| DTU Nanolab | Always check on-line for validity. **Manual for furnace computers for the A-, B-, C- and E-stack furnaces** | | | | Level: **PM-III** | |
|---|---|---|---|---|---|---|
| | | | | | Approved by: | |
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## 1) Identification of the equipment

Tempress furnace computers.

## 2) Equipment responsible

The Thin Film group at DTU Nanolab is responsible for the furnace computers and should be adressed in case of problems, or if you need help. Please send an email to thinfilm@nanolab.dtu.dk. The contact information for the responsible persons can be found on the "Equipment Info" pages for the furnaces in LabManager.

## 3) Location of the eqiupment

There are two furnace computers in the cleanroom. See also section 6.

The computer for the A-, B- and C-stack furnaces is located in room B-1, on the table between the B- and C-stack furnaces.

The computer for the E-stack furnaces is the located on the table in room E-6.

## 4) Safety

**This manual only describes how to use the furnace computers. It does not replace training or reading of the user manuals for the individual furnaces.**

All furnaces can be controlled from the furnaces computer. Therefore it is very important to ensure, that the right furnace has been selected on the computer, and to keep an eye on the furnace that is being controlled from the computer.

## 5) Purpose

The furnace computers are used to control and view the status, recipes and log data for the A-, B-, C- and E-stack furnaces.

By use of the furnace computers it is possible to:

**1. View furnace recipes**
  • View recipe steps and parameters

**2. Start a process:**
  • Select and start a process.
  • Edit variable commands/process parameters

**3. Check furnace status**
  • See e.g. gas flows and temperature during a process

**4. Check log data**
  • After a process, the log data can be checked to see if there have been any problems during the process

## 6) Overview of the equipment

There are two furnace computers in the cleanroom.

On the furnace computers, the furnaces have short names compared to the names in LabManager as can be seen from the tables below.

The A-, B- and C-stack furnaces are controlled from the furnace computer that is located on the table between the B- and C-stack furnaces.

**A-stack furnaces:**

|  | LabManager | Furnace computer |
|---|---|---|
| A1 | Furnace: Boron Drive-in and Pre-dep furnace (A1) | BORON |
| A2 | Furnace: Gate Oxide (A2) | GATE OX |
| A3 | Furnace: Phosphorus Drive-in (A3) | PHOSPHOR |
| A4 | Furnace: Phosphorus Pre-dep (A4) | POCL3 |

**B-stack furnaces:**

|  | LabManager | Furnace computer |
|---|---|---|
| B2 | Furnace: LPCVD Nitride (4") (B2) | NITRIDE |
| B3 | Furnace: LPCVD TEOS (B3) | TEOS |
| B4 | Furnace: LPCVD PolySi (4") (B4) | POLY SI |

**C-stack furnaces:**

|  | LabManager | Furnace computer |
|---|---|---|
| C1 | Furnace: Anneal-oxide (C1) | ANEAL OX |
| C2 | Furnace: III-V Oxidation (C2) | III-V |
| C3 | Furnace: Anneal-bond (C3) | ANN-BOND |
| C4 | Furnace: Al-Anneal (C4) | AL ANEAL |

The E-stack furnaces are controlled from the furnace computer that is located on the table behind the furnaces.

**E-stack furnaces:**

| | LabManager | Furnace computer |
|---|---|---|
| B2 | Furnace: LPCVD PolySi (6") (E2) | E2 POLY |
| B3 | Furnace: LPCVD Nitride (6") (E3) | E3 NITRI |

## 6.1) Furnace computer overview

On the furnace computer different screens can be selected in the bottom of the screen:

***Overview:*** *Overview over the furnace stack(s).*

For each furnace, the status is indicated by color codes:
- White: Selected furnace
- Red: Active alarm
- Purple: Acknowledged alarm
- Small green square above the furnace name: Indicates that a process is running and the time left in the process

If you cannot see an overview over the furnace stack(s), then press the left or right arrow in the bottom of the screen.



***Operations:*** *Furnace overview, see furnace status and start a process*

The drawing on the screen shows an overview over the furnace:
- Boat position
- Temperature zones (spike and paddle temperatures)
- Gas lines, gas flows and valves
- Torch/steamer/bubbler temperature (for oxidation furnaces, POCL and TEOS)
- Pressure and pump status (for LPCVD furnaces)
- LabManager lock status

In the bottom left side of the screen, the process status is shown:
- Active recipe and active step in the recipe
- A message showing what the furnace is actually doing (e.g. heating up). Here you can also see, if a process has stopped because of an error.

