

Tegramin 30 Polisher – General Use

The Tegramin 30 Polisher is a fully programmable grinder/polisher capable of both mechanical and chemical polishing. Equipped with automated chemical/slurry dispensing and the ability to apply equal force to up to 6 samples at a time. The Tegramin 30 allows for replicable higher throughput polishing. The system is designed to handle Struers wide variety of MD grinding/polishing pads and slurries. Contact staff to discuss which consumables would be ideal for your specific process.

Prerequisites for operating the Tegramin 30 Polisher:

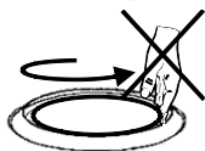
- a) Obtain a NRF ID (if you do not already have one) by completing the [NRF Lab Use Request Form](#) and safety training.
- b) Receive “one on one” training and certification from NRF Staff. Discuss your process with a staff member.

Safety

DANGER! Do not remove the covers of the instrument. Do not modify the instrument.

1. **Risk to physical injury** - The User must observe caution when loading/unloading samples from the system. Never try to move samples while the base is rotating as this could cause severe injury to hands and fingers.

Manual Preparation



WARNING

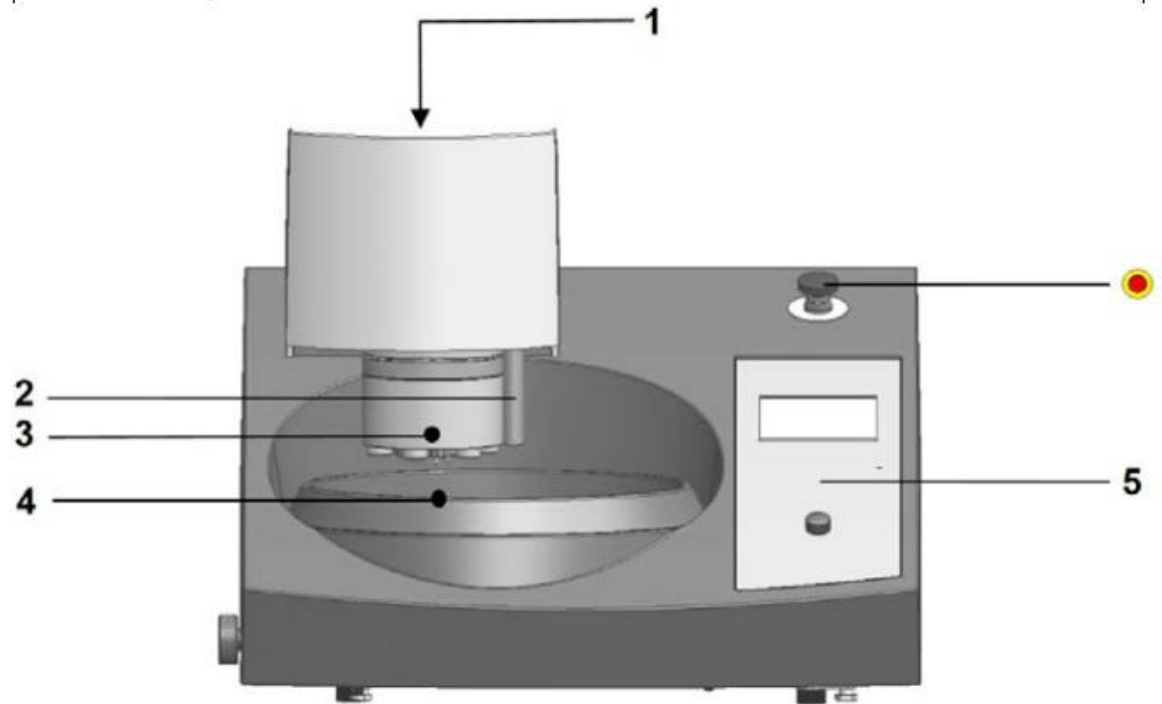
- While grinding manually, be careful not to touch the grinding surface.
- Wear gloves to protect fingers from abrasives and warm specimens.
- Wear safety goggles if required in the consumables SDS.
- Do not attempt to collect a specimen from the tray while the disc is running.
- While the disc is rotating, ensure hands are kept well clear of its periphery and out of the bowl.

