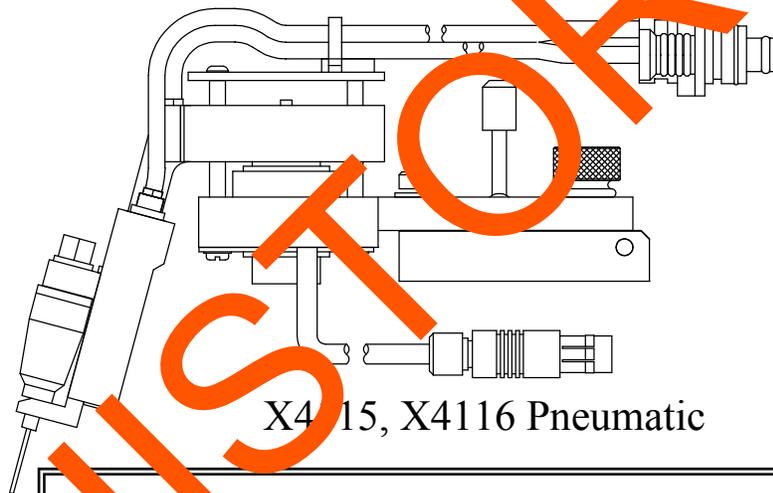




MOTORIZED Z SERIES PNEUMATIC INKER  
with SMALL DOT FEATURE  
INSTALLATION AND OPERATION MANUAL  
Models X4115/X4116 (EG), X4215/X4217 (KLA)

820-0096 Revision R



X4115, X4116 Pneumatic

**IMPORTANT OPERATION NOTICE!**

The Model 350-0018 Motorized Z Pneumatic Controller is designed to operate at **80 ± 5 PSI**.

FAILURE TO SET THE REGULATOR PROVIDING AIR TO THE CONTROLLER AT 80 PSI WILL RESULT IN INCONSISTENT SYSTEM OPERATION!

# Service and Support Information



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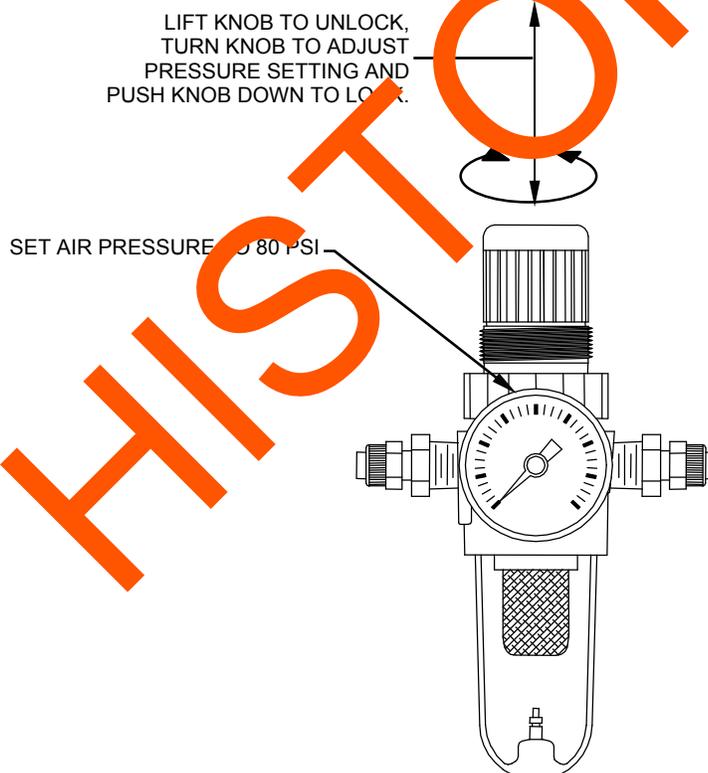
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# IMPORTANT OPERATION INFORMATION!

The Model 350-0018 Motorized Z Pneumatic Controller is designed to operate at **80 ± 5 PSI**. This setting is 10 PSI higher than the 70 PSI setting recommended for all other Xandex pneumatic controller units.

***FAILURE TO SET THE REGULATOR PROVIDING AIR TO THE  
CONTROLLER AT 80 PSI WILL RESULT IN INCONSISTENT SYSTEM  
OPERATION.***



For more information contact Xandex Customer Service at (707) 763-7799 or Toll Free in the U.S at (800) 767-9543, FAX (707) 763-2631, or visit us on the Internet at [www.xandexsemi.com](http://www.xandexsemi.com)

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HISTORY

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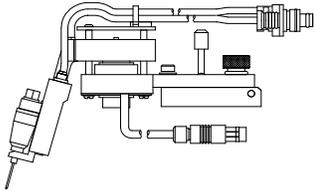
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HISTORY

# Section 1. Introduction

## Theory of Operation



The X4115/X4116, X4215/X4217 pneumatic Motorized Z inkers are designed for use as cabled in in-line and off-line inkers on Electroglas and KLA probers. The innovative motorized Z design combines operator friendly motorized Z movement capability, which provides fast, precise Z adjustment, with a dual air regulation system to provide the first dependable high speed small dot capability available in a pneumatic inker.

The Motorized Z series inker also incorporates the convenience of DieMark™ 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 prober 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 25.2 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 equal to 1/2 the dot setting duration (6.7 - 13 mS) 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 Xandex 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 [www.xandexsemi.com](http://www.xandexsemi.com) or email: us at [info@xandex.com](mailto:info@xandex.com).

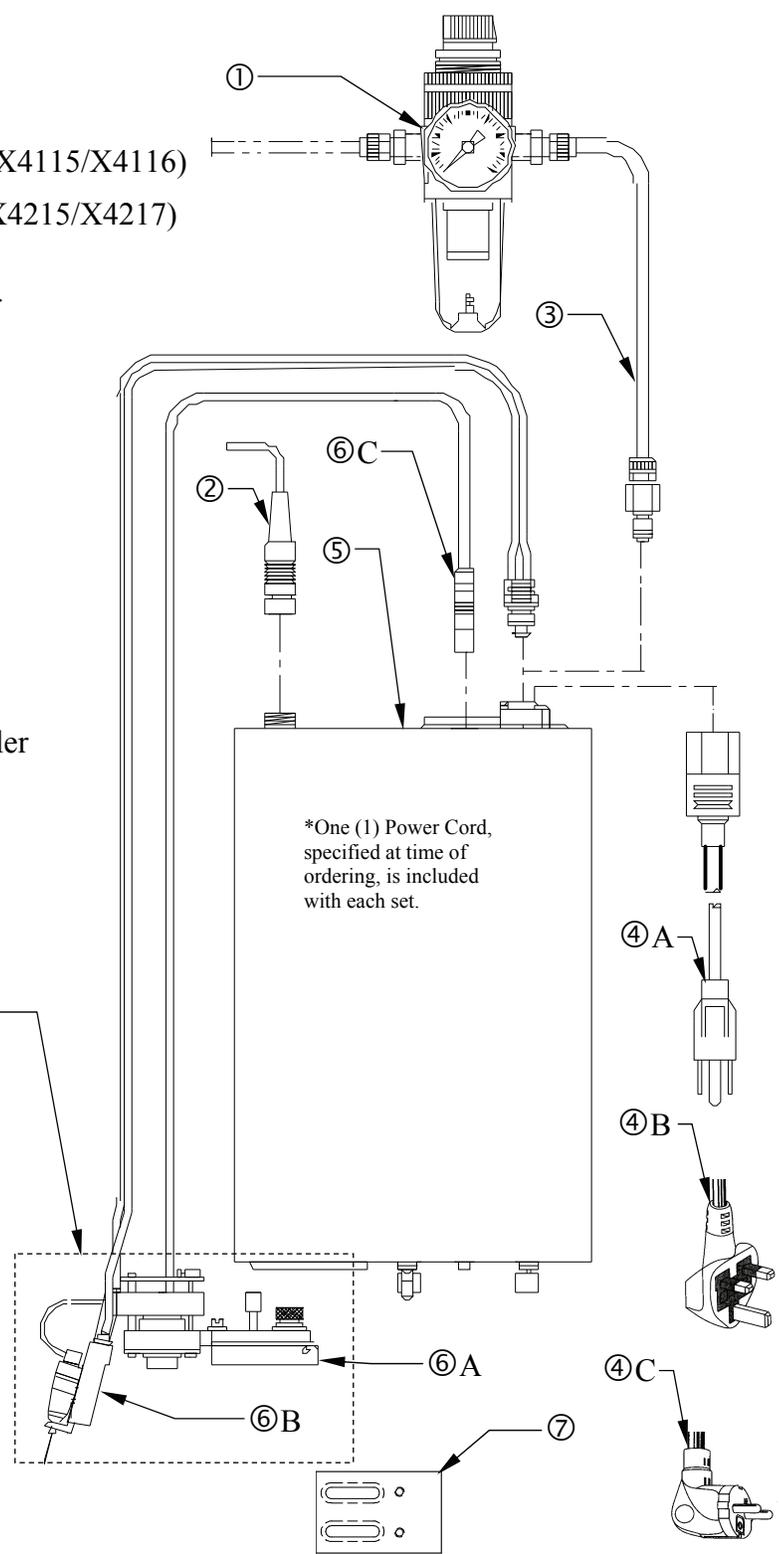
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# Section 2. System Overview

## System Components

Set Part No. 340-4115/340-4116 ( X4115/X4116 EG) Set Part No. 340-4215/340-4217 (X4215/X4217 KLA)

1. Regulator Assembly  
Part No. 220-0076
2. Cable/Connector Assembly  
Type AC - Part No. 210-0109 (X4115/X4116)  
Type CC - Part No. 210-0110 (X4215/X4217)
3. Air Hose Regulator > Controller  
Part No. 210-2001
4. **A.** AC Power Cord (USA)\*  
Part No. 158-0051  
**B.** AC Power Cord (UK)\*  
Part No. 158-0408  
**C.** AC Power Cord (Europe)\*  
Part No. 158-0407
5. Motorized Z Pneumatic Controller  
(Includes AC Power Cord)  
Part No. 350-0018
6. Pneumatic Inker Assembly  
Part No. 320-4215 (All Models)
  - A. Inker Base  
Part No. 220-0031  
(All Models)
  - B. Pneumatic Shuttle  
Part No. 216-0005
  - C. 7 Pin Plug, Stepper Motor  
Part No. 158-0008
7. Inker Mounting Plate  
Part No. 120-0019 (X4215/  
X4217)



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## Section 3. Installation

### X4115/X4116 Inker Installation

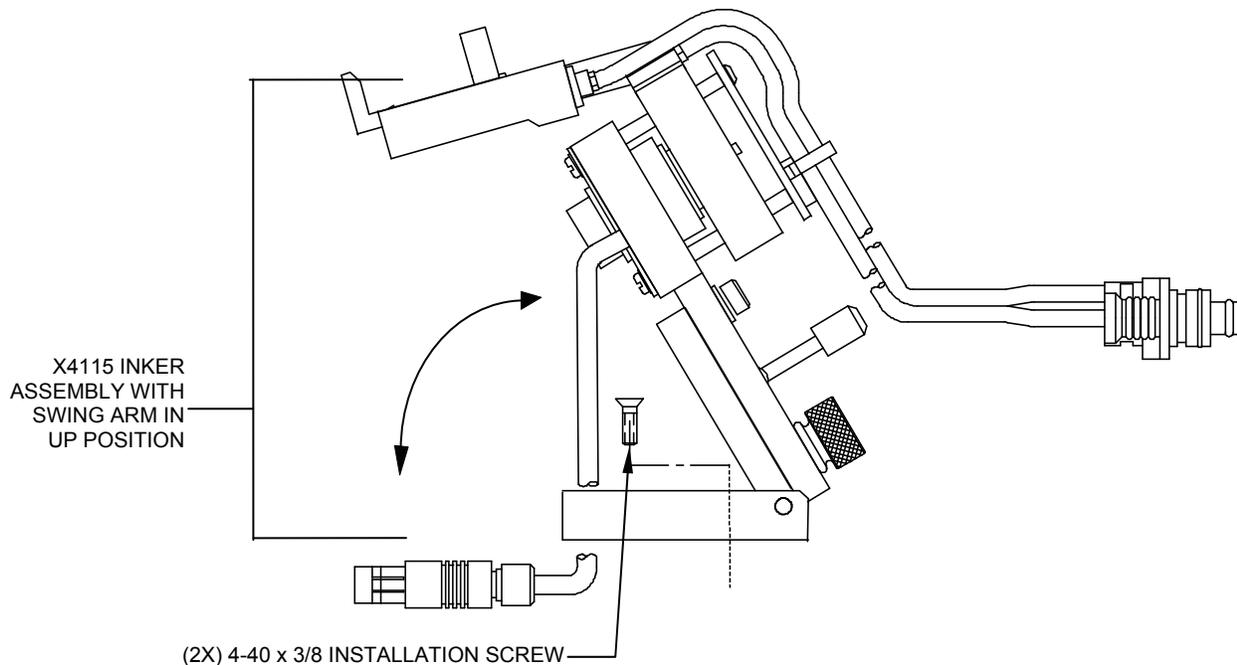
The X4115/ X4116 pneumatic inker installs directly onto the insert ring on an Electroglas model 10XX, 20XX or 40X0 series prober. The X 4115/X 4116 inker sets are identical except for pneumatic controller software. The X4116 inker set for EG probers comes with a pneumatic controller that incorporates the "Half-Puff" software option (X4115 = Standard Motor-Z controller).

