

# University of Minnesota Nano Center

## AJA 1- Standard Operating Procedure

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<b>Badger Name:</b>	K3 Sputterer AJA1	<b>Revision Number:</b>	9
<b>Model:</b>	ATC 2000	<b>Revisionist:</b>	Wanjohi Kimani
<b>Location:</b>	Bay 3 Keller Hall	<b>Date:</b>	March 26, 2020

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### 1. Scope

- 1.1. This document provides detailed instructions on how to properly operate the AJA 1 Sputtering system.

### 2. Tool Description

- 2.1 The AJA sputter system utilizes ionized gas (Ar, O<sub>2</sub>, N<sub>2</sub>) to sputter material from source targets to substrates, depositing a thin film in the process. There are 4 shuttered guns on the system: 2 DC, and 2 RF.

### 3. Safety

- 3.1 Be careful not to pinch your fingers while lowering the hoist (chamber lid).

### 4. Restrictions/Requirements

- 4.1 Must be a qualified user on the AJA sputter system.
- 4.2 Watch the AJA-1 video in the equipment training section, on our website, prior to attending the in-person training

### 5. Required Facilities

- 5.1 Compressed air
- 5.2 Chilled water
- 5.3 Cryo at 10 K
- 5.4 Vacuum
- 5.5 Ar
- 5.6 O<sub>2</sub>
- 5.7 N<sub>2</sub>

### 6. Notes

- 6.1 Gold and Platinum targets are located in a badger interlocked locker in chase 2. To retrieve either, you need to enable “**K2C GOLD TARGET AJA**” in badger. Weight is recorded before and after each run and noted on log sheets also located in the locker. All other AJA targets are located in the silver, nitrogen purged cabinet in chase 3.

### 7. Operating Instructions

- 7.1 Login on
  - 7.1.1 Log in on the MNC Badger system.
  - 7.1.2 FILL OUT user info in LOG BOOK.
  - 7.1.3 On AJA login screen, the username is '**apex**', and there is no password. Click Ok.
  - 7.1.4 Type in your assigned 4 digit PIN number and click 'accept' -- do not hit 'enter' on this screen or later you will receive error messages saying you are not logged in.

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### 7.2 CHANGING TARGETS

(If you don't need to change targets, see section 'c' for sample loading)

#### **TIPS: SCREWS ONLY NEED TO BE SNUG, DO NOT OVERTIGHTEN**

- 7.2.1 Look at the box labeled **Automated Control**, click on the button labeled **VENT**. Then when the vent window appears on the screen, press **START**
- 7.2.2 Venting the system will shut off the DC and RF power supplies, but check that the front of the power supplies have no displays lit up to ensure that they have been powered off. If they have not shut off, **DO NOT CONTINUE**; contact an MNC staff member for assistance.
- 7.2.3 Locate the gun angle adjuster and note the position, so you can return to it after the target change. Also make sure the chamber view port shield is covering the view port, this ensures it is in a position that will give clearance for the guns when you lower the hoist later.
- 7.2.4 Use the hoist button to raise the chamber lid. Raise it so the top of the threaded bolt on the hoist matches the height of the black bracket which is attached to the hoist (going further will stretch the cables too much!).
- 7.2.5 You may now swing the chamber lid over to access the target guns for target changes. Swing it slowly at first to make sure you have clearance, and then fasten the lid to the system control box using the metal clip and chain.
- 7.2.6 Adjust the gun angle adjuster and turn it until the target gun is straight down.

**Note: Place several clean room wipes on a table top to set all fixtures onto during dis-assembly, to capture debris from the fixtures, and to keep the fixtures clean from the table top. You do not need to use wipes if you are placing fixtures on the corner of the sputterer station.**

**\*\* If there is debris/flakes seen on the shutter prior to removal, try to contain the mess on the shutter to prevent debris/flakes from falling on the floor \*\***

- 7.2.7 Loosen the shutter clamp one turn (without removing)--which will be a knurled twist-on type clamp (knob)--slide off the end of the shutter shaft to remove the shutter.
- 7.2.8 Remove the gun chimney by removing the two vertically mounted screws. Leave the horizontally mounted screws in place. Slide the chimney assembly off of the shutter shaft.

