

# Vapor Sorption Analyzer



## Quick Start Guide

Version 1

## 1. Getting Started—

- Place AquaLab VSA on a flat surface. Use the bubble level (Figure 1: Adjustment and bubble level) and use the adjustable feet to level the instrument. The small rubber feet on the back of the lower plate are to prevent tip-over and do not need to be touching the table.
- Use AquaLab VSA where environmental temperature and humidity remain fairly stable.

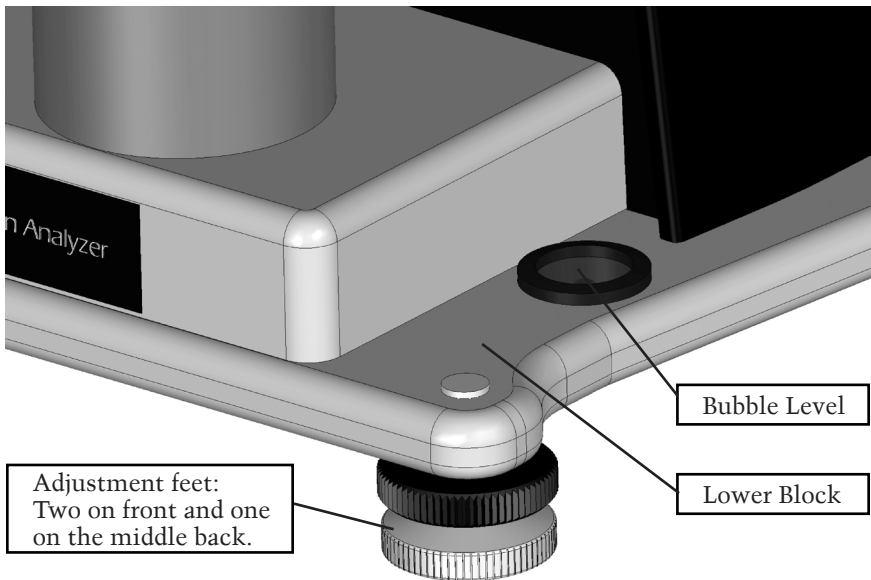

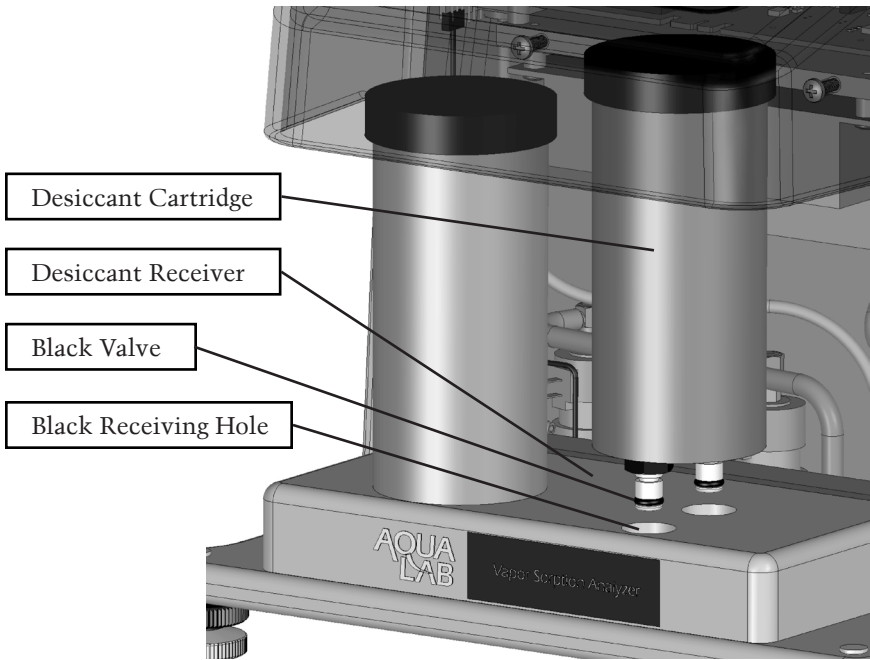


Figure 1: Adjustment and bubble level.

