



PAS IV

Passive Alcohol Sensor



CALIBRATION MANUAL

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PAS Systems International recommends having the calibration checked once a year, or whenever it seems to be losing sensitivity. Instructions for both wet bath and dry gas checking/calibrating are included in this manual. You may also choose to send your PAS IV into the manufacturer (PAS Systems) to be calibrated.

Equipment Checklist for *Wet Bath* Sensitivity Check/Calibration

- The PAS IV Passive Alcohol Sensor Flashlight
- The “Calibration Assembly” (A modified plastic mouthpiece that connects the outlet of the wet bath simulator to the intake port of the PAS IV. Available from PAS Systems).
- A NHTSA approved Wet Bath Simulator
- 500 milliliters of .005% ethanol alcohol solution.* To set sensitivity lower, a 0.01% ethanol solution may be used.
- Plastic tubing to connect the simulator’s inlet to a mouthpiece into which the operator blows (or can also be used to connect the simulator’s inlet to a wet bath simulator air pump).
- A jeweler’s screwdriver to adjust the fuel-cell sensitivity if calibration should be necessary.
- A PAS Cal-Pump wet bath simulator air pump (recommended)

* Premixed Certified Stock Solutions are available from PAS Systems International

Mixing the Wet Bath Solution (optional)

Certified calibration solution (500 ml) is available from PAS Systems International but making your own calibration solution by diluting a stronger stock solution with distilled water is a simple process using the following steps.

Stock Solution To mix your (water/ethanol) stock solution, use a 100 ml graduated cylinder for your mixing.

[1] Pour 77 ml of 100 proof vodka into the 100 ml graduated cylinder

[2] Pour the 77 ml of vodka into a 500 ml volumetric flask and fill the flask up with distilled water.

This completes your mixture of stock solution.

You may keep your stock solution in a refrigerator for mixing calibration solution as necessary. We do not recommend keeping stock solution for longer than 45 days.

0.005% Ethanol Calibration Solution

[1] Using a 0.5 ml volumetric pipette, draw in 0.5 ml of the premixed Stock solution into a 500 ml volumetric flask

[2] Fill the 500 ml volumetric flask up with distilled water.

This result gives you 0.005% calibration solution for use in the wet bath simulator. For accuracy, if you have access to a quality evidential unit, run your calibration fluid in the evidential unit to verify.

Operating the Alcohol Wet Bath Simulator



The Alcohol Wet Bath Simulator

The lower (jar) portion is filled with a heated solution of water and alcohol, which simulates the blood running through the arteries in the lungs. The upper portion (the head space) is filled with a mixture of air and alcohol that simulates the air in the lungs that is in contact with the blood across the cell membranes. Air flowing out of the outlet pipe simulates the expired air of a person who has been drinking.

In order to work properly, the temperature of the water/alcohol solution must be 34° C (body temperature) and the mixture of alcohol and water must be accurate for the BrAC to be used in the test (.01 or .005 BrAC).

Preparing Wet Bath Simulator

1. Remove the glass jar from the simulator by unscrewing it from the top assembly.

Caution: DO NOT remove Top Assembly and expose the heating element to open air with power turned ON. This will result in damage to the heating element.

2. Place 500 ml of the .005 calibration solution into the simulator.
3. Assemble by tightly turning the jar back into the top assembly.
4. Add tubing to the inlet and outlet of the simulator.
5. Check the seal of the lid on the jar by blowing into the inlet while holding outlet closed. There should be resistance to the airflow.
6. Plug in the simulator and turn the power ON and allow the solution to heat to 34°F (approx 15 min). The heater lamp is lit when the heating element is heating. The heater lamp goes off when the simulator fluid has reached 34°F. However, it will come back on from time to time to keep the fluid at 34°F. When 34°F is reached, the simulator is ready to be used.

