



## Standard Operating Procedure: Mask Aligner

SUSS MicroTec MA/BA6

December 2025

### **Contact Information:**

Shawn Wagoner (swagone@gmu.edu)

Sezin Sayin (ssayin@gmu.edu)

Pranav Choori (pchoori@gmu.edu)

### **Table of Contents**

1. Lab Safety Information.....	2
2. SUSS MA/BA6 Safety Information .....	3
3. Principles of Mask Aligner .....	4
4. Photolithography Process Flow .....	5
5. Operation.....	6
5.1. Start Screen .....	6
5.2. Setup the SUSS for Exposure .....	6
5.3. Exposure .....	8
5.4. Remove the Mask .....	9

## 1. Lab Safety Information

- ✓ All GMU NFF users are required to complete the Lab Safety Orientation (LSO) before performing any lab work.
- ✓ Proper Personal Protective Equipment (PPE) should always be worn before entering the clean room: safety glasses, hair net, shoe covers, gloves, and lab coat. Additional PPE is available for specialized chemical work as needed.
- ✓ No shorts, sandals, tank tops, or spaghetti-strap shirts are allowed in the clean room!
- ✓ Material Safety Data Sheets (MSDS) are available in a binder in the gowning room.
- ✓ Read the SDS for any chemicals you plan to use before proceeding with your work. Any materials used in the clean room for the first time should be brought in after the approval of NFF staff.
- ✓ A safety buddy is required in the clean room with you when doing chemical work. They must remain in the clean room the entire time you are handling the chemical. Feel free to ask NFF staff if no one qualified is available!
- ✓ Prohibited clean room items: cardboard, pencils, cloth, hats/coats, and contact lenses.
- ✓ Accepted clean room items: plastic, pens, synthetic fabrics, clean room paper.

## 2. SUSS MA/BA6 Safety Information

- ✓ Any irregular system behavior should be reported to NFF staff promptly. Never attempt to fix the system yourself!
- ✓ Proper choice of a substrate chuck and mask holder is critical for proper machine operation. Ask for assistance from NFF staff to select the proper chuck and mask holder.
- ✓ The proximity flags on the back of the mask holder are delicate. Be careful when ever handling the mask holder so the proximity flags are not damaged.
- ✓ Gloves can become contaminated when loading wafers or removing wafers. Always check your gloves and replace them when necessary.
- ✓ Failure to use the system safely and properly may result in your access to the system being reviewed and/or revoked.
- ✓ Fill out the logbook before you begin.
- ✓ If a new recipe is required ask for assistance from the NFF staff.

### 3. Principles of Mask Aligner

As a key part of the photolithography process, the Mask Aligner can perform the precise alignment of photomask and substrate that is needed for creation of microscale structures.

SUSS MicroTec MA/BA6 Mask Alignment System is capable of topside alignment and backside alignment with mask sizes from 2.5" X 2.5" to 7" X 7". Substrate sizes can range from 1" to 150 mm diameter with maximum substrate thickness of 10 mm.



#### **4. Photolithography Process Flow**

This is not intended to be an in-depth guide to the photolithography but a simple outline of the steps involved. There are several steps to the photolithography process. Each step is simple but proper execution is required for a successful result. The steps of the photolithography process are (in order):

1. Coating of the substrate with photoresist.
2. Baking the resist prior to exposure.
3. Exposing the resist in an exposure tool.
4. Baking the resist after exposure.
5. Development of the exposed resist.

## 5. Operation

### 5.1. Start Screen

The Start Screen is shown in Figure 1.