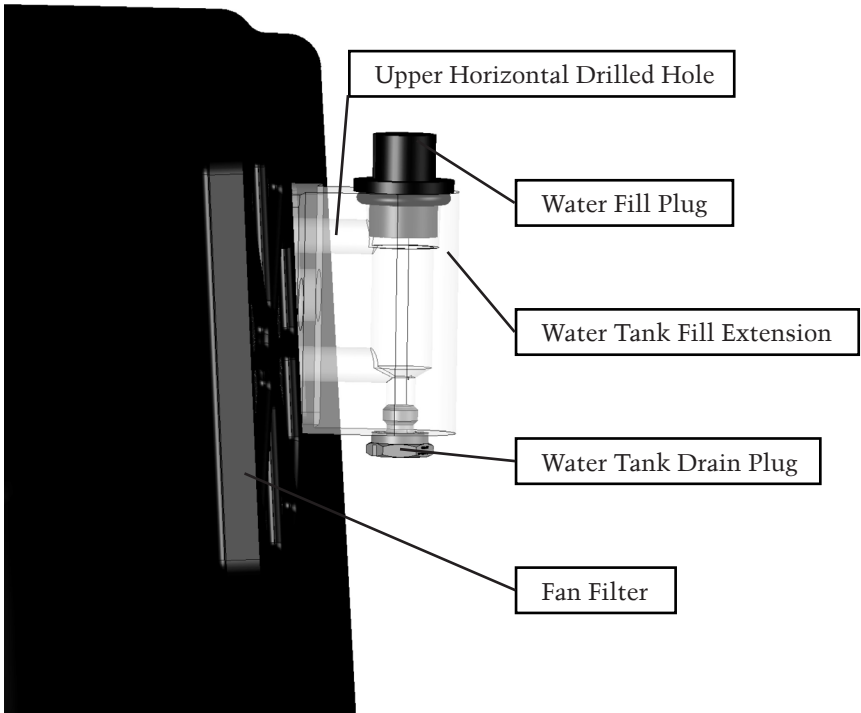
- The AquaLab VSA needs to be on a stable platform and evaluated to verify shipping did not damage the scale performance. To test scale stability:
  1. Turn on VSA and allow instrument to warm up for 2 hours.
  2. Navigate to the diagnostics screen in the Configuration menu and press .
  3. Scroll down to the screen that shows the weight. Readings should vary no more than 0.1 mg.

4. Lightly tap the table with one finger. If the readings vary more than 0.2 mg after tapping, the table is probably too unstable for accurate weight readings during a test and will need to be made more rigid or another location found for this equipment. Contact your AquaLab distributor if the scale readings are unstable after placing the unit on a stable structure.



*Figure 2: Desiccant installation*

- Desiccant tubes are installed by orienting the tube so that the black colored valve inserts into the black receiving hole as shown in Figure 2: Desiccant installation. Before insertion make sure that the desiccant tube lid is firmly sealed onto the desiccant tube. (See Manual for instructions) Lift the tube into the area above the desiccant receiver and then insert the tube into the mating holes while shaking the tube slightly. Once in place, the desiccant tube is sealed for flow purposes and may move side to side if contacted.



*Figure 3: Tank fill extension*

- Remove the black plug on the clear plastic tank fill extension located on the back right of the VSA. (see Figure 3: Tank fill extension). Fill the tank with deionized water until full. Reinstall the black plug once finished. It is not necessary to tighten the lid with a screwdriver, hand-tight is good enough.
- To remove the water from the water tank, the water tank drain plug is used.
- Figure 3 shows the location of a filter that will need to be removed from time to time when dust builds up on it. The housing around the filter is a snap on housing that is easily removed.