1.0 Pre-Operation

- 1.1 Tool Reservations may be made via the NRF Reservation Page.
<https://rsc.aux.eng.ufl.edu/resources/default.asp>
- 1.2 Change gloves. **WARNING** Proper cleaning of the tool will prevent cross contamination of grit sizes which will affect your polish and subsequent users polishing!!
- 1.3 Log into the tool by using the TUMI computer in Room 125.

2.0 System overview

1. The system consists of two utility inputs (water, compressed air), the bowl and bowl liner, polishing chuck, sample plate holder with 6 adjustable force pistons, dosing nozzles for precise control of abrasive, adjustable water dispenser with variable knob, an emergency off switch, safety cover and the front panel controller. See schematics below for locations of most of these pieces. Additionally it is equipped with the MD magnetic chuck allowing for very stable polishing pad surfaces. Consequently, this tool requires use of Struers MD pads for polishing. Please do not put random pads onto the tool without consulting staff.
















- 1 Adjustment screw for the specimen mover plate height
- 2 Dosing nozzles
- 3 Button for release of specimen holder/ mover plate
- 4 Bowl and Bowl Liner
- 5 Front panel control(s)

2. The Front panel controller is the main way you will setup all your recipes. It consists of simple keys that have set functions as well as a more complex menu system for setting up multiple step recipes. While you can run the tool as a simple polisher like the Allied Multiprep, the advanced programming of recipes allows for highly programmable and reproducible polishes.



Front Panel

Front Panel Controls

	Key	Function		Key	Function
FUNCTION KEY		Controls for various purposes. See the bottom line of the individual screens.			
DISC ROTATION		Starts rotation of the disc.	WATER		Manual override - push button to apply water (applies water when no process is running). Push button again to stop applying water (water will automatically switch off after 5 min.) ²
LUBRICANT		Only active when dosing module is installed. Manual override – push button to apply lubricant from the doser bottle.	ABRASIVE		Only active when dosing module is installed. Manual override – push button to apply diamond suspension from the doser bottle.
LEFT		Moves the specimen holder head left.	RIGHT		Moves the specimen holder head right.
LOWER/RAISE		Lowers & raises the specimen mover head when preparing single specimens or when adjusting positions of specimen mover plate or specimen holder.	ROTATE		Rotates the Specimen Mover Plate.
START		Starts the preparation process.	STOP		Stops the preparation process.
ESC		Returns to the Main Menu or aborts functions/changes.	Turn/Push Knob		Used for entering and changing steps and parameters. Combined cursor and enter key. Enables selected parameter values to be activated for editing. Saves the edited parameter values. Toggles when only 2 options available.

3.0 Pre – Operation Considerations

The user must understand what consumables are needed for their grind/polish and confirm that the pads/slurries are available or compatible with the system. **All CMP chemistries/slurries must be approved by staff to be compatible with the system before use. Proper waste streams may need to be made prior to use.** And individual SOPs may need to be made for proper cleanup/waste handling on a

case-by-case basis. For mechanical polishing just identifying what pads are needed/available/compatible is sufficient.




4.0 Operation

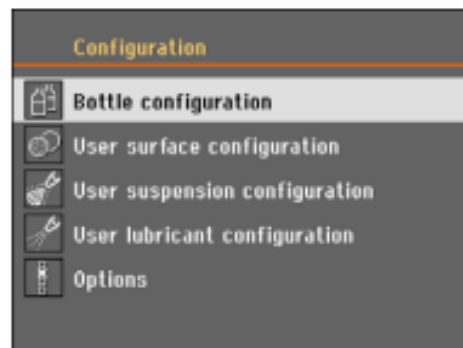
Prior to any CMP runs, confirm your process is vetted with staff and proper waste bottles are prepared. Failure to do so can result in loss of tool use. A sample run sheet is attached in this SOP. For new processes make sure to fill out the sheet and for CMP send it to staff for confirmation. An example of this run sheet for processing silicon can be found at the back of this SOP.

