QAQC LAB

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QUANTEK INSTRUMENTS

Oxygen and Carbon Dioxide Analyzers

902D OPERATING INSTRUCTIONS

GENERAL DESCRIPTION

The Quantek Model 902D is a portable oxygen/carbon dioxide analyzer used for the measurement of O_2 and CO_2 in gas-flushed (CAP/MAP) food packages. The unit is powered by an internal battery pack (optional), with typically 8-12 hours of operation before recharging is required.

The Model 902D design has proven itself in hundreds of installations for food applications such as meats, fresh produce, pasta, nuts, snackfoods, dairy products and coffee. The sensor is unaffected by trace hydrocarbons or other background gases.

Components which make up the Model 902D include the case, oxygen sensor, LCD readout, internal sampling pump, two circuit boards, 12 Vdc NiMH battery (optional), battery charger or AC adapter module and sampling probe. The sample probe is tipped with a particulate filter and luer fit syringe needle with side-port holes to prevent plugging. Sample is drawn through the probe and tubing and then simultaneously to the oxygen and CO_2 sensors when the pump is turned on. The pump is electronically timed to draw in sample required for the analysis, and then turns itself off after the pre-set sampling time, which is adjustable from 1 to 10 seconds. The oxygen and carbon dioxide concentrations are read on the display.

The operating controls and adjustments include power switch, pump switch, span, zero and pump time adjustments.

 PRECAUTIONS

Follow these guidelines to prevent damage to the unit – the top two warnings account for most repairs:

1. Do not suck liquids into the unit through the needle. Use the PTFE filters supplied with the accessory pack – they will block particulates *and* liquids. **Contamination of the sensor(s) accounts for 70% of repairs.**

2. Use only the charger supplied with the analyzer! Do not plug in a random power supply into the analyzer, for example. The supplied charger contains sophisticated variable voltage controls. **Using an incorrect charger accounts for 20% of our repairs**. If lose or break the charger with the analyzer, you can substitute a charger made for NiMH battery packs with 10 cells, but it is better to contact us for a replacement charger.

3. Turn the unit off before plugging/unplugging the charger

4. Do not immerse in water or spray water on the unit

5. Do not drop the unit

6. Store in a clean, dry place at the end of the day – cleaning chemicals commonly used in food production facilities can corrode the circuitry.

OPERATION

1. Plug the power adapter or charger. Press the POWER switch to start unit. The meter reading at this point will not be stable. Let the unit warm up. The O_2 channel requires no warm-up time, but the CO_2 channel needs 60 seconds for the infrared sensor to stabilize.

2. Press the PUMP switch. The pump will come on for approximately 4 to 6 seconds and pull room air into the analyzer. Note that the O_2 meter reading will decrease slightly when the pump is on. This is normal due to the slight vacuum created in the sensor when the pump is running. The CO_2 meter should read 0.1 to 0.5 % when checking room air. Wait approximately 10-12 seconds for the reading to stabilize. Room air should give a reading of 20.7 to 21.1 % oxygen, and 0 to 0.2% CO_2.

3. To sample food packs, first attach the sample probe (new units have this factory installed) to the fitting on the front panel of the analyzer. The fitting should be finger tightened only, but it should be tight to prevent leaks when sampling. Insert a particulate filter on the end of the probe, and then insert a needle onto the end of the filter. Pierce the food pack with the syringe needle through a foam rubber seal (supplied) *.

4. Depress the PUMP switch and wait for the reading to stabilize (10-15 seconds). Leave the needle in the food pack until the reading is stable. This is your reading. If sampling packs with high levels of CO_2, the reading may take longer to stabilize.

Sampling from a package using the PTFE filter, needle, and foam septa.

* It is difficult to get accurate readings when piercing the bag directly with the needle

without a foam septa because air will frequently leak in around the hole caused by the needle.

BATTERY OPERATION AND RE-CHARGING

If equipped, this analyzer is provided with a 10 pack of AA NiMH batteries. You can operate the analyzer with the charger plugged in to the wall.

