

BREW CHAMBER CONTROLLER v0.07.0a

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INSTRUCTION MANUAL

Installation

1. Create bcc user account:

- ssh into BBB as root
- adduser bcc
- password (whatever you want)_____
- default the rest of the questions

2. Install bcc and prerequisites on Beaglebone Black (BBB):

- ssh into BBB as root
- cd /usr/local
- git clone <https://github.com/cyberlord8/bcc>
- chown -R bcc ./bcc
- cd bcc
- chmod +x ./bcc.py
- chmod +x ./su-bcc.run
- su bcc
- copy bcc.desktop to ~/Desktop/
- apt-get install gnuplot
- apt-get install gnuplot-x11

3. To run bcc:

- ssh into BBB as bcc
- vncserver :1
- vnc into BBB as bcc
- double click the bcc icon on the desktop
- enter bcc's password
- optionally, clean up the terminal window (this affects all terminal windows)
- right click in the terminal window
- click on preferences
- click on the display tab
- hide the scroll bar
- hide the menu bar

Operation

1. The Menu System

- S – Scale(C/F)
 - i. This menu option switches between Fahrenheit and Celsius. Values stored in the Yeast Strain.csv file (discussed later) are stored as Fahrenheit but bcc takes this into consideration when selecting a yeast strain.
- T – Set Temp
 - i. This menu option allows the user to manually set a desired brew temperature. Bcc uses the temperatures in the Yeast Strains.csv file to automatically set the normal and warm brew temperatures. If you need to adjust the desired temperature from these automatically calculated temperatures then this is the way to do it. It's important to know that selecting a new (or the same yeast strain) with the Y menu option the normal and warm temperatures will be reset and the desired temperature adjusted accordingly.
- D – Set Dwell
 - i. The dwell setting is how far you want the brew chamber temperature to deviate from the desired temperature. A smaller number means a more precise temperature but more times the compressor or heater kicks on to maintain the temperature. Dwell is used to calculate the min and max alarm temperatures and a large value can skew this calculation up. Recommended setting is 1.5F to 2F and no more than 3F. 3 degrees dwell will result in a 6 degree temperature swing. A dwell of 1.5 will result in a 3 degree temperature swing. You are welcome to use a smaller dwell setting but too low a setting may make the software try to switch the compressor on to soon after it shut off. While this is protected from doing this by the software it's best to increase the dwell setting so the software doesn't try to turn the compressor on too soon.
- Y – Yeast Prof
 - i. The Yeast profile menu option allows the user to select a desired yeast strain from a comma separated value (csv) spreadsheet and use the data pertaining to that particular yeast strain. Selecting a new yeast strain or reselecting the same yeast strain will reset the normal, warm, and consequently the desired temperature settings along with the min and max alarm settings.
- A – Alarms
 - i. The Alarms menu option allows the user to turn the alarm system off altogether or selectively turn the SMS texting feature off by itself. If you turn the alarm system on then you are asked to manually set the min and max alarm temperatures. If you want to use the SMS texting feature you must edit bcc.py and find both the lines that contain XXXXXXXXXX and replace both instances with your phone number. This will be changed to include a phone number

setting in bccconfig.py in the future. The SMS feature is set to send no more than 1 text per hour. There is a maximum limit of 3 texts per hour (75 per day actually) set by the SMS service that bcc uses. However 1 text per hour is probably adequate for what we are trying to achieve.

- B – Brew Info
 - i. The brew info menu option gathers information about the brew that will be used to aid in the automation process which will be added in a future version. Currently the brew info option asks for Brew Name, Batch Number, Batch Size, Brew Style, and Brew Method. More data will be gathered in future versions to aid in the automation process.
- F – Refresh
 - i. Since this version of bcc is a text based program running in a terminal sometimes the screen can get messed up. This menu option will clear and redraw the screen. If you resize the terminal window you are likely to mess the display up so it will not format properly. Exiting out of the program and restarting from the desktop icon should fix the terminal window size.
- G – Graphics
 - i. Turns graphical charting on or off. If on, set the interval to write the data to the database. For details on how to use gnuplot to chart your brew session see paragraph 4. A smaller interval will produce larger data files but produce a smoother chart. To large an interval will display a course chart and may miss a temperature swing (the alarm system will still trigger). Recommended interval is 15 minutes.
- C – Clear
 - i. The Clear menu option is used to store/cellar/clear the final product. Bottles can be stored in the brew chamber also at cellar temperatures. If you want to store the contents at refrigerated temperatures then use the R – Crash menu option. This value can be adjusted from the bccconfig.py settings file.
- L – Lager
 - i. The lager option is used to maintain a cooler fermenting temperature when lager conditioning a beer. This value can also be adjusted from the bccconfig.py settings file.
- N – Normal
 - i. The normal brew cycle is the primary cycle used when fermenting. The temperature used is calculated from the variables in the Yeast Strain.csv file. You can manually override the calculated value with the T – Set Temp menu option but remember if you select a new yeast or reselect the same yeast all the temperatures are automatically recalculated.
- O – Off
 - i. The Off menu option turns the brew cycle off which turns off the cooling and heating functions along with the alarm system. If the brew cycle is turned back

on again the system should return to the previous settings except if you selected a different brew cycle from the previous one.

