

# **T962A TFT CONTROLLER**

## **USER GUIDE**

Version 1.0.0

08/18/2019

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# INTRODUCTION

This user's guide will give an overview of the basic hardware used in this T962A oven controller, and some details behind the functionality of the hardware components.

Also, this guide will go over the GUIs used in this controller, as the entire system is 'touch screen' driven, NONE of the original oven buttons are used with this controller. It is 100% touch driven.

# HARDWARE

The T962A TFT Controller is based around the STM32H7 microcontroller. This micro was chosen because of its' extensive peripherals, core speed (400Mhz), ARM architecture, and most importantly, built-in parallel LCD controller, as well as external memory controller for LCD frame buffer and extra ram.

The STM32H7 contains 2MB of internal flash, 1MB of internal SRAM, scattered about into different partitions and busses.

The controller contains several main components most noticeable on the PCB:

- 1) STM32H7 processor – core processor
- 2) 64MB SDRAM – for LCD frame buffer, JPEG decoding buffer, extra SRAM
- 3) ESP32-WROOM-32D – module for Wi-Fi/Bluetooth capability
- 4) MicroSD socket – for MicroSD card (any size) for config storage, profile storage, image storage
- 5) CR2032 Batt Holder – for RTC clock backup pwr when oven is off

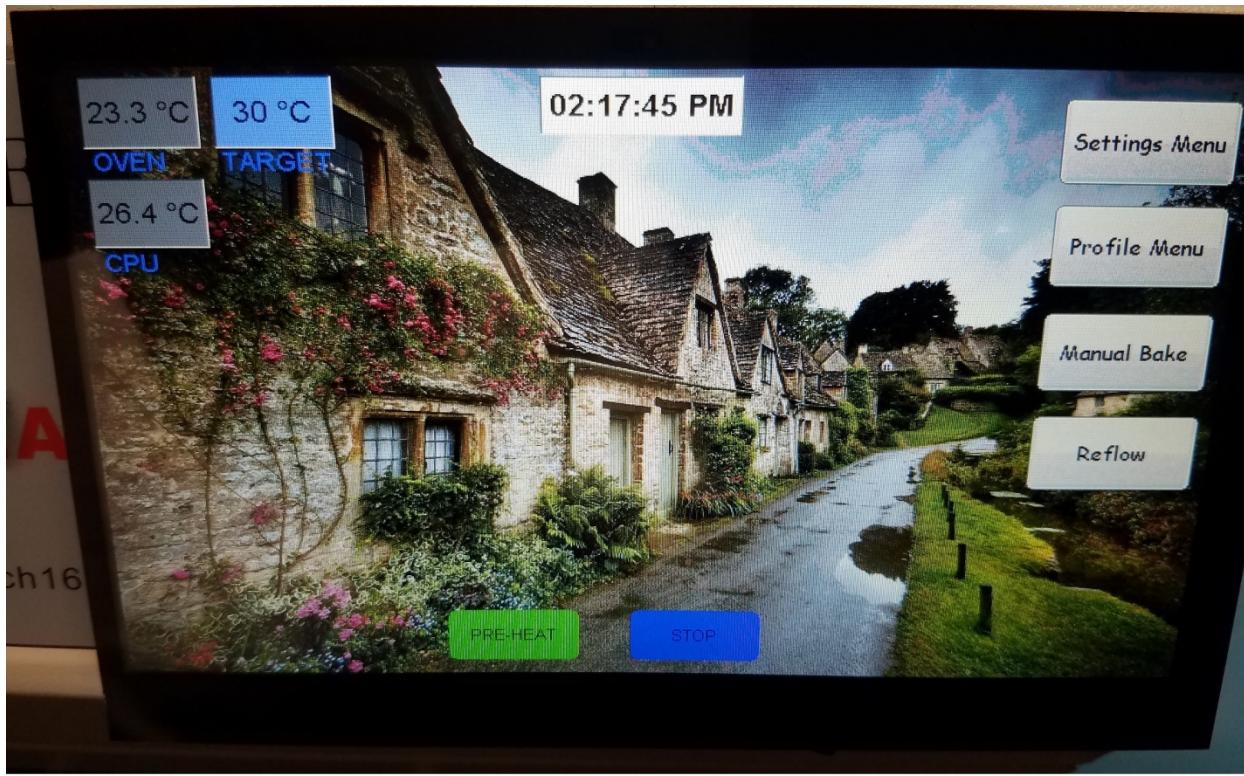
## SOFTWARE

The T962A TFT controller contains a small amount of source from the T962A Unified Engineering code, mostly the PID related code. The controller contains free public source for the following functions:

- 1) FreeRTOS – embedded RTOS for threading/etc
- 2) FatFS – embedded FAT32 filesystem for MicroSD
- 3) STemWin – embedded GUI library for TFT graphics, etc
- 4) MinINI – portable INI library for configuration ini file on microSD
- 5) STM32H7 HAL – STMicro HAL and related peripheral code

## MAIN MENU

When the oven is first powered on (after the power-on beep and then two consecutive ‘boot good’ beeps), the following screen will appear. In the picture below the ‘cool’ button was pressed, hence its’ blue color.



