instruction manual

Teledyne Analytical Instruments
A Business Unit of Teledyne Electronic Technologies

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Dear Valued Customer:

Thank you for purchasing a Teledyne Analytical Instruments product.

We've been in business for over 40 years and we've learned how important it is to keep our customers satisfied. We appreciate your business now and would like to do additional business with you in the future. This is the reason why everyone here at Teledyne is committed to the highest standards of quality and customer satisfaction.

Again, thank you for choosing a Teledyne Analytical Instruments product. We hope you'll keep us in mind for all your chemical analysis needs. If there's anything that we can do to improve your satisfaction with our product, we want to know about it. We welcome and encourage your candid comments.

Sincerely,

Teledyne Analytical Instruments

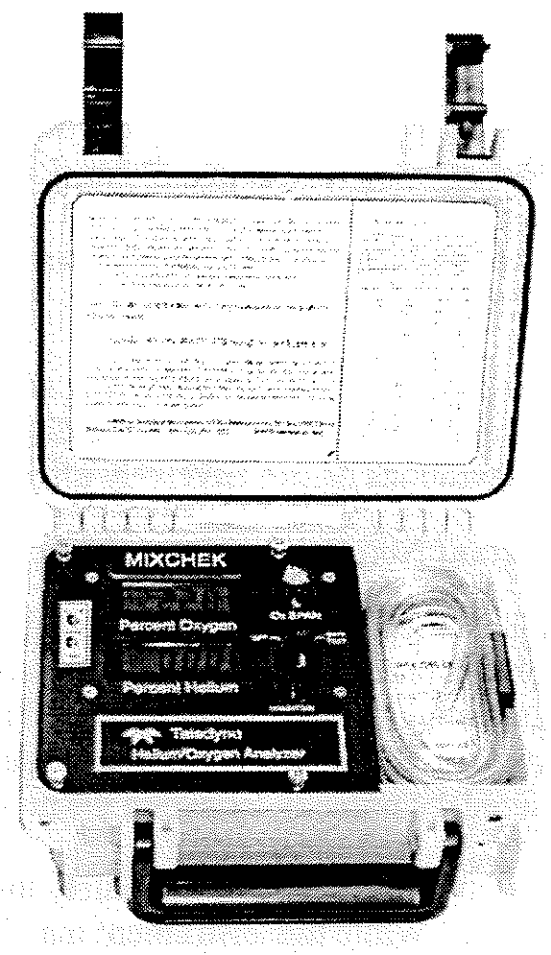
FOR ASSISTANCE CONTACT CUSTOMER SERVICE AT
(626) 961-9221 OR (626) 934-1500 / FAX (626) 961-2538

OPERATING INSTRUCTIONS FOR

MIXCHEK

HELIUM/OXYGEN

MIXTURE ANALYZER



P/N M75030
10/13/02
ECO #

DANGER

This instrument is designed to monitor the helium and oxygen concentrations in a gas mixing process. When processing gas mixtures intended for breathing, the instrument must be calibrated and functioning properly. Suffocation or other fatal respiratory complications can result from improperly calibrated or malfunctioning equipment.

Oxygen accelerates combustion. Do not use this instrument around open flames and combustible gases, liquids or solids.

Only authorized personnel should conduct maintenance and/or servicing. Before conducting any maintenance or servicing, consult with authorized supervisor/manager.

Warranty

This equipment is sold subject to the mutual agreement that it is warranted by us free from defects of material and of construction, and that our liability shall be limited to replacing or repairing at our factory (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgements provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by Teledyne or an authorized service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by his process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Teledyne at the time the order is placed.

Therefore, the purchaser must be aware of the process conditions and the potential for misuse. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that all devices and instrumentation are calibrated, maintained and operated properly.

Teledyne Analytical Instruments, the manufacturer of this instrument, cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

Specific Model Information

The instrument for which this manual was supplied may incorporate one or more options not supplied in the standard instrument. Commonly available options are listed below, with check boxes. Any that are incorporated in the instrument for which this manual is supplied are indicated by a check mark in the box.

