



AMI

Portable Trace Oxygen Analyzer Manual

Model 1000RS



Advanced Micro Instruments, Inc.

Made in the USA

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Preface

Thank you!

We would like to thank you for purchasing the most advanced portable trace oxygen analyzer available. The AMI 1000RS is simple, but complete. It includes our patented cell block, (patent numbers 5,728,289 and 6,675,629), and our patented sensor. It uses an integral 4-way valve that provides a bypass mode with the sensor sealed off (both inlet and outlet simultaneously), and a measurement mode that connects the sensor to the sample. A sample source can be connected with a single plug-in connection and the analyzer and tubing purged before the sensor is exposed to the gas. The result is immediate and accurate trace oxygen measurement without the long come-down times that traditional analyzers are subject to.

The electronics is microprocessor-based with a high definition 24-bit Analog to digital converter for high precision performance with no range changes necessary.

Please verify that the analyzer was not damaged in transit. If so please contact the shipper as well as AMI.

DO NOT ROTATE THE ON/OFF SELECTOR VALVE (LOCATED ON THE FRONT OF THE ANALYZER) BEFORE YOU CONNECT THE ANALYZER TO A SOURCE OF LOW OXYGEN LEVEL GAS. Read this manual before you operate the analyzer.

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. **Please read the next section that discusses intrinsic safety.**

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The 1000RS Portable Trace Oxygen Analyzer

Introduction

Intrinsic Safety Notes and Warnings (Very Important Please Read !!!)

1. Do not use the USB Interface and/or the 12VDC Input in a Hazardous Area.
2. A data download device may only be connected to the USB connector of this analyzer in a non-hazardous area and shall be approved as SELV or Class 2 equipment against UL 60950 or an equivalent IEC standard. The maximum voltage from a data download device shall not exceed 5.25 VDC.
3. Only connect Intrinsically Safe Equipment to the Analog Out (Parameters $U_o=4.65V$, $I_o=47mA$, $P_o=34.8mW$, $C_i=30.50\mu F$, $L_i=0\mu H$)
4. Substitution of any components in this analyzer may effect intrinsic safety.
5. Potential Electrostatic Charging Hazard:
 - a. No precautions against electrostatic discharge are necessary for portable equipment that has an enclosure made of plastic, metal or a combination of the two, except where a significant static-generating mechanism has been identified. Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk. However, where a static-generating mechanism is identified, such as repeated brushing against clothing, then suitable precautions shall be taken, e.g. the use of anti-static footwear.
 - b. The certification marking plate is aluminum. Care must be exercised during use to avoid causing sparks by impact or friction.
6. The analyzer should only be charged in a non-hazardous area using a charger specifically supplied for use with the unit (for example part number 3ACA13, type TRG1512-A, manufactured by CINCON Electronics Ltd), approved as SELV or Class 2 equipment against UL 60950-1 or an equivalent IEC standard. The maximum voltage from the charger shall not exceed 12.0 VDC.
7. **Failure to observe any of the above requirements will invalidate the Hazardous Locations certification.**
8. **Exia** means Intrinsically safe.

Remarques et avertissements de sécurité intrinsèque (Très important Prière de lire !!!)

1. Ne pas utiliser l'interface USB et/ou l'entrée 12 V CC à un endroit dangereux.
2. Un dispositif de téléchargement de données peut uniquement être branché au connecteur USB de cet analyseur dans une zone non dangereuse et doit être homologué comme équipement TBTS ou équipement de classe 2 en vertu de la norme UL 60950 ou d'une norme CEI équivalente. La tension maximale provenant d'un dispositif de téléchargement de données ne doit pas dépasser 5,25 V c.c.
3. Raccorder uniquement un équipement intrinsèquement sûr à la sortie analogique (paramètres $U_o=4,65 V$, $I_o=47 mA$, $P_o=34,8 mW$, $C_i=30,50 \mu F$, $L_i=0 \mu H$)
4. La substitution de tout composant de cet analyseur peut affecter la sécurité intrinsèque.
5. Danger potentiel de charge électrostatique :
 - a. Aucune précaution contre la décharge électrostatique n'est nécessaire pour l'équipement portable dont le boîtier est fait de plastique, de métal ou d'une combinaison des deux, sauf lorsqu'un mécanisme

généralisant un niveau important d'électricité statique a été identifié. Les activités telles que placer l'appareil dans une poche ou sur une ceinture, l'utilisation d'un clavier ou le nettoyage à l'aide d'un chiffon humide ne présentent aucun risque électrostatique significatif. Cependant, lorsqu'un mécanisme producteur d'électricité statique est identifié, tel que le brossage répété contre des vêtements, des précautions adéquates doivent alors être prises, telles que l'utilisation de chaussures de sécurité antistatique.

- b. La plaque de marquage de certification est faite d'aluminium. L'utilisation doit se faire prudemment pour éviter de produire des étincelles par impact ou friction.
6. L'analyseur doit uniquement être chargé dans une zone non dangereuse à l'aide d'un chargeur fourni spécialement pour cet appareil (par exemple, référence 3ACA13, type TRG1512-A, fabriqué par CINCON Electronics Ltd), homologué comme équipement TBTS ou équipement de classe 2 en vertu de la norme UL 60950-1 ou d'une norme CEI équivalente. La tension maximale provenant du chargeur ne doit pas dépasser 12,0 V c.c.
7. Tout non-respect des exigences ci-dessus invalidera l'homologation pour zones dangereuses.
8. **Exia** signifie intrinsèquement sûr.

Warning on Using the Appropriate Charger for 61010 Assessment

1. The charger for this unit must be rated at a maximum of 12V, 1A and approved as SELV or Class 2 equipment against UL 60950-1 or an equivalent IEC standard.

Basics of trace oxygen

Oxygen is unlike any other gas in that it is very reactive, and a major constituent of air. In many industrial processes it is a very undesirable contaminant, and levels of oxygen must be kept in the low part-per-million range. When measuring these levels, it is essential to take precautions against oxygen from the air leaking into and contaminating the gas causing erroneously high readings. The model 1000RS analyzer makes taking these precautions easy.

Oxygen is present in air at 209,000 parts per million (ppm). In a typical process stream, oxygen levels above 10ppm are a concern. If the sensor in the analyzer is exposed to air, it has to come down from 209,000ppm to below 10ppm to get a good reading. Any electrochemical sensor will take some time to do this, depending on how long it has been exposed. AMI sensors are the fastest in the industry, and the AMI cell block is very effective at purging air from the sensor, but after a one minute air exposure even an AMI sensor/analyzer combination will take up to 15 minutes to get down to 10ppm. The model 1000RS contains a unique 4-way valve that allows you to plumb the analyzer up to the sample point and thus purge the sample tubing and the analyzer cell block of air without exposing the sensor to the air. After a minute of purging, simply turn the analyzer valve to the ON position and the sample is allowed to flow to the sensor which rapidly comes to a valid reading. Competitive analyzer designs expose the sensor to the surge of air caught in the sample tubing, causing them to take a considerable time to stabilize at the correct reading.

Having taken the measurement, the sample with its low oxygen content can be sealed around the sensor by turning the analyzer valve back to the OFF position. Now the analyzer can be moved without worrying about contaminating the sensor with air.

It is important to understand that at the ppm levels we are concerned with, oxygen readily diffuses through plastic materials, some worse than others. It is acceptable to use O rings, but any plastic tubing in the sample system must be made of special low permeability material, such as the sample tubing AMI supplies.

Trace oxygen is measured using a disposable electrochemical sensor that is specific to oxygen. It wears out in use like a flashlight battery, and thus has to be replaced occasionally, typically once per year. AMI makes a proprietary sensor line that gives particularly good performance in aggressive industrial applications – the T-2 is resistant to H_2S up to 10ppm, while the T-4 can tolerate up to 500ppm H_2S through its warrantied life.