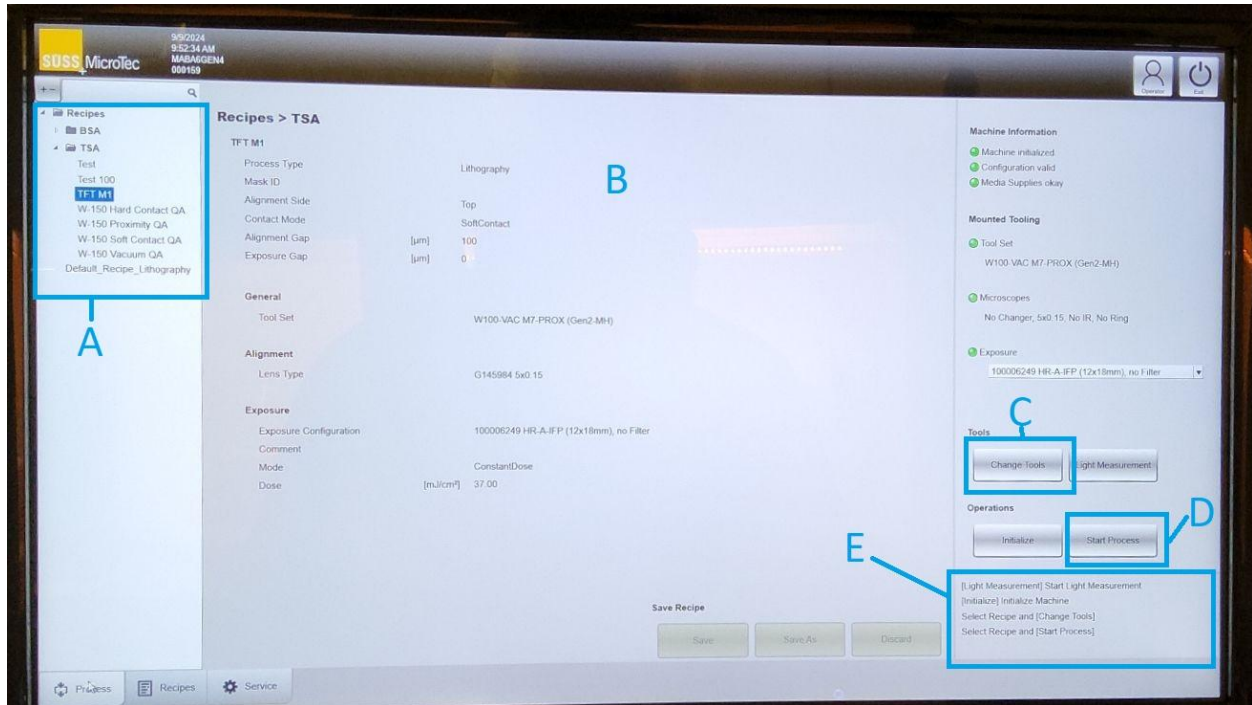


Figure 1.

There are different areas in the start screen that are used in an exposure sequence.

Area A – List of recipes available for use.

Area B – Parameters of the selected recipe.

Area C – “Change Tools” button used for changing the photomask

Area D – “Start Process” button used for starting the exposure sequence.

Area E – Box where the MA/BA6 gives the operator cues to progress to the next step.

### 5.2. Setup the SUSS for Exposure

1. Highlight the desired recipe in area “A” of the start screen. Contact a member of the NFF staff if you need assistance creating or modifying a recipe.
2. If the photomask needs to be changed click the “Change Tools” button. If the mask does not need to be changed, skip to 4.3 “Exposure”.

3. After pressing the “Change Tools” button the change tools screen appears. The change tools screen is shown in Figure 2.