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**\*\* If there is a noticeable amount of flaking on the chimney or shutter, go to the “Resolving Shield Flaking” section at the end of this SOP \*\***

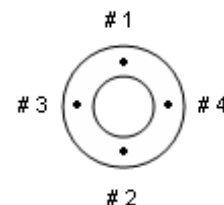
- 7.2.9 Locate the two extension screws (knurled) in the corner of the sputterer station. Remove two of the small target retainer screws (opposite from one another) and replace them with the extension screws (knurled); tighten them until slightly snug, and then loosen them a half-turn.

**Note: If target retainer screws are stuck and the torque Allen wrench cannot remove them, temporarily use the regular Allen wrench to loosen them (located in blue toolbox), then, once loosened, put that tool back in the toolbox.**

- 7.2.10 Remove the other two target retainer screws: While holding up the target retainer and target, remove the extension screws. There are three parts to this target assembly: the target, the target retainer, and the copper mesh.
- 7.2.11 Place your target material sputter-side-down into the target retainer so it rests on the lip (or place the 0.125" adaptor ring on the lip first, **IF a 0.125" target is used instead of a 0.250" target**). Then place the target on the adaptor ring).
- 7.2.12 Center the copper mesh over the back of the target. The copper mesh goes between the target and the gun. Do not bend or fold the copper mesh. If the mesh is frayed or damaged, replace it with a new piece (located in blue toolbox).

**Note: If you are using a target which is bonded into a copper power cup, a separate target retainer is not used, but you MUST USE the copper mesh as usual.**

- 7.2.13 Hold the target assembly, with copper mesh centered, up to the gun. Use the two extension screws and tighten them until slightly snug, then loosen them a half-turn. Now install two of the small target retainer screws but leave them a little loose. Remove the two extension screws and install the two remaining retainer screws. Tighten all four screws in a cross pattern (ex: #1, 2, 3, then 4 as shown below) until you hear the torque Allen-wrench “click”. The screws should be



snug, so you will not be able to wiggle the target at all.

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- 7.2.14 Carefully slide the chimney assembly over the shutter shaft. Be sure the blocked (gas) hole on the chimney goes into the short shaft. Secure this in place with the two larger screws, tighten until snug.
- 7.2.15 Slide the shutter back onto the shaft; leave ~3 to 5 mm space between the shutter and the chimney (like the other targets). Center the shutter over the target and then tighten the knurled knob of the twist-on clamp (it **MUST** be tight enough so the shutter doesn't swing freely, the shutter should only be able to open when the shaft rotates during the run).
- 7.2.16 Re-adjust your gun angle setting (if you haven't already); typically 10mm is used.
- 7.2.17 Test the shutter by clicking on your target's # displayed in the target circle on the computer screen. Click it again to close the shutter. This is especially important so the twist-on shutter clamp doesn't slip off the shutter shaft during operation. Readjust the shutter, and tighten if necessary.

**Note: Make sure that all targets are angled inward and the view port shield is blocking the window, or these will crash into each other when you lower the hoist.**

- 7.2.18 Use the hoist button and lower the hoist.

**Make sure the load lock cover is in place and the chamber is fully closed.**

### 7.3 Pump down

- 7.3.1 On the computer screen go to the box labeled, **Automated Control** click on the **PUMPDOWN** button. Then when the pump-down window appears on the screen, press **START**. The automatic pump down sequence will begin in a couple minutes. It will take about 12.5 minutes to rough-pump down the system.
- 7.3.2 pop up window will appear when the pump down sequence has finished. Then you will need to wait until the base pressure is reached ~ **2.0 E-6 Torr**.

## 8 SAMPLE LOADING

- 8.1 If load lock is not vented, do the following:
  - 8.1.1 Check that the **Load Lock Gate Valve** is closed or close **Load Lock Gate Valve** if open.
- 8.2 Turn off **Load Lock Pump** ("**L.L.**" on computer screen).
- 8.3 Wait until vented (Load lock pressure gauge will read "**OR**" (over range) or ~760).
- 8.4 Load samples into vented load lock.
- 8.5 When finished loading samples, return lid.

