AMI

Oxygen Analyzer Manual
Model 2001LC

AMI, Costa Mesa, CA

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Preface

The AMI series of analyzers provide the latest in high-definition oxygen analysis. The series includes trace (ppm) and percent models in several configurations. All of them share the same basic design approach, using AMI-manufactured oxygen sensors and advanced high definition electronics for noise and interference free performance. Several aspects of the design are the subject of patents, number 5,728,289 and 6,675,629; the sensors have a patent pending.

Trace Oxygen measurement is difficult because the air contains 20.9% (209,000ppm) of oxygen, and it can get into a pressurized pipeline through the smallest leaks. Oxygen molecules will enter through a leak, no matter the pressure or the nature of the gas in the line. This analyzer is an exceptionally sensitive leak detector – including those provided by improper installation. Make sure you read this manual carefully prior to installation.

Caution

Read and understand this manual fully before attempting to use the instrument. In particular understand the hazards associated with using flammable or poisonous gases, and associated with the contents of the sensor used.

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Model 2001LC Series Oxygen Analyzer

Introduction

The Advanced Micro Instrument Oxygen Analyzer Model 2001LC provides the latest in low-cost high precision oxygen measurement. It is designed for monitoring oxygen in trace (ppm) ranges in a non-hazardous area.

This manual covers software version 1.0.

Features:

- Compact size
- Unique patented cell block
- Auto-ranging display with user-selectable output range
- Front panel sensor access
- Optional air or span gas calibration, no zero gases required
- Virtually unaffected by hydrocarbons or other oxidizable gases
- High accuracy and fast response
- Large liquid crystal display
- Standard isolated 4-20mA output
- Two fully adjustable alarm relay contact closures 24VDC/230VAC 5A.

Oxygen sensor:

AMI manufactures its own electrochemical sensor. This measures the concentration of oxygen in a gas stream, using an oxygen specific chemistry. It generates an output current in proportion to the amount of oxygen present, and has zero output in the absence of oxygen, thus avoiding any requirement to zero the analyzer. The cell is linear throughout its range. The span calibration may be performed using standard span gases or ambient air. Unlike competitive sensors, the AMI sensor is made using a high capacity metallic body that provides long life with about twice the active ingredients of conventional sensors, but with much faster come-down times – typically under twenty minutes to 10ppm from a 1 minute air exposure.

Installation and Operation

Receiving the analyzer

When you receive the instrument, check the package for evidence of damage and if any is found, contact the shipper.

Do not install the sensor until the analyzer is completely installed, the gas lines are plumbed and the electrical connections are all made; and sample or a suitable low oxygen level gas such as nitrogen or a low level span gas is ready to flow into it.

Installation

Location:

The unit is designed to be mounted in a panel in a general purpose area. It should be mounted at a suitable viewing level. Refer to the drawing (figure 1) showing the analyzer dimensions. It is not suitable for use in a hazardous area or with flammable gases.

Although the unit is RFI protected, do not to mount it close to sources of electrical interference such as large transformers, motor start contactors, relays etc. Also avoid subjecting it to significant vibration.

Precaution

Do not install the sensor until you have connected the plumbing and power and are ready to flow zero gas. **The sensor will become saturated with oxygen by exposure to air for more than a minute or so, and once it is saturated, it may take many hours or even weeks to return to a stable low reading.**

Installation Procedure

Figure 1. Back panel of 2001LC analyzer

Don't open the T-2 or T-4 Oxygen Sensor bag until step 20 of this procedure!!!

1. Mount analyzer at a convenient eye level.
2. Confirm sample pressure is less than the analyzer specification (100psig). If it is higher, use a suitable regulator which must have a stainless steel diaphragm.
3. Deal with any potential condensation or liquid contamination issues.
4. Connect the sample line to the sample inlet port with ¼" ss tubing.
5. Pressurize the sample line to line pressure (between 1psig and 20psig).
6. Leak check every fitting and weld from the analyzer inlet to the sample tap.
7. Connect vent line to outside or a suitable purge system.
8. Connect power, relay contacts, and analog output. If using conduit, run the power and alarms in one conduit, and the analog output in the other.
9. Turn on the analyzer.
10. Adjust the sample flow to approximately 1 SCFH with the Flow control valve.

