



DOUGH-O!

USER GUIDE



INTRODUCTION

Dough-O! is the first artisan retarder-proving designed for home bakers and fermented-products lovers.

It consists of a central unit, which is the brain of the whole system, a power unit which contains the high-tension interface, and the box fermentation unit consisting of a suitably modified freezer (Diag. 1).

The feature that certainly stands out is the presence of two heating elements. One is responsible for the global warming of the leavening chamber, while the other has been designed to gently heat the containers and thus minimize the thermal barrier between the dough and the environment.

The use of a freezer box, in addition to the ability to reach temperatures below 0 °C, has the advantage of great thermal insulation which translates into energy savings and less fluctuations of the temperature curve.

The document you are about to read is only the final user manual; read it and you will learn how to take advantage of every function of your new home-appliance. If you're still not sure which Dough-O! right for you, read it anyway and you will have no more doubts!

Assembly Guide and *Configuration Guide* are available on the official website:

www.dougho.com

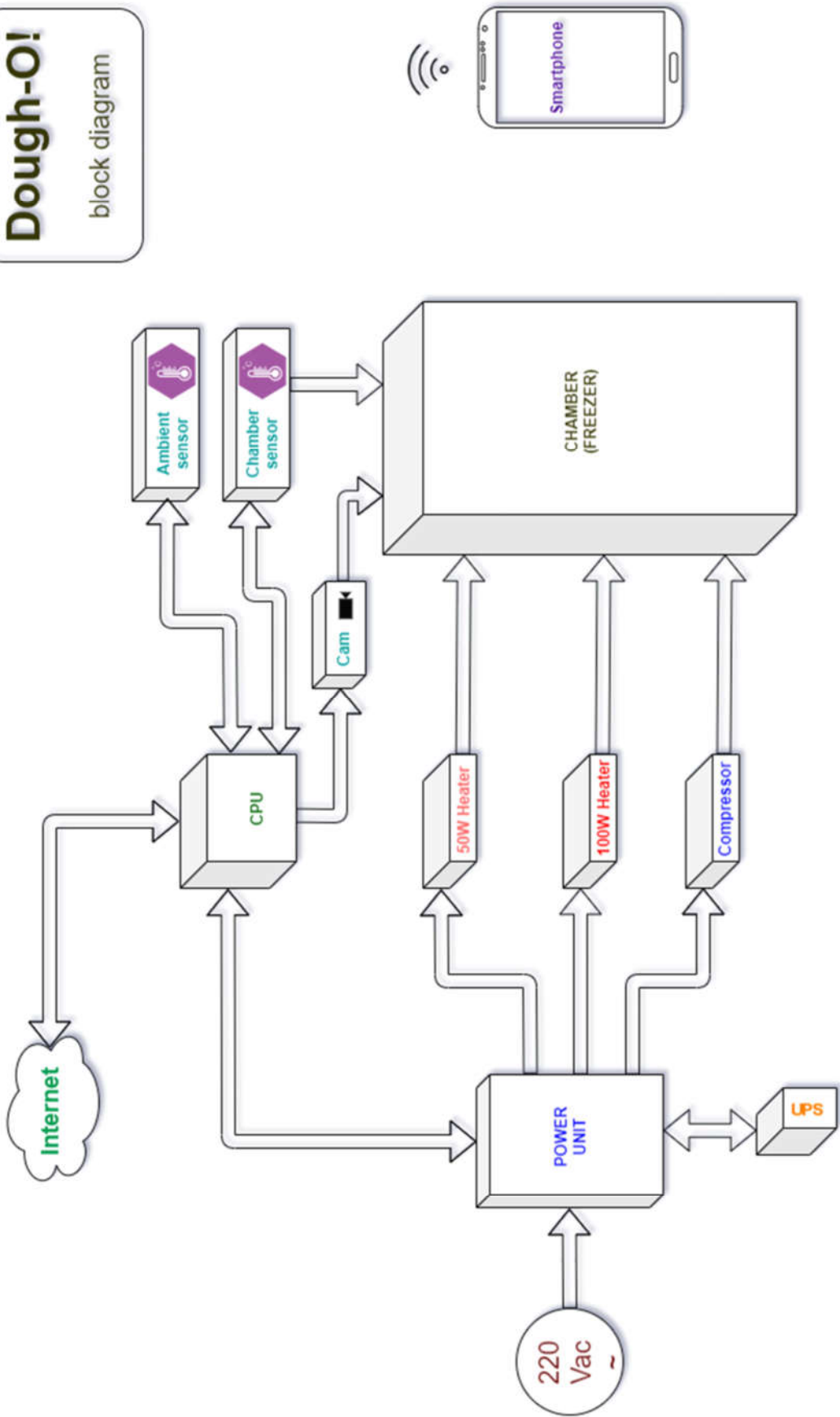
For suggestions, bug reporting, or other info you can refer to the official Facebook page, or fill out the contact form on the website.



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Dough-O!

block diagram



author: Marco Neroni
rel.: 1.1
date: Dec 2020

Diag. 1

FEATURES

- Raspberry Pi 3B+ based: 4 cores, low-consumption CPU
- 2 large + 1 small shelves for your doughs, containers, baking tins, jars
- High-precision waterproof temperature sensors (DS18B30)
- 7" touch screen display
- - 15°C to +50°C temperature range
- 5 freely programmable temperature cycles, from 0 to 999 hours
- Scheduled start function
- Customizable sound alerts
- Integrated wireless and ethernet LAN
- Save and recall infinite programs
- Remote control via smartphone
- Ubidots cloud charts visualization data
- Mail notifications
- Indoor camera
- Overheating protection, overcooling protection, power failure protection

Electrical characteristics:

Supply voltage:	220 Vac
Min power rating:	~2.5 W
Max power rating:	~155 W

Installation space:

Total height:	95 cm
Total width:	57 cm with no UPS / 70 cm with UPS on the side
Total depth:	70 cm

Shelves net dimensions (width x depth x height in cm.)

Top shelf:	38 x 37 x 18
Middle shelf:	38 x 37 x 17.5
Bottom shelf:	37 x 24 x 23

BEFORE STARTING

- You must have finished assembling Dough-O! in all its parts as shown in the assembly guide.
- You must have completed the first setup and set *config.ini* file as shown in the *Configuration Guide*.
- You must have correctly set the protection thermostats before first turning-on the apparatus. If not, check if freezer thermostat is in position '5' and heater protection thermostat is set to 50°C.
- You must have UPS connected and *main power unit switch* ON.

You should have already completed the first startup (see *Configuration Guide*), however for convenience I report it again in chapter [1].

1. FIRST STARTUP

Dough-O! takes about 40 seconds to boot. If the screen in *Fig.1* appears, you have to set the sensors ids.

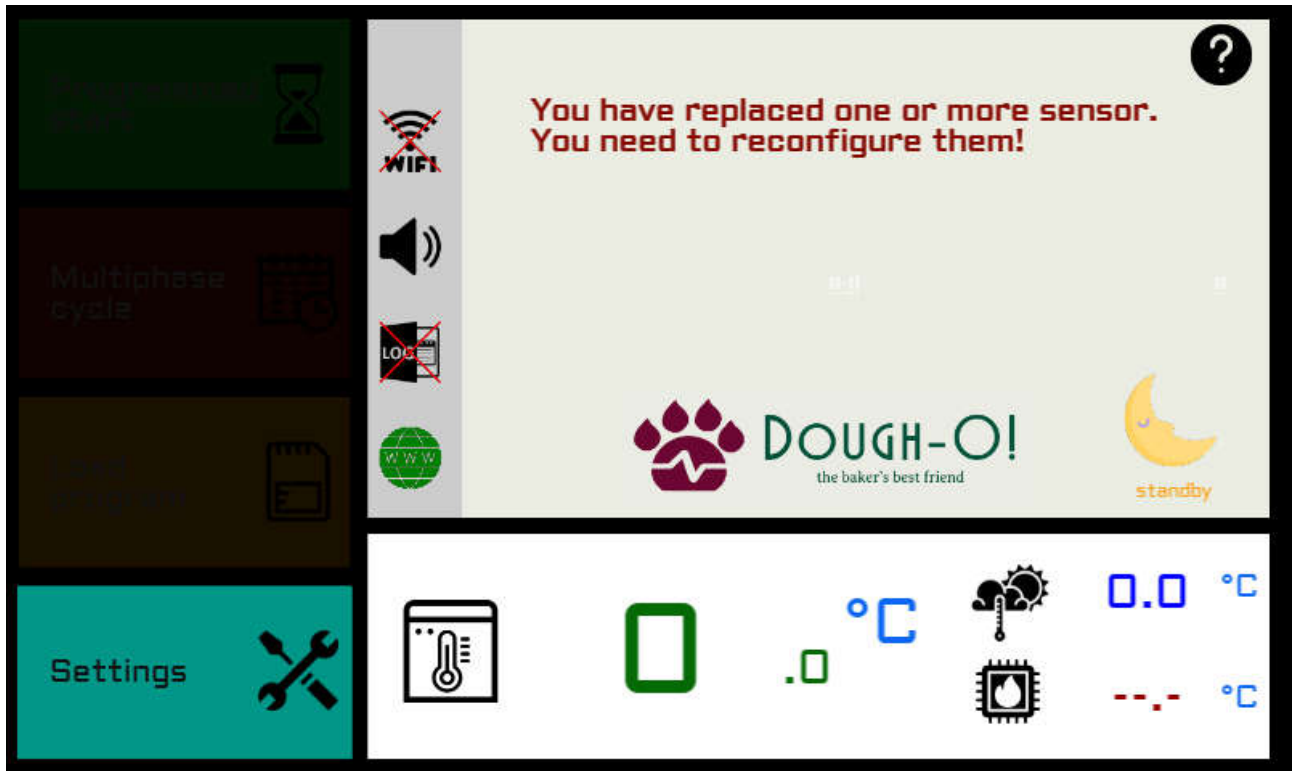



Fig. 1

Tap on *Settings*, go to *ID chamber sensor*, tap on checkbox to enable editing and check if both sensors ids are detected (move with the right or left arrow buttons). Select any ID then the accept  button (*Fig.2*).

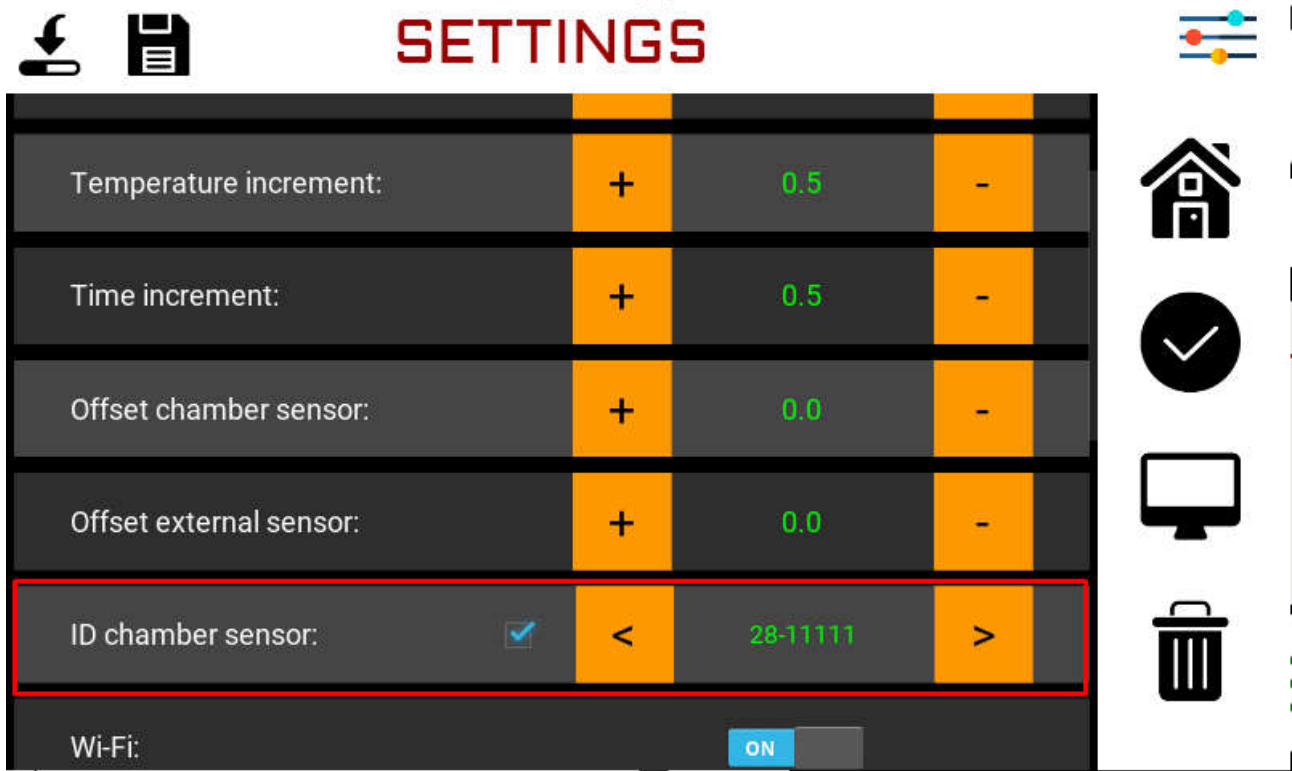


Fig. 2

Dough-O! automatically reboot after 5 seconds then finally shows you main menu. You will also need to perform the calibration procedure shown in *APPENDIX 2*, but first read the following chapters and familiarize yourself with navigating the menus¹.

