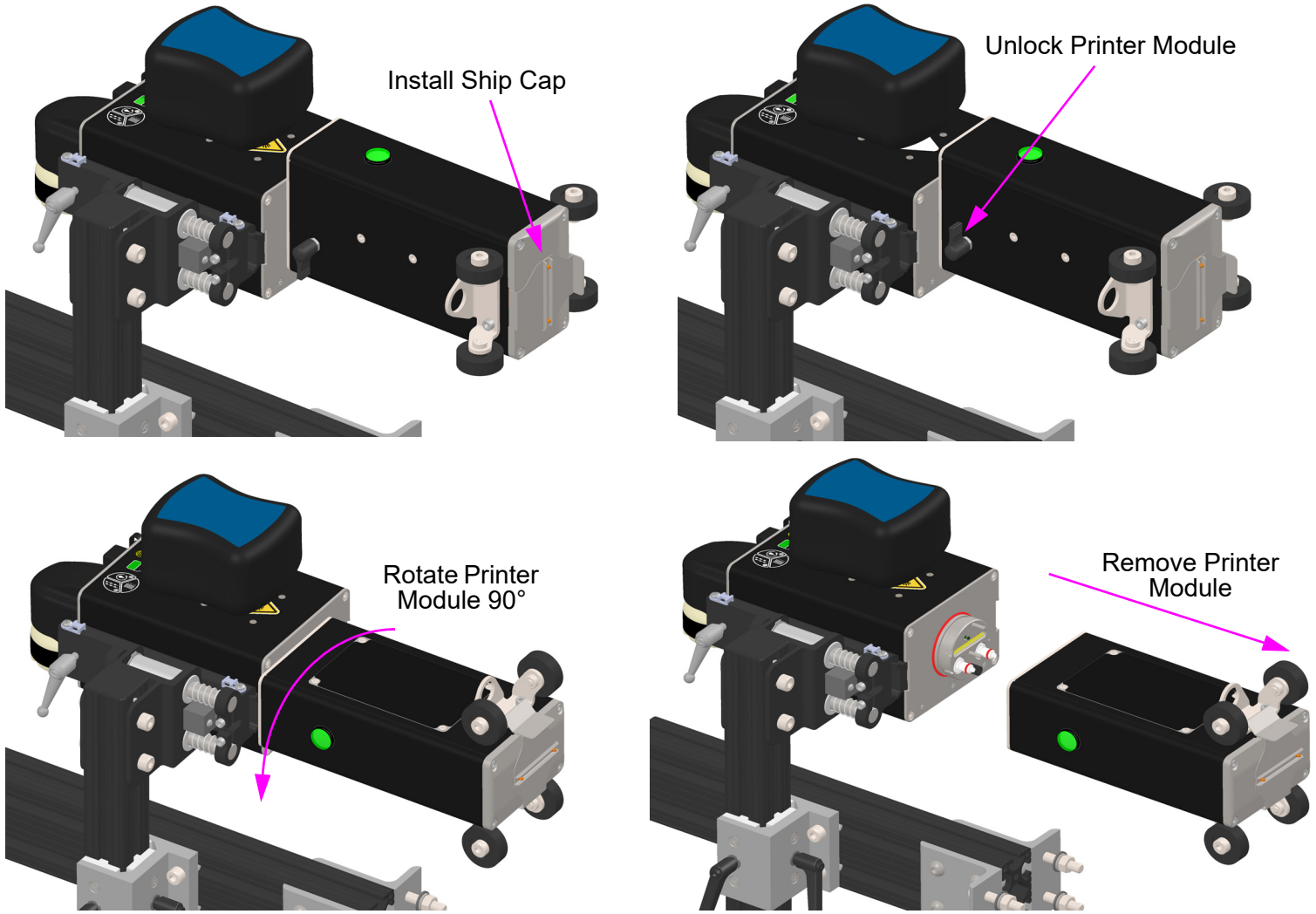
   Automatically: By default, the Printer is programmed to run a cleaning cycle every 4 hours. To change the timing, consult Create & Control manual 400463.

2. Once a Printer has been cleaned, verify that all channels are printing properly by touching the **All Channel Print** button located on the back of the Printer. Swipe a sheet of paper or other material across the front of the Printer as the head purges. The Printer fires all channels for three seconds each time the **All Channel Print** button is touched.
3. Automatically, from the controller **Clean** menu: The system can also be programmed to automatically clean the Printers during regular down times in the production schedule in increments of 30 minutes, or on a weekly schedule.

Printer Module Replacement

The normal life of a high-resolution piezoelectric Printer is dictated by the amount of debris the orifice plate encounters during the coding application. Fine corrugate will fly into the orifice holes and clog / disrupt printing. The Printer Module can be returned to the factory and disassembled, cleaned (down to the engine level), and returned to normal service making it more economical and green for the environment.

Printer Module swap is easy. Installation is the reverse of the below removal steps.



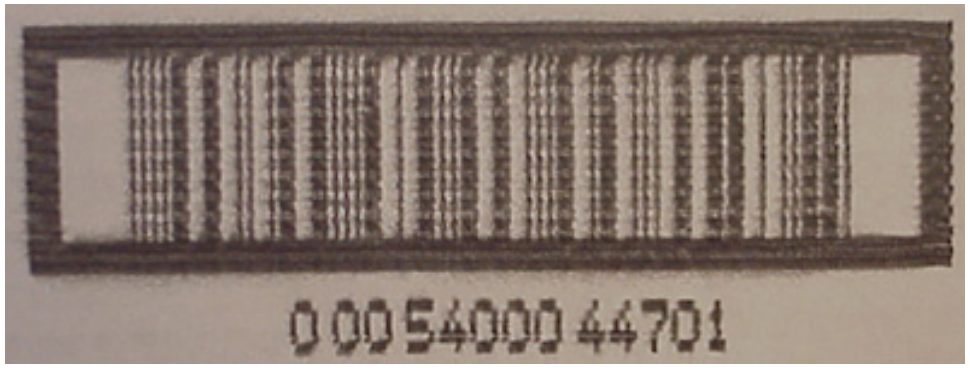
Section 4: Troubleshooting

Print Quality

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

Minor Fractures in Print

Possible Cause	Action
Debris on front plate	**Step 1:** Run Cleaning cycle. **Step 2:** Use a foam swab to clean debris on orifice plate in a vertical downward motion while ink is flowing. **Step 3:** Run Prime feature for 5 seconds.



Fuzzy Print

Possible Cause	Action
Printer too far away from substrate	**Step 1:** Move Printer to within 1/8” from product.

Missing Channels

Possible Cause	Action
Excessive debris on front plate	**Step 1:** Run Prime feature for 5 seconds. **Step 2:** Use a foam swab to clean debris on orifice plate in a vertical downward motion while ink is flowing. **Step 3:** Run Prime Feature for 5 seconds.
Air in channel	**Step 1:** Install orifice plate ship cap and run Recirculation feature for 2 minutes. **Step 2:** Remove ship cap and run Prime feature for 5 seconds. **Step 3:** Install ship cap and recirculate for 15 minutes. **Step 4:** Remove ship cap, swab orifice plate, and run Prime feature for 5 seconds.

Missing Lower Channels

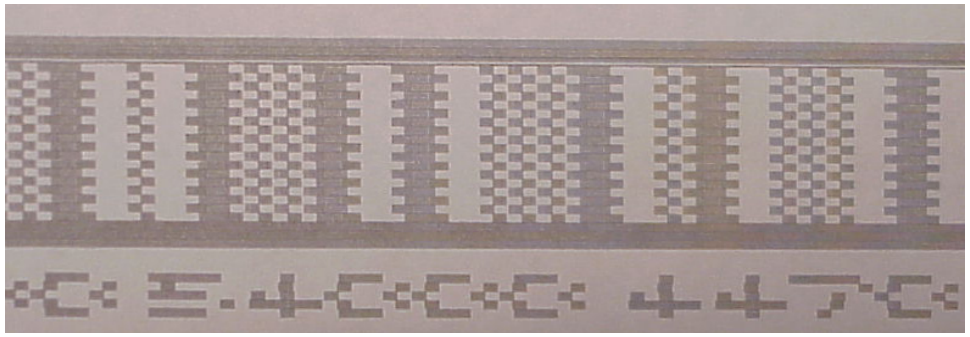
Possible Cause	Action
Printer not level	**Step 1:** Adjust bracketry to level Printer front to back.
Lack of recirculation during startup	**Step 1:** Install ship cap and recirculate for 15 minutes. **Step 2:** Remove ship cap, swab orifice plate, and run Prime feature for 5 seconds.

Top-Down Dropout

Possible Cause	Action
Vent Cap installed on vent	**Step 1:** Remove vent cap and install filter. **Step 2:** Install orifice plate ship cap and recirculate for 15 minutes. **Step 3:** Remove ship cap, swab orifice plate, and run Prime feature for 5 seconds.
Ink on vent filter or clogged with debris	**Step 1:** Remove vent filter, clean with alcohol, and dry completely. **Step 2:** Install ship cap and recirculate for 15 minutes. **Step 3:** Remove ship cap, swab orifice plate, and run Prime feature for 5 seconds.
Lack of Recirculation during startup	**Step 1:** Install ship cap and recirculate for 15 minutes. **Step 2:** Remove ship cap, swab orifice plate, and run Prime feature for 5 seconds.