- R – Crash
 - i. The crash menu option drops the chamber temperature which causes the yeast in suspension to stop their activity and drop out of suspension. This cycle should be used when the fermentation has naturally stopped or you are forcing it to stop because a higher FG is desired. If the fermentation is stopped prematurely then steps need to be taken to assure fermentation does not reoccur in the bottle.
- W – Warm
 - i. The warm cycle is an optional cycle that may be used to help a fresh pitched yeast get a good start in fermenting. It is calculated from the variables in the Yeast Strain.csv file. You can manually override this temperature with the T – Set Temp menu option.
- X – Exit
 - i. The exit menu option stops all functionality of the bcc program, saves the current settings to the bccconfig.py file and exits the program, closing the terminal window. The program can be restarted by double clicking on the bcc desktop icon.

2. The Display System

- Brew Status display
 - i. The Brew Status display shows the current brew cycle, whether the cooler or heater is on and whether the Fahrenheit or Celsius scale has been selected. Yellow colored lettering indicates the system is temporarily halted while the bcc program reads temperatures over a certain time period or waits 5 minutes before turning the compressor on again. Once that time period has expired the system is live and ready to operate.
- Alarm Status display
 - i. The Alarm Status display shows the status of the alarm system. The status of the alarm system as a whole is shown along with the SMS text messaging feature. The high and low alarm temperatures are shown. Also shown are the high temp and low temp alarm statuses. Currently the malfunction alarm has not been written into the software but should be available in a future version once it has been decided what entails a malfunction.
- System Status display
 - i. The system status display shows the desired temperature, the current temperature, the temperature trend (up/same/down) but still needs some tweaking to make it useful. The lowest and highest temperatures in the brew chamber are indicated by the min and max numbers. The T1 through T4 numbers are the temperature readings taken every 15 seconds for the last minute. The MAvg temperature is the average of the last 4 readings. The Dwell is also shown in this display area.
- Yeast Profile display
 - i. The Yeast Profile display shows some of the characteristics of the selected yeast from the Yeast Strain/csv file along with a brief description.
- Brew Info display
 - i. The Brew Info display shows the data entered by the user from the Brew Info menu option. Currently this is for info only and the data is not used by the bcc.py to make any decisions.

3. The File System

- database.csv
 - i. Every 15 minutes and when a menu option is selected the current system status is logged to a database. This database will be used for historical purposes.
- Yeast Strains.csv
 - i. A database containing a selection of yeasts gathered from the internet. This file can be edited; the only caution is the Yeast ID needs to be sequential with 0 on the header line and 1 as the first yeast strain in the list. You may trim it down to only yeasts you use or add more yeast strains to it.
- bccconfig.py
 - i. This is the bcc.py saved configuration. It is written to during program operation and when the program exits. It is read into bcc.py when the program starts. It is suggested not to manually edit this file except to add your cell phone number to allow SMS Alarm texting to work. Please only put your cell phone number in the config file so as not to send unwanted texts to random persons.
- bcc.desktop
 - i. This is a desktop icon that should be copied to /home/bcc/Desktop. This will allow you to open bcc.py in a Graphical User Interface. It sizes the terminal window so as to display the output of bcc.py properly.
- su-bcc.run
 - i. This is a script file to automatically run bcc.py as root. You can start bcc.py this way in a terminal window. You may have to size the terminal window to properly display bcc.py output and refresh the screen with the F – Refresh menu option. Using the bcc.desktop icon is the preferred method to start bcc.py.
- .gp and .dat files
 - i. These are files used by gnuplot to show a graph of a brew session.

4. Charts

- The charting function in bcc.py uses a separate program called gnuplot. To use the charting function properly you must install gnuplot and gnuplot-x11 (see installation instructions paragraph 2.).
- If charting is turned on (menu option G – Graphics) data to be charted is written to a data file and a script file is created that is used by gnuplot to create and display a chart of the data.
- The script file and data file are named after your brew session information in the format 'Brew Name-Batch Number-Batch Size-Beer Style-Brew Method'
- Once there are at least two points of data to chart a chart should display showing the data in a chart. On a new brew session this may take twice the charting interval timing.
- If you want the chart to refresh press the Replot (revolving arrows) button on the chart.
- To move the graph up or down in the chart window use the wheel mouse.
- To zoom in or out hold the CTRL key and use the mouse wheel.
- To move the graph left or right in the chart window hold the SHIFT key and use the mouse wheel.
- To display a chart of a previous brew session data:
 - i. Open a separate terminal window in VNC
 - ii. `cd /usr/local/bcc/data`
 - iii. `gnuplot 'file name of your brew session.gp'`