The Model 1000RS

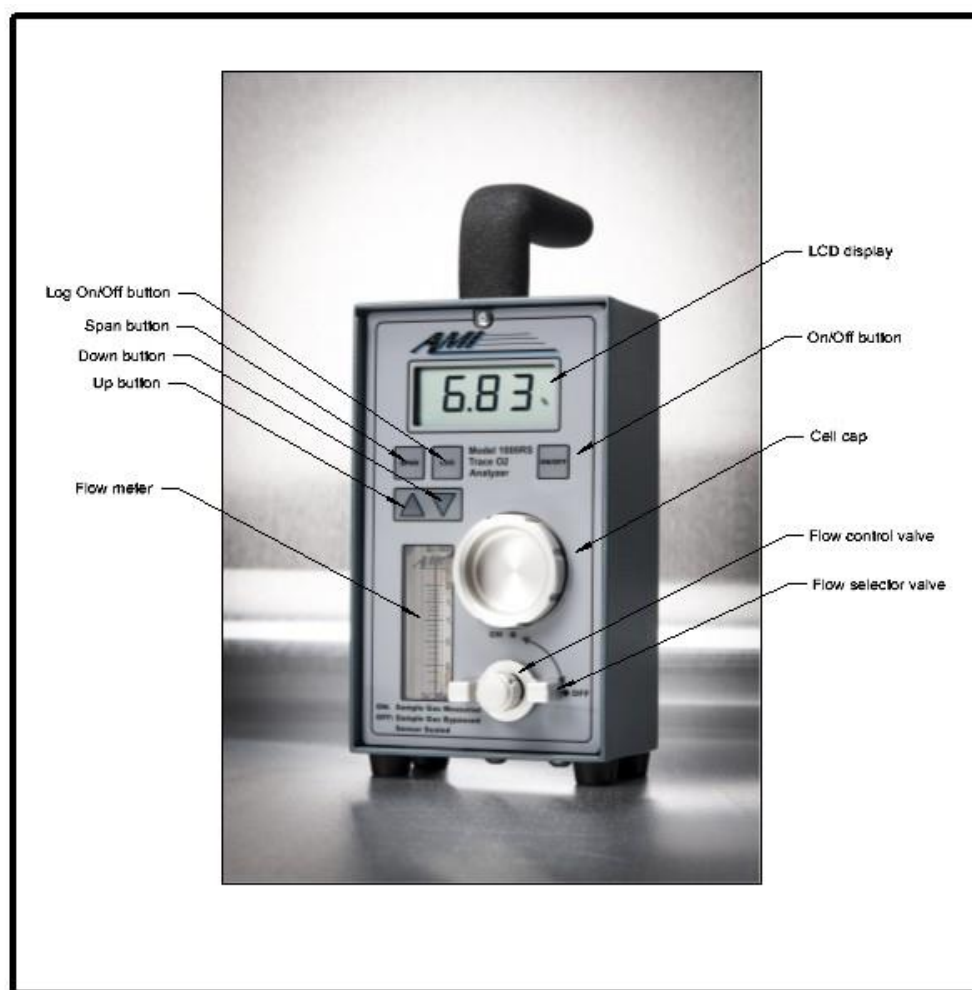


Figure 1 Front view

The Model 1000RS provides all the features required to make measuring and spot checking trace oxygen levels simple. It includes a complete sample system together with a state-of-the-art electronics package that provides USB connectivity, datalogging of the O₂ readings, battery voltage and temperature, and many other advanced features such as calibration history and sensor life indication.

With the optional user interface, a USB cable and a standard PC or laptop, the data log of oxygen readings can be downloaded into the computer and presented either as a spreadsheet or a graph.

The batteries typically last about 500 hours of operation before they need to be recharged.

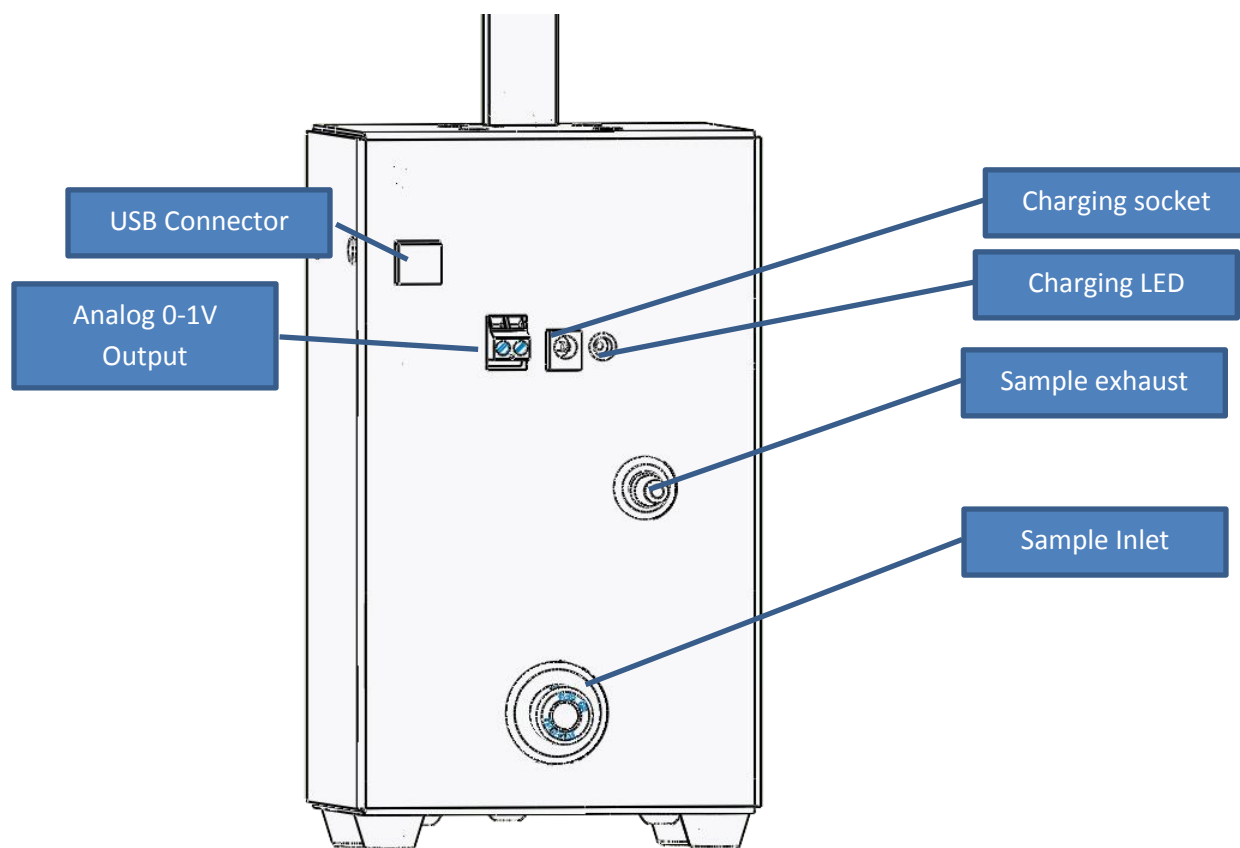


Figure 2 Back view

On the back the analyzer is a quick-disconnect fitting for the sample inlet. It is provided so as to minimize wear on the fitting - it is not required to seal gas in the analyzer. Conventional compression fittings cannot be used more than a few times without damaging them to the point that they leak enough to cause erroneous readings. An exhaust fitting is also provided suitable for a length of silicone tubing should you need to vent the exhaust somewhere (for example, out of the cab of a truck). A charging socket and an analog output with a 0-1V signal, and a standard USB type B connector such as is often used on a printer are also provided.

