

---

# TRIO-TECH SOFTWARE

## CONTENTS

|                                     |   |
|-------------------------------------|---|
| Main VI.....                        | 2 |
| 1.1 Overview.....                   | 2 |
| 1.2 Temperature Collection.....     | 2 |
| 1.3 Using the Graph .....           | 3 |
| 1.4 Chuck Power.....                | 3 |
| Settings.....                       | 3 |
| 2.1 Set Ambient Temperature .....   | 3 |
| 2.2 Controller Settings .....       | 3 |
| Configuration .....                 | 4 |
| 3.1 Editing Set Points.....         | 4 |
| 3.2 Saving recipes .....            | 5 |
| 3.3 Opening recipes .....           | 6 |
| 3.4 Programing Mode .....           | 6 |
| Slow ramp .....                     | 7 |
| 4.1 Running a Sequence.....         | 7 |
| 4.2 Limitations .....               | 7 |
| Database.....                       | 8 |
| 5.1 Microsoft Access .....          | 8 |
| 5.2 Manually Changing Recipes ..... | 8 |

# MAIN VI

## 1.1 OVERVIEW

To start use of the Trio-Tech, turn on the controller and open the TrioTech1000.exe application. Check to make sure there are no start up errors on the controller, and check the pump for low water level. On the control software, 3 LED indicators show the basic status of the controller. If the controller indicator is not green, the software cannot communicate with the controller and will result in errors being thrown. Check the GPIB connection to the PC and make sure the controller is actually on. Figure 1 shows the user interface and its components.