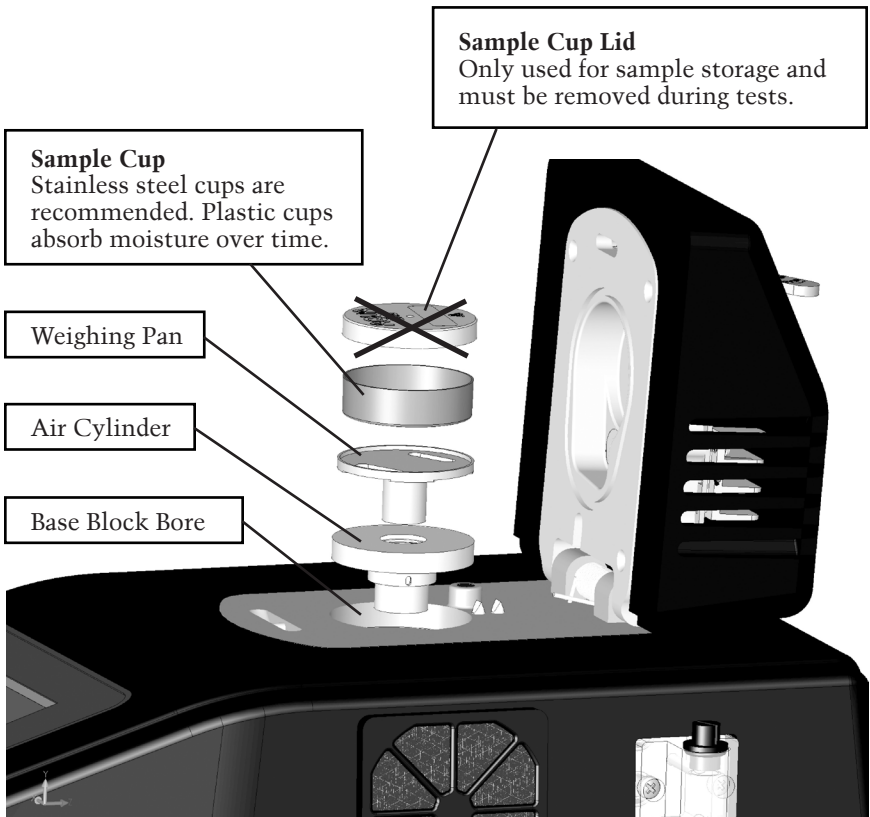


Figure 4: Sample cup and lower block assembly

- Figure 4: Sample cup and lower block assembly illustrates the proper positioning of the parts in the lower block. The air cylinder is placed into the bore of the base block. It should slide into the block easily and settle at the bottom of the bore. The weigh pan connects to the scale and holds the sample cup. For best results, verify cleanliness of all parts.

## 2. AquaLab VSA Performance Verification overview—

- AquaLab VSA performance and cleanliness should be checked frequently; before each isotherm test is recommended.
- Press **☰** until you are at the Measurement screen (2nd tab).
- Use AquaLab Verification Standards to verify performance or adjust linear offset.
- To verify, remove weigh pan and then place sample cup containing one of AquaLab's verification standards in sample chamber. Close lid and carefully avoid spillage; See Figure 5: Sample Chamber.
- Move latch left and/or press **▶** to start a reading. The pinwheel will spin indicating a measurement is running. The  $a_w$  reading for the standard and the temperature will display when finished. Make sure the  $a_w$  reading on the standard is within  $\pm 0.005$  of the correct  $a_w$  for the standard. ( $\pm 0.02$  if cap sensor is used)
- If an offset adjustment is needed, refer to chapter 7 in the user's manual.