¹ Important note: Each menu (except dashboards) has an internal timer that automatically returns to the previous if no operations are performed within a certain time.

2. MAIN MENU AND FRONTAL PANEL

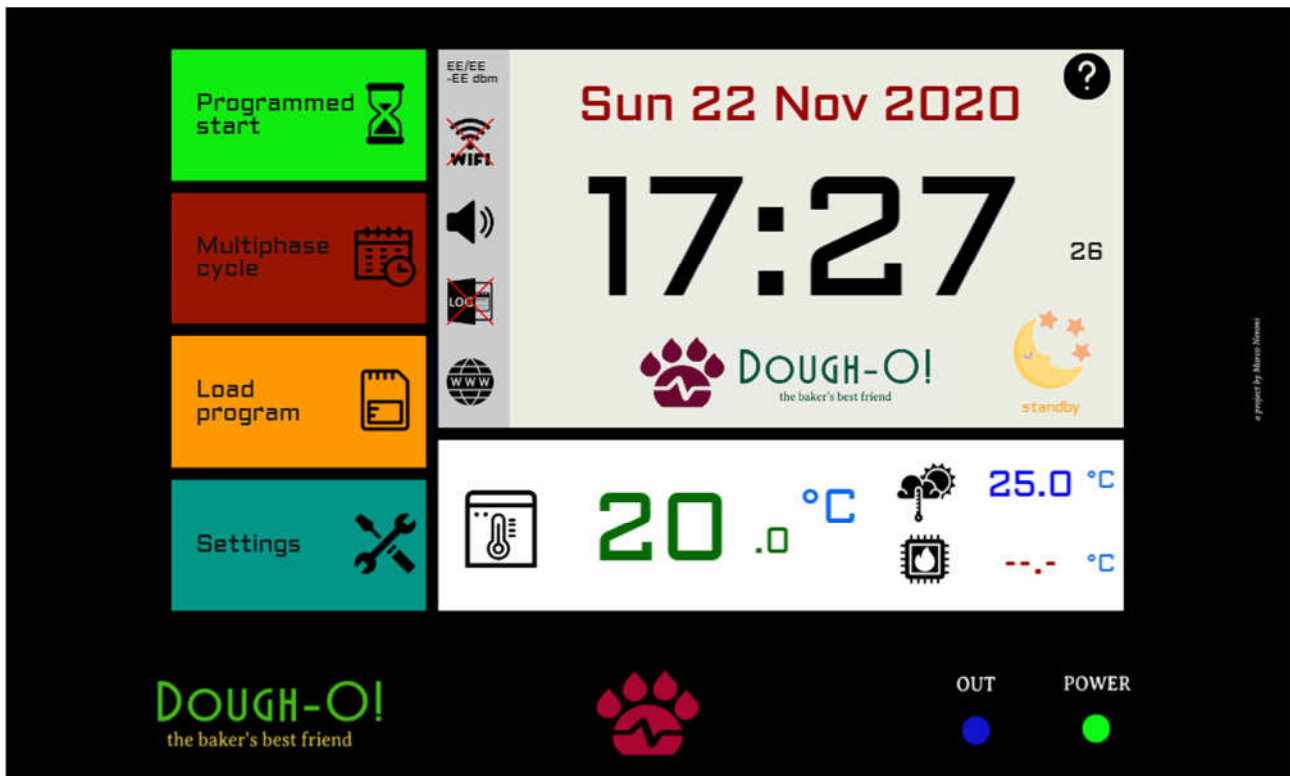


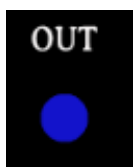
Fig. 3

Main menu is really straightforward.

On the left you have the submenus selection buttons; in the center are shown date and time, while at the bottom are displayed the measured data.

Touch screen is inserted inside a frame on which only two LEDs are mounted. Let's see in detail the meaning of the icons, buttons and indicators.

2.1 – ICONS, BUTTONS AND STATUS LEDs



Output state multicolor LED
See Tab.1 for corresponding status



Power state multicolor LED
See Tab.1 for corresponding status



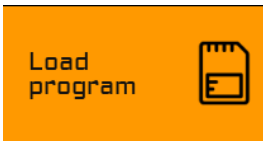
Programmed start button

Tap to select the programmed start mode



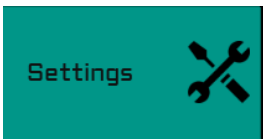
Multiphase cycle button

Tap to select the multiphase cycle mode



Load program button

Tap to load saved program



Settings menu button

Tap to select the user settings menu



Shows wi-fi signal quality and strength

Shows if Wi-Fi connection is available/enabled or disabled

Shows if audio is enabled or disabled

Shows if LOG is enabled or disabled

Shows internet availability, detected by pinging a server every 20 seconds. Icon flashes green when connection is regular, otherwise remains dark.



Info menu button

Tap on this icon to view README page



Camera view button (new on release 1.1)
 Tap on this icon to view real-time camera images



Output state animated icon
 Tap to show GUI log utility




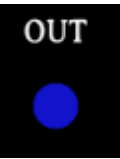
Actual chamber temperature
 Unit (°C or °F) depends on settings



Actual external temperature
 Unit (°C or °F) depends on settings



Actual CPU temperature.
 Unit (°C or °F) depends on settings

LED	COLOR	STATUS
POWER 	Green	Main power ok
	Yellow/Green flashing	Failure detected
	None	Off
OUT 	Blue	Freezer on
	Yellow	50W heater on
	Purple	100W heater on
	Red	100W+150W heaters on
	None	Outputs disabled

Tab.1

3. SETTINGS MENU

Click on *Settings* button on main screen to display the settings menu (Fig.4). There are many options, so you can swipe with finger to show them all.

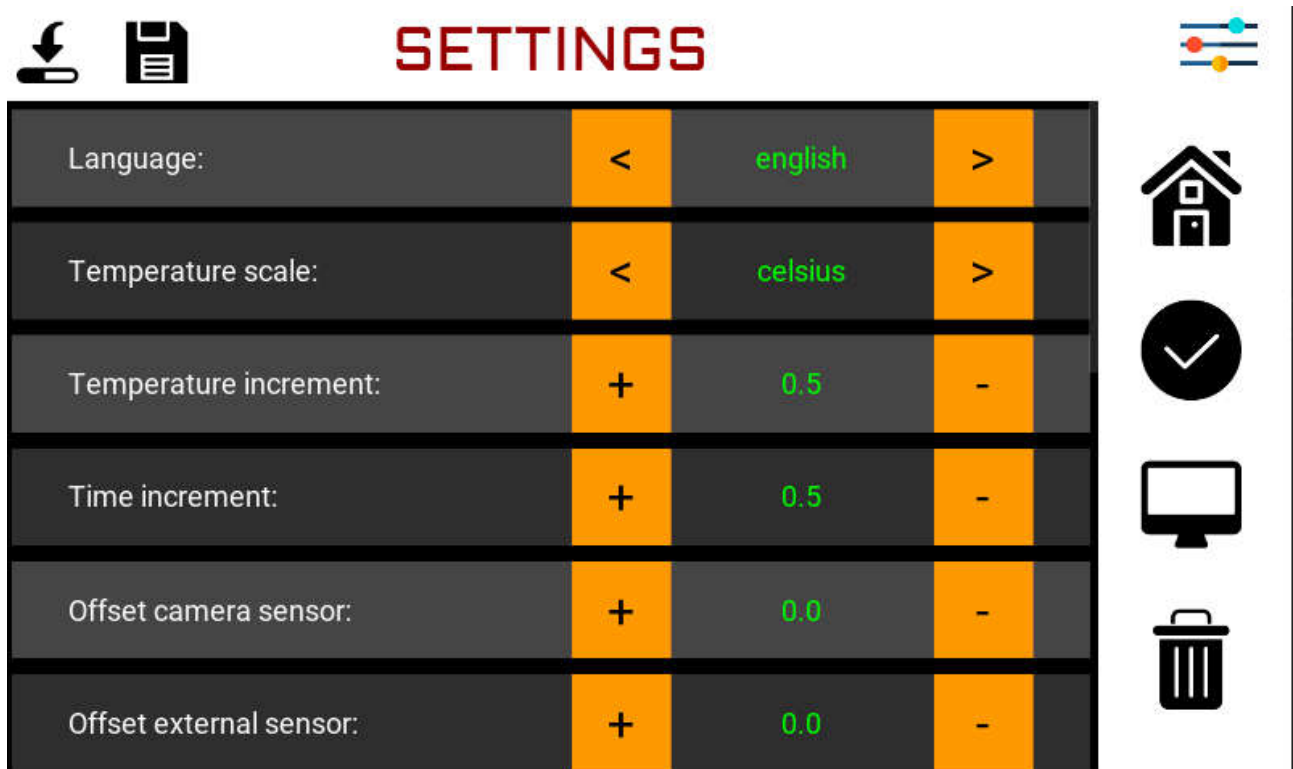


Fig. 4

Before moving on to the menu items, let's take a look at the icons.

3.1 – ICONS



Backup settings button

Store your settings in a backup file on Pi directory (external to app installation folder) so you can reload them after Dough-O! reinstallation or upgrade



Load backup settings button

Load backup settings previously saved



Home button

Tap to return to main menu



Accept button

Tap to save your settings in config.ini and reboot the system



Desktop button

Tap to exit application and show Pi desktop



Reset button

Tap to populate menu items with factory values

3.2 – SETTINGS ENTRIES

- **Language**

Sets the app language. There are 4 language files preinstalled in Dough-O/Lang folder, default is english but you can choose from italian, french, spanish if you have installed respective locales during Pi configuration.

Is possible to easily edit a .py file and translate it into your language. See chapter 10 for more.

- **Temperature scale**

Sets the app's temperature unit scale (Celsius or Farenheit).

- **Temperature increment**

Sets the temperature increment steps when you set up the program. Values range from 0.1 to 1.

- **Time increment**

Sets the time increment steps when you set up the program. Values range from 0.5 to 10.

- **Offset chamber sensor**

Calibration of the chamber sensor.

Sets the linear deviation from temperature detected by sensor and the real temperature measured with reference thermometer in the middle of chamber.

- **Offset external sensor**

Calibration of the external sensor.

Sets the linear deviation from temperature detected by sensor and the real temperature measured in the ambient with reference thermometer.

- **ID chamber sensor**

Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Dough-O! auto detects each IDs but does not know where the sensor is located: this setting therefore indicates which sensor is inserted in the fermentation chamber.

- **Wi-Fi**

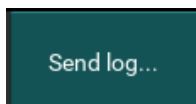
Enable or disable permanently on-board Wi-Fi.