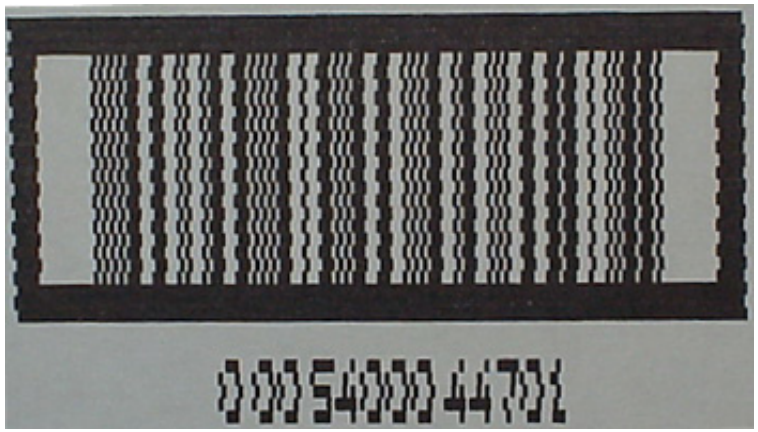
Occasional Checkerboard Print Pattern

Possible Cause	Action
Encoder slipping or bouncing on belt	**Step 1:** Tighten encoder spring mechanism to ensure constant contact with the conveyor belt.
Conveyor is not smooth or has discontinuities	**Step 1:** Relocate encoder to a smooth representative surface or a new conveyor will be needed.



Stretched Out, Light Print, Checkerboard Pattern

Possible Cause	Action
Incorrect encoder or wheel size	**Step 1:** Check for correct encoder (must use part number 400206 or equal).
Speed set too low for internal encoder	**Step 1:** Measure actual conveyor speed with a tachometer. **Step 2:** Adjust internal line speed to match actual line speed.



Short Image, Dark Print, Checkerboard Pattern

Possible Cause	Action
Incorrect encoder or wheel size	**Step 1:** Check for correct encoder (must use part number 400206 or equal).
Speed set too high for internal encoder	**Step 1:** Measure actual conveyor speed with a tachometer. **Step 2:** Adjust internal line speed to match actual line speed.

Backwards Print

Possible Cause	Action
Incorrect print direction specified in setup	**Step 1:** Correct print direction in Control software.

System

System Symptom	Possible Cause	Review	Observation	Action
General Power and functionality issues (Membrane LEDs abnormal or not illuminated, buttons don't function)	Power Supply	Check for Power LED to the Ink Supply Module. If LED is not illuminated, check power supply LED and / or barrel output.	No power from power supply	Replace power supply
	Power Jumper Cable	Exterior LED 6 of secondary Printer OFF - disconnect power jumper cable and measure voltage	24 VDC	See PCB Board exterior test
			OFF	Replace power jumper cable
	PC Board (exterior)	Exterior LED 6	ON	Disconnect power from Printer and remove rear plate-PCB assembly
			OFF	Replace PCB
	PCB Board (interior)	Insulate PCB assembly from surrounding metal objects. Connect power. Interior LED 14 heartbeat.	ON	Unlock J12, re-seat ribbon cable and engage lock
			OFF	Replace PCB
Ink pump not working during Clean / Prime cycle	PC Board	LED11: Green; indicates a Printer is signaling for the Liquid Pump to turn on.	ON	Replace ISM
			OFF	Replace PCB
	Air in System	Clean both orifice plate and ship cap seal with approved sponge swab, install PM shipping cap (properly seat in grooves), and run Recirculation system for 15 minutes, decap, and run Prime cycle.	Ink flows	Check All Channel Print. If all channels are not present, repeat Recirculation as necessary
			Ink does not flow	Internal issue; run PCB board test
	Waste Full	Waste LED is red. Remove waste bottle; LED should change to green.	Green	Empty waste bottle
			Red	Check internal connections to of LED array / membrane switch and re-seat J12 connector or replace PCB

System Symptom	Possible Cause	Review	Observation	Action
No vacuum at Printer during Clean / Prime Cycle. Ink is overflowing the Printer	PC Board	LED8: Green; indicates a Printer is signaling for the Vacuum Pump to turn on.	ON	Replace Ink Supply Module
			OFF	Replace PCB
	Waste Full	Waste LED is red. Remove waste bottle; LED should change to green.	Green	Empty waste bottle
			Red	Check internal connections to of LED array / membrane switch and re-seat J12 connector or replace PCB
	Clog	Clean orifice plate and ship cap. Hold Prime button for 5 seconds and listen to vacuum pump.	Vacuum pump turns on and sounds strained, but ink slightly overflows or completely overflows.	Separate ISM / PM, remove ink waste bottle, insert rubber tipped air nozzle into vacuum port on PM. Ensure the front of the PM is covered with adequate clean cloths and apply 20psi until clear. Repeat for ISM.
	Vacuum Loss	Clean orifice plate and ship cap. Hold Prime button for 5 seconds and listen to vacuum pump.	Vacuum pump turns on and sounds normal, but ink overflows or completely overflows.	Ensure waste bottle o-ring is installed and not damaged. Ensure waste bottle is installed and tight. If waste bottle is normal replace PCB or ISM.
Printer never reaches temp / “At Temperature” LED on membrane never turns ON	Ambient Too Cold	Measure ambient temperature with appropriately calibrated device.	Less than 4°C (40°F)	Consult factory technical support.
	Printer Module	Membrane At-Temperature and Heater LEDs	At-Temp Red and Heater always OFF	Swap Printer Module
	Ink Supply Module	Printer module swap did not fix		Replace Ink Supply Module
Missing print	Air in Printer	Clean both orifice plate and ship cap seal with approved sponge swab, install PM shipping cap (properly seat in grooves), and run Recirculation system for 15 minutes, decap, and run Prime cycle. Perform All Channel Print.	Channels recovered	Store ship cap
			Some channels still missing	Swab clean orifice plate and repeat Recirculation
	Channels clogged or contaminated	Clean orifice plate with approved sponge swab, use prime feature, and perform All Channel Print button on clean white paper.	Print is fractured or very scratchy	Return Printer Module for cleaning
Printer will not print at all	PC Board		No audible or visible channel firing	Replace PCB
	Printer Module		Replacing PCB does not fix the issue	Replace Printer Module

Photosensor

Normal operation:

- Photosensor plugged into the Primary Printer.
- The photosensor green power on LED is illuminated.
- The photosensor yellow detect LED illuminates when an object is held between 5 mm - 100 mm (0.2 in - 4 in) from the face of the sensor.

Do the following test to determine if the photosensor operates correctly for the application.

1. Place a representative object between 5 mm - 100 mm (0.2 in - 4 in) in front of photosensor; photosensor should sense object.
2. Place object on far guide rail; photosensor should not sense object.
3. Check that objects on the far side of conveyor do not trip the photosensor.
4. 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.

NOTE: If the green power LED or yellow LED on the photosensor fails to illuminate when an object is placed in front of the photosensor, it indicates that the photosensor and / or power supply is disconnected, or the power supply, CPU, or photosensor has failed.

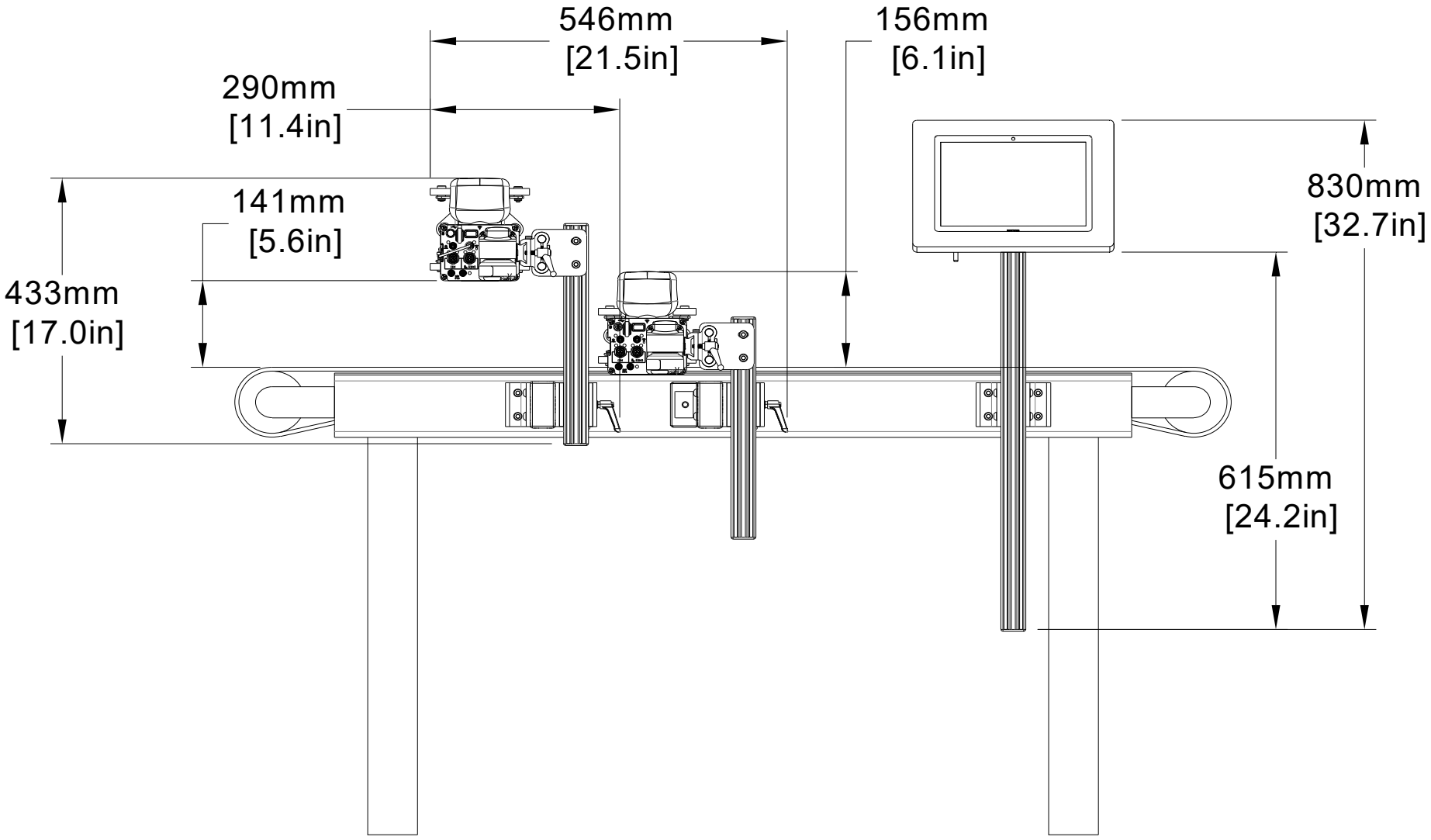
Encoder

Ensure the encoder is plugged into the Primary Printer.

