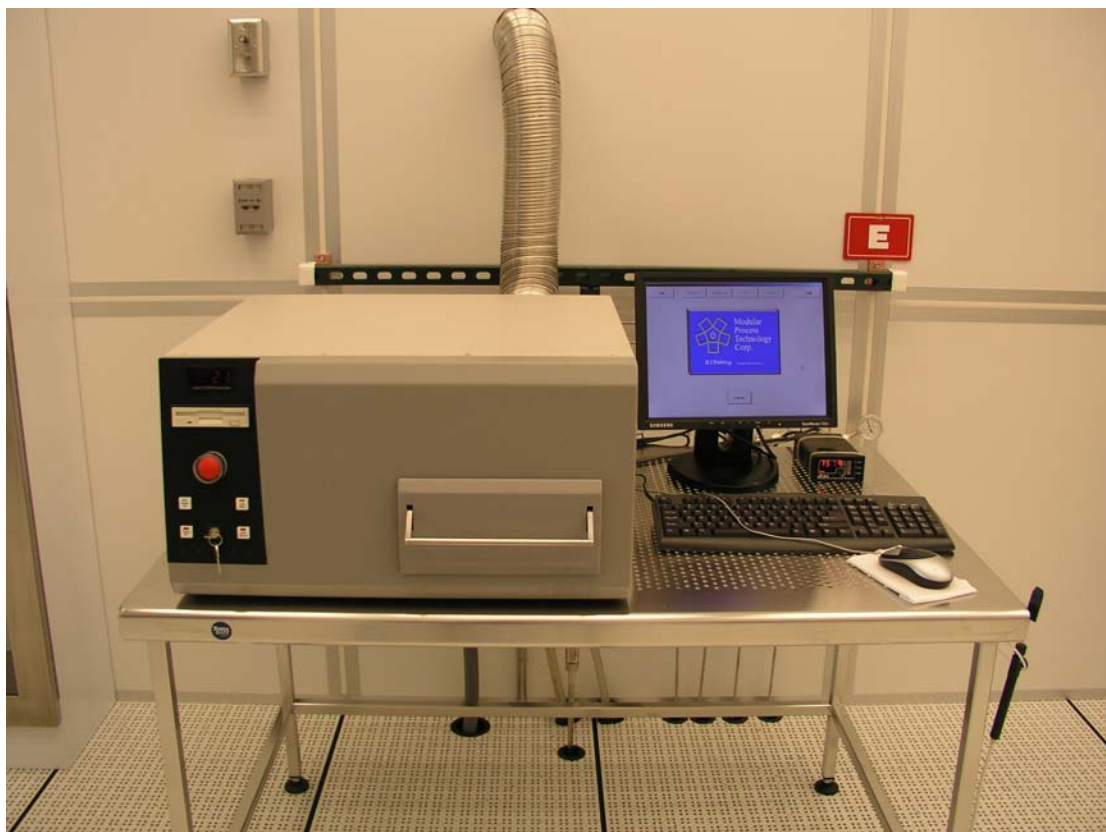# Modular Process Technology-RTP-600xp Rapid Thermal Processing System

Standard Operating Procedure Document for Rapid Thermal Processor
CNST Nanofab

National Institute of Standards and Technology (NIST)

Standard Operating Procedure Document for Rapid Thermal Processor

Overview

- The RTP-600xp system is an advanced bench-top rapid thermal processing system with multi-gas capabilities. The system processes wafers up to 6" in diameter. The integrated process control system features real-time graphics, recipe management, data acquisition and display and has a comprehensive diagnostic function. The system consists of a heating chamber unit with an integrated computer control system and software. The wafer to be processed is placed on a quartz tray, which slides into a quartz tube in the processing chamber. There are two sets of quartz tubes separated for CMOS application and other purposes. [see Figure 1]

- Processes The system can be used for Contact alloying, Implant activation, Silicide formation, Nitridation of metals and Oxidation.

- Stability: +/-2°C; Temperature Accuracy: +/-2°C.