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8.6 Turn on **Load Lock Pump** (“L.L.” on computer screen).

**Once the L.L. is in the  $10^{-5}$  range, it is okay to proceed:**

8.7 Open **Load Lock Gate Valve**.

8.8 Make sure the toggle switch on the stage control panel is switched to the **Load/Unload** position. Table should be in the Down position with **Down LED** lit. Push the Transfer Fork all the way into the chamber so that the Substrate Holder is situated directly over the Stage.

8.9 Bring the Stage up using the yellow **UP** button on the **Rotation/Z-Height Control Panel**. Continue to press the yellow button until the **UP LED** is lit. Stage will stop moving when in **UP** position.

8.10 Pull the **Transfer Fork** out; note it must be pulled out as far as possible to contact the micro-switch.

8.11 Close the **Load Lock Gate Valve**.

## 9 PROGRAMMING LAYERS AND PROCESSES

9.1 Select **Program Layers** in the upper left hand of the screen. (See examples below for explanation on how to program)

9.2 Enter parameters. **Always be sure to hit 'Enter' after each entry**, or it won't be recognized by the software program

**Some examples of typical programs follow below. These have proven to be quite reliable. Users are encouraged to use them as templates for their own programming.**

The three examples outlined below include:

- a) **Program Template for DC Powered Metal Target:** no strike layer required for DC gun
- b) **Program Template for RF Powered Metal Target:** strike layer  
**Program Template for RF Powered Metal Target:** deposition layer
- c) **Program Template for RF Powered Semi. or Dielectric Target:** strike layer  
**Program Template for RF Powered Semi. or Dielectric Target:** deposition layer

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## AJA 1- Standard Operating Procedure

- A. Program Template for DC Powered Metal Target (No strike layer required with DC Guns. Plasma will light at 5mtorr.)

RSView32 Runtime 1500

RESTORE SAVE LAYER DESCRIPTION EXIT

CH #1	CH #1 BIAS	POS #1 RF-SS#1 SiO2	POS #3 RF-SS#2 InSn	POS #2 MDX 1K#1 Ta	POS #4 MDX 1K#2 Cu
<b>PRESSURE</b>					
CHAMBER ENABLE	1				
CONTROL 0=POS 1=PRES	1				
PRES STPT (mT)	5				
POS STPT (0-1000)	0				
BASE PRES* (mT) * first layer only	0				
<b>GAS</b>	AR				
GAS #1 STPT (sccm)	20				
	O2				
GAS #2 STPT (sccm)	0				
	N2				
GAS #3 STPT (sccm)	0				
<b>SUBSTRATE</b>					
HEAT (0=OFF, 1=ON)	0				
SP (°C)	0				
SOAK TIME (sec)	0				
		<b>RF POWER SUPPLIES</b>		<b>DC POWER SUPPLIES</b>	
		OIL-OFF (0=OFF, 1=ON)	0	OIL-OFF (0=OFF, 1=ON)	1
		DELAY TIME (sec)	0	CTRL MODE (0=W, 1=A, 2=V)	0
		CTRL MODE (0=W, 1=V)	0	DELAY TIME (sec)	10
		RAMP UP / DH (sec)	0	RAMP UP / DH (sec)	15
		WATTS STPT	0	WATTS STPT	250
		VOLTS STPT (mA)	0	VOLTS STPT	0
		SHUTTER DELAY (sec)	0	AMPS STPT (mA)	0
		SHUTTER (0=OFF, 1=ON)	0	SHUTTER DELAY (sec)	120
		COAT TIME (sec)	0	SHUTTER (0=OFF, 1=ON)	1
		IDLE WATTS STPT	0	COAT TIME (sec)	300
		IDLE VOLTS STPT (mA)	0	IDLE WATTS STPT	0
		SWITCH OUTPUT (0=OFF, 1=ON)	0	IDLE VOLTS STPT	0
				IDLE AMPS STPT (mA)	0
				SWITCH OUTPUT (0=OFF, 1=ON)	0

PRINT SCREEN

Clear Clear All

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### B. Program Template for RF Powered Metal Target (Strike layer required with RF Guns. Light plasma at 20 mtorr, deposit film at 5 mtorr.)

