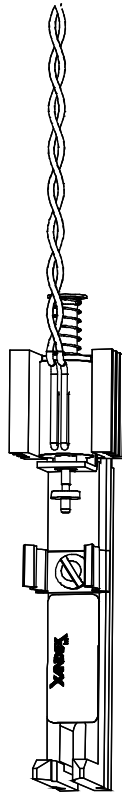




Electric Inker Operation

820-0325 Revision D
January, 2024



Typical DieMark DM-1 Electric Cartridge Holder

SERVICE AND SUPPORT INFORMATION



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TABLE OF CONTENTS

SERVICE AND SUPPORT INFORMATION.....	2
DieMark Cartridge Holder Assembly	5
Assembly Components	6
Wire Color Code	6
Popular Connector Options.....	7
Coil Screw Reference	11
Plunger Stop Bracket Assembly	12
Easy Setup Instructions.....	12
Electric Inker Operation.....	13
Inker Actuation	13
Inker Drive Verification.....	14
NEW Electric Inker Controller	15
Inker Assemblies.....	17
Electric Inker Assemblies	17
Model EG101	18
Model EG301	19
Model EG601	20
Model EG601	21
Inker/Cartridge Troubleshooting	23
Ink Cartridge Troubleshooting.....	23
Electric Inker Troubleshooting	25
DieMark Limited Warranty	26

TABLE OF FIGURES

Figure 1. DieMark Cartridge Holder Assembly	5
Figure 2. Exploded View of Cartridge Holder Assembly.....	6
Figure 3. 12VDC Coil wire color changed from black to blue.....	9
Figure 4. 24VDC Coil wire color changed from white to yellow	10
Figure 5. Plunger Stop Assembly	12
Figure 6. Electric Inker Controller.....	15
Figure 7. EG101 Inker Assembly	18
Figure 8. B101 Inker Base	18
Figure 9. EG301 Inker Assembly	19
Figure 10. B301 Inker Base and Mounting Plate.....	19
Figure 11. EG601 Inker Assembly	20
Figure 12. EG601 Swing Arm	21

DieMark Cartridge Holder Assembly

Xandex manufactures multiple DieMark cartridge holder assemblies that have been designed for specific applications or for use with specific wafer probing equipment.

All holder assemblies have similar design components that are adapted and modified to produce different configurations and models. One of the most common configuration changes is the electrical connector that connects to the electrical signal source (a wafer prober or other wafer inking equipment) that provides the voltage signal that actuates the cartridge holder's solenoid in order to place an ink dot.

Figure 1 shows a typical example of a DieMark holder assembly with component parts labeled. An exploded view, illustrating component assembly is shown in **Figure 2**.

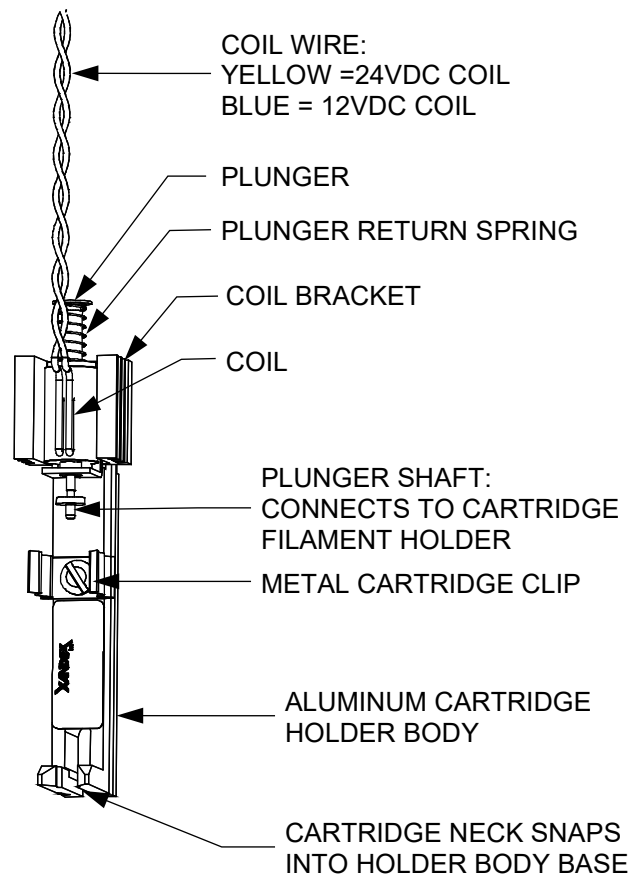


Figure 1. DieMark Cartridge Holder Assembly

Assembly Components

Figure 2 illustrates an exploded view of basic holder components. The plunger, spring, coil and plunger washer, when assembled, are referred to as an actuator.