When the battery is low, the LOW BATT indicator light will come on indicating that the battery needs to be re-charged. The 902D will run 2-4 hours before recharging. To re-charge the battery, turn the unit off and plug the external charger module into a standard 115 Vac outlet and connect the male plug from the charger to the jack located at the back panel. A full charge requires 2-4 hours of charging time.

It is advised that you unplug and plug the charger back into the wall socket before charging – the charger has a 4 hour timer in it to prevent overcharging of the battery pack. By unplugging and plugging the charger in, you reset this timer.

If the battery is low, the analyzer can be operated with the charger plugged in, but it may first require a 1-2 hour charge with the unit turned off before it will operate. The battery is a

10 pack AA NiMH pack, and the 902D may be run while plugged into the charger.

The best practice is to fully charge the battery pack occasionally – this will preserve its life. To do this,
1) turn the analyzer off,
2) unplug the charger from the wall,
3) plug the charger back into the wall (this resets the timer completely), and
4) connect it to the analyzer.
5) The green light on the charger should begin blinking. When charging is complete, the green light will turn solid green.

NOTE ABOUT CHARGING: We use extremely high quality battery packs, capable of being cycled 2100 times. However, to preserve battery life, it is best to turn the unit off when not in use for long periods of time.

The charger will begin to recharge the pack when it sees the pack decrease to 7/8 of the starting full voltage – therefore, when the pack reaches an age where it is at about 11.45V fully charged, then it will start to discharge below 10V. When it reaches this age in 3-4 years, you can preserve the life of the pack by charging it more frequently and preventing the pack from going below 10V.

CALIBRATION AND PUMP TIME ADJUSTMENTS

These adjustments are made using the potentiometers located on the back panel of the unit.

CALIBRATION SETTING – OXYGEN

Accurate calibration of the O_2 reading can be checked at any time by sampling room air, which should give a reading of 20.9% oxygen, plus or minus 0.2%. If the reading is off, it can be set by adjusting the O_2 SPAN potentiometer, with the screwdriver supplied with the unit.

The O_2 calibration setting does not have to be constantly adjusted to 20.9%. Most users find that making this span adjustment at the beginning of a day if more than enough - for most applications, any reading for room air between 20 and 22 is probably more than accurate when sampling packages between 0% and 5% oxygen.

Any error in the O_2 reading at the high end is a relative error which is proportionally the same through the whole O_2 range. For example, if the O_2 reading for room air was set at 20 instead of 20.9, this is an error of 0.9/20.9 x100=4.3 %. This same relative error applied to low readings would be, for example at 2% O2,

a reading of 95.7% X 2% O_2 = 1.9 % O_2, which is not statistically significant.

CALIBRATION SETTING – CO_2

Likewise, the CO_2 calibration can be adjusted as required by turning the CO_2 SPAN potentiometer located on the back of the unit. However, you must first introduce a known concentration of CO_2, using preferably a calibration gas which contains the concentration close to that which you will want to measure later.

NOTE: Ideally, use a calibration gas that is between 15% and 40% of the full scale range of the analyzer; i.e. for 0-20% range analyzers, use a calibration standard between 3% and 8% CO_2 with the balance being nitrogen.

DO NOT USE 100% CO_2 OR ROOM AIR FOR CALIBRATION PURPOSES – THESE POINTS ARE AT THE EXTREME END OF THE RANGE. The analyzer is not accurate if calibrated with either of these points. If you have absolutely no other option – and you believe that an operator has inadvertently adjusted the CO_2 span, then you could calibrate it to the original 100% reading that the analyzer arrived at. For example, if the calibration certificate states that 100% CO_2 was reading 100.8%, you could calibrate the analyzer to read 100.8% and use the method

described after these paragraphs to set it to that point.

Some customers may not have access to a premixed cylinder – i.e. the packaging equipment may mix nitrogen and CO_2 for gas flushing the package. For calibrating the analyzer, you should procure a pre-mixed, analyzed gas cylinder from a local vendor (such as Airgas), or contact us – we can provide a very small 17L cylinder with regulator.