- **Cloud**

Enable or disable communication with *Ubidots cloud*.

- **Log**

Enable or disable system logging service.



Press this button to sends all log txt files to the e-mail specified in *config.ini*

- **Buzzer**

Enable or disable buzzer permanently.

When buzzer enabled, sound effects are disabled and vice-versa.

- **Mail notify**

Enable or disable mail notification.

- **Volume audio**

Set the volume of the sound effects.



Press this button to test audio volume.

For the settings to take effect, you must tap on the accept button and restart the application. Press only home button will discard the changes.

4. PROGRAMMED START

Programmed start allows you to set the start date and time of your program. Dough-O! sleeps until the set time arrives, then it activates and works to reach and maintain the target temperature for an *indefinite* time. Tap on *Programmed start* button on home screen to show the relative program settings:

4.1 – PROGRAMMED START SETTINGS

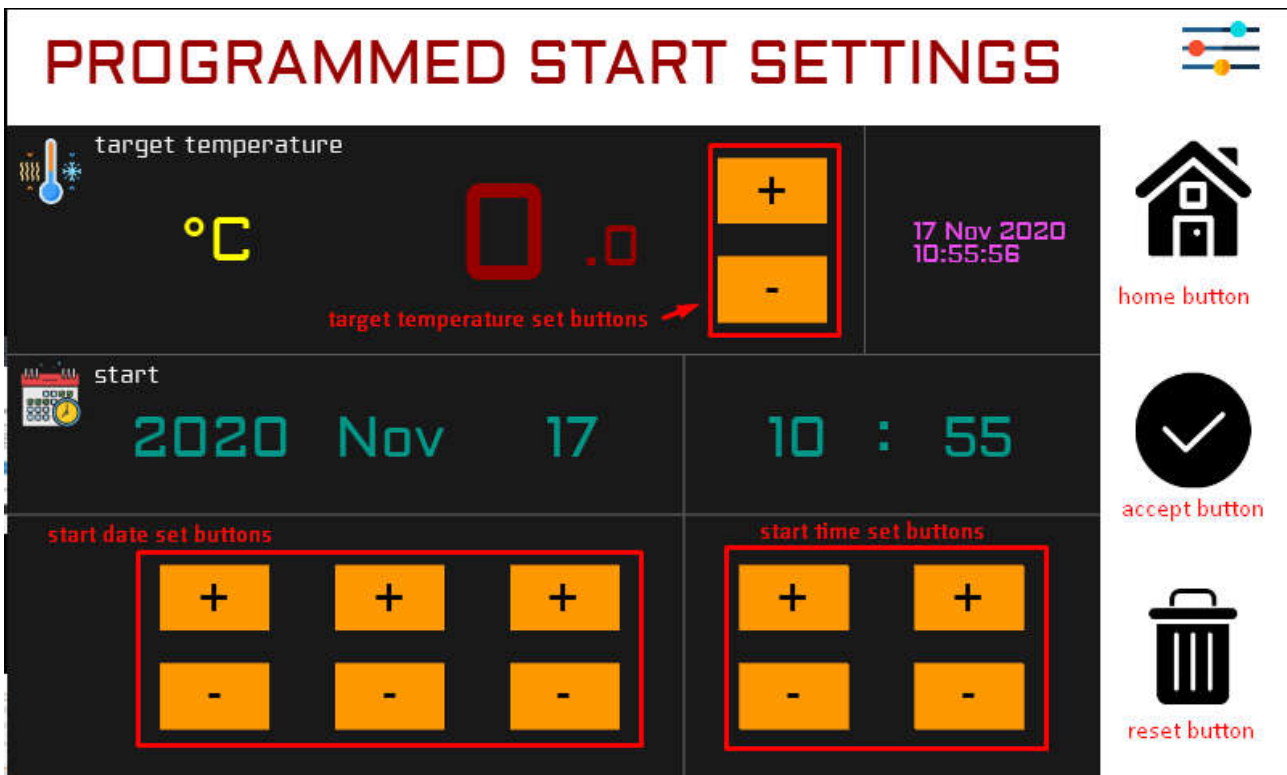


Fig. 5

The *Fig.5* shows the simple structure of settings menu: obviously, you can not set a date earlier than the current one. On the right, notice the navigation buttons. Tap on *home* button to return to the main menu; or *bin* button to reset fields. If instead you are ready, tap on *accept* and you will be redirected to the Programmed Start Dashboard (*Fig. 6*)

4.2 – PROGRAMMED START DASHBOARD

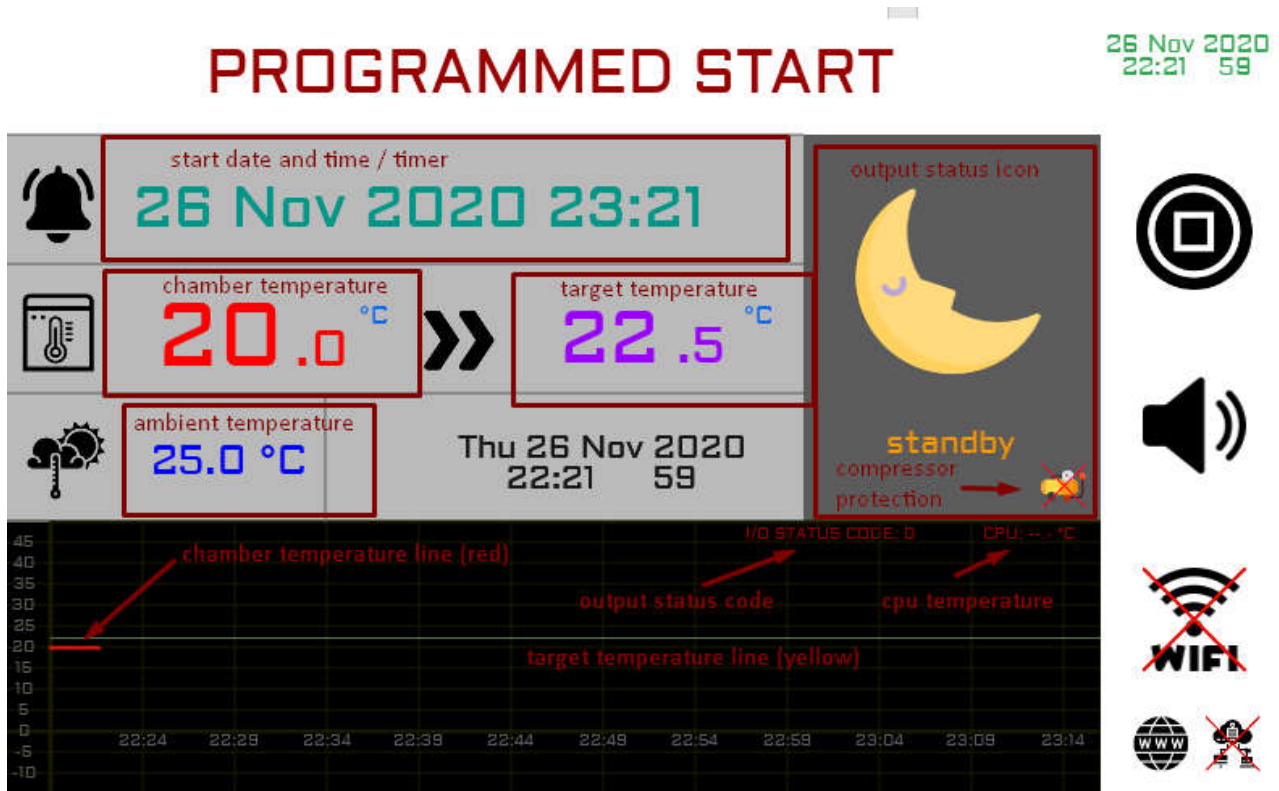



Fig. 6

The dashboard is divided into areas so that you have an immediate snapshot of the situation.

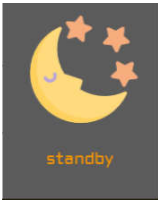
When idle, the central-top area displays start date and time with  icon.

When program starts, will be displayed a stopwatch with  icon.

New on release 1.1: tap on  icon will display chamber camera screen (see *chapter 5*).

On central-right area will be displayed *I/O status animated icons*. Let's see what they represent.

4.3 – I/O STATUS ANIMATED ICONS



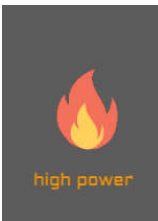
Standby animated icon
Outputs are disabled



Low power animated icon
50W heater is working



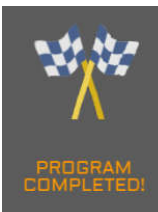
Mid power animated icon
100W heater is working



High power animated icon
both 50W and 100W heaters are working



Cooling animated icon
Freezer's compressor is working



Program completed animated icon
Is displayed when program is completed successfully



Error animated icon

Is displayed when there is a fault
See chapter 8 for details



Compressor protection animated icon

When this small icon flashes it means that compressor protection is active.

Protecting the compressor is very important because it prevents close starts, which could damage the freezer (see *Configuration Guide* for details)

4.4 – GUI LOG UTILITY

Tap on output status area (over I/O status icon) will display *GUI LOG UTILITY* (Fig. 7):

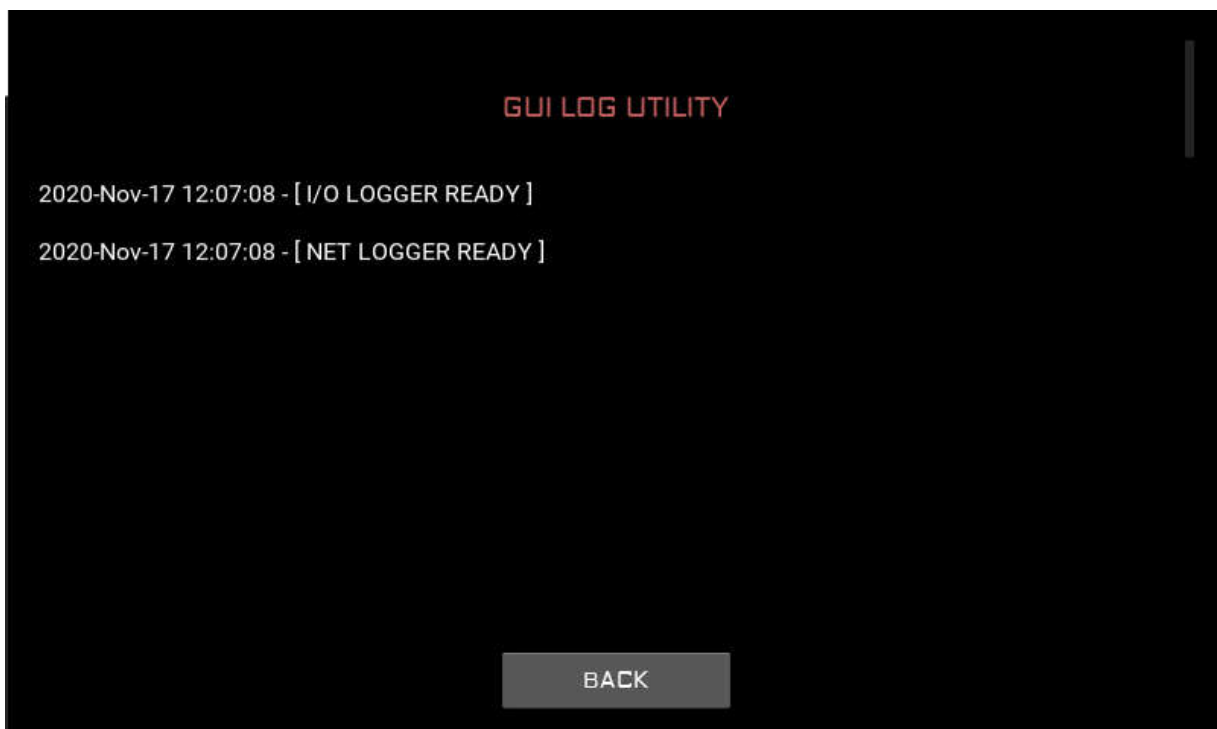


Fig. 7

Here you can have a direct view of issues/background messages related to power, I/O and network, even when *Log* general setting is disabled.