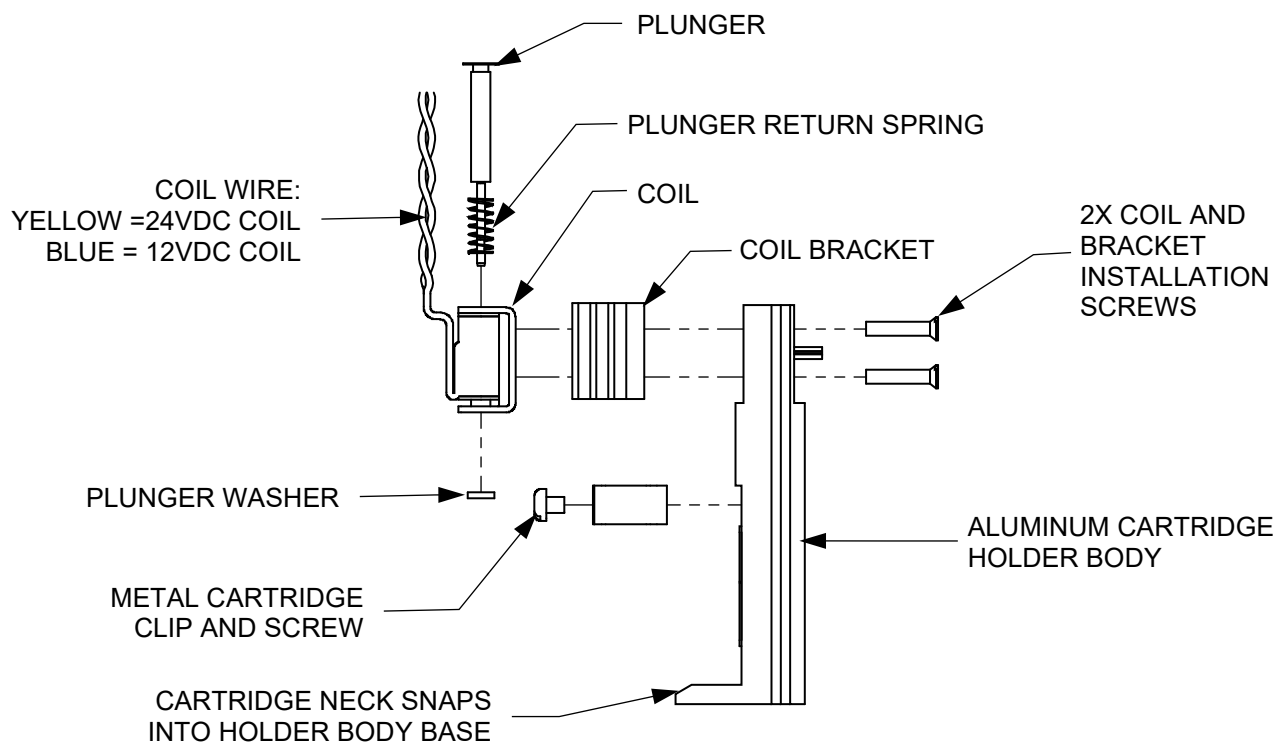


Figure 2. Exploded View of Cartridge Holder Assembly

Wire Color Code

Xandex has two main "open frame" actuator types that are classified as 12VDC and 24VDC. These two "open frame" actuator types consist of a coil and frame with lead wires, plunger, spring and washer.

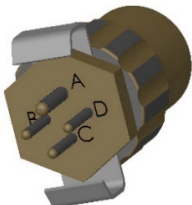

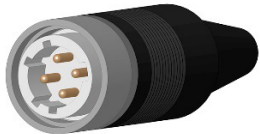

The two main actuator types can be further expanded with the addition of a variety of connector options to match your equipment's inking signal output terminal. See a table with illustrations of the most common electrical termination options in **Table 1**.

Prior to 2019, Xandex purchased actuator coils from a third-party manufacturer. Beginning in 2019, Xandex began shipping actuators with coils manufactured by Xandex. Wire color coding was changed at this time to differentiate between the third-party and internally manufactured coils. See **Figure 3** and **Figure 4**.

Popular Connector Options

Table 1 lists the most common actuator assembly / holder electrical termination connectors. If the connector you need is not listed, contact Xandex Customer Service for more connector options.

Table 1. DieMark Actuator Assembly Connector Options

IMAGE	TYPE	DESCRIPTION	USED ON	Xandex Connector PN
	A	Winchester Miniature Connector	EG, PWS, R&K Teradyne & LTX Lasers	110-0401
	B	Winchester Side Mount Connector	PWS inker manipulator	110-0402
	C	Hirose 4 pin connector	KLA Probers	110-0403
	D	Cambion Connector pin 0.315 inch pin length	Teledyne TAC inker manipulator	110-0404 this part number to designate connector pin only (unwired)





	E	Cambion Connector pin 0.590 inch pin length	Standard H7 Holder connector	110-0405 this part number to designate connector pin only (unwired)
	Z	No Connector (stripped bare wire leads)	NA	NA
	5 Pin Straight	5 Pin Hirose Connector Straight	TEL P8, P12 SACC Arm Inker Retrofit	110-0415
	5 Pin 90 degree	5 Pin Hirose Connector 90 degree	TEL P8, P12 Optical Bridge Inker Retrofit	110-0406