Readying the PAS IV

1. Be sure the battery is installed and fully charged, with the flashlight ON. There should be no blinking red battery light.
2. Inspect the inlet/outlet ports of the PAS IV to make sure that they're not clogged.
3. Conduct an air blank:

NOTE: *Be sure the room air is free from alcohol and that the ambient temperature is above 50°F. Do not have jars of stock solution or other alcohol open in the room during testing.*

- a. Turn on the flashlight and take an air sample by pressing the Sensor Control Button; the green indicator light comes on
- b. Observe the light bar for 15-20 seconds. If only the small green sampling indicator light comes on, the air blank check is OK.
4. Clear a fuel cell overload (if one or more of the bar-graph indicator lights comes on during air blank):
 - a. Turn the flashlight on to activate fuel cell heater (check that the HTR light is on). This speeds the cell's response, clearance and recovery time.
 - b. Turn off the PAS IV. This also speeds the recovery of the fuel cell.
 - c. After 5 minutes, repeat the air blank making sure that the flashlight is on. If none of the bar-graph indicator lights come on (after observing for 15-20 seconds), the air blank check is OK.
 - d. If however, one or more of the indicator lights come on again, this clearance process should be repeated. If after two attempts to clear the unit, the indicator lights are still coming on when the air blank is performed, there are two possibilities:
 1. The unit requires an internal zero adjustment. To have this adjustment made, the unit has to be returned to the manufacturer.
 2. The air in the test room contains a significant amount of alcohol. To determine if this is the case, air blanks should be made away from the test room to see whether the unit gives a zero reading when removed from the test area.

NOTE: *Throughout the procedure, the test conductor should check for a flashing battery light to ensure that the battery is not running down during the testing procedure.*

5. Once the air blank has been performed with a satisfactory result, the PASV unit is ready for sensitivity testing.

PAS IV Sensitivity Checking

NOTE: *If the low battery lamp starts flashing at any point in the procedure, recharge the battery before proceeding.*

1. Turn on the flashlight to activate the fuel cell heater. Leave it on for 5 minutes so that the fuel cell comes up to design temperature before starting the test.
2. Check that the inlet and outlet ports of the PAS IV are free of obstruction.
3. Hold the PAS V and insert the tip of the Calibration Assembly firmly into the PAS inlet port. Place the opposite end of the Calibration Assembly modified mouthpiece against the simulator outlet. The bar graph display will be facing upwards.
4. Check that the simulator is running at 34°F and take a deep breath and blow slowly but steadily into the simulator. (If Cal-Pump is used, follow Cal-Pump instructions.) After 5 seconds, tap the Sensor Control Button on the PAS IV to start a sampling cycle. Continue to blow for another 5 seconds.
5. Look for the green sensor lamp and the yellow sampling lamp and listen for the sound of the air pump which should come on immediately after the Sensor Control Button is activated. Keep blowing until the PAS IV pump stops (pump lamp goes out) 5 seconds after sampling began.
6. Disconnect the Calibration Assembly and observe the bar-graph display. **All but one** of the bars should light up. There should be two green, four yellow and two of the three red bars lit 15-20 seconds from the time the pump stops.
7. Record the number of red bars that light up (this should be two). Repeat the sensitivity test two more times noting each time how many red bars light up. If in two out of the three tests, two red bars are illuminated, the sensitivity of the unit is satisfactory. Note that the number of red bars lit may vary by one in either direction because of variations in the rate and strength of blowing through the simulator. This is the reason for conducting three tests. If two out of the three tests do not result in the lighting of red bars (a blinking light counts), then the unit should be recalibrated following the calibration procedure described below.

NOTE: *A minimum of 5 minutes should pass between each sensitivity test and an air blank should precede each sensitivity test.*

Periodic functional checks are recommended. These quality control checks can be performed by simply holding the intake port near a known source of alcohol, activating the pump and observing the bar graph display for indications that alcohol vapor is being detected. This will verify the pump assembly is operating properly and the fuel cell sensor is functioning.

PAS IV Calibration

This procedure follows the same steps as the sensitivity check procedure except that after the sample has been blown into the unit, the signal gain is adjusted to the point where two red bars light up.