The top left corner is temperature status for the OVEN, CPU (controller board itself, ie what we've known as CJ temp), and TARGET temp, which is the desired temp if 'pre-heat' or 'cool' button was pressed. If in idle, ie no pre-heat or cool pressed, the 'TARGET' box will display '---'.

The top-center box is the time-of-day, which is set via the 'clock' tab in the settings GUI. In future software versions, this may be enhanced to also show date settings as well. The TimeOfDay setting is maintained when oven is powered off, as long as a \*\*\*ML2032\*\*\* battery is installed.

**\*\*\*DO NOT USE CR2032, AS THEY ARE NOT RECHARGABLE\*\*\***

**You can ONLY use ML2032 re-chargable batteries in this controller, as the STM32H7 processor charges the battery while the oven is powered on.**

The FOUR buttons to the right of the screen are as follows:

- 1) “**Settings Menu**” -> multi-tab based GUI for configuration of lcd, oven, sensors, wifi, etc
- 2) “**Profile Menu**” -> GUIs for selection of current profile, loading, saving, manual drawing profiles
- 3) “**Manual Bake**” -> manual timed mode for heating to oven to a set temp
- 4) “**Reflow**” -> GUI for actual run of the current selected profile

The TWO buttons on the bottom of the screen are as follows:

- 1) “**PRE-HEAT**” -> used to preheat the oven to the temp set in the ‘pre-heat’ oven settings
- 2) “**COOL**” -> used to cool the oven to the temp set in the ‘idle temp’ oven settings

# SETTINGS MENU

The settings menu is comprised of multiple tabs, each pertaining to settings categories. They are as follows:

- 1) “General” -> lcd brightness and minimum fan speed
- 2) “Clock” -> time of day settings
- 3) “Oven” -> setting for idle temp and pre-heat temp
- 4) “Sensors” -> displays enable/disable flags and curr temp for all 8 possible sensors
- 5) “Wallpaper” -> allows you to load/set a new wallpaper (jpg) image from the microsd
- 6) “WiFi” -> settings for enable & connecting to your wifi
- 7) “About” -> displays version information for the controller, STM32 HAL, memory usage, etc