Instrument Serial Number: 226324

- ☐ **CE CONFORMITY:** This Teledyne Analytical instruments **MIXCHEK** Analyzer meets or exceeds all requirements of the Commonwealth of Europe (CE) for Radio Frequency Interference and Electromagnetic Interference (RFI/EMI) protection.
- ☐ **MIXCHEK MCWHE:** Wall-mountable instrument with view window for helium analysis.
- ☐ **MIXCHEK MCWHEO2:** Wall-mountable instrument with view window for helium and oxygen analysis.
- ☐ **MIXCHEK MCPHE:** Battery operated portable instrument for helium analysis.
- ☑ **MIXCHEK MCPHEO2:** Battery operated portable instrument for helium and oxygen analysis.
- ☐ **Optional AC to DC Adapter:** Power instrument directly from 115VAC US plug source.
- ☐ **Optional International Power Adapter:** Powers instrument directly from an AC power source 100-240 VAC 50/60 Hz CE approved. Includes US and 3 international AC plugs.

Safety Messages

Your safety and the safety of others are very important. We have provided many important safety messages in this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:

GENERAL WARNING/CAUTION: Refer to the instructions for details on the specific danger. These cautions warn of specific procedures which if not followed could cause bodily Injury and/or damage the instrument.

CAUTION: HOT SURFACE WARNING: This warning is specific to heated components within the instrument. Failure to heed the warning could result in serious burns to skin and underlying tissue.

WARNING: ELECTRICAL SHOCK HAZARD: Dangerous voltages appear within this instrument. This warning is specific to an electrical hazard existing at or nearby the component or procedure under discussion. Failure to heed this warning could result in injury and/or death from electrocution.

TECHNICIAN SYMBOL: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

NOTE: No Symbol — Additional information and comments regarding a specific component or procedure are highlighted in the form of a note.

CAUTION: **THE ANALYZER SHOULD ONLY BE USED FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.**

CAUTION: **THE MIXCHECK ANALYZER ELECTRONICS ARE NOT WATER RESISTANT. DO NOT ALOW WATER INSIDE THE ENCLOSURE.**

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

This manual provides information designed to guide you through the installation, calibration and operation of your new analyzer. Please read this manual and keep it available.

Occasionally, some instruments are customized for a particular application or features and/or options added per customer requests. Please check the front of this manual for any additional information in the form of an Addendum which discusses specific information, procedures, cautions and warnings that may be peculiar to your instrument.

Manuals do get lost. Additional manuals can be obtained from Teledyne at the address given in the Appendix. Some of our manuals are available in electronic form via the internet. Please visit our website at: www.teledyne-ai.com.

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DANGER
COMBUSTIBLE GAS USAGE
WARNING

This is a general-purpose instrument designed for use in a non-hazardous area. It is the customer's responsibility to ensure safety especially when oxygen is being analyzed. Oxygen readily promotes and accelerates combustion. Combustible gases should not be present in the immediate area nor should this instrument be used near an open flame or ignition source.

Helium and nitrogen, while inert, can pose a suffocation risk. The customer must eliminate the possibility of displacing atmospheric air with helium or nitrogen at or near the instrument during the mixing or analysis process.

The customer must also ensure that the principles of operating this equipment are well understood by the user. Misuse of this product in any manner, tampering with its components, or unauthorized substitution of any component may adversely affect the safety of this instrument.

Since the use of this instrument is beyond the control of Teledyne, no responsibility by Teledyne, its affiliates, and agents for damage or injury from misuse or neglect of this equipment is implied or assumed.

Introduction

The Teledyne **MIXCHEK** is a dedicated instrument designed to accurately monitor the composition of a gas during mixing or cylinder filling operations. Independent LCD displays mounted on the front panel of the instrument report the percentage of helium and oxygen during the mixing operation.