Oxygen Sensor:

AMI makes a series of proprietary electrochemical sensors. The particular one used depends on the level of hydrogen sulfide in the gas stream – the standard T-2 sensor can tolerate small amounts of hydrogen sulfide (up to 10ppm), while the T-4 tolerates up to 500ppm of hydrogen sulfide. The sensor 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 sensor is linear throughout its range. The span calibration may be performed using standard span gases or ambient air.

Using the Analyzer

Introduction:

The AMI model 1000RS analyzer is meant to be used for spot checking gas samples for trace levels of oxygen contamination. "Trace" means oxygen at levels from zero to about 1000ppm. It does provide percent ranges but these are intended only to allow for air calibration if desired. It uses a special oxygen sensor that is easily field replaceable, and it provides a number of features that make the whole process as easy as possible.

The analyzer is shipped with its batteries fully charged. Since NiCd batteries self-discharge, charge it overnight before using it. When charged the batteries will last for up to 500 hours of continuous use.

The analyzer automatically reads the oxygen level and scales the display so that it always shows the best resolution. The voltage output and the data log use a preset range (normally 0-100ppm) that can be changed with the PC interface program. The data log also records over-range excursions up to ten times the range. By default, it will store data points up to 1000ppm, even though the range is set to 100ppm.

When the analyzer is first turned on the data log function is always off. If you wish to data log you have to manually turn it on, by pressing and holding the LOG button on the front panel for one second.

Although the analyzer is rugged, and built into a steel case, it should nevertheless be treated carefully. Do not expose it to rain, or sudden temperature changes. For example, taking it from a heated building to the outdoors in winter will cause a rapid temperature change that will temporarily upset the temperature compensation, and it will take a little while for the sensor to come back to equilibrium. Low temperatures below 50°F will slow the chemical reactions in the sensor and cause it to respond more slowly. If the temperature drops below about 26°F the sensor can freeze, which will damage it. If it is to be used outside in cold weather, keep the analyzer in a warm place such as the cab of a truck, and run the sample line into it. Make sure that you run an exhaust line so that the sample vents outside of the cab of your truck!

For best reliability, transport it in its carrying case and avoid exposing it to extreme temperatures.

Once you have finished taking a measurement, MAKE SURE THE ON/OFF VALVE IS TURNED TO OFF before disconnecting the sample. Failure to do so will make the sensor very sluggish.

Powering up the analyzer:

Press the On/Off selector button on the right side of the front panel to turn the analyzer on or off. It will show "Init" for a few seconds, then possibly a high value, and then the reading will drop to zero and climb up to whatever the sensor is currently measuring. When the analyzer has been stored for a while with the valve in the "Off" position, it is normal for the unit to display between 50 and 500ppm. This is caused by diffusion of oxygen through the O rings in the valve and sensor cap. This level of oxygen is not a problem. When low level gas flows past the sensor the reading will drop immediately to the correct value.

If the batteries are low, the unit will flash "Bat" and "Lo" every 7 seconds or so, and otherwise show the correct oxygen reading. You can use the analyzer if it does this, but you should recharge it as soon as you can. If the batteries get too low for reliable operation, it will display "dEd" until the power fails so deeply that it can't do anything at all. If this occurs you will have to recharge it. For a complete recharge, leave it charging for at least 14 hours.

Ranging:

The electronics and software in the analyzer automatically ranges the LCD display for best resolution. The maximum it will read is 25% oxygen, and the minimum is 0.01ppm of oxygen. The percent measurement is provided purely for an air calibration (which is a quick and accurate way of calibrating the analyzer if you don't have a certified span gas).

Calibration:

When shipped, the unit and sensor have already been calibrated at the factory. However you may wish to verify the calibration; the general procedure for doing this is to bring a suitable calibration gas into the analyzer, press the "SPAN" button, and then adjust the reading with the UP and DOWN buttons until the analyzer agrees with the span gas value. There is a detailed procedure describing the exact steps given later in this manual.

It is rather common to find that when you introduce span gas into the analyzer, the reading is quite different from what you expect. This is normally caused by errors in gas handling, rather than by calibration errors. If the gas doesn't read close to what you expected, carefully check the calibration and troubleshooting section of the manual - paying particular attention to the "Bleeding a regulator" section - rather than simply adjusting the span to what may well be a completely incorrect value.

The span adjustment actually changes an internal parameter, a number called the "Span Factor" that you can read by simply pressing the UP arrow. This number is only meaningful after a calibration when it gives you a gauge of the remaining sensor life.

The analyzer stores the last five times it was calibrated, along with the calibration factor and the value of the gas used. These records may be viewed with the User Interface program.

Sensor Life:

A sensor is slowly used up during its life, rather like a flashlight battery. As it gets used up, you will need to increase the span to keep the unit calibrated. You can judge the state of the sensor by performing a calibration, and then reading the "Span factor" by pressing the UP button. When the sensor is new this number will be around 450; by the time it reaches 1000 the sensor is used up. You will find that this number doesn't change much at first, but as the sensor ages it begins to change more rapidly. We recommend that you order a new sensor when the number reaches 900. Do not keep sensors on the shelf as they have a shelf life of six months or less, depending on temperature. The sensor is provided in a sealed, oxygen free bag. The sensor is always working, so it consumes any oxygen that comes into the bag. When the temperature is higher the bag becomes more permeable to oxygen from the air so the sensor is used up faster. It is best to order a new sensor just before you need it.

The analyzer calculates how long the sensor has been in use, and also how long it has been exposed to temperatures above 110F or below 32F, and how long the analyzer has been switched off. It calculates the total amount of oxygen the sensor has been exposed to during the time it was switched on (obviously it can't do this when it is switched off). All of these numbers can be viewed using the User Interface Program which is an option from AMI.

Data logging

The voltage output and the data logging are scaled to a particular range, normally 0-100ppm. It is possible to change this range to one of ten values between 0-10ppm and 0-25% by the use of the optional PC interface program.

The data logging function will log readings over the active output range, but will also log excursions above this up to ten times the output range value. For example, if the output range is set at 0-100ppm, the unit will capture spikes up to 1000ppm. The resolution of the data log is 1% of its range – that is if the range is set to 100ppm, it will store values like 21 ppm, 22ppm and so forth, with no decimal point. If the reading goes over range it will store the over range value at a resolution of 1% of the higher range – for example, if the reading goes to 423 ppm it will store 420, not 423.

It also stores the time and date of the reading set, and the battery voltage and the temperature. All of these can be recovered from the analyzer using the AMI user interface program and the USB connection on the back of the analyzer.