1) BEST METHOD - The preferred calibration method is to attach a needle to the end of the probe, and loosely place a tube of flowing cal gas (such as 20% CO_2) over the needle, without attaching it leaktight. Press the pump to draw in sample, and adjust the potentiometer.

2) ALTERNATE METHOD - Fill a bag with the calibration gas and sample from it as you would a regular sample, using a foam septa. This may introduce error as it is sometimes

difficult to flush an airtight bag entirely of room air.

3) *POOR METHOD* – Connecting a tube directly to the probe and flowing gas into the analyzer will pressurize the sensor. If you introduce gas this way, 20% may read about 21-22%. Therefore, this is not recommended.

IF YOU DO NOT HAVE A KNOWN CONCENTRATION OF CO2 AVAILABLE:

If you do not have a known concentration of CO2 available, please contact QAQC LAB. We can supply you with a small canister and regulator – typically with 20% CO2 with 80% nitrogen. Alternately, there are retail gas suppliers who can accurately mix a tank to this specification relatively inexpensively.

ZERO SETTING – OXYGEN CHANNEL

The zero setting of the O_2 channel is very stable, and will change little even over a period of several months. Although usually not required, The O_2 ZERO reading can be checked one of two ways:

1) **BEST METHOD** – If a source of pure N_2 is available with an outlet flow, turn it on with a light flow and place the sample probe (with needle attached) straight into the tube from which the flow is generating – but do not create a tight seal. Make sure the nitrogen is flowing at a high rate, so that when you press the pump button, you are not drawing in room air.

Also, make sure that the nitrogen has been flowing for at least 30 seconds to flush out any other air that may have been in the tubing.

Press the PUMP button, drawing in the flow . The zero will read 0.0, plus or minus 0.1% O_2. If the reading is not in this range adjust the O_2 ZERO potentiometer as needed. Several turns will be needed to see any movement in the

reading, as the adjustment is not very sensitive. This adjustment should be done carefully because it will affect all readings, and it must be done with N_2 in the sensor.

2) **ALTERNATE METHOD** - Fill a plastic bag with nitrogen, flushing the bag thoroughly first. It is difficult to expel all the air out of it to get a true zero sample. Place a foam septa pad on the bag, and pierce the septa with the needle on the end of the sample probe. Press the pump button, drawing in sample from the bag. The zero will read 0.0, plus or minus 0.1% O_2. If the reading is not in this range adjust the O_2 ZERO potentiometer as needed. Several turns will be needed to see any movement in the reading, as the adjustment is not very sensitive. This adjustment should be done carefully because it will affect all readings, and it must be done with N_2 in the sensor.

Take note that the “electronic zero” of the sensor and electronics is very stable, with typical variance of less than 0.1% O_2 over a period of 6 months. If you perform the above test and your reading is high, 0.2 to 0.5, the fault is probably due to an inadequately flushed bag and not the zero adjustment. However, leaks in the system can also cause high readings as described below.

3) *POOR METHOD* – Connecting a tube directly to the probe and flowing nitrogen or

pure CO_2 gas into the analyzer is not recommended.

ZERO SETTING – CO2 CHANNEL

The CO_2 zero is set using factory software and is not user adjustable. The drift should be less than 0.1% every six months. Please note that room air may read 0.1% to 0.3% - this does not necessarily mean that your room is 1000 to 3000ppm CO_2. The CO2 sensor is not accurate for ambient measurements.

PUMP TIME/FLOW RATE

The pump run time can be increased or decreased as needed by adjusting the PUMP TIME potentiomenter. The volume sampled depends on the time the pump runs, but pump time does not affect accuracy as long as enough sample is drawn into the sensors. Be careful not to set the time too high with samples that have limited headspace volume. If the bag appears to be totally evacuated

when sampling, re-set the pump time to a smaller value so that less sample is drawn from the bag. The pump will normally draw about 5 cc per second of flow, so a 6 second time setting will draw in about 30 cc of sample. An excess of sample will not cause errors in the reading.