The standard analyzer is a wall-mountable unit housed in an enclosure equipped with a window for viewing the helium and oxygen displays. It is powered by a plug-in 6V DC adapter which uses a conventional 120VAC source (100-240 VAC 50/60 Hz optional).

A portable instrument is offered as an option and is housed in a rugged high-impact plastic watertight enclosure. It has a molded-in handle for easily transporting the instrument to the mixing or process area. Both models, the standard wall-mount and the portable instrument, use corrosive-resistant materials where applicable for enhanced durability in salt air or spray environments. The standard wall-mount model is shown in Figure 1-1 and the portable instrument is shown in Figure 1-2.

1.1 Overview

The **MIXCHEK** analyzes the oxygen and helium concentrations in a gas mixture using a dedicated two-channel sensor network sharing a common sample system. The gas to be monitored is drawn into the analyzer and passed to the sensor network. A high output micro-fuel cell is used to determine the oxygen concentration of the gas mixture. The output of the micro-fuel cell is fed to the display and read out as percent oxygen.

Note: In addition to oxygen, the micro-fuel cell used in this instrument is sensitive to oxidizing gases such as NO_2, ammonia and chlorine. Since these gases are usually not associated with breathable mixtures, cross interference will generally not arise under the conditions for which this instrument is designed.

The sample gas is then directed to a thermal conductivity sensor. This sensor provides a signal that is proportional to the difference in conductivities

between the components of the gas mixture. A microprocessor compares the sensor output to data contained in an onboard chip and converts the raw data into a linearized signal that is sent to the helium LCD display.

Accuracy is maintained to ± 1% across the entire 0-100% analysis range (He or O_2) of the instrument at constant temperature (25°C) at constant pressure (atmospheric).