Figure 3. 12VDC Coil wire color changed from black to blue

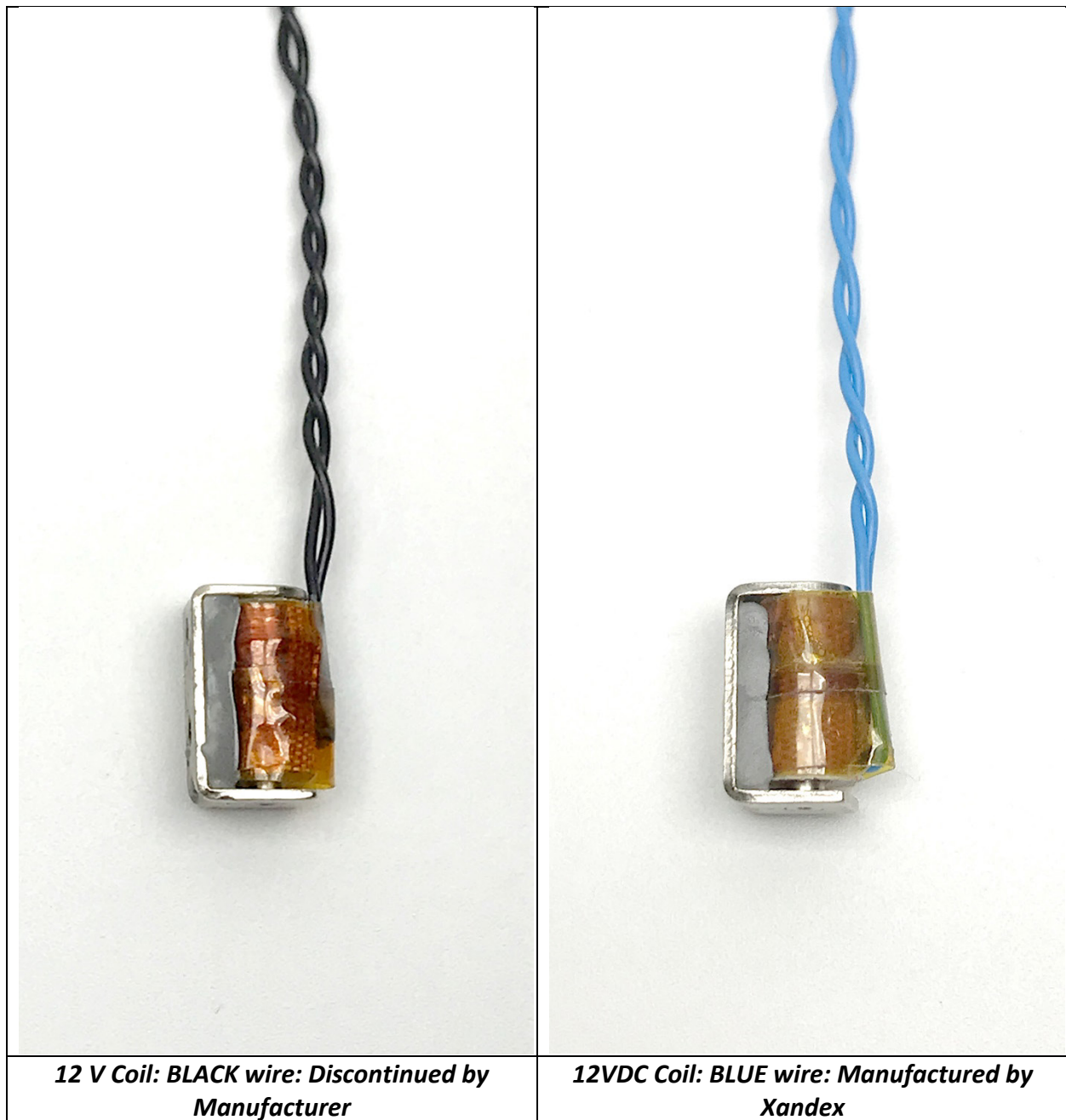


Figure 4. 24VDC Coil wire color changed from white to yellow



Coil Screw Reference

Each actuator type can be installed on multiple Xandex Holder assemblies. The actuator is installed on the holder assembly using two screws. It is critical that the screws are the correct length. If the screws are too long, they can protrude into the actuator bracket and contact the coil windings.

Screw contact with the coil winding generally results in non-repairable coil failure. The Xandex warranty does not cover damage to the actuator caused by incorrect installation, especially if the damage is caused when attempting to install an actuator on a non-Xandex Holder. **Table 2** describes which screws to use when installing any Actuator to a Xandex Holder.

Table 2. Actuator Installation Screw Reference

For Holder Type (left column) use screw listed in right column to install actuator.

HOLDER TYPE	SCREW PART NUMBER
H1	510-1106
H2	510-1106
H2R	510-1106
H3	510-1203
H4	510-1106
H5	510-1106
H6	510-1203
H7	510-1203
H11	510-1106
H14	510-1203
H16	510-1219

Note: 510-1106 = 1/72 x 3/8", 510-1203 = 1/72 X 3/16", 510-1219 = 1/72 X 7/16"

Plunger Stop Bracket Assembly

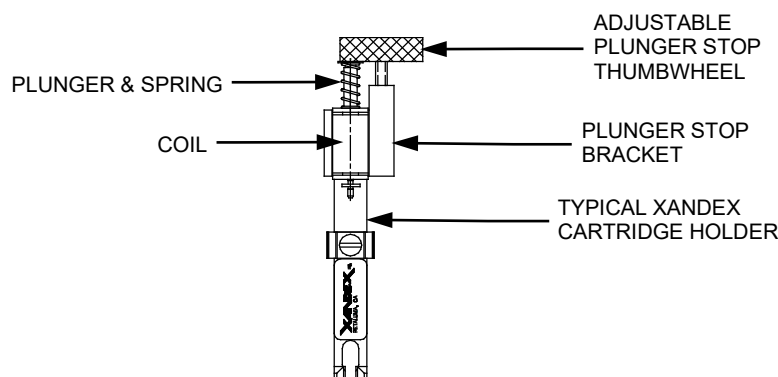


Figure 5. Plunger Stop Assembly

This assembly is recommended for use in all 3 mil and 5 mil DM-1 cartridge applications and is available for all electric inker H style cartridge holders. The assembly consists of an adjustable plunger stop which is attached to the solenoid/cartridge holder with a bracket and set screw.

The exposed filament length of the 3 mil and 5 mil DM-1 cartridge is 0.025 inch shorter than other DM-1 cartridges to deposit a minimal amount of ink. The 3 mil and 5 mil applications also require a very short plunger stroke to limit the amount of ink drawn to the filament tip.

Limiting plunger travel via the adjustable plunger stop provides better control of the amount of ink transported by the filament and therefore consistency of dot sizes in applications where small dots (~5 mil) are required.

To install, simply remove the two screws that retain the solenoid and bracket from the holder and reassemble by replacing the bracket with the plunger stop assembly and re-install on the holder. Order part number 210-0016 or contact [Xandex Customer Service](#) for assistance with your specific application.

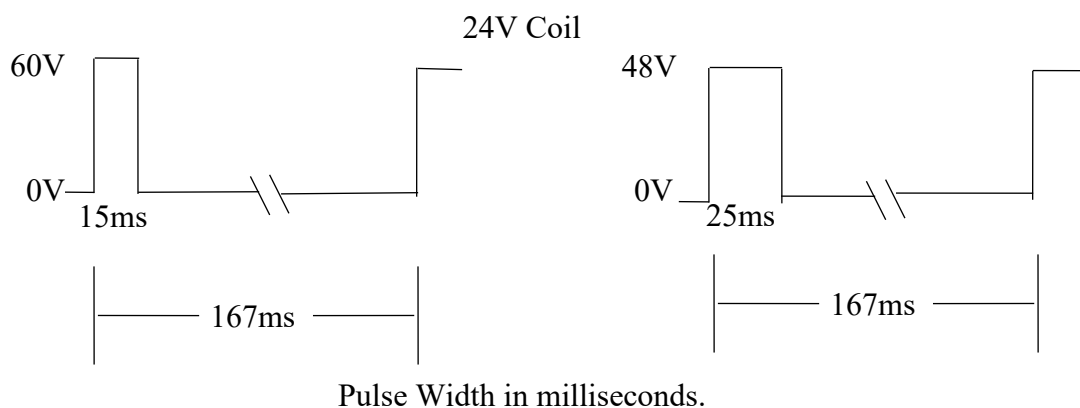
Easy Setup Instructions

Download Plunger Stop Installation and Setup instruction from:
<https://www.xandexsemi.com/products/manuals/8200206.pdf>

Electric Inker Operation

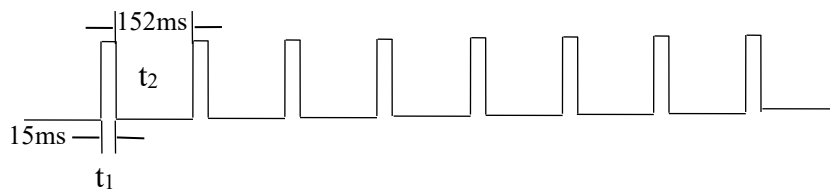
Inker Actuation

The Xandex Electric Inkers operate via an electronic pulse sent from the prober to actuate the inker solenoid. Upon actuation, the solenoid plunger drives the cartridge filament to the fully extended position, making slight contact with the wafer surface and depositing an ink droplet, forming a dot. The electronic pulse will vary depending on the coil drive voltage (48VDC minimum), as well as the pulse width and duty cycle. It is recommended that the drive voltage of the pulse is at least twice the solenoid coil voltage specification (i.e., 24VDC solenoid = 48VDC drive voltage). The pulse width will vary depending on the drive voltage, as shown below:



For voltages greater than 60VDC the on time of the cycle must be shortened. Maximum coil operating temperature must not exceed 100°C. The inker should not be operated more than 10 cycles without an ink cartridge installed (the cartridge can be empty) or damage to the solenoid may occur. 167ms is the minimum total cycle time. If faster inking is required, a Xandex pneumatic inker is recommended.