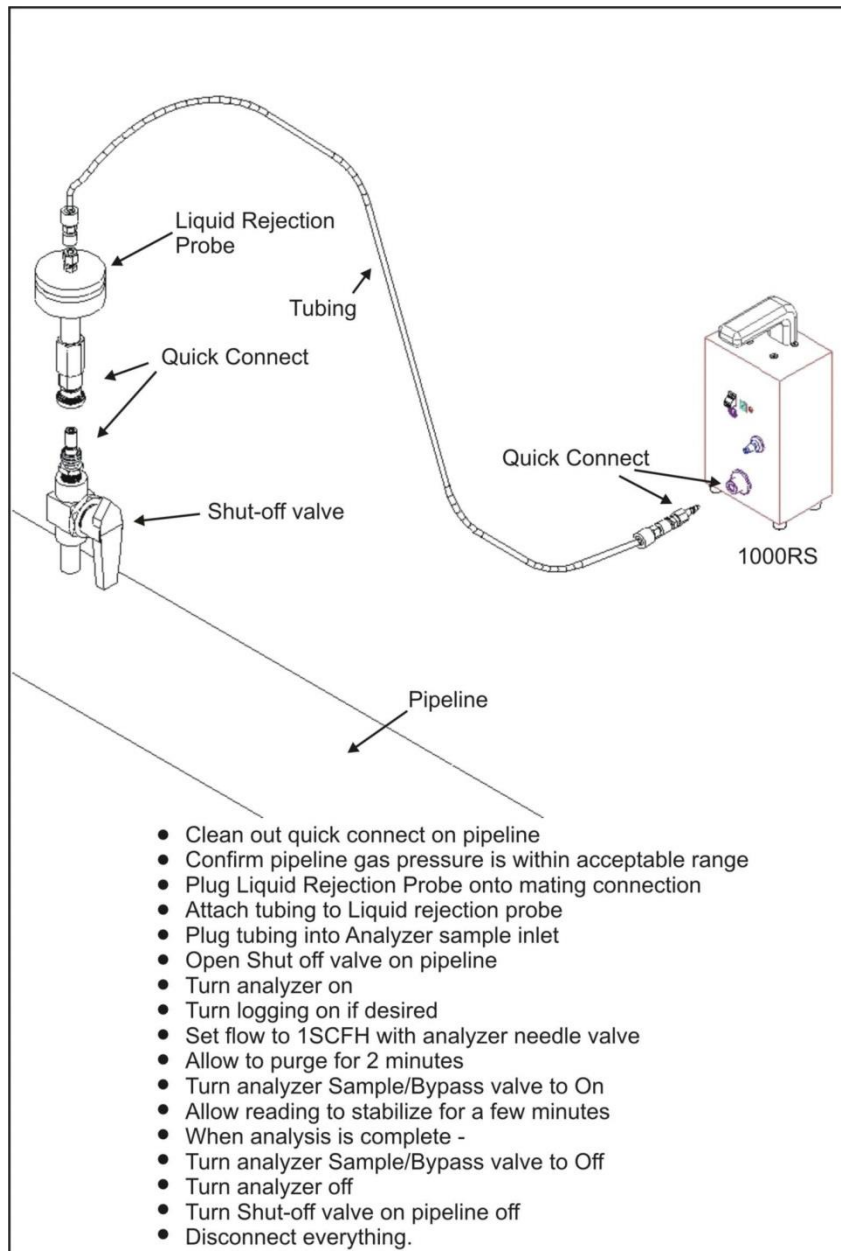


Figure 3 Sampling from a pipeline (demister not shown for clarity)

Sample Line Connection:

The sample is brought into the “quick connect” fitting on the rear of the analyzer. We use this kind of fitting because it can be made and unmade many times without damage, unlike a compression fitting.

If you are using the flexible tubing supplied as an optional accessory, simply plug it into this fitting. Otherwise, you will need to attach the male matching fitting to the tubing you are using.

We strongly suggest that you use the flexible tubing AMI supplies. It has very low diffusion, but it remains flexible even at low temperatures. Stainless tubing can become a real problem after a while, particularly after it work-hardens.

Be aware that most plastic tubing will allow oxygen to diffuse into itself at a fairly high rate; typical PVC tubing will add about 1ppm oxygen for every foot of tube at a flow rate of 1 SCFH at 70F. The rate goes up strongly with temperature. DO NOT USE SILICONE TUBING! It will allow percent levels of oxygen to diffuse into the sample.

Make absolutely sure that the sample tubing, fittings and sample tap have no leaks. Oxygen from the air will diffuse into a leak even though the gas inside is at a high pressure. High oxygen readings are almost always caused either by leaks or by a regulator that has not been properly bled. Pressurize the line before you attach it to the analyzer, and use "Snoop™" or equivalent to check for leaks at every joint or fitting. Remember that this analyzer can be viewed as a very sensitive leak detector.

If you are sampling natural gas in an enclosed space, such as a "Pod building", you must use some tubing to bring the exhaust outside the building. Slip it onto the exhaust fitting, and run it downhill to a suitable place outside. Any kind of tubing, such as silicone or other plastic, is acceptable for the exhaust line (unlike the sample inlet line).

NOTE: Never allow the vent to become restricted, thus back-pressuring the sensor. Doing so will cause inaccurate readings and may damage the sensor.

Valves:

The unit contains two valves, a needle valve for flow control, and a unique 4-way On/Off selector valve. The needle valve is mounted in the middle of the On/Off selector valve. When the On/Off selector valve is in the Off position, gas can flow into the analyzer and out through the exhaust port, but the sensor is sealed off from it. When in the On position, the flow goes over the sensor, allowing it to measure the oxygen content. It is so designed that the flow is the same no matter which position the On/Off selector valve is in. Trace oxygen sensors are of course very sensitive, and so it is desirable that they not be exposed to air (which has a very high oxygen content) more than absolutely necessary. If a sensor is exposed to air for more than a minute or so, its electrolyte will become saturated, and it will take a long time for the internal chemistry to reduce all the dissolved oxygen. During this time the sensor will read high, and not be able to measure low oxygen levels. The arrangement of valves in this analyzer avoids this problem, without requiring any great skill on the part of the operator. The result is that the analyzer can be taken from sampling point to sampling point and immediately used, without having to wait for excess oxygen to be used up.

Don't try to use the needle valve to shut off the flow! Not only will this damage the needle valve, but the exhaust line of the sensor won't be sealed, thus defeating the purpose. Use the On/Off selector valve.

Measuring a sample:

Plug the sample line into the quick connect fitting located on the back of the analyzer, and allow gas to flow with the On/Off selector valve in the Off position. Use the needle valve (the knob in the center of the On/Off selector valve) to control the flow to about 1 SCFH. Allow the sample to flow through the analyzer for a minute or so, until you feel the sample line is suitably purged. When you are satisfied that the sample line is purged, turn the On/Off selector valve to the On position. Gas will now flow over the sensor, and you will see the analyzer respond to the sample gas rapidly. Allow the reading to stabilize for a minute or so.

When you are done reading the oxygen level, turn the On/Off selector valve back to the Off position. This will lock a low-oxygen level sample onto the sensor, thus preventing it from being exposed to air and getting saturated. Unplug the sample line (and the exhaust line if fitted) and either turn the analyzer off or move on to the next sample point.

Data Logging Feature:

The analyzer can log its readings periodically. When power is turned on, the logging is always disabled. You have to tell it to log by pressing the “LOG” button, and holding it down until the display changes from “OFF” to “On”. By default, it will then log an averaged reading once a minute. You can use the optional PC program to increase this interval up to 60 minutes. It will log up to about 21,000 data points – that is, for somewhat more than 2 weeks at 1 point per minute.

You can start and stop it logging at will. If you turn the power off, that will stop the unit from logging, and you will have to restart it as above if you want it to log the next time you turn it on. If you fill up the storage, it will continue again at the bottom, overwriting the earliest data.

As well as the oxygen value, it also stores the battery voltage and the temperature along with the time and date.

You will need the optional program and a USB cable to download the log onto a PC. The program lets you view the data as a graph or as a table of values, and allows you to export it as a data file that can be manipulated by programs such as Excel. It also allows you to erase all stored data.

RFI Interference:

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

Battery Charge:

Make sure that the batteries are charged. When you turn the unit on, it will indicate the battery state as follows:

LCD flash		Meaning
“---”	Momentary flash, followed by “Init”	Batteries are OK

"Bat Lo"	Shows alternately "Bat" then "Lo" with the reading, every ten seconds	Batteries are low, but OK for a while. Recharge soon.
"Ded"	Shown continuously	Batteries are too low for operation (dead). They must be recharged

Although the batteries are charged when the analyzer leaves the factory, NiCd batteries self-discharge and they may be discharged by the time you use it. Since it is not possible to overcharge the batteries, recharge them before using the instrument. Do this by plugging the AC charger provided into a suitable receptacle, and into the charging receptacle on the rear of the analyzer. The LED on the rear of the unit will glow green indicating that charging is occurring. For a full charge allow fourteen hours. It is best to completely recharge them if you are going to charge them at all.