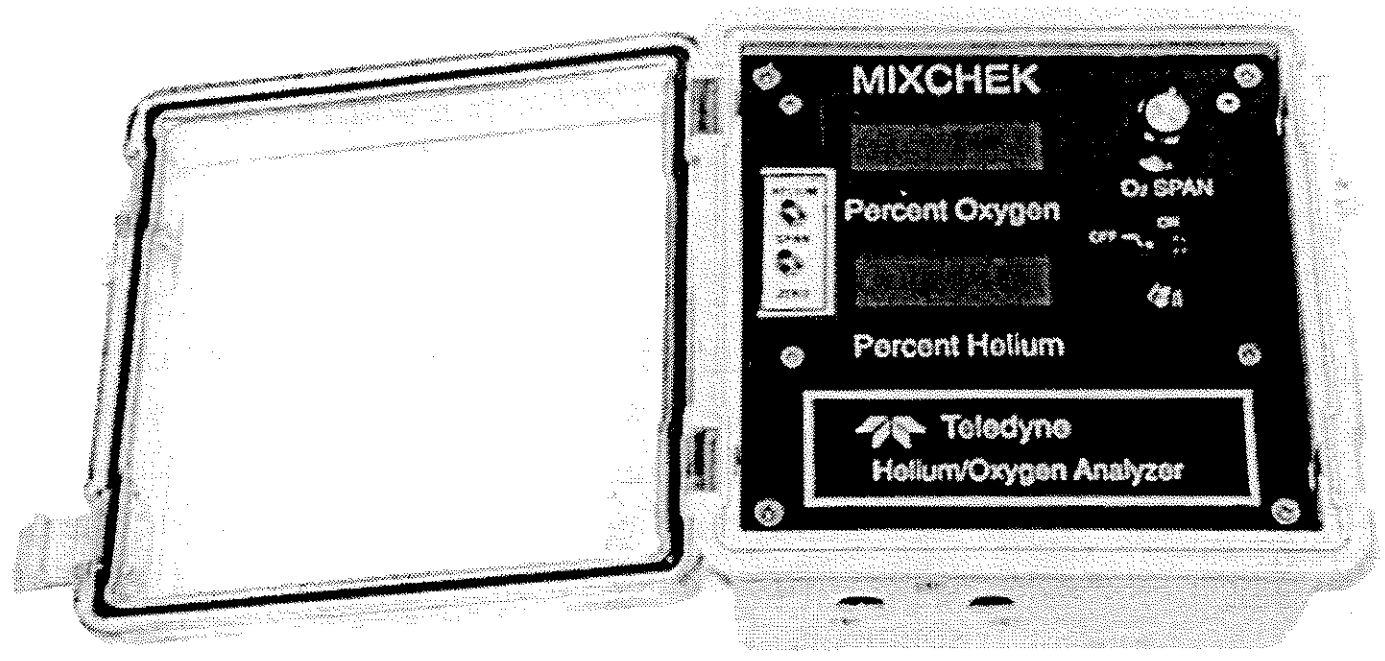

Figure 1-1: Wall-mountable MIXCHEK

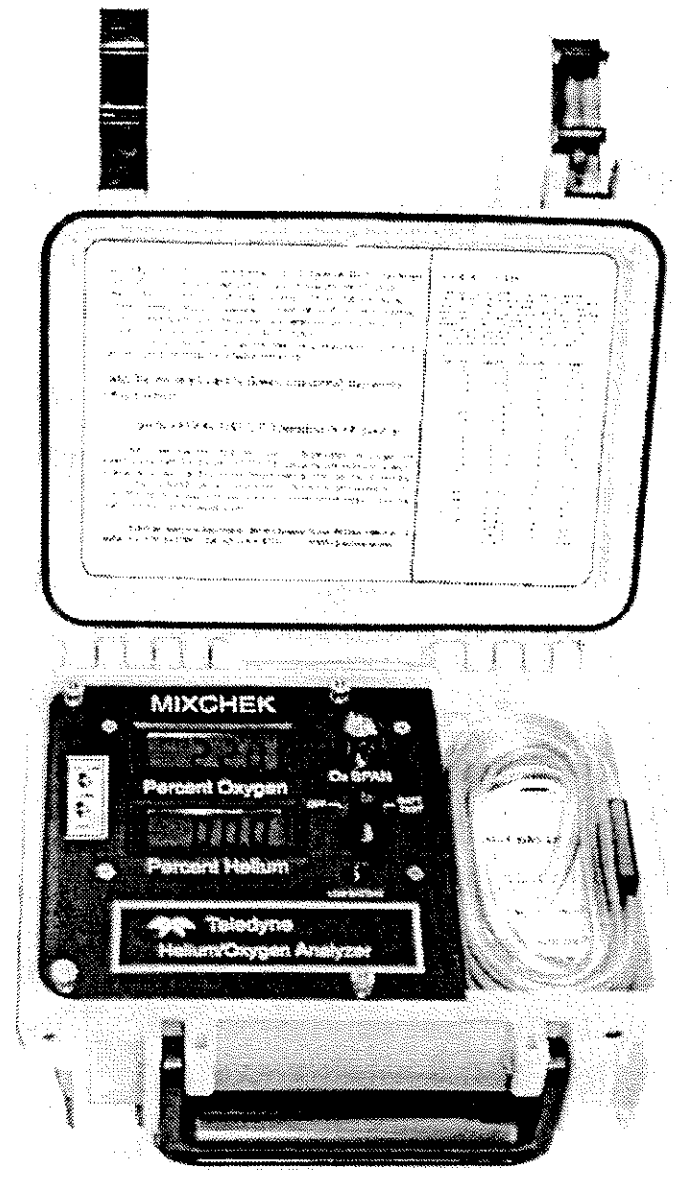

Figure 1-2: MIXCHEK—Portable Configuration

1.2 Features

In the **MIXCHEK**, Teledyne has combined sophisticated features and advanced sensor technology to produce a cost-effective monitoring tool for confirming the composition of helium and oxygen in a gas mixture.