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



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

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

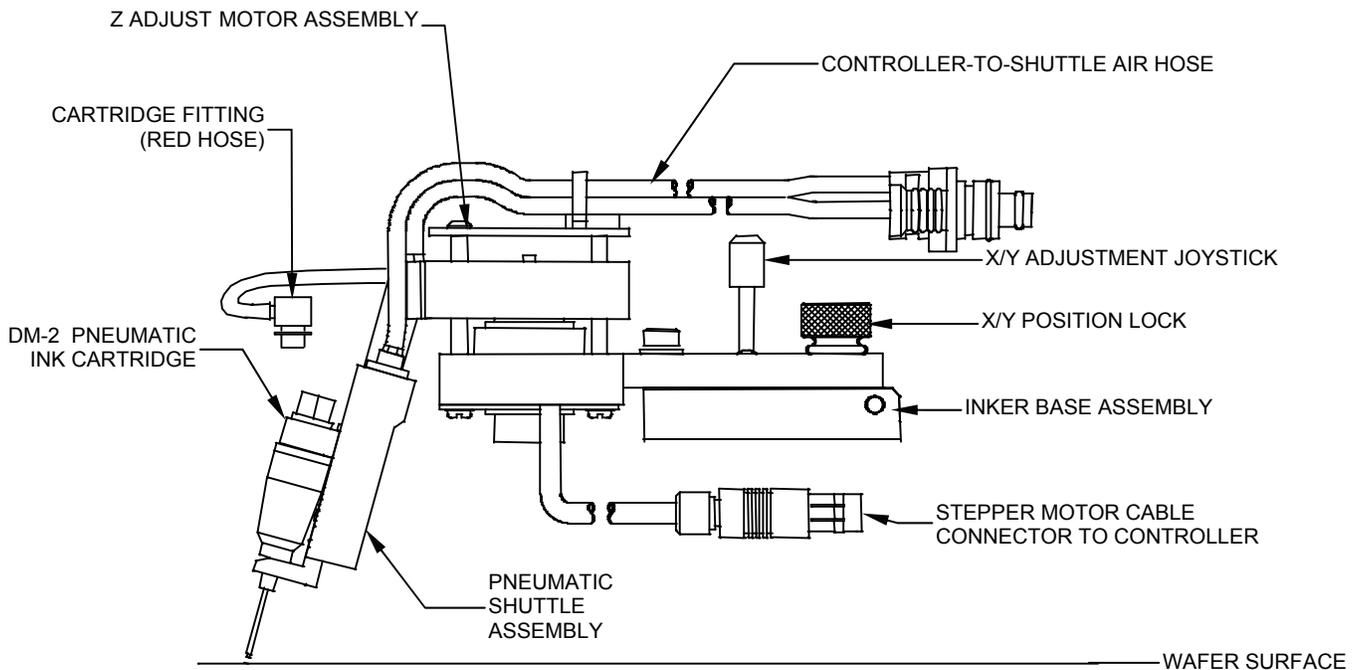


3. Install inker using two (2) 4-40 x 3/8 screws (supplied) into existing mounting holes on the prober insert ring.
4. Proceed to the “**Controller Installation**” portion of this Installation Section (3), and install the pneumatic controller per instructions for your application.

5. With the controller and inker installed, connect the fitting on the *controller-to-shuttle air hose* into the pneumatic connection on the rear of the pneumatic controller labeled "SHUTTLE".
6. Plug the jack from the inker stepper motor into the mating jack on the rear of the controller labeled "MOTOR".
7. Proceed to **Section 4 "System Operation"** for ink cartridge installation, inker setup, alignment and controller operation instructions.



**CAUTION:** 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!



## X4215/X4217 Motor Z Inker Assembly Installation

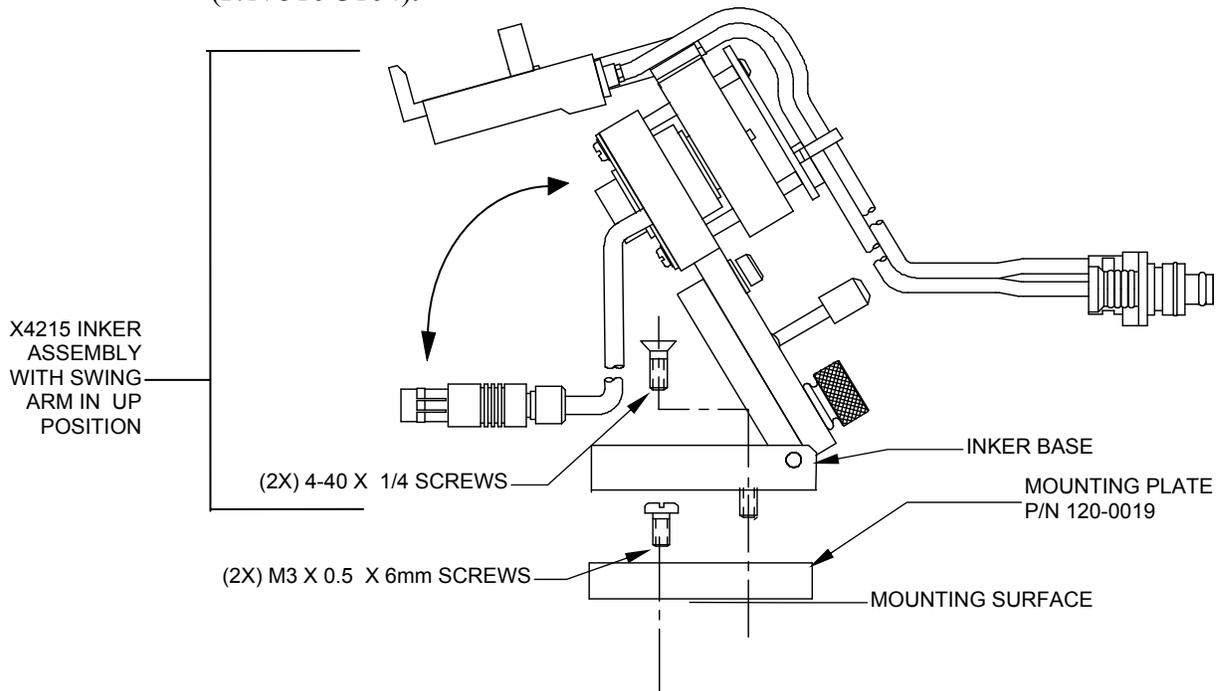
The X4215/X4217 pneumatic inker is for use with KLA 1007, 1011, 1200 and 1220 model probers. The X4215/X4217 installs directly onto the head plate of a KLA/TEL prober, using a mounting plate (P/N 120-0019, supplied). The X 4215/X 4217 inker sets are identical except for pneumatic controller software. The X4217 inker set for KLA probers comes with a pneumatic controller that incorporates the "Half-Puff" software option (X4215 = Standard Motor-Z controller).

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



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

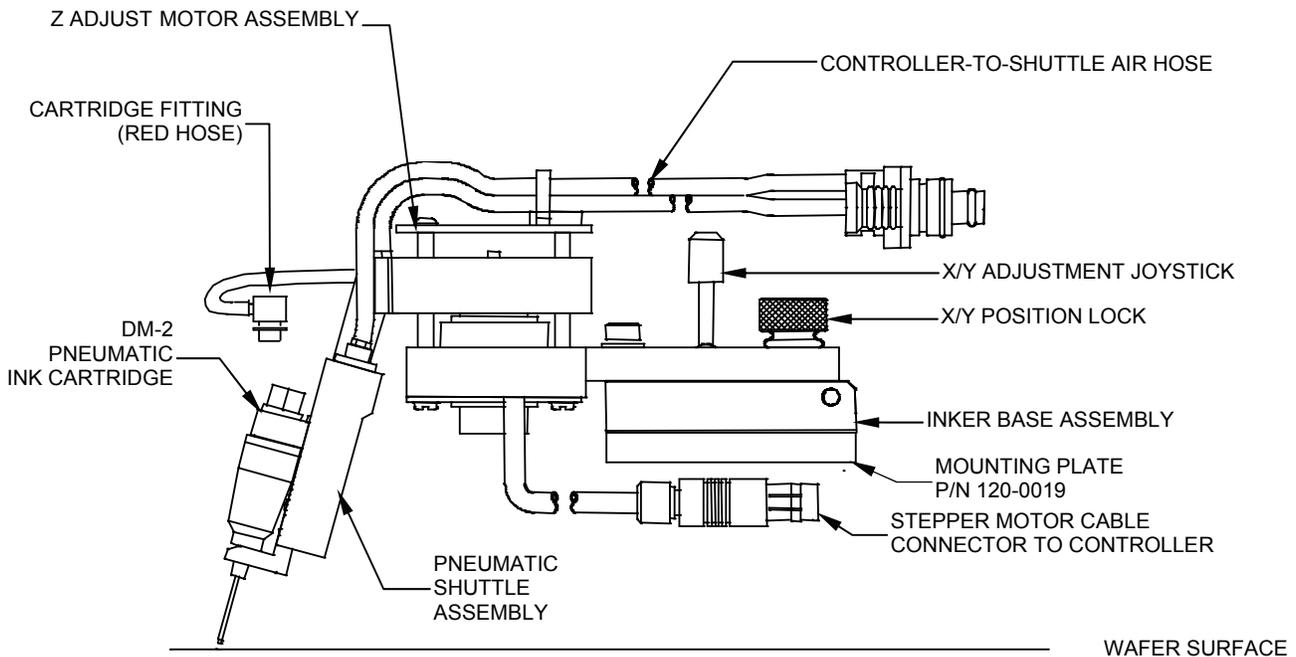
2. Align the mounting plate (P/N 120-0019) over the existing inker mounting holes on the prober.
3. Install the mounting plate using two M3 X 0.5 X 6mm screws ((P/N 510-9201 supplied).
4. Lift the inker swing arm into the up position. The inker base mounting screws should now be accessible.
5. Install the inker base onto the mounting plate using (2) 4-40 x 1/4 screws (P/N 510-3104).



6. Proceed to the “**Controller Installation**” portion of this Installation Section (3), and install the pneumatic controller per instructions for your application.
7. With the controller installed, connect the fitting on the *controller-to-shuttle air hose* into the pneumatic connection on the rear of the pneumatic controller labeled "SHUTTLE".
8. Plug the jack from the inker stepper motor into the mating jack on the rear of the controller labeled "MOTOR".
9. Proceed to **Section 4 “System Operation”** for ink cartridge installation, inker setup, alignment and controller operation instructions.