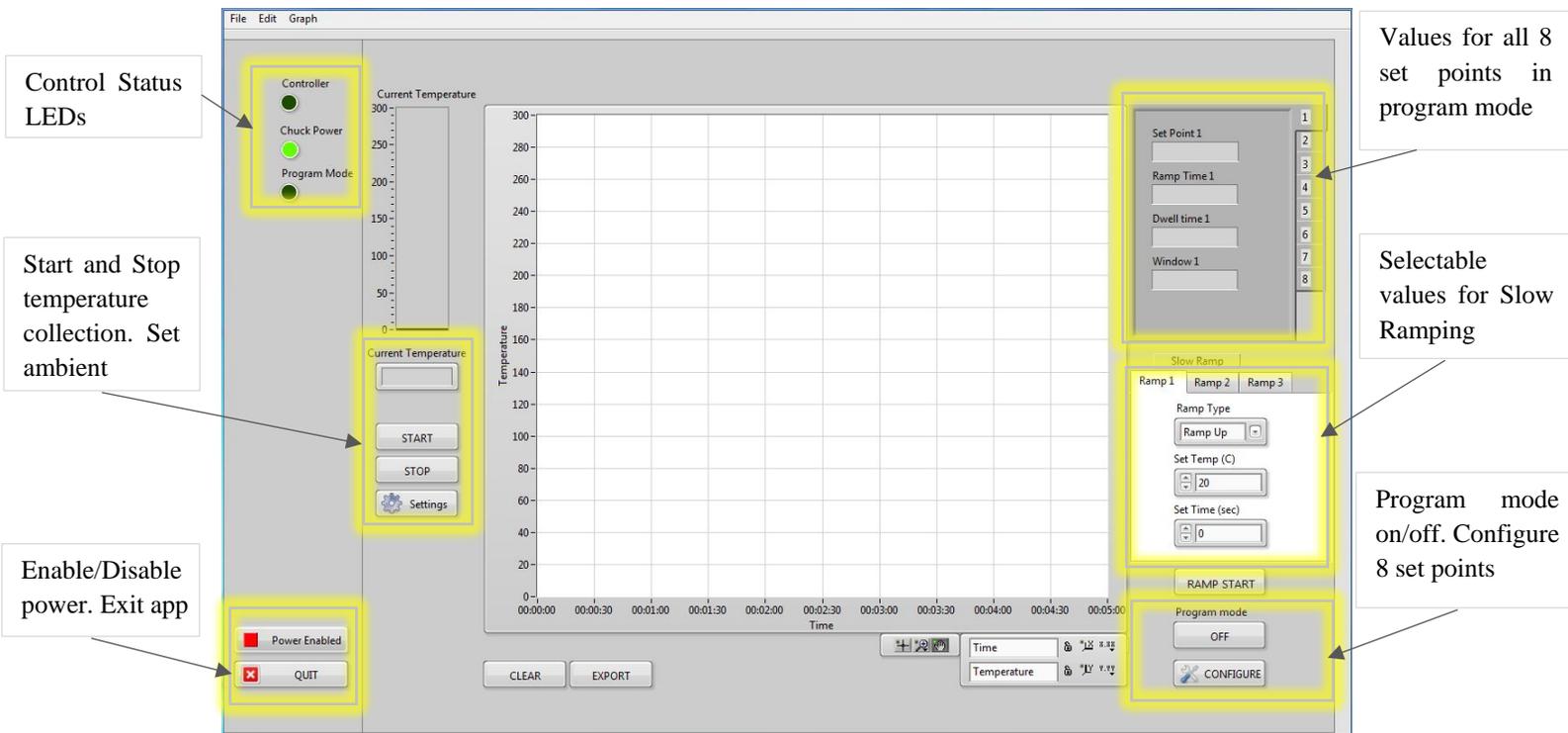


FIGURE 1 MAIN USER INTERFACE

## 1.2 TEMPERATURE COLLECTION

Press **START** to collect current temperature values during any process. The temperature values are shown in the **CURRENT TEMPERATURE** box, **CURRENT TEMPERATURE** bar, and in the graph with accordance to time in seconds. Once the collection process has begun, no other actions are allowed until collection is stopped. This is because the GPIB can only send one command at a time to the controller. Also for this reason, the **SLOW RAMP** feature does not support temperature collection. The program mode set points need to be used instead.

### 1.3 USING THE GRAPH

The graph displays the temperature in Celsius on the Y-axis and time in seconds on the X-axis. Data is only written to the graph when **START** is pressed. The graph allows zooming, waveform moving, and several axis formatting options for the users convenience. These tools are located at the bottom right of the graph. The graph can be cleared at any time by pressing the **CLEAR** button. The graph values can also be exported to an Excel spreadsheet at any time by pressing the **EXPORT** button. Exporting the graph does not clear the graph.

### 1.4 CHUCK POWER

Use the **POWER ENABLE/DISABLE** button to turn on/off power to the temperature chuck. This feature should only be used when absolutely necessary and not during normal processing. Turning off the power will mess up the PID control loop and cause unstable temperature ramping that will ruin any processing. If power is disabled, turning the controller off and then on again will reset the system which will run in normal operation again. If a ramping sequence needs to be stopped, turn program mode off and set the ambient temperature to the desired value.

## SETTINGS

---

### 2.1 SET AMBIENT TEMPERATURE

The controller ambient temperature can be set to any value between 20<sup>0</sup>C and 300<sup>0</sup>C. This is the only available setting that can be changed in software. The controller does not support altering any other settings.

1. Click on **SETTINGS** to open the settings VI
2. Enter the ambient temperature value.
3. Click **OK** to save.

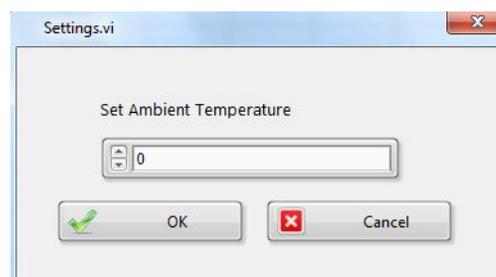


FIGURE 2 SETTINGS DIALOG BOX

### 2.2 CONTROLLER SETTINGS

The TC-1000 controller has several other settings that can be changed directly on the controller such as: PID values, time and date, and temperature calibration. Calibration can be done by setting the chuck temperature to 20<sup>0</sup>C, then record the temperature using a temperature sensor. The value is then entered in the calibration section. Repeat for temperature values: 30<sup>0</sup>C, 40<sup>0</sup>C, 50<sup>0</sup>C... 300<sup>0</sup>C. The PID

values determine the temperature ramping control loop. P (Proportional Gain), I (Integral Time), and D (Derivative Time), can be changed to maximize ramping efficiency. The current PID values are:

P-      I-      D-

# CONFIGURATION

## 3.1 EDITING SET POINTS

The TC1000 controller allows up to 8 programmable set points. The temperature value, ramp time, dwell time, and temperature window can be changed with each of the programmable set points (See [Note 1 Below](#)). To edit the set point values, click the **CONFIGURATION** button on the Main interface. Figure 3 shows the window that will appear.