11. Allow the sample gas to purge the unit for a few minutes. Make sure the cell cap is in place.
12. Set up the alarms and the output range from the front panel of the analyzer.
13. Unscrew the cell cap, and install the oxygen sensor.
14. Remove the shorting tab on the sensor.
15. Stabilize for 45 seconds ONLY, adjust span to 20.9%.
16. Replace the Cell cap and tighten it down (hand tight).
17. Purge with sample gas for half an hour, or until the oxygen reading has fallen to low ppm levels.
18. If desired, span with known calibration gas.
    a) Connect a regulator (with Stainless Steel diaphragm ONLY) to span gas tank.
    b) Bleed high pressure side of the regulator 7 times.
    c) Bleed low pressure side of the regulator 7 times.
    d) Shut off the regulator outlet valve and leak check all the tank fittings, gauges and packing glands with Snoop™ or equivalent liquid leak detector (not spray).
    e) Disconnect the sample tubing from the inlet port, either by physically removing it or by using an external three-way valve.
    f) Flow calibration gas WHILE you are connecting the span gas tubing to the inlet fitting or the selection gas valve port. Allow the gas to purge through the fitting for about 20 seconds before you tighten it.
    g) Press the ALARM BYPASS button, and adjust the time displayed to a suitable value (typically 10 minutes).
    h) Verify that the analyzer reads within about 15% of the span gas value.
    i) If so, adjust the analyzer span (see below) until it reads the span gas value.
    j) Let it go back to normal operation (the "SPAN" flag goes out on the LCD display), then press the UP arrow and note the number displayed (the "Calibration factor).
    k) Disconnect the span gas from the inlet fitting and reconnect the inlet tubing.
    l) Turn off the valve on the span gas tank (so it doesn't all leak out).

If the span gas reads worse than 15% wrong, something is wrong either with the gas, or with the plumbing (you have a leak) or some other error. See the troubleshooting section for some ideas about curing this.

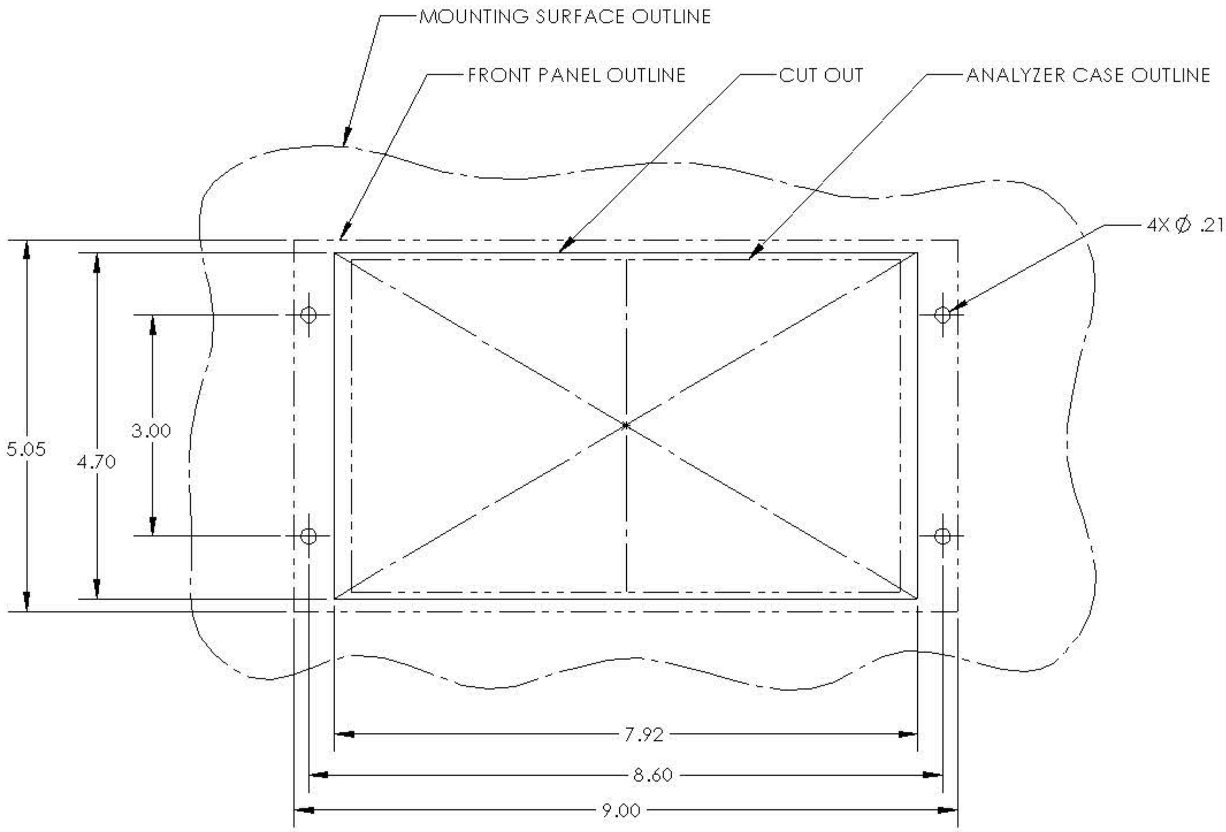

Figure 2. Outline and Cut Out Drawing

Connect gas and power lines:

Do not install the sensor until the gas lines have been connected and the electrical connections made.

Install the unit, and connect the sample gas inlet and exhaust, power and appropriate alarm and output connections. Connect the sample gas line to the fitting on the rear panel using the ¼" compression fittings provided, and the exhaust line to a suitable vent.

