Quantek Instruments

MODEL 901
OPERATING INSTRUCTIONS

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BEFORE YOU BEGIN

Thank you for your purchase. Before you begin using the Model 901, please review the following tips and precautions. 90% of repairs are due to the issues outlined below:

Use a filter on the tip of the sample probe. This prevents liquid intake.

Do not charge (or plug in) the instrument if you install alkaline batteries. The charger cannot tell the difference between rechargeable and alkaline batteries. The alkaline batteries will melt and/or explode if you attempt to charge them!

The 901 is designed to be charged overnight, and then unplugged during use.

Turn it off at the end of the day and plug it in. If you leave it on, and plugged in, the charger will stop after four hours, and the analyzer batteries will deplete.

This is a frequent issue when operators leave it on, and plugged into the charger, on a Friday. When they come back Monday the analyzer is dead and needs to be recharged.

Store the unit in a clean, dry location at the end of the day/shift. Cleaning chemicals commonly used in food production facilities can corrode the circuitry in the unit.

GENERAL DESCRIPTION

The Quantek Model 901 is a battery-operated, portable oxygen analyzer used for the measurement of oxygen in packages, gas streams, containers, and hundreds of other applications.

INITIAL SETUP

The analyzer arrives with fully charged batteries. Perform this procedure to compensate for changes in elevation, temperature, and/or humidity:

1) Turn the instrument on.
2) Remove the needle cover (or sheath).
3) Press the pump button – the reading will go down temporarily.
4) Once the reading stabilizes, adjust the span so that the reading is 20.9%.

It is recommended that you perform this procedure at the beginning of each day. The amount of oxygen in a room is always 20.9%, regardless of ventilation or number of people breathing nearby.

While humidity has a very small effect on O_2 concentration, this effect is very minimal. At 100% relative humidity, the O_2 concentration in air is about 20.4%.

Changes in elevation will also affect your initial O_2 reading. If the analyzer is calibrated for sea level, and you bring it to 5000 feet above sea level, you may notice the starting O_2 concentration shows 17.9%. This is normal – repeat the "initial setup" procedure so that the instrument reads 20.9%.

UNDERSTANDING THE ADJUSTMENTS

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

SPAN: Use this on the side of the instrument to adjust the analyzer to 20.9%. Press the pump button, let the reading stabilize, then adjust to 20.9%. You should do this once a week, or if the instrument's altitude has changed. You should wait until the pump has stopped, and the reading has stabilized, before adjusting the span.

ZERO: This should generally not be touched. See the section on checking the zero.

PUMP TIME: Use this to set the pump time. 5 seconds is ideal, but if your application, package, or container has limited headspace, you can set it to 3 seconds. Use a longer pump time if the sensor is responding slow.

If you ever need to run the pump for longer than 12 seconds, you can hold the button down. This is rare, and would only be applicable to situations where you might not have the probe positioned properly to get a good reading.

When turning the PUMP TIME adjustment:

COUNTERCLOCKWISE = SHORTER
CLOCKWISE = LONGER

PRECAUTIONS

Follow these other guidelines to prevent damage:

1. Do not immerse in water or spray water on the unit.
2. Do not drop the unit.
3. Store the unit in a clean, dry location at the end of the day/shift. Cleaning chemicals commonly used in food

production facilities can corrode the circuitry in the unit.

4. Do not operate the unit while plugged in – it is designed to be operated from the batteries.
5. Be sure to check the battery polarity (+ and -) if you decide to swap out batteries.

⚠ RECHARGING ANALYZER

To charge the analyzer, *shut it off* and leave it plugged in to the charger. If you need to use it right away, you can substitute alkaline AA batteries, but again – DO NOT CHARGE THE UNIT WITH ALKALINES INSTALLED!

The charger will go from solid orange, to blinking orange, to fast blinking green, to slow blinking green, to solid green. Your charger may look different.

Note: These batteries are NiMH 2600 mAh AAs. The total time to charge the analyzer fully from 0-100% charge is approximately 2-3 hours.

The rechargeable batteries are high quality, low self-discharge batteries. If you do need to replace them, any rechargeable NiMH or NiCad batteries can be used. Mixing brands is not advised.

IF YOUR CHARGER IS DAMAGED:

Contact us for a replacement charger. In the meantime, use alkalines.

If you absolutely must purchase a charger locally, the specifications are: 2.5mm barrel, center +. Most NiMH chargers will work, just be sure to use a charger that is designed for 4 AA NiMH cells. Most NiMH chargers will work for a range of AA quantities (i.e. 2-10 cells).

Please note: you *will* void your warranty if you use a non-Quantek charger.

