

# Operation manual

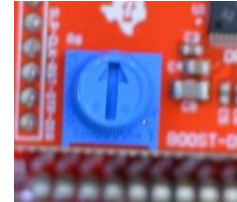
Before providing details on the operation, a few parts of the control unit have to be introduced:



**Figure 1** Switch at battery holder for power supply of logic. Leave it always on or turn on first.



**Figure 2** Main Switch. Use only this switch to turn the system on and off.



**Figure 3** Useless potentiometer. Leave it in a somewhat middle position. Everything but far left or far right is acceptable.



**Figure 4** Display of the development board. "**Left Button**", "**Right Button**", and "**Encoder / Wheel**". Note: The Left Button is not used in this version.

## Menu Navigation

**Color of display text**

**Color of required action**

Note: Whenever necessary, you can turn the system off and on again. No matter, if the motor is driving or you are in a specific menu, the system will simply start over from an initial state after being powered off. No damage will occur from shutting it down.

*Push the main switch* to start. Upon start, the following message will scroll over the screen:  
**"TURN WHEEL TO DRIVE MOTOR TO REFERENCE POSITION    PRESS RIGHT TO START AND AGAIN TO CONFIRM"**

Upon *right button click*, an **<EMPTY SCREEN>** will appear. At this point, the system does not know the rotor position, which needs to be set manually. The user must align the port connected to the funnel (i.e. the outer port in the rotor) with the port in the stator connected to the first sampling bottle. The most precise way to do so is by removing the tubes and sight through the ports. **The reference position must always be set clockwise.** Between clockwise and counterclockwise movement, there are roughly 200 steps of backlash where the motor turns but nothing actually moves. If the reference position was reached counterclockwise, the next valve position would be wrong by the amount of backlash. If you need to go counterclockwise, say by 20 steps, turn counterclockwise 220 steps and then clockwise 200 steps.

If you *turn the encoder/wheel*, the number of steps will appear on the screen (e.g. "-0030 S" for 30 steps counterclockwise or "0200 S" for 200 steps clockwise) and the motor will start turning. The motor always starts slowly and accelerates over time. One step accounts for roughly 0.0234°. In other words, 854 Steps correspond to 20°, which is the rotary distance between two sampling bottle ports. One detent of the encoder moves the motor by 10 steps. At the end of every movement, the motor will automatically "overtwist" by 10 additional steps and then 10 steps back, to leave the rotor in a torque-free position. Therefore, 20 additional steps will be added to the display, so it will show "30 – 40 – 50 ..." although effectively only "10 – 20 – 30..." forward steps are made.

*Right button click* -> **"CHOOSE SAMPLING INTERVAL    PRESS RIGHT TO START"**

*Right button click* -> **"0000 D"**

*Turn the encoder/wheel* to set the days of the sampling interval. Choose between 0 and 30 days.

*Right button click* -> **"0000 H"**

*Turn the encoder/wheel* to set the hours of the sampling interval. Choose between 0 and 23 hours.

*Right button click* -> **"0000 M"**

*Turn the encoder/wheel* to set the minutes of the sampling interval. Choose between 0 and 59 minutes.

*Right button click* -> **"CHOOSE TIME TO START    PRESS RIGHT TO START"**

In this menu, you can choose the start of the first interval. That means the motor will be turning for the first time after "time to start" + "interval". It is important to note, that an interval ends with the motor turning to the next position. It does not start with the motor turning. For instance, if you set up the system at noon of Friday, the 9th of June 2017, and want it to turn every Sunday noon, you set "time to start" to "0002 D" and the interval to "0007 D". This way, the first bottle will contain precipitation from the 9th of June till the 18th of June, the second bottle will contain precipitation from the 18th of June till 25th of June etc. This setup was chosen because the system should be setup before the rain events and therefore we expect the first bottle to be empty anyway. There is no need to waste another bottle by turning the motor after "time to start".

*Right button click* -> **"0000 D"**

*Turn the encoder/wheel* to set the days before the first interval. Choose between 0 and 30 days.

*Right button click* -> **"0000 H"**

*Turn the encoder/wheel* to set the hours before the first interval. Choose between 0 and 23 hours.

*Right button click* -> **"0000 M"**

*Turn the encoder/wheel* to set the minutes before the first interval. Choose between 0 and 59 minutes.

*Right button click* -> "SAMPLING INTERVAL <dd>D <hh>H <mm>M STARTING IN <dd>D <hh>H <mm>M ENTER SLEEP MODE"

This scroll text confirms your choice of sampling intervals and starting time. After showing this text, the system will go to sleep and wake up after "time to start" (if not = 0) just to show you this message and go back to sleep: "START OF FIRST SAMPLING INTERVAL". If "time to start" = 0, the interval starts immediately and no message is shown.

After each sampling interval, the system will shortly wake up and show: "TURNING MOTOR" and then the decreasing number of steps to turn while moving the rotor: "0874 S" ... "0000 S"

After the last sampling interval, the system shows "SAMPLING COMPLETED STANDBY" and shuts down.

## Deinstallation

*Push the main switch* to go from standby to off. Make sure, the ports are still aligned and the correct bottle is connected.

Unscrew all bottle caps and replace them by closed caps.

For long-term storage, it might be a good idea to loosen the spring. When doing so, you can remove the rotor, check the sealing for damage, and let the sealing foam expand.