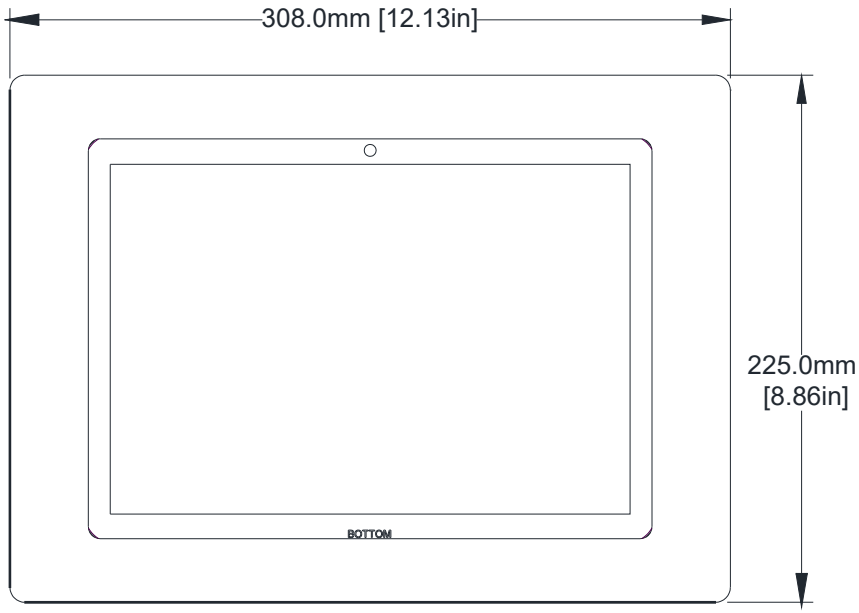
Navigate to the Control Status screen. If the line speed displays a value comparable to the known line speed, then the encoder is functioning correctly. If the line speed displays "0", then check electrical connections to the encoder and PCB. Refer to **Create & Control manual 400463**.

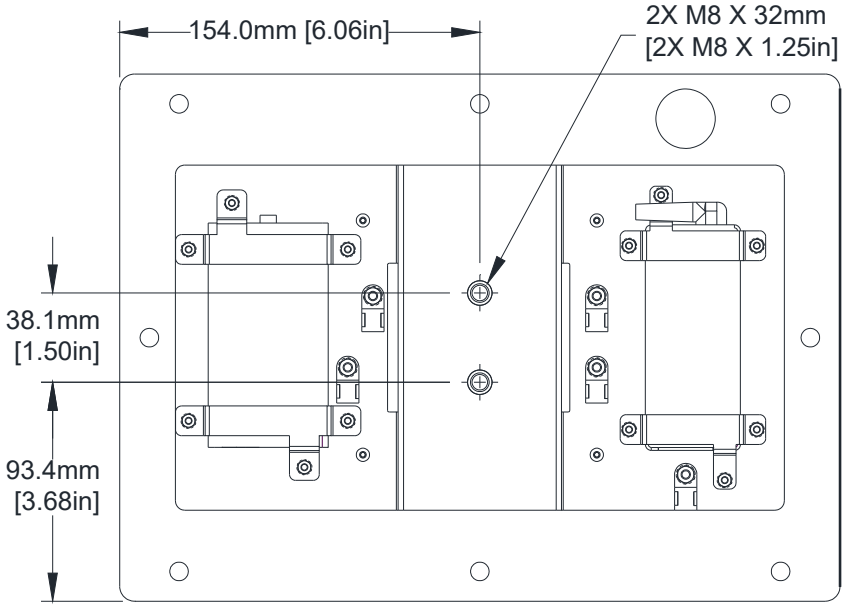
Appendix A: System Specifications

System



Controller HMI





Size
Weight: 2,18kg [5.5lb]
Height: 196,1mm [7.72in]
Width: 330,7mm [13.02in]
Depth: 41,3mm [1.62in]

IP Rating
IP34 (estimated)

Enclosure
HDPE Plastic

User Interface
Graphical User Interface
with on screen keyboard

Fonts
True Type

Display
274.3mm [10.5in] LCD with TFT touch screen, 1920 X 1280 pixels

Storage & Memory
64GB SSD
4GB RAM

Ports
(2) USB-A 3.0 port
(1) Gigabit Ethernet port

Electrical
Input: 12VDC, 3A

Environment
Ambient operating temperature: 0°C - 40°C (32°F to 104°F)
Operating humidity: 10% - 90%, non condensing

2" Printer

Size - 2" Head
L: 447mm [17.6in]
W: 66mm [2.6in]
H: 117mm [4.6in]
Weight: 2,7kg [6lbs]

IP Rating
IP65 (estimated)

Enclosure
Anodized aluminum, black

Electrical
24VDC, 2A input

Filtration
75 micron ink supply vent filter

Print Speed
Alpha/Numeric Text: Up to 61 meters per minute [200 feet per minute] @ 200 dpi; 40 meters per minute [130 feet per minute] @ 300 dpi.

Barcode: Up to 46 meters per minute [150 feet per minute] @ 200 dpi.

* Higher line speeds achievable with reduction of dpi.

Print Resolution
384/128 Engine: 128 addressable channels, 51mm [2in] solid print height

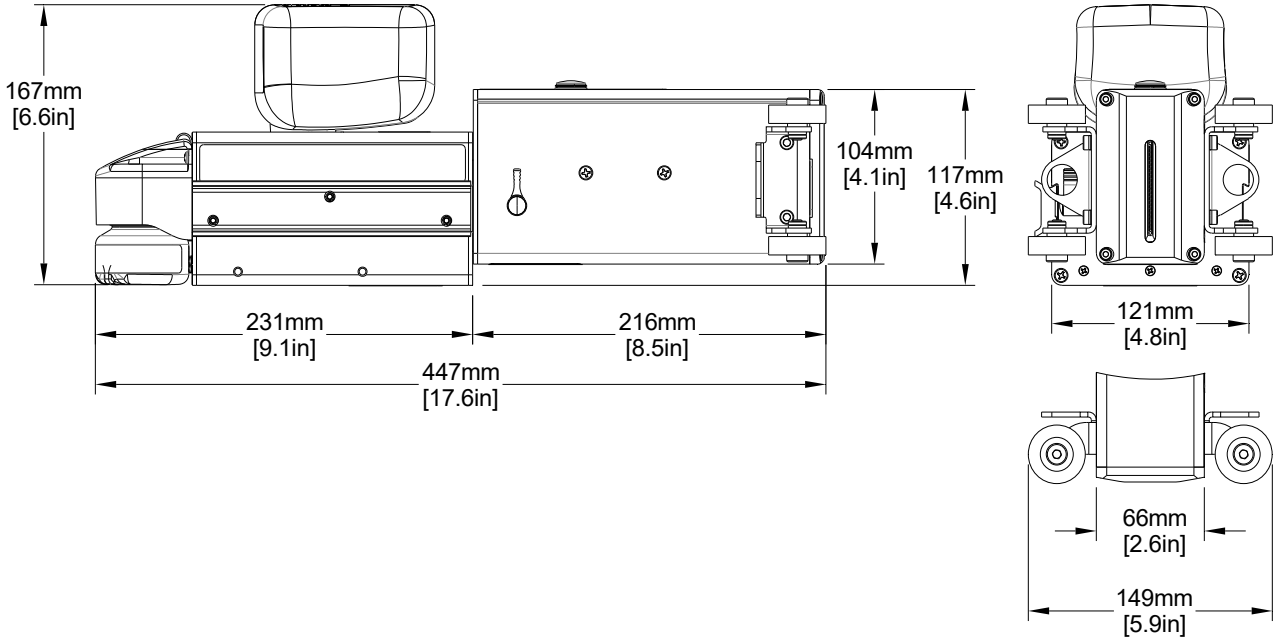
Throw Distance (Print Gap)
Up to 6,4mm [1/4in] for alphanumeric. 3,2mm [1/8in] recommended for best barcode quality.

Ink Type
Pigmented Ink for porous substrates, black

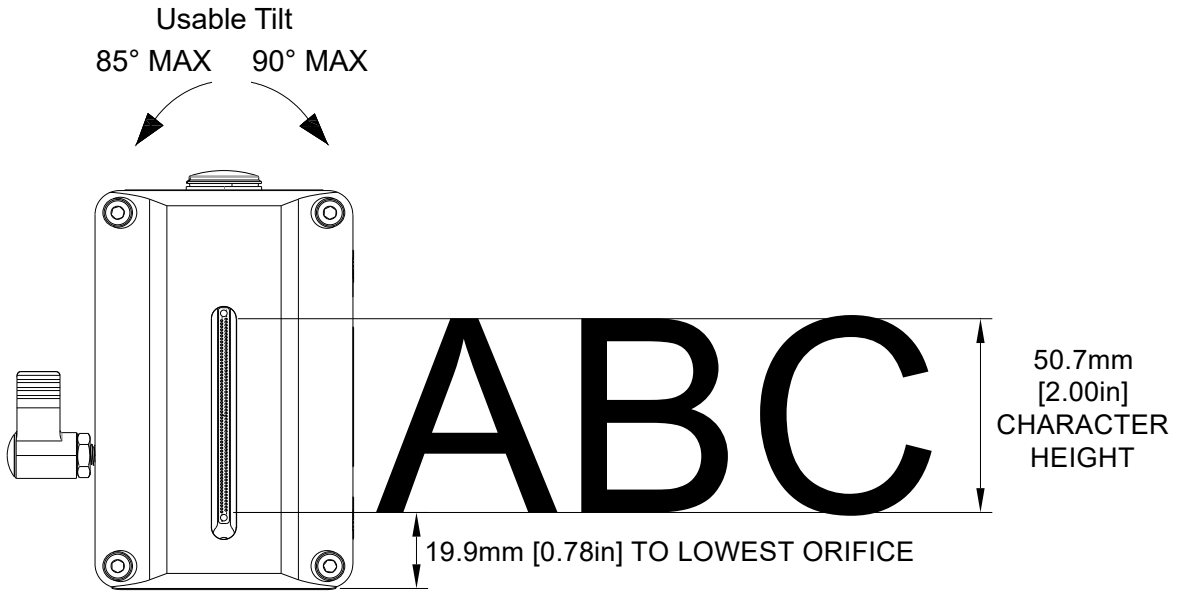
Environment
Ambient operating temperature: 4°C to 40°C (40°F to 104°F)