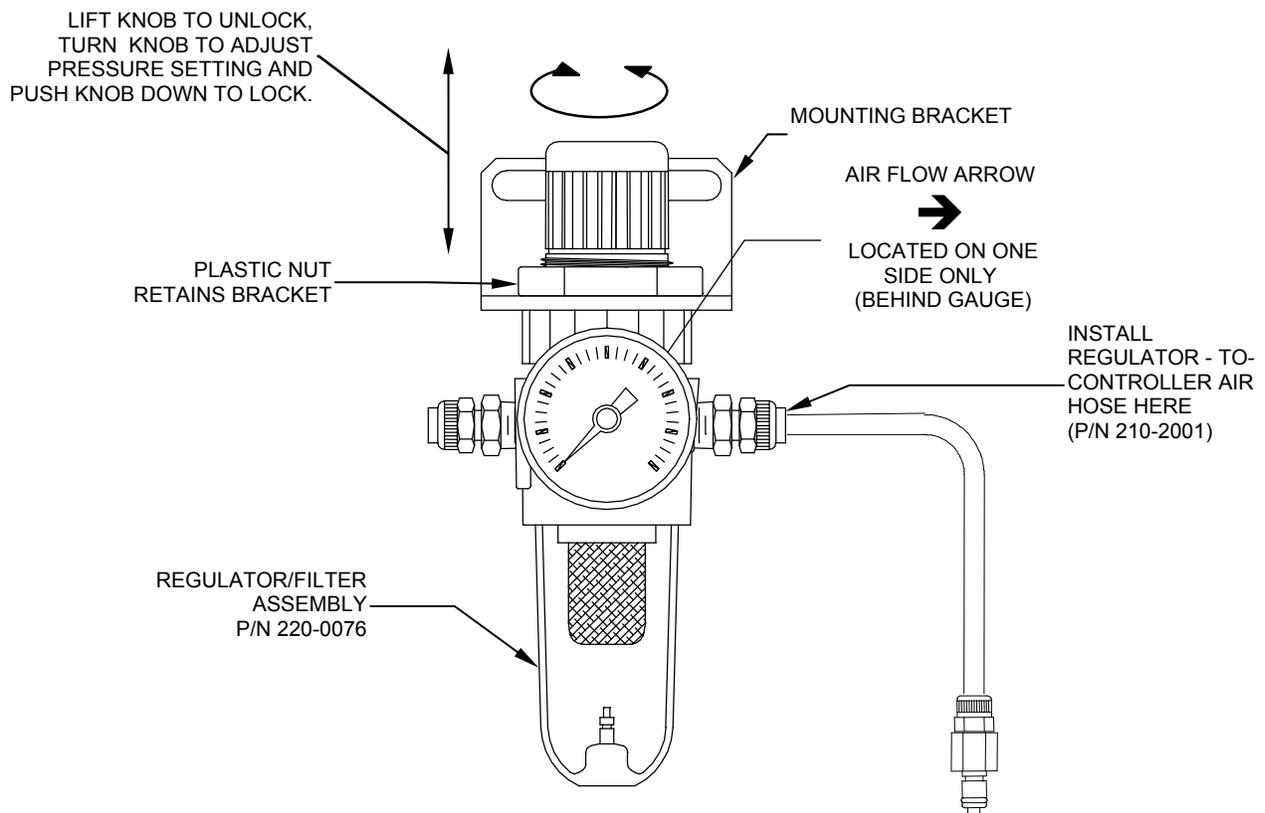
**CAUTION:** After an ink cartridge is installed, the inker arm should **NOT** be lowered back into operating position with the Z height adjusted completely down. The cartridge may be positioned too low, resulting in the Teflon® tube in the cartridge needle smashing into the wafer when the arm is lowered.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



### Controller Installation

**Note:** The Model 350-0018 Motorized Z controller is designed to operate at  $80 \pm 5$  PSI. This is 10 PSI higher than the 70 PSI setting recommended for all other Xandex pneumatic controllers. **FAILURE TO SET THE REGULATOR PROVIDING AIR INPUT TO THE CONTROLLER AT 80 PSI WILL RESULT IN INCONSISTENT SYSTEM PERFORMANCE!**

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.



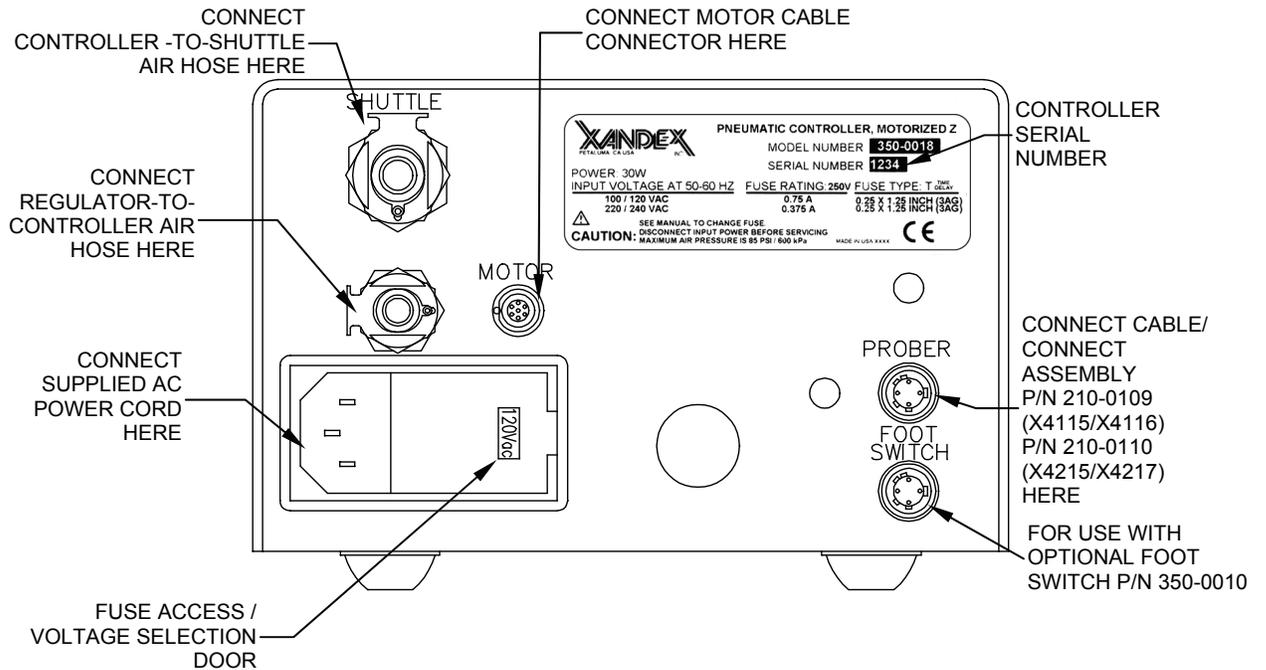
2. Install 1/4 O.D. x 0.170 I.D. polyethylene tubing (not supplied) to the main air source and then connect to the input fitting on the regulator. (The left side when facing the gauge.)
3. Connect the *regulator-to-pneumatic controller air hose* (P/N 210-2001 supplied) to the *output fitting* on the 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 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  $80 \pm 5$  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 or 210-0110) 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. The controller is factory set at 120 VAC @ 50-60 Hz. If your AC input voltage is different than 120V, follow the instructions in this Section (3) "**Voltage Selection and Fuse Replacement**" to change the controller to your requirement.
10. Install the *AC power cord* into the back of the controller. Plug the power cord into an AC supply outlet. At this point, the "INK ON" LED will flash once, while the "STATUS" LED will stay on. Proceed to **Section 4 "System Operation"** for ink cartridge installation, inker setup, alignment and controller operation instructions.



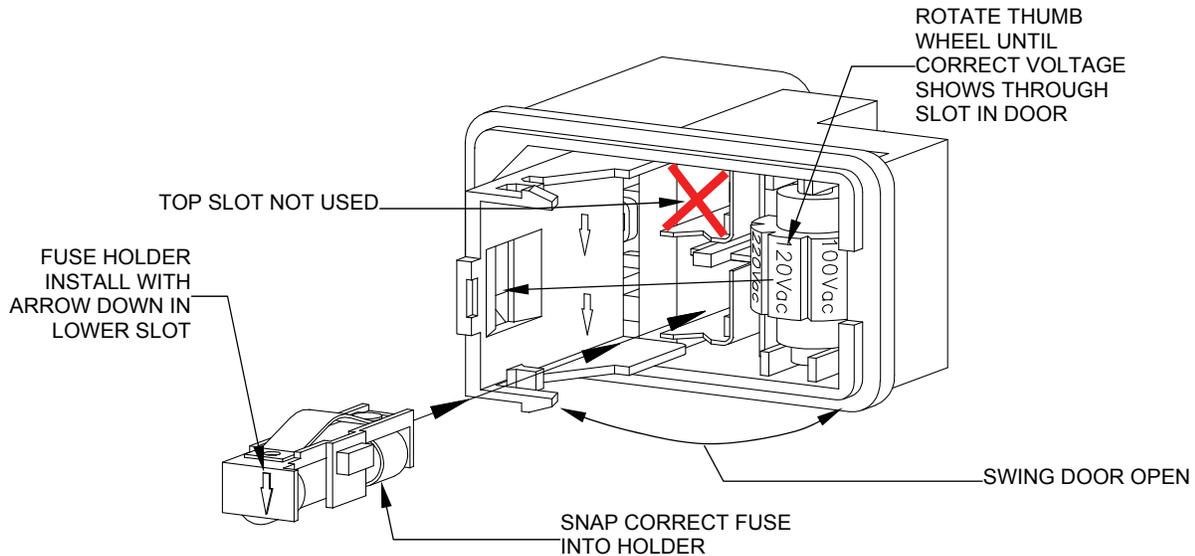
**Voltage Selection & Fuse Replacement**

*Note: This unit is shipped with the voltage set for 120VAC. Two fuse types are included, one for 100/120VAC and one for 220/240VAC, however, **the controller unit is shipped without a fuse installed.** Select the correct fuse for your voltage rating from the chart below and install per instructions. Discard unused fuse.*

1. Disconnect power cord from rear of controller (if connected).

*Note: There is no power switch on this unit. If the unit loses power, memory of any hour or dot count programmed into the unit will be lost.*

2. Swing open the fuse cover door by lifting on tab on the right side of the door. (A small screwdriver may be necessary.)



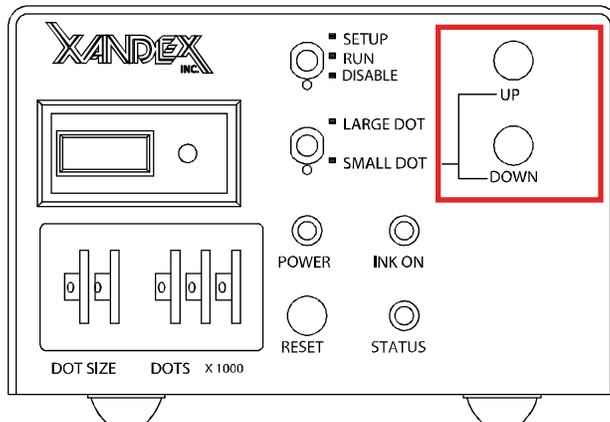
3. To change voltage setting, rotate the thumbwheel until correct voltage listed on the thumbwheel is facing out (visible through the slot in the door when the door is closed.)
4. To change the fuse, remove the fuse holder from the module by pulling it straight out. Carefully pry the fuse from the holder and replace (see fuse rating chart below.)
5. Insert the fuse holder into the **bottom** (lower) slot in the module with the arrow on the fuse holder pointed down.
6. CAREFULLY close fuse cover door. Verify that the correct voltage shows through the window on the module door. Reconnect power cord and verify controller power.

INPUT VOLTAGE AT 50-60HZ	FUSE RATING; 250 V	FUSE TYPE: T or Time Delay	XANDEX PART NUMBER
100/120VAC	0.75A	3AG (0.25" x 1.25")	158-0032
220/240VAC	0.375A	3AG (0.25" x 1.25")	158-0479

# Section 4. System Operation

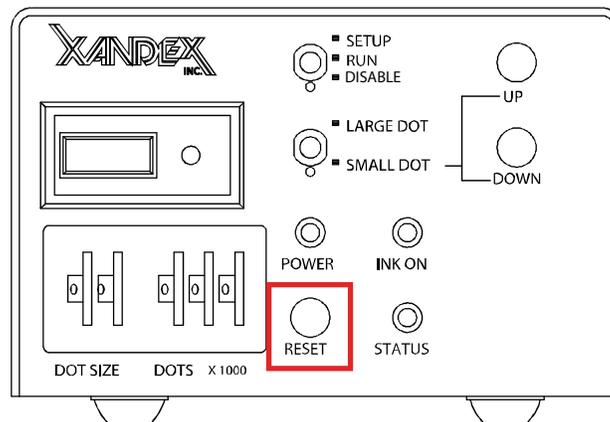
## Controller Operation

### Programmable Thumbwheel Counter



Individual thumbwheel settings are available to monitor the number of Dots placed by an ink cartridge (Dots X 1000). These three thumbwheels can be set to any number of dots between 1 and 999,000. A red "STATUS" LED will be illuminated and an audible alarm will sound when the programmed limit is exceeded. 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. Upon installation of a new ink cartridge, it is recommended that the thumbwheels be reset to alert the operator when a cartridge is nearing replacement. The Dots X 1000 setting is programmed by using the RESET button.

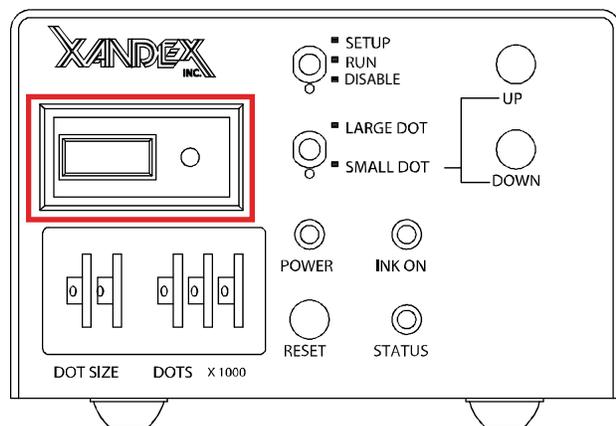


**Reset Button:** A "RESET" button is located to the right of the thumbwheels for resetting the counters in the microprocessor. When the "RESET" button is depressed once, the "INK ON" LED will flash for 5 seconds. If it is pressed a second time within 5 seconds, it will "read" the setting on the Dots X 1000 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 "INK ON" LED will stop flashing and the current set points and internal counts will not be changed.

