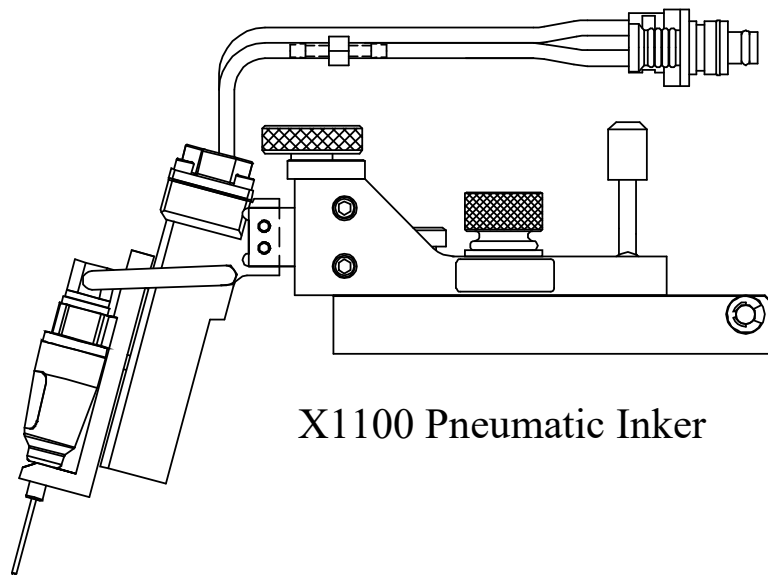




## X1100 SERIES PNEUMATIC INKER INSTALLATION AND OPERATION MANUAL

820-0069 Revision AE  
January, 2024



X1100 Pneumatic Inker

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# SAFETY INFORMATION

Safety and Hazard identification symbols used in this document are intended to be compliant with ANSI/NEMA Z 535.6 2006. The table below lists the symbols used in this document along with a description of each type of safety hazard. Failure to observe identified safety risks may result in serious injury or death.

## Safety and Hazard Identification Symbols

SYMBOL	DESCRIPTION
	<b>DANGER</b> = Indicates a hazardous situation which, if not avoided, will result in death or serious injury
	<b>WARNING</b> = Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	<b>CAUTION</b> = Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	<b>NOTICE</b> = Indicates a practice that is not related to personal injury, but may cause damage to equipment or property.

	<i>Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.</i>
	<i>Install the pneumatic controller in a location that is easily accessible to the operator. The ON/OFF switch is the pneumatic controller's main disconnecting device and must be easily accessible at all times.</i>
	<i>For your safety, the AC power cord set provided with your product has a grounded plug. Always use the power cord with a properly grounded wall outlet, to avoid the risk of electrical shock.</i>
	<i>Do not operate this product with a damaged AC power cord set. If the AC power cord set is damaged in any manner, replace it immediately. Damaged cords may result in user exposure to hazards.</i>

	<p><i>The power cord set received with the product meets the requirements for use in the country where you purchased the equipment. Use only the power cord provided with the unit or an authorized replacement power cord from Xandex Inc. or an approved Xandex distributor. Use of an inadequately rated power cord may result in shock or injury.</i></p>
	<p><i>Do not operate this product with a damaged DC power supply. If the DC power supply is damaged in any manner, replace it immediately. A damaged DC power supply may result in user exposure to hazards.</i></p>
	<p><i>The DC power supply received with the product meets the requirements for use in the country where you purchased the equipment. Use only the DC power supply provided with the unit or an authorized replacement power supply from Xandex Inc. or an approved Xandex distributor. Use of an inadequately rated power supply may result in shock or injury.</i></p>

## CONTROLLER REDESIGN

The X1100 series pneumatic inker assemblies documented in this manual, incorporate two new design improvements:

- A new Precision Pneumatic Shuttle design.  
The Precision Shuttle provides improved dot placement accuracy and repeatability, and reduced friction surfaces that simplify and extend maintenance cycles.
- The X1100 inker assembly now incorporates micro-fine Z stage adjustment for improved dot geometry and consistency.

What hasn't changed is the way the inker assembly operates and connects to the pneumatic controller. Inker assemblies can be used interchangeably with existing pneumatic controller versions. Please note that in order to obtain your desired dot size, you may have to adjust dot size settings used in your previous setup when using the redesigned inker and shuttle with your existing controller.

In a previous design improvement, Xandex DieMark<sup>®</sup> pneumatic controllers with serial numbers 4000 and higher replaced the controller's internal AC/DC transformer with a new, external AC/DC power supply. If you have a pneumatic controller with a direct AC input, please go to the product manuals section of the Xandex Semiconductor Products website at [www.xandexsemi.com](http://www.xandexsemi.com) to locate the manual for your AC controller model.

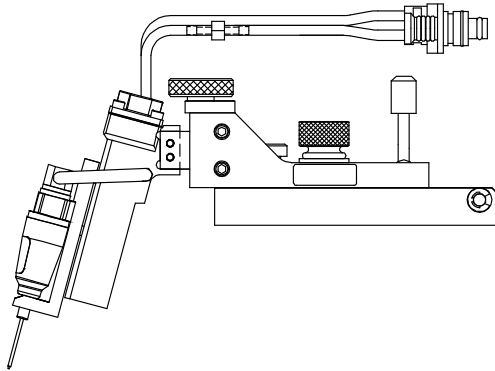
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# Section 1. Introduction

## *Theory of Operation*



The X1100 Series Pneumatic Inker incorporates the convenience of DieMark™ disposable ink cartridges with the reliability of a microprocessor-controlled pneumatic dispensing system for the ultimate inking solution.

Ink dots are deposited via pneumatic actuation of the inker shuttle mechanism and a simultaneous pulse of air into the cartridge reservoir. There is no filament and no direct contact with the wafer surface. A probe signal to the controller initiates the inking sequence, actuating the shuttle mechanism downward and sending an air pulse to the cartridge.

As the shuttle extends to the downward position, the air pulse to the cartridge forces ink out of the cartridge barrel and forms a drop at the end of the needle tip. When the shuttle is at its lowest position, the drop makes contact with the wafer surface and forms a dot.

After 23.3 milliseconds the shuttle returns to the normal position. After completion of each dot, a small amount of vacuum is developed in the cartridge by the closure of the valve, causing the ink to back up into the cartridge reservoir, preventing dripping.

If another dot sequence is not initiated within 10 seconds, a “puff” pulse of air that varies with the dot size setting duration (6.75 - 13.15ms) will displace a small amount of ink back into the Teflon® tube to aid in maintaining proper dot size after long delays between dots.

The dot size is determined by cartridge air pulse duration. Adjust the controller setting to change the dot size - without changing the cartridge. Pneumatic cartridges are factory tuned, ensuring consistent dots and contain 40% more ink than standard DieMark™ cartridges.

Thank you for selecting ...  ...as your inking choice.

Please spend a few minutes familiarizing yourself with the unit. Most questions you may have will be answered in this manual. If you would like further assistance, please contact your local Xandex distributor or call us at (707) 763-7799 or Toll Free in the U.S: (800) 767-9543. FAX (707) 763-2631. For more information about Xandex and our complete line of quality inking and interfacing products, visit us on the Internet at <http://www.xandexsemi.com/> or email: us at <mailto:info@xandex.com>.

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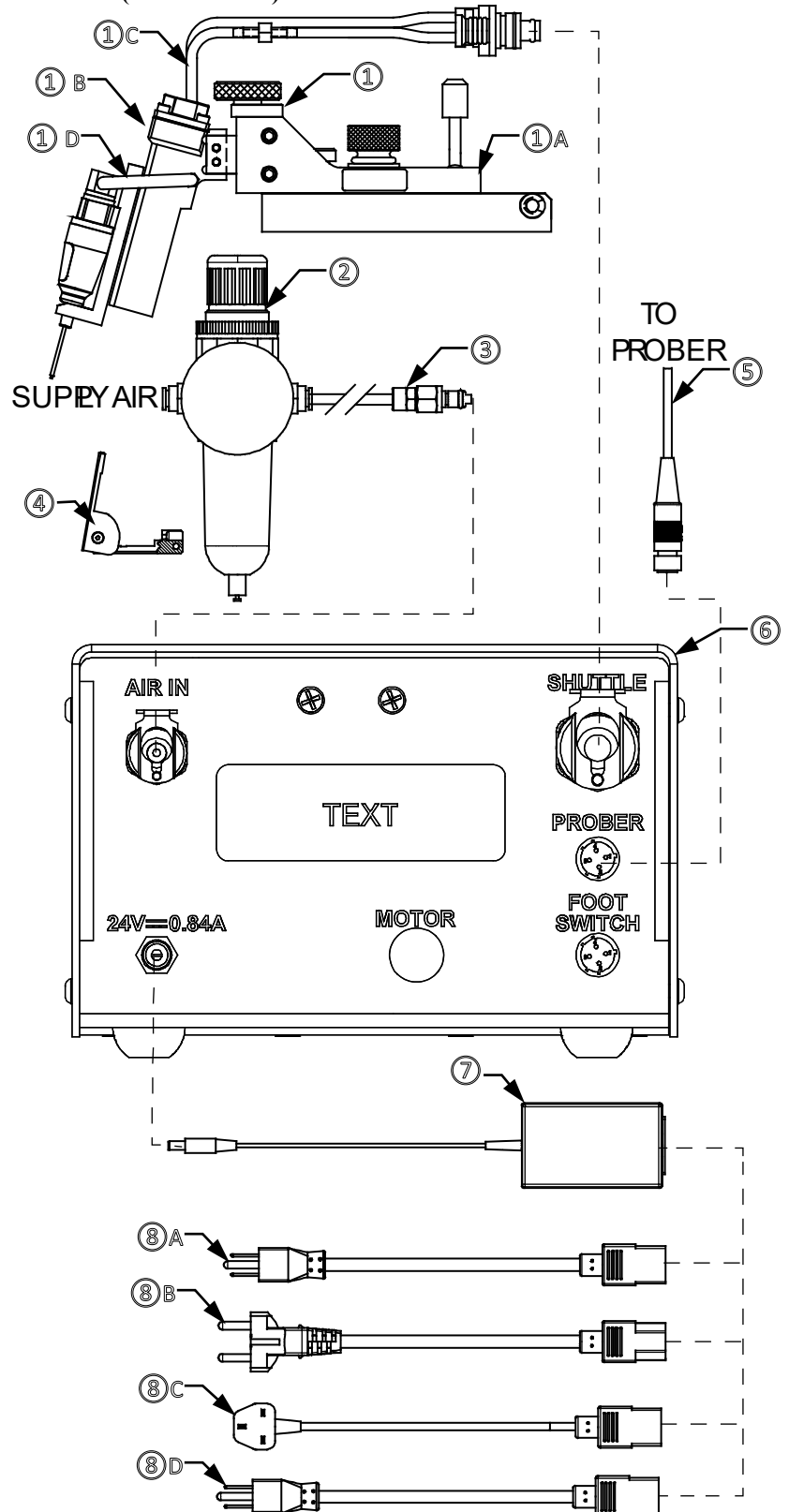
# Section 2. System Overview

## System Components

**Set Part No. 340-1100 (Model X1100) / 340-1105 (Model X1105)**

1. Pneumatic Inker Assembly  
Part No. 320-1100 (X1100)  
Part No. 320-1105 (X1105)
  - A. Inker Base  
Part No. 220-0064 (X1100)  
Part No. 220-0036 (X1105)
  - B. Pneumatic Shuttle, Precision, Direct Mount  
Part No. 316-0010
  - C. Air Hose Controller > Shuttle  
Part No. 210-2014 (X1100, X1105 = 36")
  - D. Air Hose Shuttle > Cartridge  
P/N 210-2016
2. Regulator Assembly  
Part No. 220-0076
3. Air Hose Regulator > Controller  
Part No. 210-2001
4. Cartridge Opening Tool Part No. 200-0001
5. Cable/Connector Assy., 72 inches  
Type AC Part No. 210-0109
6. Pneumatic Controller Part No. 350-0002 (\*Includes ONE AC Power Cord-Item 9)
7. 24VDC Power Supply Part No. 220-0078
8. A. AC Power Cord (USA)\*  
Part No. 158-0051  
B. AC Power Cord (Europe)\*  
Part No. 158-0407  
C. AC Power Cord (UK)\*  
Part No. 158-0408  
D. AC Power Cord (PSE-Japan)\*  
Part No. 158-0727

\*One power cord is shipped with each set and must be specified at ordering.



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## Section 3. Installation

### ***X1100 Inker Installation***

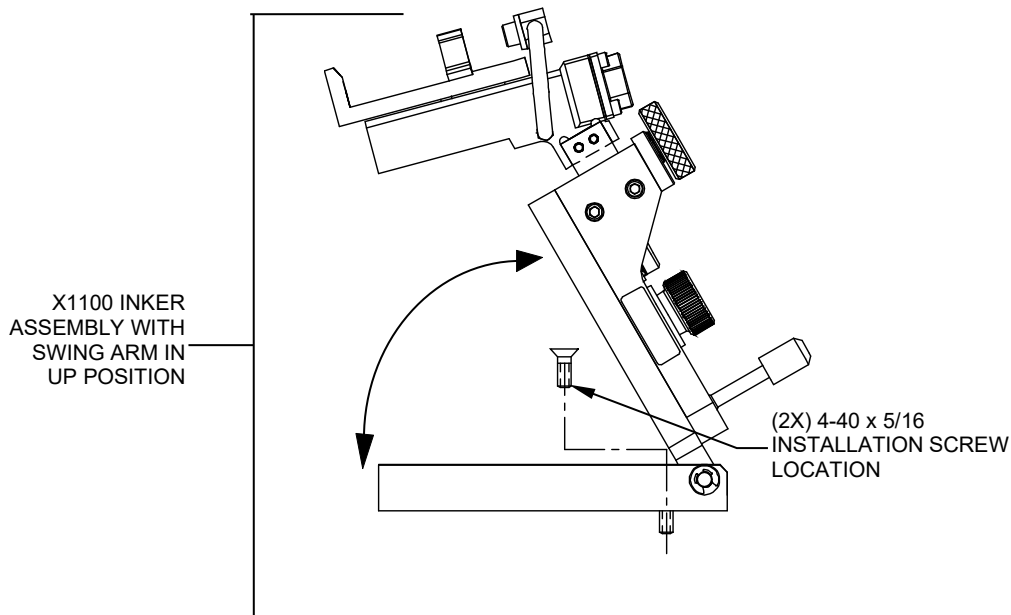
The X1100 and X1105 pneumatic inker installs directly onto the insert ring on an Electroglas 10XX, 20XX, 30XX or 40X0 model prober.