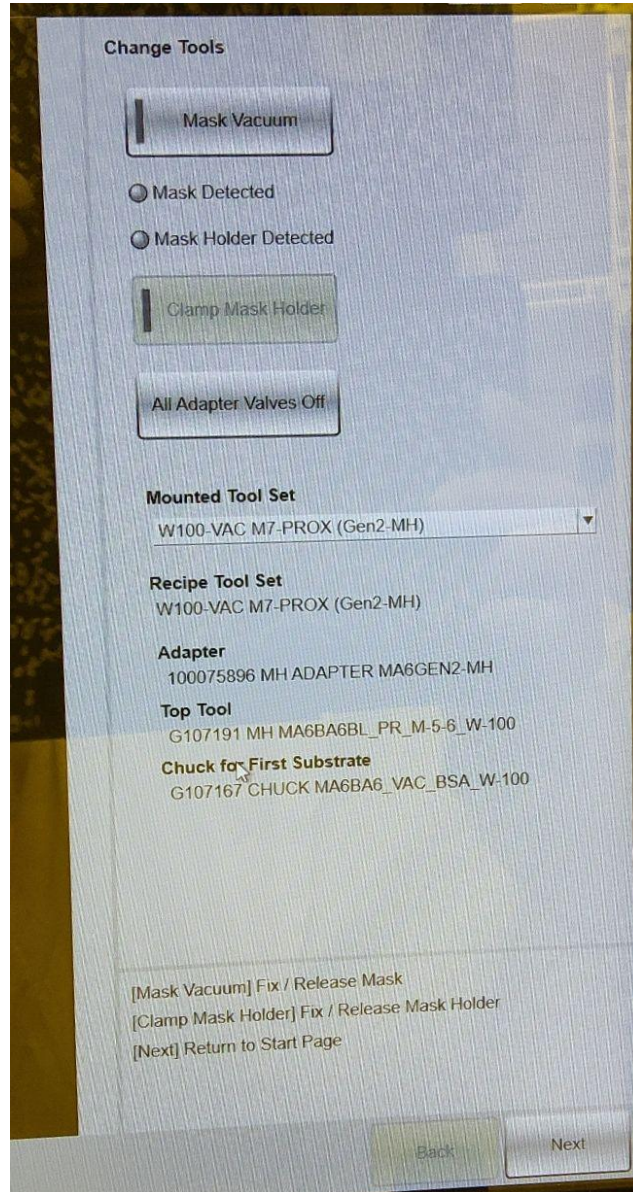


Figure 2.

4. Remove the mask holder from the machine and place it on the upper left surface of the machine in an upside-down orientation.
5. Place the photomask on the mask holder. A mask holder with a mask installed is shown in Figure 3.

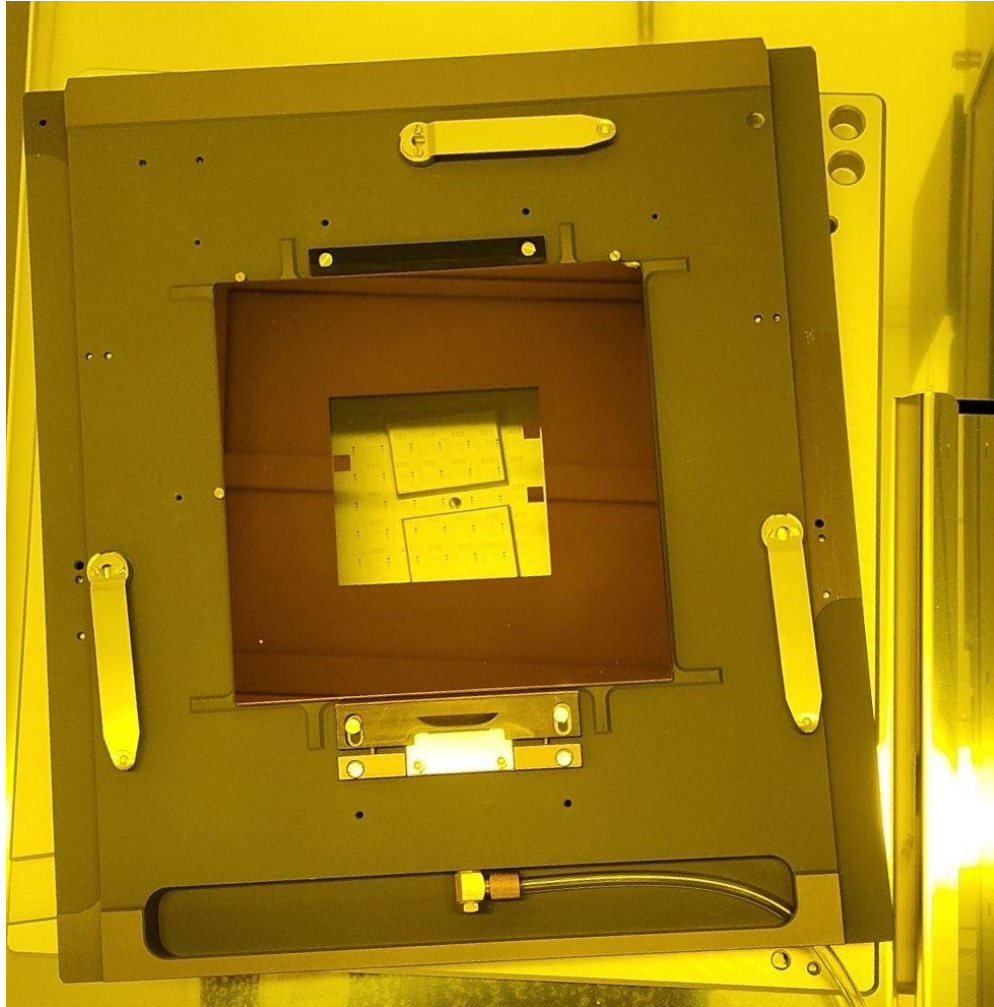


Figure 3.