*This is the strike layer...*

RSView32 Runtime 1500

RESTORE SAVE LAYER DESCRIPTION EXIT

CH #1	CH #1 BIAS	POS #1 RF-SS#1 SiO2	POS #3 RF-SS#2 InSn	POS #2 MDX 1KG1 Ta	POS #4 MDX 1KG2 Cu
<b>PRESSURE</b>					
CHAMBER ENABLE	0	0	1	0	0
CONTROL 0=POS 1=PRES	0	0	10	0	0
PRES STPT (mT)	20	0	0	0	0
POS STPT (0-1000)	0	0	15	0	0
BASE PRES* (mT)	0	0	250	0	0
* first layer only			0	0	0
<b>GAS</b>					
GAS #1 STPT (sccm)	AR	0	0	0	0
	20	0	0	0	0
GAS #2 STPT (sccm)	O2	0	0	0	0
	0	0	0	0	0
GAS #3 STPT (sccm)	N2	0	0	0	0
	0	0	0	0	0
<b>SUBSTRATE</b>					
HEAT (0=OFF, 1=ON)	0	0	0	0	0
SP (°C)	0	0	0	0	0
SOAK TIME (sec)	0	0	0	0	0
<b>RF POWER SUPPLIES</b>					
ON-OFF (0=OFF, 1=ON)	0	0	0	0	0
DELAY TIME (sec)	0	0	0	0	0
CTRL MODE (0=W, 1=V)	0	0	0	0	0
RAMP UP / DN (sec)	0	0	0	0	0
WATTS STPT	0	0	0	0	0
VOLTS STPT (mA)	0	0	0	0	0
SHUTTER DELAY (sec)	0	0	0	0	0
SHUTTER (0=OFF, 1=ON)	0	0	0	0	0
COAT TIME (sec)	0	0	0	0	0
IDLE WATTS STPT	0	0	0	0	0
IDLE VOLTS STPT (mA)	0	0	0	0	0
SWITCH OUTPUT (0=OFF, 1=ON)	0	0	0	0	0
<b>DC POWER SUPPLIES</b>					
ON-OFF (0=OFF, 1=ON)	0	0	0	0	0
CTRL MODE (0=W, 1=A, 2=V)	0	0	0	0	0
DELAY TIME (sec)	0	0	0	0	0
RAMP UP / DN (sec)	0	0	0	0	0
WATTS STPT	0	0	0	0	0
VOLTS STPT	0	0	0	0	0
AMPS STPT (mA)	0	0	0	0	0
SHUTTER DELAY (sec)	0	0	0	0	0
SHUTTER (0=OFF, 1=ON)	0	0	0	0	0
COAT TIME (sec)	0	0	0	0	0
IDLE WATTS STPT	0	0	0	0	0
IDLE VOLTS STPT	0	0	0	0	0
IDLE AMPS STPT (mA)	0	0	0	0	0
SWITCH OUTPUT (0=OFF, 1=ON)	0	0	0	0	0

PRINT SCREEN

Clear Clear All



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**Program Template for RF Powered Metal Target** (Strike layer required with RF Guns. Light plasma at 20 mtorr, deposit film at 5 mtorr.)