- Time left in the active process step and the entire recipe
- Boat position

Recipes are selected, started and continued, and variable commands/process parameters are changed from the right side of the screen. More information can be found in section 7.3.
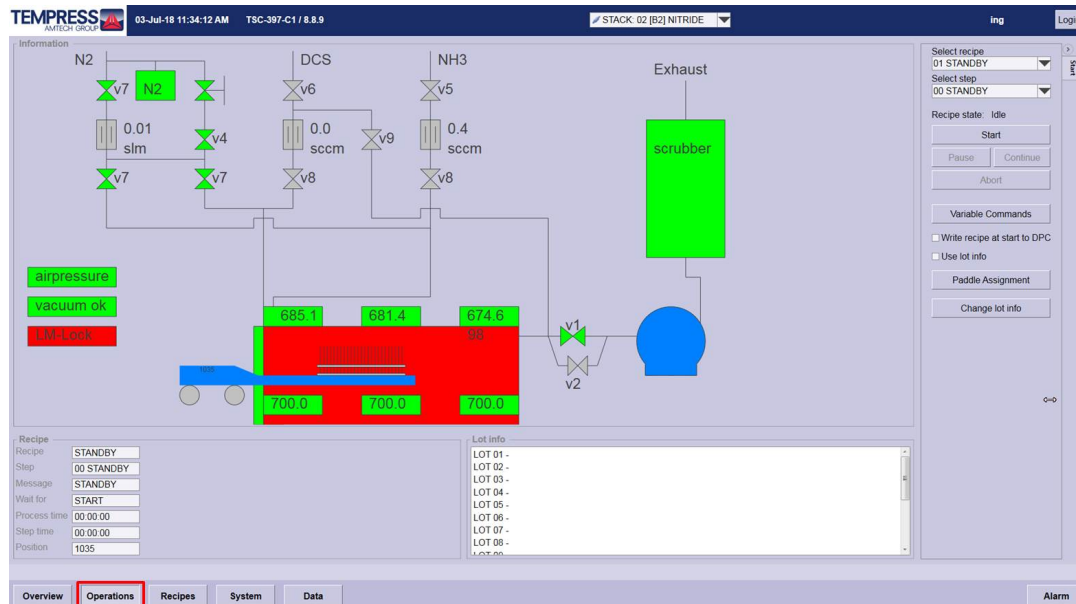


**Recipes:** *Not available*

**System:** *Not available*

**Data:** *Information about recipes and log data.*

It is possible to check recipe steps and parameters. More information can be found in section 7.4.

After a process, the log data can be checked to see if there have been any problems during the process. More information can be found in section 7.4.

**Alarm:** *Overview over active and not-active alarms.*

All active and not-active alarms are shown.

Users cannot acknowledge and clear alarms.

## 7) Instructions

### 7.1) Login

To login to the furnace computer, press the "Login" button in the upper right corner of screen. A login window will then be shown on the screen.

Type in the user name and password:

- User name: furnace
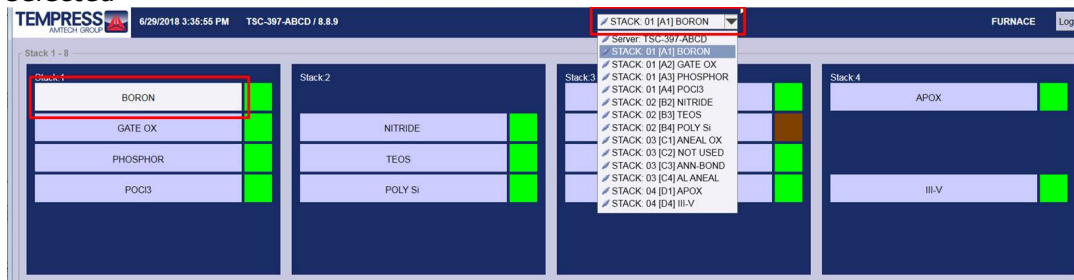- Password: user

*Note:*
*With this user login you only have access to the "Overview", "Operations", "Data" and "Alarm" screens.*

## 7.2) Select a furnace

Select a furnace:
- Select a furnace from the drop-down menu in the top of the screen
  Or
- Open the "Overview" screen and click on a furnace name.

*In the picture below, the A1 Boron Drive-in and Pre-dep/BORON furnace has been selected*



## 7.3) Select and start a process

Recipes are seleted, started and continued from the "Operations" screen.