1. If you are currently using another inker, remove it from the prober.

#### **NOTICE**

*Move the chuck/wafer from underneath the inker when installing inker to prevent damage.*

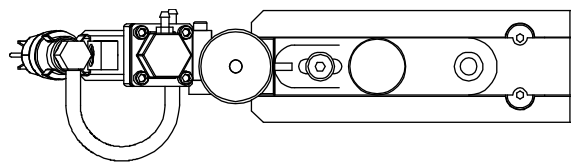
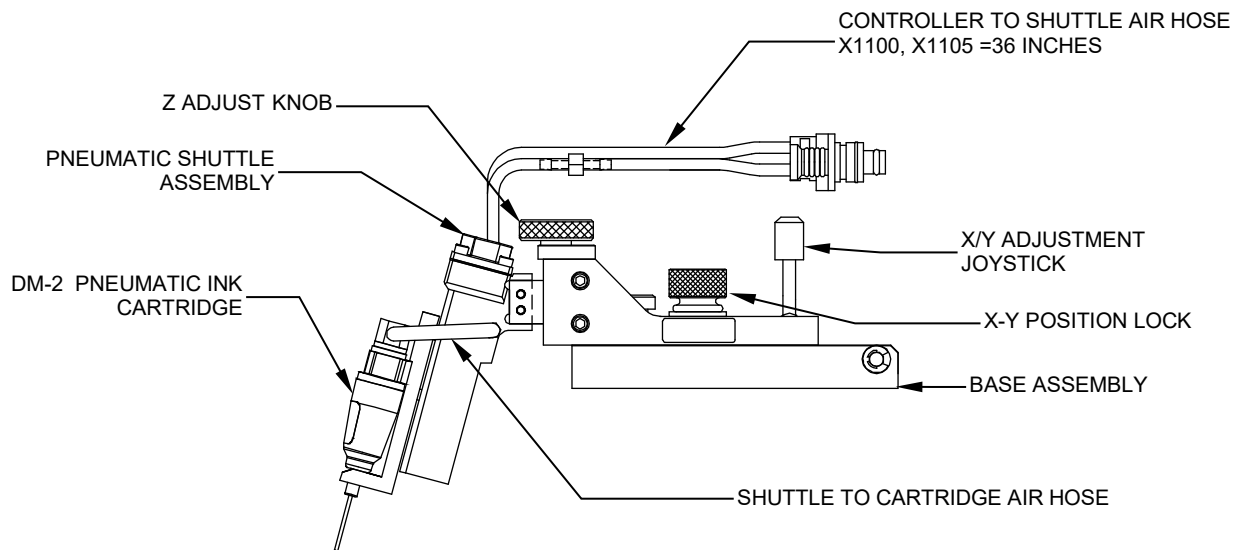
2. Lift the inker swing arm and raise it to the up position. The mounting holes in the inker base will now be visible.



3. Install inker using two (2) 4-40 x 5/16 screws (supplied) into existing mounting holes on the prober insert ring.
4. Proceed to the “**Controller Installation**” portion of this Installation Section (3), and install the pneumatic controller per instructions for your application.
5. With the controller installed, connect the fitting on the *controller-to-shuttle air hose* into the connection on the rear of the pneumatic controller labeled “SHUTTLE”.
6. Proceed to **Section 4 “System Operation”** for ink cartridge installation, inker setup, alignment and controller operation instructions.

**NOTICE**

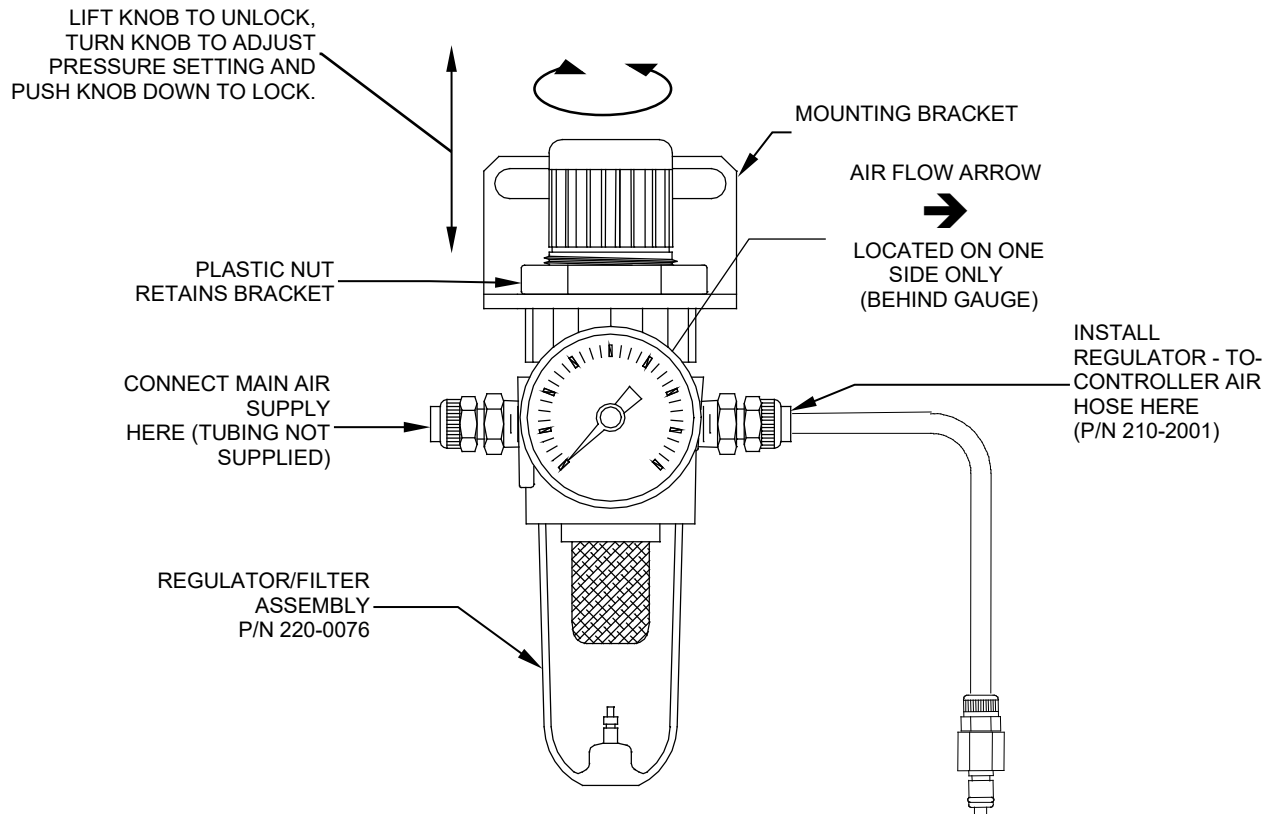
After an ink cartridge is installed, the inker arm should **NOT** be lowered back into operating position with the Z height adjusted completely down. The cartridge may be positioned too low, and the Teflon® tube in the cartridge needle will smash into the wafer when the arm is lowered. This will stop the ink flow and possibly ruin the cartridge or damage the wafer!



OVERHEAD VIEW

**Controller Installation**

1. Remove the bracket from the regulator/filter assembly by removing the plastic retaining nut. Mount the regulator/filter bracket in a convenient location (mounting screws are not supplied). The regulator can be mounted to the bracket with the supplied nut after the bracket is installed.



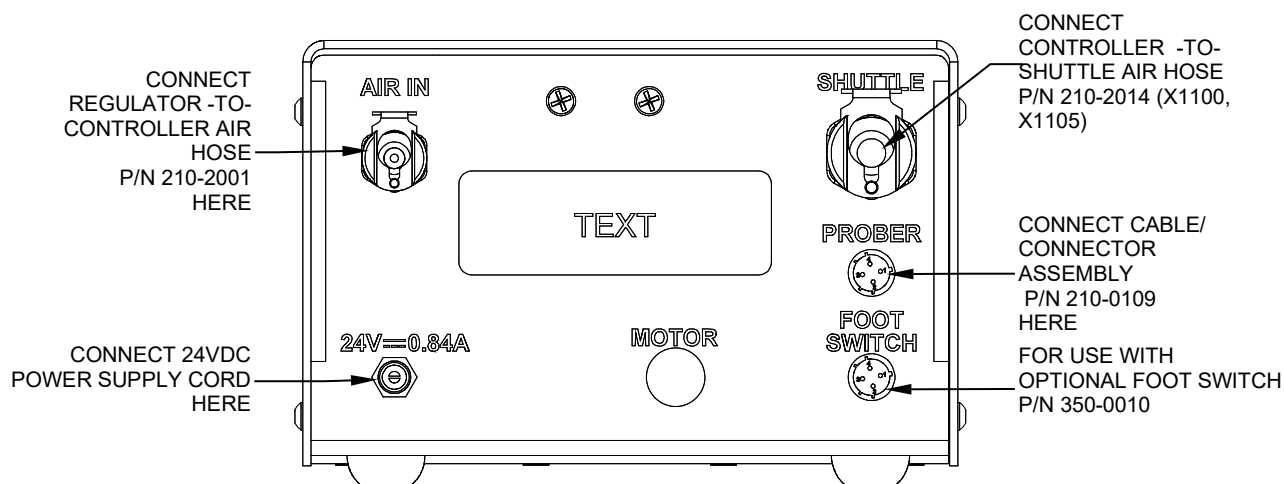
2. Install 1/4 O.D. x 0.170 I.D. polyethylene tubing (not supplied) to the main air source and then connect to the input fitting on the regulator. (The left side when facing the gauge.)
3. Connect the *regulator-to-pneumatic controller air hose* (P/N 210-2001 supplied) to the *output fitting* on the regulator. (The right side when facing the gauge.)

**Note:** The regulator-to-pneumatic controller air hose supplied by Xandex, is 6 feet long. If the distance (hose length) requirement exceeds this length, use 1/4 O.D. x 0.170 I.D. polyethylene tubing.

4. Plug the *regulator-to-controller air hose* into the **small** AIR IN connection on the rear of controller.

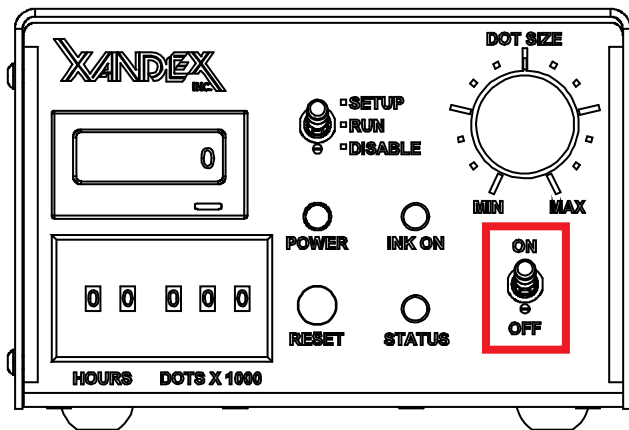
**Note:** *The air hose connectors are spring locked. If the air hose connectors do not insert easily, make sure the spring lock is in the open position by pushing the metal snap-lock down until it clicks.*

5. Turn on the main air and adjust the regulator until it reads  $70 \pm 10$  PSI on the dial. To make regulator adjustments, pull up on the knob on the top of the regulator to unlock, then rotate the knob clockwise to increase or counter-clockwise to decrease. Push down on the knob after adjustment to lock it into position.
6. Check all connections for air leaks. If required, turn off the main air and make necessary repairs.
7. Install the *cable/connector* (P/N 210-0109) to the inker port on the prober and the "PROBER" connector on the rear of the controller unit.
8. Move the toggle switch on front of the controller to "RUN" (mid ) position.
9. Install the *AC power cord* into the back of the power supply. Connect the power supply cord to the 24V-.84A socket on the back of the controller. Plug the AC power cord into an AC supply outlet. Turn the ON/OFF switch on the front of the controller to ON. At this point, the "INK ON" LED and the "STATUS" LED will flash faintly once. Proceed to **Section 4 "System Operation"** for ink cartridge installation, inker setup, alignment and controller operation instructions.