4.5 – REAL TIME GRAPH AREA

The dashboard's bottom area displays a real-time graph that cleans up every hour; it is useful for monitoring temperature fluctuations and for getting an idea of what happened over a period of time. The yellow straight line represents the target temperature. On top right of this area are displayed I/O status code and CPU temperature. I/O status is managed by software and has only debug function.

4.6 – NAVIGATION BAR

On the right vertical bar we find navigation icons and status icons. In detail:



Back button.

Tap to return to settings menu.

You can modify any setting even when program is running: timer will be updated based on your new input values

Once program started, you can stop it only by returning to home.



Mute / unmute button

Tap to mute or unmute audio *and* buzzer.

This operation does not affect general setting.

When audio is disabled, icon is covered by a red cross.



Wi-Fi enable / disable button

Tap to enable or disable Wi-Fi.

This operation does not affect general setting.

When Wi-Fi is disabled, icon is covered by a red cross.



Internet animated icon

Icon flashes green when connection is regular, otherwise remains dark.



Ubidots Cloud animated icon

Icon flashes green when cloud connection is regular, otherwise is dark.

When Cloud is disabled (main setting), icon is covered by a red cross.²

² Note that this setting does not disable the VNC functionality but only the data exchange with the Ubidots server.

5. MULTIPHASE CYCLE

Multiphase cycle is the core function of Dough-O!

Allows you to program up to 5 cycles with a wide range of timing and temperature. It's an essential function for making a professional pizza, where a low temperature fermentation phase followed by several leavening phases are required. Is also particularly useful when you want to have a dough ready at a certain time, or to make products with a different taste based on the type of fermentation you want to activate.

5.1 – MULTIPHASE SETTINGS

Tap on *Multiphase Cycle* button on main menu to show the relative settings (Fig.8)

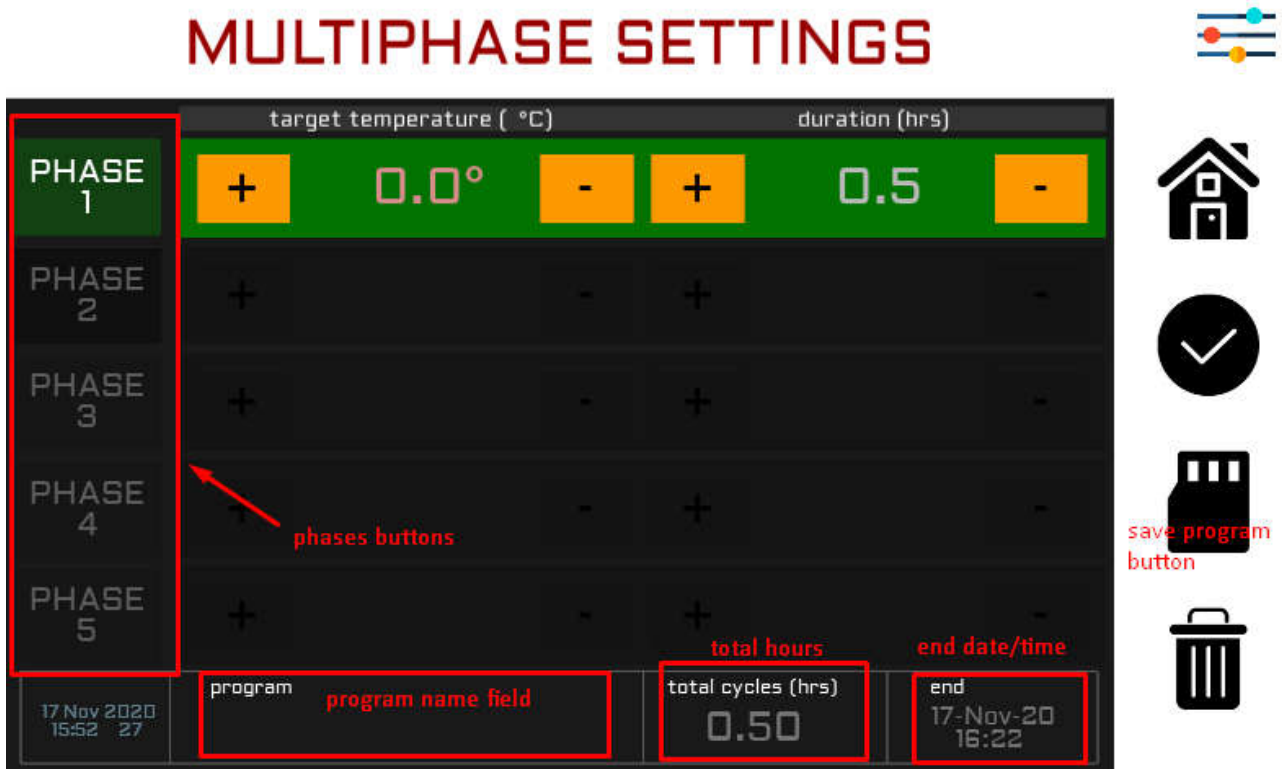


Fig. 8

Each row represents a phase: when the line is dark it means that the phase is disabled. For enable a phase, tap on phase button on the left.

Phase 1 is **always enabled**.

You have to activate the phases in sequence, then set the target temperatures and durations.

You can disable the phases 2-3-4-5 once enabled, but remember that this

operation must be done in reverse order: for example, if you have all 5 phases enabled and you want to disable phase 2, phases 3 and 4 will also be disabled. Similarly, it is not possible to rehabilitate a phase that has already passed, but you can always change parameters of the current phase and subsequent phases.

When the remaining time is lower than half of phase duration, it is possible to decrease the duration until the timer is reset and immediately pass to the next phase. For example: if you had set phase to 1 hour, and remaining time is lower than 30 minutes, if you decrease value to 0.5 the timer will reset and you will go to the next step. This is a desired behavior because the clocks are dependent on the initial values you have set for the program and give you more flexibility in control.

The bottom area has fields where summary data relating to the program are displayed.

The side navigation bar is identical to those already seen in the previous chapter; only one button is added, which we will see shortly.

5.2 – MULTIPHASE DASHBOARD

Tap on *accept button* in multiphase settings to enter in Multiphase Dashboard Screen and start program (Fig.9)

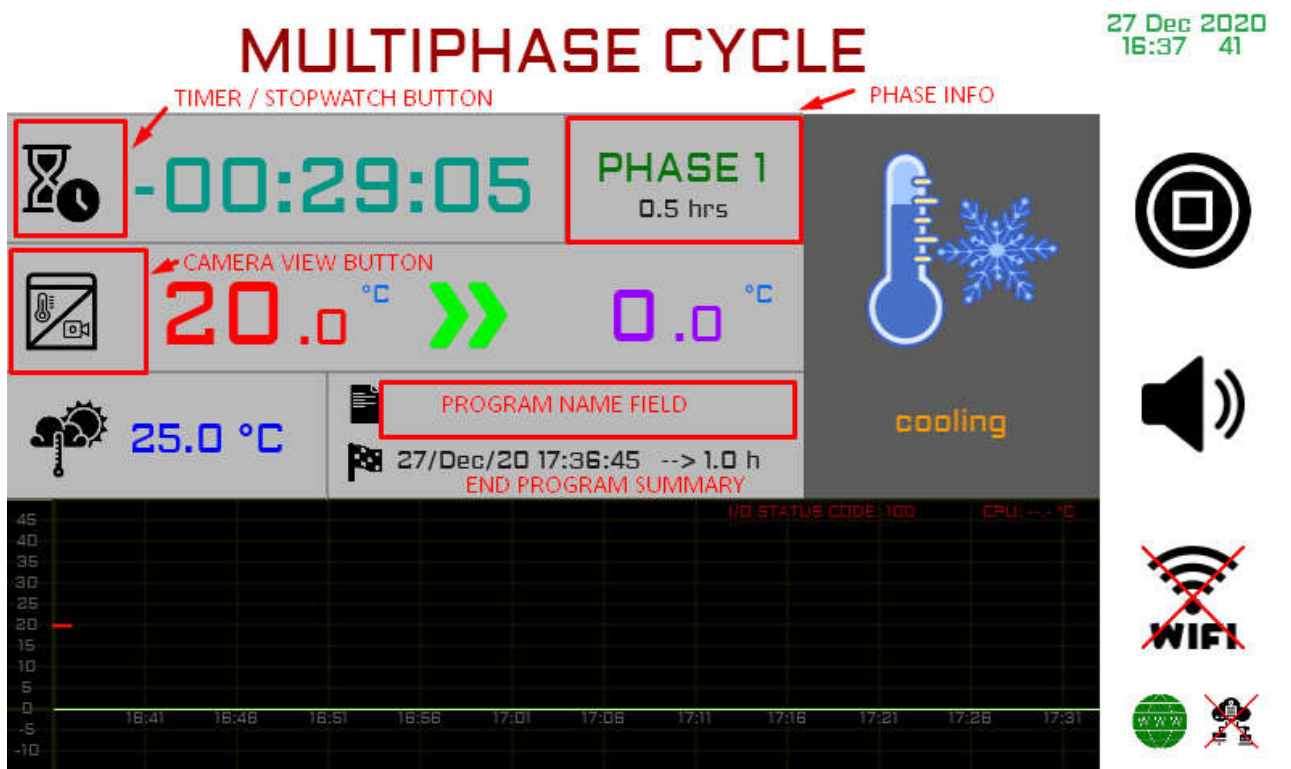


Fig. 9

Design is pretty similar to Prestart Dashboard as seen above, therefore there is nothing special to add.

The central area shows various info on the current phase, including the name of the program if it has been loaded from the memory (we will see how to do it later).

Tap on the  icon to toggle Timer / Stopwatch mode view

5.3 – CHAMBER CAMERA

New on release 1.1.

From this release you can connect IP67 USB endoscope with light (or another webcam) and view the inside of the chamber from anywhere.

Tap on  icon from any menu.

Dough-O! take a screenshot every second, so you can see what happens in there.

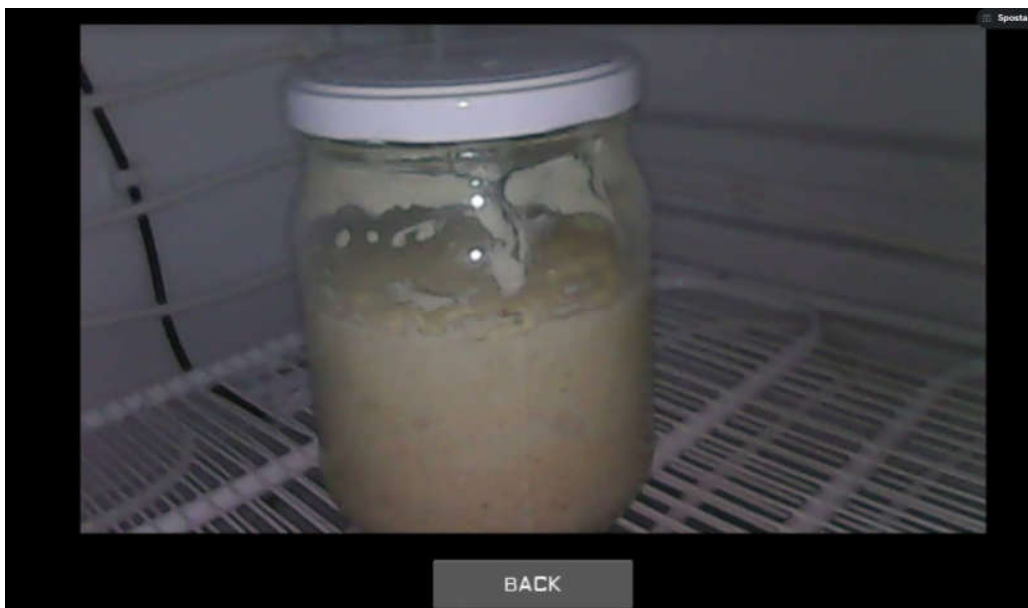


Fig. 10

6. SAVE A PROGRAM TO MEMORY

Return to *Multiphase settings* menu.