Operating humidity: 5% - 90% non-condensing

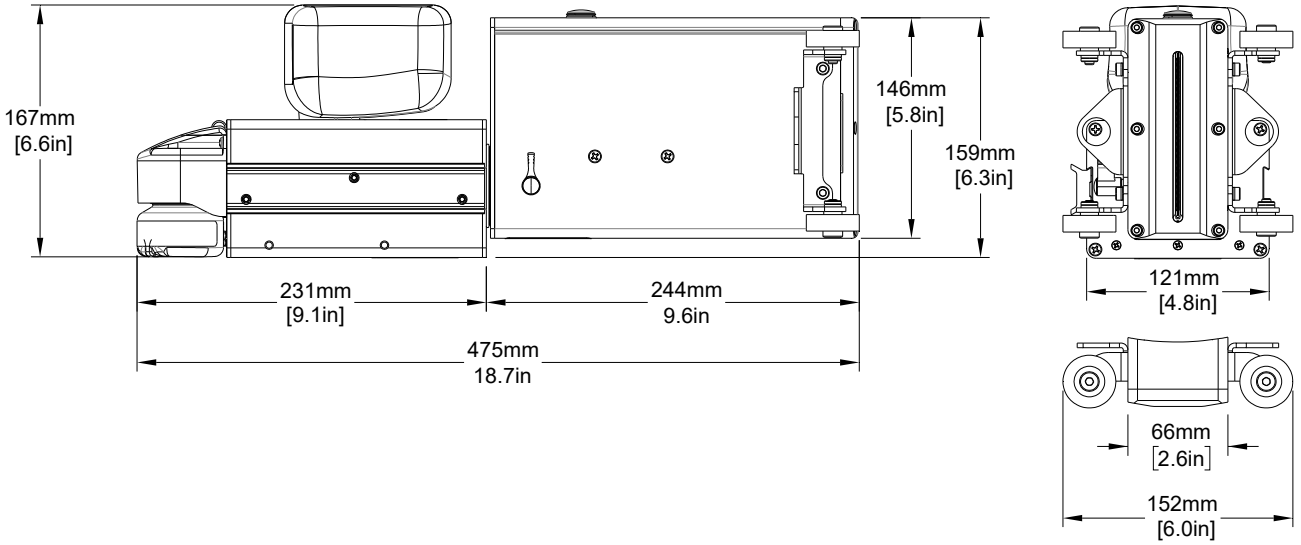
Cleaning System Consumable Usage
Ink: 0.6ml



Print Swath and Tilt



4" Printer



Size - 4" Head
L: 338,1mm [13.31in]
W: 71,1mm [2.80in]
H: 160,8mm [6.33in]
Weight: 4,3kg [9.5lbs]

IP Rating
IP65 (estimated)

Enclosure
Anodized aluminum, black

Electrical
24VDC, 2A input

Filtration
75 micron ink supply vent filter

Print Speed
Alpha/Numeric Text: Up to 61 meters per minute [200 feet per minute] @ 200 dpi; 40 meters per minute [130 feet per minute] @ 300 dpi.

Barcode: Up to 46 meters per minute [150 feet per minute] @ 200 dpi.

* Higher line speeds achievable with reduction of dpi.

Print Resolution
768/256 Engine: 256 addressable channels, 102mm [4n] solid print height

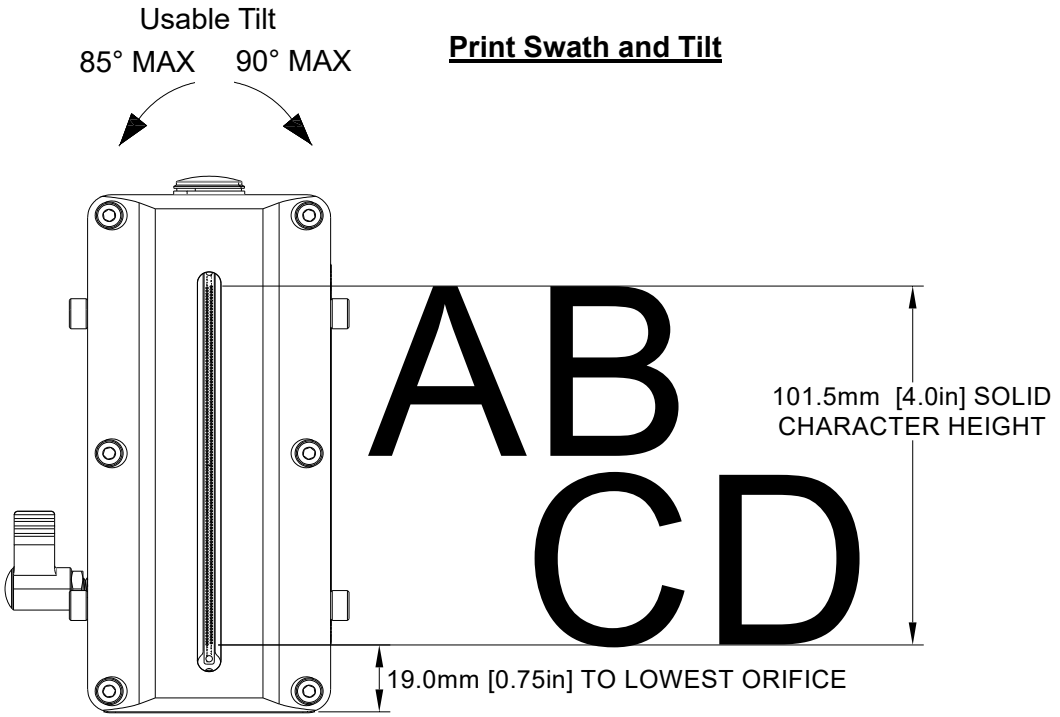
Throw Distance (Print Gap)
Up to 6,4mm [1/4in] for alphanumeric. 3,2mm [1/8in] recommended for best barcode quality.

Ink Type
Pigmented Ink for porous substrates, black

Environment
Ambient operating temperature: 4°C to 40°C (40°F to 104°F)
Operating humidity: 5% - 90% non-condensing

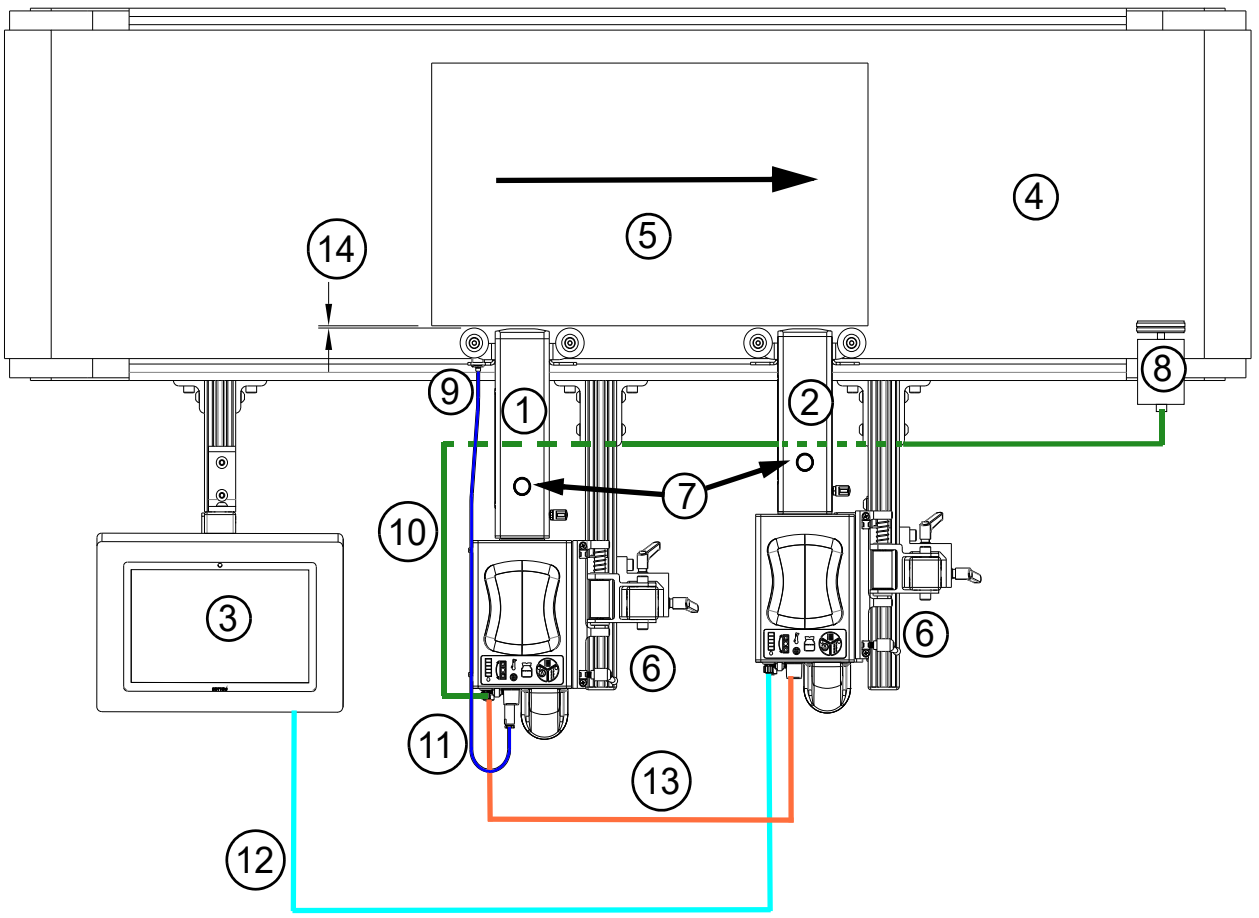
Cleaning System Consumable Usage
Ink: 0.7ml