OPERATION SUMMARY:

1. Insert a particulate filter onto the end of the sample probe. If you are testing through a septum, or a package, you'll want to use a needle at the end of the probe. If you are

testing a gas stream, or a chamber, you may want to use a blunt needle.

2. Press the POWER switch to start unit. No warm up is required.

3. Press the PUMP switch. The pump will come on for approximately 2 to 12 seconds and pull room air into the sensor through the syringe needle and filter. Note that the 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. Wait approximately 10-12 seconds (after the pump has stopped) for the reading to stabilize. Room air should give a reading of 20.5 to 21.3 % oxygen. Adjust the oxygen span to 20.9% if you'd like.

NOTE: You only need to perform step three once a day – at most.

4. For non package applications – place the probe in the area you'd like to measure. Depress the PUMP switch and wait for the reading to stabilize (12-18 seconds). Leave the needle in the gas stream until a stable reading has been obtained.

NOTE: Make sure that you have the blunt tip needle placed in a location where ambient air cannot be drawn into the probe.

To see examples of package testing, use the following URL:

www.quantekinstruments.com/901support/

CALIBRATION OVERVIEW

The factory calibration schedule is two years after initial purchase, and every year thereafter. Customers who are comfortable self-calibrating can use the procedure below.

Since the response of the oxygen sensor is very linear (especially between 0.0% and 20.9%), checking the zero point and the span point are sufficient for excellent accuracy. Factory calibration includes a full checkup of all components (such as the pump, sample probe, circuit board, etc) and leak test of the system.

SELF-CALIBRATION: O2 SPAN

Accurate SPAN calibration of the unit can be checked at any time by sampling room air, which should give a reading of 20.9% oxygen, plus or minus 0.3%. If the reading is off, it can be set by adjusting the SPAN potentiometer, located on the side of the unit, with the flathead screwdriver supplied.

Significant changes in elevation will require resetting the span calibration – for example, if

you take the instrument from sea level to Denver, it will read 17.9%.

The amount of oxygen in a room will not vary much – even in a closed building with many people. However, if you ever want to be sure, you can set the span using outside fresh air.

SELF-CALIBRATION: O2 ZERO

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** –

We also now include an orange tube for calibration which you can insert into a tube of flowing gas:

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) **OKAY METHOD** If you keep the flow very light, you can flow nitrogen directly into the sample probe. While this is the easiest method to zero the instrument, it is critical that you make a good connection with the tubing.

3) LAST RESORT METHOD

If a source of pure N_2 (or other zero oxygen gas) is available with an outlet flow, turn it on

with a robust 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.

This is risky, though, because it is very easy to draw room air in as the needle is only about 1.5 inches long. This method works better if you have as long a needle as possible.

NOTE ABOUT THE ZERO ADJUSTMENT

This adjustment should be done carefully because it will affect all readings, and it must be done with N_2 (or any other zero gas) 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 12 months.

COMPLETE SYSTEMS TESTING

To ensure 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 section 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.

PUMP TIME

The pump run time can be increased or decreased as needed by adjusting the PUMP TIME potentiometer on the side of the unit. Be careful not to set the time too high with samples that have limited headspace volume.

If your package appears to be totally evacuated after sampling, or you hear the pump “laboring” mid sample, re-set the pump time to a smaller value. Avoid pulling the entirety of the headspace of a package; this can create a vacuum effect that will cause erroneously low readings.

The pump draws about 5cc of volume per second. The recommended pump time is 4 seconds, which would draw about 20cc of volume from a package.

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:

1) Check to make sure the sample probe is screwed into the instrument tightly at the hex fitting.
2) Put the last needle and filter you used on the end of the probe.
3) Press the pump button (without testing a package) and watch the LCD closely.
4) The reading will go down, but what is the minimum that it reaches?

a. if the reading goes down to 19-20%, then goes back up to 20.9%, then you probably have **no blockage** in the filter, needle, or probe.
b. if the reading goes down to 14-19%, then back up slowly to 20.9%, you have a **blockage** in the filter, needle, or probe.
c. if the reading goes down to 10-14%, then you have a **very serious blockage** in the needle, filter, or probe.

5) If you discover a blockage, you can replace the needle first, and repeat the test – or you can replace the filter and repeat the test. If you replace the needle and filter, you may want to check the probe for kinks. 99% of the time, you have a blockage in the needle and/or filter.

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. 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 O_2 sensor.

The probe assembly should be replaced if any part of it is cracked, or if contamination is visible inside the tubing. 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.

BATTERY OPERATION AND RE-CHARGING

It is best to operate the instrument from the batteries, and not leave it plugged in.