If sampling a rigid container, or an extremely small package with limited headspace, then the reduction in air pressure needs to be taken into account in regards to the amount of headspace removed. When sampling rigid containers, the pump time should be set as short as possible.

In other words, if 10cc of a rigid container with 100cc of headspace is drawn into the analyzer, then you've just reduced the pressure inside the container by 10%. Therefore, a 20% CO_2 concentration will now read 18%. While this correction can be taken into account when conducting headspace analysis, it is possible that this will reduce the lifetime of the sensor(s).

NEEDLE/FILTER REPLACEMENT

The needle and filter should be replaced if they get plugged up and impede the flow. Both have standard luer fittings, as does the probe tip, and are simply pressed on with a twist to provide a leak-free fit. A simple test can determine if either is plugged. This test can be

done with one or both attached to the probe tip. When sampling room air, the O_2 reading will drop from 20.9 to about 19, and then rise back to 20.9. This is normal due to the slight vacuum created in the sensor when the pump runs. As the filter collects dirt over a period of time, this reading will go progressively lower because the pump is not able to pull sample through the filter at the same flow rate. If the filter or needle is totally plugged, this reading will go as low as 13 or 14, and may stay there because of the check valve in the flow line (internal) which prevents backflow of air into the sensor when the pump shuts off. As a rule, replacement of the filter, or needle (if clogged) is necessary when this reading is below 17.

The filter should also be replaced if any part of it is cracked. Air can leak in through the crack and cause errors in the readings.

COMPLETE SYSTEMS TESTING

To insure that the complete unit is working properly requires periodic testing of the unit under controlled conditions. Factors which can affect accuracy include calibration, pump function, electronic functions and leak-tightness of all the parts used for sampling, including the needle, filter, sample probe, tubing, fitting, internal tubing and valve. A simple, periodic test can determine proper operation. With the needle and filter installed,

simply perform the zero test described in the previous paragraph and the unit should read zero. With the needle still in the bag, operate the pump several times. The reading should not change.

If there are leaks in any part of the system, the readings can be inaccurate on the high side because of air leaking in. If a leak is suspected, perform this simple test: fill a bag with nitrogen and check the zero reading as before with 2-3 pump cycles. Keep the needle in the bag. Next, compress the bag by hand (with the pump off), which will force more sample through the tubing into the sensor. This should yield the same reading as sampling with the pump, if there are no leaks. With this positive pressure, air cannot leak into the system with any leaks which may be present. If the reading goes lower, it indicates a leak somewhere which should be corrected.

SAMPLE PROBE ASSEMBLY

The probe assembly is a one piece assembly and cannot be taken apart. The tubing used is a very narrow bore inert polymer which extends from the flanged end to the tip of the probe assembly, covered by a protective tygon tube. The inert composition prevents O_2 adsorption on the internal surface. The internal tubing volume is small to minimize the volume of sample required to flush out the sensor to

provide an adequate response time. The tip is a male luer fitting which will accept any luer-hubbed needle or filter. When screwed into the bulkhead fitting, the captive black screw presses the flanged end tightly against a mating piece, also flanged, which connects to the inlet port of the CO_2 sensor.

The probe assembly should be replaced if any part of it is cracked which would produce leaks. If liquid or other contaminate is visible inside the tubing, it can usually be cleaned by removing the probe from the analyzer, flushing with soap solution, clean water and then N_2 or air to dry it out. Minor kinks in the tubing are generally not a problem, but severe kinks can impede the sample flow or can develop a crack causing leaks. To replace, unscrew the black plastic screw from the fitting on the analyzer case. Inspect the interior of the fitting for any dirt or particles, which might cause a bad seal. Screw in the plastic screw for the new probe. The threads are easily stripped, so make sure that the screw is properly aligned before tightening. Turn until finger tight only. Do not use a tool to tighten, because this can strip the threads.