Sample gas:
The sample gas inlet pressure should be between 1-40psig.

Span gas:
Span gas (if desired) must be provided by a user-supplied valve.

Exhaust:
The exhaust line may be left open, or vented to a suitable vent. If used with a scavenging system, use a large diameter pipe (for example, ½" pipe) as the input to the scavenging system, and allow the ¼" vent to terminate a little way inside this larger line without sealing it. The scavenging system will then draw in room air along with the sample, while leaving the exhaust at atmospheric pressure.

Power connections:
The 2001LC is designed to be operated from a 24V power supply only. Use a suitable wall adapter, or other kind of stable DC power supply. Make sure the ground is connected to a real ground – otherwise you may experience excessive noise and RFI interference.

Interconnections:

Figure 3. Back panel screen print of the 2001LCS.

Alarm connections:

The alarm connections are single pole double throw relays, i.e. Form C contacts. They are normally preset to operate as high alarms, failsafe, with no alarm delay, though they can be supplied with other settings. By failsafe is meant that the relays are powered when NOT in alarm, so that if power fails, they indicate an alarm condition. The contacts can handle AC or DC voltages, and can carry up to 5A of current for a resistive load. Inductive loads such as solenoid valves should be "snubbed" – we suggest that you connect diodes or Zener diodes or "Transzorbs" directly across them to absorb the inductive spike. Do not connect them across the relay terminals on the analyzer, since the resultant current loop will transmit a lot of RFI that could upset sensitive devices nearby.

Output connections:

This unit is equipped with an isolated 4-20mA output. It is capable of driving a 600 Ohm load and will saturate at more than 125% of the nominal full scale range.

Serial connections:

No serial connection is provided on this analyzer.

Sample Handling:

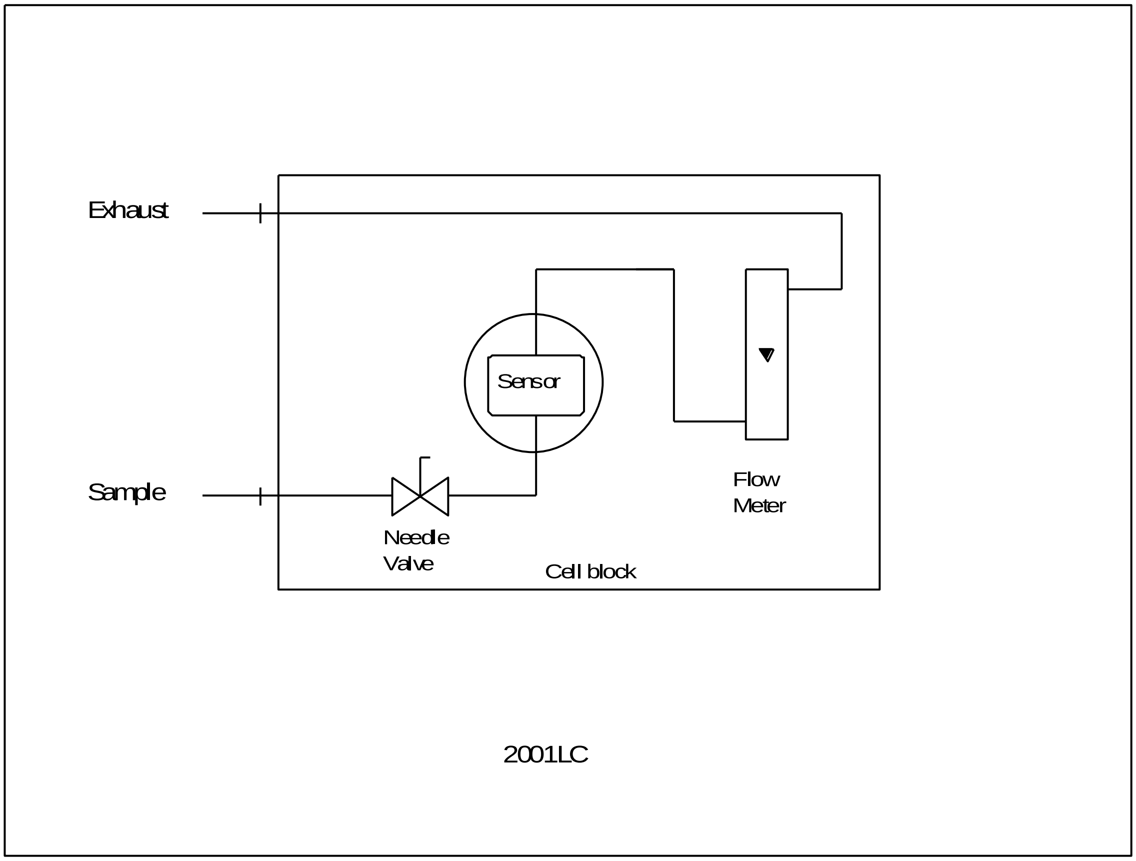

Figure 4 Flow Schematic of the 2001LC

The analyzer expects to get a sample of gas at a pressure between 1 and 100psig. A built-in needle valve and flowmeter allow the user to control flow to 1SCFH with any pressure within this range. Higher pressure applications, or varying pressure applications, will need a regulator to control pressure. The analyzer is not sensitive to flow changes between about 0.2SCFH and 5 SCFH, but it is sensitive to back pressure changes (changes in exhaust pressure).