The following features are included in the standard **MIXCHEK**:

- Two independent easy to read LCD displays for He and O_2
- Low power consumption—up to 150 operational hours on 4 C-cell batteries (portable unit)
- Convenient front panel ON-OFF power switch with Battery Test
- Front panel mounted Span and Zero calibration potentiometers
- Linearized He channel output over the entire analysis range

- Accessible 1/8" NPT inlet and outlet gas connections for easy setup (wall mount unit)
- Microprocessor controlled electronics
- Long-life, low temperature solid state thermal conductivity sensor for accurate helium analysis
- State-of-the-art, long life (36 month) R-33D1 oxygen sensor
- High output and rapid response oxygen sensor directly drives oxygen display
- Convenient span calibration control for calibrating the oxygen cell
- ABS enclosure for wall-mounting—rugged water resistant plastic housing for portable model

1.3 Options

Teledyne's design goal to produce a versatile, yet dedicated instrument at an industry-leading low price is enhanced with the following available options:

- Portable instrument configuration
- AC/DC adapter to power either unit using 120VAC power
- AC/DC adapter for universal power (100-240 VAC) with 4 interchangeable international AC power plugs (CE rated)
- Low pressure power inflator hose sampling adapter

1.4 Applications

The **MIXCHEK** is a dedicated instrument designed to monitor and confirm the composition of mixed gases which include oxygen and/or helium in a background of air or nitrogen.

This instrument is specifically directed to the diving industry where specific mixtures of oxygen and helium in air are required for technical diving. The **MIXCHEK** will allow on-site confirmation of gas mixtures prepared for divers. It is also useful in the gas mixing process during cylinder charging where adjustments to the gas composition can be made based on the real-time analysis of the gas mixture.

Other applications include:

- Oxygen analysis in (He/N_2 or air) gas environment
- Gas purification and air liquefaction process control

Theory of Operation

The **MIXCHEK** employs a dual sensor design to independently analyze the helium and oxygen concentration in a gas mixture containing helium, oxygen and nitrogen (air) in real time. The analyzer is comprised of three subsystems:

- Sensor network
- Electronics
- Display

Typically, this instrument is used to monitor or confirm a specific gas mixture, therefore there is no operator interface other than a span potentiometer for calibrating the oxygen sensor.

In operation, a sample of the gas mixture is extracted from the process line, gas cylinder or cylinder filling station and directed to the instrument for analysis. Since the function of the instrument is to accurately monitor or confirm the gas composition, the sample gas is not altered in any way prior to entering the unit. There are no provisions for filtering or drying the sample as this could alter the composition of the sample gas. The sample is passed to the oxygen sensor and then to the helium sensor. A fitting is supplied on the instrument for directing the sample gas after analysis to vent (wall mount unit only).

2.1 Sensor Network

At the core of **MIXCHEK** is dual sensor network comprised of Teledyne's patented high output, extended-lifetime oxygen micro-fuel cell and a sophisticated thermal conductivity sensor. Oxygen analysis is performed first on the sample gas using the special R-33D1 high output micro-fuel cell which is sensitive to oxygen.

Note *This sensor is also sensitive to other oxidizing gases such as NO_2, ammonia and chlorine, however due to their toxicity, cross sensitivity should not be a factor in preparing breathable gas mixtures.*

The sample gas is then directed to a temperature compensated thermal conductivity sensor that has been specifically calibrated to

correctly measure the helium content in a gas mixture of air, nitrogen or oxygen. The output from each sensor is either sent to the display or processed first and then sent to the display for readout.

2.1.1 Oxygen Analysis

Oxygen analysis is performed using Teledyne's R-33D1 high output micro-fuel cell. The micro-fuel cell is an electrochemical galvanic device that translates the amount of oxygen present in the sample into an electrical current. This cell is similar in principle to Teledyne's standard micro-fuel cells but has been designed specifically for higher output, longer life and rapid response. This particular micro-fuel cell is equipped with temperature compensation circuitry and has a voltage output. These special features enhance its suitability for the intended application.