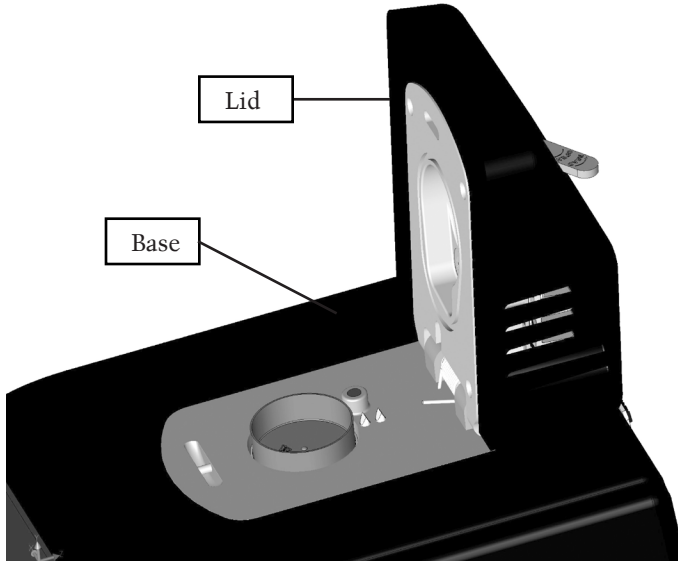






Figure 5: Sample chamber



### 3. Sample Preparation—

- Fill sample cup no more than half full (~7ml).  
**Do Not Overfill!**
- Minimum sample amount should cover bottom of sample cup (500-2000 mg) (small gaps OK).
- Ensure rim and outside of sample cup are clean.
- Make sure sample temperature is not more than 4°C above chamber temperature.








### 4. Starting a Test—

- Before starting a test, set the Volatiles: Yes/No option in the configuration menu. If your sample has volatiles, select “Yes” otherwise select “No”.
- On the main screen, select the test wizard .
- Provide a name for the test using the arrow keys and then press . (The name of a previous test will appear by default.)
- Enter initial moisture content if known (optional). Press  to continue or  to go back.
- Setup each stage of the isotherm test. A stage is used to adjust the isotherm settings for an individual sample (up to 20 stages). Each stage is setup with the isotherm method (DDI or DVS) and the settings for that portion of the isotherm. Once a stage is created, it can be modified or deleted anytime before the test is started.

*i.e. For milk powder, Stage 1 could use the DDI method to ramp quickly from 0.1 to 0.4  $a_w$  and Stage 2 could use the DVS method to step from 0.4 to 0.8  $a_w$  slowly in 0.05  $a_w$  increments.*



- To setup a new stage, select “new” and press . A screen with several parameters will appear. If a previous test has been run, the stages for that test will be listed by default. These stages can be used as is or updated with new settings. If you need to delete a stage, go to the specific stage and press . Scroll down to the bottom of

the stage settings select "Delete" and press .






- Select the isotherm method as either Dynamic Dewpoint Isotherm (DDI) or Dynamic Vapor Sorption (DVS). DDI will create a dynamic isotherm and DVS will create a static or equilibrium isotherm. The other choices will adjust based on which method is selected.
- **For DDI method**
  - To choose the starting  $a_w$ , press  with "Start" highlighted and then cycle to the desired value using the up and down arrows. Any value between 0.03 and 0.95  $a_w$  can be chosen including "current". Choosing "current" means that the stage will start at the initial  $a_w$  of the sample. Press  when finished.
  - To choose the final  $a_w$ , press  with "Final" highlighted and then cycle to the desired value using the up and down arrows. Any value between 0.03 and 0.95  $a_w$  can be chosen including current (see "current" definition above). Selecting a final  $a_w$  that is lower than the starting  $a_w$  will result in desorption, while selecting a final  $a_w$  higher than the starting  $a_w$  will result in adsorption. Press  when finished.
  - To choose the temperature of the stage, press  with "Temperature" highlighted and then cycle to the desired temperature using the up and down arrow keys (hold down arrows for accelerated scrolling). Any temperature between 15-60°C can be chosen. Each stage can run at a unique temperature.
  - To choose the desired  $a_w$  resolution, press  with "Resolution" highlighted and then cycle to the desired value using the up and down arrows. Any value between 0.003 and 1.0  $a_w$  can be chosen. The resolution for DDI determines the target  $a_w$  resolution. Setting a higher resolution value will make the test faster, but will decrease the  $a_w$  resolution. A DDI step of 0.01  $a_w$  is recommended.
  - To choose the air flow rate, press  with "Flow" highlighted, and then cycle to the desired value using the up and down arrows. Any value between






10-600 ml/min can be selected. Higher flow rates will speed up the test, but may result in lower data resolution and non-equilibrium conditions. The default value of 100 ml/min is suitable for most products.