The flowmeter is mounted on the exhaust so that the oxygen reading is not affected by potential leaks around the flowmeter tube.

Operation

Analyzer operation

It is just as important that the analyzer's sample system – the components used to control the gas flow – are perfect as the measurement methodology itself. No matter how good the analyzer is, if you don't connect the plumbing correctly you won't get good results.

Sample tubing and components

Oxygen diffuses through plastics, to a greater or lesser extent. Standard blue poly tubing will diffuse about 1ppm per foot into 1SCFH at 70°F. Silicone tubing is very much worse. In general, use stainless steel tubing, or at least copper tubing, not plastic. Use high quality compression fittings such as "Swagelock™" or "Gyrolock™" and high quality stainless steel filters, valves or regulators if necessary. Make sure that they are assembled correctly and perform a thorough leak test on the sample system before use.

The analyzer expects to see sample pressures between about 1 psig and 100psig. Higher pressures will make the flow control valve very touchy. If your pressure is higher than this use a regulator with a stainless steel diaphragm to bring the pressure down appropriately. The analyzer is not very much affected by changes in flow rate and the internal flow meter is adequate for setting the flow. Don't use a high precision external flowmeter in front of the analyzer because oxygen will diffuse in through its O rings.

The span gas pressure should also be held below 100psig. If you permanently connect a span gas tank to it via a user-supplied three way valve, make very sure that the connection is leak tight as otherwise not only will the calibration be in error but also you will lose all of your span gas as it leaks out.

Leaks

If you suspect a leak due to high oxygen readings, change the flow rate and see how long it takes for the oxygen reading to change. A higher flow rate will dilute the effects of a leak so that the reading will drop as you increase the flow (this is a very good way of making sure that you do not in fact have a leak, by the way). Turn the flow up from 1 SCFH to 2 SCFH using the front panel valve and see how long it is before the reading changes. If it does so immediately, the leak is close to the analyzer. If it takes longer, the leak is further away.

Exhaust

The exhaust port of the analyzer should be given at least a foot of tubing, but it should not be allowed to become pressurized, or the readings will be affected. If the sample gas is innocuous, such as pure nitrogen, it can be vented into the room with no ill effects, if the room itself is ventilated. Otherwise it should be vented outdoors or brought into a scavenging system. If the latter, have the scavenging system suck in room air around the exhaust line so that the pressure at the exhaust is atmospheric. A typical way of doing this is to have the scavenging system suck on a 1" pipe, and have the ¼" exhaust line from the analyzer extend six inches or so into the end of the pipe.

Calibrating the analyzer

The oxygen sensor gradually gets used up over its life, and as it does so its sensitivity slowly drops until it is at the end of its life, when the sensitivity drops much faster. Therefore you have to calibrate the sensor every so often to make sure that your readings are correct.

There are two ways of doing this. You can use a span gas, a mixed gas containing a certain level of oxygen in a background gas that ideally matches your sample, or you can use air. The advantage of using air is that its value really is 20.9% and it doesn't change; the disadvantage is that it means that the sensor is exposed to air and so it will take a while for the reading to come down again afterwards. Typically, at room temperature, and AMI analyzer will take about fifteen minutes or less to come down to below 10ppm after a one minute exposure to air.

The advantage of using a span gas is that you can calibrate it to a value close to the range of interest – often people use 80ppm oxygen in nitrogen as the span gas. You may have political reasons for having to do this. The sensor recovers from this level of oxygen immediately so there is no down time before the analyzer is working properly again. The disadvantage is that span gases sometimes are incorrectly made, and they can be contaminated by improper handling. Also you will have to provide an external sample/span selection valve.

Calibrating with a span gas

Fist put a suitable regulator on the span gas tank, and "bleed" it as described below. This step is essential, since otherwise the air in the regulator will contaminate the gas in the tank. Connect the regulator to the analyzer with a stainless steel line, and leak check the connection with "Snoop™" or similar leak detection fluid. Purge the line for several minutes with a small flow of gas prior to doing this, and leave the gas flowing while you make the connection to the analyzer. This prevents a slug of air from giving you excessively high readings when you start spanning the analyzer.

Make sure the analyzer is seeing a low oxygen level gas – you want the analyzer to go UP to the span gas, not down to it, particularly not from air. Otherwise it will take a very long time to get a good calibration.

When all is assembled, flow the span gas into the analyzer, and you should see the reading move to the span gas value. Assuming it stabilizes somewhere reasonably close, press the UP or DOWN button until the reading on the LCD shows what the span gas bottle says the value should be.