The duty cycle is a function of the time the solenoid is energized versus the total cycle time, as shown below where t_1 = time on and t_2 = time off. For example:



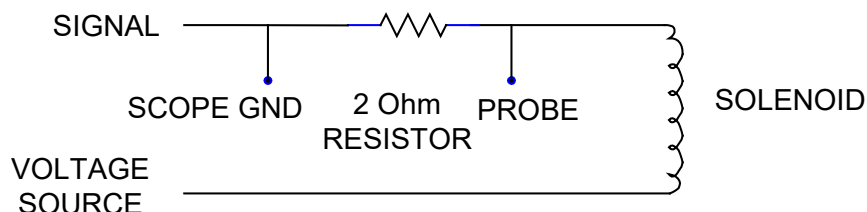
$$\text{Duty Cycle (as \%)} = \frac{t_1}{(t_1 + t_2)} \times 100 \quad \text{or} \quad \frac{15}{(15 + 152)} \times 100 = 8.9\%$$

A duty cycle of 20% is acceptable, <10% is optimal. If problems exist with the inker actuation, please refer to Inker Drive Verification, Electric Inker Troubleshooting or contact Xandex Customer Service.

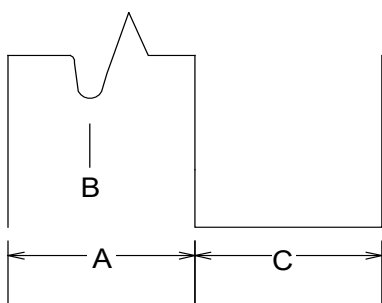
Inker Drive Verification

Xandex inkers operate nominally across all common prober circuits. If inker performance is not acceptable, it may be due to an incorrect inker drive. The coil used in the Xandex inker requires a signal that is a minimum of twice the coil voltage rating for consistent solenoid actuation. Verify that the inker drive output signal is \geq twice the coil voltage rating by connecting an oscilloscope to the prober inker connection and actuating the inker several times. If the drive voltage is less than twice the coil voltage rating consult your prober manufacturer for prober inker drive voltage modification procedure. If the voltage is \geq twice the coil voltage rating and acceptable results are still not achieved, the drive signal may be analyzed using the procedure below.

Referring to the prober manual, install a 2 Ω 10 watt resistor in series with the inker solenoid as shown below:



Using an oscilloscope, connect a probe as shown above and measure the arrival time of the solenoid. Set the time scale to 5 ms per division and the voltage to 1 mV per division. Fire the inker several times and look for the following trace.



A = On time of inker pulse.

B = Solenoid arrival point. This indicates that the plunger has bottomed out in the coil.

C = Off time of inker cycle.

“B” is the critical component of this waveform. It is the visual indication that the plunger has traveled its full stroke. If the “kick” is not visible, or if it moves off the right side of the trace to a point beyond the falling edge,

adjustment to the prober inker drive circuit is required.

Table 3. Coil Arrival Times

COIL DESCRIPTION	COIL RESISTANCE	MINIMUM DRIVE VOLTAGE	COLD ARRIVAL TIME (milliseconds)	HOT ARRIVAL TIME (milliseconds)
12 V Open Frame	60 Ω	24 VDC	6-8 ms	8-12 ms
24 V Open Frame	290 Ω	48 VDC	8-9 ms	9-12 ms
12 V Ledex	55 Ω	24 VDC	12-15 ms	16-20 ms
24 V Ledex	222 Ω	48 VDC	9-10 ms	13-17 ms

To verify the inker drive circuitry, perform a minimum of 5 test cycles with each cycle consisting of 2 minutes of constant inking using “Typical Drive Voltage” with a 25 ms pulse width and a 30 second rest period between cycles. The “Cold Arrival” times are measured during the 1st cycle and the “Hot Arrival” times are measured during the 5th cycle.

If arrival times are acceptable, no further change is required. If the current configuration is inadequate, increase the drive pulse width to 30 ms. If this still does not provide acceptable operation, increase the inker drive voltage by 20% and decrease the pulse width by 25%.

If acceptable results are still not achieved, contact [Xandex Customer Service](#) for assistance.

NEW Electric Inker Controller

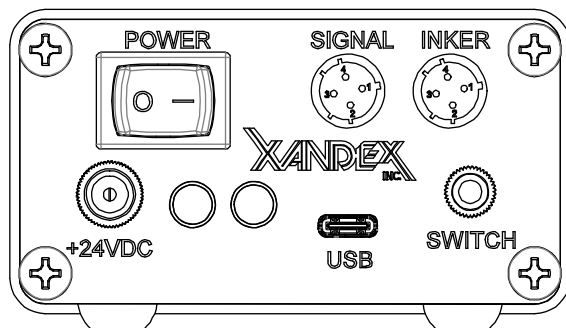


Figure 6. Electric Inker Controller

The NEW 350-0028 DieMark Electric Inker Controller is designed to power a Xandex Electric Inker. It is intended for uses where a wafer prober or other actuation signal is not present or is not configured to drive the actuator. Designed to work with 12V and 24V DieMark actuator coils, the controller automatically detects the coil's voltage after the first signal actuation and automatically sets output voltage to either 24 or 48 VDC (2x rated coil voltage).

The Electric Inker Controller is powered by an external 24VDC power supply and automatically detects the DieMark inker's actuator voltage upon the first triggered pulse after power up. It then sets the output signal to either a 24V or 48V depending on the coil Voltage. The output signal to the inker can be triggered by a wafer prober signal, a foot or hand switch, or serial data commands via a PC.