The high output of this cell is used to directly drive the oxygen display. It is a sealed, disposable electrochemical transducer with an anticipated lifetime of 36 months.

The oxygen section can be easily calibrated by adjusting the O_2 Span control until the oxygen display indicates 20.9% while the sensor is in 100% air.

2.1.1.1 THE EFFECT OF PRESSURE

In order to state the amount of oxygen present in the sample as a percentage of the gas mixture, it is necessary that the sample diffuse into the cell under constant pressure.

If the total pressure increases, the rate that oxygen reaches the cathode through the diffusing membrane will also increase. The electron transfer, and therefore the external current, will increase, even though the oxygen concentration of the sample has not changed. It is therefore important that the sample pressure at the fuel cell (usually vent pressure) remain constant between calibrations.

2.1.1.2 CALIBRATION CHARACTERISTICS

Given that the total pressure of the sample gas at the surface of the micro-fuel cell input is constant, a convenient characteristic of the cell is that the current produced in an external circuit is directly proportional to the rate at which oxygen molecules reach the cathode. This rate is directly proportional to the concentration of oxygen in the gaseous

mixture. In other words, it has a linear characteristic curve, as shown in Figure 2-2. This means that the measuring circuits do not have to compensate for nonlinearity.

Note: This is not necessarily the case for a thermal conductivity sensor.

In addition, since there is zero output in the absence oxygen, the characteristic curve is close to an absolute zero. The cell itself does not need to be zeroed even on ranges as sensitive as 0-10 ppm. As the cell reaches the end of its useful life, the slope seen in Figure 2-1 decreases. As this occurs, the span adjustments will become larger. The actual output is different depending on the nature of the cell and whether it is a percent or trace cell. The characteristic slope and linearity however, would the same as shown in Figure 2-1.

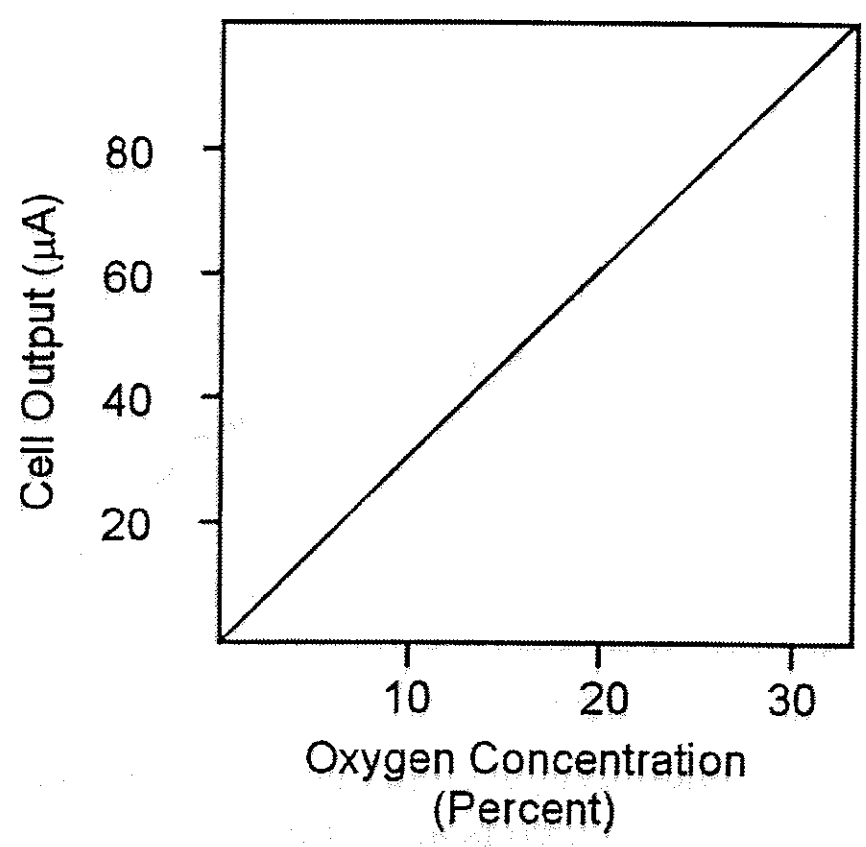

Figure 2-1: Characteristic MFC Input/Output Curve Typical of a Percent Oxygen Cell