## GENERAL TAB

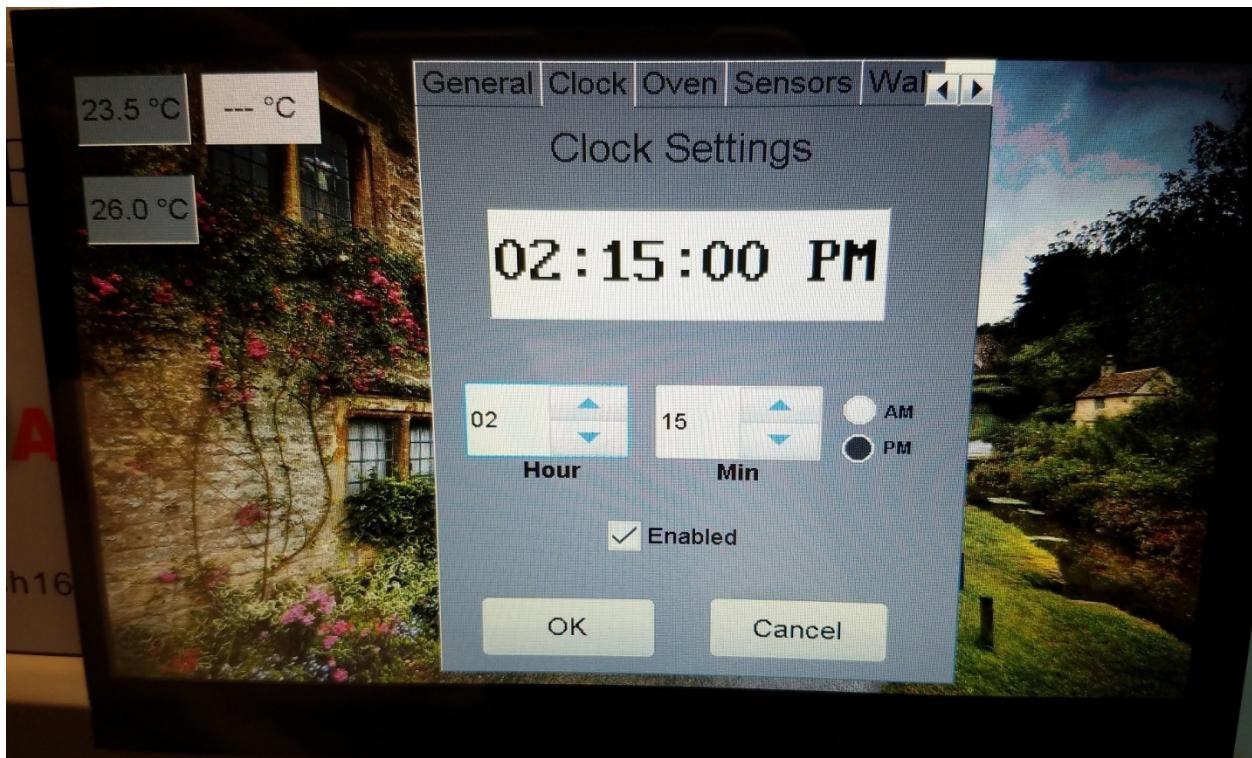


The general tab allows you to configure the LCD brightness, from 10 to 255 (255 = max brightness). The slider will not allow you to go down to below 10, since below 10 the screen is completely dark and you cannot see anything.

The ‘min fan speed’ is configurable from 0 to 255, max fan speed being 255. This allows you to set a speed > 0 if you want a ‘convection’ like oven. In the convection setup, (ie a min fan speed > 0), in manual bake and reflow mode the fan will always be on at the minimum fan speed, unless the software of course calls for a higher fan speed during the program being run.

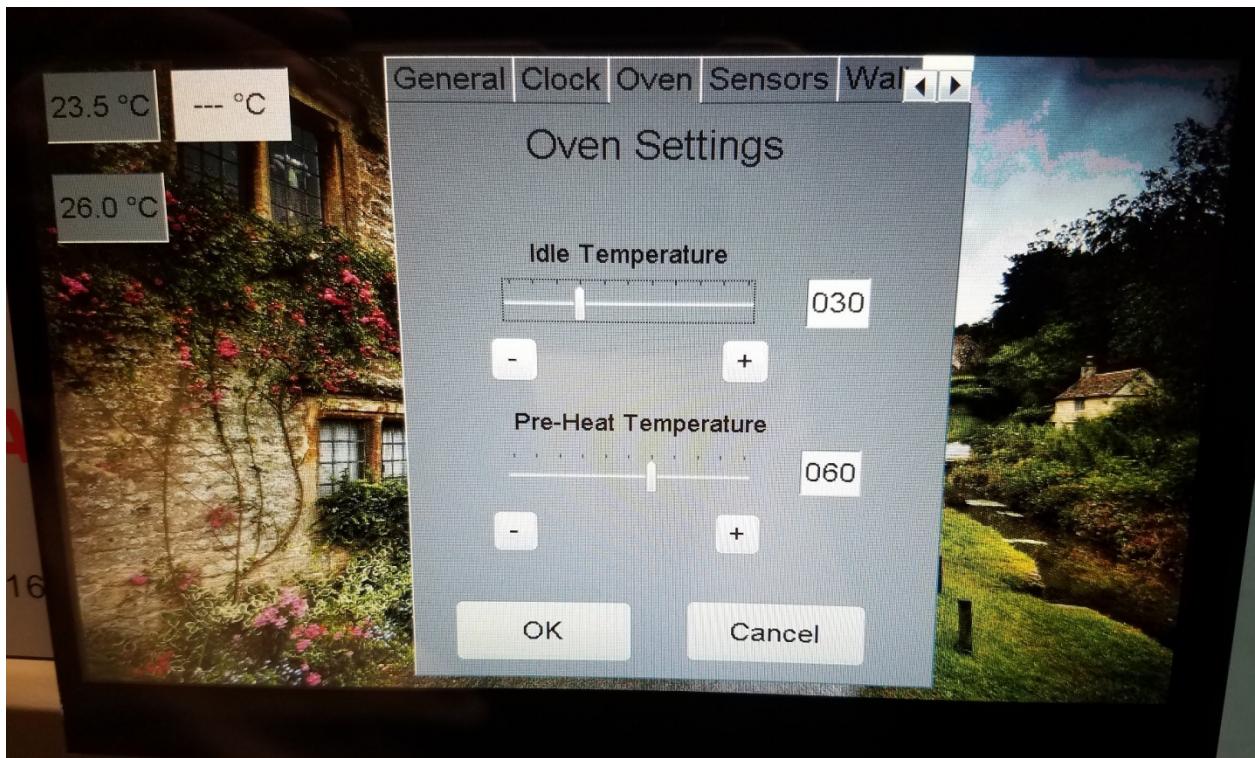
If you leave the min fan speed at 0, then the fan will only come on when the software calls for it. Using a convection like setup, seems to improve the heat distribution, because of the hot spots with infrared heating elements.