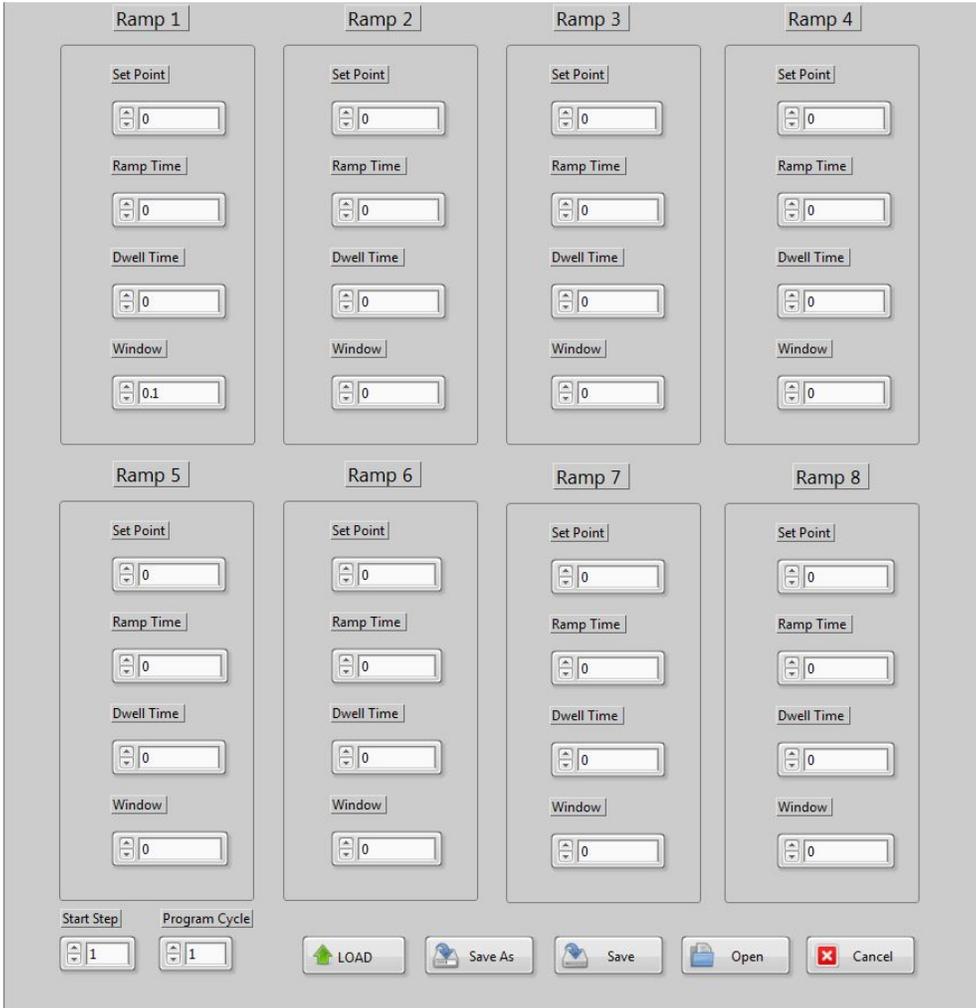


FIGURE 3 CONFIGURATION WINDOW

By default the program will start at RAMP 1 and end on RAMP 8. If you do not wish to process 8 ramp settings, the starting ramp and number of cycles can be changed, but it will always end on RAMP 8.

*Start Step:* The ramp number the process starts on. For example, if set to 1, 8 ramps will be executed. If set to 6, 3 ramps will be executed and so forth.

*Program Cycle:* The number of times the process will repeat starting on the desired *Start Step*.

### **NOTE 1**

Even though there is a ramp time variable specified, it does not change the ramping speed of a process. This feature is not available for this temperature controller version. If you would like to control the ramp speed, see section 4.1 of this document.

## 3.2 SAVING RECIPES

Saving recipes can be done by either creating a new save recipe or replacing an existing one. The methods are labeled respectively as **SAVE** and **SAVE AS**. This routine will save each of the values in every RAMP number to a database where it can be retrieved later.

### To Save a New Recipe

1. In the Configuration Window, Enter all the desired values for set points
2. Click on **SAVE**.
3. Type a new name for the recipe.
4. Click **OK**.