NOTE *Monitor the red low battery light of the PAS IV to ensure that it does not start flashing during the calibration procedure. If it does, the battery must be charged before proceeding.*

1. Remove the plastic plug on the back of the flashlight tube by carefully prying out with the small screwdriver. Inside you will see the PAS IV calibration adjustment pot (screw).
2. Turn on the flashlight to activate the fuel cell heater. Leave it on for 5 minutes so that the fuel cell comes up to design temperature.
3. Check that the inlet and outlet ports of the PAS IV are free of obstruction.
4. Connect the calibration Assembly to the intake port of the PAS IV. Place the opposite end of the Calibration Assembly against the outlet port of the wet bath simulator.
5. Take a deep breath and blow slowly but steadily into the Simulator or use the PAS Cal-Pump auto air pump. After 5 seconds, activate the Sensor Control Button on the PAS IV.
6. Look for the green sensor light and the yellow pump (PMP) light and listen for the sound of the air pump that should come on immediately after the Sensor Control Button is pressed. Keep blowing for another 5 seconds until the PAS IV pump stops (PMP light goes out). Disconnect from the Calibration Assembly.
7. Pass a small flat blade jeweler's screwdriver through the opening and into the calibration adjustment pot (screw). Turn the calibration adjustment all the way up (counter clockwise). The adjustment is free to rotate approximately 270°. Take care not to use any force. With the calibration adjustment at maximum, all three red bars light up.
8. When all bars of the display light up (10-20 seconds after sampling), turn the calibration adjustment down (clockwise) until the top red bar just goes out. You may need to make several small, soft and easy adjustment as the fuel cell climbs to its peak reading. If your adjustment is slightly too high, you should see the third red bar flash on and off. Turn counter clockwise just enough so that the flashing stops. Calibration is now complete.
9. Replace the plastic plug by pressing firmly.
10. Turn off the flashlight and the PAS system. The unit is now ready for operational use once it has been fully charged.

Equipment Checklist for *Dry Gas* Sensitivity Check/Calibration

- The PAS IV Passive Alcohol Sensor Flashlight
- The Calibration Connector Tube. (This connects the regulator of the dry gas to the intake port of the PAS IV)
- Ethanol Dry Gas Standard (0.005% or 0.01%)
- 1.5 LPM Trigger or Push Button Regulator

All of the necessary supplies are available from PAS Systems International.
Call 800-660-7643

Readying the PAS IV

1. Be sure the battery is installed and fully charged, with the flashlight ON. There should be no blinking red battery light.
2. Inspect the inlet/outlet ports of the PAS V to make sure that they are not clogged.
3. Conduct an air blank:
 - a. Turn on the flashlight and wait a minimum of 1-2 minutes for initialization process to complete.
 - b. Take an air sample by pressing the Sensor Control Button; the green indicator light comes on
 - c. Observe the light bar for 15-20 seconds. If only the small green sampling indicator light comes on, the air blank check is OK.
4. Clear a fuel cell overload (if one or more of the bar-graph indicator lights comes on during air blank):
 - a. Turn the flashlight on to activate fuel cell heater (check that the HTR light is on). This speeds the cell's response, clearance and recovery time.
 - b. Turn off the PAS IV. This also speeds the recovery of the fuel cell.

- c. After 5 minutes, repeat the air blank making sure that the flashlight is on. If none of the bar-graph indicator lights come on (after observing for 15-20 seconds), the air blank check is OK.
- d. If however, one or more of the indicator lights come on again, this clearance process should be repeated. If after two attempts to clear the unit, the indicator lights are still coming on when the air blank is performed, there are two possibilities:
 - i. The unit requires an internal zero adjustment. To have this adjustment made, the unit has to be returned to the manufacturer.
 - ii. The air in the test room contains a significant amount of alcohol. To determine if this is the case, air blanks should be made away from the test room to see whether the unit gives a zero reading when removed from the test area.

NOTE: Throughout the procedure, the test conductor should check for a flashing battery light to ensure that the battery is not running down during the testing procedure.

5. Once the air blank has been performed with a satisfactory result, the PAS IV unit is ready for sensitivity testing.

PAS IV Sensitivity Checking

NOTE: If the low battery lamp starts flashing at any point in the procedure, recharge the battery before proceeding.

1. Turn on the flashlight to activate the fuel cell heater. Leave it on for 5 minutes so that the fuel cell comes up to design temperature before starting the test.
2. Check that the inlet and outlet ports of the PAS IV are free of obstruction.
3. Attach the Calibration Connector Tube to the outlet on the dry gas regulator.



4. Press the Calibration Connector Tube nipple into the inlet port of the PAS IV and hold tightly in place.



5. Hold the PAS IV with your thumb near the Sensor Control Button and press the regulator button so the gas begins flowing.