Note that the unit won't know how much the batteries have been charged (due to the nature of NiCd batteries). If you just charge it for a short time, it won't know that the batteries are about to fail until it's been powered on for a while. This is due to the behavior of batteries under charge – they develop a high voltage that lasts for a while after the charging current has been removed.

Output Connections:

Wire connections for the 0 - 1 V output are provided on the rear of the unit. This corresponds to a percentage of the unit's "Output Range", a value that can be set with the optional PC program. By default this is 100ppm. 0V corresponds to 0ppm, and 1V corresponds to 100ppm. See the "Communications" section below for information on how to change this.

There is also a USB connector provided, suitable for use with a standard USB printer cable. Plug this into a USB port on a computer, and run the AMI software to download data and otherwise configure the unit.

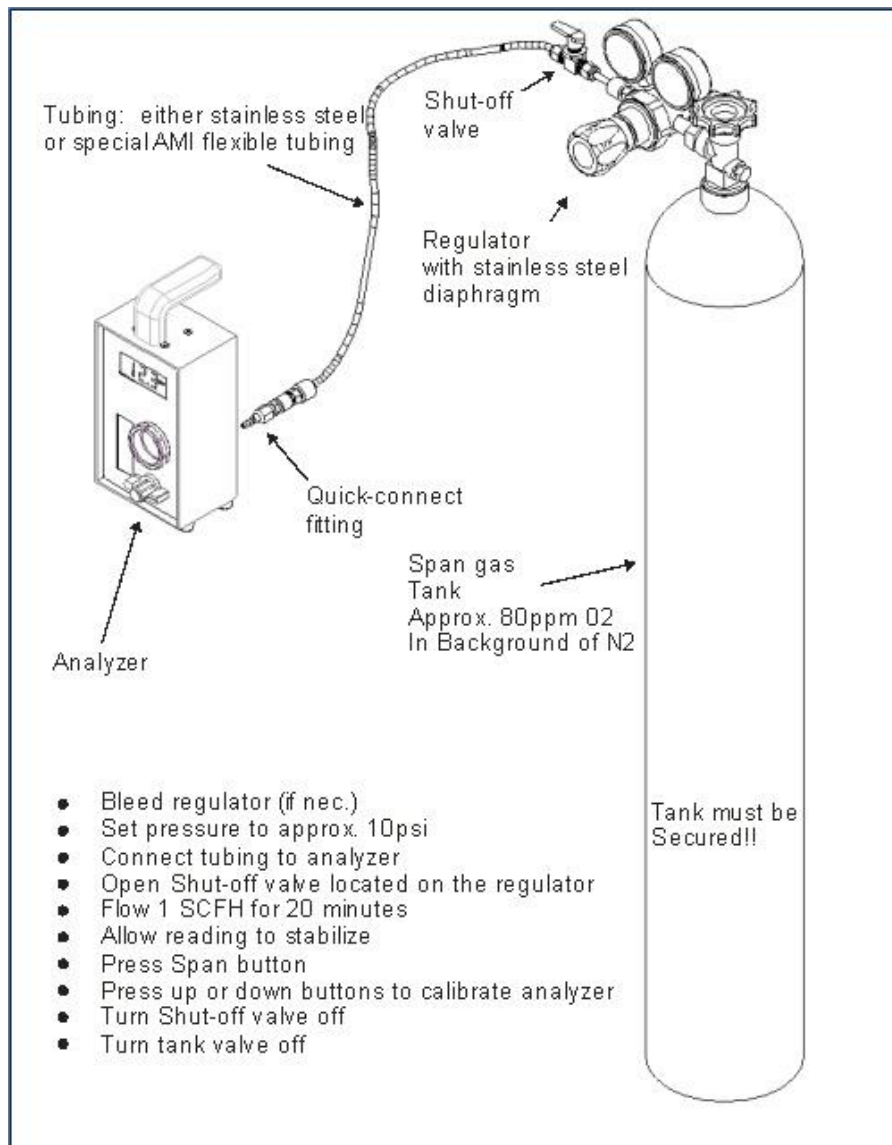


Figure 4 Calibrating the analyzer

Calibration Procedure:

A new unit is supplied with its sensor installed, and has been calibrated at the factory. It is generally not necessary to calibrate it for a month or so after receiving it. However it should be calibrated on a four to six week basis for best performance.

There are two ways that you can calibrate the analyzer – either using air, or else a low level span gas. Air has the advantage that it is quick and easy, and accurate since air has a constant level of oxygen in it. Its

disadvantage is that it takes the sensor quite a long time to come back down to low levels after exposure to air, and you will need a low level gas such as nitrogen or your sample gas to purge it when you are done. If you don't purge the sensor after an air calibration, it will become extremely sluggish to the point that it is easier to replace the sensor than to wait for it to recover!

Calibrating with a low level gas avoids the problem of saturating the sensor, but presents its own set of challenges due to the ease with which the calibration gas can get contaminated by air. For example, you **MUST** bleed the regulator before you attempt such a calibration – see the procedure below. Do not confuse “Bleeding” a regulator with “Purging” a regulator. They have very different meanings and results. See the procedure on the next page.

Often if the low level gas calibration doesn't seem to work, or gives odd results, it is sensible to do a quick air calibration as a sanity check and then use the analyzer to troubleshoot the span gas or the procedure you are using.

Air calibration

In this procedure you are exposing the sensor to air. It is important to minimize the time spent by the sensor in air, but at the same time you want to give it long enough to stabilize. As soon as you are done adjusting the span, it is very important to flow nitrogen or low level sample gas over the sensor to let it come back down. In this procedure you can substitute sample gas for nitrogen.

Procedure:

1. Make sure you have the analyzer connected to nitrogen (or your sample gas).
2. Turn the On/Off selector valve to the Off position. This allows the nitrogen to flow through the bypass plumbing, and allows you to purge the sensor rapidly at the end of this procedure.
3. Allow nitrogen to flow at about 2SCFH while you do the following QUICKLY!
4. Unscrew the cell cap. The nitrogen is not flowing past the sensor since the valve is in the Off position.
5. Blow a little air under the sensor in its compartment. You can blow with your mouth from about a foot away (you don't want the sensor to respond to your breath's oxygen level!)
6. Observe the reading. It should shoot up to about 20.9% within about ten seconds.
7. If it gets reasonably close, span it to 20.9% quickly. You want to take less than a minute to do this whole thing.
8. Span the analyzer by pressing the SPAN button, and then within five seconds press the UP or DOWN buttons to make the reading 20.9%.
9. Turn the On/Off selector valve to the On position. This allows nitrogen to start purging the sensor even without its cell cap in place.
10. Replace the cell cap, making sure not to cross-thread it.
11. Flow nitrogen for long enough for the reading to come down to a low level (ideally less than 10ppm). This should take about 20 minutes at room temperature.
12. Turn the On/Off selector valve to the Off position, sealing the nitrogen onto the sensor

Low level gas calibration

You can use a gas such as 80ppm oxygen in nitrogen to perform a low level calibration. This level of oxygen is convenient for the gas manufacturers to make, and has been found to be optimum in most cases. Make sure you are using a pressure reducing regulator with a stainless steel diaphragm – DO NOT USE A RUBBER DIAPHRAGM – IT WILL DIFFUSE OXYGEN CAUSING A LARGE ERROR!