## CLOCK TAB



The clock tab allows you to configure the time of day, HOURS, MINS, and AM/PM. Currently there is no seconds settings, as you can get close enough with hours/mins. Possibly in a future release this can be added if necessary.

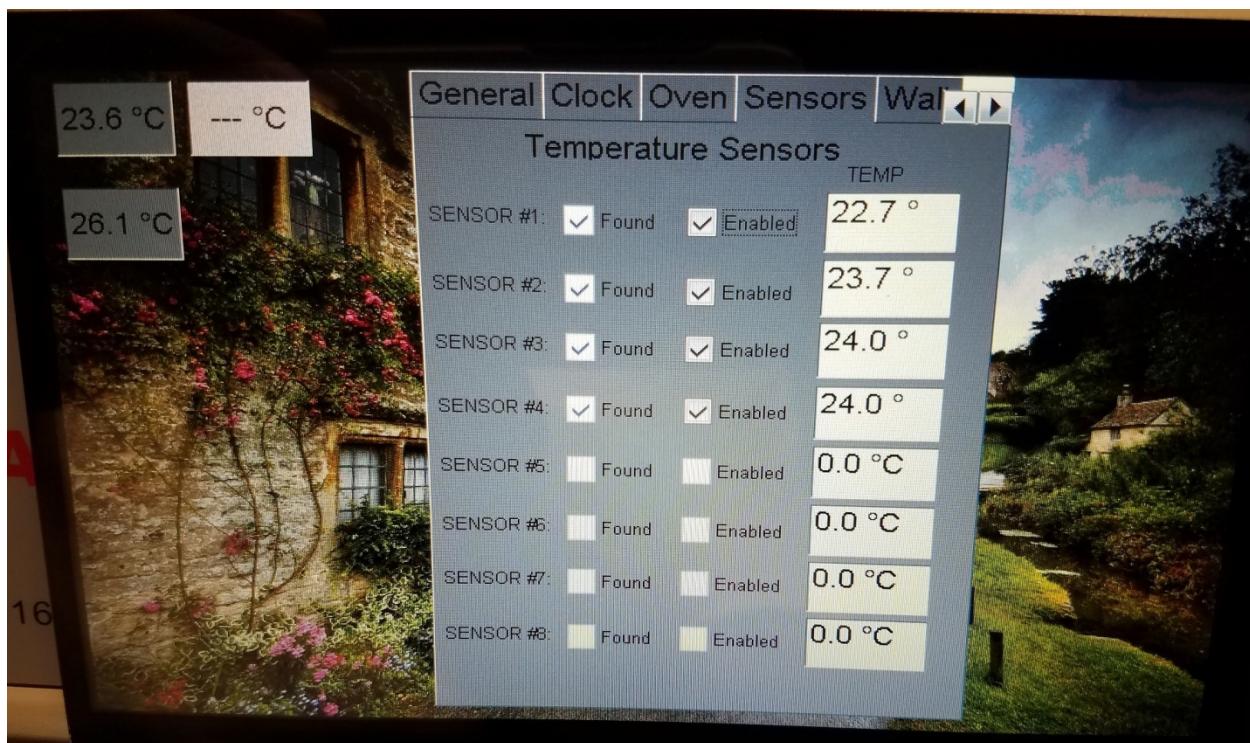
## OVEN TAB



The oven tab allows you to configure the oven ‘idle temperature’, which is the temperature that the ‘cool’ button on the main page will attempt to hold the oven at if pressed. The ‘pre-heat’ temperature is the temperature that the ‘pre-heat’ button on the main page will heat the oven to, when pressed.

The “OK” button will accept and save the current configuration to the config.ini on the microsd card. The “Cancel” button will discard all changes and revert to prior settings at the initial opening of the settings GUI.