## Section 4. System Operation

### Controller Operation

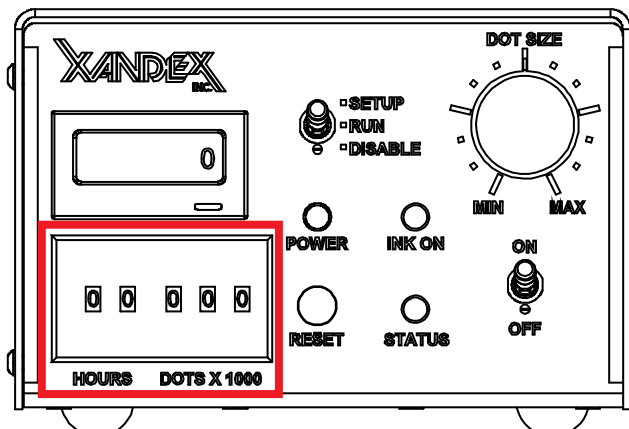


FRONT VIEW

**ON-OFF Switch:** The ON/OFF switch turns power to the controller ON and OFF.



**Install the pneumatic controller in a location that is easily accessible to the operator. The ON/OFF switch is the pneumatic controller's main disconnecting device and must be easily accessible at all times.**



**Programmable Thumbwheel Counter:** Individual thumbwheel settings are available to monitor either the number of dots, the number of hours of operation, or both. The first two thumbwheels on the left are for monitoring the number of hours, with a maximum setting of 99 hours. The next three thumbwheels are for monitoring the number of dots produced, with a maximum setting of 999,999 dots. The red "STATUS" LED will be illuminated when either

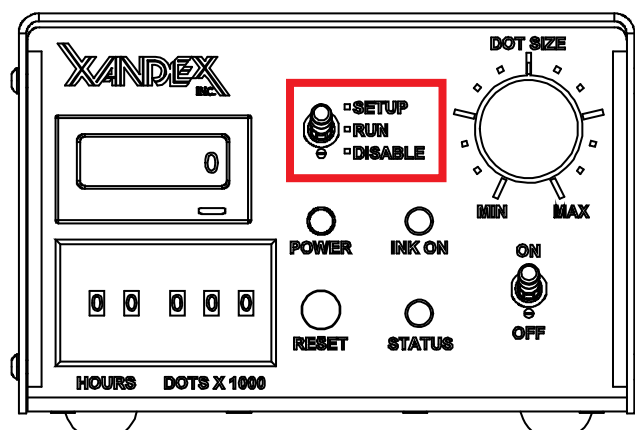
of the programmed limits is exceeded.

To set the limits, make sure the controller has power, adjust the thumbwheels to the desired setting and press the RESET button twice (within 5 seconds). To set for hours only, set the HOURS thumbwheels to the desired value and the DOTS X1000 thumbwheels to 000. To set the limits for the number of dots only, set the DOTS X1000 thumbwheels to the desired value and the HOURS thumbwheels to 00. To use both limits, set each thumbwheel to the desired values. Both settings are monitored and stored in RAM in the microprocessor and are not battery backed-up. The first setting to be reached will illuminate the STATUS LED\*.

HOURS	DOTS X 1000	REACTION
Set	000	"STATUS" LED is lit when "HOURS" set point is reached . For example, if you set the "HOURS" thumbwheel to 24, the "STATUS" LED will turn on when 24 hours of operation are complete.
00	Set	"STATUS" LED is lit when dot count set point is reached. For example, if you select 30,000 dots (turning the "DOTS X 1000" thumbwheel to 30) the "STATUS" LED will light when 30,000 dots have been deposited.
Set	Set	"STATUS" LED is lit when <b>1st</b> set point is reached, regardless if it is hours or dot count.
00	000	"STATUS" LED will not light up (inactive). Feature not invoked.

*\* If controller internal audio alarm is enabled, alarm will sound in addition to the STATUS LED when DOTS X1000 set point is reached (no audio alarm for HOURS set point). See Section 6. Maintenance and Troubleshooting for information on enabling the audio alarm. This feature is only available on controllers shipped after June, 2006.*

<b>NOTICE</b>	<p><b><i>The programmed set points (number of dots or hours) and their associated counters are stored in volatile memory (RAM). If power is lost, the set points will be lost and must be re-programmed using the RESET button after power is restored.</i></b></p>
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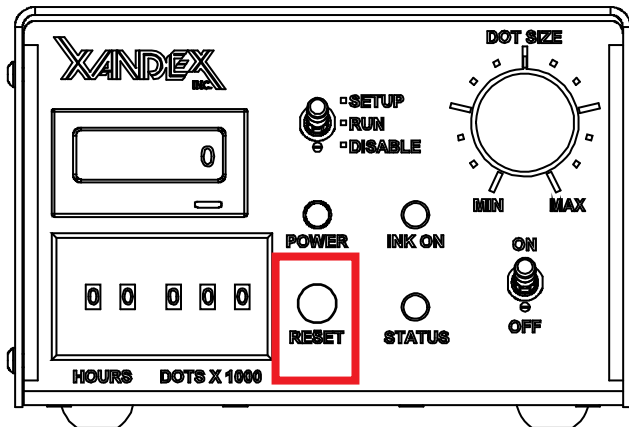
**Mode Selection Switch:** A three position toggle switch is located on the front panel for selecting different operating modes.

- SETUP = Shuttle air valve (V2) is enabled
- RUN = Normal operation
- DISABLE = Shuttle air valve (V2) is disabled

When placed in the "SET-UP" position, the shuttle air valve (V2) is enabled, moving the shuttle to its lowest position for Z set-up adjustment. While in the "SET-UP" mode, perform coarse Z height adjustment as described in the Set-Up and Alignment procedure later in this section (4).

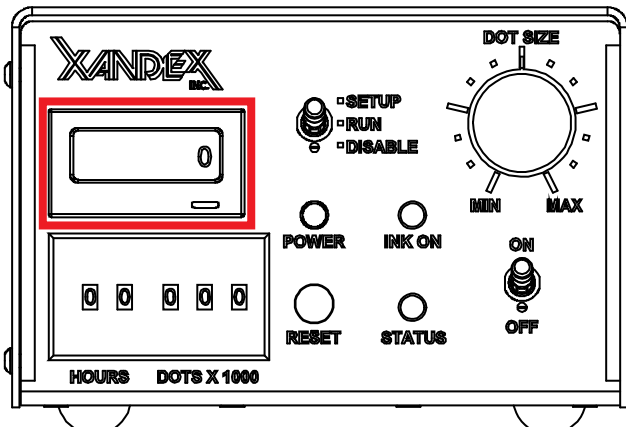
After five minutes in the "SET-UP" mode, the microprocessor will disable the shuttle air valve, returning the shuttle to the normal position. If set-up was not completed, return the switch to the "RUN" position, then back to "SET-UP". In the "RUN" position, the system operates normally. When the toggle switch is placed in the "DISABLE" position, the shuttle air valve (V2) is disabled and the shuttle does not extend during inking. This mode is used in hand-inking applications with the optional foot switch.





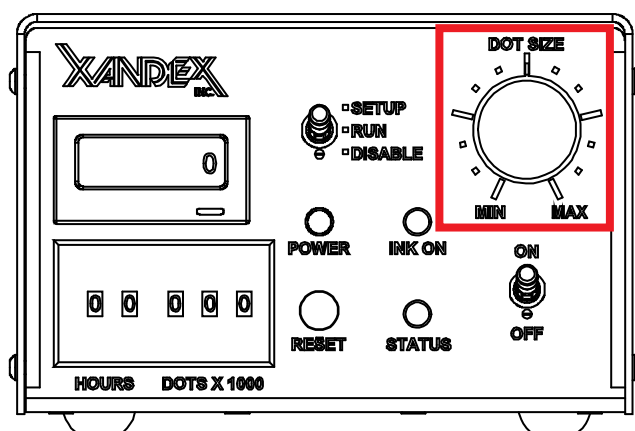
**Reset Button:** A "RESET" button is located to the right of the thumbwheels for resetting the counters in the microprocessor. When the "RESET" button is depressed once, the "STATUS" LED will flash for 10 seconds. If it is pressed a second time during the 10 second period, the controller will "read" the setting on the thumbwheel switches and load those values into the microprocessor. If the "RESET" button is not pressed a second time

and the 5 second flash time is exceeded, the "STATUS" LED will stop flashing and the current timer set points and internal counts will not be changed. The "RESET" button is also used to enter the diagnostic mode when power is applied to the controller with the "RESET" button depressed. For details and descriptions of controller diagnostic tests see "Controller Diagnostics" in Section 6.



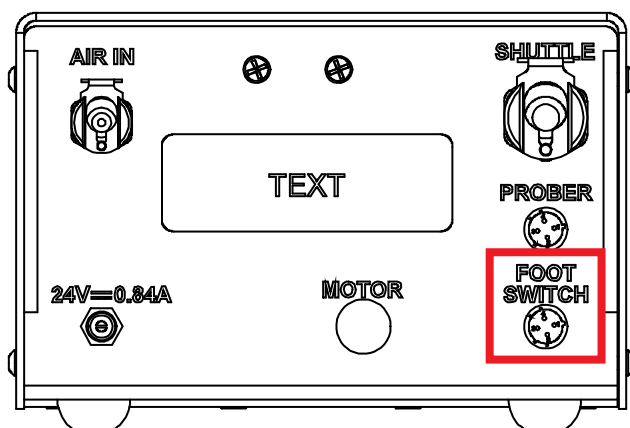
**Dot Counter:** A separate LCD "DOT COUNTER" is located on the front panel above the thumbwheels. The LCD "DOT COUNTER" gives a real time read out of the number of dots deposited. The counter has an internal Lithium battery with a nominal life of 7 years. Pressing the small reset button below the "DOT COUNTER" LCD window resets the counter display only. It will have no effect on the programmed counter circuits within the microprocessor.

Reset the counter when a new ink cartridge is installed to record the numbers of dots produced by that cartridge.



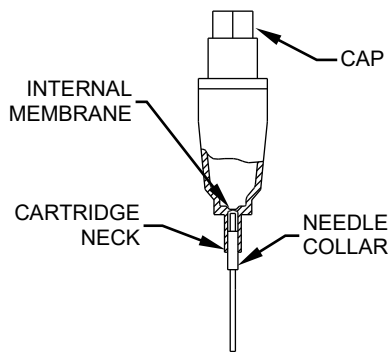
**Adjustable Dot Size:** The adjustable "DOT SIZE KNOB" on the front panel is used to vary the size of the dot produced without changing cartridges, affecting set-up or requiring additional operator steps. The microprocessor reads the knob position and outputs a signal to enable the associated air valve for a predetermined amount of time. Higher settings enable the cartridge air valve for a longer time, producing a larger dot.

Depending on the type of ink cartridge (A5, A6, or A8) and ink used (6990, 6993, 6997, 7824, 7824T, 8103, 8104), a wide range of dot sizes is possible. It is recommended that the proper dot size for the die be selected to maximize the cartridge usage and minimize problems with too large or too small dots. See **Section 7. System Specifications** for a table of dot size guidelines in mils and microns.



**External Switch Input:** There is a second input on the rear of the unit for use with a foot switch. Upon activation, the foot switch sends a > 50 mSec switch closure signal (across pins 1 & 3) to the controller, enabling an inking sequence. There is a 50-millisecond delay between the end of the sequence and the recognition of the next switch closure. No other adjustments or settings need to be made.

### Ink Cartridge



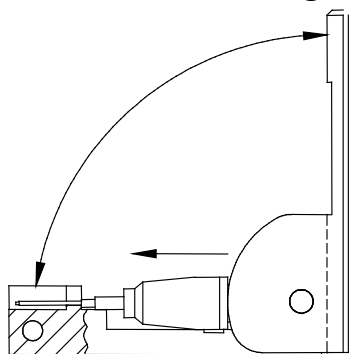
The ink cartridge used with the X1100 Series Inkers is a DM-2. DM-2 cartridges are available in A5, A6, and A8 (designating 0.005", 0.006", and 0.008" Teflon® tube I.D., respectively). The DM-2 is also available in type A4, with 0.002" Teflon tube ID. The A4 cartridge is designed for placing small ink dots using the new Micro-Z pneumatic inking systems. For more information on the DM-2 A4 cartridge, contact Xandex Customer Service. DM-2 cartridges have a polypropylene reservoir (sealed at the bottom by a thin membrane) and a small Teflon® tube encased in a stainless-steel needle. When the cartridge is opened, the needle punctures the membrane to provide ink

flow through the Teflon® tube.

Each cartridge holds 1.0 grams minimum of ink and can produce a wide range of dot sizes. Dot size is controlled by changing the duration of the air pulse into the cartridge reservoir, which determines how much ink is forced through the Teflon® tube to create the ink drop at the needle tip. A5 and A6 cartridge types will produce an average of 30,000 dots\*, while the A8 averages 10,000 dots\*. For more information see **Section 5 "Ink"** and "Ink Cartridge Specifications" in **Section 7 "System Specifications."**

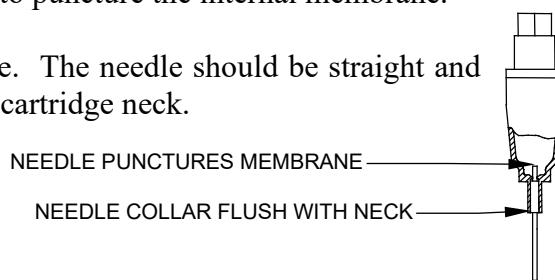
*\* Averages exclude 8104 ink type. Dot production figures are averages and as such, are not guaranteed. Testing is performed at ambient temperature of 70 degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation) and based on pneumatic controller operating at "MIDDLE" dot size setting (standard controller = dot size knob centered between "MIN" and "MAX": Motor-Z Controller = dot size thumbwheel setting of 50). Dot production figures represent an average of results for multiple ink types. Your yield may be higher or lower depending on the ink type and dot size setting you use. Average figures are based on complete cartridge use within **cartridge open shelf life periods** (5 days maximum or 3 days maximum) as stated for each specific ink type.*

### Cartridge Preparation



1. Place the cartridge into the cartridge preparation tool (Xandex Part No. 200-0001) as shown, exercising care to avoid damaging the Teflon® tip. The cartridge cap should be seated in the tool hinge with the needle resting in the slot.
2. Firmly squeeze the tool fully closed with a smooth, quick motion. This will push the cartridge body forward, causing the needle to puncture the internal membrane.