2.1.2 Thermal Conductivity Sensor

The thermal conductivity sensor used in this instrument will measure the concentration of a component in a binary stream of gas. Generally, thermal conductivity sensors are used to determine the concentration of a sample stream containing a composite mixture of gases by comparing the difference in thermal conductivity of the sample stream with calibrated reference points.

Thermal conductivity measurements are non-specific by nature. The thermal conductivity of a gas mixture depends on the conductivities of the individual components of the mixture and their relative concentration. The sensor and circuitry used in the **MIXCHEK** is calibrated at the factory to correctly measure the helium content in a gas mixture of air, nitrogen, and oxygen over the entire 0-100% helium analysis range.

In order to accurately detect and quantify a component such as helium in a sample stream, the sample gas must be composed of the particular component and background gas for which it was calibrated. While the sensor would detect differences in thermal conductivities for other gases, the linearity of output and the value displayed on the display would only be accurate for He in the mixture of oxygen, nitrogen or air.

CAUTION: **CONSULT THE FACTORY IF YOU INTEND ON USING THIS INSTRUMENT FOR ANALYZING MIXTURES DIFFERENT THAN THE GAS MENTIONED ABOVE.**

2.2 Electronics

The electronics section of the **MIXCHEK** is contained on a single PC board, which is accessible after removing the front panel. Figure 2-2 shows internal components including the PC board for the portable model. The standard wall-mountable unit is similar but does not have the battery pack and has the gas lines (inlet and vent) routed to connectors installed on the bottom panel of its housing.

Both the standard and portable units share the same circuitry. The portable model has a battery test function and battery pack that are not present on the standard instrument.