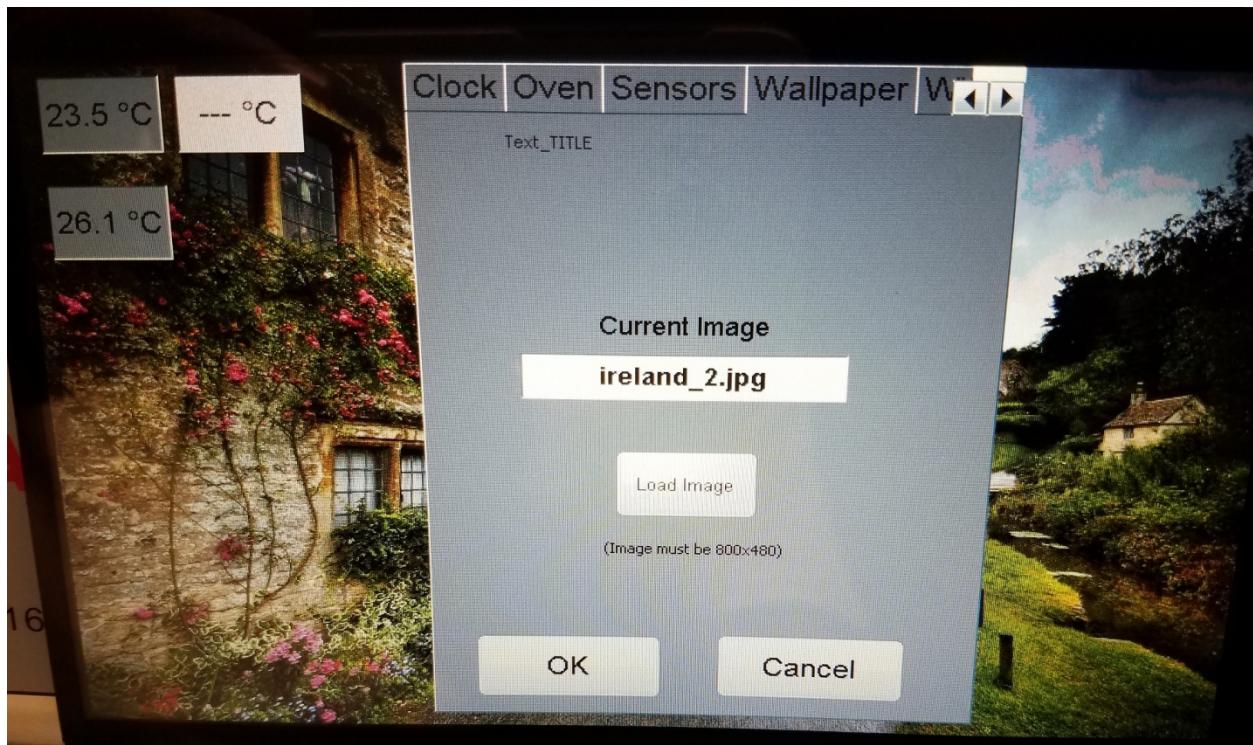
## SENSORS TAB



The sensors tab will show you all sensors that have been detected, ie via the 'found' checkbox. The 'found' checkbox is a read-only checkbox, the software will check the box if it finds a sensor at that address. The TEMP box will display the current temperature for each sensor it finds. The 'Enabled' checkbox can be enabled/disabled by touching the checkbox.

The initial configuration on the microsd (config.ini) has sensors #1-#4 to be ENABLED by default if found when it starts up. You can obviously enable/disable any of these at any time if they are installed. The enable/disable checkbox does not respond to touch if there is no sensor found. The software calculates the oven 'average' temp based on all sensors that are both found AND enabled. If you have 4 sensors installed, but only 2 enabled, then the avg temp is based on just the 2 sensors enabled.