3. Open tool and remove cartridge. The needle should be straight and the needle collar flush with the cartridge neck.

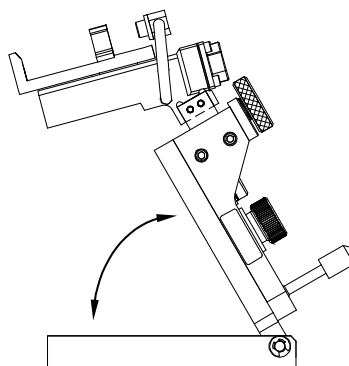
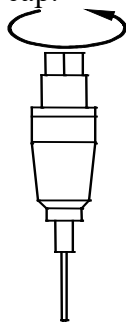


## Cartridge Installation

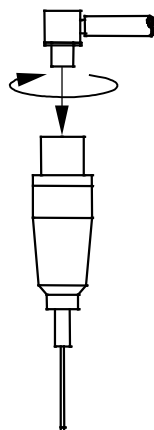
**NOTICE**

*Move the inker arm to the UP position when installing or changing cartridges to prevent damaging the cartridge tip.*

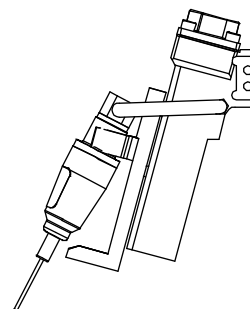
1. Use the slotted section of the cartridge preparation tool and a *counter-clockwise* motion to remove cap.



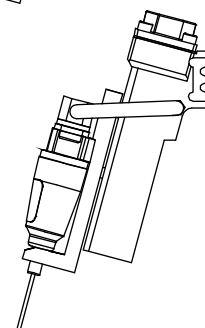
2. Thread the cartridge onto the brass air fitting of the RED AIR HOSE, turning the cartridge *clockwise* until snug.



3. Press top of cartridge into shuttle spring clip.



4. Press cartridge body into shuttle dovetail forks until the neck fully snaps into place.



Cartridge is now ready for priming. (See “**Cartridge Priming**” later in this Section (4) for instructions)

**NOTICE**

*Do not shake the cartridge at any time, as air bubbles may be introduced into the reservoir and restrict the flow of ink. If mixing of the ink in the reservoir is desired, roll the cartridge between thumb and forefinger (or between palms) for 1-2 minutes prior to installation.*



**Caution:** Ink Cartridge needle can pierce skin when moved manually or when shuttle valve is actuated:

- 1. Keep hands and fingers clear of the cartridge needle tip when tilting the inker swing arm down into inking position after cartridge change out and priming.*
- 2. Never place hands or fingers under the cartridge needle when inker swing arm is tilted down in inking position.*
- 3. Keep hands and fingers clear of needle tip during cartridge change out and priming. Always follow recommended cartridge priming procedure, which is performed with the inker swing arm tilted up. Place the controller toggle switch in RUN position and press the controller RESET button, which fires ONLY the cartridge valve to send ink to the needle tip. Priming using any other mode that actuates the shuttle valve during the priming process exposes the user to possible hand or finger puncture when the shuttle actuates.*

### Changing the Cartridge

1. Lift the inker swing arm to the UP position.
2. Place thumb and forefinger on each side of the cartridge and gently pull up to remove cartridge.
3. Unthread the cartridge from the air fitting and discard in the proper manner.
4. Inspect the air fitting, Buna (rubber) washer and air hose for ink contamination and clean or replace as necessary.

**Note:** *Inspect the Buna washer on the cartridge fitting each time a cartridge is changed to ensure it is not distorted, broken or over compressed. Failure to replace a damaged washer can result in a range of performance issues, including leaking ink, and/or ink splatter during inker operation. For optimal performance, Xandex recommends replacing the Buna washer after 50 cartridges have been used. Buna washers (Part Number 511-1003) are available from Xandex in packages of quantity 25 by ordering Part Number 330-0001.*

5. Install a new cartridge per installation instructions.

### Cartridge Priming



*Always wear protective eyeglasses when handling an active pneumatic inking system!*

1. Prepare a cartridge per the “Cartridge Preparation” section of this manual.
2. Install a cartridge to the inker per the “Cartridge Installation” section of this manual.

*Note: Cartridge priming is done with the inker arm in the UP position.*

3. Lift the inker swing arm to the UP position.
4. Move the controller switch to “RUN”.
5. Push the “RESET” button on the controller for at least 3 seconds and hold down until ink appears at the needle tip.

**Note:** *When the “RESET” button is initially pushed the “INK ON” LED will not be lit and the “STATUS” LED will begin to flash. At the end of 3 seconds both the “INK ON” and “STATUS” LED will light continuously and the cartridge air valve will begin to pulse, priming the cartridge.*

6. Once priming is completed, clean excess ink from the needle tip with a lint free cloth or swab.
7. Cartridge is now ready for operation. Proceed to “**Inker Assembly Setup and Alignment**” in this section (4) to prepare the inker.

### NOTICE

*Always use the RESET button to pulse the cartridge valve when priming a cartridge with the inker swing arm in the up position. The RESET button fires only the inker's cartridge valve. If the shuttle valve is fired with the swing arm in the up position, (by using the prober's test inker function for example) ink may be forced into the cartridge air fitting and air hose, contaminating both.*

***Cartridge Priming and Use Tips*****Tips to avoid common problems with DieMark Pneumatic Ink Cartridges.**

DO NOT attempt to refill Xandex DieMark Ink Cartridges. Cartridges are disposable and designed for single use only. Using a refilled cartridge will have an adverse effect on functionality and performance. Please note, Xandex does not warranty refilled cartridges.

**Handling Tips:**

Handle cartridges with care to avoid damaging the exposed Teflon tube at the tip of the needle

When removing the cartridges from the clamshell package, lift the cartridge straight up to avoid bending the needle or damaging the Teflon tube.

Allow the cartridge to reach optimal temperature of 18-25C (65-78F) before priming the cartridge. Never attempt to prime and use cartridges that are not at optimal temperature.

Inspect the Buna washer on the cartridge fitting each time a cartridge is changed to ensure it is not distorted, broken or over compressed. Failure to replace a damaged washer can result in a range of performance issues, including leaking ink, and/or ink splatter during inker operation. For optimal performance, Xandex recommends replacing the Buna washer after 50 cartridges have been used. Buna washers (Part Number 511-1003) are available from Xandex in packages of quantity 25 by ordering Part Number 330-0001.

**Priming Tips:**

Wipe off any excess ink on the outside of the needle using a lint free cloth or swab before use.

DO NOT use the cartridges beyond the recommended open time for the ink type in the cartridge. Recommended open time is three (3) days for 7824, 7824T, 8103 and 8104, and (five) 5 days for 6990, 6993, and 6997.

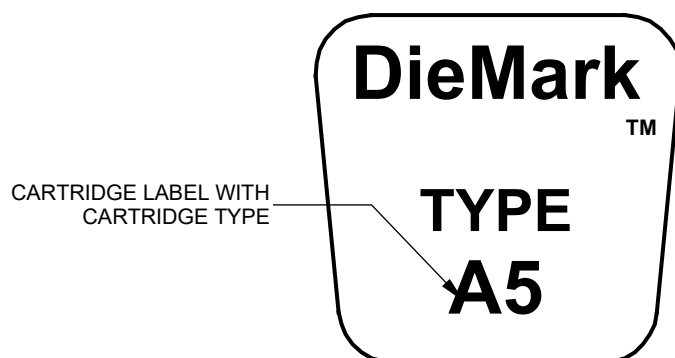
**Ink Cartridge Labeling**

DieMark™ ink cartridges are individually labeled with two distinct labels. One label shows the cartridge type and the other label indicates the ink batch number, ink type and expiration date of the cartridge.

Do not remove the labels from the cartridges as this can cause cartridge type and ink types to be confused at cartridge installation, resulting in improper performance. Removal of cartridge labels will also void the cartridge warranty.

**DieMark™ Cartridge Type Label**

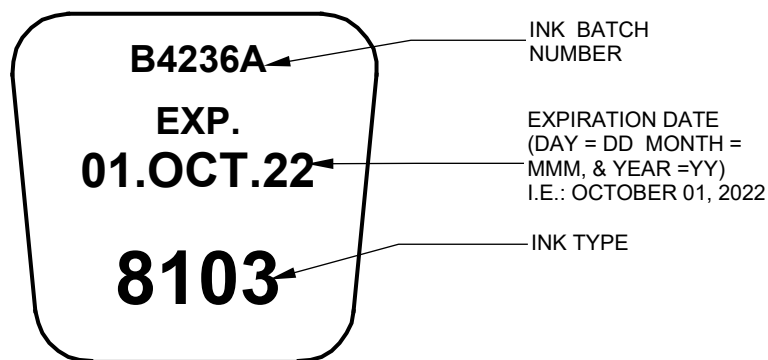
This label contains the cartridge type, (either A4, A5, A6 or A8).

**DieMark™ Cartridge Expiration Date Label**

This label indicates the ink type and batch number of the ink contained in the cartridge and the cartridge expiration date. Expiration dates shown are for *unopened* cartridges.





- ◆ 6990, 6993, 6997, 7824, 7824T, 8103 and 8104 (except 8103 White), = Four (4) months.
- ◆ 8103 White = Two (2) months

After the cartridge is opened, consistent ink flow can only be expected for up to five (5) days for 6990, 6993, 6997 and three (3) days for 7824, 7824T, 8103 and 8104.





**Cartridge Type Label Color Coding**

<b>DM-2 &amp; DM-2.3 PNEUMATIC CARTRIDGE LABELS</b>	
<b>LABEL</b>	<b>DESCRIPTION</b>
	<b>A4 IS GREEN</b>
	<b>A5 IS RED</b>
	<b>A6 IS BLUE</b>
	<b>A8 IS YELLOW</b>

**Note:** A4 cartridges are qualified by Xandex for use on Micro-Z Small Dot inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions. The A4 is available only in the DM-2 cartridge configuration, as of the release date of this manual.

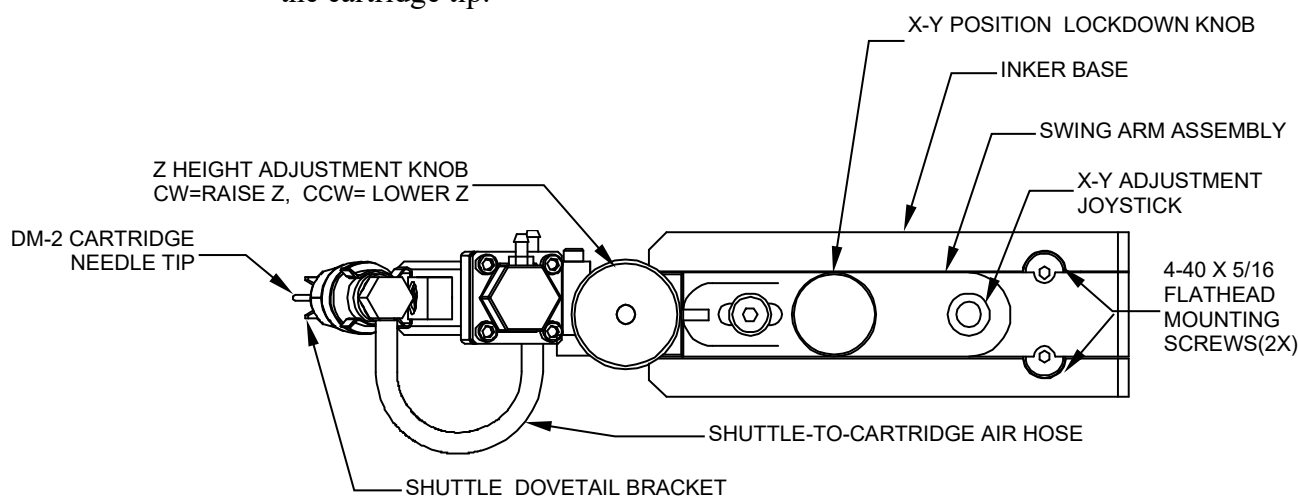
**Inker Assembly Setup & Alignment**

1. Prepare, prime and install an ink cartridge per the instructions in this Section (4).
2. Once priming is completed, verify that the inker is at maximum Z height (CW) adjustment, then lower the inker arm and snap into the inker base.
3. Set the prober chuck "Z Up".