Print Swath and Tilt

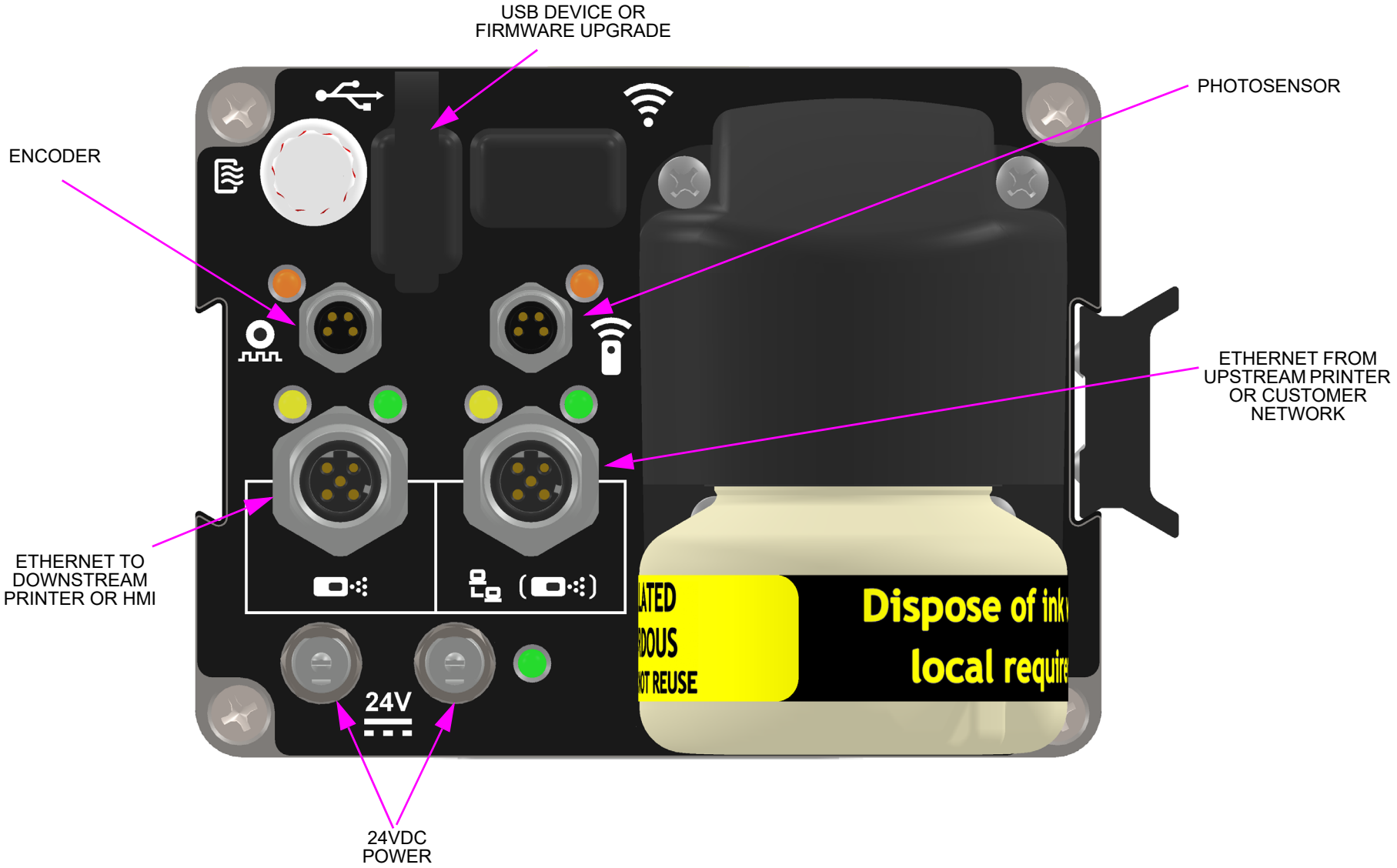


System Interconnect Diagram

1. 4" Printer (Primary)
2. 2" Printer (Secondary)
3. HMI
4. Conveyor
5. Product and Print Direction
6. Printer Bracketry
7. Ink Status / Communications LED
8. Encoder
9. Photosensor
10. Encoder Cable
11. Photosensor Cable
12. Ethernet Cable, HMI to Printer
13. Ethernet Cable, Printer to Printer
14. Throw Distance (1mm - 2mm [.04in - .08in] Recommended)



Customer System Connection



Appendix B: Theory of Operation

Functional Description

This high-resolution inkjet Printer prints text, autocodes (such as product counts or time and date stamps), barcodes, and/or graphics onto products as they travel by conveyor past stationary Printers. Print can be placed on any one of, or a combination of, the product's sides. 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 whose elements are created and controlled in software and maintained on the Ink Supply Module.

2" and 4" Printer

This Printer consists of an Ink Supply Module (ISM) and Printer Module (PM). The ISM is comprised of a Smart CPU printed circuit board, ink cartridge, ink manifold, ink pump, vacuum waste system, and male coupling. The PM contains a female receiver coupling, ink management fluidics, and piezoelectric print engine.

Ink Supply Module (ISM)

Ink flow and pressure is managed by the ISM along with ink waste recovery. When the ink cartridge is inserted into the septum receiver, two needles puncture the septum on the cartridge and allow for ink to flow into the manifold up to a control point level. Atmospheric pressure is allowed through a vent on the rear of the ISM. When the system is printing, capillary action pulls the ink from the ISM into the PM, and to the piezoelectric print engine. The action of ink flow from printing or priming lowers the ink level in the manifold reservoir to the control point where atmospheric pressure allows the flow of ink from the cartridge. In addition to ink flow, the ISM manages ink recirculation and priming via an ink pump. When either the **Recirculation** or **Clean / Prime** feature buttons are activated, the ink and vacuum pumps turn ON, and the print is disabled. During **Recirculation**, the ship cap should be installed. When using the recirculation feature, downstream pressure builds allowing optimal conditions for removing unwanted air from the ink supply system and wetting of the print engine ink pathways. Finally, the ISM provides a means of ink / waste collection from the use of the **Clean / Prime** feature.

The ISM CPU electronics control all functionality of the Printer. These functions include all fluidic management, LED’s, button presses, wireless and wired connectivity, photosensor and encoder communication, message storage, and all print imaging features. Once a message has been sent to the Printer and requested to print, external HMI / controller connectivity is not necessary (i.e. Smart Printer).

Printer Module (PM)

The fluidics in the PM appropriately manage ink as it enters and exits the ink ports of the print engine. When the system is placed in **Recirculation** mode, with the ship cap installed, ink pressure and flow from the ISM through the PM moves air bubbles back to the ISM and is ventilated from the system.

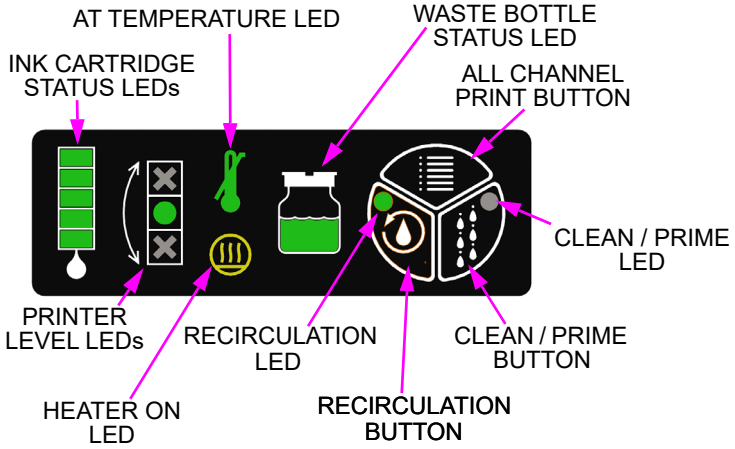
The piezoelectric inkjet print engine has a nozzle plate with an array of orifices and a corresponding array of piezoelectric crystals. These crystals expand and contract rapidly based on voltage being supplied to them. Very small ink pulse waves are created as a result of piezoelectric crystals expanding rapidly, creating a pressure pulse to force ink droplets out the orifices. The print engine also incorporates a heater to control the head temperature, allowing ink viscosity to be maintained over a wide spread of ambient temperatures. The print engine must be at the correct operating temperature before printing and can be monitored via the LEDs located on the rear of the ISM. They show when the heater is ON (irregular modulation) and when the print engine is at the appropriate temperature (steady ON light).

NOTE: Since ink is fed to the print engine via gravity, it is important to maintain the Printer at a level position during operation.

ISM Features

Recirculation

This feature can only be controlled locally at the Printer as the orifice shipping cap must be aligned properly and securely mounted in place. Recirculation is a unique and valuable feature as channel priming time is reduced at initial setup, or channel loss due to significant vibration and / or high-impact events. The feature can be activated by pressing and holding the **Recirculation** button on the top of the ISM for 10 seconds; its LED turns ON as shown. During this time it is critical to have the orifice shipping cap installed and properly aligned with the supplied front-plate grooves. The user can choose when to disengage the feature by manually pressing the button again, or it will time-out after 15 minutes. After removing the ship cap and swabbing the orifice plate, the prime feature should only be needed 1-2 times, significantly reducing the amount of ink usage. In addition, the expectation should be for significant channel recovery.