## WALLPAPER

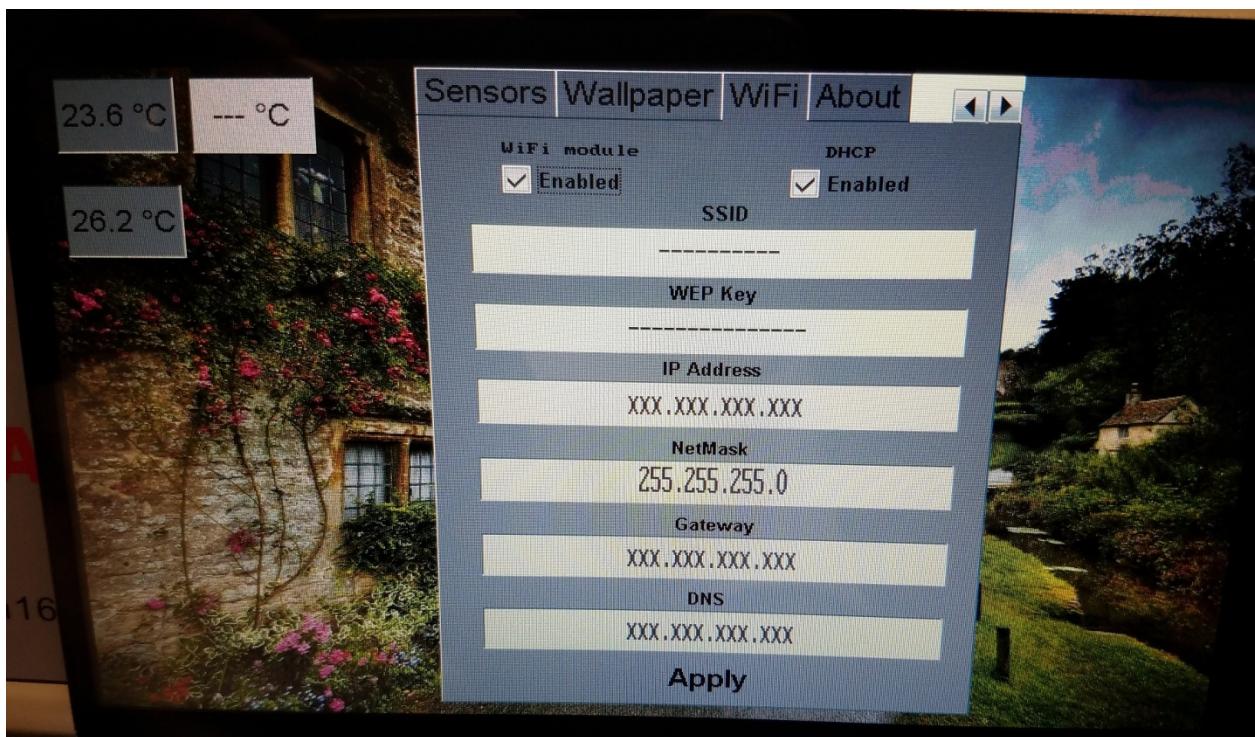


The wallpaper tab allows you to change the background wallpaper of the main menu. The ‘current image’ box displays the name of the current image that is the background. Clicking on the ‘Load Image’ button will bring up a file dialog box, showing all “.JPG” files found in the “images\” folder on the microsd card. (This folder already exists in the microsd files included with this software).

The controller software comes with a default image “wallpaper.jpg” in the \images folder on the microsd, and the configuration (config.ini) by default points to this image. Background images MUST be 800x480 JPG images, or they will not be decoded and loaded by the software.

The “OK” button will commit and save the changes, and this WILL take about 5-10 secs for the changes to be saved, and the image decoded and loaded to the LCD frame buffer, so BE PATIENT...the menu will seem to be frozen while this is going on, but it just takes some time for the JPG to be loaded from the microSD and decoded to the SDRAM.