**Note:** *If the prober is running and the "RESET" button is pushed, the "INK ON" LED will flash intermittently. After 5 seconds, the "INK ON" LED will stop flashing and the unit will continue with the current programming. If the prober is running and the "RESET" button is depressed a second time within the 5 second reset time, INPUT SIGNALS FROM THE PROBER WILL BE INHIBITED AND THE UNIT WILL RESET AND RE-PROGRAM ITSELF.*

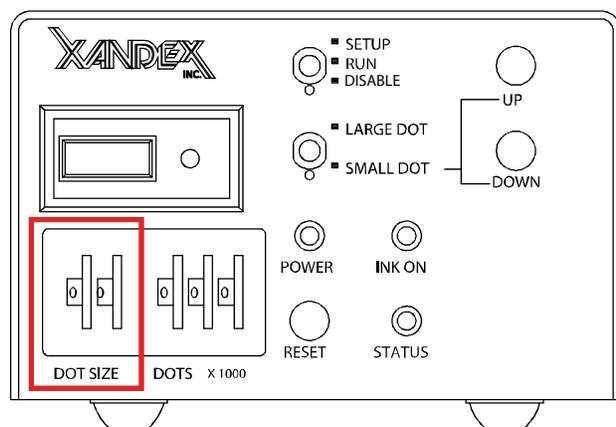
The "RESET" button is also used to enter the diagnostic mode when power is applied to the controller with the "RESET" button depressed. For details and descriptions of controller diagnostic tests see **"Controller Diagnostics"** in Section 6.



counter be reset to accurately record the numbers of dots produced by that cartridge.

**Dot Counter:** A separate LCD dot counter is located on the front panel above the thumbwheels. This counter has an internal Lithium battery with a nominal life of 10 years, and an integral reset button. Pressing the small red reset button next to the LCD window will reset the counter display only. It will have no effect on the counter circuits within the microprocessor. Upon installation of a new ink cartridge, it is recommended that the

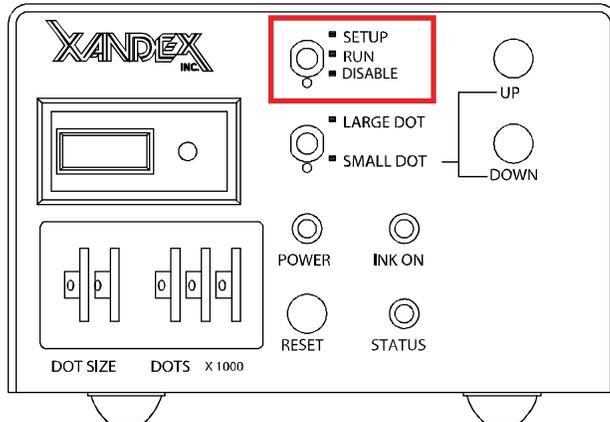
**Audible Alarm:** An audible alarm is activated, along with the "STATUS" LED, whenever the "DOTS X 1000" thumbwheel setting has been reached. The alarm is silenced and reset by pausing the prober, resetting the "DOTS X 1000" thumbwheels if desired and depressing the "RESET" button twice within five seconds. The audio alarm may be disabled by means of an internal jumper on the controller PCA. See **Section 6 "Maintenance and Troubleshooting"** "Controller Internal Maintenance" for detailed instructions.



**Dot Size Thumbwheels:** The adjustable Dot Size Thumbwheels on the front panel are used to vary the size of the dot produced without affecting set-up or requiring additional operator steps. The microprocessor reads the thumbwheel settings 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 (Markem 6990, 6993, 6997 or Xandex 8103, 8104 7824 or 7824T), a 14 mil to 50 mil dot is possible. It is recommended that the proper dot size for the die be selected to maximize cartridge usage and minimize problems with too large or too small dots. **Refer to Section 7 for dot size specification tables.**

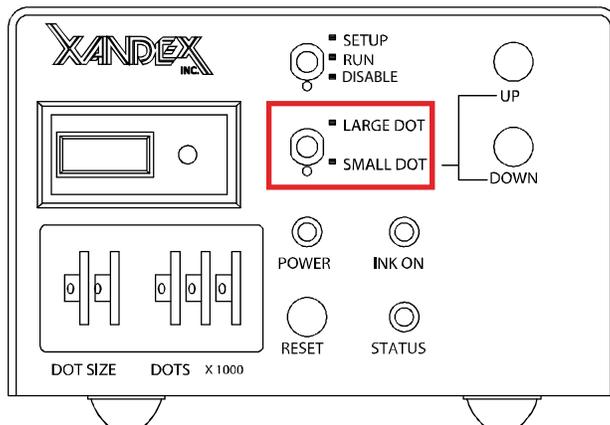
**Mode Selection Switches:** There are two mode selection mode switches located on the front panel for selecting different inker operating modes. The following is a description of the functions of each switch position.



### Top Mode Switch Positions

- SETUP = Shuttle air valve enabled for coarse Z height setup
- RUN = Normal Operation
- DISABLE = Shuttle air valve disabled (troubleshooting aid)

When placed in the SET-UP position, the shuttle air valve (V2) is enabled, moving the shuttle to the lower position for Z set-up adjustment. While in the SET-UP mode, perform coarse Z height adjustment as detailed in the Set-Up and Alignment procedure. 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. The switch is placed in the RUN position for inking. 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 controller diagnostics, to place dots in hand-inking applications with the optional foot switch or when utilizing the prober Z function without actuating the shuttle.



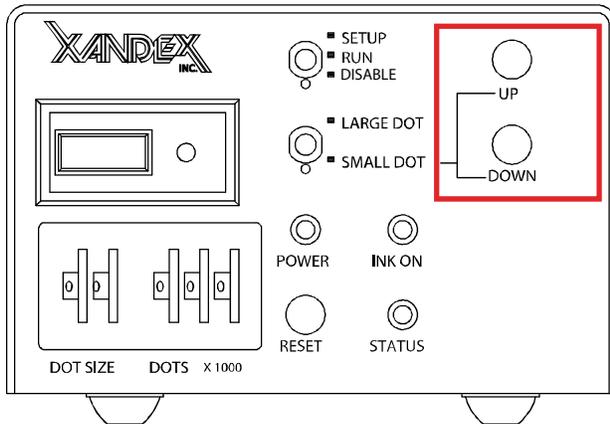
### Bottom Mode Switch Positions

- LARGE DOT = Controller operates at external regulator pressure
- SMALL DOT = Cartridge valve operates at internal regulator pressure

Dot size is determined by the cartridge type (A5, A6 or A8), ink viscosity, air pressure supplied to the cartridge valve and the dot size thumbwheel setting, which regulates the duration of the air pulse to the cartridge. When the bottom switch is placed in LARGE DOT position, the controller operates at the air pressure setting of the external regulator (80 psi nominal). Average large dot size parameters for the three available cartridge types with different ink varieties in dot size thumbwheel increments of 5, are included in **Section 7**. When the bottom switch is placed in SMALL DOT position, the controller operates the cartridge valve (V1) at an air pressure determined by a second, internal regulator, which is factory set at 10 psi. This regulator is not operator adjustable, but may be reset if necessary to optimize small dot production. See “Small Dot Configuration” later in this section (4) for detailed instructions on small dot mode.

**Bottom Mode Selection Switches (cont'd):** Dot Size Thumbwheels, Dot Counter and Motorized Z UP and Z DOWN buttons do not change function in SMALL DOT mode. Small dot production requires the use of the A5 cartridge type. Typical small dot size parameters for the A5 cartridge with available ink types are included in **Chapter 7**. For more information on the small dot capabilities of the motorized Z controller, see “Motorized Z Small Dot Configuration” later in this section (4).

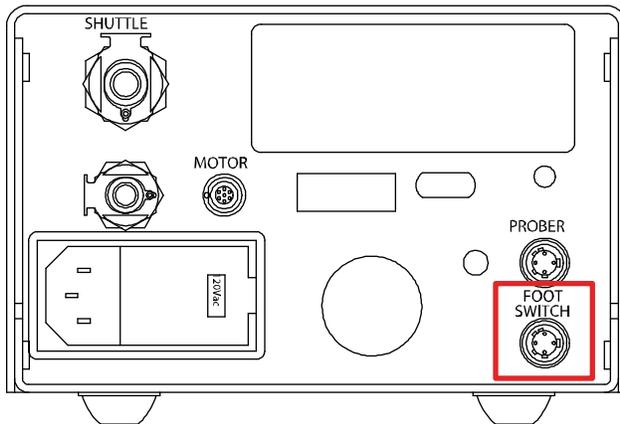
**Z UP and Z DOWN Buttons:** Z UP and Z DOWN buttons allow motorized adjustment



of the inker Z height in 0.0005" (.5mil) increments each time either button is depressed. The buttons should be pressed no faster than one time per second as the unit cannot react to faster use and such use will result in zero movement. This fast, precise method of setting inker Z height simplifies operator/inkers interface and shortens initial setup time. Minor adjustment of Z height may also be necessary after changing an ink cartridge, due to slight

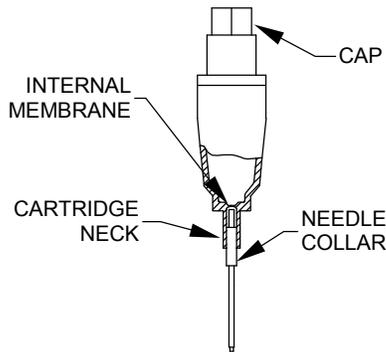
manufacturing variations between cartridges. The Z UP and Z DOWN buttons can be used to quickly move the inker up or down by depressing and holding down either button. This function is useful to quickly raise inker Z height when changing cartridges, but great care should be taken not to “run” the inker down into the wafer in this mode.

**Note:** The specifications for the bipolar stepper motor installed on the Motorized Z inkers are listed in Section 7. The manufacturer’s specification of 0.001” linear movement per step is correct. The motor is driven in 1/2 steps to achieve 0.0005” linear movement per activation.



**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 > 50mSec 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. This input is not used with the X4000 Series inkers.

### Ink Cartridge

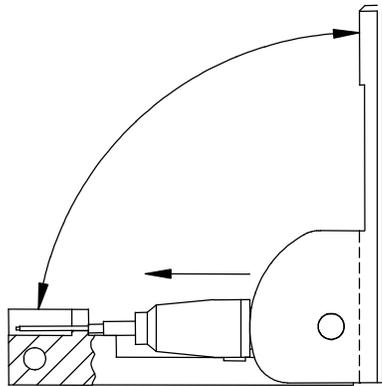


The ink cartridge used with the X4000 Series Inkers is a DM-2, available in A5, A6, and A8 types (designating 0.005", 0.006", and 0.008" Teflon® tube I.D., respectively). DM-2 cartridges have a polypropylene reservoir (sealed at the bottom by a thin membrane) and a small Teflon® tube encased in a stainless steel needle. When the cartridge is opened, the needle punctures the membrane to provide ink flow through the Teflon® tube.

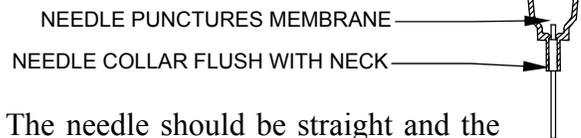
Each cartridge holds 1.0 grams minimum of ink and can produce a wide range of dot sizes. Dot size is controlled by changing the duration of the air pulse into the cartridge reservoir, which determines how much ink is forced through the Teflon® tube to create the ink drop at the needle tip. A5 and A6 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": Auto-Z/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.



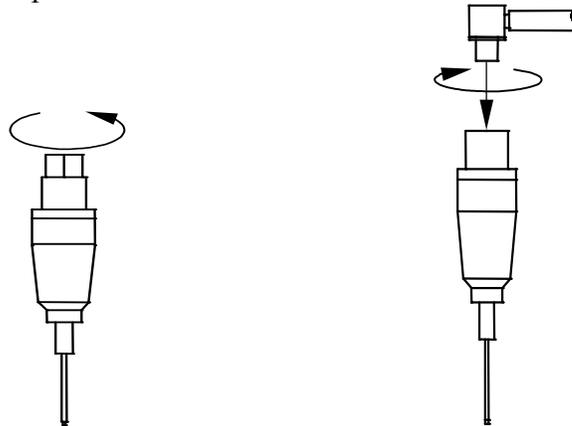
**CAUTION:** Do not shake the cartridge at any time, as air bubbles may be introduced into the reservoir and restrict the flow of ink. If mixing of the ink in the reservoir is desired, roll the cartridge between thumb and forefinger (or between palms) for 1-2 minutes prior to installation.

### Cartridge Installation



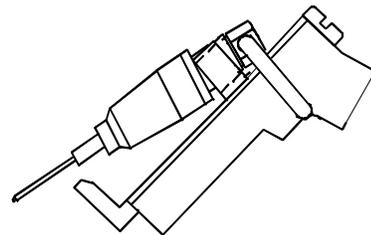
**CAUTION:** Move the inker arm to the UP position when installing or changing cartridges to prevent damaging the cartridge tip.