Clean / Prime

Clean – Momentary press of the **Clean / Prime** button and assumes the ship cap is not installed: The Printer incorporates a Cleaning System to remove debris from the orifice plate. A small vacuum channel has been designed into the bottom of the nozzle plate. During a cleaning cycle, a small amount of ink is pulsed through the orifices. When a cleaning cycle is activated, the vacuum pump turns ON, as well as its button LED (shown here in the OFF state), shortly after, ink pulses out of the nozzle plate, and then the vacuum pump continues to run for 45 seconds to ensure ink / waste residue is pulled to the waste collection bottle located at the rear of the ISM. A **Clean** cycle can be manually initiated by pushing the **Clean / Prime** button located on the rear of the ISM, or it can also be programmed to run at specified times by using the **Control** software.

Prime – Press and hold the **Clean / Prime** button for up to 5 seconds and assumes the ship cap is not installed: When recovering print after de-capping the Printer Module or a more aggressive cleaning is desired, the **Prime** feature can be used and will pulse out more ink. After the ink is pumped out, the behavior of the **Printer** is identical to the **Clean** feature.

NOTE: For either the Clean or Prime feature, print is disable for 15 seconds after the flow of ink. During this time, the Clean / Prime LED on the button is illuminated. When print is re-enabled, the LED turns OFF.

All Channel Print

The functionality to check for 100% print from the Printer is available locally at the Printer. This function can be performed by momentarily pressing the **All Channel Print** button on the rear of the Printer while passing a substrate in front of it in a horizontal direction.

PM Digital Level

A digital level indication is provided by three LEDs located on the top rear of the enclosure. The Printer is considered level, as indicated by a central green LED, when the PM is within +/- 1.5° front-to-back, level to the horizon. The digital level is factory calibrated.

Ink Cartridge Status Gauge

Ink volume in any given cartridge is tracked down to the milliliter. Status is both read and written to the cartridge. If the cartridge is moved to another Printer, then the correct ink volume is maintained with the cartridge. In addition, there are five LED divisions on the rear of the ISM. Each division representing 20% ink volume.

Waste Bottle Status

During normal operation the waste bottle status light will be green; indicating the waste bottle is not full. When the ink waste level rises to a point where it lifts the float UP in the waste module, this LED will turn red. The waste ink will then need to be removed and emptied according to local laws and regulations. When the waste bottle is removed, the float switch will drop DOWN, and the LED will change to green.

Ink States

Normal Operation

During Normal Operation, the Primary LED on top of the PM is illuminated green because there is at least 20% or more ink left in the cartridge, and the smart chip on the cartridge is being read properly. Print is always enabled in Normal Operation.

Ink Low

When there is less than 20% ink left in the cartridge, the lowest two LED's on the ink supply gauge are yellow and red from top to bottom alerting the user that Ink Out is imminent. Also, the Primary LED changes to red. Print does not disable.

Ink Out

When **100% of all the ink has deposited from the cartridge** and into the ISM reservoir, the ink level begins to drop. At a controlled point, the float in the reservoir drops low and triggers the Ink Out state. The lowest LED on the ink gauge changes to flashing red as does the Primary LED. For best practices, **this is the appropriate time to change the ink cartridge**. The time to refill the reservoir with a new cartridge is minimal. Print does not disable.

Ink Error (Faults)

1. If the Ink Out state is ignored, a buffer is in place to allow for additional printing. Ten more milliliters of ink are allowed. The time to consume this volume is variable based on application parameters. Once this 10ml volume is consumed the system will change to an Ink Error state. The LED's on the ink gauge will fast flash as will the red primary LED. In addition, print will be disabled. It will take approximately 30 seconds to refill the reservoir and lift the float switch up. At this point, print will be enabled.
2. If the ink cartridge is removed, then the operator will have 15 minutes to replace the cartridge. After this time is expired, and the cartridge has not been replaced, then print will be disabled, and all LEDs will flash on the ISM interface.
3. If an incorrect cartridge type is inserted, then print will immediately be disabled and all LEDs will flash on the ISM interface.

NOTE: Never mix ink types because they are not miscible. Irreversible internal damage will occur.

Ink Waste Collector Full

Upon filling the ink waste collector bottle, a float level detect raises inside the separator assembly. The feature disables pumps inside the ISM until the waste bottle is emptied. By disabling the pumps, overflow is prevented at the waste bottle. If the waste bottle is filled (waste float up) during a Clean / Prime, the cycle will complete; however, subsequent cycles are not allowed.

Printer Daisy Chain

Printers attach to the system (production line) in a daisy chain configuration via Ethernet or wireless. The Primary Printer is the beginning of the daisy chain and has the photosensor plugged into it. All data is fed downstream from the primary Printer to the daisy-chained heads.

If connecting the system via hard cables, an Ethernet cable can be connected from the HMI / Controller to the Primary Printer CPU (J6). The next downstream head will connect to the Primary head via an Ethernet cable between the output port (J7), and the input CPU port (J6) on the next Printer. This I/O repeats for all downstream heads. The maximum number of daisy chain Printers is eight.

One power supply can power up to two Printers and an HMI, independent of Printer size (2" or 4"). An additional power supply is required for every two Printers in the daisy chain.

When print messages are sent to the Primary Printer, all downstream daisy chain Printers receive the same information. When a production line is running, photocell and encoder data are dynamically communicated to all the Printers to maintain timing and stay in sync.

Print Trigger Photosensor

The photosensor detects when a product is about to pass by the PM nozzle plate and signals the CPU 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 system 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 Printer CPU (J5).

Encoder

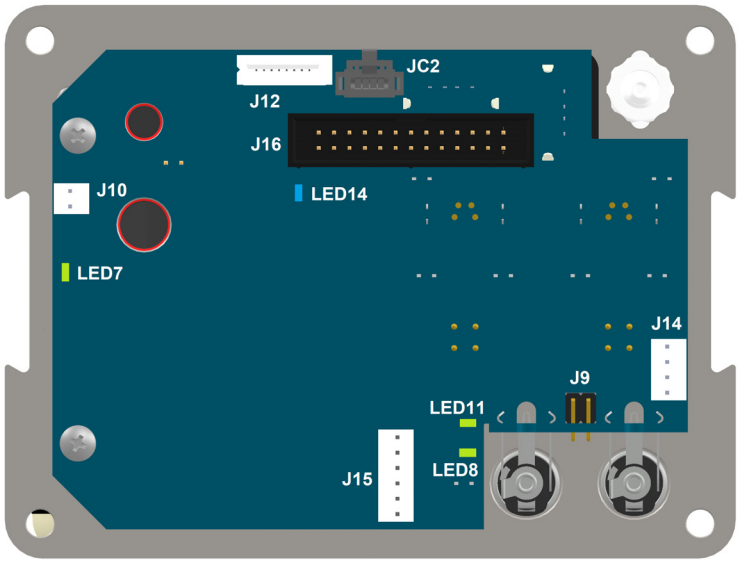
The encoder determines the time period between the printing of individual columns, or the print speed. As a product's speed increases, the time period between columns must decrease, that is, the print speed must increase, to maintain consistent column-to-column spacing. The system has two encoder options,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

The **external encoder** is a 24VDC 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 Printer CPU (J4), and its signal is used to time the sending of column data to the Printer.

The **internal encoder** signal is a constant frequency pulse stream generated on the Printer CPU. This pulse stream is divided down in the CPU to generate the desired speed / timing.