On the right side of the panel, in addition to the buttons you already know, notice the save program icon button (*Fig. 11*)

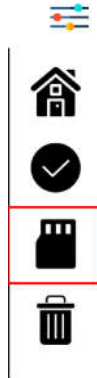


Fig. 11

Tap on it will show *Save Program Menu* (*Fig.12*). Here you can save the settings you just entered in the multiphase menu.

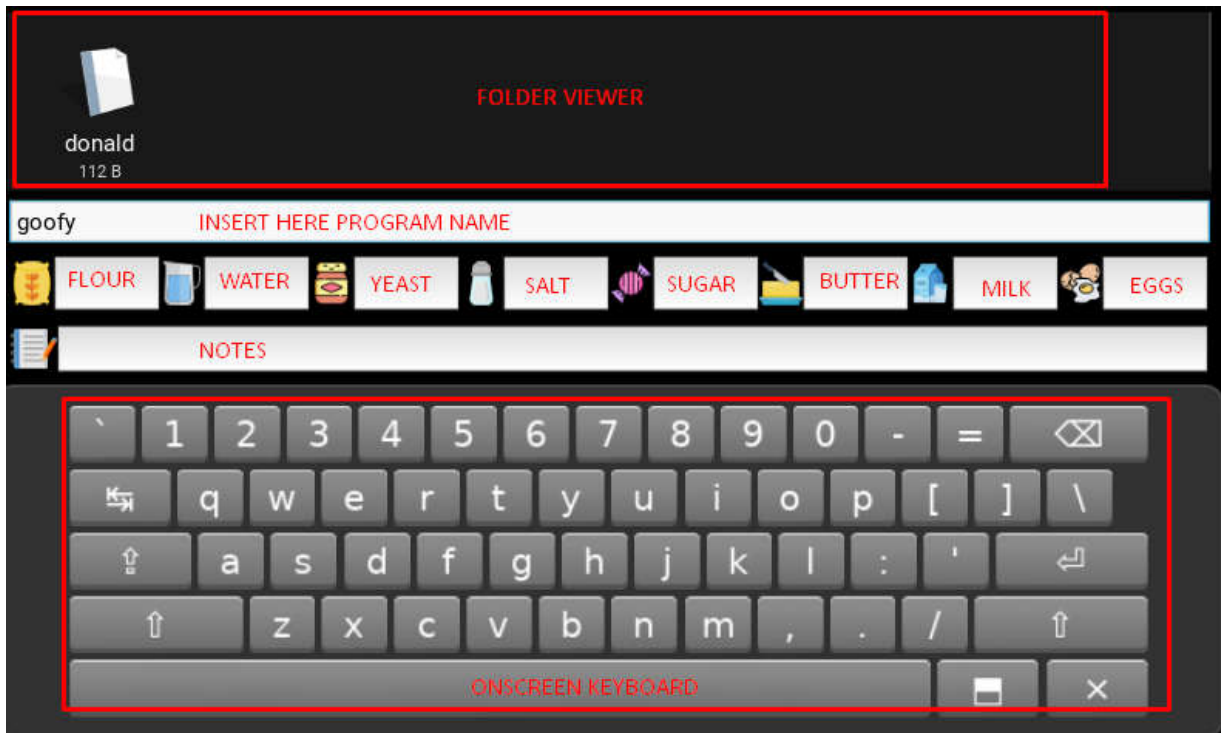




Fig. 12

The programs are stored in folder *~/Programs* created automatically at first run; **this folder will be maintained even in case of upgrade**, so you don't need to backup your programs. There is no limit to the number of programs you can store.

Tap in the field under *folder viewer* will show on-screen keyboard.

Give the program a name, press [enter]  then  .

To delete a file, select him and press *delete* button; if you select a pre-existing file you will ask before overwrite.

Remember that you can always save a program *before* its completion

You also have the option to store ingredients and notes for a recipe. Each field (excluding the notes field which has no limitations) can contain up to a **maximum of 7 alphanumeric chars**.

7. LOAD A PROGRAM FROM MEMORY

Tap on *Load program* button on main menu to display saved programs (*Fig.13*)

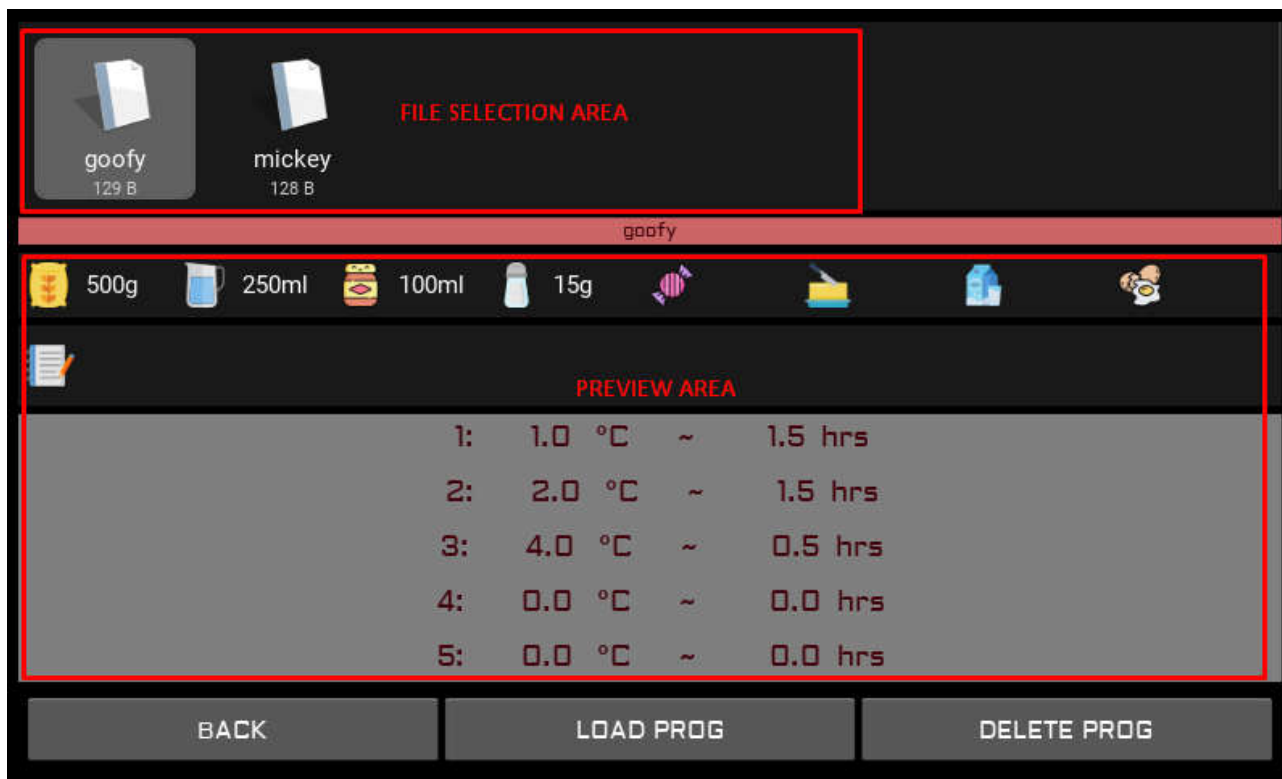


Fig. 13

Select your file: you can preview recipe data and other settings in the central area. Tap on *LOAD PROG* will redirect you to Multiphase dashboard settings, where you can accept or modify the program (*Fig.14*)

MULTIPHASE SETTINGS

	target temperature (°C)		duration (hrs)			
PHASE 1	+	1.0°	-	+	0.5	-
PHASE 2	+	2.0°	-	+	0.5	-
PHASE 3	+	1.0°	-	+	0.5	-
PHASE 4	+		-	+		-
PHASE 5	+		-	+		-
20 Nov 2020 10:22 37	program	PROGRAM NAME goofy		total cycles (hrs)	1.50	end 20-Nov-20 11:52

Fig. 14

Note that if you change any parameter, the program name will no longer be referenced. This is a reasonable behavior because a program is immutable in the parameters that have been assigned to it.

8. ISSUES AND WARNING CODES

Dough-O! software performs continuously several checks on the input/output states.

The reliability of the apparatus largely depends on the care taken in assembly: therefore, a *state-of-the-art* work minimizes the occurrence of failures.

8.1 – I/O FAILURES

When a failure on sensors and/or output is detected, Dough-O! shows a blinking icon with numeric message code (*Fig. 15*), switches off the outputs and blocks the program (if running). An alarm sound is emitted regardless of the audio settings. Power led on frontal panel flashes orange/green.

You can tap also on failure icon to read failure message with GUI LOG UTILITY



Fig. 15

Refer to the following table for the meaning of each code:

ERROR CODE	MEANING
200	Generic error
201	Temperature out of range
301	Error reading chamber sensor
302	Error reading ambient sensor
603	Error reading both sensors

Tab. 2

8.2 – POWER FAILURES

When a **power failure** is detected, a flashing battery icon appears on chart area if program is running (Fig.16) or on top area if Dough-O! is in standby mode (Fig. 17).

Outputs are disabled (because UPS supplies **only** CPU module) and *power led* on frontal panel flashes orange/green.

No alarm sound is played.