Variable commands are also changed from the "Operations" screen. Variable commands are process parameters that users are allowed to change, e.g. annealing/oxidation/ deposition times and gas flows.

*Note:*
- *A new recipe can only be selected, when step 0 (normally a "Standby" step) is the active step in a recipe.*
- *A variable command in a certain step in a recipe can be changed, until this step becomes the active step.*

**Select a recipe:**
- Open the "Operations" screen
- Select the furnace you want to use from the drop-down menu in the top of the screen.
- Select the recipe you want to use from the drop-down menu in the right side of the screen.

**Edit variable commands/process parameters:**

- Press the "Variable Commands" button in the right side of the screen. A window showing all variable commands in the selected recipe will then pop up on the screen.
- Click on the variable command that you want to change.
- Change the variable command.
- If you want to change more variable commands, then repeat the two previous steps.
- Press "Write to DPC". A message, "Writing recipe to DPC succesful", should then be shown on the screen.
- Pres "OK" to close the window.

**Start a process:**
- Press the "Start" button in the right side of the screen to start a process. The process will then start.
- Check the total process time in the left side of the screen, so that you know when your process will be done. Here you can also see the actual step in the furnace recipe and the remaining step time. Furthermore, a message is showing what the furnace is actually doing (e.g. heating up).

*Important:*
*Do NOT mark "Write recipe at start to DPC" and "Use lot info", when you start a process.*

**Continue a process:**
When a process has been started, it can be continued (e.g. when you have to open and close the furnace) from the furnace computer in the same way it can be controlled from the touch screens as described in the user manuals for the furnaces:
- *On the furnace computer:* Press "Continue" to continue a process
- *On the touch screens:* Press "Start" to continue a process

**Abort a process:**
- Press the "Abort" button in the right side of the screen to abort or stop a process. Depending on what furnace you are using, the recipe will then either jump to step 0 (normally a "Standby" step), or a dedicated "Abort" recipe will start (for LPCVD furnaces). If an "Abort" recipe starts, you should for safety reasons NEVER abort this, i.e. NEVER press "Abort" two times.

## 7. 4) Check recipes and log data

From the "Data" screen, it is possible to check recipes and log data for processes that have been run in the furnaces.

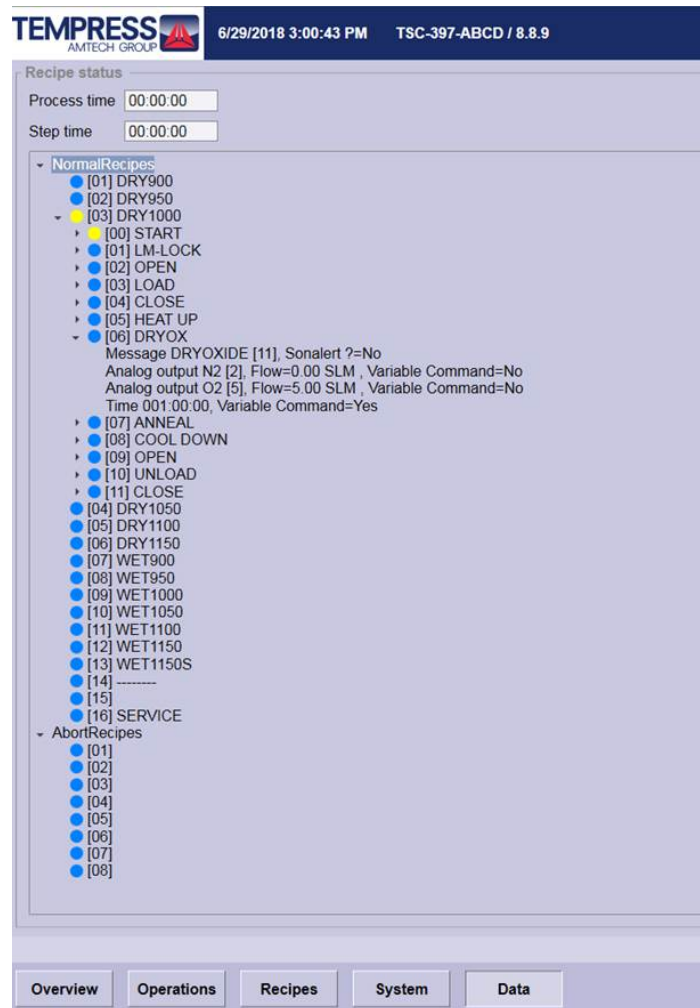*It is not possible modify recipes from the "Data" screen.*

**How to check a recipe:**
- Open the "Data" screen.
- Select the furnace you want to check from the drop-down menu in the top of the screen.
- Press the "Recipe" button in the right side of the screen. A list containing all recipes on the furnace is then shown in a tree-like fashion on the screen.
- To view a recipe, press on the blue or green dot and then on the arrow in front of the recipe. The recipe is then expanded, so that all steps are shown.
- To expand a step in the recipe, click on the arrow in front of the step. You will now see all lines in the step.