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

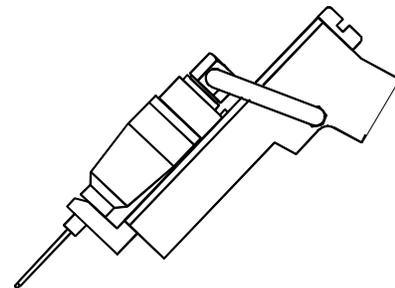


2. Thread the cartridge onto the brass air fitting of the RED AIR HOSE, turning the cartridge *clockwise* until snug.

3. Press top of cartridge into shuttle spring clip.



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



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

### 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 and air hose for ink contamination and clean or replace as necessary.
5. Install a new cartridge per installation instructions.

### Cartridge Priming



**CAUTION:** 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.
3. Lift the inker swing arm to the UP position.

*Note:* Cartridge priming is done with the inker arm in 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 begin to flash. At the end of 3 seconds the “INK ON” LED will light continuously and the 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. Cartridge is now ready for operation. Proceed to “**Inker Assembly Setup and Alignment**” in this section (4) to prepare the inker.

**Note:** 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 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.

**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.

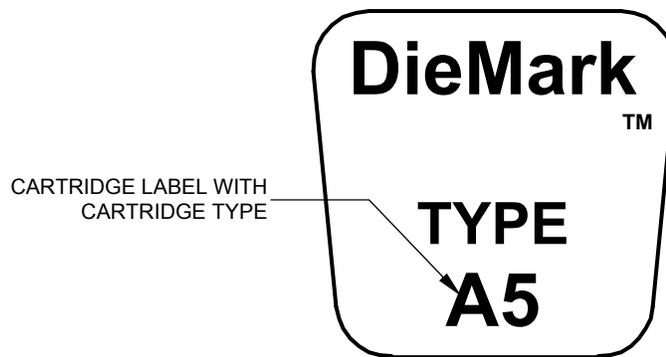
### ***Ink Cartridge Labeling***

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 **A5**, **A6** or **A8**).

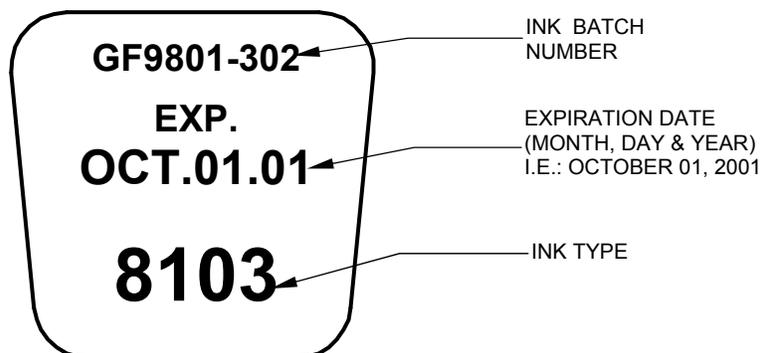


#### **DieMark™ Cartridge Expiration Date Label**

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.

- ◆ Markem® 6990, 6993, 6997 and Xandex 8103, 8104 = Four (4) months.
- ◆ Xandex 7824 and 7824T = Four (4) months.

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



### Cartridge Type Label Color Code

DM-2 & DM-2.3 PNEUMATIC CARTRIDGE LABELS	
NEW LABEL	DESCRIPTION
	<b>A5 = RED</b>
	<b>A6 = BLUE</b>
	<b>A8 = YELLOW</b>

### Inker Assembly Setup & Alignment

1. Prepare, install and prime an ink cartridge per the instructions in this section (4).
2. Once priming is completed, verify that the inker is at maximum Z height adjustment, set the top mode switch to "RUN", then lower the inker arm and snap into place.
3. Position the chuck/wafer under the inker and set the prober chuck "Z Up".



**CAUTION:** *If the inker height is adjusted with the forcer 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!*

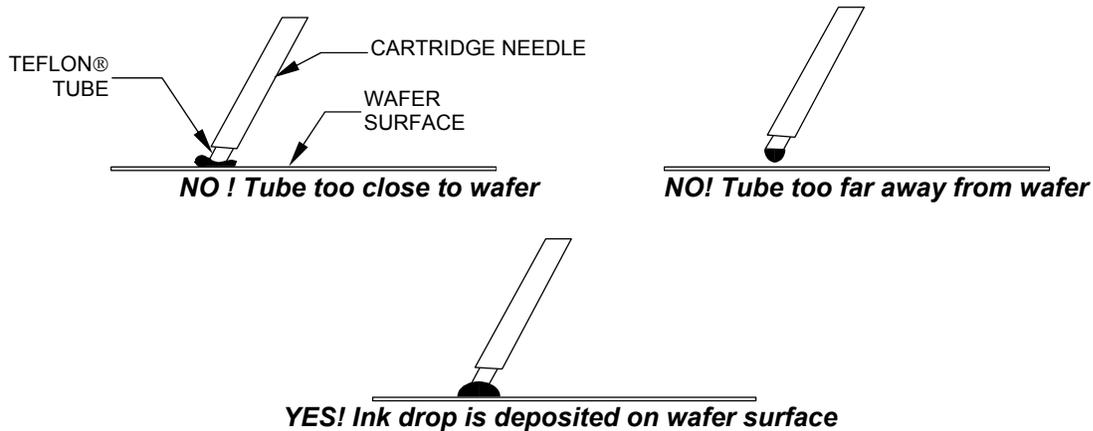
4. Move the top mode switch to "SETUP". The shuttle will extend to its lowest position. Create a droplet of ink at the needle tip by pressing the prober "TEST INKER" button twice.

**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) preventing damage to the valve caused by extended operation. If this happens, move the toggle switch to "RUN" then back to "SETUP" to complete alignment.*

5. 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 to the center of the die.
6. Press the Z DOWN button once per second to lower the shuttle until the ink droplet at the needle tip touches the wafer surface. The Teflon<sup>®</sup> tube will be 1-2 mil from the wafer surface.



***CAUTION:*** *Extreme care should be taken when using the "Z UP" and "Z DOWN" buttons. The buttons should be pressed no faster than one time per second. The switch cannot react to faster use and such use will result in zero movement. Pressing and holding down either of the "Z UP" or "Z DOWN" buttons will cause the motor to "RUN", moving the inker rapidly up or down. The "Z UP" and "Z DOWN" buttons should be used in this manner only when it becomes necessary to quickly move the mechanism up or down a considerable distance (i.e., cartridge replacement).*



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

7. Set the top mode 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. Using the "DOT SIZE" thumbwheels, change the setting until the desired dot size is achieved (see the tables in **Section 7**). If you have problems, refer to "Inker Troubleshooting" in **Section 6 "Maintenance & Troubleshooting"** of this manual. **It is recommended that during initial setup, several rows of dots be placed and inspected for consistency. If skipped dots are detected, lower inker Z height until consistent dots are achieved.**
- Note: Due to the unavoidable incidence of slight manufacturing variations from cartridge to cartridge, additional Z height adjustment of the inker may be necessary after changing cartridges.*
9. If the dots are round and of proper size, basic installation is complete.
  10. If adjustment is required, use the Z UP and Z DOWN buttons on the front of the controller to make the final adjustments until round dots are achieved. Pressing either the Z UP or Z DOWN button results in a movement of approximately 0.0005 inches up or down for each time pressed. The "INK ON" LED will flash each time either button is pressed (only when the unit is not placing dots (inking)).
  11. If the unit fails to operate as specified, please contact Xandex Customer Service for assistance at (707) 763-7799 or toll free in the United States at (800) 767-9543.

**Motorized Z Small Dot Configuration**

When the mode switch on the front of the controller is switched to SMALL DOT, the air supplied to the cartridge valve, (V1) is routed through a second, internal regulator, which reduces the air pressure sent to the cartridge. This regulator is not operator adjustable but may be internally reset to optimize controller small dot performance. See “Controller Internal Regulator Adjustment” in **Section 6 “Maintenance and Troubleshooting”**.

Small dot production with the Motorized Z pneumatic inking system requires use of the A5 cartridge type. Tables are provided in Section 7 that show average dot size results for different ink types in thumbwheel setting increments of 5. These tables indicate average results from testing performed on unetched wafers with no passivation and are intended for use as guidelines only.

All controller functions, UP and DOWN buttons, LED dot counter, programmable dot counter and dot size thumbwheels, SETUP, RUN and DISABLE toggle positions, have the same function in SMALL DOT mode as they do in LARGE DOT mode. For more information or assistance in optimizing small dot production using the Motorized Z small dot feature, contact Xandex Customer Service at (707) 763-7799 or Toll Free in the U.S: (800) 767-9543. FAX (707) 763-2631. Internet [www.xandexsemi.com](http://www.xandexsemi.com) or email [info@xandex.com](mailto:info@xandex.com).

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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.

Xandex 8103, 8104, 7824, 7824T and Markem<sup>®</sup> 6993 inks are opaque and easily recognizable under all lighting conditions. Xandex Glycol Free 8103 ink is thick in viscosity and delivers opaque dots ranging from 6 to 40 mils. Xandex 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. Markem<sup>®</sup> 6990 and 6997 are less opaque and may not offer sufficient contrast under all lighting conditions.

Xandex 8103 ink is certified to contain less than 10 ppm of Sodium (Na) and Chloride (Cl). Xandex 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. Xandex 7824 and 7824T inks are certified by Xandex to contain less than 10 ppm of Na and Cl. Markem<sup>®</sup> 6990 is certified by Markem<sup>®</sup> to contain less than 25 ppm of Na and Cl. Analysis reports are available upon request from Xandex Customer Service.

Although Markem<sup>®</sup> 6993 and 6997 are not contaminant controlled, periodic test data indicates that these inks typically contain less than 100 ppm of Sodium (Na) and 300 ppm of Chloride (Cl). These levels are not certified or guaranteed by Markem or by Xandex<sup>1</sup>.

Xandex Glycol Free 8103 and 8104 inks have a 4 month shelf life, rapidly air dry at ambient conditions and will give consistent flow for 3 days after cartridge opening. Markem<sup>®</sup> 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. Xandex 7824 and Xandex 7824T inks have a 4 month shelf life and will give consistent flow for 3 days after cartridge opening. Xandex 7824 and 7824T can be air or “heat set” cured.

Xandex 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 Markem<sup>®</sup> 6990, 6993 and 6997 or Xandex 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 of the inks offered by Xandex are non-magnetic.

Material Safety Data Sheets (MSDS) are available for all inks offered by Xandex. To obtain MSDS 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 dependant on test method

**Ink Curing**

The procedure for curing will depend on the type of ink used. Markem® 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.

Markem® 6990, 6993, and 6997 inks, which are air-dried, will not smear when touched. They are not permanent, however, and will not withstand most post-probe handling or processes. Conversely, Xandex 7824 and 7824T inks air cure within 2.5 hours (≤20 mil, up to 8 hours for >20 mil dots). Xandex 7824 and 7824T may also be “heat set” at 120°C for 10 minutes.

