

CMP (Chemical Mechanical Polishing) - STEAG MECAPOL 460

User Guide

Summary

- I. Machine Start-up
- II. Setting of the polishing parameters
- III. Starting the polishing
- IV. Stopping the machine

I. Machine Start-up

- a. Log on.
- b. Turn the machine on with the main switch (Fig. 1).



Fig. 1 : Main Panel

- c. Behind the tool there are two tubes (Fig. 2) for the slurry supply that are placed in a water container. **The tube #1 should be used only for specific slurries (contact staff).** Use tube #2 for standard slurries.



Fig. 2 : Pumps and tubes for slurries (behind the machine)

- d. Remove tube #2 from the water container and place it in the appropriate container of slurry (Fig. 3).



Fig. 3 : Back of the machine with tube #1 in the water container and tube #2 in a slurry container.

Slurries :

- **30N50** : Standard CMP slurry For SiO_2 and Si. Basic solution.
 - **40EA50** : For Si. This slurry should be used in a 1:10 dilution with water. There is a bucket with pure 40EA50, and a bucket with 1:10 diluted 40EA50. If needed refill the diluted bucket. Prepare the diluted solution using the beaker with a "CMP" label near the sink. **Do not use the beakers labeled "TSV"**.
 - **30H50** : Slurry reserved for specific applications. Contact staff for information.
 - For CMP of wafers with metallic layers, please contact staff.
- e. Take off the carpet/towels covering the polishing pad. Take the polishing head in the tray (Fig. 4) and humidify the joint, and secure the polishing head to the axis after humidifying the plastic joint (Fig. 5 left). Take the conditioning head and secure it to the axis (Fig. 5 right). There is a dedicated polishing head and a conditioning head for copper that are labeled "Cu". The non-labelled heads are for other materials (Si, SiO_2 , etc...). Make sure to check that the polishing head configuration is adapted to the thickness of the wafer to be polished. **Polishing heads are designed for 525 μm wafers. For every other dimensions, it is essential to change the black ring of the polishing head (contact staff).**