4.1 System startup



1. Log onto the Tegramin 30 polishing system with the TUMI computer located in room 1225.
2. Turn on the cooling water and the compressed air utilities.
3. Turn on the power switch on the back of the tool.
4. Load the sample bottles with the media you plan on using.

Before a preparation can be started, the bottles with suspensions and lubricants must be configured.

-  Turn the knob to select *Configuration*.
-  Push knob to activate the *Configuration Menu*.
-  Turn the knob to select *Bottle configuration*




Depending on the number of pumps installed, from 1 to 7 configuration possibilities are displayed.

-  Turn knob to select the first bottle.
-  Push knob to toggle between *Suspension*, *Lubricant* or *None* (if no dosing bottle is connected).
If a bottle with diamond suspension is connected to pump 1, select *Suspension*.



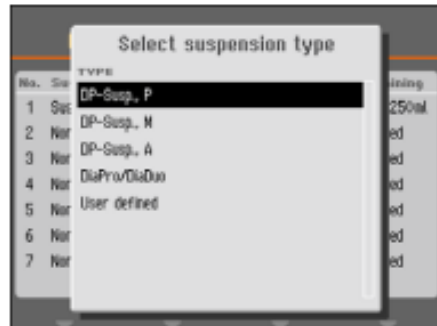
No.	Susp./Lub.	Type	Remaining
1	Suspension	DP-Suspension, P 15 µm	200-250ml
2	None		Disabled
3	None		Disabled
4	None		Disabled
5	None		Disabled
6	None		Disabled
7	None		Disabled



-  Turn knob to select *Type*.



Push knob to display the *Select suspension type* menu.



Select the correct type and grain size of the suspension you are using.

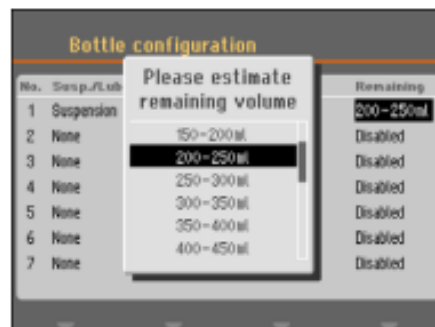


Push knob to save the selection.



Turn knob to select *Remaining*.

Push knob and a pop-up will appear.



Turn knob to select the approximate volume that is in the bottle and push the knob to save this value.

(This function requires that the parameter: *Level measuring in bottles* in the *Options* menu under *Configuration* is set to Yes.)



The amount of every suspension or lubricant used in the following preparations is automatically calculated and deducted from the remaining volume in each of the bottles and a message is displayed when the calculated volume gets too low.

Repeat the procedure for all of the following pumps / bottles until all bottles are configured correctly.

4.2 Sample Preparation

1. If using the thin section holder, or individual sample holder both require adhering your sample to them via crystal bond.
2. Using the hotplate on a setting of 7 (the one across from the solvent hood in [room 1252](#)) heat the metal holder. Using crystal bond mount your sample(s) onto the plate(s). Ensure your sample is firmly pressed onto the holder to ensure a thin layer of crystal bond is between your sample and the holder.
3. Carefully remove the holder from the hotplate onto the heat sink next to it to solidify the crystal bond.

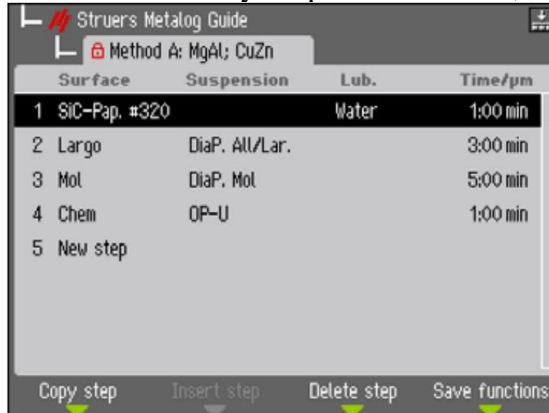
4.3 Manual Operation (Similar to Multiprep)

