JAKES
Custom Shop

Oven Monitoring and Timing - Manual

Revision A
02/12/2023

Description of Systems

Four-Lab Ovens:

- 4-single Channel Ovens each
- 1 TC per Oven
- For monitoring and recording temperatures during testing to meet ISO17025 cert.

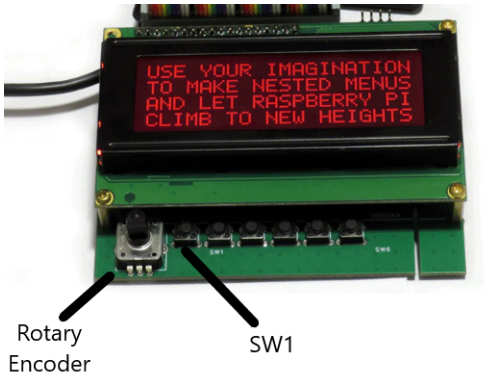
Conveyor ovens:

- 2 Ovens (Upgradable to 4)
- 2 TCs Per Oven
- A duplicate of the Four-Lab system, but with only 2 Start/Stop buttons and 1 Stacklight.

Software

Can be found on the Jake's Custom Shop Github page:
https://github.com/JakesCustomShop/OvenMonitoringCtrl.git

Menu Screens



Rotary Encoder: Sets a numeric value
SW1: Navigate to the next menu screen.

Home:

Displays the current temperatures, remaining cook time in minutes, and the Oven Status Byte.

Access: This is the default screen that appears when you first turn on the device.

Oven ID:

Sets a unique identifier for the oven, used for data transmission.

Temperature Setpoint:

Sets the desired cooking temperature for the oven. A temperature less than this value will cause the system to report an Error

Cook Time:

Sets the desired cooking duration for the oven in units of minutes

Data Interval Time

Sets the frequency at which the oven sends and saves data (temperature and status updates). Units of seconds

Num T.C's per Oven:

Specifies the number of thermocouples installed in each oven. Note that each oven can have more than one thermocouple. Temperature data from each thermocouple will be grouped by its corresponding oven.

Number of Ovens:

Indicates the total number of ovens being monitored by the system. Each oven will have its own data file containing data from its TCs.

Buzzer On/ Off:

Turn the audible buzzer on (1) or off (0).

TC Calibration:

Enters a mode for calibrating thermocouples.

Option 0) Skip calibration menu

Option 1) Calibrate each of 8 thermocouple temperature values. Turn the knob until you reach the desired temperature. Press SW1 to go to the next thermocouple. The menu displays the calibration of 8 thermocouples independent of the number of thermocouples attached to the system.

Detailed Calibration Instructions:

1. Navigate to “Thermocouple Calibration” menu by pressing SW1
2. Use the Rotary Encoder to set the value to 1
3. Press SW1
4. Adjust the Rotary Encoder to set the the first TC to the correct value
5. Press SW1 to navigate to the next TC.
6. Repeat steps 4&5 for each TC1-8
7. Press SW1 to return to the Home screen

SAVE_PARAM (Hidden):

Parameters are automatically saved to an SD card to file “parameters.txt” after each complete menu cycle. There is no displayed values for the “SAVE_PARAM” menu option.

Timing System

A timer interval of 0 disables the timer
Note: Minimum cook time is 2 minutes.

Controls

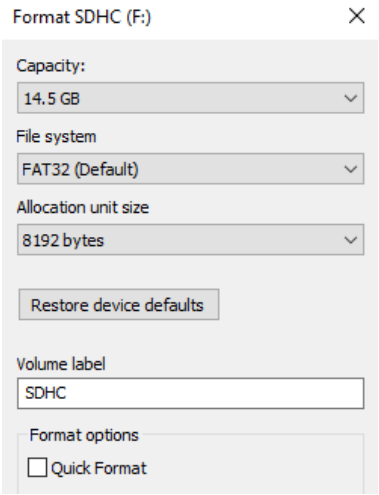
Start/ Stop Buttons: Starts the corresponding oven timer and data collection. A button press during an active cycle (Status 2) will end the cycle and save the temperature data. When the cycle is complete (Status 3) pressing the button acknowledges the cycle completion and saves data (Status 4). Pressing the button again will start a new cooking cycle (Status 2).

Status Symbols

Status Byte	Buzzer	Indicator Light	Description
0	Off	Red	Startup/ Pre-heating/ Below target temperature.
1	Off	Solid Green	Oven Ready for load
2	Off	Orange	Cycle active (GUI starts collecting data). Timer active
3	Short beeps	Flashes	Time Complete. Waiting for Acknowledgement.
4	Off	Solid Green	Acknowledged (GUI Stops collecting data). Waiting for next cycle start.
5	Off	Solid Green	Temperature Data saved
6	Continuous Long Beeps	Flashing Red	Error

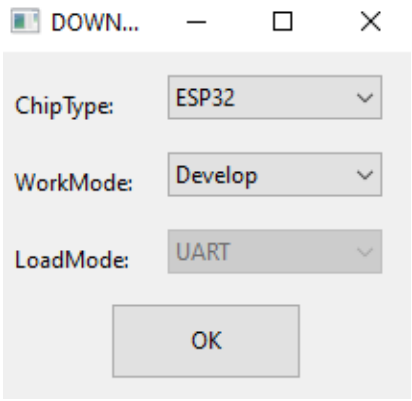
SD Card

The ESP32-PI PLC has a 16 Gb SD card located on the bottom left. The SD card contains “parameters.txt” that allows the system to maintain its settings through a power cycle. There also exists basic temperature data logging to the SD card. New SD cards may need to be Formatted in the FAT32 Format. Be sure to uncheck “Quick Format”