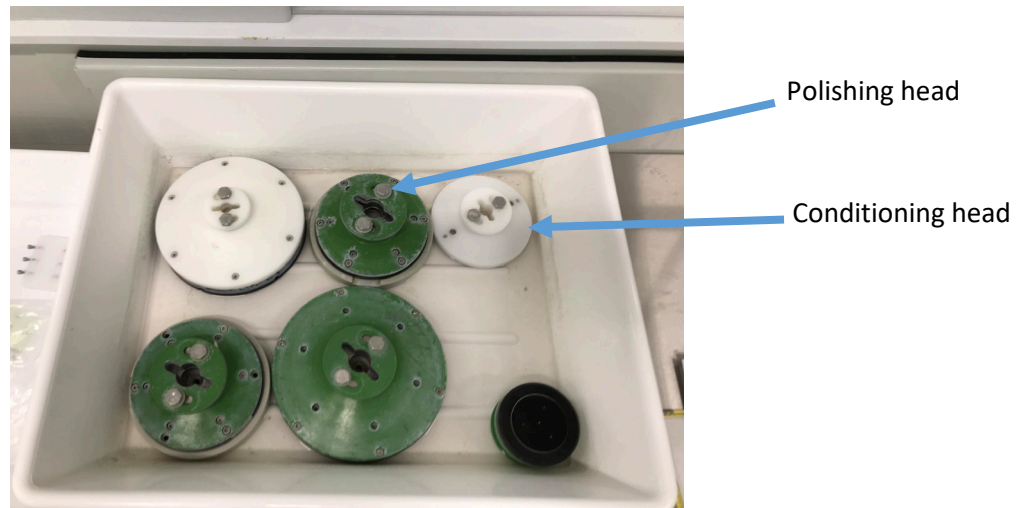


Fig. 4 : Polishing and conditioning heads

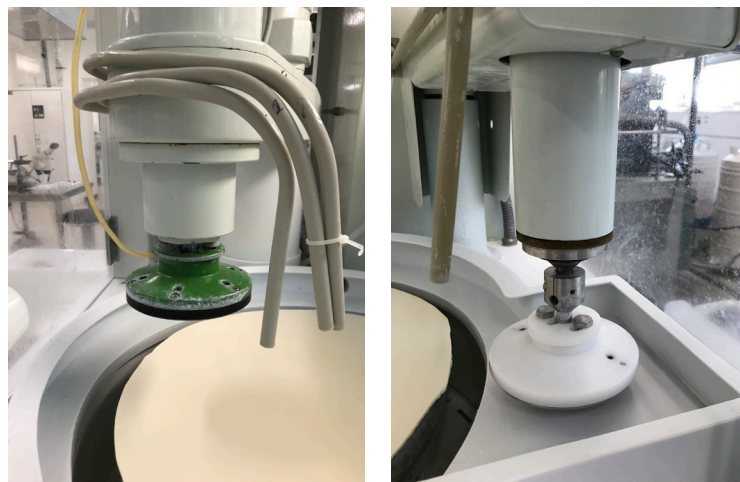


Fig. 5 : Mounted Polishing head (left) and Conditioning head (right)

- f. Make sure that the machine is in manual mode (Fig. 6). The red square button should be off.

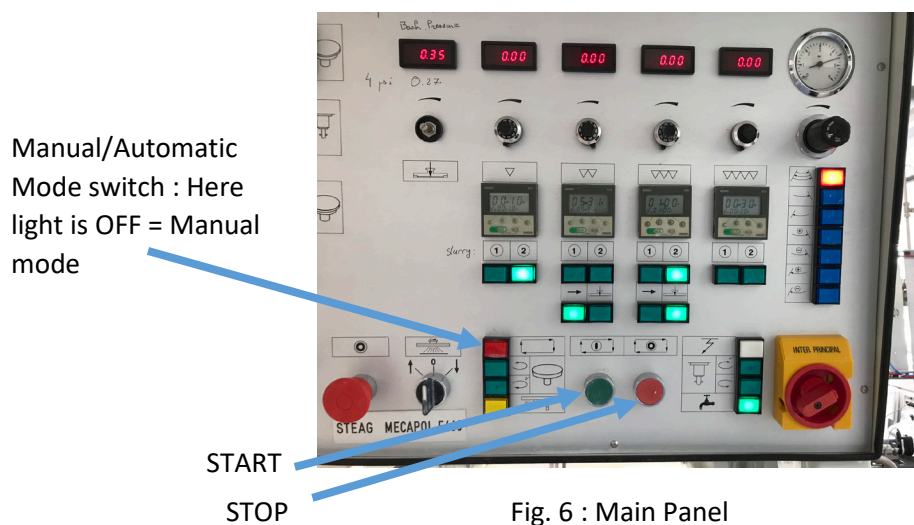


Fig. 6 : Main Panel

- g. Switch the pump ON (pump #2 if you are using slurry tube #2) by placing the lever on the left (Fig. 7). Rinse the line by pushing START (green round button on the main panel). Regulate the slurry flow to the maximum value. You will first see water flowing and after a moment slurry will flow (whitish color). When slurry flows, switch the flow to 2 and press STOP (red round button on the main panel).

Remark : If the red button lights on, please contact the staff.