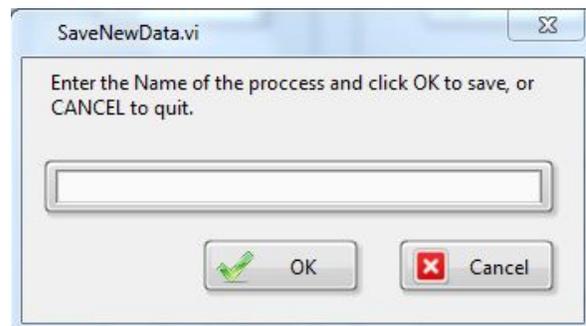


FIGURE 4 SAVE WINDOW

### To Save an Existing Recipe

1. In the Configuration Window, Enter all the desired values.
2. Click on **SAVE AS**.
3. Select the desired recipe name.
4. Click **SAVE**.

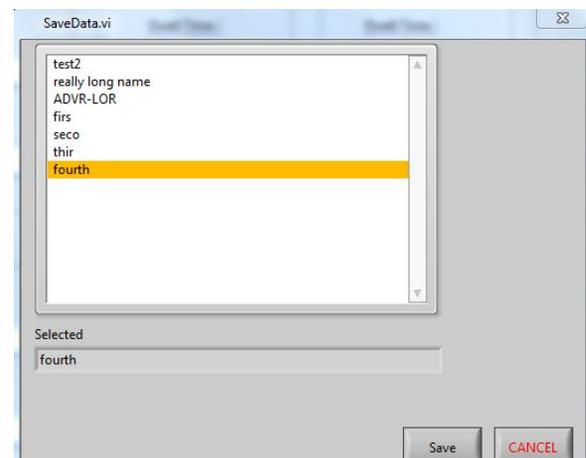


FIGURE 5 SAVE AS WINDOW

### 3.3 OPENING RECIPES

A previous recipe can be opened from the database and edited or loaded. All values currently in the RAMP values will need to be saved if necessary as opening a recipe will discard all values.

1. In the Configuration Window, Click on **OPEN**.
2. Select the name of the recipe you want to open.
3. Click **OPEN** again.

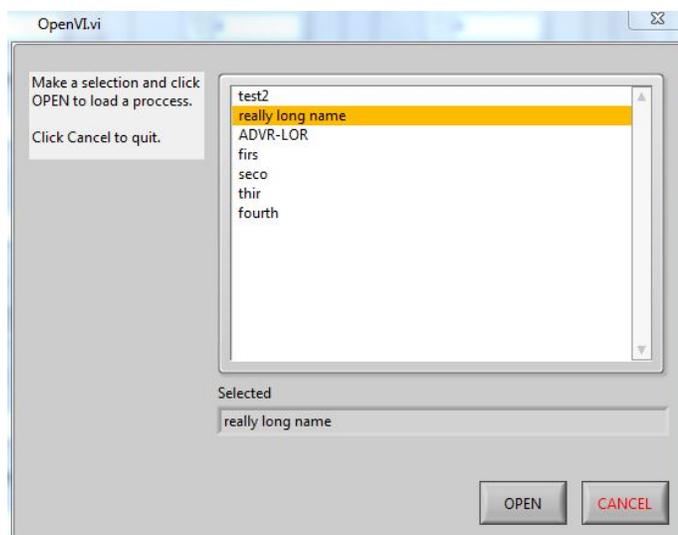


FIGURE 6 OPEN WINDOW

### 3.4 PROGRAMING MODE

Programming mode is used to control the 8 RAMP set points and dwell times. When you have the configuration setup as desired, the RAMPS can be loaded into the controller to start the process. Loading the information can take up to 1 minute to process as LabView is slow communicating with the temperature controller. After it is done loading, the configuration window will disappear and return to the main screen. The top right hand tabs section will display all the current ramp values. When this is done, the Program mode button can be pressed to start the processing. If temperature monitoring is desired, after pressing program mode, press start to record data on the graph. The programmed process can be easily ended early by stopping recording temperature, and turning program mode off. The temperature controller will continue to ramp or hold the last updated temperature set point.

1. Enter in desired values in the Configuration Window or open an existing recipe.
2. Click **LOAD** to send values to the controller.
3. Wait approx. 1 minute for window to close and Main Window to appear.
4. In Main Window, turn **PROGRAM MODE** on.
5. Click **START** to collect data.
6. Click **STOP** when finished collecting data.
7. Check that **PROGRAM MODE** is set to off.