Special Notes and Restrictions

- You must be qualified by a super user to use this tool.

- Introduction of materials other than Si, SiO$_2$ or SiN$_x$ into the chamber needs authorization from super user.

- **Do not run any chamber calibration and pyrometer calibration!**

Temperature Range: 250-1300°C; Ramp Rate: 0-150°C/sec; Temperature Control
Coral Name: RTP
Model: Modular Process Tech. Corp. RTP-600xp
Location: Nanofab, building 215, room B105, machine ID

Safety Precautions

- You must ensure the external water, air and water valves have been enabled before running the recipe.
- Handle the thermocouple and chamber carefully. Make sure the door is closed before running any recipe.
- **Do not exceed a steady state temperature >1250°C**.

Step-by-Step Instructions

1. Power Up Procedure

- Turn on the front panel key switch. [See Figure 2: Front Control Panel]
- Ensure all external water, gas and air valves have been enabled.
- Turn on the monitor if it is off. The "Power" LED on the front panel should illuminate green once system is turned on. Press the "EMO Reset" button to turn the entire computer system on if it is off. Log in and Enter Password. Choose user name "PROD" and enter password "P" for general user. Choose user name "ENG" and enter password "E" for general user.
- Once the RTP-600xp software is on, you are able to check all the gas banks, water, air and gas valves on/off by choosing the "BANK CONTROL" and "DIAGNOSTICS" button from "System" mode. [See Figure 3: System Diagnostics Screen]
- Press the "Power On" button – this enables the heating unit.
- **Troubleshooting tip**: if "Power On" button is not working or gas and water are not flowing, stop any operation and notify Nanofab staff and super-user.

2. Edit RTP recipe (if you need, get authorization from a super user.)

- It is recommended to choose an existing recipe for annealing and oxidation.
- Press "Engineering" mode in the main screen to edit the recipes. [see Figure 4] You can choose an existing recipe to copy and save under different name and edit it for

your purpose. You can also create a new recipe. [see Figure 5] After editing the
recipe, press "Validate" and then "Save" button to save the new recipe.

- You can set flow rates for different gases: N_2, Ar, O_2 and forming gas. You can set
  the ramp-up and hold time. Computer will remind you if you set a wrong time range
  shorter than that the RTP system allows [see Table 1: Maximum hold time at different
  Temperatures]

3. Run RTP recipe

- Pull the quartz tray out carefully and slowly. Make sure that the thermocouple wafer
  is connected and that no sample was left by the previous user.

- Place your samples on the wafer holder. Push the tray in and close the door slowly.

- **Recommendation**: you can run the recipe first with control samples or without any
  sample. This step will ensure the system is running properly without damaging you
  useful samples.

- Choose "Production" or "Engineering" mode in the main screen to run any recipe.
  Choose a recipe for oxidation or annealing. Press "Start Process". Let technical
  support and super user know if the temperature and gas flow are not controlled
  precisely (i.e. not following the recipe). The words "Process Over" will appear across
  the screen after the process has completed.

- You can view last-run data of the recipe by pressing "View Last Run".

- Pull out the tray and take out you sample carefully. **Do not pull the quartz tray out
  if the temperature is higher than 200°C.** Push the tray in carefully and close the
  door.

- Once your experiments are done, Press the "Cancel" button and get back to main
  screen. **Leave the system and computer on.**

4. Power Down Procedure

- The RTP-600xp system may be left with power on continuously, unless maintenance
  to the system requires removing power from the system. [Note: we recommend

leaving the computer on when the system is not in use. The system should be turned off only for maintenance and service.]

- Press the "Power off" button.

- Log off and select **[Exit]** from Main screen.

- Shut down operating system using appropriate Microsoft Windows procedures.

- Press the EMO switch.

- If any accessories are being used with the system, turn them off as needed.

- If system is to be left unattended for any extended period of time, the external water, gas and air inlets should be turned off.