1. From the Main menu, select Manual preparation.
2. Set the individual preparation parameters and consumables used.
3. Load the surface to be used and double check consumables are loaded.
4. If using CMP, ensure collection containers are set up at the outlet of the water outlet for proper disposal.
5. Load the sample holder/plate by pressing the big round button located on the sample plate holder head. This should allow the pin to slide further up into the machine. If using the holder with alignment holes, align the 3 pins by rotating the plate until the plate fully slides up into the machine. You will know it was correct if when you release the button the sample plate is held firmly in place.
6. Press the lower/raise button and ensure the plate doesn't touch the bottom surface. If using the specimen mover plate, it should be at minimum 2mm above the polishing surface.
 - a. If it is not consult staff for adjusting the plate height.
7. Place the thin section holders with samples mounted in up to 3 of the available sample spots in the specimen mover plate.
 - a. Ensure the samples are in good contact with the polishing pads.
8. Press Start. The disc will start turning at the pre-set speed and dosing will commence.
 - a. The disc and dosing will stop automatically when the pre-set time expires.

4.4 Programmed Methods (Specimen holder methods & Single specimen methods)

1. From the Main menu, select either Specimen holder methods (single piston applying pressure, aka single sample) or Single specimen method (multiple pistons applying pressure, up to 3 samples being ran).
2. The first screen that opens is the Method groups, select NRF Users or Struers Metalog Guide.
 - a. All method parameters are exactly the same when a method is created initially, except for the force. The relation between single specimen force and specimen holder force is 1 to 6, i.e. 30 N in single specimen mode will be 180 N in specimen holder mode and vice versa.
3. Select the method you want to use or create a new one for a new process. (Example below)

- a. Refer to your Grinding/Polishing Plan. Each step in a method corresponds to one block in your plan such as PG, FG, DP, OP.



4. Select each step and ensure it matches your plan and hit save.



5. Load the surface to be used and double check consumables are loaded.
6. If using CMP, ensure collection containers are set up at the outlet of the water outlet for proper disposal.
7. Load the sample holder/plate by pressing the black round button located on the sample plate holder head. This should allow the pin to slide further up into the machine. If using the holder with alignment holes, align the 3 pins by rotating the plate until the plate fully slides up into the machine. You will know it was correct if when you release the button the sample plate is held firmly in place.
8. Press the lower/raise button and ensure the plate doesn't touch the bottom surface. If using the specimen mover plate, it should be at minimum 2mm above the polishing surface.
 - a. If it is not consult staff for adjusting the plate height.
9. Place the thin section holders with samples mounted in up to 3 of the available sample spots in the specimen mover plate.
 - a. Ensure the samples are in good contact with the polishing pads.
10. Select each step as you process, Press Start, this will start that respective step. The disc will start turning at the pre-set speed and dosing will commence.
11. The disc and dosing will stop automatically when the pre-set time expires.

12. Continue with swapping out polishing pads between steps. Ensure minimal contamination of pads between steps for best polish.
 - a. You may want to confirm through optical microscopy the effectivity of your polish. You can rerun the same step multiple times if needed to ensure effective polishing.

4.5 System shutdown

1. Remove and clean all polishing plates and sample holders from the tool.
 - a. Clean all polishing plates/sample holders used with DI water.
2. Any of the bottles used for slurries should be properly cleaned out and filled with DI water for subsequent users.
3. For the bottles/tubes used perform the tube cleaning procedure to remove any leftover media in the transfer tubes.
 - a. Go to the Maintenance menu and select Cleaning of tubes then follow the on-screen instructions.
 - b. Press F4 to select all the tubes that have been used. To select or unselect a single tube move the cursor to the respective tube and press Enter.
 - c. When 1 or more tubes have been selected, press F1 to start the cleaning process.
 - d. Follow the instructions on the screen to complete the operation.
4. Wipe down the specimen holder with wet paper towels or cloths and water. Ensure to remove as much of the polishing media as possible for subsequent users.
5. Perform a Bowl Clean operation.
 - a. Go to the Maintenance menu and select Cleaning of the bowl.
 - b. Set the cleaning time to 1 min, and the speed of the disc to 300 rpm, with additional water turned on.
 - c. This will help clear out any leftover particles left on the machine.
6. Once the system looks clean turn off the power to the tool and turn off the water and compressed air.