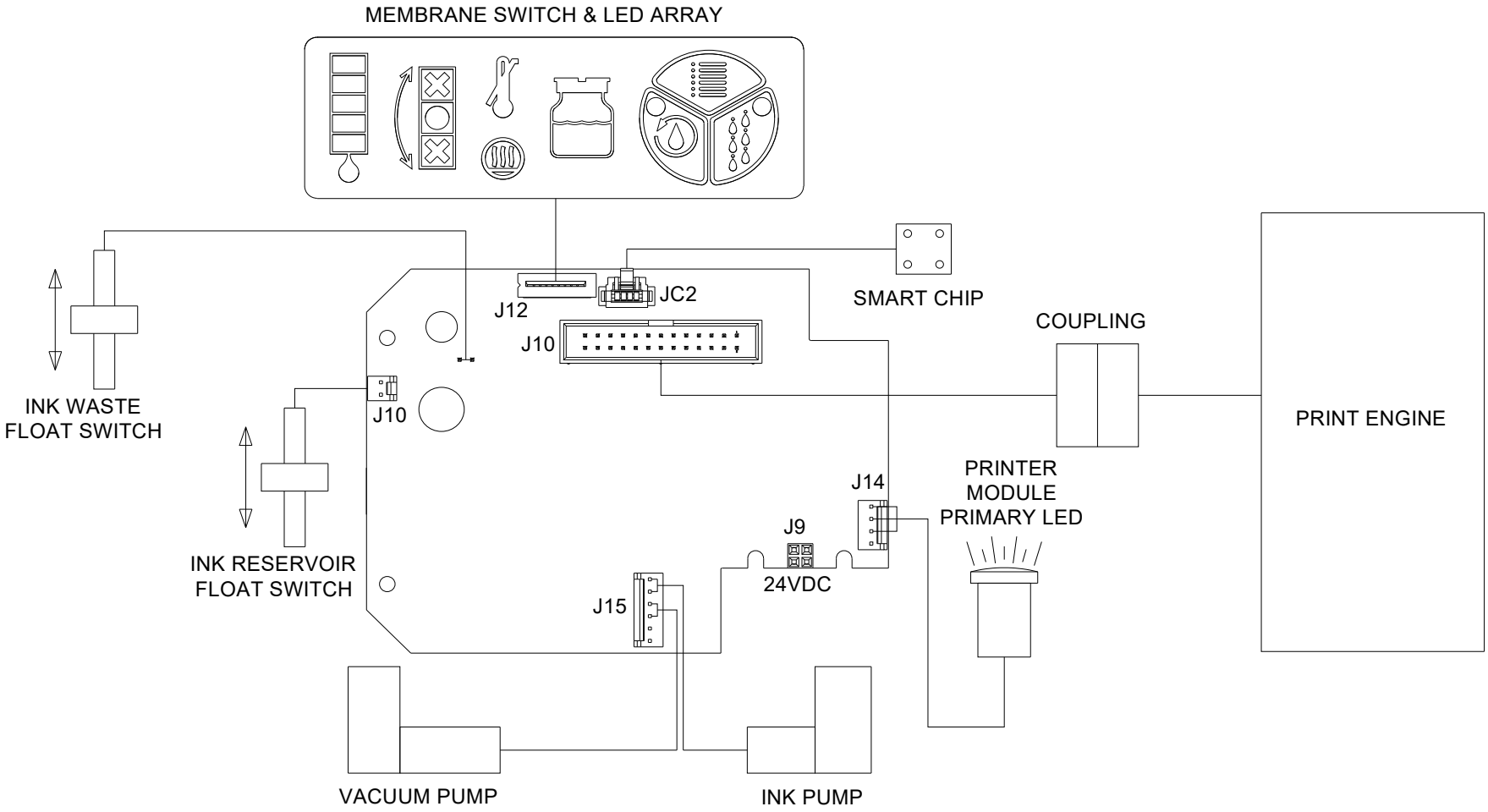
Appendix C: Diagrams

ISM Main CPU PCB Assembly



LED	Description	Connector	Description	Connector	Description
LED1	Ethernet: ON = 100 Mbps; OFF = 10Mbps	J1	WIFI Dongle: USB	J15	Ink and Vacuum Pumps: 6-pin
LED2	Ethernet: ON = 100 Mbps; OFF = 10Mbps	J2	Power: 24VDC, 3/8-32 threaded	J16	Print Engine: 26-pin
LED3	Ethernet: Flashes indicates network traffic	JC2	Smart Chip: 4-pin	J22	Optional Serial: USB-A
LED4	Ethernet: Flashes indicates network traffic	J3	Power: 24VDC, 3/8-32 threaded		
LED5	Photosensor: Indicates product detect	J4	Encoder: M8		
LED6	Power: Indicates power to ISM	J5	Photosensor: M8		
LED7	Float Switch: Indicates ink full in reservoir	J6	Ethernet Input: M12		
LED8	Vacuum Pump: Indicates ON	J7	Ethernet Output: M12		
LED9	Encoder: Indicates ON / moving	J10	Reservoir Float Switch: 2-pin		
LED11	Ink Pump: Indicates ON	J12	Membrane Switch & LED: 8-pin ZIF		
LED14	Heartbeat: Indicates program is active	J14	PM Primary LED: 4-pin		

ISM Internal Wiring Diagram



Appendix D: Ink

Storage Life of a FACTORY SEALED Cartridge of Ink

- 24 months from date of manufacture.
- Store in a cool dry environment between 10°C - 32°C (50°F - 90°F).

Temperatures above or below the recommended storage temperature for a period greater than one week will reduce the storage life of the ink.

NOTE: Do not shake the ink cartridge before use. Agitating the ink may introduce air into the Printer. If shaken, the cartridge must sit for at least two hours before use.

Use Life of an OPENED Cartridge of Ink

- 12 months from opening.

NOTE: Exposure to air, temperature and relative humidity will affect the useful life of the ink.

Storage Life of the Printer Module or Ink Supply Module

- 12 months from date of manufacture.
- Store in a cool dry environment between 10°C - 32°C (50°F - 90°F).

Appendix E: Updating the ISM Firmware via USB

For instructions on updating the ISM, refer to **Create & Control manual, 400463**.

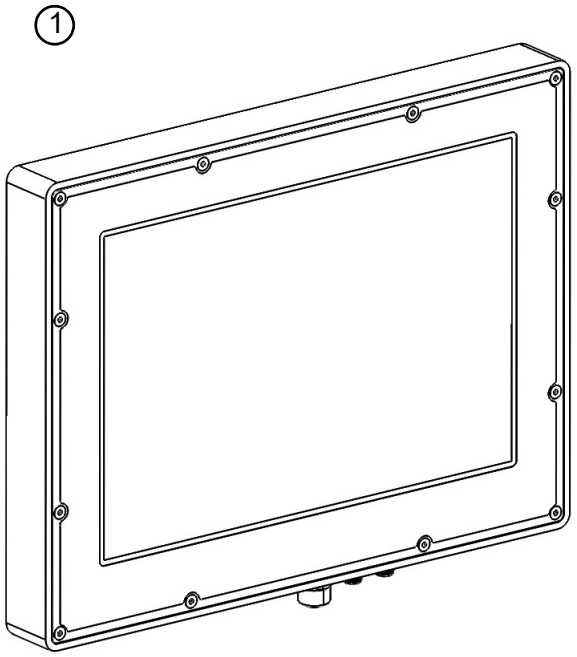
Appendix F: Software Interface

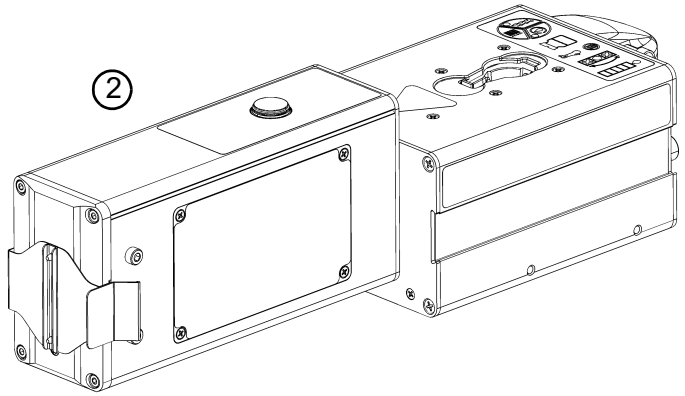
For information on interfacing with the software, refer to **Create & Control manual, 400463**.

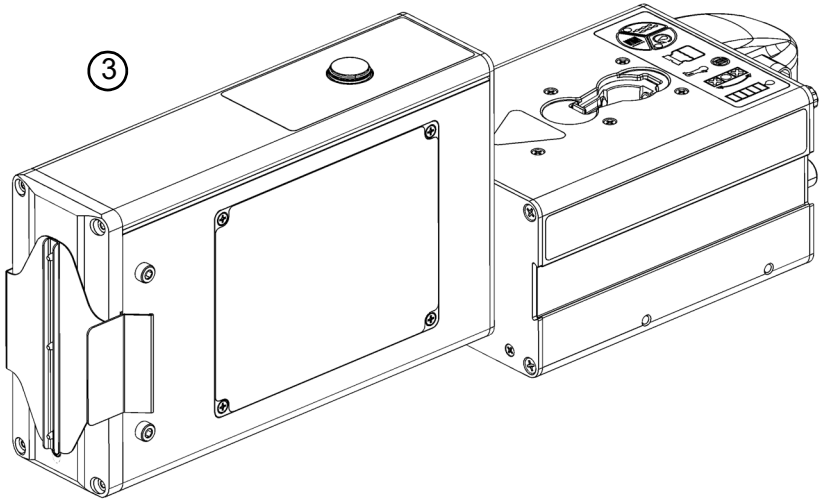
Appendix G: Part Numbers

System

Item	Part No.	Description
1	404050	HMI / Controller
2	400001PUB	2" Printer, Porous Ink (Domestic or European)
3	400004PUB	4" Printer, Porous Ink (Domestic or European)