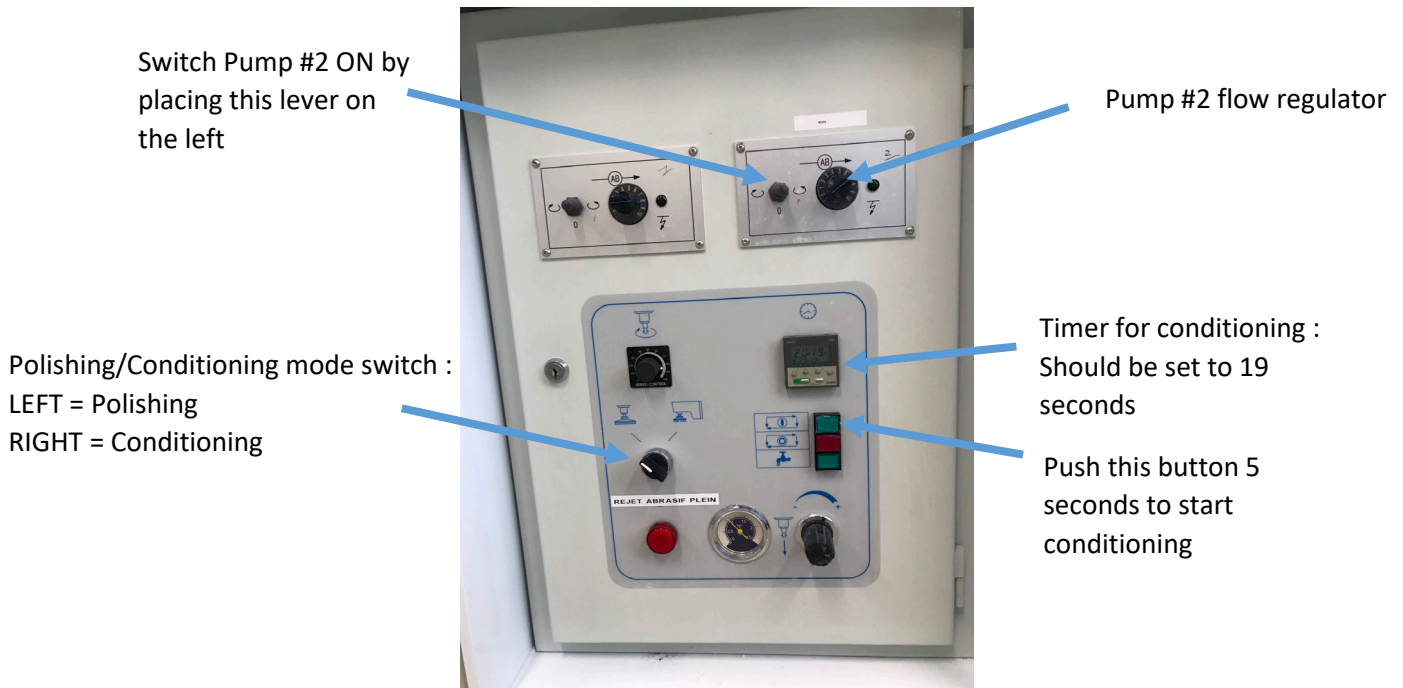


Fig. 7 : Panel for controlling the pumps, switching between polishing/conditioning mode and starting the conditioning

- h. Place the machine in Automatic mode (red square button should be ON on the main panel). Run a conditioning of the pad : switch to conditioning mode and push the green square button for 5 seconds (Fig. 7) until the polishing head starts to move away from the pad. The timer for the conditioning should be set to 19 seconds.

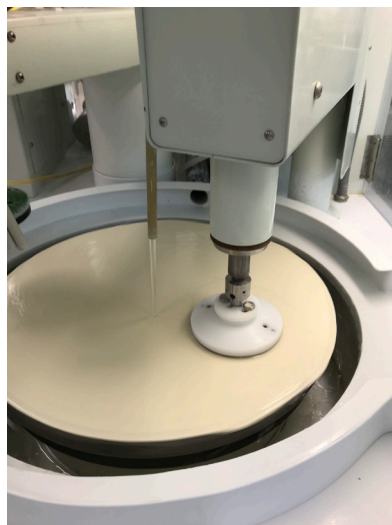


Fig. 8 : Conditioning running

II. Setting of the polishing parameters

The rotation direction of the polishing head and of the pad should both be clockwise (Fig. 9) (N.B. the light of these buttons do not work. The standard configuration is indicated with markers on the corresponding buttons).