PRECAUTIONS

To avoid possible damage to the sensor, avoid sucking dirt or liquids into the analyzer. We advise that all sampling be done with the

particulate filter provided which fits onto the end of the sampling probe. Avoid direct sampling of pressurized gas cylinders. High pressure can cause erroneous readings, or in a worst case scenario, damage to the sensor(s). To test the content of a cylinder, flush the sample into a plastic bag and sample from the bag.

Store the unit in a clean, dry location - preferably close to room temperature. Bleach and other cleaning chemicals commonly used in food production facilities can corrode the circuitry inside the analyzer over time.

CHARGER / POWER SUPPLY

 **FOR NON BATTERY UNITS: ALWAYS USE THE POWER SUPPLY THAT CAME WITH THE ANALYZER!!!** If your analyzer does not have a battery, the power supply is designed to deliver regulated 12V (1A max) into a 2.1mm center positive barrel. We always recommend you purchase a replacement from us.

 **FOR BATTERY POWERED UNITS:** The charger provided will adequately charge the 10 cell, AA NiMH battery pack and then shut off, whereas a power supply will

overcharge the battery and possibly cause it to burst or explode. We always recommend that you purchase a replacement charger from us.

CARRYING HANDLE / TIP UP FEET

The unit comes equipped with a carry handle, as well as tip-up feet on the bottom cover to tip the front of the unit upward for better viewing of the front panel.

STORAGE

If the unit is to be stored or unused for a period exceeding two weeks, it is advised to fully charge it before storage. The batteries will slowly discharge over time, so it is advised to charge the analyzer fully at least once a month.

GENERAL TROUBLESHOOTING

For most problems that arise, the oxygen sensor will provide the best clues as to what has gone wrong. For example, if the sample probe is unobstructed (i.e. no needle or filter is installed), and you press the pump button, you will see the oxygen reading drop to about 18-20% and then rise back toward ambient (20.9%). If you conduct this same test with a needle on the end of the probe, and the needle is clogged, you may see the oxygen reading drop down to 13% and slowly rise back to ambient (20.9%).

Since oxygen will read 20.9% at room air, watching the oxygen reading is the best way to troubleshoot.

Unit does not power up	Check that the unit is plugged in and the tip of the charger/adapter is firmly inserted.
Unit reads 1. on the oxygen LCD	The oxygen sensor has either failed, has come disconnected inside the analyzer, or in very rare cases, the sensor has become so contaminated that it puts out no voltage.
Unit reads very low oxygen % and will not rise, even when pumping in fresh air	The sensor has probably been contaminated with liquids. Examine the probe for evidence of liquid contamination. Unscrew the probe to rule out blockage in the probe. If the reading still does not move, contact QAQC LAB for service.
Unit has no suction	Remove the needle and filter from the end of the probe to rule out clogging; press the pump button and lightly tap your finger on the end of the probe. The sound should change. If it does not, the most likely cause is that the probe is not securely screwed into the front inlet, or the pump has been damaged.
Oxygen reading goes to a level that is expected, then immediately rises or falls toward 20.9%	A leak has developed somewhere inside the analyzer, or air is leaking around where the needle is puncturing your package. Be sure to use septa and have sufficient headspace in your package – or turn the pump timing down further.

OPERATING SUPPLIES

660 9001 Foam seal pads (pkg. of 200)
660 9002 Foam seal pads (pkg of 1000)
660 9005 Particulate filter .7µ pore (pkg. of 5)
660 9028 Particulate filter .7µ pore (pkg. of 25)
660 9085 Liquid & Particulate filter .45µ pore (pkg. of 3) 660 **9088** Liquid & Particulate filter .45µ pore (pkg. of 15)
660 9003 Spare needles (pkg. of 3) side-port hole
660 9027 Spare needles (pkg. of 12) side-port hole
660 9054 Heavy duty needles for can/containers pkg of 3; 10 mm X 1.5 mm outside diameter
660 9067 Duraprobe Sampling Probe Assembly (reinforced).
660 9012 Battery charger/poweradapter for 902D