**NOTICE**

*If the inker height is adjusted with the prober stage "Z Down" the cartridge will be positioned too low and the cartridge needle will smash into the wafer when you begin inking. This will stop the ink flow and possibly ruin the cartridge or damage the wafer!*

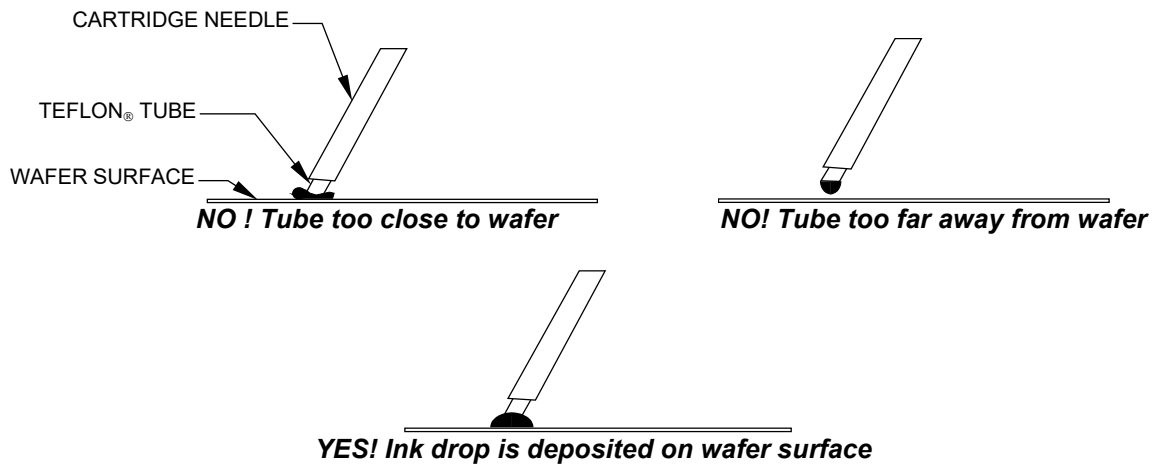
4. Loosen the X-Y lockdown knob on the inker sufficiently to allow X-Y movement of the cartridge tip when the joystick is manipulated. The X-Y lockdown knob should be tightened to give spring tension to the joystick at all times to maintain X-Y position. Use the joystick to adjust the X-Y position of the cartridge tip.



5. Set the controller "DOT SIZE" adjustment knob to the middle of the adjustment range. Move the locking toggle switch to "SETUP". The "INK ON" LED will flash continuously and the shuttle will extend to its lowest position. Create a droplet of ink at the needle tip by pressing the prober "TEST INKER" button twice.

**Note:** The Controller can remain in the "SETUP" mode for a maximum of 5 minutes. After 5 minutes, the Controller will disable the shuttle air valve, returning the shuttle to normal position (the inker will fire, but the shuttle will not move). If this happens, move the toggle switch to "RUN" then back to "SETUP" to complete alignment.

6. Slowly turn the *Z Adjust knob* counterclockwise to lower the *shuttle* until the ink droplet at the *needle tip* touches the wafer surface. The Teflon® tube will be 1-2 mil from the wafer surface.

**NOTICE**

*Do not let the Teflon® cartridge tube contact the wafer surface. This may crush the tip preventing ink flow and damaging the cartridge or the wafer!*

7. Set the toggle switch to "RUN" to retract the shuttle. Index and test fire the inker a few times and check the dots for size and roundness. Each time the inker fires, the "INK ON" LED flashes.
8. Perform minor X,Y and Z adjustments as necessary for dot placement and adjust the "DOT SIZE" knob until the desired dot size is achieved.
9. After initial set-up is completed, some additional adjustment of the Z height may be required to achieve round dots. If you have problems, refer to **Section 6 "Maintenance & Troubleshooting."**

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## Section 5. Ink

### ***General Information***

Semiconductor manufacturers use the vision system of automatic pick and place equipment during the assembly process to detect damaged and/or rejected die. This is done by shining a combination of different lights on the wafer surface to create a “white” background. Ink dots and defects such as chipped corners are easily recognizable against this background.

DieMark 8103, 8104, 7824, 7824T and 6993 inks are opaque and easily recognizable under all lighting conditions. Glycol Free 8103 ink is thick in viscosity and delivers opaque dots ranging from 6 to 40 mils. 8104 is not as viscous as 8103 and provides thinner dots with excellent geometry and adhesion in a larger dot range up to 86 mils. 6990 and 6997 are less opaque and may not offer sufficient contrast under all lighting conditions.

8103 ink is certified to contain less than 10 ppm of Sodium (Na) and Chloride (Cl). 8104 ink is certified to contain less than 20 ppm of Sodium (Na) and Chloride (Cl). Both 8103 and 8104 premium inks are free of glycol ethers, which are identified reproductive hazards and carcinogens. 7824 and 7824T inks are certified to contain less than 10 ppm of Na and Cl. 6990 is certified to contain less than 25 ppm of Na and Cl. Analysis reports are available upon request from Xandex Customer Service.

Although 6993 and 6997 are not contaminant controlled, periodic test data indicates that these inks typically contain less than 100 ppm of Sodium (Na) and 400 ppm of Chloride (Cl). These levels are not certified or guaranteed.<sup>1</sup>

Glycol Free 8103 and 8104 inks have a 4 month shelf life, except for 8103 White ink, which has a 2 month shelf life. Glycol Free inks rapidly air dry at ambient conditions and will give consistent flow for 3 days after cartridge opening. 6990, 6993 and 6997 inks have a 4 month shelf life, require heat curing to be permanent, and will give consistent flow for 5 days after cartridge opening. 7824 and 7824T inks have a 4 month shelf life and will give consistent flow for 3 days after cartridge opening. 7824 and 7824T can be air or “heat set” cured.

Glycol Free 8103 and 8104 inks are thermally stable at temperatures up to 150° C and can be used in hot chuck or oven drying applications without cracking or loss of adhesion. Use of either 6990, 6993 and 6997 or 7824 and 7824T inks in hot chuck applications is not recommended as the elevated ambient temperature in the probing area can reduce cartridge life and cause inconsistent ink flow. However, use of a hot chuck to heat set dots during offline inking has reportedly been successful when employed by some customers. All the inks offered by Xandex are non-magnetic.

Safety Data Sheets (SDS) are available for all inks offered by Xandex. To obtain SDS or information about choosing the appropriate ink for your application please contact your local distributor or Xandex Customer Service. <sup>1</sup> Test results are dependent on test method

**Ink Curing**

The procedure for curing will depend on the type of ink used and other factors such as dot size and spacing (see “General Notes on Ink Curing”, below). Xandex guidelines are developed under laboratory conditions using single wafers and are intended as a baseline to develop a curing process that meets your specific needs.

6990, 6993, and 6997 should be cured/baked within 2 hours of inking due to the evaporation of solvents in the ink over time. If a wafer (or boat of wafers) is left uncured for an extended period of time, the dots may crack and/or flake after the baking process.

6990, 6993, and 6997 inks, when air-dried, will not smear when touched. They are not permanent, however, and will not withstand most post-probe handling or processes. Conversely, 7824 and 7824T inks air cure within 2.5 hours ( $\leq 20$  mil, up to 10 hours for  $>20$  mil dots). 7824 and 7824T may also be heat cured at up to  $150^{\circ}\text{C}$  for 10 minutes.

8103 and 8104 Glycol Free inks hard cure under ambient conditions in the least time of any of the inks offered by Xandex. Ink dots of  $\leq 25$  mil typically air dry to a hard cure in 45 minutes. Dot sizes  $>25$  mil may require significantly longer to cure. An ambient cure time of up to 6 hours may be needed for larger dot sizes. 8103 and 8104 may also be heat cured at up to  $150^{\circ}\text{C}$  for 10 minutes if a faster cure is desired.

**General Notes on Ink Curing**

Several factors have greater influence on the time required to get a full cure in the shortest amount of time, either when heat curing or curing at room temperature:

- **Dot Size:** Larger dot sizes will require longer cure times.
- **Dot Spacing:** Large numbers of closely spaced ink dots will require a longer cure time than small numbers of widely spaced dots.
- **Air Flow:** Continuous air flow across the wafer surface will reduce the amount of time required for ink curing. This is especially important when air curing at ambient temperatures.
- **Wafer/Die Surface:** Both the surface chemistry and degree of patterning on the die affect how the ink spreads on the wafer. If the ink does not spread as much, the dots will be thicker. And if the dots are thicker, they will require a longer cure time.
- **Temperature:** Higher temperatures will lead to faster ink cure times.
- **Wafer Boat / Cassette:** Wafers stacked in a boat / cassette will require increased cure time compared to single wafers.

**Ink Curing Guidelines**

The following table provides guidelines for curing each type of ink sold by Xandex:

<b>INK CURING GUIDELINES</b>			
<b>CURE TYPE</b>	<b>TEMPERATURE</b>	<b>CURE TIME</b>	<b>RESULT</b>
<b>6990, 6993, and 6997</b>			
Soft Cure	70-100°C	5-15 minutes	Ink is semi-permanent and will not withstand wash of alcohol, acetone, or photoresist removers
Hard Cure	150-185°C	30-60 minutes	Ink is permanent and resistant to wash process
<b>7824, 7824T</b>			
Hard Cure	Air dry, ambient conditions*	1-3 hours for ≤20 mil 3-4 hours for 20-25 mil 4-10 hours for 25-40 mil	Ink is permanent and may only be removed with great difficulty
Hard Cure	150 Watt heat lamp at 5-6 inches <b>OR</b> oven at 110-150°C	5-10 minutes	Ink is permanent and may only be removed with great difficulty
<b>8103 and 8104 Glycol Free</b>			
Hard Cure	Air dry, ambient conditions*	5-15 minutes for ≤ 15 mil 15 minutes – 3 hours for 15-25 mil 3-6 hours for 25-40 mil	Ink is permanent and may only be removed with great difficulty
Hard Cure	150 Watt heat lamp at 5-6 inches <b>OR</b> oven at 110-150°C	5-10 minutes	Ink is permanent and may only be removed with great difficulty

*\*Ink cure testing performed on single, (not stacked in a wafer boat/cassette) polished silicon wafers with dot spacing of 50 mil (1270 μm) with moderate air flow at 70-72 °F (21.1-22.2 °C).*

**Ink Removal Information**

A rinse with isopropyl alcohol or acetone generally removes ink completely if the wafer is washed shortly after inking (within 5 minutes). An ultrasonic bath is recommended to ensure complete removal of ink residue. Ink dots, which have been air dried or hard cured, require the application of an ink remover.

**DieMark Remover 8000**

Xandex has developed DieMark Remover 8000 specifically for the semi-conductor industry. DieMark Remover 8000 thoroughly removes all inks supplied by Xandex, including oven baked ink dots. DieMark Remover 8000 has very low levels of organic and inorganic contaminants and is an efficient and thorough ink remover when used in simple bench top cleaning methods. Due to its high flash point, DieMark Remover 8000 is also safe and effective when used in ultrasonic, temperature/pressure cycling under vacuum and deep bath heating and agitation ink removal processes.

DieMark Remover 8000 is carcinogen free (NTP, OSHA) and all ingredients used are TSCA listed. For an MSDS or more information on using DieMark Remover 8000 in your specific ink removal process, contact Xandex Customer Service.

**Ink Removal Procedure**

The following is the recommended bench top procedure for removing ink from wafers using DieMark Remover 8000. \*



*All procedures should be performed under a laboratory hood, following proper safety precautions (protective goggles, gloves and clothing).*

1. Apply sparingly with an eyedropper to a localized area of the wafer.
2. Allow 2-3 minutes for the DieMark Remover 8000 to begin solvating. Time required will vary depending on the degree that the ink was cured.
3. For highly cured ink dots, use longer soak times, then wipe gently with a clean lint-free cloth to facilitate removal. If necessary, repeat steps 1 and 2.
4. For large areas or removal of ink from entire wafer, soak a clean lint-free cloth with DieMark Remover 8000, then lay the wet cloth over the entire surface and allow time to soak/solvate ink, then remove wet cloth. Repeat as necessary.
5. After dots are removed, clean wafer via standard procedures, such as vapor degreasing, and/or rinse with a clean solvent (Isopropyl Alcohol) followed by a bake cycle at 65° C to dry.



\* The following ink removers may be substituted for DieMark Remover 8000, however, Xandex does not guarantee that satisfactory results will be obtained. None of the following solvents or ink removers are available from Xandex.

- ◆ Aptek 6515 Ink Remover
- ◆ Markem® 540
- ◆ P-300 Resist Remover
- ◆ 712-D Resist Remover
- ◆ Uresolve Resist Remover
- ◆ Methyl Ethyl Ketone (MEK)
- ◆ N-Methyl-2-Pyrrolidone (M-Pyrrol)

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## Section 6. Maintenance & Troubleshooting

This Troubleshooting section for the X1000 Pneumatic Inker is divided into three parts. The first part covers ink and the DM-2 ink cartridge. The second part covers the Inker Assembly, and the third part covers the Pneumatic Controller. See the Support section at <http://www.xandexsemi.com/> for more troubleshooting information.