- To choose to include a timeout setting, press  with "Timeout" highlighted, and then cycle to the desired value using the up and down arrows. Any value between 5.0 min to 30 days can be selected. The timeout determines the maximum time allotted to move from the starting  $a_w$  to the final  $a_w$  (DDI only) and is optional. The default value is off, which means there is no timeout value.
- To choose to have the isotherm loop, press  with "Loop" highlighted to toggle between on and off. Turning loop on causes the isotherm to automatically return to the start  $a_w$  (with the same settings) once the final  $a_w$  has been achieved. This would create both an adsorption and desorption curve (or vice versa depending on the starting direction).

- **For DVS method**





- To choose the starting  $a_w$ , press  with "Start" highlighted, and then cycle to the desired value using the up and down arrows. Any value between 0.03 and 0.95  $a_w$  can be chosen including "current". Choosing "current" means that the stage will start at the initial  $a_w$  of the sample. Press  when finished.
- To choose the final  $a_w$ , press  with "Final" highlighted, and then cycle to the desired value using the up and down arrows. Any value between 0.03 and 0.95  $a_w$  can be chosen including current (see "current" definition above). Selecting a final  $a_w$  that is lower than the starting  $a_w$  will result in desorption, while selecting a final  $a_w$  higher than the starting  $a_w$  will result in adsorption. Press  when finished.
- To choose the temperature of the stage, press  with "Temperature" highlighted, and then cycle to the

desired temperature using the up and down arrow keys. Any temperature between 15-60°C can be chosen. Each stage can run at a unique temperature.



- To choose the desired  $a_w$  step, press  with "Step" highlighted and then cycle to the desired value using the up and down arrows. Any value between 0.003 and 1.0  $a_w$  can be chosen. The step setting for DVS determines the  $a_w$  values for equilibration and consequently the resolution. A step setting of 0.10  $a_w$  will result in humidity being controlled to 0.1, 0.2, 0.3 ... up to the final  $a_w$ , remaining at each level until either equilibrium is achieved based on the trigger value or the timeout value is reached. Setting a higher value will make the test faster, but will decrease the  $a_w$  resolution.
- To choose the trigger %dm/dt value that will indicate equilibration, press enter with "Trigger" highlighted and then cycle to the desired value using the up and down arrows. The trigger can be shut off or be any value between 0.001-1%/hr. Choose the number of events required to meet the trigger value. The trigger value represents an acceptable change in mass per change in time to indicate equilibrium for a given step. Setting a higher value will make the test faster, but may not result in complete equilibrium. If the trigger is turned off, the sample will be held at each step for the time indicated by the timeout setting.
- To choose to include a timeout setting, press  with "Timeout" highlighted and then cycle to the desired value using the up and down arrows. Any value between 5.0 min to 30 days can be selected. The timeout determines the maximum time allotted for each  $a_w$  step NOT the time from starting  $a_w$  to final  $a_w$ . The default value is off, which means there is no timeout value and only the trigger value will determine the end of step. If both a trigger value and timeout value are set, whichever is reached first will determine the end of the step.
- To choose to have the isotherm loop, press  with

“Loop” highlighted to toggle between on and off.

Turning loop on causes the isotherm to automatically return to the start  $a_w$  (with the same settings) once the final  $a_w$  has been achieved. This would create both an adsorption and desorption curve (or vice versa depending on the starting direction).

- The delete entry is used to remove an unwanted stage.
- After setting up all stages, press the next arrow button. A message comes up to make sure the water is full and check the blue desiccant level in preparation for the test. Press  to continue.
- Follow the message on the screen to place an empty stainless steel cup in the chamber and seal it. Press  to tare the cup.
- Follow the message on the screen to place the sample in the cup and press  to weight the sample.
- Press  to begin the test.

## 5. Running a water activity test— (Can not be done when isotherm test is running)

- Remove the weighing pan.
- Press  until you are at the Measurement screen (2nd tab). Move latch left and/or press  to start a reading. The pinwheel will spin indicating a measurement is running.
- The  $a_w$  reading for the sample and the temperature will display when finished.
- To change between dew point and capacitive readings, you will need to toggle the Volatiles Yes/No option in the Configuration menu.

Volatiles = Yes → Capacitive Sensor

Volatiles = No → Dew Point Sensor

*Note: Accuracy changes to +/- 0.02 when volatiles “Yes” is selected.*



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