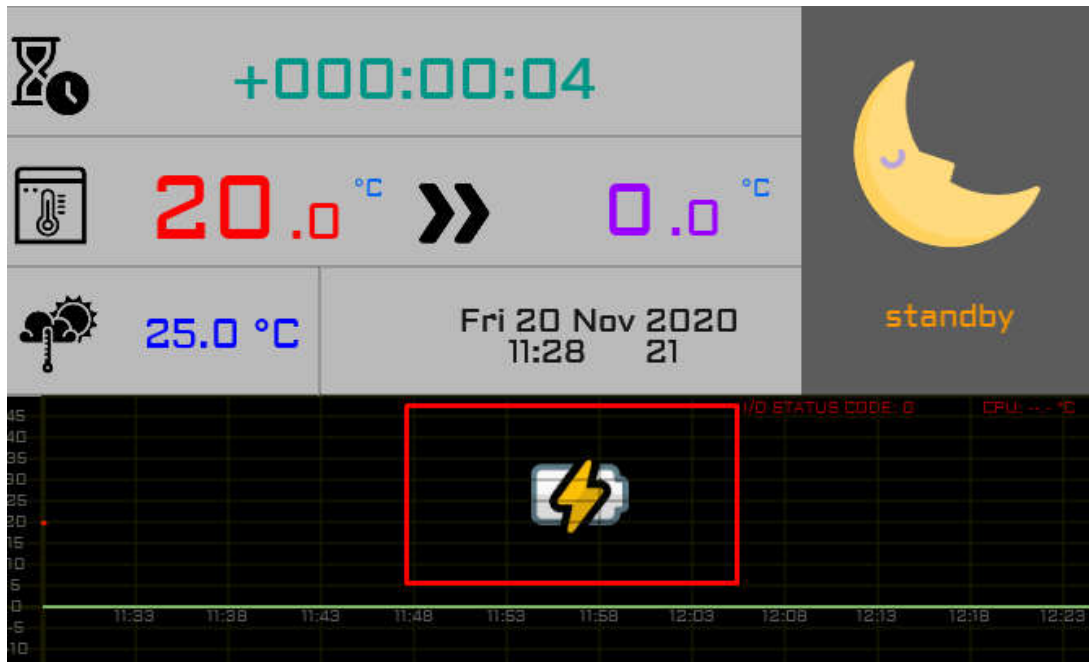


Fig. 16

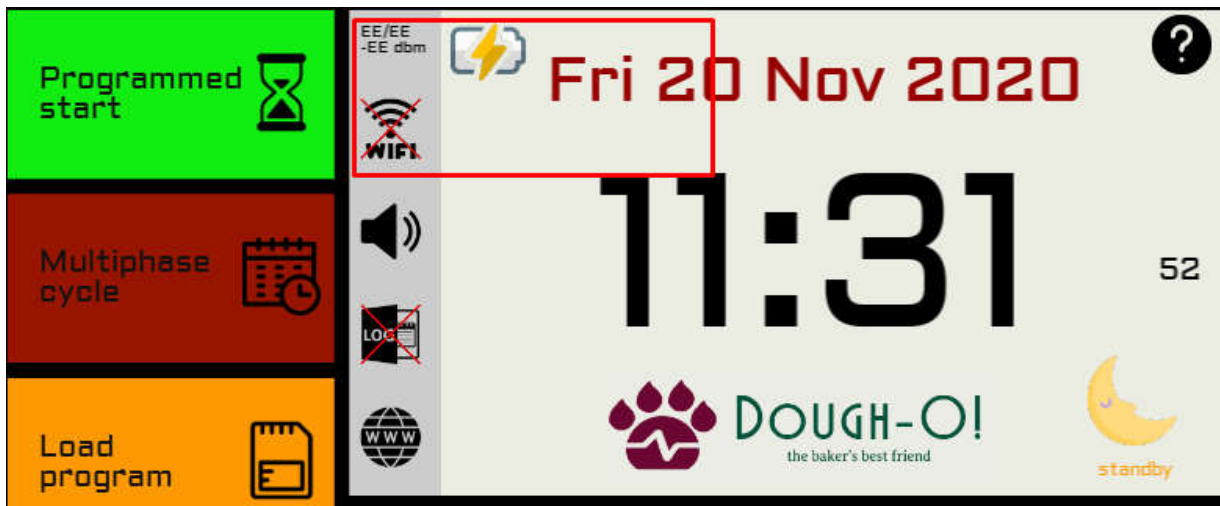


Fig. 17

Tap on output icon to view log messages (*Fig. 18*): device will be safely turn-off by itself after the time setted in the `config.ini` file (see *Configuration Guide*). If the power problem is resolved in the meantime, **the shutdown timer will be disabled.**

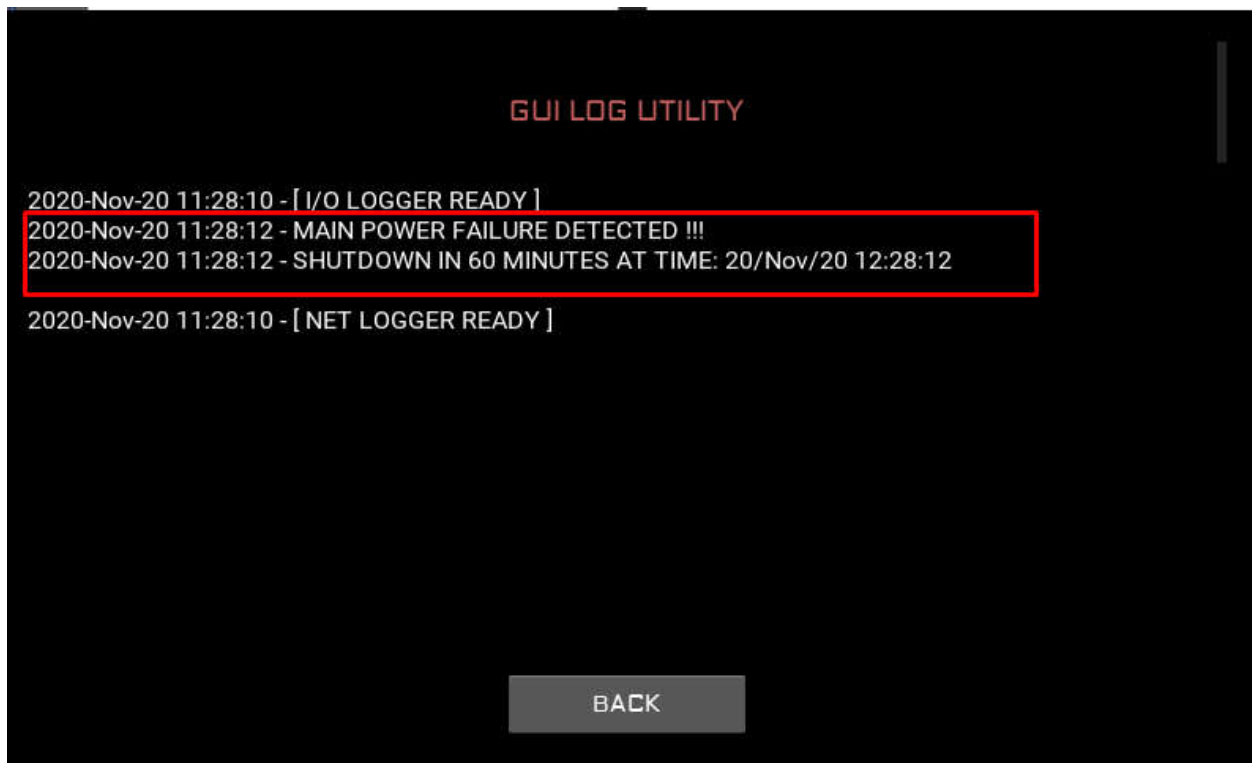


Fig. 18

8.3 – NETWORK FAILURES

Network issues does not generate critical situations, therefore they are managed in the background. If you encounter a connection issue, take a look at the *GUI LOG*: in most cases it is a temporary loss of connection or an error in data exchange.

8.4 – SYSTEM LOG

As seen in the **chapter [3]** you can enable system log to trace any critical errors. This feature is crucial for developers, less useful for normal users. When log is enabled, several txt files are generated in `/Logs` folder. You can send these to your email for a more comfortable debugging (if you have correctly configured your account). If Dough-O! app fails to start, you need to manually set `log = True` entry in `config.ini`, try to restart application then investigate inside generated logs.

9. NETWORK UTILITIES

9.1 – REMOTE CONTROL VIA REALVNC CLOUD

Thanks to *RealVNC* free cloud service, you can easily control Dough-O! from your smartphone or other remote device.

If you want to know in short *what* VNC is, take a look at this link:

<https://www.realvnc.com/en/news/what-vnc-cloud/>

Read *Dough-O! Configuration Guide* for installation tips.

It's not the task of this guide to repeat what you will find written on the official website:

<https://www.realvnc.com/en/>

Therefore it is advisable to read it to fully exploit the potential it offers.

Fig. 19 shows what you can visualize on your device.

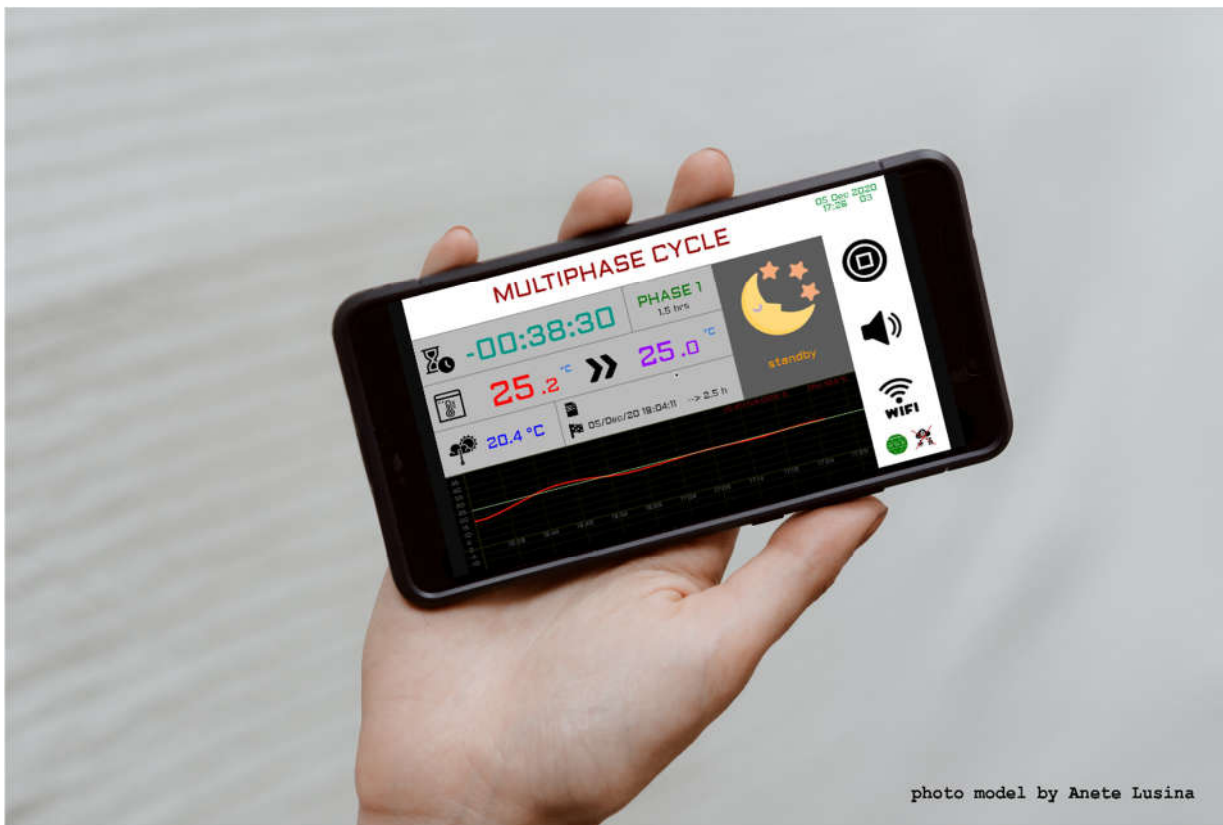


Fig. 19

9.2 – UBIDOTS STEM CLOUD

Ubidots STEM is a platform that offers a professional cloud service (free if limited to the non-commercial area) very useful for data visualization.

Dough-O! is already programmed to connect to the server and exchange a maximum of 10 variables.

Read the *Dough-O! Configuration Guide* for details.

Subscribe to service and read the documentation at the following link:

<https://ubidots.com/stem/>

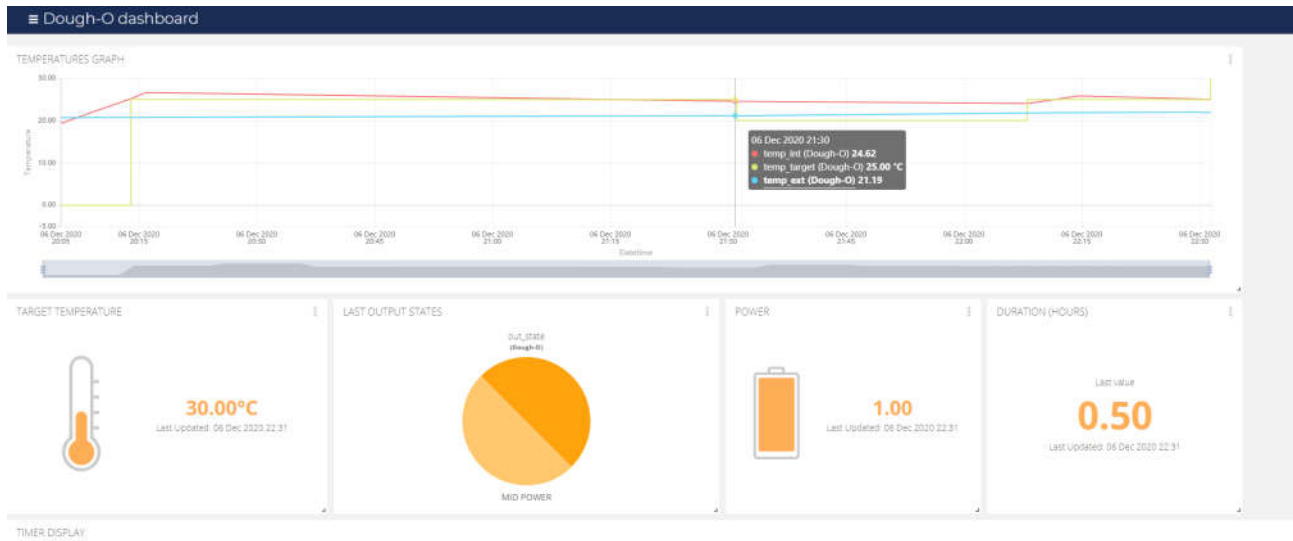


Fig. 20

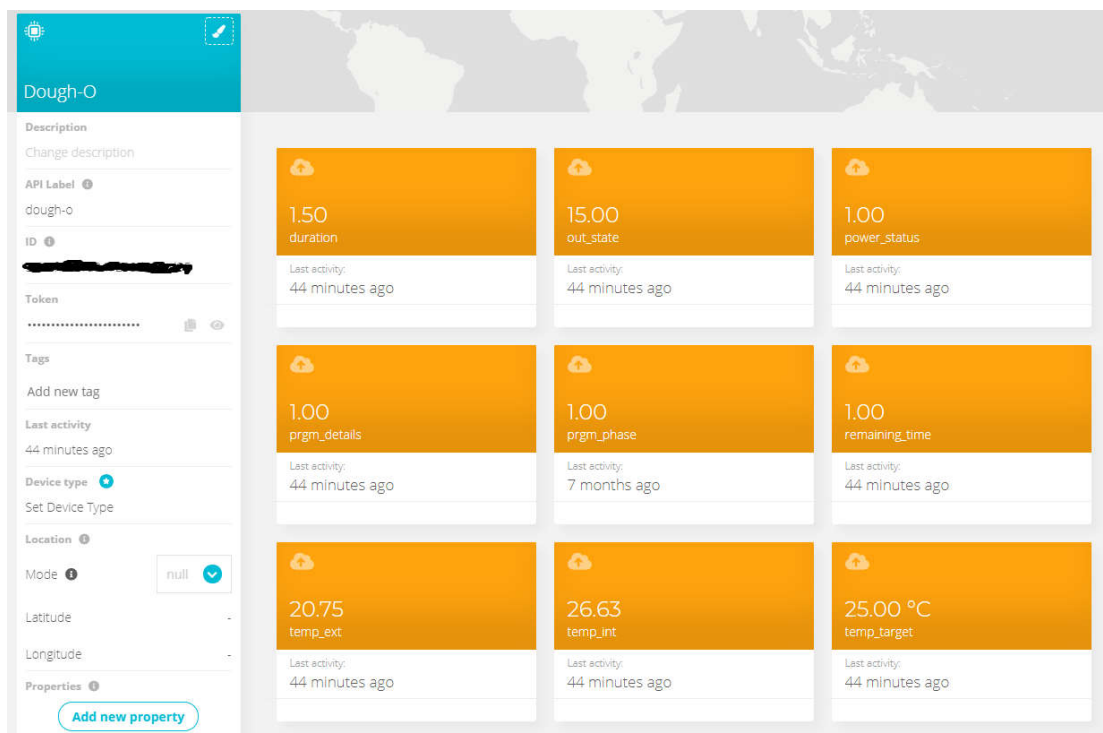


Fig. 21

9.3 – MAIL NOTIFICATIONS

Dough-O! is able to react to certain events and send a mail notification with some status information:

- Start program
- Change phase
- End program
- Issues

Refer to *Dough-O! Configuration Guide* for account setup in *config.ini*.

The messages are constructed based on presets in the language file; *Fig.22* shows an example of a mail sent at the beginning of a phase.

Go to **chapter [10]** to learn more.



Fig. 22

10. CUSTOMIZATIONS

Dough-O! standard installation should cover most of everyone's needs. However, it is possible to customize some aspects such as sound effects and, if you know a bit of computer science, you can also edit the language files.

Do not modify the source code unless you are an experienced developer.

10.1 – CUSTOMIZE AUDIO EFFECTS

All sounds must be in `.wav` format and located into `/Dough-O/Sounds` folder.

Open file `config.ini` in App installation directory, then scroll to **[AUDIO]** section.

Modify entries is rather elementary: you just have to indicate the `.wav` complete filename.

Do not overdo the length of the audio file -especially the buttons- or the graphical interface may become much less responsive!

10.2 – CUSTOMIZE LANGUAGE

Language file is a `.py` file stored in `/Lang` folder.

You can open it with any text editor.

Fig. 23 shows the structure: on the **left** you will find the **properties** that must never be changed. On the **right**, instead, UI text between quotes which **you can modify**.

Remember to set the correct Pi language pack³ name in header, otherwise the file will not be loaded. Any error will causes that the default language file (`english.py`) to be loaded.

```
locale_linux = 'en_GB.UTF-8' ← Linux language pack name
locale_win = 'en-GB' # for Windows ← Windows language pack name
btn_main_prestart = 'Programmed\ncstart'
btn_main_multiphase = 'Multiphase\ncycle'
btn_main_load_from_menu = 'Load\nprogram'
btn_main_settings = 'settings'
prestart_set_title = 'PROGRAMMED START SETTINGS'
prestart_set_temp_target = 'target temperature'
prestart_set_start = 'start'
prestart_dash_title = 'PROGRAMMED START' ← property names
```

Fig. 23

You can insert `'\n'` escape sequence for carriage return

³ Language pack must be installed in the system

10.3 – CUSTOMIZE CONTROLLER ALGORITHM

The default algorithm is optimized for use with the recommended freezer or similar, but it is possible to modify the activation parameters to adapt them to cold rooms of different sizes.

This operation will be illustrated in a separate document reserved to developers or more experienced users.

10.4 – BYPASS THE UPS AND DISABLE POWER FAILURE CHECK

In the event of a temporary power failure, UPS is essential to avoid unexpected shutdown: in fact, sudden resets are dangerous because they could damage Pi's system files (remember that the CPU module is a real mini PC!).

The shutdown button behind the CPU module actually commands a control system that performs a "gracefully" power off, therefore you will never need to turn off the device from the desktop.

However, there is the possibility of bypassing the UPS and disabling the check of power failures (this option could be useful for those who have a solar panel system with storage and they will never have problems with energy supply).

All you have to do is to connect directly a cable from UPS input socket and UPS out (see *APPENDIX 2*); then open *config.ini*, find *ups_shutdown* entry in **[APP]** section and set value to **0** (*Fig.24*)

```
show_cursor = False
auto_reboot = True
ups_shutdown = 0
```

Fig. 24

APPENDIX 1

sensors calibration

When apparatus installation has been completed is necessary to proceed with fine calibration of the sensors.

The ideal equipment should consist of a multimeter with temperature probe and a laser thermometer. If you only have one of the two, that's okay too; if you don't have anything, you need to get at least one thermometer already calibrated.

▪ CALIBRATION OF THE AMBIENT SENSOR

Follow these steps:

1. Turn on Dough-O!
2. Place a thermometer **near** external sensor.
3. **Wait some minutes** to stabilize temperature.
4. Compare the outside temperature measured by the app and that read by the thermometer.
5. The **temperature difference** between the sample thermometer and that reported in the app is the value you will need to set in the *offset external sensor* entry in *Settings* menu.
For example, if thermometer shows 17°C and Dough-O! indicates 16°C, you will set *offset external sensor* to +1.

▪ CALIBRATION OF THE CHAMBER SENSOR

Follow these steps:

1. **Make a quick and small dough** and place it into a bowl, then place the bowl in the **middle shelf** of Dough-O!
2. Place the sample thermometer probe **near** indoor sensor
3. Turn on Dough-O!
4. Set a program with a temperature 5 degrees **higher** than the ambient and duration 1 hour at least.
5. Start the program and **wait** for the target temperature to be reached.
6. Once reached, **wait for end program**, then compare the temperature measured by the app and that read by the thermometer.
7. The **temperature difference** between the sample thermometer and that reported in the app is the value you will need to set in the *offset chamber sensor* in *Settings* menu.
For example, if thermometer shows 25°C and Dough-O! indicates 24°C, you will set *offset chamber sensor* to -1.
8. If you have a **laser thermometer**, you can make the application measurement more close to the temperature of the dough.
Point the laser on the **dough's surface** and perform a fine calibration of chamber offset.
9. **Perform a further calibration** with a **lower** temperature; set a temperature 5 degrees lower than ambient temperature and **repeat steps from 5 to 8**.

APPENDIX 2

photos with captions



Fig. A1 – Front internal view

Shelves dimensions (width x depth x height) in cm.