*This is the deposition layer...*

RSView32 Runtime 1500

RESTORE SAVE LAYER DESCRIPTION EXIT

CH #1	CH #1 BIAS	POS #1 RF-SS#1 SiO2	POS #3 RF-SS#2 InSn	POS #2 MDX 1K#1 Ta	POS #4 MDX 1K#2 Cu
<b>PRESSURE</b>					
CHAMBER ENABLE					
CONTROL 0=POS 1=PRES					
PRES STPT (mT)					
POS STPT (0-1000)					
BASE PRES* (mT)					
* first layer only					
<b>GAS</b>					
GAS #1 STPT (sccm)					
GAS #2 STPT (sccm)					
GAS #3 STPT (sccm)					
<b>SUBSTRATE</b>					
HEAT (0=OFF, 1=ON)					
SP (°C)					
SOAK TIME (sec)					
	<b>RF POWER SUPPLIES</b>				
	ON-OFF (0=OFF, 1=ON)				
	DELAY TIME (sec)				
	CTRL MODE (0=W, 1=V)				
	RAMP UP / DN (sec)				
	WATTS STPT				
	VOLTS STPT (mA)				
	SHUTTER DELAY (sec)				
	SHUTTER (0=OFF, 1=ON)				
	COAT TIME (sec)				
	IDLE WATTS STPT				
	IDLE VOLTS STPT (mA)				
	SWITCH OUTPUT (0=OFF, 1=ON)				
	<b>DC POWER SUPPLIES</b>				
	ON-OFF (0=OFF, 1=ON)				
	CTRL MODE (0=W, 1=A, 2=V)				
	DELAY TIME (sec)				
	RAMP UP / DN (sec)				
	WATTS STPT				
	VOLTS STPT				
	AMPS STPT (mA)				
	SHUTTER DELAY (sec)				
	SHUTTER (0=OFF, 1=ON)				
	COAT TIME (sec)				
	IDLE WATTS STPT				
	IDLE VOLTS STPT				
	IDLE AMPS STPT (mA)				
	SWITCH OUTPUT (0=OFF, 1=ON)				

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## AJA 1- Standard Operating Procedure

- C. Program Template for RF Powered Semi. or Dielectric Target (Strike layer required with RF Guns. Light plasma at 20 mtorr, deposit film at 5 mtorr.)

*This is the strike layer...*

RSView32 Runtime 1500

RESTORE SAVE LAYER DESCRIPTION EXIT

CH #1	CH #1 BIAS	POS #1 RF-SS#1 SiO2	POS #3 RF-SS#2 InSn	POS #2 MDX 1K#1 Ta	POS #4 MDX 1K#2 Cu
<b>PRESSURE</b>					
CHAMBER ENABLE					
CONTROL 0=POS 1=PRES					
PRES STPT (mT)					
POS STPT (0-1000)					
BASE PRES* (mT)					
* first layer only					
<b>GAS</b>					
GAS #1 STPT (sccm)					
GAS #2 STPT (sccm)					
GAS #3 STPT (sccm)					
<b>SUBSTRATE</b>					
HEAT (0=OFF, 1=ON)					
SP (°C)					
SOAK TIME (sec)					
	<b>RF POWER SUPPLIES</b>			<b>DC POWER SUPPLIES</b>	
	ON-OFF (0=OFF, 1=ON)			ON-OFF (0=OFF, 1=ON)	
	DELAY TIME (sec)			CTRL MODE (0=W, 1=A, 2=V)	
	CTRL MODE (0=W, 1=V)			DELAY TIME (sec)	
	RAMP UP / DI (sec)			RAMP UP / DI (sec)	
	WATTS STPT			WATTS STPT	
	VOLTS STPT (mA)			VOLTS STPT	
	SHUTTER DELAY (sec)			AMPS STPT (mA)	
	SHUTTER (0=OFF, 1=ON)			SHUTTER DELAY (sec)	
	COAT TIME (sec)			SHUTTER (0=OFF, 1=ON)	
	IDLE WATTS STPT			COAT TIME (sec)	
	IDLE VOLTS STPT (mA)			IDLE WATTS STPT	
	SWITCH OUTPUT (0=OFF, 1=ON)			IDLE VOLTS STPT	
				IDLE AMPS STPT (mA)	
				SWITCH OUTPUT (0=OFF, 1=ON)	

PRINT SCREEN

Clear Clear All

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**Program Template for RF Powered Semi. or Dielectric Target** (Strike layer required with RF Guns. Light plasma at 20 mtorr, deposit film at 5 mtorr.)