6. Click the “Mask Vacuum” button. The mask will be held by vacuum and the green mask detected light will illuminate.
7. Place the mask holder back into the machine. The green mask holder detected light will illuminate.
8. Click the “Clamp Mask Holder” button. You should hear the mask holder being clamped into place.
9. Press the “Next” button to return to the start page.

### 5.3. Exposure

1. Press the “Start Process” on the start screen.
2. The machine walks through an exposure test. Press next.

3. Place the wafer chuck and the wafer on the slide. Click Next. A photo of a wafer on the chuck is shown in Figure 4.

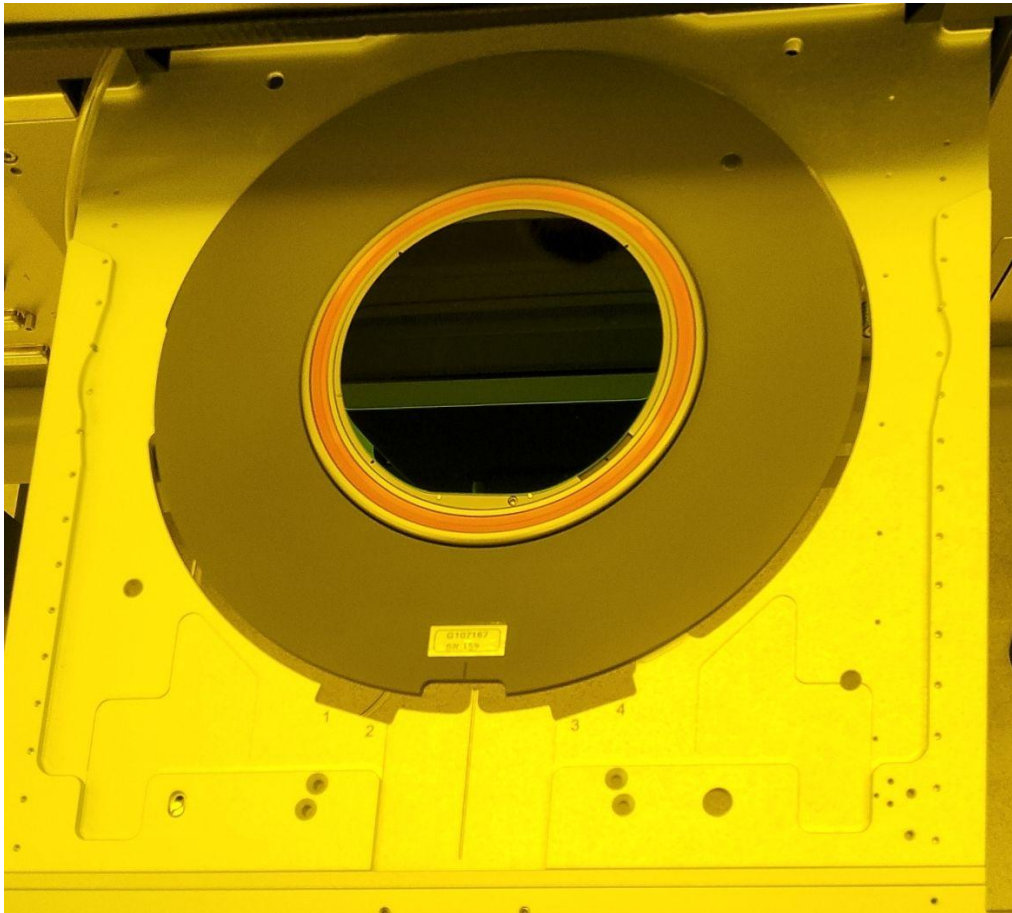


Figure 4.

4. Close the slide with the wafer and chuck and click Next.
5. The chuck and wafer will load into position under the mask. The cameras will move into position over the mask.
6. If necessary, perform alignment of the wafer to the mask.
7. Click Next to expose the wafer.
8. The machine will tell you to open the slide and remove the wafer (and chuck if no further exposures are needed).
9. Press “Back” to go to the start screen.

#### 5.4. Remove the Mask

1. From the start screen press the “change tools” button.

2. Click the “Clamp Mask Holder” button. You should hear the mask holder being clamp releasing the mask holder.
3. Remove the mask holder from the machine and place it on the upper left surface of the machine in an upside-down orientation.
4. Click the “Mask Vacuum” button. The mask vacuum will release the mask and the green mask detected light will turn off.
5. Remove the photomask from the holder.
6. Place the mask holder back into the machine. The green mask holder detected light will illuminate.
7. Press the “Next” button to return to the start page.