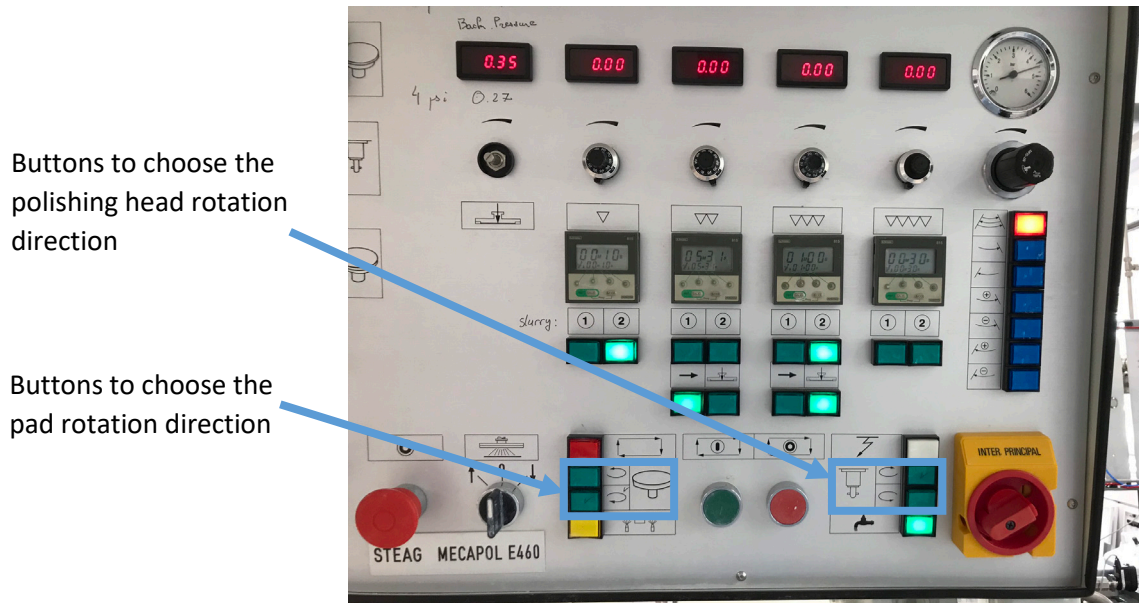


Fig. 9 : Main Panel : Control of the rotation direction of the pad and the polishing head

The CMP sequence has 4 steps that can be individually programmed. The steps are labeled with 1 to 4 triangles looking down (Step 1 = ▽, step 2 = ▽▽, etc...). Steps 2 and 3 can be skipped by switching on the green square button with an arrow facing right. When a process is launched, the steps are executed in a sequence. Step 1 corresponds to the landing of the polishing head on the pad, step 2 is generally skipped, step 3 is the polishing step, and step 4 is the rinsing.

Each step has the following parameters :