Xandex 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 ≤25 mil 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. Continuous air flow across the wafer surface will reduce the amount of time required for curing. The following table provides specifics for each type of ink:

INK CURING			
CURE TYPE	TEMPERATURE	CURE TIME	RESULT
<b>Markem® 6990, 6993, and 6997</b>			
Soft Cure	100-150°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>Xandex 7824, 7824T</b>			
Hard Cure	Air dry, ambient conditions	2.5 hours ± 0.25 hrs for ≤20 mil, up to 8 hrs >20 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 110-120°C	5-10 minutes	Ink is permanent and may only be removed with great difficulty
<b>Xandex 8103 and 8104 Glycol Free</b>			
Hard Cure	Air dry, ambient conditions	5-15 minutes for 5-15 mil 15-45 minutes for 15-25 mil 45 min-6 hours for 25-40 mil	Ink is permanent and may only be removed with great difficulty

*Note: Longer drying times are required for larger dot sizes.*

*Note: Markem® is a registered trademark of Markem Corporation, Keene, NH*

### ***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. \*



***CAUTION:*** All procedures should be performed under a laboratory hood, following the 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)

## Section 6. Maintenance & Troubleshooting

This Troubleshooting section for the Motorized Z 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. More troubleshooting information is available in the “Support” section at [www.xandexsemi.com](http://www.xandexsemi.com)

### 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. Markem® 6990, 6993, 6997 inks should be used within 4 months or 5 days of cartridge opening. Xandex 8103 and 8104 air dry glycol free inks should be used within 4 months or 3 days of cartridge opening. Xandex 7824 and Xandex 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.</li> <li>3. Z height adjustment is incorrect. After cartridge replacement, minor Z height adjustment may be required. See <b>Section 4 “Inker Assembly Setup and Alignment.”</b></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
<p>Small, inconsistent or no ink dots.</p>	<ol style="list-style-type: none"> <li>1. Soft Teflon® tip of the cartridge tube is clogged or damaged. Change ink cartridge.</li> <li>2. The dot size setting may be too low. Increase dot size setting.</li> <li>3. Wrong cartridge type. Change cartridge type.</li> <li>4. Air pressure too low. Verify that controller regulator setting is 80 ± 5 PSI.</li> <li>5. Z height adjustment is incorrect. After cartridge replacement, occasional Z height adjustment may be required due to the unavoidable incidence of slight manufacturing variations from cartridge to cartridge. It is recommended that at setup, several rows of dots be placed and inspected for consistency. See <b>Section 4 “Inker Assembly Setup and Alignment.”</b></li> <li>6. Verify that the inker swing arm is all the way down and locked in position.</li> </ol> <p>Shuttle mechanism may be binding. See <b>“Shuttle Maintenance”</b> in this section.</p>

### Inker Troubleshooting

Problem	Solution
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". The cartridge tip should be 1-2 mil from the wafer surface. Adjust Z height per <b>"Inker Assembly Setup and Alignment"</b> in <b>Section 4 "System Operation"</b> of this manual.</li> <li>2. SETUP mode switch was not used when inker was initially aligned. See <b>"Inker Assembly Setup and Alignment"</b> in <b>Section 4</b>.</li> </ol>
Unit functions normally, no dots, no shuttle movement.	<ol style="list-style-type: none"> <li>1. Verify that the Controller-to-Shuttle air hose connector is plugged into the controller.</li> <li>2. Verify that the Controller-to-shuttle air hose is not kinked, clogged or pinched closed.</li> <li>3. Check Main Air pressure setting (verify <math>80 \pm 5</math> PSI air input).</li> </ol>
Unit functions normally, shuttle moves, no dots.	<ol style="list-style-type: none"> <li>1. Check air hose to top of cartridge to be sure it is connected and not clogged, kinked or pinched.</li> <li>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>3. Check the Teflon® tip of cartridge tube to confirm that it is not clogged or damaged.</li> <li>4. Verify rubber washer on cartridge air hose connector is installed.</li> </ol>

Problem	Solution
Motorized Z not working.	<ol style="list-style-type: none"> <li>1. Verify that the inker stepper motor is plugged into the "MOTOR" connection on the back of the Controller.</li> <li>2. Verify that there is power connected to the controller and that the voltage setting is correct.</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.</li> <li>◆ BLUE AIR HOSE connects to the shuttle connection on the shuttle mechanism.</li> </ul> </li> </ol>
Cartridge crashes into wafer surface after setup.	<ol style="list-style-type: none"> <li>1. Controller SETUP mode (switch), which extends the cartridge to inking depth, was not used when the inker was initially setup. Replace cartridge and repeat inker setup per <b>"Inker Assembly Setup and Alignment"</b> in <b>Section 4</b>.</li> <li>2. Chuck was not set to "Z up" position when the inker was initially setup. Replace cartridge and repeat inker setup per <b>"Inker Assembly Setup and Alignment"</b> in <b>Section 4</b>.</li> </ol>

## Shuttle Maintenance

### Schedule and Preventive Maintenance Kits

Periodic preventive maintenance of the shuttle mechanism is recommended to insure 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

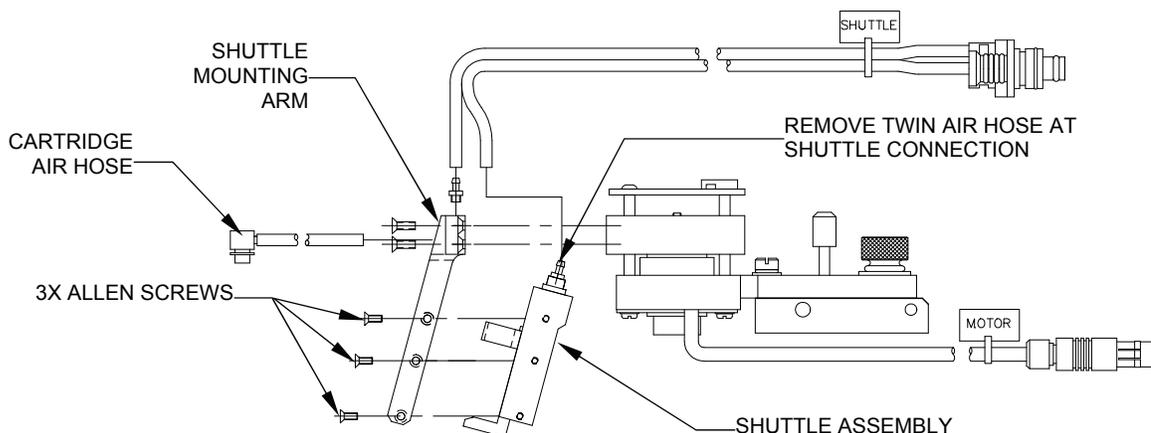
Shuttle preventive maintenance kits are available, which include all parts necessary for one normal shuttle maintenance procedure. These kits may be ordered direct from Xandex or through your local Xandex distributor. All Motorized Z model inkers require kit number 370-0001.

### Maintenance Procedure

The following describes the procedure for disassembly and reassembly of the Pneumatic Shuttle for maintenance purposes. Reference Drawing 320-4215 and 216-0005 on the Drawings CD included with this manual for part identification and associated part numbers.

#### Shuttle Removal (Reference Drawing 320-4215)

1. Remove the ink cartridge from the inker and remove the inker from the prober, retaining all mounting screws and hardware (if necessary see **Section 4 “Changing the Cartridge”** and **Section 3 “Installation”**).
2. Disconnect the *twin pneumatic hose* at the shuttle connection (grasp, do not crush the hose, with needle nose pliers over the fitting point and pull gently to disconnect, being careful not to damage hose).
3. Remove the *three Allen screws* (Item 9) securing the *shuttle assembly* (Item 6) to the *shuttle mounting arm* (Item 1) and remove the shuttle for maintenance.



**Shuttle Disassembly (Reference Drawing 216-0005)**

1. Loosen the two *Allen Screws* (Item 6) at the top corners of the *bracket* (Item 1), then unscrew the *cylinder/adapter* assembly (Items, 3, 4 & 9) from the *bracket* (Item 1) and remove it from the *bracket* (Item 1).
2. Carefully lift and remove the *pneumatic holder* (Item 2) from the *bracket* (Item 1), paying close attention to the *spring* (Item 8) located in the bottom of the *pneumatic holder* (Item 2).

**Shuttle Inspection and Cleaning**

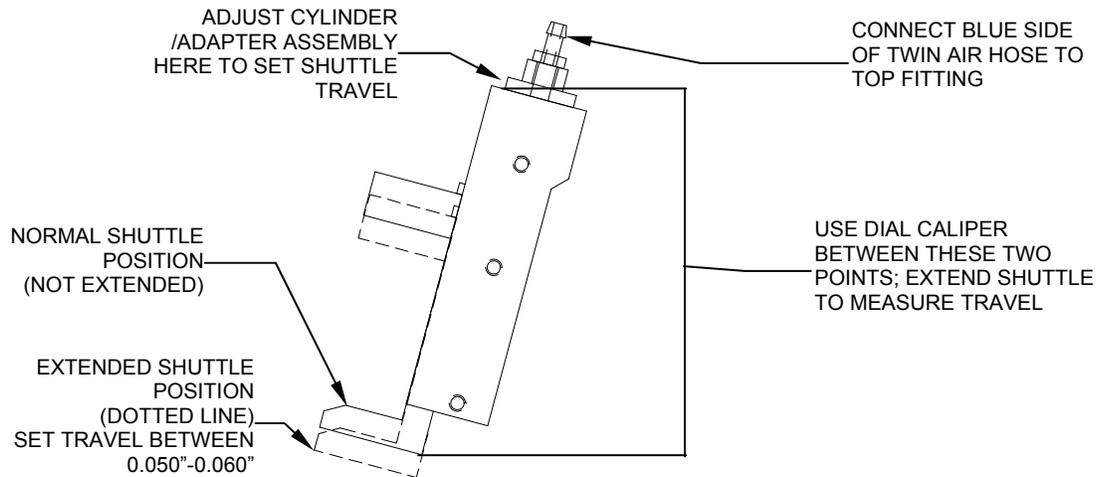
With the Shuttle removed and disassembled, perform the following checks to verify condition/operation.

1. Clean both the *pneumatic holder* (Item 2) and *bracket* (Item 1) with Isopropyl Alcohol and a clean lint free cloth. Inspect the *pneumatic holder* (Item 2) and *bracket* (Item 1) for wear or physical deformation. Replace as necessary.
2. Inspect the cylinder/adapter assembly (Items, 3, 4 & 9). Apply/remove 40-80 PSI to the cylinder/adapter (Items, 3, 4 & 9) and verify operation. The cylinder should extend/retract as the air signal is applied/removed. If problems are noted in operation (air leak, cylinder sticking, etc.) replace the cylinder assembly.
3. Inspect the spring (Item 8) for fatigue or physical deformation. Free length of the spring is 0.250" nominal. Replace as needed.
4. Remove the Allen screws (Item 6) that lock the cylinder/adapter (Items, 3, 4 & 9) in place from the bracket (Item 1). Replace with new screws.
5. Inspect the cartridge fitting (Item 4 on 320-4215) and the red cartridge air hose (Item 14 on 320-4215) for ink contamination. Clean fitting as necessary and replace the washer (Item 12 on 320-4215), on the cartridge fitting (Item 4). Replace the hose if necessary.
6. Inspect the spring clip (Item 7). Remove and replace the spring clip (Item 7) if it is bent or deformed.

**Shuttle Re-Assembly**

1. Apply a light coating of lubrication (Item 12, Magnalube-G P/N 520-0208, supplied with maintenance kit) to the *pneumatic holder* (Item 2) and *bracket* (Item 1), as detailed in Note 2 on Drawing 216-0005.
2. Install the *spring* (Item 8) in the bottom of the *pneumatic holder* (Item 2), then carefully install the *pneumatic holder* (Item 2) in the *bracket* (Item 1). Verify that the *spring* (Item 8) is in the proper position and the *pneumatic holder* (Item 2) moves freely in the *bracket* (Item 1).

3. Install the *cylinder/adaptor assembly* (Items 3,4 & 9) into the *bracket* (Item 1). Using a Dial Caliper, measure the stroke of the *holder* (Item 2) from normal to extended position. Adjust the *cylinder/adaptor assembly* (Items 3, 4 & 9) until the *holder* (Item 2) stroke is between 0.050" and 0.060".

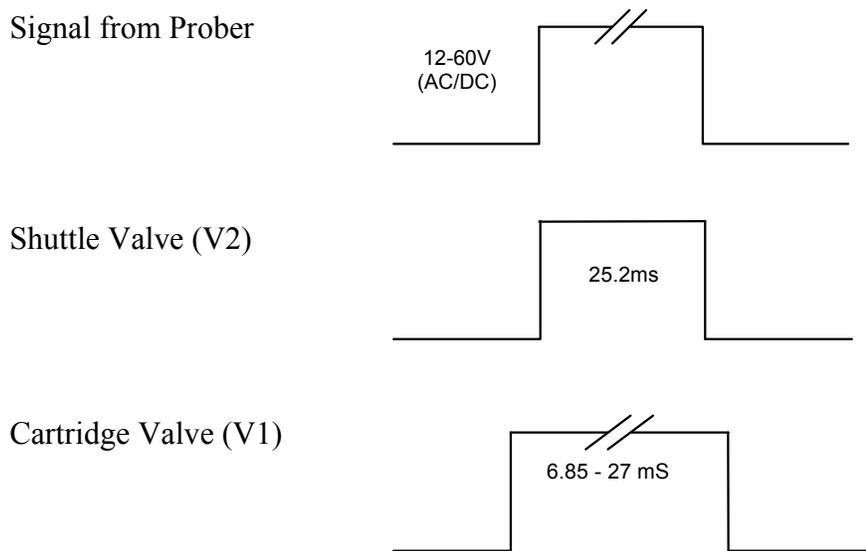


4. Tighten the two *Allen screws* (Item 6) in the *bracket* to lock down the *cylinder/adaptor assembly*. Apply 40-80 PSI air signal to the pneumatic connection on *shuttle assembly* and verify operation of *shuttle*.
5. Re-install the *shuttle assembly* on the *shuttle mounting arm* using the three *Allen screws* previously removed. Apply a dab of threadlocker Loctite to the screws before installation.
6. Reconnect the *twin pneumatic air hose*, install a cartridge and test to verify operation. The red side of the twin air hose connects to the cartridge fitting on the shuttle mounting arm. The blue side connects to the top fitting on the shuttle.