If the regulator has been recently attached to the tank, you MUST BLEED IT before proceeding!

Bleeding the regulator

A newly installed regulator on a bottle of span gas is of course filled with air, at 209,000 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 over several days, it is much quicker and more reliable to “Bleed” the regulator first. You will only have to do this once if you leave the regulator on the cylinder if it is leak tight.

1. Install the regulator on the span gas cylinder, but do not open the cylinder valve yet.
2. Briefly open the cylinder valve to pressurize the regulator, and immediately close it.
3. Loosen the nut connecting the regulator to the cylinder and allow the pressure to bleed off completely (approximately 1 second), then quickly tighten it again.
4. Repeat this procedure 5 to 7 times.
5. Open the cylinder valve to pressurize the regulator.
6. Open the regulator to its working pressure.
7. Shut off the cylinder valve.
8. Open the shut off valve on the outlet side of the regulator. Allow the pressure to bleed off completely.
9. Repeat steps 7-8 another 5-7 times.

Low level Calibration

1. Leave the On/Off selector valve in the Off position in order to be able to purge the system.
2. Set the output pressure on the tank regulator to 10psig.
3. Connect the span gas into the analyzer quick-disconnect sample input and set the flow to about 1SCFH.
4. Allow to purge for about 2 minutes (assuming you have bled the regulator!).
5. Turn the On/Off selector valve to the On position, allowing span gas to flow past the sensor.
6. If done properly, it should only take about one minute for the reading to stabilize.
7. If the reading is reasonably close to the value on the tank, press the “SPAN” button, and then the up or down arrow buttons until the number displayed on the LCD is the same as that on the span gas tank.
8. Turn the On/Off selector valve back to the Off position, shut off the span gas and disconnect it.

Using the Advanced Features:

The advanced features of the analyzer require the use of the User Interface Program described in its own manual available from AMI. This program allows you to keep track of a number of things about the analyzer and sensor.

Data Logging Procedure:

The analyzer has a built-in data logger that can store up to about 21,000 data points. You can turn the logger on and off with the button on the front panel – if you press the button once it will show you whether it is currently logging or not.

It doesn't matter if you leave it logging all the time – you will just have a lot of uninteresting data points logged if you do. You can set the log period – the time in between when it stores data points – with the AMI User Interface program. Normally it is set for 1minute.

Procedure:

1. Set up the analyzer as above on your sample point.
2. Turn it on.
3. Press the LOG button.
4. It will say "On" or "OFF"; hold the LOG button down to turn it on if it isn't already.
5. Let the analyzer measure gas for a few minutes until you have a satisfactory amount of data stored.
6. Press the LOG button again and hold it until the display says "OFF" to turn off the logging function.

When you get back to the office, or wherever you have your laptop, you can download the data log by clicking on the "Download Data" button on the user interface screen. The program will discuss matters with the analyzer, and in due course show the downloaded data in a spreadsheet, which it stores in its default directory.

You can see a graph of the data by clicking on "Graph".

The unit stores data as a percentage of its output range – normally 0-100ppm. If the reading goes over this range, it stores it as a percentage of the range ten times bigger, i.e. it changes its output range for the data log to 0-1000ppm, in this case. This allows you to track over-range spikes.

The datalog also shows the analyzer temperature and the battery voltage, useful in troubleshooting.

Sensor tracking:

When you install a new sensor, you can use the User Interface program to tell the analyzer that it has a new sensor, and record the sensor serial number in the analyzer. The analyzer will then track how long the sensor

has been in operation, how much oxygen it has been exposed to, and how long it has been exposed to temperature extremes. Of course it can only do this while it is turned on, but it does track the total length of time it was been out of operation as well, so you can get an idea of the state of the sensor.

It also keeps in storage the details of the last sensor it used, so you can compare them. All of this is available through the User Interface Program.

Calibration History:

The analyzer stores the last five times it was calibrated, whether via the front panel or via the User Interface program. When it detects a change in its Span Factor, it stores the time and date, the new value of Span Factor, and the oxygen value it was reading when it does so, giving you an idea of the span gas that was being used. If the unit is calibrated several times in one day, it only stores the last time – it doesn't fill up the storage with failed attempts.

Note that if a user adjusts the span without using a span gas, this feature will tell you that, since the gas value it stores will look odd.

Turn-on/turn-off history:

The analyzer stores the last ten times it was turned on (it doesn't have a chance to store times it was turned off). It also records how many memory errors it saw when it was turned on and loaded its operational memory from its non-volatile storage. It actually stores its important parameters in four separate locations and thus won't be affected by individual memory errors, but if it does ever show errors it implies something is wrong with the electronics.

Maintenance and troubleshooting

Maintenance:

The AMI oxygen analyzer is virtually maintenance free other than for periodic calibration and occasional sensor replacement.

Periodic Calibration:

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

Sensor Replacement:

The analyzer records the “Span Factor” every time you perform a calibration. It is useful to know this in order to determine the remaining sensor life. Use the UP arrow on the front panel to see it (after a valid gas calibration). When it has reached about 900, it is time to buy a replacement sensor, and replace it when the Span Factor reaches 1000.

Sensor	Part number	Description	Warrantied life
T2	4SEN09-1	Trace oxygen - CO2 background, up to 10ppm H2S	6 months
T4	4SEN18	Trace oxygen - CO2 background, up to 500ppm H2S	6 months

Table 1. AMI sensor types

Sensor Replacement:

CAUTION: The sensor contains an acid liquid about as strong as vinegar. Do not allow this 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, state and federal 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.

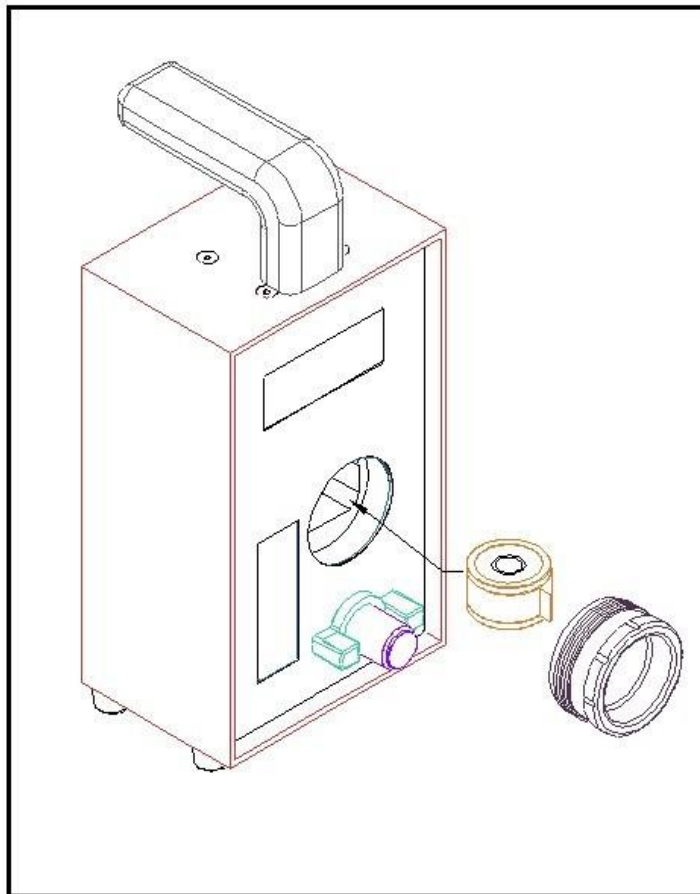


Figure 8 Sensor installation

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

Before installing sensor, turn ON power.