The Controller can be signaled to actuate a coil via three input ports: by an “ink” signal from a wafer prober or other inking equipment or via an optional foot switch available from Xandex. Either signal source can be connected to the SIGNAL port.

The controller can be signaled via a hand switch (not available from Xandex) connected to the SWITCH port. The controller can also be signaled to actuate a coil and serially programmed via the USB C port connected to a PC.

For more information on the Electric Inker Controller, visit the webpage at...

<https://www.xandexsemi.com/products/e-controller.html>

...or review the User Guide at <https://www.xandexsemi.com/products/manuals/8200338.pdf>

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Inker Assemblies

Electric Inker Assemblies

NEW: The 101 and 601 inker assemblies have recently been updated with a higher thread Z-Adjustment screw that increases Z adjustment resolution by 20%. As dot size requirements decrease into 6 mil or less range, this improvement in Z adjust resolution, along with the new 3 mil small dot ink cartridge, enable reliable, repeatable production of uniform dots in the 3-5 mil range.

In addition to DieMark Cartridge holders that can be retrofitted to existing manipulator assemblies, Xandex manufactures inker manipulator assemblies that are compatible with wafer probing and inspection equipment from major equipment manufacturers.

This section contains line drawings of three typical DieMark inker assembly types, with descriptions of their operation and adjustment features. The models shown are compatible with Electroglas wafer probers, however models with the same features are available for wafer probing/marketing equipment from many other manufacturers.

Assembly dimensional drawings are available at www.xandexsemi.com/drawings.html for use in determining clearances required for your application

Inker assemblies can also accommodate different cartridge holder types to accommodate drive voltage and electrical connection requirements.

Model EG101

Basic inker assembly using the B101 inker base and H1 cartridge holder. For dimensional information, see [drawing number 900-0089](#), EG 101 Inker. Inker base includes the manipulator and base plate without the cartridge holder assembly.