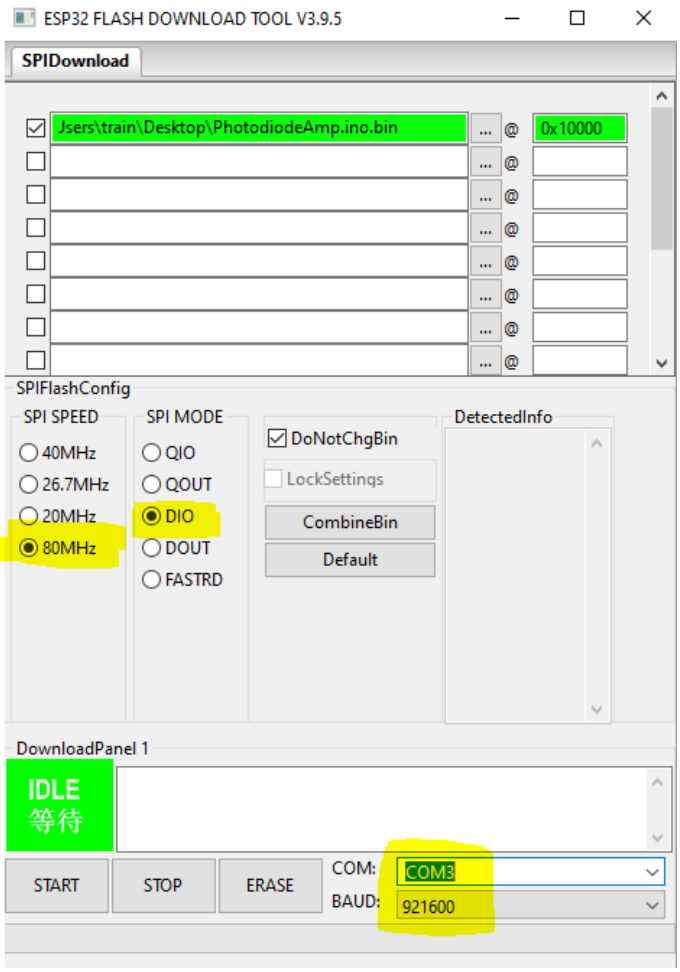


Updating Firmware

1. Install Flash Download Tool from Espressif.
2. Open the “flash_download_tool_3.9.5.exe”
3. Set the ChipType to ESP32. Set the WorkMode to Develop. Click OK.



4. Select the “Transmitter.ino.bin” file, and set the parameters as shown in the snip below. The COM port will depend on which USB port you use on your PC.



5. Select “START”
6. Once the code has uploaded, restart the system by turning off the power and unplugging the USB cable.
7. The device should now be updated.

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Bill of Materials

Item	QTY	Price	Total
J-Type Thermocouples	6	$29.93	$175.80
Thermocouple Wire, 10Yds	1	$29.95	$29.95
ABS Enclosure w/ Window 11.4*7.5*5.5	1	$33.48	$33.48
RPi DIN Rail adapter	1	$10.00	$10.00
ESP32-PI	2	$50.00	$100.00
Eight Thermocouples DAQ	1	$95.00	$95.00
Four Relays Four HV Inputs	1	$45.00	$45.00
LCD Hat	1	$25.00	$25.00
LCD Screen (4x20) LCD2004 (98x60mm)	1	$10.50	$10.50
AC/DC 5V Power Supply, MDR-20-5	1	$18.99	$18.99
Terminals and DIN rail	1	$29.88	$29.88
Micro SD card	1	$5.99	$5.99
RED/ GRN/ YEL/ ALRM Stack Light	1	$31.99	$31.99
Momentary Push button (qty4)	0.25	$14.79	$3.70
		TOTAL:	$615.28
Additional Items for Revised PO			
RED/ GRN/ YEL/ ALRM Stack Light	2	$32.00	$64.00
Momentary Push button (qty4)	1	$15.00	$15.00
8-Relays Hat	1	$45.00	$45.00
Horizontal Din Rail Adapter	1	$10.00	$10.00
40pin f-f cable for connecting IO Cards	1	$12.00	$12.00
ABS Enclosure 13.8*9.8*5.9	1	$57.00	$57.00
USB-C Panel mount	1	$14.00	$14.00
TC Panel Connector	4	$3.79	$15.16
SW Upgrades, HW assembly, Setup	1	$256.00	$256.00
		TOTAL:	$488.16

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Conveyer OMT System - BOM			
Item	QTY	Price	Total
J-Type Thermocouples	0	$29.93	
Thermocouple Wire, 10Yds	0	$29.95	
ABS Enclosure 13.8*9.8*5.9	1	$57.00	$57.00
ESP32-PI	1	$53.00	$53.00
Eight Thermocouples DAQ	1	$95.00	$95.00
Four Relays Four HV Inputs	1	$45.00	$45.00
8-Relays Hat	0	$45.00	
LCD Hat	1	$25.00	$25.00
RPi DIN Rail adapter	2	$10.00	$20.00
LCD Screen (4x20) LCD2004 (98x60mm)	1	$11.00	$11.00
AC/DC 5V Power Supply, MDR-20-5	1	$19.00	$19.00
Terminals and DIN rail	1	$30.00	$30.00
Micro SD card	1	$6.00	$6.00
RED/ GRN/ YEL/ ALRM Stack Light	0	$31.99	
Momentary Push button (qty4)	1	$15.00	$15.00
40pin f-f cable for connecting IO Cards	1	$12.00	$12.00
USB-C Panel mount	1	$14.00	$14.00
TC Panel Connector	12	$6.00	$71.94
		TOTAL:	$473.94