TOP SHELF:	38 x 37 x 18
MIDDLE SHELF:	38 x 37 x 17.5
BOTTOM SHELF	37 x 24 x 23

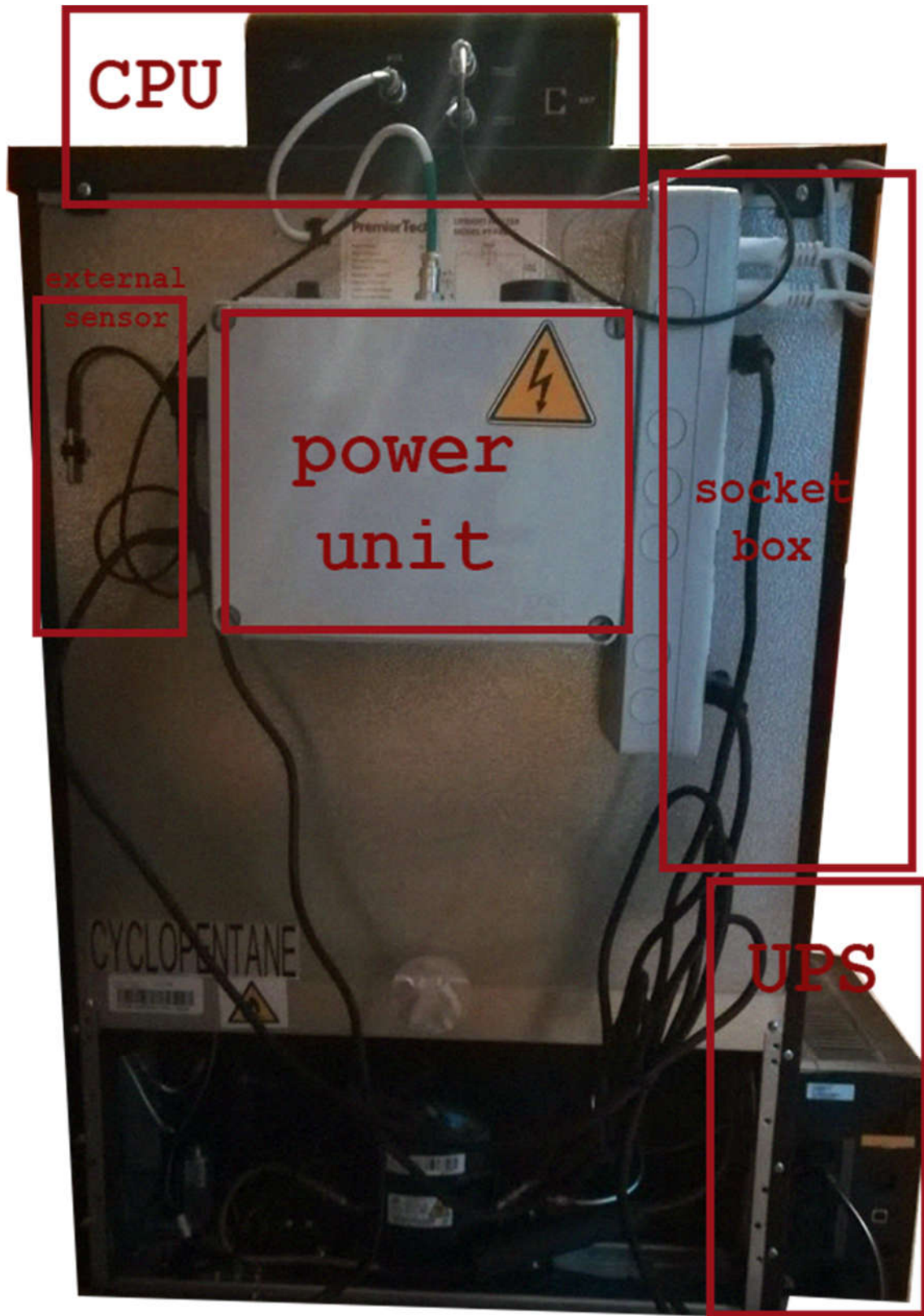


Fig. A2 - Rear view



Fig. A3 – CPU unit detail

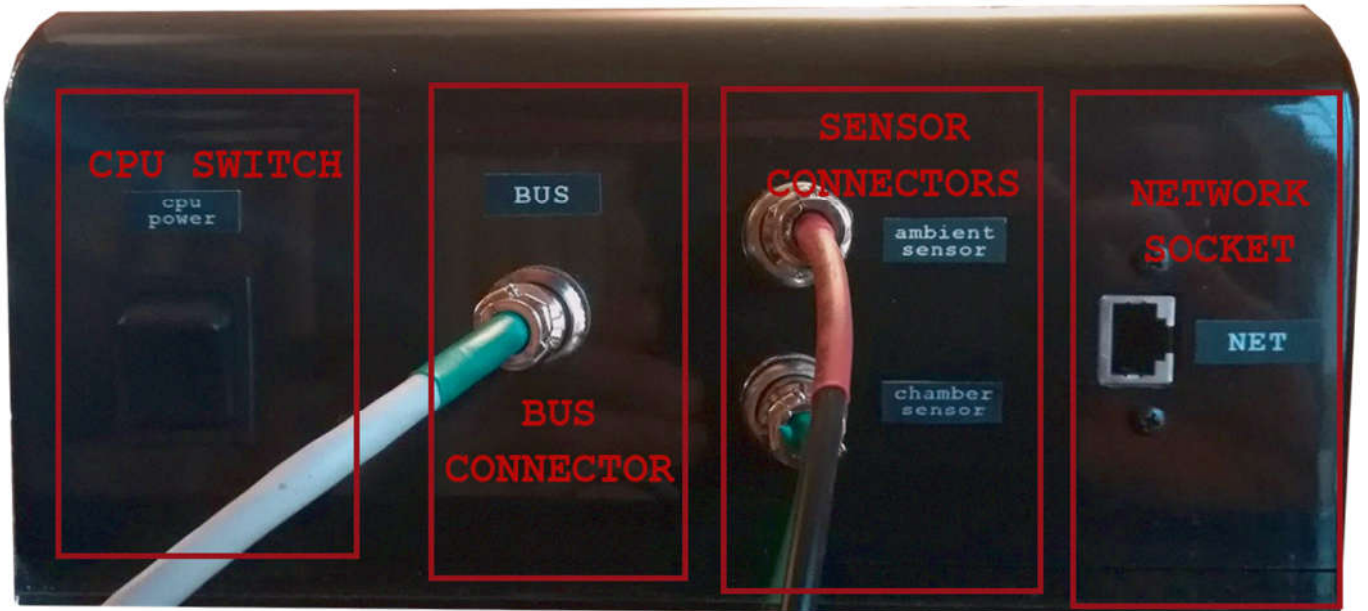


Fig. A4 – CPU unit rear view



Fig. A5 - CPU box left side



Fig. A6 - Power unit frontal view

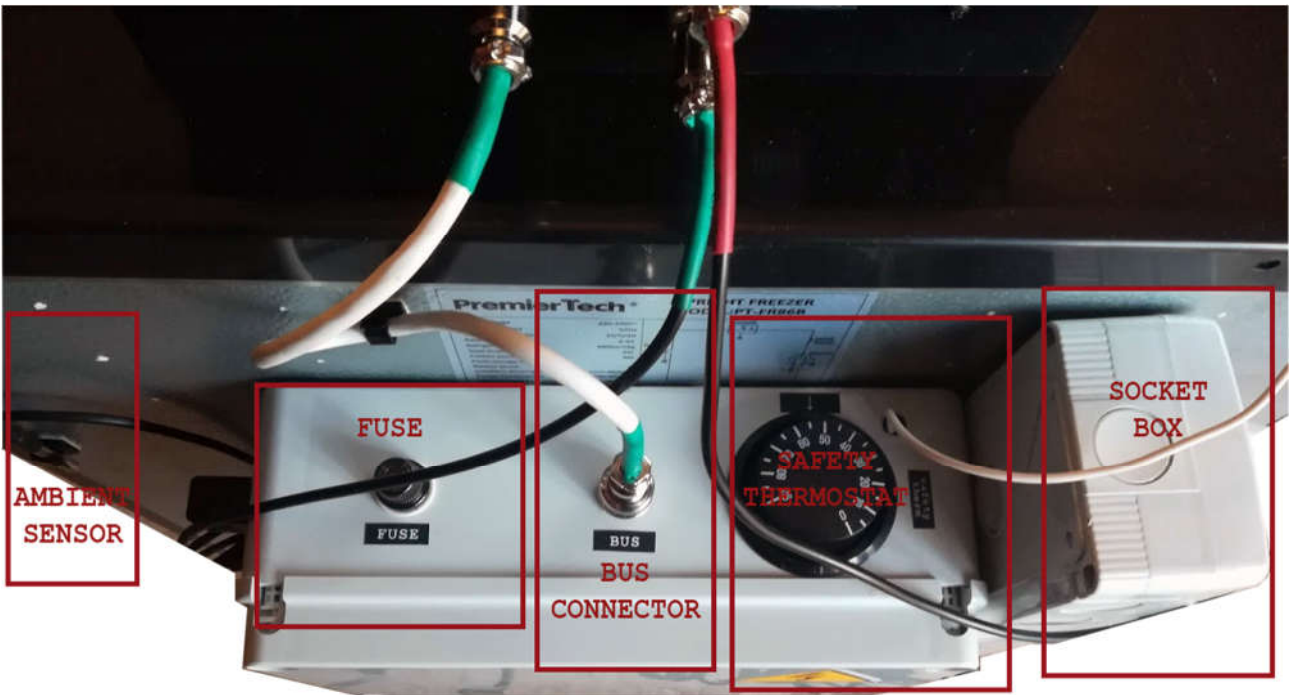


Fig. A7 - Power unit top view

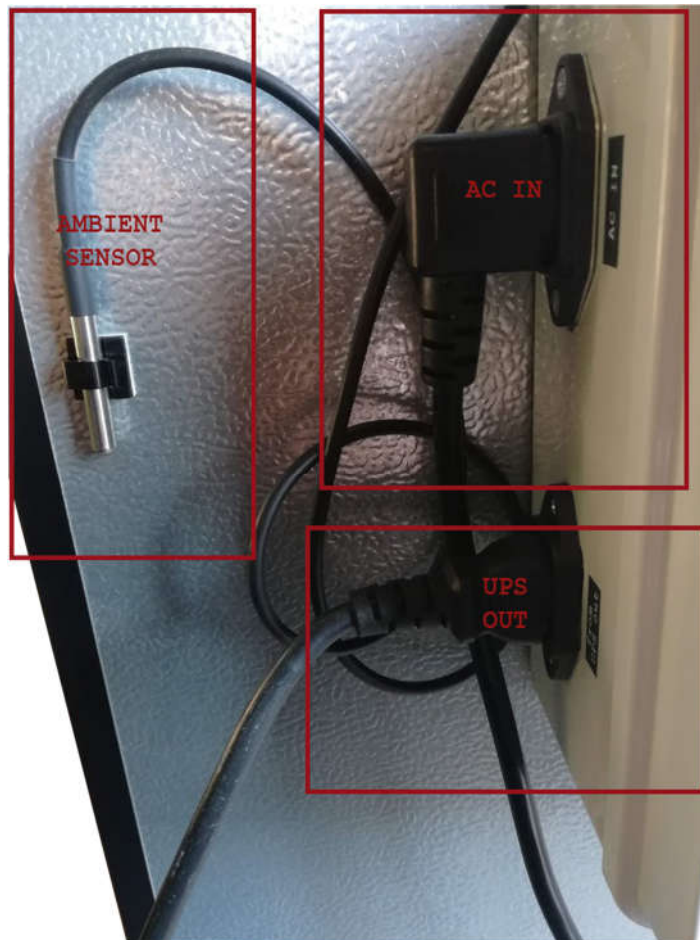


Fig. A8 - Power unit left side view

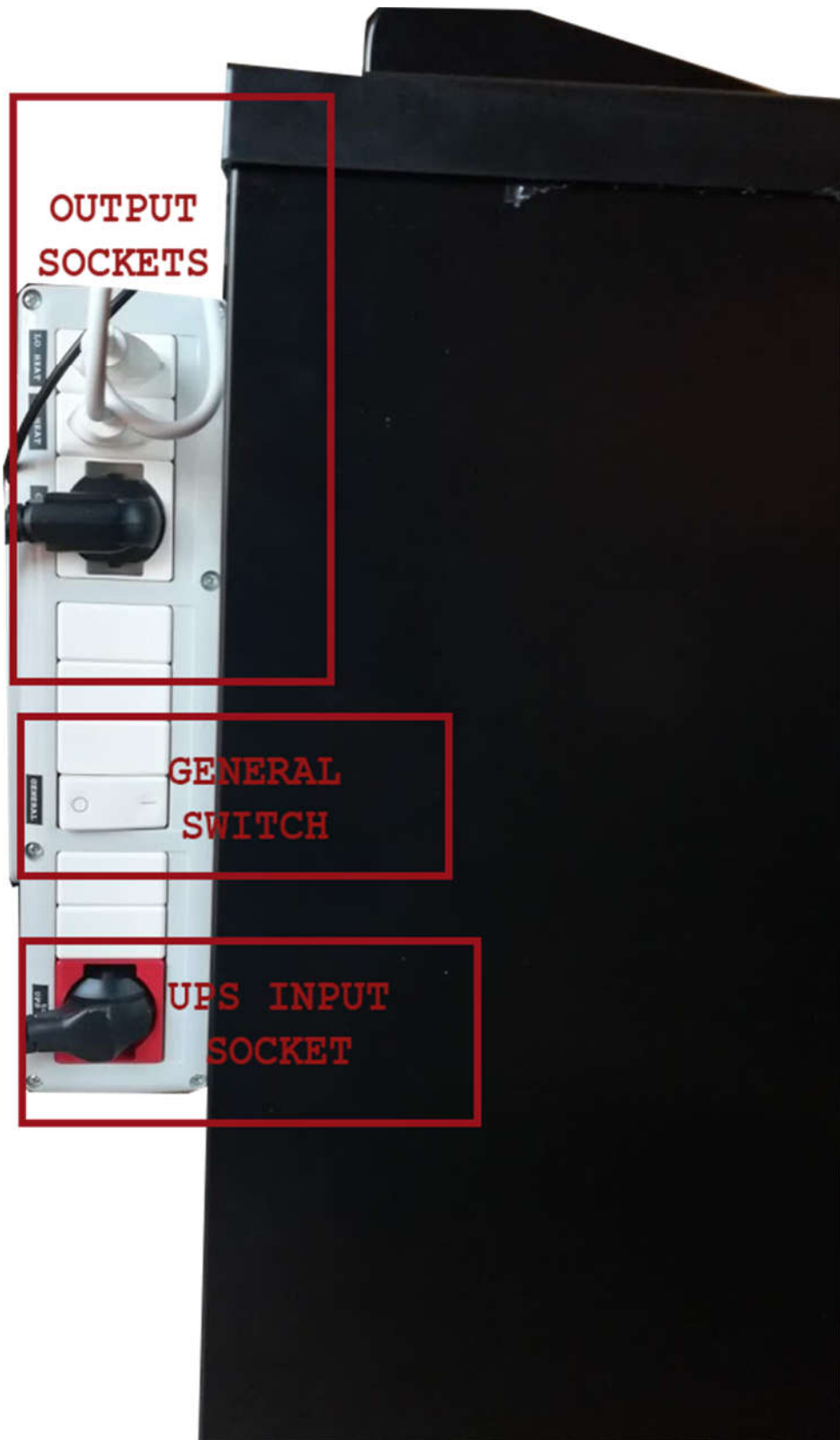


Fig. A9 – Socket box view (power unit right)



Fig. A10 - Indoor camera (endoscope)