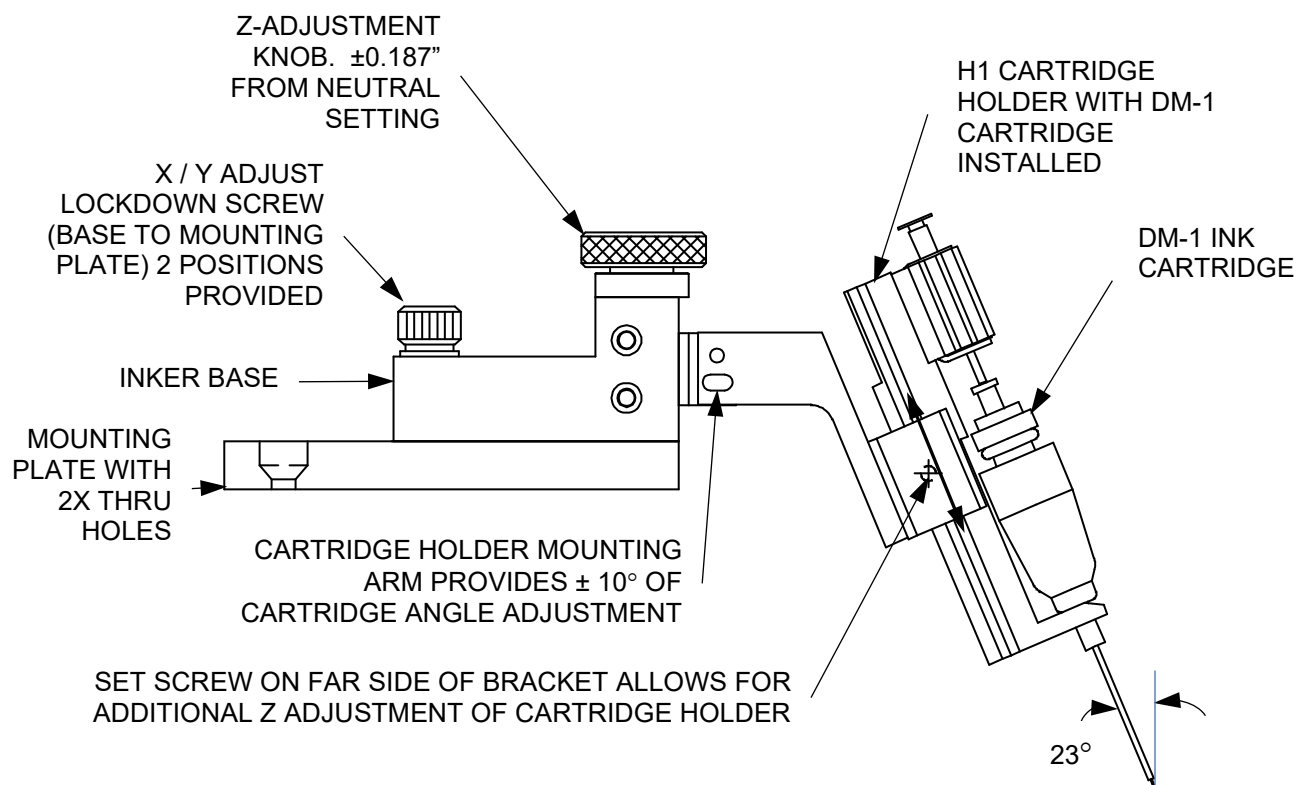


Figure 7. EG101 Inker Assembly

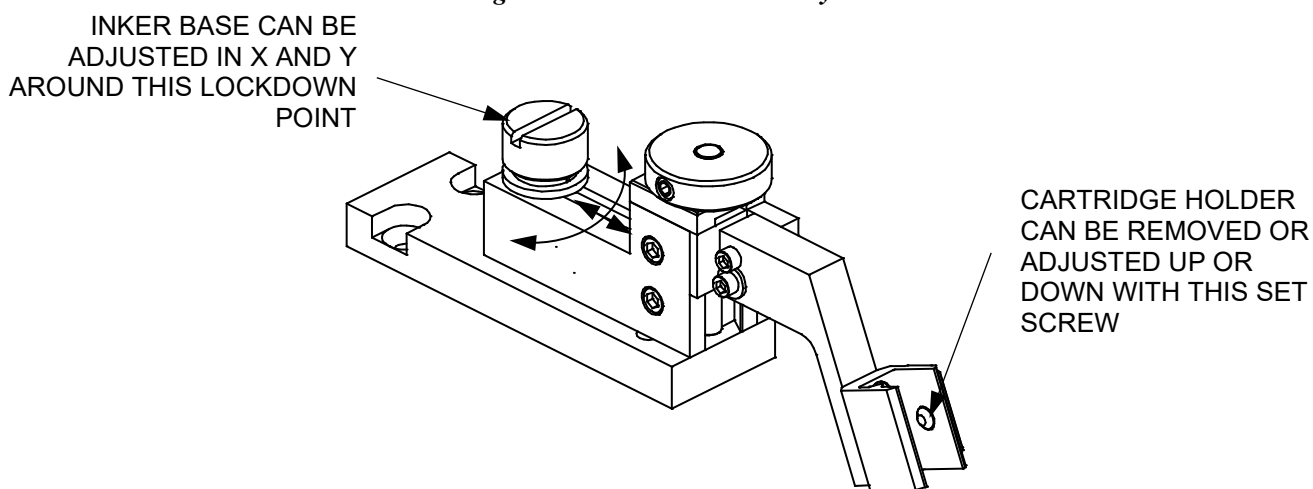


Figure 8. B101 Inker Base

Model EG301

The EG301 model inker expands on the basic 101 model, by integrating an X-Y Joystick that can be used to adjust inking position more accurately. For dimensional information, see [drawing number 900-0097](#).

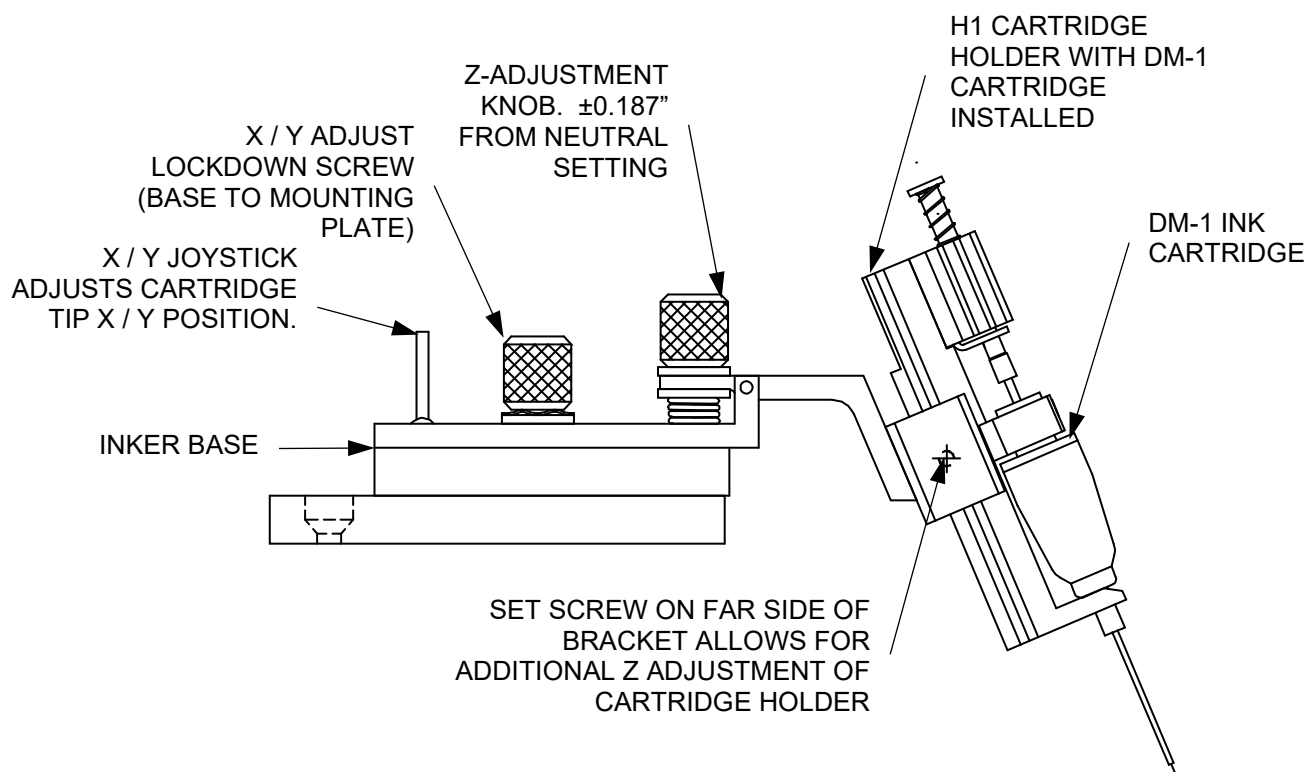


Figure 9. EG301 Inker Assembly

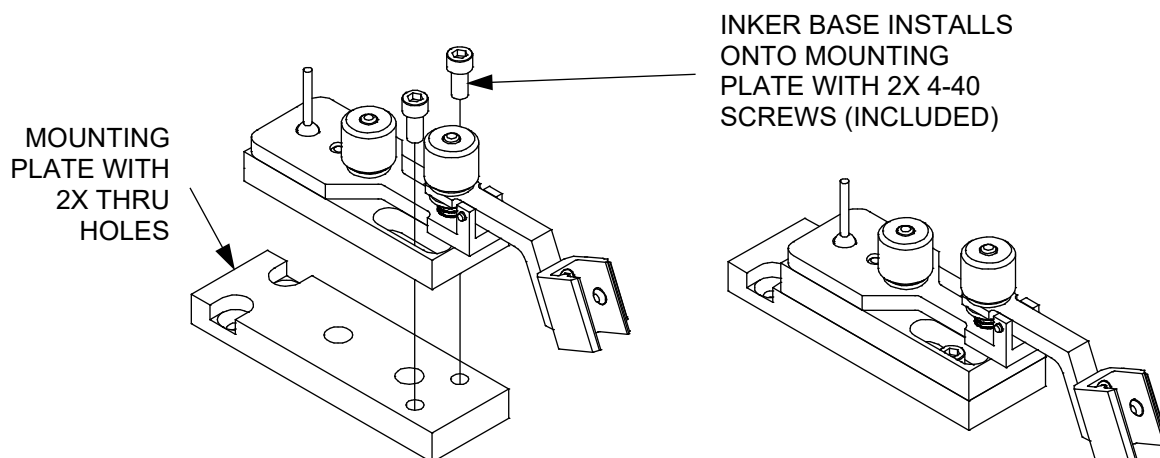


Figure 10. B301 Inker Base and Mounting Plate

Model EG601

The EG601 incorporates all of the features of the B101 and B103 inker bases with the addition of a high speed coil for faster ink dot placement. To enable easier ink cartridge change out, the cartridge holder is mounted on a swing arm that can be raised to place the cartridge in an optimal position for replacement and priming. See **Figure 11**.