### ***Ink Troubleshooting***

Problem	Solution
Some ink dots tend to crack after baking using Xandex recommended cure cycles.	This occurrence is related to the ink surface tension, the wafer surface conditions and too long a delay time between inking and curing. To remedy this situation, the curing cycle has to be modified (reduce time and temperature). See <b>Section 5 “Ink Curing.”</b>
Runny, blobbing ink or skipping dots.	<ol style="list-style-type: none"> <li>1. Check ink shelf life. 6990, 6993, 6997 inks should be used within 4 months or 5 days of cartridge opening. 8103 and 8104 glycol free air dry inks should be used within 4 months (except for 8103 White ink which should be used within 2 months) or 3 days of cartridge opening. 7824 and 7824T air-dry ink within 4 months or 3 days after cartridge opening.</li> <li>2. Check for exposure to extreme temperatures. Cartridges should be stored at 25°C. <b>DO NOT refrigerate the cartridges.</b> Occasionally, ink is subjected to much higher temperatures (40-50° C) for an extended time during transport. This could break down the ink such that its viscosity and surface tension are altered permanently. Contact Xandex Customer Service.</li> <li>3. Improper Z Height set-up. Review proper procedures detailed in <b>Section 4 “Cartridge Setup and Alignment”</b> and re-adjust Z Height.</li> <li>4. Chuck top or wafer surface not planar. Verify planarity of both.</li> </ol>
After changing the controller dot size settings, the dots are too small or the ink blobs at the tip of the needle.	<ol style="list-style-type: none"> <li>1. The cartridge tip may be damaged. Examine cartridge and replace if necessary.</li> <li>2. Whenever dot size is changed there may be minor Z height adjustments required. The inker should be set so that just the bottom of the ink drop touches the wafer.</li> </ol>

Problem	Solution
Small, inconsistent or no ink dots.	<ol style="list-style-type: none"><li data-bbox="659 268 1341 338">1. Soft Teflon® tip of the cartridge tube is clogged or damaged. Change cartridge.</li><li data-bbox="659 373 1341 443">2. The dot size setting may be too low. Increase dot size setting.</li><li data-bbox="659 478 1279 516">3. Wrong cartridge type. Change cartridge type.</li><li data-bbox="659 552 1341 590">4. Air pressure too low, verify setting is <math>70 \pm 10</math> PSI.</li><li data-bbox="659 625 1341 695">5. Z height adjustment is incorrect. Adjust Z Height. See <b>Section 4 “System Operation.”</b></li><li data-bbox="659 730 1341 800">6. Verify that the inker swing arm is all the way down and locked in position.</li><li data-bbox="659 835 1341 905">7. Shuttle mechanism may be binding. See <b>“Shuttle Maintenance”</b> in this section.</li></ol>

**Inker Troubleshooting**

Problem	Solution
Dots too large.	<ol style="list-style-type: none"> <li>1. Dot size setting too high. Decrease dot size setting.</li> <li>2. Main Air pressure too high, verify setting at <math>70 \pm 10</math> PSI.</li> <li>3. Wrong cartridge type. Change cartridge type.</li> <li>4. Dot size potentiometer defective. Run diagnostic test B. described in “<b>Controller Diagnostics</b>” later in this section (6). If test results are not within parameters, consult Xandex Customer Service.</li> </ol>
Cartridge tip does not reach wafer surface.	<ol style="list-style-type: none"> <li>1. Check Z height by switching the controller into "SETUP" mode, which will extend the shuttle downward into the "inking position".</li> <li>2. Adjust Z height per "<b>Setup and Alignment</b>" in <b>Section 4 “System Operation”</b> of this manual.</li> </ol>
Unit functions normally, no dots, no shuttle movement.	<ol style="list-style-type: none"> <li>1. Verify that the Controller-shuttle air hose connector is plugged into the controller.</li> <li>2. Verify that the Controller-shuttle air hose is not kinked, clogged or pinched closed.</li> <li>3. Check Main Air pressure setting (verify <math>70 \pm 10</math> PSI air input).</li> </ol>
Inker produces dots during “puff pulse” or ink flows out of cartridge with toggle switch in “SETUP”.	<ol style="list-style-type: none"> <li>1. Verify that the air hoses from the controller to the inker are connected properly: <ul style="list-style-type: none"> <li>◆ RED AIR HOSE connects to the ink cartridge. On the 316-0001 pneumatic shuttle, this is the bottom port on the side of the shuttle body, directly across from the red shuttle to cartridge air hose on the opposite side of the shuttle body.</li> <li>◆ BLUE AIR HOSE connects to the shuttle connection on the shuttle mechanism. On the 316-0001 pneumatic shuttle, this is the top port on the side of the shuttle body.</li> </ul> </li> </ol>

Problem	Solution
Unit functions normally, shuttle moves, no dots.	<ol style="list-style-type: none"><li data-bbox="662 258 1352 338">1. Check air hose to top of cartridge to be sure it is connected and not kinked, clogged or pinched.</li><li data-bbox="662 369 1352 527">2. Verify cartridge preparation, insuring Needle Collar is flush with the Cartridge Neck and the internal membrane is broken. See <b>Section 4 “Ink Cartridge.”</b></li><li data-bbox="662 558 1352 638">3. Check the Teflon® tip of cartridge tube to confirm that it is not clogged or damaged.</li><li data-bbox="662 669 1352 749">4. Verify that the rubber washer on the cartridge air hose connector is installed.</li></ol>

**Shuttle Maintenance****Schedule and Preventive Maintenance Kits**

Periodic preventive maintenance of the shuttle mechanism is recommended to ensure continued, trouble free operation of your Xandex pneumatic inking system. The recommended maintenance schedule is as follows;

- Off-line use = 6 month intervals
- In-Line / Post Probe use = Once per year

Shuttle preventive maintenance kits are available, which include all parts necessary for one normal shuttle maintenance procedure. These kits may be ordered direct from Xandex or through your local Xandex distributor.

With the introduction of the Precision Shuttle in spring of 2022, shuttle maintenance has been dramatically simplified. The new Direct Mount Precision Shuttle PN 316-0010 and can be serviced without disassembly or removal from the Inker Base. The Maintenance Kit for the Direct Mount Precision Shuttle used in the X1100 and X1105 model inkers, is kit part number 370-0006\*.

All previous X1100 Series inkers require Shuttle Maintenance Kit number 370-0002 for shuttle 316-0001.

*\*A Direct Mount Precision Shuttle Maintenance Kit is available for obsolete X1101 and X1102 inker models that have been retrofitted with the new Direct Mount Precision Shuttle. Order Precision Shuttle Maintenance Kit Part Number 370-0008.*

**New Precision Shuttle Replacement (Retrofit) Kits**

The new Precision Pneumatic Shuttle incorporates design and materials improvements that reduce friction, which in turn, enables tighter part tolerances that improve repeatability and dot placement accuracy and simplify preventive maintenance. In addition, end of stroke dampening has been added to reduce vibration at shuttle end of stroke, which also enhances placement accuracy and helps to eliminate ink "splatter".

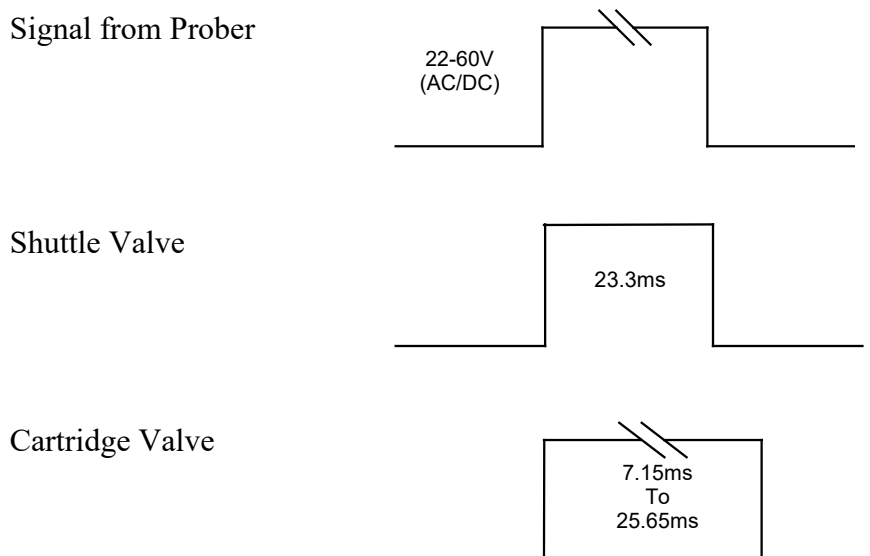
Beginning in Spring 2022, Xandex will implement two models of the Precision Pneumatic Shuttle that will replace existing Pneumatic Shuttles in all inker models.

Existing inker bases can be modernized by installing the Precision Shuttle. X1100 series inker bases do not require a retrofit kit, as the shuttle mounts onto the inker base assembly directly. To modernize your X1100 series inker base to use the new Precision Shuttle, order Direct Mount Precision Shuttle Assembly 316-0010.

**Pneumatic Controller****Controller Sequence of Operation**

To initiate an ink dot, the Prober sends a 22-60 V (AC/DC unregulated) active-high signal to the Controller. After receipt of the signal, the microcontroller performs various checks of system status prior to firing the pneumatic valves.

Upon completion of the status checks, a 23.3ms pulse is sent to the *Shuttle Valve*, while at the same time a 7.15-25.65ms pulse (depending on position of Dot Size knob) is sent to the Cartridge Valve (V1).



As the shuttle extends to the lower position, the air pulse from Valve 1 forces ink out of the cartridge barrel and forms a drop at the end of the needle tip. When the shuttle is at its lowest position, the drop makes contact with the wafer surface and forms a dot. The shuttle then returns to the normal position.

At the completion of each dot, a small amount of vacuum is developed in the cartridge by the closure of the valve, preventing dripping. If another dot sequence is not initiated within 10 seconds, a short “puff” pulse equal to 1/2 the dot size duration (6.75 - 13.15ms) is sent to the cartridge to displace a small amount of ink back into the Teflon® tube to aid in maintaining proper dot size after a long delay between dots.



**Controller Diagnostics**

There are a few internal diagnostic tests available for testing the Controller. To enter the Diagnostics mode, apply power to the Controller with the “RESET” button to the right of the thumbwheels depressed.

The following tests are available:

**A. Test Thumbwheels**

1. Place the toggle switch on the front panel to SET-UP, set the thumbwheels to 12345, then reset the LCD Counter.
2. Press the RESET button and verify that the counter increments 15 counts.
3. Place the toggle switch to RUN, set the thumbwheels to all 1's, reset the LCD Counter, and press RESET. The counter should increment one count.
4. Repeat the procedure for the rest of the digits (2 through 9). With the thumbwheels set for 00000, the counter increments 10 counts.

**B. Test Dot Size Potentiometer**

1. Place the toggle switch to DISABLE, set the HOURS thumbwheels to 01, then reset the LCD Counter.
2. Set the knob to 50% and press RESET. The Counter should display approximately 130 counts. (Variations in Dot Size knob alignment to scale may occur. An increment of  $\pm 10$  is not significant in this case.)
3. Reset the LCD Counter, adjust the knob to maximum, and press RESET. The Counter should display 255 counts.

**C. Test Cartridge Valve**

To test fire the Cartridge Valve 20 times:

1. Set the HOURS thumbwheels to 02
2. Place the toggle switch to DISABLE
3. Reset the LCD Counter
4. Press RESET.

The cartridge valve fires 20 times, each time incrementing the LCD Counter.

***D. Test Shuttle Valve***

To test fire the Shuttle Valve 20 times:

1. Set the HOURS thumbwheels to 03
2. Place the toggle switch to DISABLE
3. Reset the LCD Counter
4. Press RESET.

The shuttle valve fires 20 times, each time incrementing the LCD Counter.

***E. Life Test***

This test will continuously fire the Cartridge and Shuttle valves for a predetermined number of cycles as set on the thumbwheels.

1. Place the toggle switch to DISABLE.
2. Set the HOURS thumbwheels to 10.
3. Set the DOTS X1000 thumbwheels for the desired number of cycles X1000 (i.e.: 250 Equals 250,000 cycles).
4. Reset the LCD Counter.
5. Press RESET.

The Controller begins continuous firing, incrementing the Counter each cycle. To discontinue the Life Test prior to reaching the set amount, remove power.

**Controller Troubleshooting**

Problem	Solution
The Unit is plugged in but the "POWER" LED is off.	<ol style="list-style-type: none"> <li>1. Make sure that the AC outlet has power. The requirement is 100-240 VAC @ 47-63Hz.</li> <li>2. Verify that the power supply is connected to the 24V input on the back of the controller and that the ON/OFF switch on the controller is in the ON position.</li> </ol>
Unit powers up okay but will not respond to prober signal.	<ol style="list-style-type: none"> <li>1. Verify input cable is plugged into the proper input on the Controller.</li> <li>2. Verify input cable is plugged into inker jack on prober.</li> <li>3. Check continuity of input cable.</li> <li>4. Perform system diagnostics checks to verify Controller operation. See <b>Section 6 "Controller Diagnostics."</b></li> </ol>
Unit powers up okay, responds to prober input but the shuttle does not move.	<ol style="list-style-type: none"> <li>1. Check that shuttle toggle switch on the front of the controller is in the RUN position.</li> <li>2. Check that the air hose "quick disconnects" are correctly oriented.</li> <li>3. Perform Shuttle Valve diagnostic test to verify operation. See <b>Section 6 "Controller Diagnostics."</b></li> </ol>
Dot size does not change or does not change sufficiently with adjustment of Dot Size Knob	<ol style="list-style-type: none"> <li>1. Verify that the air hoses from the controller to the inker are connected properly: <ul style="list-style-type: none"> <li>• RED AIR HOSE connects to the ink cartridge. On the 316-0010 (and previous 316-0001) pneumatic shuttle, this is the bottom port on the side of the shuttle body, directly across from the red shuttle to cartridge air hose on the opposite side of the shuttle body.</li> <li>• BLUE AIR HOSE connects to the shuttle connection on the shuttle mechanism. On the 316-0010 (and previous 316-0001) pneumatic shuttle, this is the top port on the side of the shuttle body.</li> </ul> </li> </ol>

Problem	Solution
Dot size does not change or does not change sufficiently with adjustment of Dot Size Knob (continued)	<ol style="list-style-type: none"><li data-bbox="721 258 1354 451">2. Run diagnostic test “B.” Dot Size Potentiometer Test described in “<b>Controller Diagnostics</b>” in this section (6). If test results are not within parameters, consult Xandex Customer Service.</li><li data-bbox="721 472 1354 659">3. Wrong ink cartridge type. Replace ink cartridge with larger (or smaller) type dot size rating. See “<b>Dot Size Parameters</b>” table in <b>Section 4. “Operation.”</b></li></ol>