1. Connect a low level gas like nitrogen to the sample inlet.
2. Turn the On/Off selector valve to Off if it isn't already there.
3. Adjust the flow of nitrogen to 2 SCFH using the metering needle valve.
4. Unscrew the cell cap, being careful not to lose the O ring.
5. Carefully remove the old cell by pulling on the little handle provided.
6. 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.
7. Carefully open the bag using a pair of scissors or a knife. Make sure you don't cut yourself or stab the sensor! Make sure that there is no sign of any liquid in the bag, if so do not proceed, you need a new sensor
8. Quickly install the sensor, membrane side down, into the cell block (gold plated contact side of sensor should be facing up touching the cell block contacts).
9. Remove the shorting tab from the little socket on the sensor. You may also want to write down the serial number.
10. 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 (dirt).
11. Allow the sensor to sit for about 30 seconds and adjust the reading to 20.9% using the span adjustment.
12. Carefully replace the cap, making sure that you do not cross thread it, and tighten firmly by hand. Do not over tighten.
13. Turn the On/Off selector valve to the On position.
14. Allow the gas to flow until the reading has dropped to the low ppm range – ideally to less than 10 ppm.
15. Turn the On/Off selector valve to the Off position, and disconnect the nitrogen.
16. If desired, use a suitable 80-100ppm span gas to calibrate the unit per the calibration procedure above.

Common Calibration Errors:

Common errors when spanning the analyzer are as follows:

- Leaky gas fittings.
- Incorrect regulator, or regulator with non-metallic diaphragm.
- Regulator and gas line not properly bled.
- Not allowing long enough for the sensor to come down to its reading from air exposure.
- Use of any plastic tubing (should be the special AMI tubing or stainless steel tubing).

- Inaccurate gas in the calibration cylinder.
- Exposing the sensor to air for more than about a minute.

Any of these will cause an erroneously high reading. If you turn the span down to compensate, the unit will read much too low. Generally, if the span doesn't seem to adjust enough, do a sanity check as follows:

1. Turn the On/Off selector valve to the Off position.
2. Disconnect the span gas, and instead connect a low level gas such as nitrogen or maybe your sample gas.
3. Allow the low level gas to flow at about 2SCFH while you do the following QUICKLY!:
4. Open the cell cap.
5. Blow a little air under the cell in its compartment.
6. Observe the reading. It should shoot up to about 20.9%.
7. If it gets reasonably close, span it to 20.9% quickly. You want to take less than a minute to do this whole thing.
8. Turn the On/Off selector valve to the On position, and replace the cell cap.
9. Flow nitrogen or sample gas for long enough for the reading to come down to a low level (ideally less than 1ppm).
10. Turn the On/Off selector valve to the Off position.

If it only comes up to a small number, or if you can't span it up to 20.9%, you will need to replace the sensor.

If it did easily span to 20.9%, then the analyzer is now pretty well calibrated. Go through the calibration procedure above until you get to step 6.

If the value the analyzer now reads is within about 15% of what it says on the span bottle, go ahead and calibrate.

Sensor Going Negative:

Sometimes a sensor will go negative. When you expose it to a span gas, or to air, it reads normally, but when you put it on a low level gas the reading drops very rapidly and the analyzer simply goes to zero and stays there. This is caused by various chemical issues related to the construction of the sensor. It is sometimes possible to repair a sensor that does this, and you should at least try the following procedure. If it doesn't work, or if the sensor immediately fails again, then it must be replaced. If it happens within the warranty period, return it to AMI for credit.

Procedure:

1. Connect the analyzer to a source of low level gas, such as nitrogen or your sample.
2. Turn the On/Off selector valve to the Off position.
3. Open the cell cap, and remove the sensor.
4. Let the sensor sit in air for about a minute.
5. Put the sensor back in, and close the cap.
6. Turn the On/Off selector valve to the On position.
7. Allow nitrogen (or sample gas) to flow at 1 SCFH.
8. Wait for the reading to come down to a low level.

Accessories

Carrying case



This rugged protective carrying case extends the life of our portable gas analyzers in the most demanding and hazardous environments.

It is lined with a thick die cut foam providing complete protection to your portable analyzer during travel and storage periods. The die cut foam also has built in compartments for the battery charger and quick disconnect fitting, as well as the flexible tubing and Liquid Rejection Probe accessories.

These compartments not only protect them, they keep all the necessary components together and organized.

Calibration Tubing



This special flexible tubing not only provides very low oxygen diffusion but also an o-ring sealed fitting that avoids the common problems of wear on fittings that are disassembled frequently.

User Interface CD

Provides a user-friendly way of using the advanced features of the analyzer, including accessing the sensor history, the advanced calibration capability and the data log. It runs on a standard Windows PC or laptop, and uses the standard USB connection.

Troubleshooting

Analyzer does not power up.

1. Recharge the batteries. Recharge them, and if they do not take a charge, replace the battery board.
2. When charging, check that the charger is plugged into a receptacle and that the receptacle is itself powered. The Green LED will glow if the batteries are being charged.

Analyzer reads too low

1. Sensor is not calibrated. Flow span gas through it as described and adjust the span until the analyzer reads appropriately.
2. If the new sensor still reads too low, check its calibration with air and read the span gas - the span gas may be incorrect. If so, please see the section entitled "Calibration Troubleshooting" above.
3. If you cannot adjust the span enough to accomplish this, replace the sensor.
4. If the sensor seems to die quickly, it may be getting poisoned by excess acid or sulfur bearing gases such as SO₂ or H₂S. If so use a more resistant sensor such as the T-4. The reduction in cell life is cumulative, it depends both on the level of poison and the duration of the exposure
5. The span gas you are using is incorrect. Span the analyzer using natural air as the span gas, and measure the span gas. If it reads incorrectly, replace it.
6. The tank of compressed air you are using is manufactured air whose oxygen content is not 20.9%. Span the analyzer using natural air as the span gas, and measure the bottled air. If it reads incorrectly, replace it with a tank of certified gas.

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 - 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. 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.
5. Verify the analyzer calibration using air as the span gas. Expose it to air for the minimum possible time! It is common for span gases to be in error, and the analyzer may well be more linear than the span gas is.
6. Flow zero gas through the analyzer for a while until the reading is stable: turn the valve to the Off position.. Let the unit sit for four hours or so, and make sure its reading is less than 40ppm. If it is greater than this, there is an internal leak. If so, return the unit to the factory for repair
7. Remove the cell 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.

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.
2. Verify that the cell block contacts are touching the sensor. 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. The output should be around 150 to 500 microAmps in air. This will take a few seconds 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.
5. Sensor has gone negative. Try to repair it with the procedure under "Sensor going negative". Otherwise replace it.

Batteries don't last long, or will not charge at all.

1. Charge the batteries with the power off, for at least 14 hours.
2. NiCd batteries have an expected life of about 300 charge/discharge cycles. They will last best if they are never completely discharged. Legend has it that they prefer to be well discharged so as to avoid a memory effect, but it is by no means clear that this is true. In any case they will eventually die.

Still no correct operation

1. Look at the AMI web site at **www.AMI02.com**.- there may be some hints there that will help you.
2. Call AMI at 714 848 5533, and ask for Service.