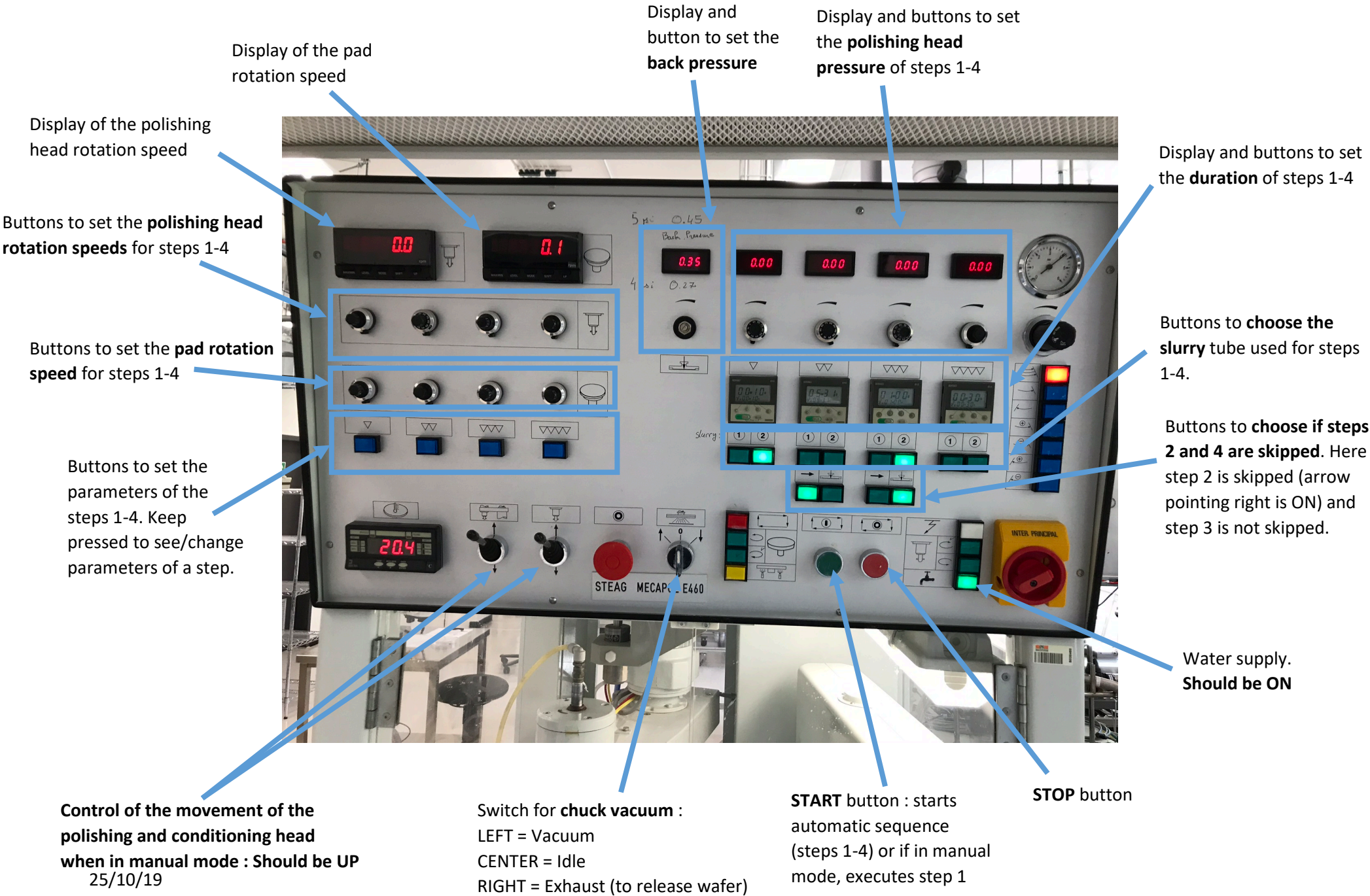
- Rotation speed of the pad
- Rotation speed of the polishing head
- Pressure of the polishing head
- Duration of the step

The rotation speed of the pad and of the polishing head during each step can be set on the left part of the panel (Fig. 10). The pressure of the polishing head and the duration of each step can be set on the right part of the panel. Press the square blue button corresponding to the step that you want to set and keep it pressed while changing all the parameters.

In addition the back pressure applied to the back of the wafer can be set. This value is not individually controllable but is the same for all the steps. Ideally the back pressure should be set just under the value where bubbles start to appear in the slurry during the polishing step. Set the initial value to 0.2 bar and when the polishing step starts adjust it.

Note : if a process is started in manual mode, the parameters corresponding to step 1 are used.

Fig. 10 : Main Panel : Control of the polishing parameters



Standard parameters :

Step	Duration	Pad rotation speed	Polishing head rotation speed	Polishing head pressure
1 ▽ (Landing)	10 s	50 rpm	40 rpm	0.2 bar
2 ▽ ▽ (Skip)	-	-	-	-
3 ▽ ▽ ▽ (Polishing)	1 min 30 s	85 rpm	78 rpm	0.79 bar
4 ▽ ▽ ▽ ▽ (Rinsing)	40 s	100 rpm	100 rpm	0.25 bar

III. Starting the polishing

Remark : It is strongly recommended to proceed to about 3 to 5 polishings with wafers “dummies” to stabilize the operating conditions of the machine.

- Make sure the machine is in automatic mode (red square button should be on)
- Switch to polishing mode (Polishing/Conditioning mode switch on left position, Fig. 7)
- Place the wafer in the wafer holder (plastic part where the polishing head is placed when not in use) with the side to be polished facing down (Fig. 11). Place the holder with the wafer under the polishing head and switch the chuck vacuum on (see Fig. 10). Remove the holder.