**Internal Maintenance****NOTICE**

*Use appropriate ESD precautions when working inside of the controller!*



*Making any modifications to the controller circuitry or components other than Xandex recommended maintenance procedures may void your controller warranty, disable protections provided by the manufacturer and expose the user to electric shock hazard.*

**Turn Audible Alarm ON/OFF**

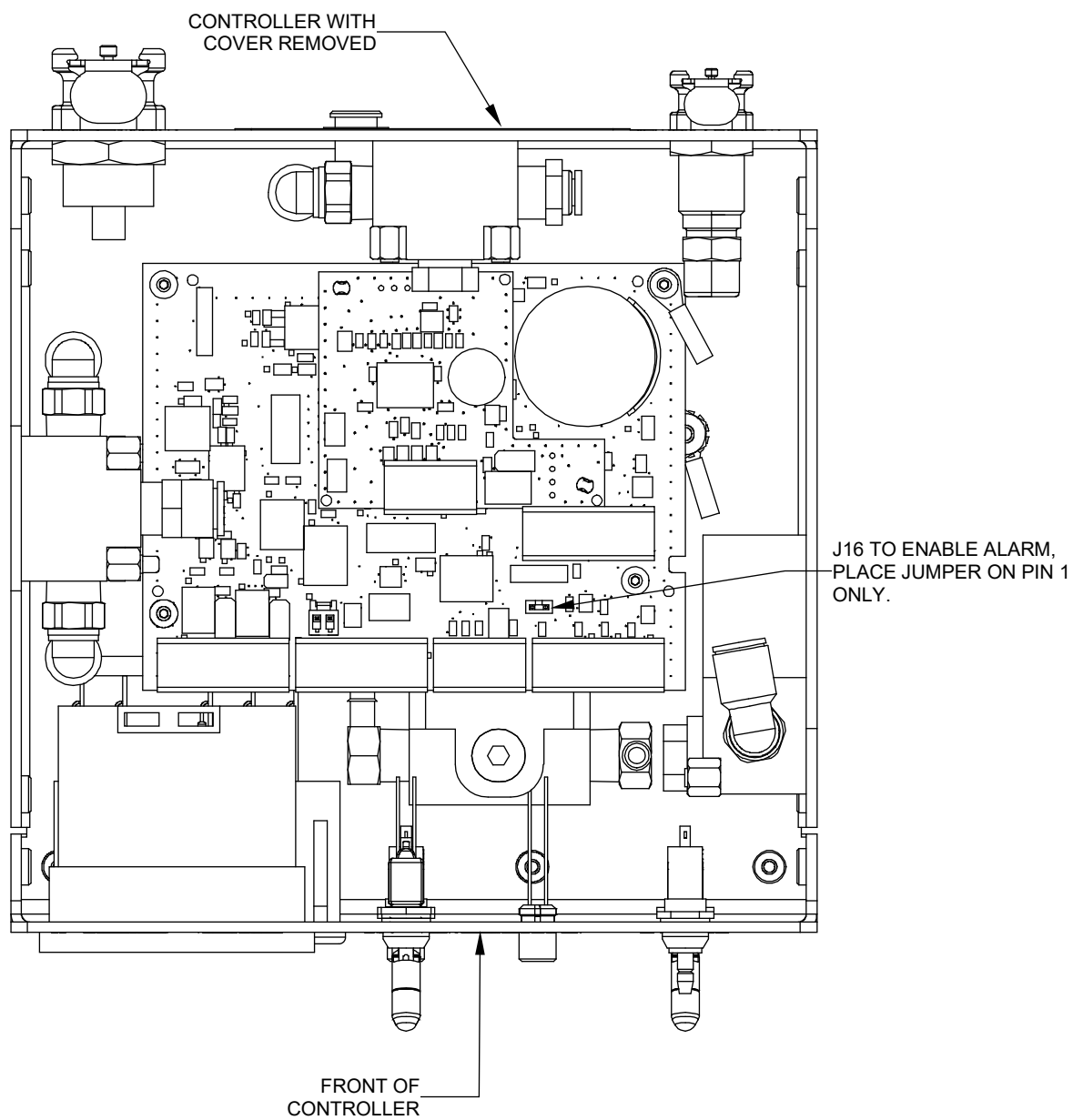
Standard controller units (P/N 350-0002) with serial numbers higher than 4000 are equipped with an audible alarm feature. When enabled, an audio alarm will sound (in addition to the STATUS LED illuminating) when the programmed number of dots set point is reached. The controller is shipped with the audio alarm feature disabled.

**With Power and Main Air removed:**

1. Remove the cover by removing the 8 screws on the left and right sides of the controller (4 screws per side) and lifting the cover off the controller assembly.
2. Locate J16 on the 250-1226 controller printed circuit board. In the default factory condition, J16 is populated with a jumper on pins 1 and 2. This is the default audio alarm disabled condition.
3. To enable the audio alarm remove the jumper and install the jumper onto pin 1 only on J16. This is the audio enabled condition.

**Before Returning the Controller to Service**

1. Install the cover, apply power and main air, and perform controller diagnostics, as documented in this chapter, to verify operation. If problems are noted, review the installation of the audio alarm jumper to ensure installation is correct, none of the component leads are bent, and verify connection of J2 through J6 connectors on the printed circuit board.



### Preventive Maintenance

#### Pneumatic Controller Preventive Maintenance Schedule and Sets

There are two solenoid driven air valves used in Xandex pneumatic controllers to drive the Pneumatic Shuttle and Ink Cartridge. Valve one (V1) supplies air to the ink cartridge, and is referred to as the Cartridge Valve. Valve two (V2) supplies air to the pneumatic shuttle and is referred to as the Shuttle Valve.

Xandex Motorized Z controllers contain a third valve (V3) that is identical to the Shuttle and Cartridge valves. The Motorized Z uses this valve to change the air pressure supplied to the cartridge valve when inking in small dot mode. In normal operation, the third valve (V3) in the Motorized Z controller will not need replacement for the life of the unit.

Preventive maintenance for Xandex pneumatic controllers requires replacement of just the Cartridge Valve, or of both the Cartridge and Shuttle valves at the intervals specified below.

Controller Model	Replace	Interval
All Models	Cartridge Valve	Continuous High Speed Use = 6 months  All other applications = 12 months
All Models	Cartridge Valve, Shuttle Valve and internal tubing, as required	Every 24 months

Two valve replacement sets are available from Xandex to facilitate controller preventive maintenance.

- Cartridge Valve Set, containing a single cartridge valve assembly, pneumatic and electrical connectors and replacement instructions. This set is used for 6/12 month cycle controller preventive maintenance that replaces the cartridge valve. Order part number 370-0105.
- Dual Valve Set containing one cartridge valve assembly and one shuttle valve assembly, pneumatic and electrical connectors, adequate tubing to replace all internal controller pneumatic routes in all Xandex pneumatic controllers and replacement instructions. This set is used for 24 month controller preventive maintenance that replaces both the cartridge valve and the shuttle valve. Order part number 370-0106.

*\*The kits listed here are compatible with Xandex pneumatic controllers with serial numbers over 4000 that use an external AC/DC power transformer (brick). If your controller plugs directly into the wall socket without an external power transformer, order Cartridge Valve Set 370-0100 and Dual Valve Set 370-0101.*

For more information or to order pneumatic controller PM sets, contact Xandex Customer Service at (707) 763-7799, (800) 767-9543 (toll free in the US), FAX (707) 763-2631; email <mailto:info@xandex.com> or order online at <http://www.xandexsemi.com/>.

**Valve Replacement****Cartridge (V1) or Shuttle (V2) Valve Replacement**

*Note: This generic procedure can be used for replacement of either the Cartridge or Shuttle valves.*

**NOTICE**

*The Cartridge Valve and the Shuttle Valve have the same form factor but are **NOT INTERCHANGEABLE**. The Cartridge Valve is a 12VDC valve and the Shuttle Valve is a 24VDC valve. Failure to install the correct valve at either location will result in a non-operational controller.*

**With Power and Main Air removed:**

1. Remove the four (4) cover screws from each side of the controller and remove the controller cover.
2. Disconnect the input and output pneumatic hoses from the defective valve by depressing the colored fitting collar and pulling on the pneumatic hose simultaneously.
3. Disconnect the two snap in connectors that connect the valve wires to the controller.
4. Remove the two Phillips mounting screws securing the valve to the Controller base and remove the valve.



**Installation:**

1. Match fittings from the kit to the ones installed on the old valve and install them on new valve assembly using Teflon thread sealant tape (not supplied).
2. Install the replacement valve assembly in the *controller base*, securing with the two Phillips screws previously removed.
3. Connect the two snap in connectors on the valve wires to the receptacle connectors on the controller. Polarity does not matter.
4. Install the pneumatic lines accordingly, insuring that each hose is firmly seated in the valve fitting.
5. Apply power and main air.
6. Refer to “**Controller Diagnostics**” in this section and perform appropriate valve functional and diagnostic tests. Re-install the controller cover.




## Section 7. System Specifications





### DC Power Supply Requirements

<b>Input Power Requirement:</b>	100-240 VAC @ 50-60Hz
<b>Output Power Requirement:</b>	24V  (VDC) / 0.8A or greater
<b>Approvals:</b>	UL / FCC / PSE / CCC / CE / WEEE / ROHS
<b>Protection:</b>	Overvoltage/Short Circuit
<b>Output Pin Assignments:</b>	Center: +V Outside: Return 
<b>Output Plug Size:</b>	Outside Diameter: 5.5mm Inside Diameter: 2.5mm Barrel Length: 9.5mm

*The DC power supply received with your DieMark inking system meets these requirements. Use only the DC power supply provided with the unit or an authorized replacement power supply from Xandex Inc. or an approved Xandex distributor. For the exact specification of your power supply, request the “24VDC Power Supply” drawing listed in your product manual drawing package from [Xandex Customer Service](#).*

### Pneumatic Controller Specifications

<b>Size:</b>	6" x 6" x 4" (152mm x 152mm x 102mm)
<b>Weight:</b>	2.5 lbs (1.13 kg)
<b>Input Power Requirement:</b>	24V  (VDC) 0.84A
<b>Foot Switch Input:</b>	Contact Closure >50 msec
<b>Air Consumption:</b>	70 PSI ±10 PSI Instrument Air per ISA 7.3 specification <0.5 cfm @ 10 dots/second
<b>Cycle Rate:</b>	Exceeds 750 cycles/minute
<b>On-Time Range:</b>	Cartridge Air Feed - Continuously Variable Pulse (7.15-25.65 mS) Shuttle Air Feed - Fixed @ 25.2 ms
<b>Counters:</b>	Eight Digit with External Reset (Independent of Microprocessor)
<b>External Regulator/Filter</b>	5.0 micron Air Filtration

<b>Prober Input</b>	<p>12 - 60 volts @ minimum 30 ms pulse width. The input circuit presents approximately 1 K<math>\Omega</math> - 700 <math>\Omega</math> input resistance. Typical current as a function of input voltage is listed in the following table:</p> <table> <tr> <td>15 V</td><td>25 mA</td></tr> <tr> <td>20 V</td><td>45 mA</td></tr> <tr> <td>40 V</td><td>65 mA</td></tr> <tr> <td>60 V</td><td>85 mA (Maximum input)</td></tr> </table>	15 V	25 mA	20 V	45 mA	40 V	65 mA	60 V	85 mA (Maximum input)
15 V	25 mA								
20 V	45 mA								
40 V	65 mA								
60 V	85 mA (Maximum input)								
<b>Environmental Range:</b>	<ul style="list-style-type: none"> <li>➤ Indoor use</li> <li>➤ Altitude up to 2,000 m</li> <li>➤ Temperature range 5° C to 40° C</li> <li>➤ Maximum relative humidity 80 % for temperatures up to 31°C decreasing linearly to 50 % relative humidity at 40 °C</li> </ul>								
<b>Certifications</b>									
	<p>Standards to which conformity is declared: EN61010-1 / EN61326-1 Marked for LVD and EMC</p>								
<b>RoHS</b>	RoHS Compliant with EU Directive 2011/65/EU								
	<p>Conforms to UK Directives: 2016 No.1101 Electrical Equipment (Safety) 2016 No.1091 Electromagnetic Compatibility 2012 No.3032 RoHS</p> <p>Standards to which conformity is declared: BS EN IEC 61010-1:2010 BS EN 61326-1:2013</p>								
	<p>This device complies with FCC Rules Part 15. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference that may be received or that may cause undesired operation.</p>								
	<p>Xandex Inc. has labeled its branded electronic products with the WEEE Symbol to alert our customers that products bearing this label should not be disposed of in a landfill or with municipal or household waste in the EU.</p>								

### Ink Cartridge Specifications

<b>Models:</b>	DM-2, Type A4, A5, A6, A8
<b>Teflon Tube I.D.:</b>	A4* - 0.002" A5 - 0.005" / A6 - 0.006" / A8 - 0.008"
<b>Reservoir Capacity:</b>	1.0 grams minimum
<b>Available Inks:</b>	6990, 6993, 6997, 7824, 7824T, 8103, 8104
<b>Dot Sizes:</b>	Dot sizes ( $\pm 10\%$ ) consistent for speeds of 12 dots/second to 1 dot/2 minutes

\* A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

### Cartridge Availability

The following table illustrates ink and cartridge configurations. Configurations designated with a 0 are available as a Customer Specific Product (CSP) but have not been tested by Xandex and are subject to limited warranty conditions. The information in this table is accurate as of the time of publication but is subject to change without notice.