Specifications

- **10 user selectable datalog and output ranges to choose from:** 0-10ppm, 0-50ppm, 0-100ppm, 0-500ppm, 0-1000ppm, 0-.500%, 0-1%, 0-5%, 0-10% and 25%
- **Digital display:** High resolution 3 ½ digit LCD. Reads full scale from 0.00ppm to 25.0% independently of output range selection
- **Analog output signal:** 0-1VDC Represents the output range selected
- **Data logger:** Logs data for 10 days @ 1 minute intervals, 20 days @ 2 minute intervals, etc. Represents the output range selected
- **Power requirements:** 115/230VAC to 12VDC battery charger. Rechargeable NiCad batteries, 350 hours continuous.
- **Minimum detection:** 0.05ppm of oxygen
- **Repeatability:** +/- 1% of range or +/- 0.2ppm of oxygen, whichever is greater
- **Operating temperature range:** 25 to 115° F
- **Charging temperature range:** 25 to 105° F
- **Diurnal temperature specification:** < +/- 3 % of scale over temperature range
- **90% upscale response times:** 10ppm – 25% <10 seconds 0-10ppm < 25 seconds
 - Typical downscale response: 1 minute exposure to air down to 10ppm: < 15 minutes
- **Area Classification:** Designed for intrinsic safety for Class 1, Div. 1, Groups B,C,D
- **Inlet gas pressure:** 0.5 to 150psig
- Gas connections: ¼" quick disconnect 316 S.S. compression fitting
- **Wetted parts:** 316 S.S. fittings, electroless nickel plated cellblock, gold plated contacts, acrylic flow meter and Viton O-rings.
- **Unaffected by changes in flow rate from 0.1 to 2.0 SCFH**
- **Portable dimensions:** 4.5"W x 9.5"H x 4.5"D
- **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 H₂S 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 APPLICABLE 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.



Certificate of Compliance

Certificate: 70043390

Master Contract: 227773

Project: 70043390

Date Issued: April 15, 2016

Issued to: Advanced Micro Instruments Inc.
18269 Gothard Street
Huntington Beach
CA 92648
USA

Attention: Charles Schacht

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and US Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only



Issued by:

P Johnson

PRODUCTS

CLASS 2258-03 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non Incendive Systems – For Hazardous Locations

CLASS 2258-83 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations - Certified to U.S. Standards

Class I, Division 1, Groups B, C and D:

Model 1000RS battery powered portable oxygen analyzer and Model 3000RS battery powered portable hydrogen sulfide analyzer. Built in non-replaceable battery pack. Output rated 0-1V provides intrinsically safe output to attached external measurement device. Temperature code T4, Tamb = -3.8°C to +46.1°C (25°F to 115°F)

For details related to rating, size, configuration, etc. reference should be made to the CSA Certification Record or the descriptive report CSA Hazardous Location Report 70043390.



Certificate: 70043390

Project: 70043390

Master Contract: 227773

Date Issued: April 15, 2016

Conditions of applicability

The Models 1000RS and 3000RS shall only be charged in a non-hazardous area using a charger specifically supplied for use with the unit (for example part number 3ACA08, type TRG1512-A, manufactured by CINCON Electronics Ltd), approved as SELV or Class 2 equipment against UL 60950 or an equivalent IEC standard. The maximum voltage from the charger shall not exceed 12.0 Vdc.

A data download device may only be connected to the Models 1000RS and 3000RS in a non-hazardous area and shall be approved as SELV or Class 2 equipment against UL 60950 or an equivalent IEC standard. The maximum voltage from a data download device shall not exceed 5.0 Vdc

APPLICABLE REQUIREMENTS

CSA C22.2 No 0-10	General Requirements – Canadian Electrical Code, Part II – Tenth Edition
CAN/CSA C22.2 No. 157-92	Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations.
CAN/CSA-C22.2 No. 61010-1-12	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
UL Std. No. 61010-1 (3rd Edition)	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
ANSI/UL 913 (8th edition)	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
ANSI/UL 60079-0:2013	Explosive Atmospheres - Part 0: General requirements
ANSI/UL 60079-11:2013	Explosive Atmospheres - Part 11: Equipment Protection by Intrinsic Safety "i"

MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.



Certificate: 70043390

Master Contract: 227773

Project: 70043390

Date Issued: April 15, 2016

For the models 1000RS and 3000RS the following markings are permanently painted on a metallic nameplate with a minimum thickness of 0.5mm, which is secured to the flow-meter enclosure by two rivets.

- Manufacturer's name: "Advanced Micro Instruments", or CSA Master Contract Number "227773", adjacent to the CSA Mark in lieu of manufacturer's name.
- Model number: As specified in the PRODUCTS section, above.
- Electrical ratings: As specified in the PRODUCTS section, above.
- Manufacturing date in MMY format, or serial number, traceable to month of manufacture.
- The CSA Mark with or without "C" and "US" indicators, as shown on the Certificate of Conformity.
- Hazardous Location designation: As specified in the PRODUCTS section, above (may be abbreviated).
- Temperature code: As specified in the PRODUCTS section, above.
- Ex ia
- The following words:
 - Warning: Explosion Hazard. Substitution of components may impair intrinsic safety. Do not connect DC charger or USB in hazardous areas. Only connect intrinsically safe equipment to Analog Out when in hazardous area. See instructions.
Potential electrostatic charging hazard, see instructions
 - Avertissement : Danger d'explosion. La substitution de composants peut affecter la sécurité intrinsèque. Ne pas brancher un chargeur CC ou un USB à des endroits dangereux. Raccorder uniquement de l'équipement intrinsèquement sûr à la sortie analogique à un endroit dangereux, voir instructions. Danger potential de charge électrostatique, voir instructions.

The following markings are screen printed on the rear panel of the models 1000RS and 3000RS:
EXPLOSION RISK! DO NOT CONNECT USB OR 12V DC TO THIS UNIT IN A HAZARDOUS LOCATION]. ONLY CONNECT INTRINSICALLY SAFE EQUIPMENT TO ANALOG OUTPUT!

RISQUE D'EXPLOSION! NE PAS RACCORDER USB OU 12V CC ACER APPAREIL A UN EMPLACEMENT DANGEREUX. RACCORDER UNIQUEMENT UN EQUIPMENT INTRINSEQUEMENT SUR A LA SORTIE ANALOGIQUE.

The following warnings are stated in the product user manual:

1. Do not use the USB Interface and/or the 12VDC Input in a Hazardous Area.
2. A data download device may only be connected to the USB connector of this analyzer in a non-hazardous area and shall be approved as SELV or Class 2 equipment against UL 60950 or an equivalent IEC standard. The maximum voltage from a data download device shall not exceed 5.25 VDC.
3. Model 1000RS:
Only connect Intrinsically Safe Equipment to the Analog Out (Parameters $U_o=4.65V$, $I_o=47mA$, $P_o=34.8mW$, $C_i=30.50\mu F$, $L_i=0\mu H$)
Model 3000RS:
Only connect Intrinsically Safe Equipment to the Analog Out (Parameters $U_o=4.65V$, $I_o=47mA$, $P_o=34.8mW$, $C_i=57.76\mu F$, $L_i=0\mu H$)
4. Substitution of any components in this analyzer may affect intrinsic safety.

**Certificate:** 70043390**Project:** 70043390**Master Contract:** 227773**Date Issued:** April 15, 2016

5. Potential Electrostatic Charging Hazard:
 - a. No precautions against electrostatic discharge are necessary for portable equipment that has an enclosure made of plastic, metal or a combination of the two, except where a significant static-generating mechanism has been identified. Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk. However, where a static-generating mechanism is identified, such as repeated brushing against clothing, then suitable precautions shall be taken, e.g. the use of anti-static footwear.
 - b. The certification marking plate is aluminum. Care must be exercised during use to avoid causing sparks by impact or friction.
6. The analyzer shall only be charged in a non-hazardous area using a charger specifically supplied for use with the unit (for example part number 3ACA08, type TRG1512-A, manufactured by CINCON Electronics Ltd), approved as SELV or Class 2 equipment against UL 60950-1 or an equivalent IEC standard. The maximum voltage from the charger shall not exceed 12.0 VDC.
7. **Exia** means Intrinsically safe.