Fig. 11 : Wafer placed on the wafer holder

- Push the start button.
- The amplitude of the polishing head displacements can be set with the blue square buttons on the right (Fig. 12). The standard amplitude is chosen so as the polishing head goes almost until the extremity of the pad on the left and almost to the center of the pad. **Usually, it is not necessary to use these buttons except if the previous user has modified the amplitude settings.**

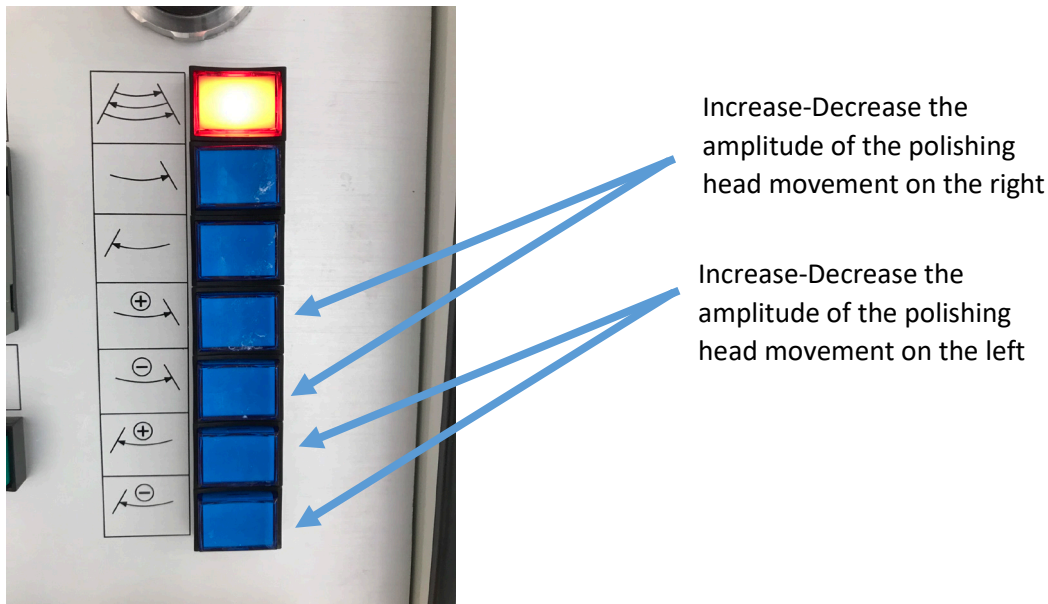


Fig. 12 : Main Panel : Control of polishing head movements amplitude

- f) When the polishing is finished, place the holder under the wafer and turn the vacuum off.
- g) Rinse the wafer in the water tank : place in the cassette and turn the water on (Fig. 13), with or without tank draining. When done, place the wafer in the spinner for drying, close it and turn it on.

Button to switch ON the rinsing tank drain. If OFF, the rinsing will be in "Cascade" mode, if ON, it will be in "Spray mode".