Ink Type	Pneumatic Cartridge Types							Filament Cartridge Types											
	DM-2				DM-2.3			DM-1							DM-1.25			DM-S	
	A4	A5	A6	A8	A5	A6	A8	3 mil	5 mil	8 mil	10 mil	15 mil	25 mil	30 mil	10 mil	15 mil	25 mil	10 mil	15 mil
6990 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	+	+	+	+	+
6993 Black	+	+	+	+	+	+	+	T	+	+	+	+	+	+	+	+	+	+	+
6997 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	+	+	+	+	+
Empty (no ink)		+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
7824 Black	+	+	+	+	+	+	+	T	T,F	+	+	+	+	+	0	+	+	0	0
7824T Black	+	+	+	+	+	+	+	T	T	+	+	+	+	+	0	0	+	0	0
8103 Black	+	+	+	+	+	+	+	T	T	+	+	+	+	+	0	0	0	0	0
8103 Red	0	+	+	+	+	+	0	T	T	+	+	+	+	+	0	0	0	0	0
8103 White	0	+	+	+	+	+	+	0	T	+	+	+	+	+	0	0	0	0	+
8104 Black	0	+	+	+	+	+	+	X	X	X	X	X	X	X	X	X	X	X	X

+ = Available standard cartridge and ink configuration.

0 = Not yet qualified by Xandex. Available as a special order, subject to limited warranty conditions.

T = with Tungsten filament

F = with Mono-Filament

X = Not available in filament cartridge configurations.

# Dot Size Guidelines in Mils (0.001 inch)      System Specifications

<i>Dot Size Guidelines in Mils (0.001 inch)</i>	<b>Micro-Z X711X Manual &amp; X712X Micro-Z Motorized Series DM-2</b>		<b>X1000 &amp; X901 Series DM-2</b>		<b>X5000 Series DM-2.3</b>	
<b>8103 INK</b>						
<b>A4</b>	Min.	3.5 mil	Min.	0	Min.	0
	Mid.	6.75 mil	Mid.	0	Mid.	0
	Max.	10 mil	Max.	0	Max.	0
<b>A5</b>	Min.	10 mil	Min.	12 mil	Min.	13 mil
	Mid.	19 mil	Mid.	21 mil	Mid.	23 mil
	Max.	22 mil	Max.	24 mil	Max.	27 mil
<b>A6</b>	Min.	11 mil	Min.	15 mil	Min.	17 mil
	Mid.	23 mil	Mid.	25 mil	Mid.	27 mil
	Max.	28 mil	Max.	29 mil	Max.	30 mil
<b>A8</b>	Min.	17 mil	Min.	22 mil	Min.	23 mil
	Mid.	32 mil	Mid.	37 mil	Mid.	39 mil
	Max.	38 mil	Max.	42 mil	Max.	43 mil
<b>6990 / 6993 / 6997INK</b>						
<b>A4</b>	Min.	4 mil	Min.	0	Min.	0
	Mid.	7 mil	Mid.	0	Mid.	0
	Max.	10 mil	Max.	0	Max.	0
<b>A5</b>	Min.	9 mil	Min.	16 mil	Min.	17 mil
	Mid.	12 mil	Mid.	28 mil	Mid.	29 mil
	Max.	16 mil	Max.	32 mil	Max.	33 mil
<b>A6</b>	Min.	8 mil	Min.	20 mil	Min.	18 mil
	Mid.	16 mil	Mid.	32 mil	Mid.	32 mil
	Max.	19 mil	Max.	36 mil	Max.	36 mil
<b>A8</b>	Min.	12 mil	Min.	29 mil	Min.	27 mil
	Mid.	24 mil	Mid.	52 mil	Mid.	50 mil
	Max.	29 mil	Max.	60 mil	Max.	57 mil
<b>7824 INK</b>						
<b>A4</b>	Min.	6 mil	Min.	0	Min.	0
	Mid.	8.5 mil	Mid.	0	Mid.	0
	Max.	11 mil	Max.	0	Max.	0
<b>A5</b>	Min.	10 mil	Min.	19 mil	Min.	18 mil
	Mid.	18 mil	Mid.	33 mil	Mid.	33 mil
	Max.	21 mil	Max.	38 mil	Max.	38 mil
<b>A6</b>	Min.	13 mil	Min.	25 mil	Min.	20 mil
	Mid.	24 mil	Mid.	44 mil	Mid.	36 mil
	Max.	29 mil	Max.	50 mil	Max.	41 mil
<b>A8</b>	Min.	20 mil	Min.	37 mil	Min.	29 mil
	Mid.	34 mil	Mid.	59 mil	Mid.	50 mil
	Max.	40 mil	Max.	69 mil	Max.	56 mil
<b>8104 INK</b>						
<b>A5</b>	Min.	14 mil	Min.	26 mil	Min.	24 mil
	Mid.	25 mil	Mid.	49 mil	Mid.	44 mil
	Max.	30 mil	Max.	54 mil	Max.	50 mil
<b>A6</b>	Min.	20 mil	Min.	33 mil	Min.	27 mil
	Mid.	34 mil	Mid.	56 mil	Mid.	50 mil
	Max.	39 mil	Max.	65 mil	Max.	56 mil
<b>A8</b>	Min.	38 mil	Min.	51 mil	Min.	54 mil
	Mid.	59 mil	Mid.	80 mil	Mid.	85 mil
	Max.	67 mil	Max.	90 mil	Max.	93 mil

\* Contact [Xandex Customer Service](#) for information on using 8103 ink in small dot applications.

0= A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

Dot production figures are averages and as such, are not guaranteed. All ink dot characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% using polished, unetched silicon wafers (no passivation).

<i>Dot Size Guidelines in Microns (µm)</i>	<b>Micro-Z X711X Manual &amp; X712X Micro-Z Motorized Series DM-2</b>		<b>X1000 &amp; X901 Series DM-2</b>		<b>X5000 Series DM-2.3</b>	
<b>8103 INK</b>						
<b>A4</b>	Min.	89 µm	Min.	0	Min.	0
	Mid.	172 µm	Mid.	0	Mid.	0
	Max.	254 µm	Max.	0	Max.	0
<b>A5</b>	Min.	254 µm	Min.	304.8 µm	Min.	330.2 µm
	Mid.	482.6 µm	Mid.	533.4 µm	Mid.	584.2 µm
	Max.	558.8 µm	Max.	609.6 µm	Max.	685.8 µm
<b>A6</b>	Min.	279.4 µm	Min.	381 µm	Min.	431.8 µm
	Mid.	584.2 µm	Mid.	635 µm	Mid.	685.8 µm
	Max.	711.2 µm	Max.	736.6 µm	Max.	762 µm
<b>A8</b>	Min.	431.8 µm	Min.	558.8 µm	Min.	584.2 µm
	Mid.	812.8 µm	Mid.	939.8 µm	Mid.	990.6 µm
	Max.	965.2 µm	Max.	1066.8 µm	Max.	1092.2 µm
<b>6990 / 6993 / 6997 INK</b>						
<b>A4</b>	Min.	102 µm	Min.	0	Min.	0
	Mid.	178 µm	Mid.	0	Mid.	0
	Max.	254 µm	Max.	0	Max.	0
<b>A5</b>	Min.	228.6 µm	Min.	406.4 µm	Min.	431.8 µm
	Mid.	304.8 µm	Mid.	711.2 µm	Mid.	736.6 µm
	Max.	406.4 µm	Max.	812.8 µm	Max.	838.2 µm
<b>A6</b>	Min.	203.2 µm	Min.	508 µm	Min.	457.2 µm
	Mid.	406.4 µm	Mid.	812.8 µm	Mid.	812.8 µm
	Max.	482.6 µm	Max.	914.4 µm	Max.	914.4 µm
<b>A8</b>	Min.	304.8 µm	Min.	736.6 µm	Min.	685.8 µm
	Mid.	609.6 µm	Mid.	1320.8 µm	Mid.	1270 µm
	Max.	736.6 µm	Max.	1524 µm	Max.	1447.8 µm
<b>7824 INK</b>						
<b>A4</b>	Min.	152 µm	Min.	0	Min.	0
	Mid.	216 µm	Mid.	0	Mid.	0
	Max.	279 µm	Max.	0	Max.	0
<b>A5</b>	Min.	254 µm	Min.	482.6 µm	Min.	457.2 µm
	Mid.	457.2 µm	Mid.	838.2 µm	Mid.	838.2 µm
	Max.	533.4 µm	Max.	965.2 µm	Max.	965.2 µm
<b>A6</b>	Min.	330.2 µm	Min.	635 µm	Min.	508 µm
	Mid.	609.6 µm	Mid.	1117.6 µm	Mid.	914. µm
	Max.	736.6 µm	Max.	1270 µm	Max.	1041. µm
<b>A8</b>	Min.	508 µm	Min.	939.8 µm	Min.	736.6 µm
	Mid.	863.6 µm	Mid.	1498.6 µm	Mid.	1270 µm
	Max.	1016 µm	Max.	1752.6 µm	Max.	1422.4 µm
<b>8104 INK</b>						
<b>A5</b>	Min.	355.6 µm	Min.	660.4 µm	Min.	609.6 µm
	Mid.	635 µm	Mid.	1244.6 µm	Mid.	1117.6µm
	Max.	762 µm	Max.	1371.6 µm	Max.	1270 µm
<b>A6</b>	Min.	508 µm	Min.	838.2 µm	Min.	685.8 µm
	Mid.	863.6 µm	Mid.	1422.4 µm	Mid.	1270 µm
	Max.	990.6 µm	Max.	1651 µm	Max.	1422.4 µm
<b>A8</b>	Min.	965.2µm	Min.	1295.4 µm	Min.	1371.6 µm
	Mid.	1498.6 µm	Mid.	2032 µm	Mid.	2159 µm
	Max.	1701.8 µm	Max.	2286 µm	Max.	2362.2 µm

\* Contact [Xandex Customer Service](#) for information on using 8103 ink in small dot applications.

0= A4 cartridges are qualified by Xandex for use on Micro-Z inking systems. A4 cartridges can be purchased for use on other DieMark pneumatic inker models, however, performance is not guaranteed, and subject to limited warranty conditions.

Dot production figures are averages and as such, are not guaranteed. All ink dot characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% using polished, unetched silicon wafers (no passivation).

**DieMark Limited Warranty**

Seller warrants as follows:

All material supplied will conform to the description stated. All products will be free of defects in materials and workmanship under normal use for the following periods:

**Stated shelf life of DM-2, DM-2.3 Ink Cartridges:**

- ◆ 6990, 6993, 6997 = Four (4) months. Five (5) days after cartridge opening.
- ◆ 8103 and 8104 (except for 8103 White) = Four (4) months. Three (3) days after cartridge opening.
- ◆ 8103 White = Two (2) months. Three (3) days after cartridge opening.
- ◆ 7824 and 7824T = Four (4) months. Three (3) days after cartridge opening.

**Pneumatic Controller** = One (1) year only when clean, dry, filtered air is used, and when product is installed and operated per manufacturer's recommendations and instructions.

Ninety (90) days from the date of delivery to the customer for all other products.

Xandex makes no other warranty, express or implied, including without limitation any warranty of merchantability or of fitness for a particular purpose. Customer, OEM or Distributor's exclusive warranty shall be, at Xandex's option, to have defective product repaired or replaced, or to receive a refund of purchase price.

Xandex may, upon request, furnish to buyer such technical advice, as it may be able to supply with reference to the use by buyer of any materials delivered. Xandex assumes no liability for the advice given or results obtained. Buyer expressly agrees that it will implement any advice thus given at its own risk and agrees to indemnify and hold Xandex harmless against any liabilities, costs or expense resulting therefrom.

Xandex makes no warranty for performance, service or support of any products unless they are purchased directly from Xandex or through an authorized Xandex Distributor.

**Exclusions:** This warranty shall not apply to defects or damage resulting from;

- Improper or inadequate maintenance by customer, including failure to perform preventive maintenance per manufacturer's specified schedule
- Misuse or unauthorized modification
- Operation outside the environmental specifications for the product
- Improper site preparation and maintenance

Some states and provinces do not allow limitations on how long an implied warranty lasts, so the limitation or exclusion contained in this warranty may not apply to you. However, any implied warranty of merchantability or fitness is limited to the duration period of this written warranty. If you have any questions or need further assistance please contact your authorized Xandex distributor or contact our Customer Service Group.



Customer Service

1360 Redwood Way, Suite A

Petaluma, California 94954 U.S.A.

Toll Free in the United States (800) 767-9543

or (707) 763-7799 FAX (707) 763-2631

<http://www.xandexsemi.com/> email; <mailto:info@xandex.com>

**System Drawings**

The Inker Assembly Dimensional Drawing is available via link from [www.xandexsemi.com](http://www.xandexsemi.com) The remaining drawings in the list below are available on request, in Adobe PDF format, from [Xandex Customer Service](#).

Description	Drawing Number
Pneumatic Controller Assembly, Standard	350-0002
Schematic, Pneumatic Controller, Standard	950-1226
Controller Logic Board PC Assy	250-1226
24 VDC Power Supply	220-0078
Inker Assembly, X1100 Series Overall Dimensions Drawing	<a href="#">900-0221</a>
Inker Assembly, 1100 (EG)	320-1100
Inker Assembly, 1105 (EG detent)	320-1105
Precision Direct Mount Pneumatic Shuttle 36" Air Hose	316-0010
Overall Dimensions Drawing, Precision Pneumatic Shuttle - X1100 Series	<a href="#">900-0219</a>
Inker Set X1100 (EG)	340-1100
Inker Set X1105 (EG detent)	340-1105

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