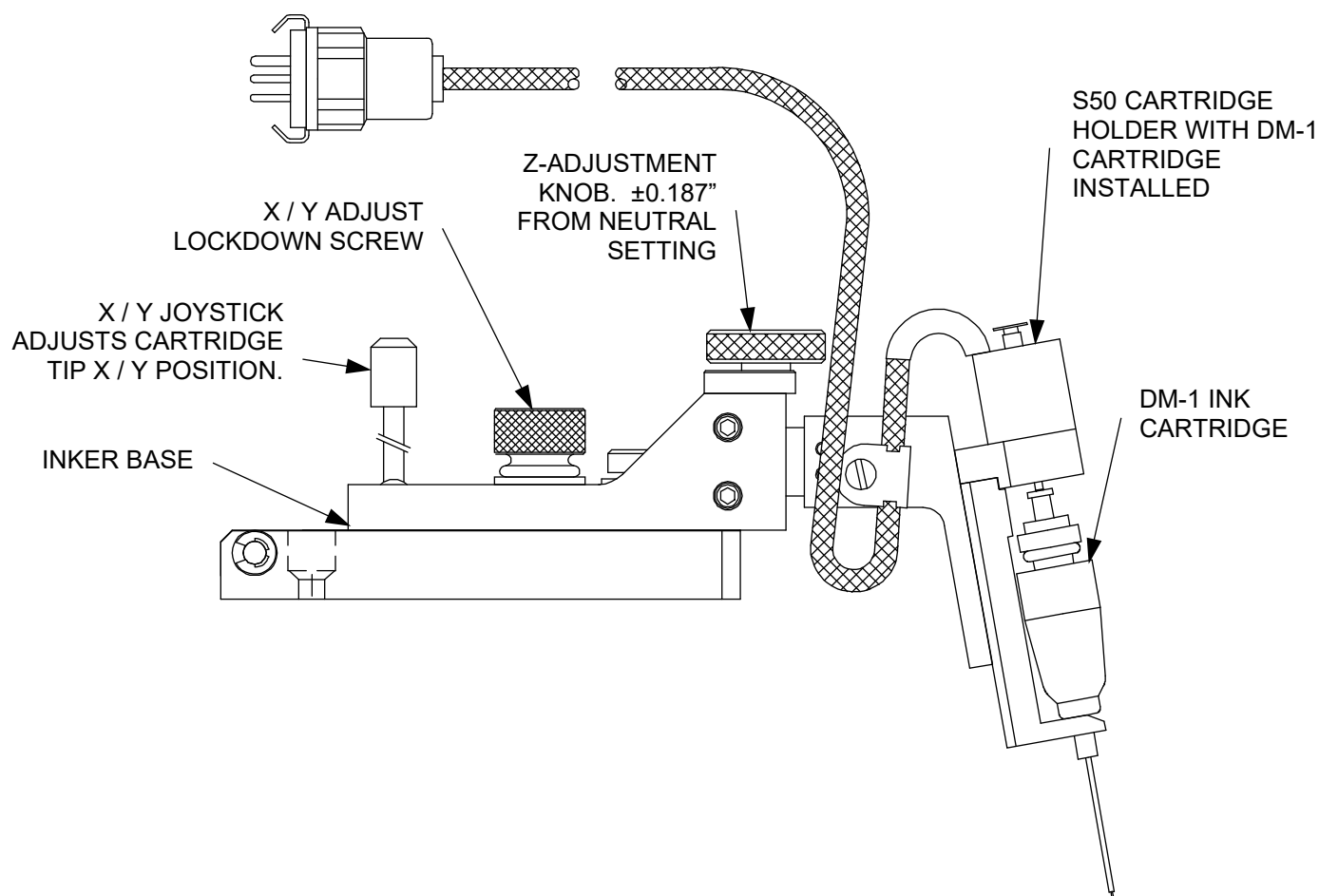


Figure 11. EG601 Inker Assembly

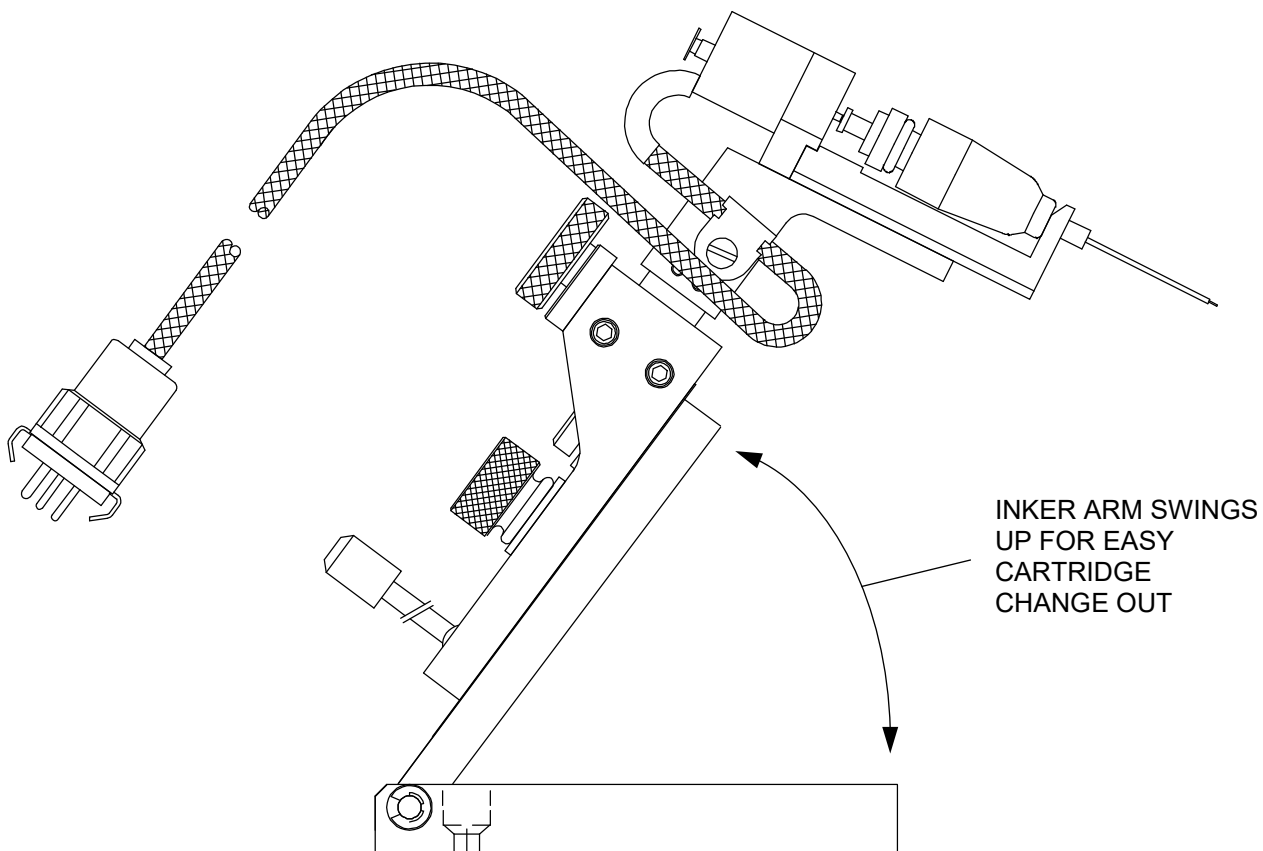
Model EG601

Figure 12. EG601 Swing Arm

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Inker/Cartridge Troubleshooting

This Troubleshooting section is divided into two parts. The first part covers the Filament Ink Cartridge and the second covers the Xandex Electric Inker. **For more information on the DM-1, DM-1.25 or DM-S filament ink cartridge, download Xandex manual [820-0013 DieMark Ink Cartridge Operation and Troubleshooting](#) . Ink and Ink Cartridge Troubleshooting information is available in the Support section of the www.xandexsemi.com website.**

Ink Cartridge Troubleshooting

Problem	Solution
The lower O-ring does not lift when opening a cartridge.	This happens sometimes when some ink dries around the lower O-ring. Push the main shaft down, keeping the indicators aligned, then pull up the shaft while slanting it to one side as much as possible.
The cartridge is opened per instructions and the fishline / wire comes out smoothly, but the ink does not flow down the needle.	It usually takes 30 to 40 strokes before the phenolic inks travel all the way down the needle. Viscous epoxy and air-dry inks may require longer. After priming and installation, manually activate the inker plunger 30 to 40 strokes until ink appears at the needle tip. For 3 mil and 5 mil cartridge priming, see the new Vacuum Priming Tool information in the Ink and Cartridge manual 820-0013 .
Some ink dots tend to crack after baking using Xandex recommended cure cycles.	This occurrence is related to the ink surface tension, 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).
Runny, blobbing ink or skipping dots.	<ol style="list-style-type: none"> 1. Check ink shelf life. Filament ink cartridges with 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 2 days of cartridge opening. 7824 and 7824T inks within 4 months or 3 days after cartridge opening. 2. Check for exposure to extreme temperatures. Cartridges should be stored VERTICALLY at 25°C. DO NOT refrigerate the cartridges. 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.

	3. Inker Z height may be adjusted too high. Ink cannot wick off the filament and builds up, creating blobbing and skipping. Readjust inker Z height.
--	--

Problem	Solution
Small, inconsistent, skipping or no ink dots.	<ol style="list-style-type: none"> The ink flow channels may be blocked. It could be due to any one of the following: <ul style="list-style-type: none"> A. The bottom O-ring is not lifted at all. In this case, when the cartridge is primed only a small amount of the ink flows into the space below the O-ring. This is enough to start inking, but the inker quickly uses up that ink (i.e., on two or three wafers) and will start to skip. To eliminate the problem, close the cartridge, re-open and prime again. B. The cartridge is opened and primed correctly but is closed inadvertently before it is mounted on the holder. The main shaft is pushed down all the way, leaving no gap and the fishline appears to be too