5.0 Available Consumables for Service Requests:

SiC Adhesive Pads	
<i>Grit</i>	<i>μm</i>
80	200
120	137
180	94
220	77
320	54
500	36
800	23
1000	18.5
1200	15.6
2000	9.6
4000	5

MD-System				
<i>Pad</i>	<i>Pad Material</i>	<i>Polish Material</i>	<i>Polish Grit</i>	<i>Notes</i>
MD-Gecko	Magnetic adapter plate for attaching adhesive films. (Ex. SiC pads)	N/A	N/A	Must be well cleaned between uses.
MD-Dac	Satin woven acetate	Universal	9 - 3 μm	
MD-Mol	Wool	Ferrous/non-ferrous metals and polymers	≤ 3μm	
MD-Plan	Woven polyester	Soft metals & Pre-polishing	15 - 3 μm	
MD-Nap	Short synthetic nap	Final polish	≤ 1μm Diamond, oxide slurries	
MD-Chem	Porous Neoprene	Final polish	≤ 1μm Oxide slurries	Ideal for CMP, chemically resistant

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Date: 3/20/2024

Grinding/Polishing Plan Example

Sample Description: Silicon wafer piece 1.5"x1.5", 500um thick mounted to the Thin section holder in the specimen mover plate

Grinding		PG (Plane Grinding)	FG1 (Fine Grinding)	FG2 (Fine Grinding)	FG3 (Fine Grinding)	FG4 (Fine Grinding)
<i>Steps</i>						
Surface	Type	SiC Foil #320	SiC Foil #500	SiC Foil #1200	SiC Foil #4000	
	Disc Speed	300	300	300	300	
Abrasive	Type					
	Predosing/dosing	0/0	0/0	0/0	0/0	
Lubricant	Type	Water	Water	Water	Water	
	Predosing/dosing	0/0	0/0	0/0	0/0	
	Force (N)	20	20	20	20	
	Holder Direction	>>	>>	>>	>>	
	Holder Speed	150	150	150	150	
	Time (min)	1	1	1	1	
	Goal Removal Amount (µm)	100	50	20	10	
Polishing						
Polishing		DP (Diamond Polish)	DP2 (Diamond Polish)	DP3 (Diamond Polish)	OP (Oxide Polish)	OP2 (Oxide Polish)
<i>Steps</i>						
Surface	Type	MD-Mol	MD-Nap		MD-Chem	
	Disc Speed	150	150		150	
Abrasive	Type	DiaPro Mol R 3 um	DiaPro Nap R 1 um		OP-S, 0.25 um	
	Predosing/dosing	3/12	3/14		1/10	
Lubricant	Type					
	Predosing/dosing					
	Force (N)	30	20		10	
	Holder Direction	>>	>>		><	
	Holder Speed	150	150		150	
	Time (min)	3	2		1	

Name:

Date:

Grinding/Polishing Plan

Sample Description:

Grinding		PG (Plane Grinding)	FG1 (Fine Grinding)	FG2 (Fine Grinding)	FG3 (Fine Grinding)	FG4 (Fine Grinding)
<i>Steps</i>						
Surface	Type					
	Disc Speed					
Abrasive	Type					
	Predosing/dosing					
Lubricant	Type					
	Predosing/dosing					
	Force (N)					
	Holder Direction					
	Holder Speed					
	Time (min)					
	Goal Removal Amount (µm)					

Polishing		DP (Diamond Polish)	DP2 (Diamond Polish)	DP3 (Diamond Polish)	OP (Oxide Polish)	OP2 (Oxide Polish)
<i>Steps</i>						
Surface	Type					
	Disc Speed					
Abrasive	Type					
	Predosing/dosing					
Lubricant	Type					
	Predosing/dosing					
	Force (N)					
	Holder Direction					
	Holder Speed					
	Time (min)					