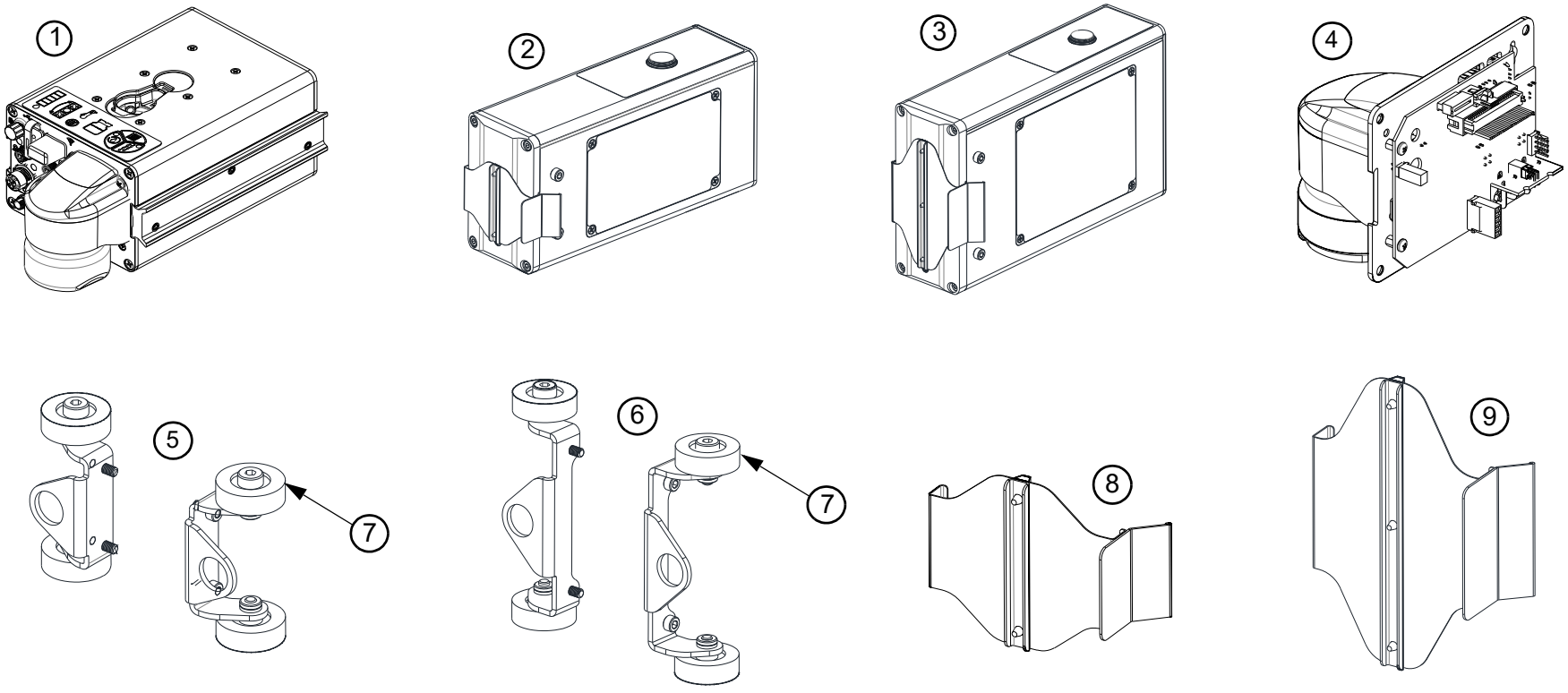






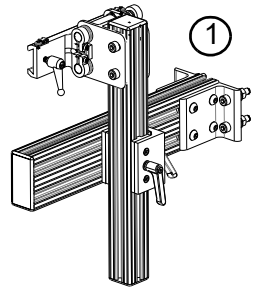
Printer Replacement Parts

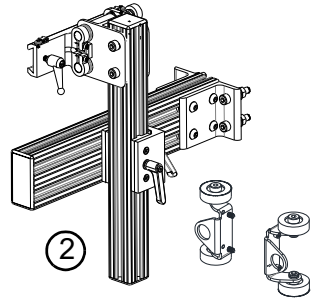
Item	Part No.	Description
1	400002PUB	Ink Supply Module, Porous Ink
2	400003PUB	Printer Module, 2", Porous Ink (Domestic or European)
3	400005PUB	Printer Module, 4", Porous Ink (Domestic or European)
4	400205	PCB, Rear Plate, & Vacuum Module Assembly
5	400214	Roller with Mounting Bracketry, 2" Printer
6	400215	Roller with Mounting Bracketry, 4" Printer
7	5760835	Roller Replacement Kit (5 Rollers)
8	400209	Orifice Ship Cap, 2" Printer
9	400210	Orifice Ship Cap, 4" Printer

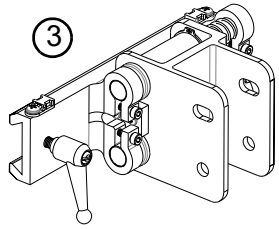


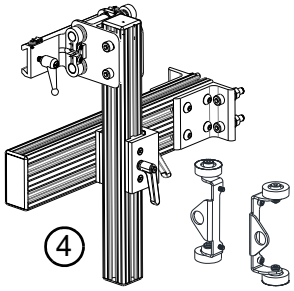
Bracketry

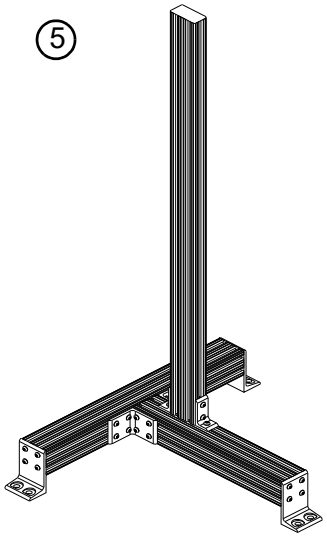
Item	Part No.	Description
1	400200	Mounting Bracket Kit with Retractor for 2" or 4" Printer (Domestic or European)
2	400201	Mounting Bracket Kit with Retractor and Rollers for 2" Printer (Domestic or European)
3	400202	Retractor Mounting Bracket Kit
4	400204	Mounting Bracket Kit with Retractor and Rollers for 4" Printer (Domestic or European)
5	5765249	T-Base Stand Kit
6	5765250	HMI / Controller Conveyor Mounting Bracket Kit
7	5760354	Multi Printer Conveyor Mounting Kit *
8	5760355	Printer Floor Mounting Kit *
9	5760356	Multi Printer Floor Mounting Kit w/24" Bar *
	5760357	Multi Printer Floor Mounting Kit w/44" Bar *
* Requires Single Printer Kits (400200, 400201, or 400204)		

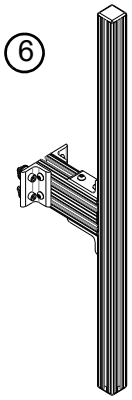


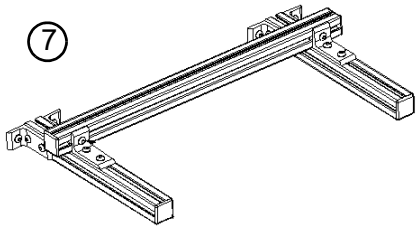


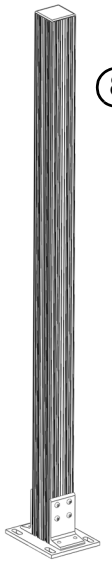


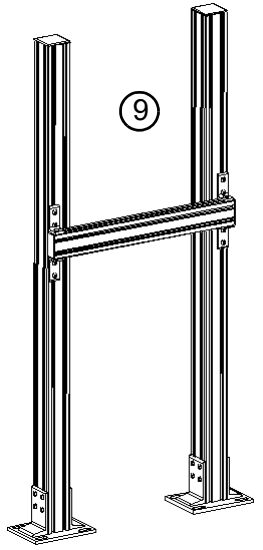






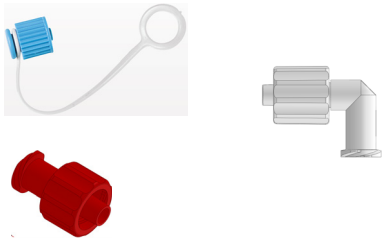






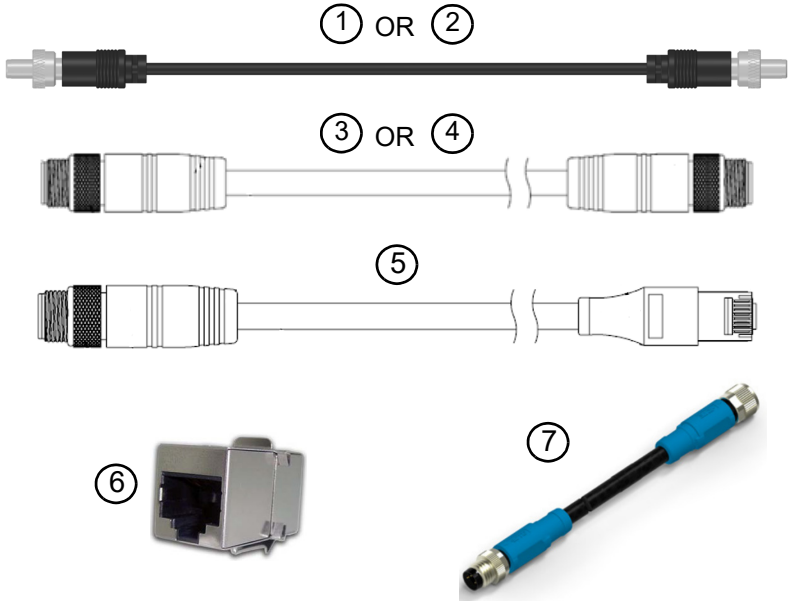
Fittings

Part No.	Description	Contents	Where Used
400223	Fitting, 400522, Luer Cap, Male	5 fittings per kit	ISM vent port - storage
400224	Fitting, 400521, Luer, 90 degree	5 fittings per kit	ISM vent port - while printing
5765241	Fitting, 5765562, Luer, 75 Micron Filter	5 fittings per kit	ISM vent port - while printing



Cables

Item	Part No.	Description
1	400490-2.0	Cable, Power Jumper, 2m
2	400490-3.0	Cable, Power Jumper, 3m
3	400371-2.0	Cable, Ethernet, Printer to Printer, 2m
4	400371-3.0	Cable, Ethernet, Printer to Printer, 3m
5	400374-2.0	Cable, Ethernet, Printer to RJ45, 2m
6	400227	RJ45 Ethernet Coupler
7	400530	Extension Cable, M8, 5m (Photosensor or Encoder)
NOTE: Other lengths available; consult the factory.		



Consumables

Part No.	Description	Contents
400212UB	Ink, Pigmented Porous Media, Black, 2-PACK	2 Cartridge, 500mL
400213UB	Ink, Pigmented Porous Media, Black, 12-PACK	12 Cartridge, 500mL
5760695	High-Resolution Maintenance Spray for Porous Ink	2 Pack, Spray Can
5760800	Start Up / Cleaning Kit	Gloves, Lint-Free Wipes and Foam Swabs
5760832	Sponge Swabs	100 Sponge Swabs
6600171	Lint-Free Wiping Cloths	300 Cloths

Service Parts and Optional Equipment

Item	Part No.	Description
1	400203	Photosensor, Diffuse Type w/ 2ft Cable
2	400206	Encoder Assembly w/ Mounting Bracket & 20ft Cable
3	400208	Photosensor/Encoder Adapter (not shown)
4	400211	Beacon, Remote
5	400216	Plug, M8 Connector, pack of 10
6	400217	Plug, M12 Connector, pack of 10
7	400218	Cap, 5/16 Power Connector, pack of 10
8	400219	Shipping Plug, Ink Supply Module
9	400220	Shipping Plug, Printer Module
10	400221	Wheel Replacement, Encoder
11	400222	Power Supply and Mounting Bracket Hardware
12	400225	Waste Bottle, pack of 6
13	400235	Shipping Cap, Ink Supply Module Coupler
14	400236	Replacement Cable, Encoder (not Shown)