Operation manual

1. Overall Installation

Place the bottles including tubing into a box and place the distribution unit (Fig. 1) on top of the most centered bottle.

Figure 1 Distribution unit

Connect the tubes to the distribution unit. The water (inflow) tubes should be connected to the outer circle of connectors; the air tubes should be connected to the inner circle. This way, possible leakage would rather spill out of the system than into the motor unit. Accordingly, the tube that connects the funnel needs to be connected to the outer connector of the rotor.

2. Distribution unit

Technically, the distribution unit (Fig. 1) doesn't need to be touched. Just connect the cable to the control unit and procede with section 3 'Control Unit'. Here you find a few hints in case a new assembly is necessary.

All threads in plastic, especially those in the rotor, are extremely sensitive. Turn the screws just easily. There is not a lot of force required by any of the screws set in plastic. The o-ring at the bottom cap likes to squeeze out of its place when the bottom cap is screwed on. Take care to keep it in place or squeeze it back in its place. Again, easy does it.

Below the top cap of the stream selector, there is a spring that sets the sealing pressure (Fig. 3).

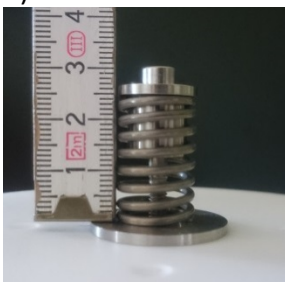

Figure 3 Spring for adjustment of sealing pressure

The spring has an initial length of 40mm and a rate of 4.94 N/mm. The spring is already set to the desired length of 25mm. This applies a sealing force of (40mm-25mm)·4.94N/mm= 74.1N. The sealing area is roughly 5945mm^2, therefore, the sealing pressure is 74.9N/5945mm^2=0.0125 N/mm^2 or 1.275m of water column. As a rule of thumb, the pressure that is applied to the sealing is equal to the water pressure, it will withstand

without leakage. Remember that there should be no water pressure applied to the sealing at all, as long as the system works as it should and all water runs immediately to the sampling bottles.

3. Control Unit

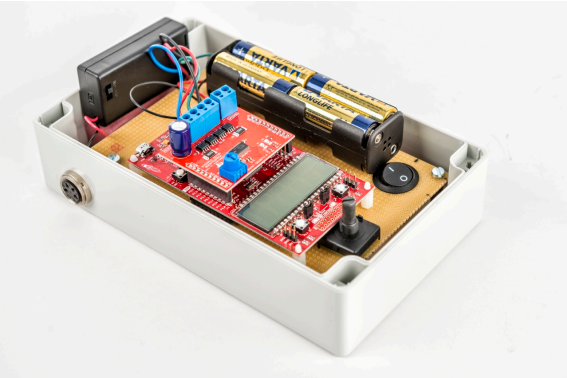

Figure 4 Control unit

Figure 5 Switch at battery holder for power supply of logic- leave it always on or turn on first!

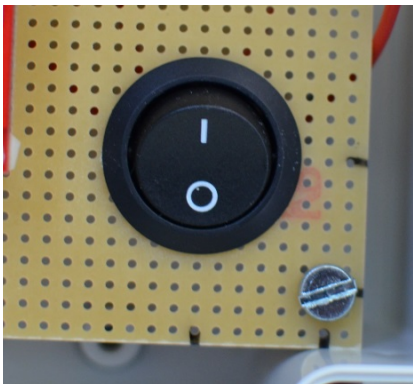

Figure 6 Main Switch. Use only this switch to turn the system on and off

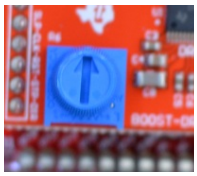

Figure 7 Useless potentiometer. Leave it in a somewhat middle position. Everything but far left or far right is acceptable.

Figure 8 Display, "**Left Button**", "**Right Button**" and "**Rotary Encoder / Wheel**". Left Button is not actually being 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 doesn't know the rotor position which needs to be set manually. The user must align the funnel connector at the rotor with the sampling bottle connector #1 at the stator. The most precise way to do so is by removing the respective tubes and sight through the connectors. ***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 rotary 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 account for 20°, which is the rotary distance between two sampling bottle connectors. One detent of the rotary 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 rotary encoder/wheel to set the days of the sampling interval. Choose between 0 and 30 days.

Right button click -> **"0000 H"**
Turn the rotary encoder/wheel to set the hours of the sampling interval. Choose between 0 and 23 hours.

Right button click -> **"0000 M"**
Turn the rotary 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 doesn’t start with the motor turning. E.g. 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 bottle 1 will contain precipitation from the 9th of June till the 18th of June, bottle 2 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 bottle 1 to be empty anyway. No need to waste another bottle by turning the motor after “time to start”.

Right button click -> **“0000 D”**

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

Right button click -> **“0000 H”**

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

Right button click -> **“0000 M”**
Turn the rotary 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 scrolltext 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 the “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.

4. Deinstallation

Push the main switch to go from standby to off. Make sure, the connectors are still aligned and the correct bottle connector is selected. If not, you’re screwed. But I’m optimistic.

Unscrew all bottle caps and replace them by closed caps.

For long term storage, it might be a good idea to loosen the spring that sits under the gray lid on the motor. This way, you can remove the rotor, check the sealing for damage and let the sealing foam expand.