*Note:*
*To change variable commands, when a furnace is operated from the touch screen, you have to select line numbers. Unfortunately, no line numbers are shown for the recipes on*

the furnace computer. However, steps numbers are shown both on the touch screen and on the furnace computer, so you will have to use these e.g. to find information about what variable commands you have to change.



**How to check log data:**
- Open the "Data" screen.
- Select the furnace you want to check from the drop-down menu in the top of the screen.
- Click on the "Log Data" button the right side of the screen.
- Select the "Nanolab" dataset in the left side of screen. Some graphs showing log data for different process parameters as function of time will then be shown on the screen.
- Select a time interval:
  ◦ Press the "Actual" button and select a period back in time. Maximum is 24 hours. Or
  ◦ Press the "History time" button and select a start and end date and time.
- If necessary, you can zoom in on some of the information in the graphs:
  ◦ Zoom in: Drag a square around the graph(s) that you want to see
  ◦ Undo zoom: Right click and press "Undo zoom"

*Datasets:*
*The "Nanolab" datasets contains the most important process parameters for each furnace: Temperature, pressure (for LPCVD furnaces), gas flows, boat position and step number. Please, do not modify these datasets.*
*If you want to add or remove some information to other datasets, you have to double click on the dataset and select the parameters your want to add or remove from the list*

*that opens on the screen. Afterwards your can click on the parameter to change the color.*
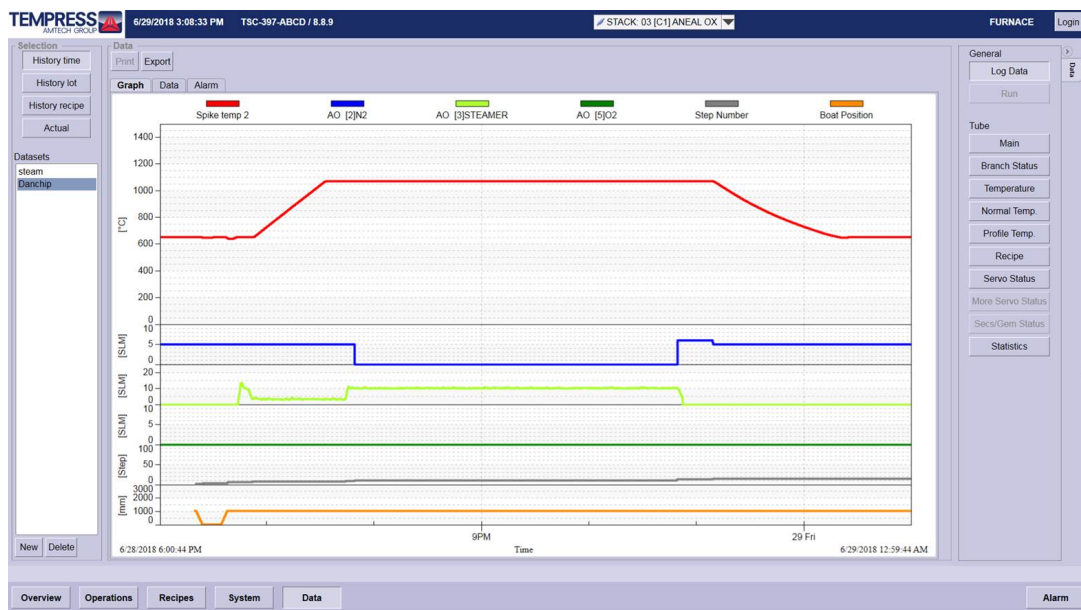


## 8) Trouble shooting

- Login to the furnace computer - if this has to be restarted:
  - User name: Administrator
  - Password: tempress

- Errors and alarms:
  - If a furnace comes up with an error or an alarm, users should not try to solve the problem themselves. Please contact the Thin Film group instead.