Calibrating with air

You can either connect a compressed air line – from the plant air, not a bottle of compressed air – to the sample inlet via a selection valve or you can shut off the flow and open the cell cap on the front of the analyzer. If you use compressed air, go through the same procedure as above, only adjust the oxygen reading to 20.9%.

If you do not have compressed air, unscrew the cell cap on the front of the analyzer. Blow some air under the sensor by waving a book or some such at it. Adjust the reading as before to 20.9% and then screw the cell cap back on the analyzer. Bring up the flow of the sample gas.

In either case, make sure you don't take more than a minute to do this. The reading may not stabilize exactly at 20.9%, but don't worry about that – any slight error will be inconsequential at the operating levels.

Let the analyzer come down to a low reading on the sample gas.

Alarm Bypass

Press the alarm bypass button prior to calibration if you have the alarms attached to anything, so as to stop them from going off when the analyzer sees the high oxygen level in the calibration gas. You can adjust the bypass time when you press that button – it shows what the bypass time is, and you can change it with the UP or DOWN buttons as desired. The analog output will also be held constant during this time.

Span problems

Sometimes you will run into problems. If the sensor is old, it may not be able to come up to the span gas level. If so, you need a new sensor. Sometimes sensor will calibrate on span gas but will fail on air. This also indicates an old sensor. You can see the sensor state by pressing the UP button when the sensor is showing the oxygen level – it displays the “Span factor”, a number between about 450 and 1000. As the sensor gets old each calibration will increase this number and when it gets up to about 850 it is time to replace the sensor.

Sometimes the sensor won’t calibrate on span gas properly, but since it is a new sensor you figure something must be wrong. If something like this is happening, perform an air calibration and allow the sensor to come back down to a low reading on the sample. Then perform a span gas calibration only don’t adjust the span factor with the UP or DOWN buttons, and see what the analyzer says the gas contains. If the gas value isn’t what you think it should be, it is the gas that is wrong, not the analyzer, because that air calibration is in fact very valid. You will have to trouble shoot whatever has happened with your gas.

Output range concept:

The analyzer displays the oxygen level in appropriate units on the LCD, automatically adjusting its sensitivity as required. Meanwhile the analog output and the alarms are set on a single (user selectable) “Output” range.

For example, you can set the analog output to correspond to 0-100ppm, and the alarms to be say 40ppm and 50ppm (i.e. 40% and 50% of range), activating above set point. If the oxygen level actually is 25ppm, the display will show 25.0ppm, and the output signal will be at 25% of full scale. If the oxygen level becomes 200ppm, the display will show 200ppm, but the 4-20mA output will be saturated, and the alarms will both be activated.

If you now manually change the output range to 0-1000ppm, the reading will stay at 200ppm, the 4-20mAoutput will go to 20% of scale, and the alarms will de-activate, since they now correspond to 400ppm and 500ppm, i.e. still 40% and 50% of range.

Front Panel Controls:

The controls all work the same way. You press the function you want for a second, and let go, and the display will show the value corresponding to that function, for about 3 seconds. For example, if you press the OUTPUT RANGE button for a second, the display will show the full scale output range. You can change this value (if the security setting allows) by then pressing the UP or DOWN arrow button within about three seconds. You can either press this once for a small change, or you can hold it down, in which case the number will change slowly at first, and then faster. If you overshoot your target, press the other button to go back, and the display will again start moving slowly. If you release any of the buttons, or don't press the UP or DOWN buttons for three seconds, the unit will cycle back into normal operation and store the new value.

Output Ranges

The output range is the range to which the 4-20mA analog output signal and the alarm settings correspond.

Output ranges	0-10ppm, 0-50ppm, 0-100ppm, 0-500ppm, 0-1000ppm, 0-5000ppm, 0-1%, 0-5%, 0-25%.

View Output Range

Press the OUTPUT RANGE button on the front panel for a second, and let go. The display will show the full scale value of the output range for about three seconds, and then change back to the oxygen reading.

Change Output Range

Press the OUTPUT RANGE button for a second and let go. While the output range value is displayed (you have approximately three seconds), press the UP or DOWN arrow buttons to change it. The output range will change to whatever you want. Simply leave it or select another function and the range will be stored and the system updated. You will note that if this results in an alarm change, the alarms will change as soon as the unit starts showing the reading again. If the output range does not change, the security level must be set to full or span only security. In this case change the security level with the laptop and the AMI User Interface program.

Alarm Set Points

The alarm set points can be viewed and changed from the front panel.

View Alarm Set Points

Press either of the ALARM SET POINT buttons and let go. The alarm set point will be displayed for about 3 seconds, and the then the display will revert to the oxygen reading. The set point shown relates to the current output range. If you change the output range, the alarm set point will change to a new value which is the same percentage of the new output range. For example, if the output range is 100ppm, you can set an alarm set point to be half way up, i.e. 50ppm of oxygen. If you then change the output range to 500ppm, the alarm set point will remain half way up the new range, and be displayed as 250ppm.