long. To correct this problem, pull up the main shaft until it stops, then turn it 1/4 of a turn in either direction. C. During priming, an air bubble may have become trapped under the bottom O-ring. This inhibits the full flow of ink. To eliminate air bubbles, reseal the cartridge and repeat the priming procedure. Verify that coil and cartridge are in line, visually check the straightness of plunger and check for possible damage to the plunger spring. The plunger should travel smoothly and freely when actuated manually from any position. If there is any binding replace the plunger and/or spring. Chuck top or wafer surface not planar. Verify planarity of both.
Elongated instead of round dots.	<ol style="list-style-type: none"> Inker is set too close to the wafer, which results in a kinked fishline. The cartridge should be positioned so that the filament barely touches the wafer surface when it is fully exposed. See Setup and Alignment or refer to your specific inker manual.

Electric Inker Troubleshooting

Problem	Solution
The inker is working intermittently from the outset.	<ol style="list-style-type: none"> 1. Incorrect inker drive, in which case the plunger will travel very sluggishly. The 290Ω coil requires an inker drive signal of 48 volts with a 25 ms pulse duration. See Inker Drive Verification. 2. The plunger might be bent. This can happen when pushing the plunger through the coil. Manually actuate the plunger a few times, rotate 1/4 turn and repeat. The plunger should travel freely. Replace if necessary. 3. During opening of the cartridge, the fishline monofilament has been kinked because the main shaft was lowered quickly or incorrectly. Replace the cartridge. 4. Faulty electrical connection somewhere on the line. Check the continuity of electrical supply connections to the inker and correct.
The inker works fine for a while (4-8 hours), then starts to skip badly.	<ol style="list-style-type: none"> 1. Ink flow channels are blocked by the lower O-ring. If the bottom O-ring is not lifted during opening and priming, a small amount of ink below will be used up after a few rows, while the remainder is trapped in the reservoir. Remove the cartridge, close and repeat opening and priming procedure. 2. When the cartridge is installed on the holder, the indicators are left aligned and the main shaft has been pushed closed. The indicators should be moved 1/4 turn into locking position. Remove the cartridge and repeat opening and priming procedure. 3. Wrong inker drive being used. Sometimes the coil problem does not appear from the outset. If the actuation pulse is marginally acceptable the plunger will travel less than a full stroke as the solenoid heats up. This causes the inker to miss badly. See Inker Drive Verification to check inker drive, pulse width, and cycle time.

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-1, DM-1.25, DM-S Ink Cartridges:

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

Electric Controller = One (1) year 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.



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