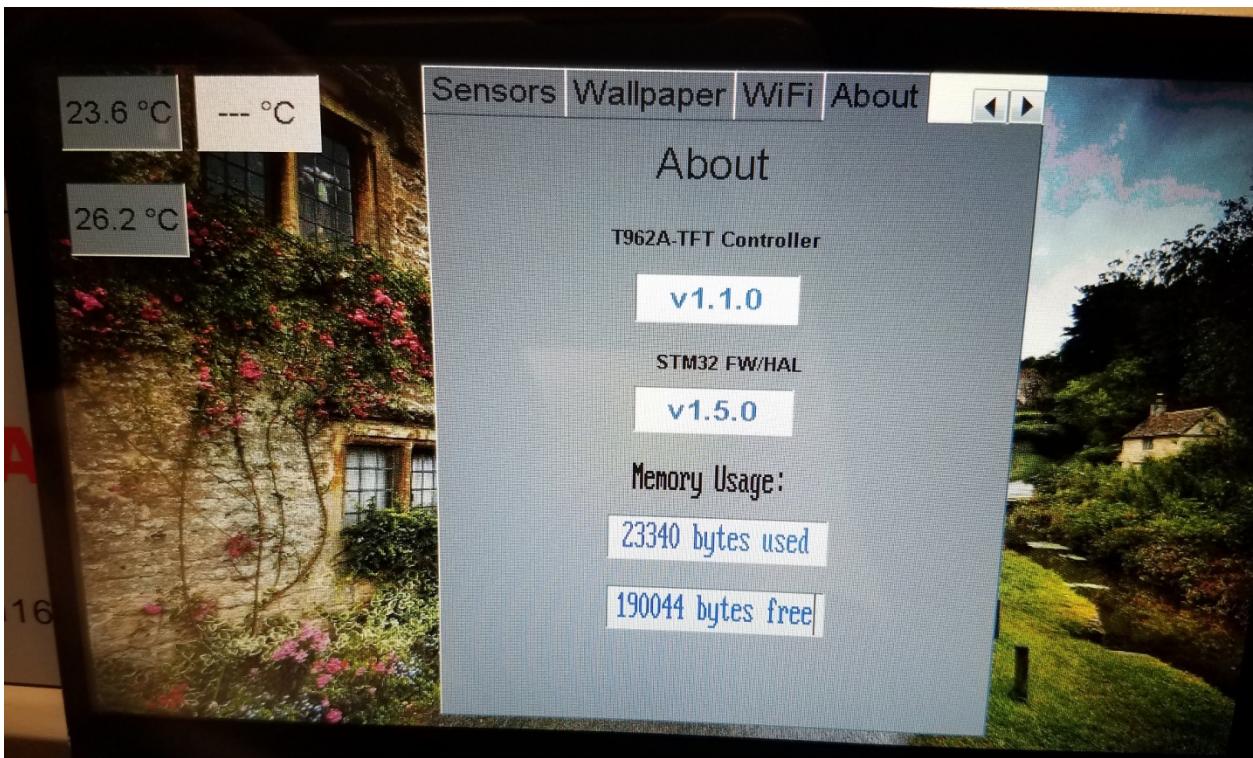
## WIFI TAB



The WiFi tab allows you to configure all of the parameters of your wifi connection, including using DHCP, or specifying a manual IP address.

\*\* currently this GUI does not do anything, except for the 'Enabled' button, which turns on and off the WiFi module. This will be updated in a software update soon \*\*

## ABOUT TAB



The about tab is an informational window only. It allows you to see your current controller software version, the STM32 HAL version that it's running on, and how much memory the STemWin GUI software is using, and how much is free.

## PROFILE MENU



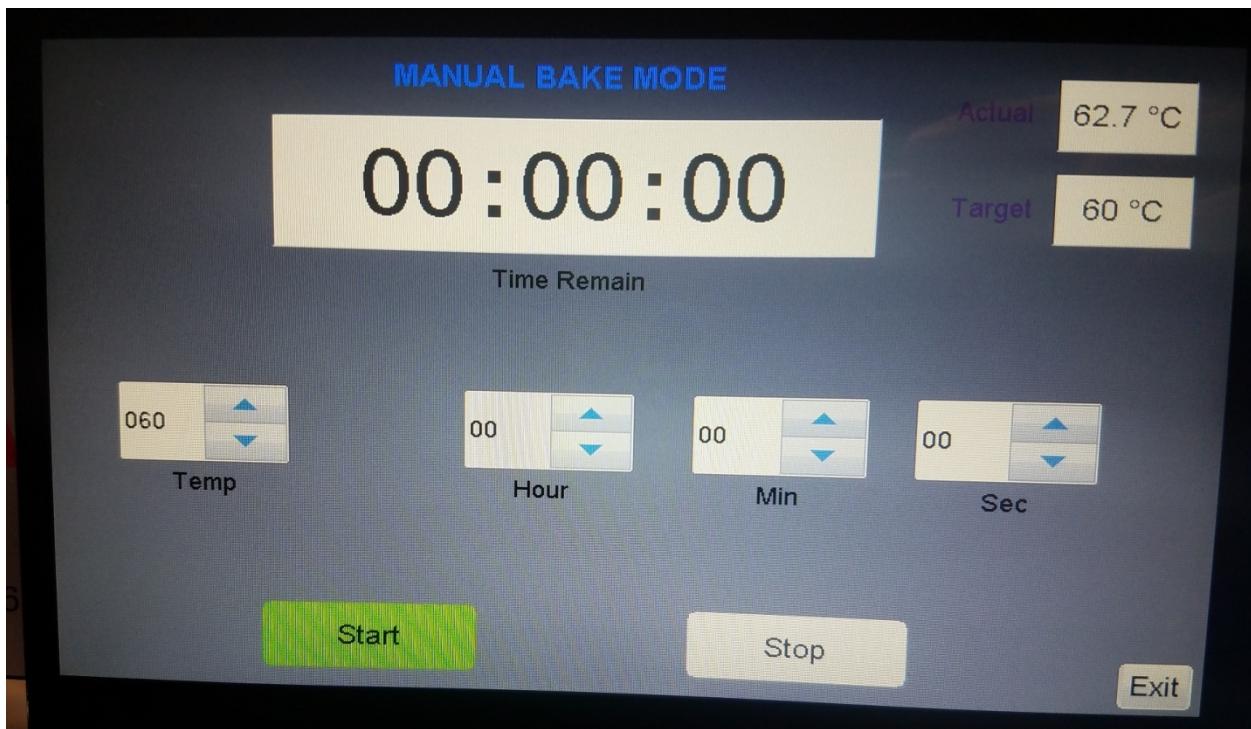
The profile menu allows you to browse through the included stock profiles, currently 7 of them, and one custom profile. Almost unlimited custom profiles can be stored on the microsd, the browsing will just display whatever the last custom one that was loaded.