Change Alarm Set Points

Press one or the other ALARM SET POINT button for a second, and let go. While the alarm set point is showing, press either the UP or DOWN arrow button and hold it until the value is what you want. The numbers will scroll slowly at first and then speed up: if you press the other button, or release and re-press the one you are using, the number will start going slowly again.

Alarm Bypass

Press the ALARM BYPASS button for a second and release it. The display will show the alarm bypass time in minutes, and if the analyzer was indicating an alarm, it will be turned off and held off for the period of the alarm bypass time. The alarm bypass time can be adjusted by pressing the UP or DOWN arrow buttons.

Verify Span Factor:

The analyzer features a “Span Factor” display to help you determine the state of the sensor. As the sensor ages, its output decreases gradually, and therefore the span factor has to be turned up during calibration to compensate.
Press and release the UP button while the unit is showing its reading to view the span factor. The factor corresponds to the setting of a traditional ten turn span pot with a turns counter dial on it.
The setting should be between 300 and 600 for a new sensor. When you calibrate the analyzer, check this value before and after the calibration. You should see that the value goes up slowly over the life of the sensor. When the value has gotten up to 1000, the sensor has reached the end of its life and should be replaced. Also, if the value suddenly jumps, it indicates that the sensor is getting close to the end of its life.

Read the Temperature:

Press the DOWN arrow button. The display will show the temperature of the cell block in degrees Fahrenheit. The value is limited to 25F at the lowest, and about 120F at the highest. Values outside this range will damage the sensor.

Alarm Functionality:

The model 2001LC series has two alarms, with two associated relays. Normally, these are set to operate as high alarms (they go into alarm if the oxygen level goes above the set point), and to close their associated relays upon alarm. Their time delay is set to zero, and they do not latch (unless specifically requested otherwise). An Alarm state is indicated by the word “ALARM” appearing on the display.

Using the analyzer front panel you can change the alarm set points, but you cannot change any of the other settings. If you want them to operate below alarm set point, to latch, or to operate in a pulse mode, you have to order the analyzer set up that way. In this case contact the factory.

Maintenance and troubleshooting

Maintenance:

The model 2001LC is virtually maintenance free other than for periodic calibration and occasional sensor replacement.

Periodic Calibration:

The analyzer should be calibrated about once every month to obtain the best accuracy. The sensor typically declines in sensitivity by about 1% per month, so a monthly calibration is usually satisfactory. Use in a particularly aggressive environment may degrade the sensor faster: in this case calibrate more often.

Sensor Replacement:

This should be done based on the Span Factor feature, rather than as a response to a dead sensor. See the chart below for recommended sensor replacement.

Sensor	Part number	Description	Expected life
T2	4SEN09-1	Trace oxygen - CO_2 background	9 months to 2 years
P2	4SEN03-1	0-50% Percent oxygen - inert gas	9 to 12 months
P3	4SEN04	0-25% Percent oxygen - CO_2 background	9 to 12 months
P4	4SEN08	100% oxygen - inert impurity	6 to 9 months

Table 1. AMI sensor types

Sensor replacement cautions:

CAUTION: The sensor contains a caustic or acid liquid. If there is any sign of a liquid in the cell compartment, do not allow it to come into contact with your skin. If it does, immediately flush the affected area with water for a period of at least 15 minutes. Refer to the Material Safety Data Sheet provided.

Dispose of leaking or used sensors in accordance with local regulations. Sensors usually contain lead which is toxic, and should generally not be thrown into ordinary trash. Refer to the MSDS to learn about potential hazards and corrective actions in case of any accident.

Figure 5. Inserting sensor in cell block

Sensor replacement procedure:

The sensor is provided in a special sealed bag. Do not open this until you are **immediately** about to install the sensor.

Before installing sensor, make sure the power is ON.

1. Press the ALARM ACKNOWLEDGE.
2. Turn the gas flow down to zero on the flowmeter.
3. Unscrew the cell block cap, being careful not to lose the O ring.
4. Carefully remove old cell by pulling the tab on the label.
5. Inspect the cell block cavity, and if any sign of moisture clean it out with a Q tip or similar. Make sure that the contact springs inside the block are intact. Be careful not to snag them with the Q tip.
6. Verify that the sealing O ring is in place in the cell cap groove. Verify that the O ring and the cap are clean and free of any particulate deposits (such as dirt).
7. Carefully open the bag using a pair of scissors or a knife. Make sure you don't cut yourself or stab the sensor! In the rare event that the sensor has leaked there will be liquid in the bag. If so do not proceed - you need a new sensor. Be careful that you don't poke anything such as a fingernail through the membrane.
8. Don't pull out the shorting tab yet!
9. Holding the sensor by its tab, membrane side down, slide it into the cell block (gold plated contact side of sensor should be facing up touching the cell block contacts. Make sure the tab is pointing towards the outside so you can pull it out!
10. When the sensor is pushed in all the way, pull out the shorting tab.
11. Let the reading stabilize and adjust it after a minute to 20.9%.
12. Turn up the flow of zero (or sample) gas.
13. Carefully replace the cap, making sure that you do not cross thread it, and tighten firmly by hand. Do not over-tighten.
14. Make sure the zero or sample gas flow is set to 1 SCFH.
15. Let the reading come down to a low level, and then if desired, calibrate it using a span gas.