*This is the deposition layer...*

RSView32 Runtime 1500

LAYER		DESCRIPTION		EXIT			
<b>PRESSURE</b> CHAMBER ENABLE <input type="checkbox"/> 1 CONTROL 0=POS 1=PRES <input type="checkbox"/> 1 PRES STPT (mT) <input type="text"/> 5 POS STPT (0-1000) <input type="text"/> 0 BASE PRES* (mT) <input type="text"/> 0 <small>* first layer only</small> <b>GAS</b> GAS #1 STPT (sccm) <input type="text"/> 20 GAS #2 STPT (sccm) <input type="text"/> 0 GAS #3 STPT (sccm) <input type="text"/> 0 <b>SUBSTRATE</b> HEAT (0=OFF, 1=ON) <input type="checkbox"/> 0 SP (°C) <input type="text"/> 0 SOAK TIME (sec) <input type="text"/> 0		<b>CH #1</b> <b>RF POWER SUPPLIES</b> ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 0 DELAY TIME (sec) <input type="text"/> 0 CTRL MODE (0=W, 1=V) <input type="checkbox"/> 0 <b>RAMP UP / DN (sec)</b> <input type="text"/> 120 WATTS STPT <input type="text"/> 0 VOLTS STPT (mA) <input type="text"/> 0 <b>SHUTTER DELAY (sec)</b> <input type="text"/> 120 SHUTTER (0=OFF, 1=ON) <input type="checkbox"/> 0 COAT TIME (sec) <input type="text"/> 0 <b>IDLE WATTS STPT</b> <input type="text"/> 0 IDLE VOLTS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0		<b>POS #1</b> RF-SS#1 SiO2 ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 1 DELAY TIME (sec) <input type="text"/> 10 CTRL MODE (0=W, 1=V) <input type="checkbox"/> 0 <b>RAMP UP / DN (sec)</b> <input type="text"/> 120 WATTS STPT <input type="text"/> 250 VOLTS STPT (mA) <input type="text"/> 0 <b>SHUTTER DELAY (sec)</b> <input type="text"/> 120 SHUTTER (0=OFF, 1=ON) <input type="checkbox"/> 1 COAT TIME (sec) <input type="text"/> 300 <b>IDLE WATTS STPT</b> <input type="text"/> 0 IDLE VOLTS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0		<b>POS #3</b> RF-SS#2 InSn ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 0 DELAY TIME (sec) <input type="text"/> 0 CTRL MODE (0=W, 1=V) <input type="checkbox"/> 0 <b>RAMP UP / DN (sec)</b> <input type="text"/> 0 WATTS STPT <input type="text"/> 0 VOLTS STPT (mA) <input type="text"/> 0 <b>SHUTTER DELAY (sec)</b> <input type="text"/> 0 SHUTTER (0=OFF, 1=ON) <input type="checkbox"/> 0 COAT TIME (sec) <input type="text"/> 0 <b>IDLE WATTS STPT</b> <input type="text"/> 0 IDLE VOLTS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0	
		<b>DC POWER SUPPLIES</b> ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 0 CTRL MODE (0=W, 1=A, 2=V) <input type="checkbox"/> 0 <b>DELAY TIME (sec)</b> <input type="text"/> 0 RAMP UP / DN (sec) <input type="text"/> 0 WATTS STPT <input type="text"/> 0 <b>VOLTS STPT</b> <input type="text"/> 0 AMPS STPT (mA) <input type="text"/> 0 SHUTTER DELAY (sec) <input type="text"/> 0 <b>SHUTTER (0=OFF, 1=ON)</b> <input type="checkbox"/> 0 COAT TIME (sec) <input type="text"/> 0 <b>IDLE WATTS STPT</b> <input type="text"/> 0 <b>IDLE VOLTS STPT</b> <input type="text"/> 0 IDLE AMPS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0		<b>POS #2</b> MDX 1K#1 Ta ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 0 DELAY TIME (sec) <input type="text"/> 0 CTRL MODE (0=W, 1=A, 2=V) <input type="checkbox"/> 0 <b>RAMP UP / DN (sec)</b> <input type="text"/> 0 WATTS STPT <input type="text"/> 0 <b>VOLTS STPT</b> <input type="text"/> 0 AMPS STPT (mA) <input type="text"/> 0 SHUTTER DELAY (sec) <input type="text"/> 0 <b>SHUTTER (0=OFF, 1=ON)</b> <input type="checkbox"/> 0 COAT TIME (sec) <input type="text"/> 0 <b>IDLE WATTS STPT</b> <input type="text"/> 0 <b>IDLE VOLTS STPT</b> <input type="text"/> 0 IDLE AMPS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0		<b>POS #4</b> MDX 1K#2 Cu ON-OFF (0=OFF, 1=ON) <input type="checkbox"/> 0 DELAY TIME (sec) <input type="text"/> 0 CTRL MODE (0=W, 1=A, 2=V) <input type="checkbox"/> 0 <b>RAMP UP / DN (sec)</b> <input type="text"/> 0 WATTS STPT <input type="text"/> 0 <b>VOLTS STPT</b> <input type="text"/> 0 AMPS STPT (mA) <input type="text"/> 0 SHUTTER DELAY (sec) <input type="text"/> 0 <b>SHUTTER (0=OFF, 1=ON)</b> <input type="checkbox"/> 0 COAT TIME (sec) <input type="text"/> 0 <b>IDLE WATTS STPT</b> <input type="text"/> 0 <b>IDLE VOLTS STPT</b> <input type="text"/> 0 IDLE AMPS STPT (mA) <input type="text"/> 0 <b>SWITCH OUTPUT</b> (0=OFF, 1=ON) <input type="checkbox"/> 0	