6. Immediately, AND WHILE THE GAS IS STILL FLOWING, press and release the Sensor Control Button which will draw a sample of gas into the unit.
7. When the pump completes its cycle (approx. 5 seconds) and the PMP light goes out, release the regulator button to stop the gas flow.

NOTE: *It is essential that the gas is flowing during the entire 5 seconds the pump is running.*

8. Disconnect the Calibration Connector Tube and observe the bar-graph display. **All but one** of the bars should light up. There should be two green, four yellow and two of the three red bars lit 15-20 seconds from the time the pump stops.
9. Record the number of red bars that light up (this should be two). Repeat the sensitivity test two more times noting each time how many red bars light up. If in two out of the three tests, two red bars are illuminated, the sensitivity of the unit is satisfactory. Note that the number of red bars lit may vary by one in either direction because of variations in the rate and strength of blowing through the simulator. This is the reason for conducting three tests. If two out of the three tests do not result in the lighting of red bars (a blinking light counts), then the unit should be recalibrated following the calibration procedure on the following page.

NOTE: *A minimum of 5 minutes should pass between each sensitivity test and an air blank should precede each sensitivity test.*

PAS IV Calibration

This procedure follows the same steps as the sensitivity check procedure except that after the sample has been blown into the unit, the signal gain is adjusted to the point where two red bars light up.

NOTE *Monitor the red low battery light of the PAS IV to ensure that it does not start flashing during the calibration procedure. If it does, the battery must be charged before proceeding.*

1. Remove the plastic plug on the back of the flashlight tube by carefully prying out with the small screwdriver. Inside you will see the PAS IV calibration adjustment pot (screw).
2. Repeat Steps 1-7 for PAS IV Sensitivity Checking.
3. Pass a small flat blade jeweler's screwdriver through the opening and into the calibration adjustment pot (screw). Turn the calibration adjustment all the way up (counter clockwise). The adjustment is free to rotate approximately 270°. Take care not to use any force. With the calibration adjustment at maximum, all three red bars light up.
4. When all bars of the display light up (10-20 seconds after sampling), turn the calibration adjustment down (clockwise) until the top red bar just goes out. You may need to make several small, soft and easy adjustment as the fuel cell climbs to its peak reading. If your adjustment is slightly too high, you should see the third red bar flash on and off. Turn counter clockwise just enough so that the flashing stops. Calibration is now complete.
5. Replace the plastic plug by pressing firmly.
6. Turn off the flashlight and the PAS system. The unit is now ready for operational use once it has been fully charged.

RECORD KEEPING

Each organization/company that employs PAS IV units should assign a staff member to be responsible for care and maintenance. A log should be established to record the checking, calibration and maintenance activities on each unit. Testers using the units should be required to report any problems with the units to the PAS IV staff member who should record the problems in the log. If a unit is dropped or is damaged in some other way this should be entered in the log so that the information can be forwarded to the manufacturer along with the unit for repair. The log will record the life history of the units and should be carefully maintained since it may be subpoenaed if the use of the PAS V is challenged.

To ensure that there is a record that these sensitivity checks have been conducted on a monthly basis, it is necessary to establish a log with a record for each of the PAS IV units employed by the Company or Department. An example of such a record is shown below.

PAS IV LOGBOOK

Date	Unit # Returned	Problem Reported	Checked By	Action Taken	Date Returned to Manufacturer	Date Returned to Field

The example shown provides a means for recording any reports from Testers of problems with the PAS IV units or any unusual occurrences such as dropping the flashlight onto the pavement. The log also provides a brief description of the action taken to overcome the problem or to examine the unit for damage as a result of a tester's report. The log will note instances in which the PAS IV has been returned to the manufacturer for service and when it was received and checked upon its return. The log should also contain a notation recording each month's sensitivity check and the outcome of that check and also a calibration adjustment if such an adjustment was necessary.

In addition to monthly sensitivity checks, PAS IV units should be checked if they have received an unusual stress such as being dropped on the pavement. If a PAS IV unit has been sent to the manufacturer and returned following repair, a check should be made to ensure that the calibration was not affected by the handling during shipping. Also, perform periodic functional checks with known sources of alcohol to be certain all functions (e.g., pump) are performing.

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