Bleeding a regulator

A newly installed regulator on a bottle of span gas is of course filled with air, at 210,000 ppm of Oxygen. Until this air is removed, the apparent oxygen concentration in the span gas will be much higher than it should be. While simply flowing the span gas will eventually accomplish this, it is much quicker and more reliable to “Bleed” the regulator first.

1. Install the regulator on the span gas bottle, but do not open the bottle valve yet.
2. Close the regulator exit valve.
3. Close the regulator to what would be no pressure on the outlet.
4. Briefly open the bottle valve, and close it again.
5. Loosen the nut connecting the regulator to the bottle and allow the pressure to bleed off, and then tighten it again.
6. Open the regulator to half its maximum pressure.
7. Repeat steps 4 and 5.
8. Open the regulator to its maximum exhaust pressure.
9. Repeat steps 4 and 5.
10. Set the regulator to its correct output pressure (typically 10 psig).

Troubleshooting

All oxygen applications

Analyzer does not power up.

1. Check that the power is connected correctly, and the switch on the power entry module is on.
2. Check that the power supply voltage is 24VDC only.

Analyzer reads too low

1. Sensor is not calibrated. Flow span gas through it and span the analyzer until the analyzer reads appropriately.
2. If you cannot adjust the span enough to accomplish this, replace the sensor.
3. If the new sensor still reads too low, check its calibration with air and read the span gas - the span gas may be incorrect.
4. If the sensor seems to die quickly, it may be getting poisoned by acid or sulfur bearing gases such as H_2S. These should be scrubbed from the sample stream by a scrubber.
5. Verify that the cell block connectors are in fact making contact with the cell. Clean them gently with a Q tip, and bend them slightly straighter so that they make a good contact. Once this is done the cell should have some resistance to being removed from the block.

Analyzer reads too high

1. Verify that there is no flow restriction in the vent line of the analyzer.
2. Increase the flow rate through analyzer by increasing the sample pressure - if the reading goes down it indicates a leak in the incoming sample line or the cell block. Use “Snoop™” or equivalent to check all the fittings back to the gas source.
3. Leak test all external fittings with “Snoop™” soap solution or equivalent.
4. Verify that the gas flow rate is correct. (0.1 to 2 SCFH)
5. Oxygen diffusion can be a serious problem. Verify that no plastic tubing or other plastic components are used in a trace gas system, including diaphragms of pressure regulators, packing of valves etc. For percent applications, similar problems may be experienced with silicone tubing. Use Teflon™ or Tygon™ or similar high quality tubing.
6. Verify the analyzer calibration using air as the span gas.
7. Flow zero gas through the analyzer for a while until the reading is stable: shut off the incoming flow with the sample valve and then immediately seal the vent tightly with a tube plug or equivalent (don’t pressurize the cell!). Monitor the reading and see if it increases significantly over a 5 minute period. Such an increase indicates a leak in the cell block or internal sample system.
8. Remove the cell (and short it out!) and verify that the analyzer reads zero - if not, there is moisture or corrosion between the sensor contacts in the cell block; clean the contacts and the area around them with isopropyl alcohol, dry with dry compressed air or nitrogen, then replace the cap on the cell block again. Pressurize the system to no more than 10 psig and leak check all the fittings and tubing.

NOTE: Almost always, high oxygen readings are due to leaks. Oxygen in the air is under a partial pressure of about 5 psi at sea level, and thus will force its way into minute leaks, no matter what the internal pressure of any other gas may be. 3000 psig nitrogen or other gas lines look like a vacuum to oxygen! This always surprises people who have not experienced it.

Analyzer reads zero

1. Verify that the sensor is in the correct position, not upside down. If it is upside down, verify that the membrane has not been punctured - i.e. there is no sign of electrolyte on the surface, and if not, put it back the right way up. If you have left it this way for a while, it may take several hours to recover to a low reading.
2. Verify that the cell block contacts are touching the sensor. Pull the sensor tab, and the contact should hold the sensor with a gentle force. If not, the contacts may be bent. If they have been bent too much, remove the sensor and gently bend them back so that they can again make contact.
3. Make sure that the gold plated contact wires are clean. If not, gently clean them with a Q tip or an eraser. Do not use an abrasive cleaner, as it will remove the gold plating.
4. Check the output of the sensor with a DVM configured to measure current. Connect its leads to the two gold rings on the back of the sensor - the center is ground. The output should be around 150 to 750 micro Amps in air. This will take a few minutes to stabilize as the sensor consumes oxygen dissolved in its electrolyte. Replace the sensor if it does not read this amount. See sensor replacement instructions under Maintenance.