PRINT SCREEN

Clear Clear All

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## AJA 1- Standard Operating Procedure

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### PROGRAMMING OF LAYERS AND PROCESSES (CONTD)

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- 9.3 Select **SAVE** to save layer. Avoid using ‘.’ ‘/’ ‘,’ (periods, slashes, comma) in the file name. These seem to cause software problems. You can use ‘\_’ and ‘-’ (under-scores, hyphens) in the file name as they seem to work okay. All recipe file names will be saved in the recipe folder (on the Window’s desktop) with the extension ‘.rcp’ and filed with the logged-in user's 4 digit PIN number in front of the name.
- 9.4 To create a process, select **Program Processes**. From the list of layers, choose a sequence of layers to create your desired process. All processes must begin with the **'base' layer (base.rcp)** and terminate with the **'end' layer (end.rcp)**. See Appendix on last page for details.
- 9.5 Select **Save** to save process. Avoid using ‘.’ ‘/’ ‘,’ (periods, slashes, commas) in the file name. These seem to cause software problems. ‘\_’ and ‘-’ seem to work okay. All process file names will be saved in the recipe folder (on the Window’s desktop) with the extension ‘.ajp’ and filed with the logged- in user's 4 digit PIN number in front of the name.

## 10 DEPOSITING FILM

- 10.1 Select **Run Process** in upper left corner of screen.
- 10.2 Select **Browse** and choose the intended process. Make any notes you wish to save with the data log file of the run.
- 10.3 Select **Next**.
- 10.4 Turn on table rotation. Switch must be in **‘Run’** mode, turn up dial to 50% (~RPMs).
- 10.5 Select **Start**.
- 10.6 Be sure to record necessary data in the log book such as:
- 10.6.1 Number of Amps reached during process (If using DC gun)
  - 10.6.2 Number of Watts Reflected Power during process (If using RF gun)
  - 10.6.3 Setpoint and Actual Gas flow rates
  - 10.6.4 Setpoint and Actual Process Pressure (look at Gauge B while the process is running – this is the capacitance manometer gauge “CM”)
- 10.7 When finished, a window pops up saying **Process Complete**. Click **OK** to acknowledge the message.
- 10.8 Turn off table rotation by returning dial to 0%, and then switch back to 'Jog' mode.