# SLOW RAMP

## 4.1 RUNNING A SEQUENCE

Slow ramping is used when a process requires an increase/decrease of temperature over a long period of time. This algorithm increments/decrements the temperature 1 degree at a time, based on the amount of time it needs to reach the set point. There are 3 ramp settings that can be configured. These settings are located in the **SLOW RAMP** section of the Main Window. After the ramp values have been set, the **RAMP START** button can be pressed to start the process.

1. Enter desired values in the slow ramp section.
2. Press **RAMP START** to begin process.
3. The **SLOW RAMP** Window will appear showing the progress.
4. The **SLOW RAMP** Window will close when the process is finished.

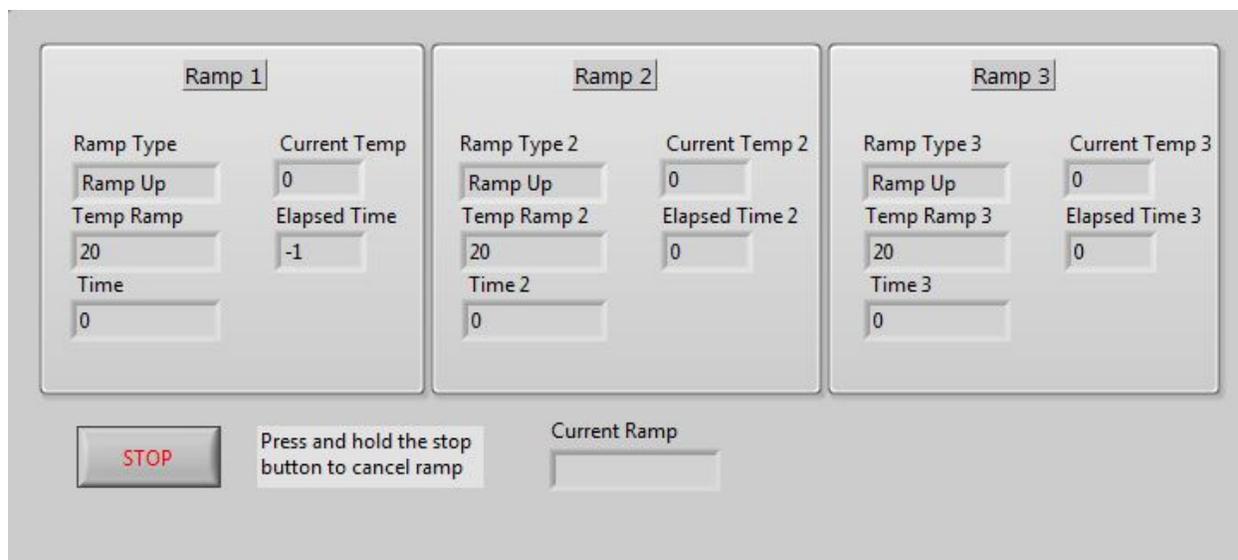


FIGURE 7 SLOW RAMP WINDOW

## 4.2 LIMITATIONS

There are several limitations to this feature to keep in mind. The algorithm switches to the next ramp cycle when the elapsed time on the previous cycle reaches the set time value regardless of whether or not the temperature has reached the desired set point. This results in some inaccuracy generally around 2<sup>0</sup>C as the worst case. To avoid this, Ramp 2 can be used as a hold cycle to ensure the hot plate reaches the

desired temperature. Stopping the process is not immediate, as stated on the window. The **STOP** button must be held for approx. 5 seconds then released.

The slow ramp process also does not support recording temperature data, as it is busy sending other commands to the controller. Reading data in between would result in timing issues and inaccurate temperature results.

## DATABASE

---

### 5.1 MICROSOFT ACCESS

The Trio-Tech software uses Microsoft Access as the database to store user recipe information. Access must be installed on the computer with the database file located in the same folder directory as the program build files. If this is not the case, the program will not be able to find the database and will result in errors. If necessary, a new database can be created with a table named “tritech” that can then be pointed to from the software. The current version of the trio-tech software does not provide a feature to change databases, but it will be included in later releases.

### 5.2 MANUALLY CHANGING RECIPES

Recipes can be manually changed or removed by accessing the database in Microsoft Access. Opening the database file will open Microsoft Access where the user can open the “tritech” table to display all the current user recipes. Multiple recipes can be modified easily at the same time. Saving the database will result in permanent modification of the recipes. As a side note, the database cannot be opened when the software is running.