The unit will run 8-12 hours before needing recharging. To re-charge the batteries, plug the external charger module into a standard AC outlet, connect the plug from the charger to the jack located on the side of the 901, and **turn**

the unit off. A full charge requires 2-4 hours of charging time. The unit will also operate with four alkaline batteries, which are non-rechargeable. However, these frequently leak and can corrode the terminals with long-term use. The unit is designed to operate with the batteries supplied.

If the analyzer batteries are completely dead, allow it to charge for at least 30 minutes before attempting to use. If you must use the analyzer right away, use alkalines – but don't charge the analyzer with alkalines installed!

BATTERY REPLACEMENT & CHARGER

Remove the battery cover by pressing and sliding in the direction of the arrow. The battery clips are designed to hold the batteries fast, and a blunt tool is required to remove the first battery. The batteries used are 4 X AA Ni-MH rechargeables, 1.2 V 2600 mAh. **Observe polarity markings when installing new batteries.**

These batteries are designed to be slow charged over a period of 4 hours, with the charger provided. Do not use a charger other than the supplied charger – it is a trickle charger specifically designed to charge the Model 901. Also, the jack and plug are of a specific type and size.

NiMH batteries designed to accept a quicker charge can also be used, as long as they are AA size, 1.2-1.4 volt, and are of the NiMH or Ni-Cad type. Do not use other rechargeable types such as lithium. AA alkaline (non-rechargeable) batteries can be used in some situations, but extreme caution must be exercised because plugging the unit into the charger with alkaline batteries installed can cause overheating or even melting of the battery compartment.

The electronics and battery compartment are fuse protected. This fuse is a thermal polyfuse, which heats up and causes the main power circuit to open when excessive current is present. The fuse is located under the circuit board and is not user accessible. If the unit operates with the charger plugged in but not on battery power alone, this fuse is probably tripped. The fuse will reset itself after a period of about 5 minutes if the source of the problem is corrected. The fuse may trip if alkaline batteries are used with the charger plugged in, if the batteries are inserted incorrectly, or if a short circuit is present in the wiring.

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 filters

provided which fits onto the end of the sampling probe. Avoid direct sampling of pressurized gas cylinders. High pressure can cause damage to the sensor. To test the content of a cylinder, flush the sample into a plastic bag and sample from the bag.

 ADVANCED SAMPLING CONCEPTS

Headspace volume: The amount of headspace in your package can impact your test results. There are two components to this concept – package flexibility, and headspace volume.

In general, it is best to avoid situations where a vacuum condition is created when testing a package. The oxygen sensor cannot discern between a change in pressure, and a change in oxygen. If you remove volume from a package you are testing, and that package does not collapse, you will reduce the internal air pressure in that package. Not only will this affect your readings (they will skew to the low side), but the pump and sensor will age quicker.

For reference, a K-Cup will contain about 7cc of headspace. There are 355cc in a 12 ounce soda can.

There are at least four different types of packages / containers which we can profile:

1) High volume / Highly Flexible packages (such as a bag of potato chips) - for flexible packages, as long as the amount of headspace is >20cc, then this is generally not a problem. Imagine a large bag of potato chips - the package will collapse as sample is removed. This is ideal, and your results will be accurate.
2) Low volume / Semi-flexible packages (such as a small, single serving snack package) – for these packages, set the pump time to be very short (3 seconds). If the package appears completely evacuated, then try not using the pump – simply pierce the foam septa, and squeeze the package. Alternatively, you can remove sample using a locking syringe, and inject it into the instrument.
3) High volume / Rigid Containers (such as a 2L glass bottle) – if the bottle is empty, you have 2000cc of headspace. Removing 20cc of sample volume will have very little effect on your readings, as the air pressure will reduce by only 1%. You can test using the pump as normal.
4) Low Volume / Rigid Containers (such as a 10cc vial) – this will not be possible to sample using the pump. There are several workarounds – you can inject water into the vial, while the needle has

pierced the septa. Once you inject water, this will displace the sample into the instrument. The absolute lower limit for the 901 is 5cc. For volumes smaller than 5cc, you will need to purchase our Model 905, 905LV, or 905V.

Shelf Life Studies / Resampling: Testing a package is considered a “destructive” test. Once the package is violated, it is difficult to ensure the package integrity. There is no need to test a package twice, unless you are:

1) conducting a shelf life study,
2) trying to measure the amount of oxygen that permeates through the package barrier over time (this may be such a small amount that it’s not measurable), or
3) attempting to measure the effect of product respiration or other processes that may alter the gas composition

However, there are several workarounds – if you have sufficient volume in the package, *and with the needle still in the package*, you can apply a small amount of pressure to the package while you remove the needle. Quickly place a second foam seal pad over the first. This may require two people.