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### 11 SAMPLE UNLOADING

- 11.1 If Load Lock is not already under vacuum, turn on **Load Lock Vacuum Pump ("L.L." on computer screen)**. Once the L.L. is in the  $10^{-5}$ 's range, it is okay to proceed:
- 11.2 Open **Load Lock Gate Valve**.
- 11.3 Make certain the Stage is in the **UP** position with the **UP LED** lit. Push the Transfer Fork all the way into the chamber which should slip the Fork around the base of the Substrate Holder.
- 11.4 Bring the Stage down using the **yellow DOWN** button on the **Rotation/Z- Height Control Panel**. Continue to press the yellow button until the **Down LED** is lit. Stage will stop moving when in the Down position.
- 11.5 Pull the Transfer Fork out (with the Substrate Holder); note it must be pulled out as far as possible to contact the micro-switch.
- 11.6 Close the **Load Lock Gate Valve**.
- 11.7 Turn off **Load Lock Pump ("L.L." on computer screen)**.
- 11.8 Wait until vented.

### 12 LOGGING OFF

- 12.1 Pump down the Load Lock by returning the cover lid to this chamber, and then turn on the **Load Lock Vacuum Pump ("L.L." on computer screen)**.
- 12.2 Make certain the **Load Lock Gate Valve** is closed.
- 12.3 Log out on the AJA screen, leaving the computer on the log in screen.
- 12.4 Fill out any remaining info in the log book.
- 12.5 Log out of the MNC Badger system.

### 13 SUBSTRATE BIASING

- 13.1 Applying a bias in the presence of a partial pressure of gas creates a localized plasma at the surface of the substrate. Prior to deposition, this plasma can be used to pre-clean, oxidize, or gently etch a substrate in preparation for the soon to be deposited film. During deposition, this plasma can provide gentle ion bombardment to improve film density, adhesion, and material reactivity.

Depending on the substrate and deposition material, either DC or RF power can be used to provide the bias. For non-conductive substrates, we recommend an RF bias.

Substrate bias can be applied on the RFMi 100/300 console manually (which would require unscrewing the clear film cover to access the knobs) or automatically by adding appropriate values to CH#1 column (see diagrams on page 7 – 11 for visual).

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### 14 Problems / Troubleshooting

- 14.1 Program goes into infinite loop
  - 14.1.1 Need to make certain a finite time is entered one of the program layers... into the "Coat Time" entry box. Zero causes an infinite loop in programming.
- 14.2 RF Power Source is not lighting
  - 14.2.1 Try using a strike layer in your process, i.e. increase pressure set point to 20 mtorr.
- 14.3 Files aren't listed in browser
  - 14.3.1 File names are saved with 4 digit PIN in front; make certain to log in using 4 digits.
- 14.4 Resolving Shield Flaking
  - 14.4.1 Place several clean room wipes on a table top.
  - 14.4.2 Remove shielding just like doing a target change. If shutter has loose flakes, try to contain them as the shutter is removed, and throw these into the trash.
  - 14.4.3 Gently tap the chimney assembly and shutter on the stack of wipes.
  - 14.4.4 If the flaking is bad, use the wire brush and scrub the shielding, collect the flakes in a wipe, dispose of the flakes in the trash (Gold flakes should be turned into NFC staff if possible – for recycling)
  - 14.4.5 Lightly dampen a clean room wipe with Isopropyl and wipe off the fixture(s).
  - 14.4.6 Blow the shielding off with N2, direct the N2 over the shield and into the trash
  - 14.4.7 Get a new clean room wipe, gently re-tap the shielding over the wipe, if it is still flaking, contact NFC staff, turn the red status indicator lamp on, and put the system into SHUTDOWN status in coral.
  - 14.4.8 If you feel that flaking metal has fallen into the chamber and would cause contamination to processing, contact NFC staff, turn the red status indicator lamp on, and put the system into SHUTDOWN status in coral.
  - 14.4.9 Please do not further disassemble the chimney assembly, or the shutter assembly (only remove them from the gun, as with any target change)
  - 14.4.10 Repeat this cleaning procedure with any of the other guns' fixtures if needed (especially the other guns' shutters, because debris can fall on your samples due to vibrations even when those other guns are not in use during your run)

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### 15 Appendix

Base Layer:

Chamber Enable = 1

Control = Position Mode = 0

Position Set point = 1000

Base Pressure = .001

All else is zero.

End Layer:

Chamber Enable = 1

Control = Position Mode = 0

Position Set point = 1000

All else is zero.