**Controller Maintenance****Controller Sequence of Operation**

To initiate an ink dot, the Prober sends a 12-60 V (AC/DC unregulated) active-low 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 25.2 ms pulse is sent to the Shuttle Valve (V2), while at the same time a 6.85-27 ms 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 (6.7-13ms) is sent to the cartridge to displace a small amount of ink back into the Teflon<sup>®</sup> tube to aid in maintaining proper dot size after a long delay between dots.

### **Controller Diagnostics**

There are four 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. All references to “mode switch” in the following tests refer to the top mode (toggle) switch. The bottom mode switch should be set to RUN during testing.

#### ***A. Test Thumbwheels***

1. Place the mode switch on the front panel to SETUP, set the DOTS X1000 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 Cartridge Valve***

To test fire the Cartridge Valve 20 times:

1. Set the DOT SIZE thumbwheels to 02
2. Place the mode switch to DISABLE
3. Reset the LCD Counter
4. Press RESET.

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

#### ***C. Test Shuttle Valve***

To test fire the Shuttle Valve 20 times:

1. Set the DOT SIZE thumbwheels to 03
2. Place the mode switch to DISABLE
3. Reset the LCD Counter
4. Press RESET.

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

***D. Test Pressure Valve***

To test fire the Pressure Valve 20 times:

1. Set the DOT SIZE thumbwheels to 09
2. Place the mode switch to DISABLE
3. Reset the LCD Counter
4. Press RESET.

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

***E. Alarm Test***

Pressing the reset button will toggle the state of the alarm signal. This signal controls the red STATUS LED and the LOUD audio alarm.

1. Set the DOT SIZE thumbwheels to 06
2. Place the mode switch to DISABLE
3. Press RESET to change the state of the alarm.

The alarm alternately is on and off.

***F. Life Test***

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

1. Set the DOT SIZE thumbwheels to 10
2. Place the mode switch to DISABLE
3. Set the DOTS X1000 thumbwheels for the desired number of cycles X1000 (i.e.: 250 Equals 250,000 cycles). If the thumbwheel count is zero, the valves cycle 6,553,600 times.
4. Reset the LCD Counter.
5. Press RESET.

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

**Controller Troubleshooting**

Problem	Solution
<p>The Unit is plugged in but the “Power” LED is off.</p>	<p>Make sure that the outlet has power. The requirement is 100/120/220/240 volts. Check controller fuse to be sure it is still good. See <b>Section 3 “Fuse Replacement.”</b></p>
<p>Unit powers up okay but will not respond to prober signal.</p>	<ol style="list-style-type: none"> <li>1. Verify input cable is plugged into the prober input on the Controller.</li> <li>2. Verify input cable is plugged into inker jack on prober.</li> <li>3. Check continuity of cable. Replace /repair if defective.</li> <li>4. Perform system diagnostics checks to verify Controller operation. See <b>Section 6 “Controller Diagnostics.”</b></li> </ol>
<p>Unit powers up okay, responds to prober input but the shuttle does not move.</p>	<ol style="list-style-type: none"> <li>1. Check that shuttle toggle switches on the front of the controller are in the RUN position.</li> <li>2. Check that the air hose "quick disconnects" on the back of the controller are correctly oriented and connected.</li> <li>3. Place top mode switch to SETUP. The shuttle should extend. If it does not, and all air hose connections are correct, the problem may be that the shuttle mechanism is binding. See <b>“Shuttle Maintenance”</b> in this section (6)</li> </ol>

Problem	Solution
"STATUS" & "INK ON" LED's Flashing	<ol style="list-style-type: none"><li>1. Verify that there is air input to the controller.</li><li>2. Unacceptable mode switch combination. Review "<b>Controller Operation</b>" in Section 4.</li></ol>
Dot size does not change with adjustment of Dot Size Thumbwheels	<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.</li><li>◆ BLUE AIR HOSE connects to the shuttle connection on the shuttle mechanism.</li></ul></li><li>2. Run diagnostic test "A." Test Thumbwheels described in "<b>Controller Diagnostics</b>" in this section (6). If test results are not within parameters, consult Xandex Customer Service.</li><li>3. Replace ink cartridge.</li></ol>

**Internal Maintenance****Controller Logic Board Removal**

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

*Note:* Making any modifications to the controller circuitry or components other than Xandex recommended maintenance procedures might void your controller warranty. These instructions are provided for replacement of the microcontroller for upgrade purposes and to enable/disable the audible alarm only.

**With Power and Main Air removed:**

1. Remove the cover of the Controller.
2. Disconnect the *Molex connectors* from J2 through J7 on the **top** of the *controller logic board*. (See controller drawing 350-0018 on the Drawings CD included with this manual)
3. Push back both locking devices on the card guides to unlock position, then lift the *logic board* from the mounting location.
4. Disconnect the *connector* from J1 on the face of the *logic board* and remove the board from the *controller*.
5. Place the *logic board* on an ESD protective surface or store in ESD protective anti-static bag.

Reverse this procedure for installation of *logic board*.

**Turn Audible Alarm ON/OFF**

Motor-Z controller units (P/N 350-0018) with serial numbers higher than 3000 are equipped with an audible alarm feature. When enabled, an audio alarm will sound (in addition to the INK ON LED illuminating) when the programmed number of dots set point is reached. The Motor-Z controller is shipped with the audio alarm feature enabled.

**With the logic board removed:**

1. Locate JP7 on the 250-1219 daughter card mounted on the 250-1166 printed circuit board. In the default factory condition, JP7 is populated with a jumper on pin 1 and pin 2. This is the default audio alarm enabled condition.
2. To disable the audio alarm remove the jumper from pin 1 and 2 on JP7 and install the jumper onto pin 1 only. This is the audio disabled condition.

3. After enabling/disabling the alarm, re-install the *logic board* by reversing the procedure outlined in the “Controller Logic Board Removal” above.

**Before returning the unit 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 insure installation is correct, none of the component leads are bent, and verify connection of J1 through J7 connectors on the *logic board*.

### Preventive Maintenance

#### Pneumatic Controller Preventive Maintenance Schedule and Kits

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

Xandex Auto Z and Motorized Z controllers contain a third valve (V3) that is identical to the Shuttle and Cartridge valves. The Auto Z controller uses this valve only when the Auto Z function is engaged. 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 either the Auto Z or 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 / Small Dot Use = 6 months All other applications = 12 months
All Models	Cartridge Valve, Shuttle Valve and internal tubing	Every 24 months

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

- Cartridge Valve Set, containing a single valve assembly, electrical connectors and replacement instructions. This set is used for 6/12 month cycle controller preventive maintenance. Order part number 370-0100.
- Dual Valve Set containing two valve assemblies, electrical connectors, adequate tubing to replace all internal controller pneumatic routes in all Xandex pneumatic controllers and replacement instructions. Replacement of the polyurethane tubing is recommended as the internal operating temperature within the controller enclosure can cause the tubing to shrink slightly over time. This can result in leaking connections at the valve and coupling connections. This set is used for 24 month controller preventive maintenance. Order part number 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 [info@xandex.com](mailto:info@xandex.com) or order online at [www.xandexsemi.com](http://www.xandexsemi.com).

### Cartridge (V1) or Shuttle (V2) and Pressure (V3) Valve Replacement

 *This procedure is to be used for replacement of all three valves, as they are identical.*

**Note:** *Controller units manufactured before June, 1999 used a soldered wire splice covered by heat shrink tubing for valve electrical connections, instead of the snap plug connectors used in the current build. The replacement valve assembly P/N 240-0261 is shipped with post-end snap plug connectors. To order crimp on receptacle connectors to retrofit an older controller unit, contact Xandex Customer Service and order snap on receptacle connector P/N 519-0031*

#### 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 and two stand-off's (504-1404) securing the valve to the Controller base and remove the valve.

#### Installation:

1. Remove appropriate fittings from old valve and install on new valve assembly using Teflon thread sealant tape (not supplied).
2. Install the replacement valve assembly (P/N 240-0261) 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.
7. Re-install the controller cover.

### Controller Internal Regulator Adjustment

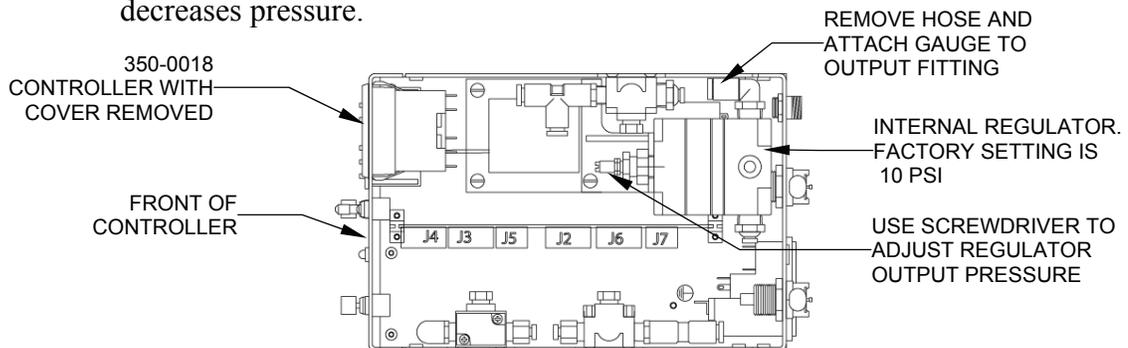
The internal regulator steps down the air pressure to the Pressure Valve (V3) that feeds the Cartridge Valve when the unit is in small dot mode. The regulator is factory set at 10 psi and should only be adjusted after all other options have failed to provide adequate small dot performance or when non standard installation (i.e., a controller-to-shuttle air hose length exceeding 60" for example) is required.

The procedure for adjusting the internal regulator is detailed below. It is recommended that only qualified maintenance personnel perform this procedure.



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

1. Disconnect the controller from main air and power supply.
2. Remove the two screws located on each of the left and right sides of the controller (four total) and remove the controller cover.
3. Reference drawing 350-0018 and the figure below and locate the internal regulator (item 40).
4. Carefully remove the hose from the output side of the regulator and attach a graduated pressure gauge to the output fitting.
5. Reconnect main air and adjust internal regulator pressure by using a screwdriver at the indicated adjustment point. Factory default setting is  $10 \pm 1$  psi. Clockwise adjustment of the screw increases pressure, counter-clockwise decreases pressure.



6. When regulator adjustment is complete, first disconnect controller main air supply and then remove the gauge from the regulator. Reconnect the regulator to the internal air hose and reconnect main air and power.
7. Verify controller operation and replace the controller cover.

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# Section 7. System Specifications

## Controller Specifications

<b>Size</b>	10.5" x 6.25" x 4.25" (267mm x 159mm x 108mm)										
<b>Weight</b>	8.0 lbs (3.7 kg)										
<b>Input Power Requirement</b>	100/120/220/240 volts AC @ 50/60 hz (approx. 30W)										
<b>Foot Switch Input</b>	Contact Closure >50 msec										
<b>Air Consumption</b>	80 PSI ±5 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 (Dot Size 6.85 - 27 mS) Shuttle Air Feed - Fixed @ 25.2 ms										
<b>Control Circuits</b>	Atmel Corporation ATMEGA325-16AU Microprocessor										
<b>Counters</b>	Six Digit with External Reset (Independent of Microprocessor)										
<b>External Regulator/Filter</b>	5.0 micron Air Filtration										
<b>Prober Input:</b>	12 - 59 volts @ minimum 30 ms pulse width. The input circuit presents approximately 1 K $\Omega$ - 700 $\Omega$ input resistance. Typical current as a function of input voltage is listed in the following table:										
	<table> <tr> <td>10 V</td> <td>10 mA</td> </tr> <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>59 V</td> <td>85 mA (Maximum input)</td> </tr> </table>	10 V	10 mA	15 V	25 mA	20 V	45 mA	40 V	65 mA	59 V	85 mA (Maximum input)
10 V	10 mA										
15 V	25 mA										
20 V	45 mA										
40 V	65 mA										
59 V	85 mA (Maximum input)										

### Environmental Range:

- Indoor use
- Altitude up to 4,000 m
- Temperature range 5° C to 40° C
- Maximum relative humidity 80 % for temperatures up to 31°C decreasing linearly to 50 % relative humidity at 40 °C
- Mains supply voltage fluctuations not to exceed ±10 % of the nominal values
- Transient overvoltages according to INSTALLATION CATEGORY II
- POLLUTION DEGREE 2



On our sole responsibility we declare this product is in conformity to the following EU directives;

- EMC Directive 89 / 336 / EEC
- Low Voltage Directive 73 / 23 / EEC

Standards to which conformity is declared:

EN50081-2, EN50082-2, EN61010-1

**Inker Specifications**

<b>Ink Cartridge Model</b>	DM-2
<b>Ink Cartridge Type</b>	A5, A6, A8
<b>Available Inks</b>	Standard Xandex Inks
<b>Dot Sizes</b>	Dot sizes ( $\pm 10\%$ ) consistent for speeds of 10 dots/second to 1 dot/2 minutes.
<b>Dot Size Range</b>	6 mil to 50 mil (with currently available inks)
<b>Shuttle Stroke Length</b>	0.050"- 0.060" factory set, user adjustable
<b>Z Adjustment Resolution</b>	0.0005" motorized adjustment
<b>Z Adjustment Range</b>	$\pm 0.18$ " motorized adjustment
<b>X Adjustment Range</b>	$\pm 0.093$ " manual joystick
<b>Y Adjustment Range</b>	$\pm 0.125$ " manual joystick

**Stepper Motor Specifications / Part No.158-0010**

Operating Voltage:	12 VDC
Resistance Per Phase:	118 $\Omega$
Insulation Resistance:	20 M $\Omega$
Power Consumption:	2.4 Watts
Nominal Force at 100 PPS:	26 oz. minimum
Linear Travel Per Step:	0.001"
Direction of Travel:	Bidirectional
Bearings:	Ball Thrust
Weight:	1.0 oz.
Operating Temperature:	-40° C to +65° C
Storage Temperature:	-40° C to +100° C
Maximum Travel:	1.875"

**Ink Cartridge Specifications**

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

**Ink and 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-1.25			DM-S	
	DM-2			DM-2.3			DM-1						10 mil	15 mil	25 mil	10 mil	15 mil
Markem Inks	A5	A6	A8	A5	A6	A8	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,F	+	+	+	+	+	+	+	+	+	+
6990 Red	0	0	0	0	0	0	T	0	0	0	0	0	0	0	0	0	0
6993 Black	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6993 Green	+	+	+	+	0	0	T,F	+	+	+	+	0	+	+	+	+	+
6993 Red	+	+	+	+	0	0	T,F	+	+	+	+	+	+	+	+	+	+
6997 Black	+	+	+	+	+	+	T,F	+	+	+	+	+	+	+	+	+	+
6997 Red	+	+	+	+	+	+	T	+	+	+	+	+	+	+	+	+	+
Empty (no ink)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xandex Inks																	
7824 Black	+	+	+	+	+	+	T,F	+	+	+	+	+	0	+	+	0	0
7824T Black	+	+	+	+	+	+	T	+	+	+	+	+	0	0	+	0	0
8103 Black	+	+	+	+	+	+	T	+	+	+	+	+	0	0	0	0	0
8103 Red	+	+	+	+	+	0	T	+	+	+	+	+	0	0	0	0	0
8103 White	+	+	+	+	+	+	T	+	+	+	+	+	0	0	0	0	+
8104 Black	+	+	+	+	+	+	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.

**Inker 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 Ink Cartridges:**

- ◆ Markem® 6990, 6993, 6997 = Four (4) months. Five (5) days after cartridge opening
- ◆ Xandex 8103 and 8104 = Four (4) months. Three (3) days after cartridge opening.
- ◆ Xandex 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

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**Dot Size: Standard Mode in Mils**

INK TYPE: 8103			
Large Dot Toggle			
DOT SIZE SETTING	DOT SIZE		
	A5	A6	A8
05	12	15	26
10	14	18	29
15	16	19	32
20	17	20	33
25	17	21	34
30	18	22	35
35	19	23	36
40	19	24	36
45	20	25	37
50	20	26	37
55	21	27	38
60	21	28	38
65	22	28	39
70	22	29	39
75	23	29	40
80	24	29	40
85	24	30	41
90	25	30	41
95	25	31	42

INK TYPE: 7824			
Large Dot Toggle			
DOT SIZE SETTING	DOT SIZE		
	A5	A6	A8
05	17	22	31
10	20	23	36
15	23	29	38
20	25	30	43
25	26	31	45
30	27	32	45
35	27	32	46
40	27	33	47
45	28	33	48
50	28	33	49
55	29	36	51
60	30	37	53
65	31	37	54
70	31	37	54
75	32	37	55
80	32	37	55
85	33	38	56
90	33	38	56
95	33	39	57

INK TYPE: 6993			
Large Dot Toggle			
DOT SIZE SETTING	DOT SIZE		
	A5	A6	A8
05	16	18	29
10	18	20	31
15	20	23	37
20	23	26	41
25	25	29	44
30	25	29	45
35	26	30	46
40	26	30	46
45	27	31	47
50	27	31	47
55	28	32	48
60	28	32	48
65	29	33	49
70	29	33	50
75	30	34	51
80	30	34	52
85	31	34	53
90	31	35	53
95	32	35	54

INK TYPE: 6990			
Large Dot Toggle			
DOT SIZE SETTING	DOT SIZE		
	A5	A6	A8
05	16	18	29
10	18	20	31
15	20	23	37
20	23	26	41
25	25	29	44
30	25	29	45
35	26	30	46
40	26	30	46
45	27	31	47
50	27	31	47
55	28	32	48
60	28	32	48
65	29	33	49
70	29	33	50
75	30	34	51
80	30	34	52
85	31	34	53
90	31	35	53
95	32	35	54

NOTE: Characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation). Air pressure 80 PSI minimum with standard 60 inch long air hose (Controller to Shuttle). Dot size may be set at any value between 1 and 99. Table dot size settings and resulting dot sizes are given in increments of 5. When a range of thumbwheel settings indicate the same dot size, choosing a thumbwheel setting in the middle of the range will provide the most consistent dot size.

**Dot Size: Standard Mode in Microns**

INK TYPE: 8103			
Large Dot Toggle			
DOT SIZE	DOT SIZE		
SETTING	A5	A6	A8
05	304.8	381	660.4
10	355.6	457.2	736.6
15	406.4	482.6	812.8
20	431.8	508	838.2
25	431.8	533.4	863.6
30	457.2	558.8	889
35	482.6	584.2	914.4
40	482.6	609.6	914.4
45	508	635	939.8
50	508	660.4	939.8
55	533.4	685.8	965.2
60	533.4	711.2	965.2
65	558.8	711.2	990.6
70	558.8	736.6	990.6
75	584.2	736.6	1016
80	609.6	736.6	1016
85	609.6	762	1041.4
90	635	762	1041.4
95	635	787.4	1066.8

INK TYPE: 7824			
Large Dot Toggle			
DOT SIZE	DOT SIZE		
SETTING	A5	A6	A8
05	431.8	558.8	787.4
10	508	584.2	914.4
15	584.2	736.6	965.2
20	635	762	1092.2
25	660.4	787.4	1143
30	685.8	812.8	1143
35	685.8	812.8	1168.4
40	685.8	838.2	1193.8
45	711.2	838.2	1219.2
50	711.2	838.2	1244.6
55	736.6	914.4	1295.4
60	762	939.8	1346.2
65	787.4	939.8	1371.6
70	787.4	939.8	1371.6
75	812.8	939.8	1397
80	812.8	939.8	1397
85	838.2	965.2	1422.4
90	838.2	965.2	1422.4
95	838.2	990.6	1447.8

INK TYPE: 6993			
Large Dot Toggle			
DOT SIZE	DOT SIZE		
SETTING	A5	A6	A8
05	406.4	457.2	736.6
10	457.2	508	787.4
15	508	584.2	939.8
20	584.2	660.4	1041.4
25	635	736.6	1117.6
30	635	736.6	1143
35	660.4	762	1168.4
40	660.4	762	1168.4
45	685.8	787.4	1193.8
50	685.8	787.4	1193.8
55	711.2	812.8	1219.2
60	711.2	812.8	1219.2
65	736.6	838.2	1244.6
70	736.6	838.2	1270
75	762	863.6	1295.4
80	762	863.6	1320.8
85	787.4	863.6	1346.2
90	787.4	889	1346.2
95	812.8	889	1371.6

INK TYPE: 6990			
Large Dot Toggle			
DOT SIZE	DOT SIZE		
SETTING	A5	A6	A8
05	406.4	457.2	736.6
10	457.2	508	787.4
15	508	584.2	939.8
20	584.2	660.4	1041.4
25	635	736.6	1117.6
30	635	736.6	1143
35	660.4	762	1168.4
40	660.4	762	1168.4
45	685.8	787.4	1193.8
50	685.8	787.4	1193.8
55	711.2	812.8	1219.2
60	711.2	812.8	1219.2
65	736.6	838.2	1244.6
70	736.6	838.2	1270
75	762	863.6	1295.4
80	762	863.6	1320.8
85	787.4	863.6	1346.2
90	787.4	889	1346.2
95	812.8	889	1371.6

NOTE: Characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation). Air pressure 80 PSI minimum with standard 60 inch long air hose (Controller to Shuttle). Dot size may be set at any value between 1 and 99. Table dot size settings and resulting dot sizes are given in increments of 5. When a range of thumbwheel settings indicate the same dot size, choosing a thumbwheel setting in the middle of the range will provide the most consistent dot size.

**Dot Size: Small Dot Mode in Mils**

INK TYPE: 8103	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	6
10	7
15	7
20	7
25	8
30	8
35	8
40	8
45	9
50	9
55	9
60	9
65	9
70	10
75	10
80	10
85	10
90	10
95	10

INK TYPE: 7824	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	Not Recommended
10	8
15	9
20	9
25	10
30	10
35	11
40	11
45	12
50	12
55	13
60	13
65	14
70	14
75	14
80	14
85	15
90	15
95	15

INK TYPE: 6993	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	8
10	9
15	10
20	10
25	10
30	11
35	11
40	11
45	11
50	11
55	13
60	13
65	13
70	13
75	13
80	13
85	14
90	14
95	14

INK TYPE: 6990	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	8
10	9
15	10
20	10
25	10
30	11
35	11
40	11
45	11
50	11
55	13
60	13
65	13
70	13
75	13
80	13
85	14
90	14
95	14

NOTE: Characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation). Air pressure 80 PSI minimum with standard 60 inch long air hose (Controller to Shuttle). Dot size may be set at any value between 1 and 99. Table dot size settings and resulting dot sizes are given in increments of 5. When a range of thumbwheel settings indicate the same dot size, choosing a thumbwheel setting in the middle of the range will provide the most consistent dot size.

**Dot Size: Small Dot Mode in Microns**

INK TYPE: 8103	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	152.4
10	177.8
15	177.8
20	177.8
25	203.2
30	203.2
35	203.2
40	203.2
45	228.6
50	228.6
55	228.6
60	228.6
65	228.6
70	254
75	254
80	254
85	254
90	254
95	254

INK TYPE: 7824	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	Not Recommended
10	203.2
15	228.6
20	228.6
25	254
30	254
35	279.4
40	279.4
45	304.8
50	304.8
55	330.2
60	330.2
65	355.6
70	355.6
75	355.6
80	355.6
85	381
90	381
95	381

INK TYPE: 6990	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	203.2
10	228.6
15	254
20	254
25	254
30	279.4
35	279.4
40	279.4
45	279.4
50	279.4
55	330.2
60	330.2
65	330.2
70	330.2
75	330.2
80	330.2
85	355.6
90	355.6
95	355.6

INK TYPE: 6993	
Small Dot Toggle	
DOT SIZE SETTING	DOT SIZE A5
05	203.2
10	228.6
15	254
20	254
25	254
30	279.4
35	279.4
40	279.4
45	279.4
50	279.4
55	330.2
60	330.2
65	330.2
70	330.2
75	330.2
80	330.2
85	355.6
90	355.6
95	355.6

NOTE: Characterization testing performed at ambient temperature of 70° degrees F, relative humidity of 50% on polished, unetched silicon wafers (no passivation). Air pressure 80 PSI minimum with standard 60 inch long air hose (Controller to Shuttle). Dot size may be set at any value between 1 and 99. Table dot size settings and resulting dot sizes are given in increments of 5. When a range of thumbwheel settings indicate the same dot size, choosing a thumbwheel setting in the middle of the range will provide the most consistent dot size.

**System Drawings**

The drawings in the list below are available in Adobe PDF format on the CD included with this manual.

<b>Description</b>	<b>Drawing Number</b>
X4115 Motorized Z Pneumatic Inker Kit (EG)	340-4115
X4116 Motorized Z Pneumatic Inker Kit (EG)	340-4116
X4215 Motorized Z Pneumatic Inker Kit (KLA)	340-4215
X4217 Motorized Z Pneumatic Inker Kit (KLA)	340-4217
Harness, Pneumatic Controller, Motor Z	240-0408
X4115/X4116 Motorized Z Pneumatic Inker Kit (EG) Dimensions	900-0202
X4215/X4217 Motorized Z Pneumatic Inker Kit (KLA) Dimensions	900-0203
Pneumatic Controller Assy	350-0018
Controller Logic Board PC Assy	250-1166
Schematic, Logic Board	950-1166
PCA, Pneumatic Controller, Daughter Card 2	250-1219
Schematic, Daughter Card	950-1219
Inker Assembly, Motorized Z Pneumatic	320-4215
Inker Base Assembly, 4000 Series	220-0031
Pneumatic Shuttle, Overhead	216-0005

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