Figure 1   Overview of RTP-600xp
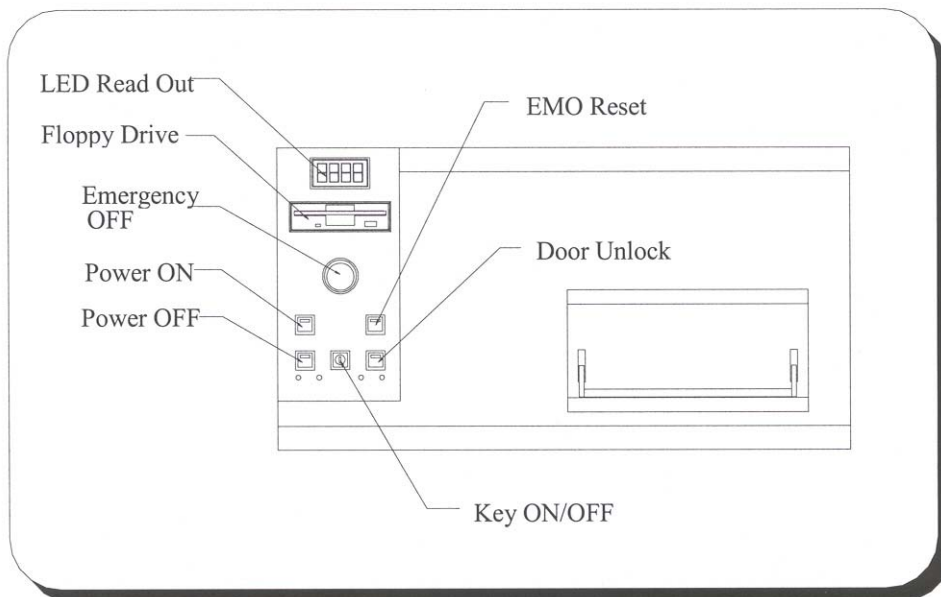
Figure 2   Front Control Panel
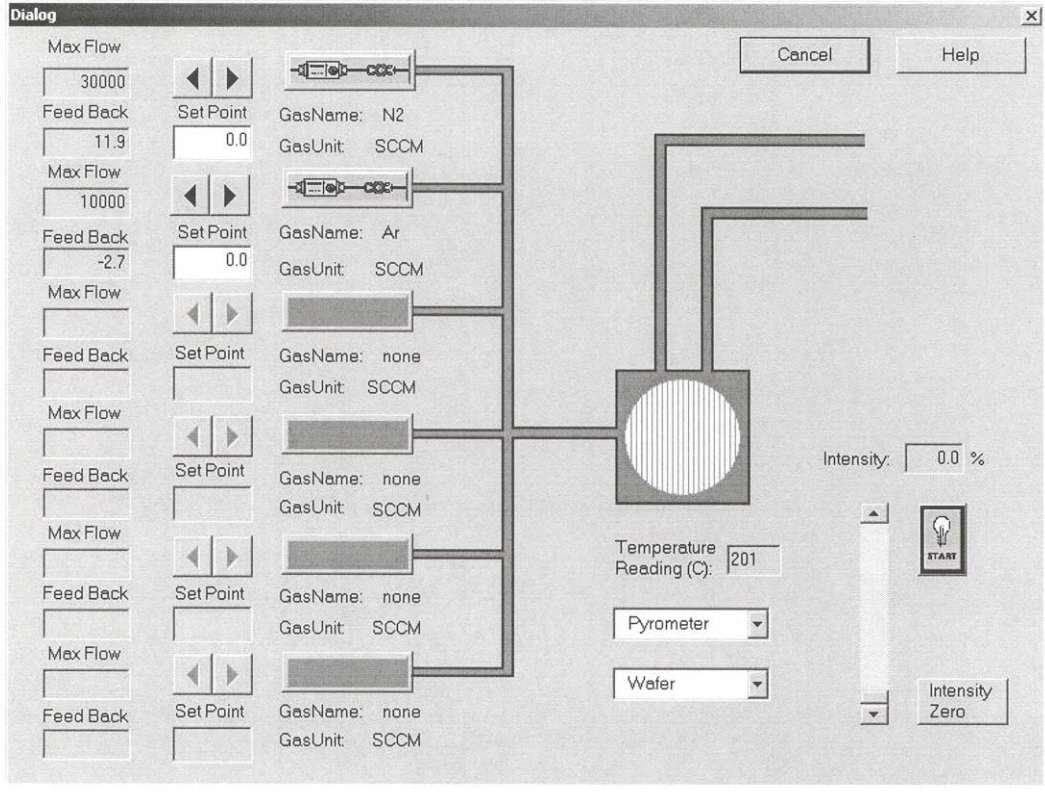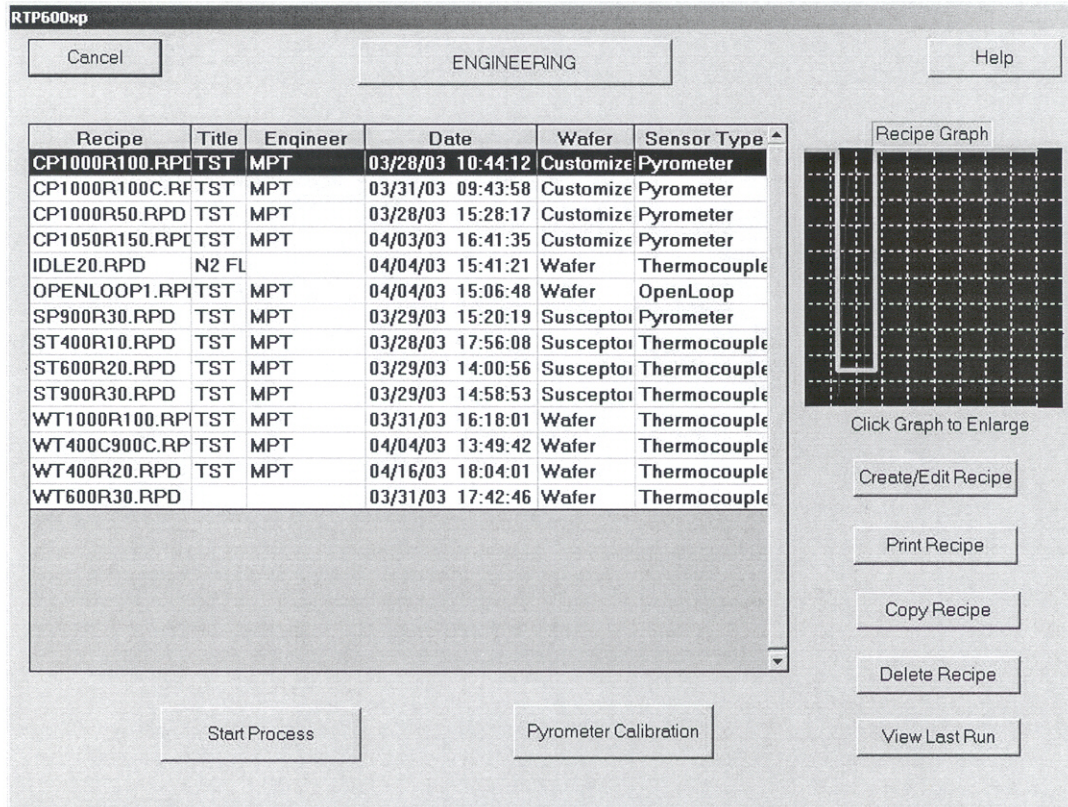
Figure 3   System Diagnostics Screen

Figure 4   Engineering Screen

Figure 5   Recipe Screen

Temperature/Deg. C.	Maximum Time/Seconds
1250	120
1200	150
1150	200
1100	300
1050	327
1000	360
950	400
900	450
850	514
800	600
750	720
700	900
650	1200
600	1800
550	3600
500	2592
450	3200
400	4050
350	5289
300	7200
250	9999 (maximum programmable time)

Table 1 Maximum time at different target temperatures