Check with Quantek for resealing foam pads, we are always innovating our consumable choices and we may have a solution.

Another option, which is less scientific, is to pull 10 packages from the same lot. Test package one after 3 days; test package two after 6 days; etc.

Interfering Gases: It is rare to run into this issue, especially when using to test food packages. For advanced users, please see the interference chart below:

Gas	Concentration	Interference Level
Sulfur dioxide	0-3%	3%
Ammonia	0-3%	1%
Hydrogen chloride	0-3%	1%
Benzene	0-100ppm	1%
Carbon monoxide	0-100%	no effect
Carbon dioxide	0-100%	no effect
Nitric monoxide	0-1%	no effect
Nitrogen dioxide	0-1%	no effect
Hydrogen sulfide	0-3%	no effect
Hydrogen sulfide	0-3%	no effect
Hydrogen	0-100%	no effect
Methane	0-100%	no effect

GENERAL TROUBLESHOOTING

Unit does not power up	Try charging the analyzer for 4 hours; if needed urgently, install alkaline batteries for immediate use. Never charge the analyzer with alkalines installed!
Unit reads 1. on the 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 % 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 Quantek for service.
Readings seem a little high – even when testing pure nitrogen	A common cause of this is the sample probe not being tightened at the hex fitting. If that fitting is loose, the pump will draw sample through the probe, as well as from the ambient air. Make sure this hex fitting is hand-tightened.
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.
Reading goes to a level that is expected, then immediately rises toward 20.9% (for low oxygen packages)	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. Check to see that the probe is tight.
Analyzer reads less than 20.9% (10%-20%) after pumping in fresh air	Try adjusting the span adjustment on the side to bring the analyzer to 20.9%. Remove the filter and needle to rule out clogging; if your analyzer is 4+ years old, then the

	oxygen sensor may be depleted; contact us for replacement sensor or send analyzer back for full testing, sensor replacement, and calibration.
Batteries do not appear to be charging, even after 4 hours	No matter which charger you have, the LED will go to a solid green when charging is complete. If this does not happen, your batteries may be old and unable to take a proper charge. You may want to replace the batteries with compatible AA rechargeables to verify this. Any AA NiMH or NiCad rechargeable battery will work (recommended mAh of 1200 to 2600mAh). You can also call us for replacements.
I left the analyzer plugged into the charger, now the batteries appear to be dead	If the analyzer is left on, and is left plugged in to the charger for a long period of time (16-24 hours) the batteries will drain, and the charger will not re-start. This is a safety feature of the charger. Try unplugging the charger from the wall and plugging it back into the outlet (and into the analyzer) to see if the charge resumes.

Technical Specifications

Range	0.0 to 100% Oxygen
Resolution:	0.1% Oxygen
Accuracy:	+/- 1% of the reading (20.9% may read 20.7 to 21.1%)
Sensor:	Electrochemical Cell, proprietary design, expected life 4-6 years
Sample Pump:	Internal, with adjustable timer
Sampling assembly:	Probe with male luer connection for side-port needle, PTFE tubing with captive insertion screw
Power Supply:	Four "AA" rechargeable batteries; auto shut-off after 45 minutes idle. Charger included.
Battery Life:	8-16 hours before re-charging
Size:	8 x 4 x 1.8 in. (200 x 100 x 40 mm)
Weight:	1 lb. (450 gms)

OPERATING SUPPLIES

1. 9001 Package of 200 foam seal pads
2. 9002 Package of 1000 foam seal pads
3. 9004 Package of 5000 foam seal pads
3. 9005 Liquid and Particulate filter, pkg. of 5
4. 9028 Liquid and Particulate filter, pkg of 25
5. 9003 Tri-Beveled Needles, pkg. of 5
6. 9027 Tri-Beveled Needles, pkg. of 20
7. 9067 Sample probe assembly
8. 9011 Battery Charger for 901
9. 9008 NiMH batteries, pkg. of 4

* - Needles are available in 18G and 20G

Shipping Address:

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183 Magill Drive.
Grafton, MA 01519
Tel 508 839-3940
Fax 508 819-3444
Email: sales@quantekinstruments.com

Please check with your local supplier or distributor if outside the U.S.

To return the analyzer for repair or calibration, please be sure to unscrew the sample probe (but include it in a separate bag), include your contact information, and include the charger and batteries.

Calibration Schedule:

Our calibration schedule for *factory* calibration is:

1) Within 2 years of shipment, i.e. month 24
2) month 36
3) month 48 – 60 (typically we recommend replacing the sensor here, to guard against premature expiration)

About half our customers stick to the schedule, another 25% only send it in when there's a problem, and 25% self-calibrate. It really depends on whether or not you have an audit schedule you have to adhere to.