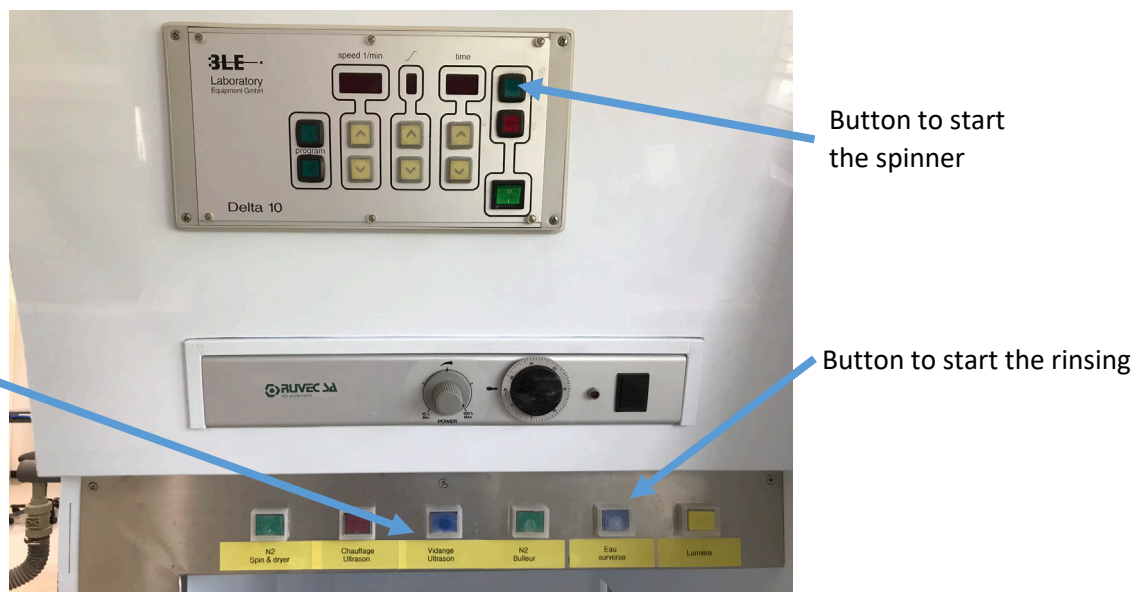


Fig. 13 : Controls for rinsing tank

N.B :

- If other wafers have to be processed, a conditioning should be run between each wafer.
- After rinsing, there will still be slurry residues on the wafer. It is possible to remove them using BHF, if compatible with the process flow.
- The "etch rate" of the CMP process is about 300 nm/min for SiO₂, and roughly the same for other materials.

IV. Stopping the machine

- a) Switch to manual mode (red square button off)
- b) Change the water in the beaker behind the machine if it is not clear.
- c) Regulate the flow of the slurry to about 7-8
- d) Push start and go behind the machine
- e) Take the tube from the slurry bucket and clean the outside with a tissue and fill it with DI water. Repeat if the tube is not clean. Place the tube in the bucket of water.
- f) Wait until there is no more slurry flowing out (only water).
- g) Start a conditioning step. Rinse the pad and the polishing head. Press stop when done.
- h) Remove the polishing head and rinse it again.
- i) Replace the carpet/tissues on the pad. Remove the conditioning head.
- j) Place the polishing and conditioning heads in the tray with water. Place the bucket full of water on the pad, under the tubes (Fig. 14). The tubes move down in the bucket when the machine is switched off.
- k) Switch off the machine with the main switch, and log off.

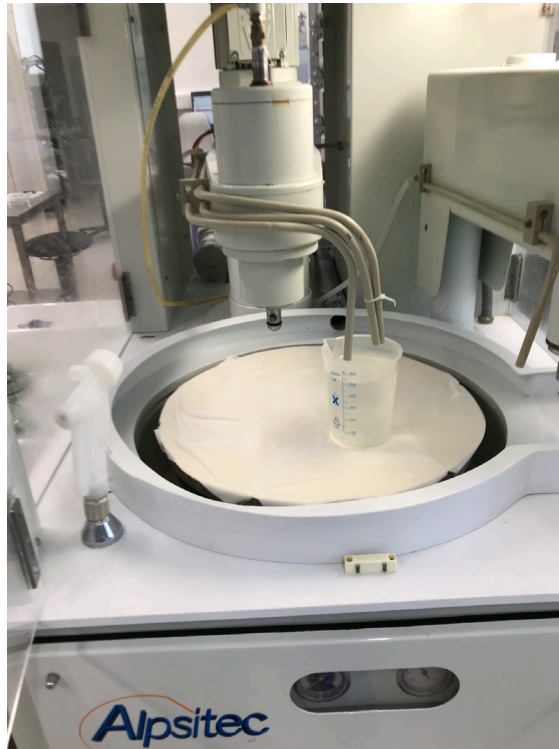


Fig. 14 : Machine in idle mode with wet towels and water bucket under the tubes.