No voltage or current output to recording device

1. Verify that the output wires are properly stripped and connected.
2. Verify the connections on the output terminal block.
3. Verify that the output connections are not shorted all the way back to the recording device. Disconnect the wires from the analyzer and use an ohmmeter to check for shorts or opens.

No output alarm indication

1. Verify the alarm set points are correct - press the appropriate switch on the front panel, and check the displayed reading on the LCD for correct setting.
2. Verify that the connections on the terminal block are properly stripped and correct.
3. Verify that the output connections are not shorted all the way back to the recording device. Disconnect the wires from the analyzer and use an ohmmeter to check for shorts or opens.

Incorrect readings

1. Verify that there are no leaks in the system.
2. Verify that the span gas bottle is correctly marked by comparing its reading when the analyzer has been spanned on air to what it actually says.
3. If spanning on air, verify that the air source is free of water vapor (humid air will contain about 3% less oxygen than expected, depending on temperature), and that bottle air does actually contain 20.9% oxygen. Manufactured air often does not!

Still no correct operation

1. Call AMI at 714 848 5533, and ask for Technical assistance.
2. Or contact us by email at sales@amio2.com.

Specifications and Disclaimer

Specifications:

2001LC Series Standard ranges:

0 – 10 ppm, 0 – 50ppm, 0 –100 ppm, 0 – 500 ppm, 0 – 1000ppm, 0 – 5000 ppm, 0 – 1%, 0 – 5%, 0 – 10%, 0 –25%

Sensitivity: 0.5% of full scale

Repeatability: +/- 1% of full scale at constant temperature

Operating temperature: 5°C to +45°C (41°F to 113°F)

Sample pressure: 1 psig to 100psig.

Humidity: < 95%, non-condensing

Operational conditions: Pollution degree 2, Installation category I I.

Drift: +/- 1% of full scale in 4 weeks at constant temperature (dependent on sensor)

Expected cell life: 9 months to 2 years.

Response times:

90% of full scale in less than:

0 – 10 ppm 25 sec

0 – 100 ppm 10 sec

0 – 1000 ppm 10 sec

Output: 4-20mA isolated.

Alarm contacts: 230/117VAC @ 5A, or 28VDC @ 5A, resistive

Power requirements: 24VDC <10W.

Absolute Maximum Power voltage 28VDC

Overall dimensions: 9” w x 95” h x 3” d

Mounting hole dimensions: 7.92” w x 4.81” h

Weight 5 lbs.

Disclaimer

Although every effort has been made to assure that the AMI analyzers meet all their performance specifications, AMI takes no responsibility for any losses incurred by reason of the failure of its analyzers or associated components. AMI's obligation is expressly limited to the analyzer itself.

The AMI analyzer is not designed as a primary safety device, that is to say it is not to be used as the primary means of assuring personnel safety. In particular it is not designed to act as a medical instrument, monitoring breathing air for correct oxygen concentration, and should not be used as such when it is the only safety device on the gas system.

AMI® WARRANTY & SUPPORT

LIMITED WARRANTY/DISCLAIMER

The warranty period is **TWO YEARS** for the Analyzer. Any failure of material or workmanship will be repaired free of charge for that specified period from the original purchase (shipping date) of the instrument. AMI will also pay for 1-way ground shipment back to the customer.

The warranty period for the electrochemical oxygen sensor is 6 months.

The warranty period for the electrochemical H_2S sensor is 6 months.

The warranty period for the zirconium oxide sensor is 2 years.

Any indication of abuse or tampering of the instrument will void the warranty.

Receiving the Analyzer
When you receive the instrument, check the package for evidence of damage and if any is found contact the shipper. Although every effort has been made to assure that the Analyzer meets all performance specifications, AMI takes no responsibility for any losses incurred by reason of the failure of this analyzer or associated components. AMI's obligation is expressly limited to the Analyzer itself.

EXCEPT FOR THE FOREGOING LIMITED WARRANTY, AMI MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE NON-INFRINGEMENT OF THIRD-PARTY RIGHTS, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. IF APPICABLE LAW REQUIRES ANY WARRANTIES WITH RESPECT TO THE SYSTEM, ALL SUCH WARRANTIES ARE LIMITED IN DURATION TO TWO (2) YEARS FROM THE DATE OF DELIVERY.

LIMITATION OF LIABILITY

IN NO EVENT WILL AMI BE LIABLE TO YOU FOR ANY SPECIAL DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF THE COMPANY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.

LIMITATION OF REMEDIES

AMI's entire liability and your exclusive remedy under the Limited Warranty (see above) shall be the replacement of any Analyzer that is returned to the Company and does not meet the Company's Limited Warranty.