You have the following options in the profile menu on the right side of the display via the touch buttons:

- 1) **"Load Profile"** -> allows you to load a custom profile from the microsd
- 2) **"Save Profile"** -> allows you to save the current profile to the microsd
- 3) **"Delete Profile"** -> allows you to delete a profile from the microsd
- 4) **"Edit Profile"** -> allows you to edit/change all of the temp points for the current profile
- 5) **"Draw Profile"** -> allows you to manually draw a new profile (up to 30 mins in length).

## LOAD PROFILE

## MANUAL BAKE

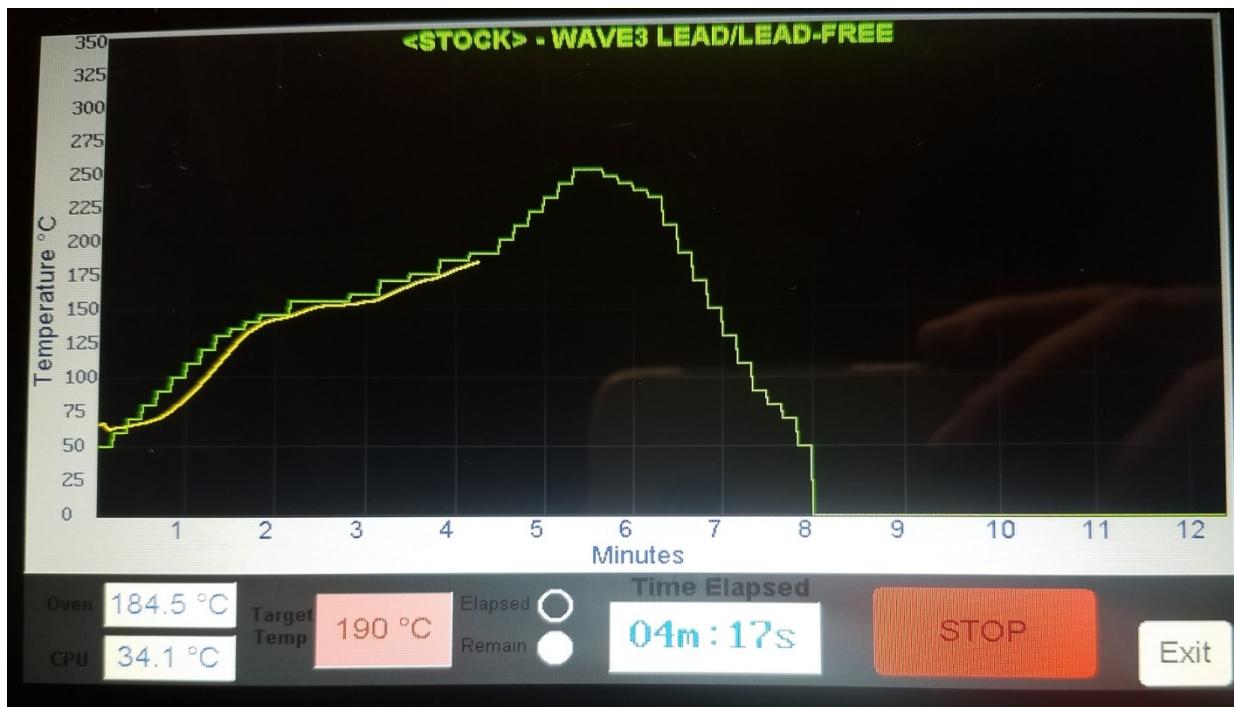


The manual bake menu allows you to set a desired target temperature (initially sets the Temp to the 'pre-heat' temp in the config.ini). You can choose the number of hours, minutes, and seconds that you would like the manual bake to run. The start button is initially green, once pressed, it will become disabled, and the Stop button will become RED, and it will be enabled.

The 'Exit' button exits the GUI and returns to the main menu, but it will become DISABLED if a manual bake is running. You must hit STOP before you can exit this menu.

The top right displays the current Oven Temp, as well as the 'target' temp you selected.

## REFLOW



The reflow GUI is where you actually run a reflow profile. It will display the last profile that you chose in the ‘profile’ menu. The target profile is displayed in **GREEN**, and the running profile will update every second, and is displayed in **YELLOW**.

The boxes on the bottom left display the current OVEN temperature and CPU (controller board) temperature (ie CJ temp). The ‘Target Temp’ box displays the current profile target temperature. The ‘START’ button once pressed becomes RED, and changes to display ‘STOP’. The ‘exit’ button becomes disabled once a profile is running. Stopping the profile will enable the exit button.

The ‘Time Elapsed’ box will show the current time elapsed while the profile is running, and you can click the ‘remain’ radio button to change the time to display ‘time remaining’. You can click on these radio buttons at any time.

## **TROUBLESHOOTING**