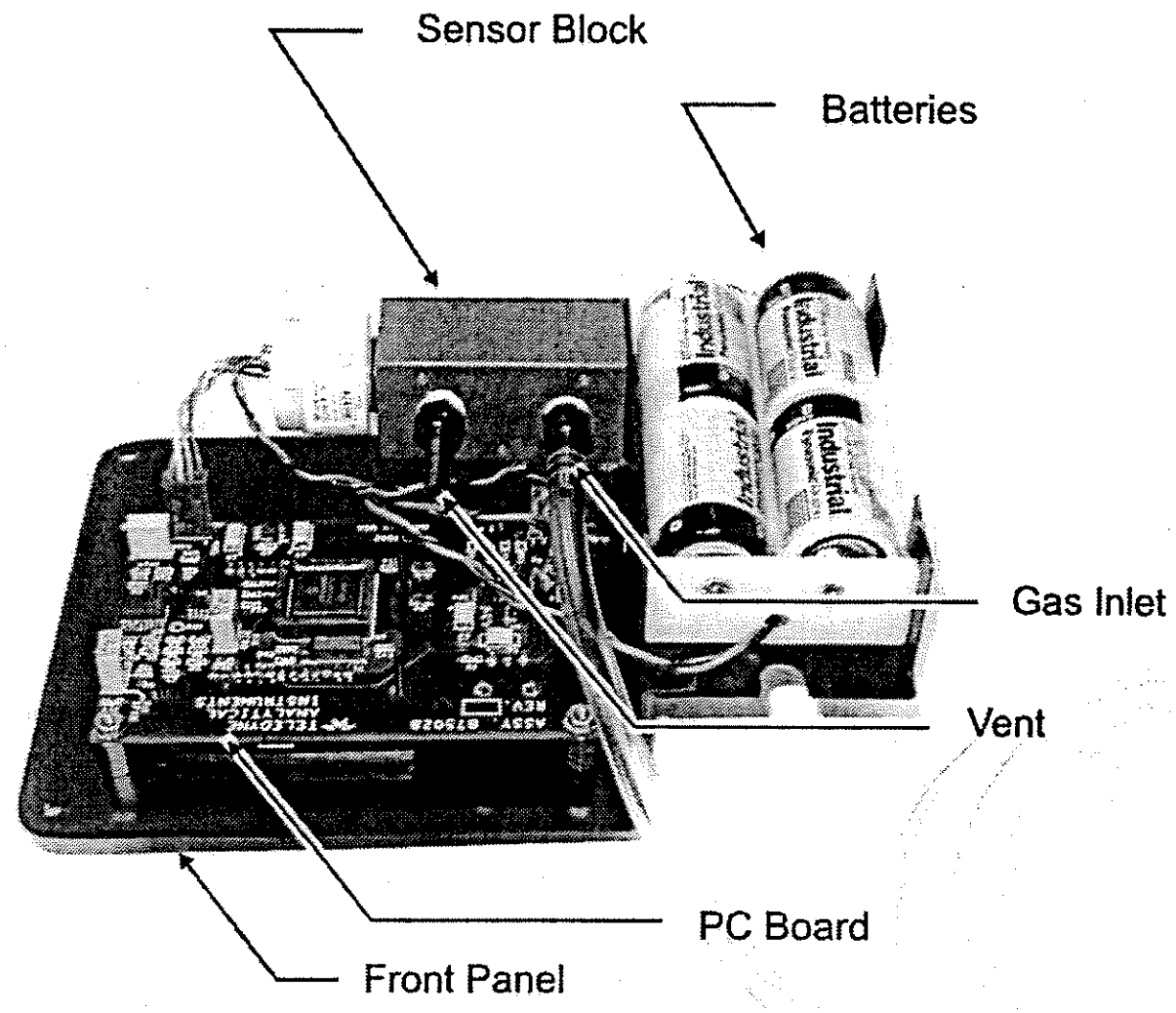

Figure 2-2: Internal Components

2.3 Sample System Considerations

The **MIXCHEK** is a dedicated analyzer for validating the components of a gas mixture. In the typical setup, sample gas is bled off from a cylinder mixing station or other sample stream at 0.5-2 liters per minute (LPM). The sample gas is brought to the instrument via a customer supplied sample system. A typical sample system is shown in Figure 2-3. The standard wall mount instrument has inlet and sample return 1/8" female NPT connectors mounted on the bottom panel for tying in to the sample system. The portable unit is equipped with a 4' vinyl 3/16" ID hose for gas inlet. There is no provision for a sample return in the portable unit. Both instruments must have gas flow restrictors or valves installed in the inlet line to reduce the pressure and flow into the analyzer. The flow rate must be between 0.2 and 2 LPM at atmospheric pressure. The instrument is not sensitive to changes in flow rate as long as the flow rate does not exceed 2.5 LPM. When this occurs, both the oxygen and helium readings will increase due to and increase in

the internal pressure. At low flow rates below 0.2 LPM, the instrument will respond sluggishly to changes in gas composition. There is also the increased likelihood of errors caused by leakage between outside air and the sample gas stream.

Occasionally, the oxygen and helium sensors will need to be calibrated. For the oxygen sensor, this is conveniently done using air as a span gas. The helium calibration procedure requires a source of 100% helium gas delivered to the analyzer at a controlled flow rate and a small screwdriver or trim pot tool. The customer supplied sample system could be fabricated to accommodate switching from sample gas to calibration gas (air and 100% helium span gas) for this purpose. Refer to Section 3.8 for calibration procedures.

All internal components of the analyzer use materials specifically matched for corrosion resistance in a salt air and sea spray environment, however precaution should be taken to ensure that the gas ports and AC adapter are not exposed to water.

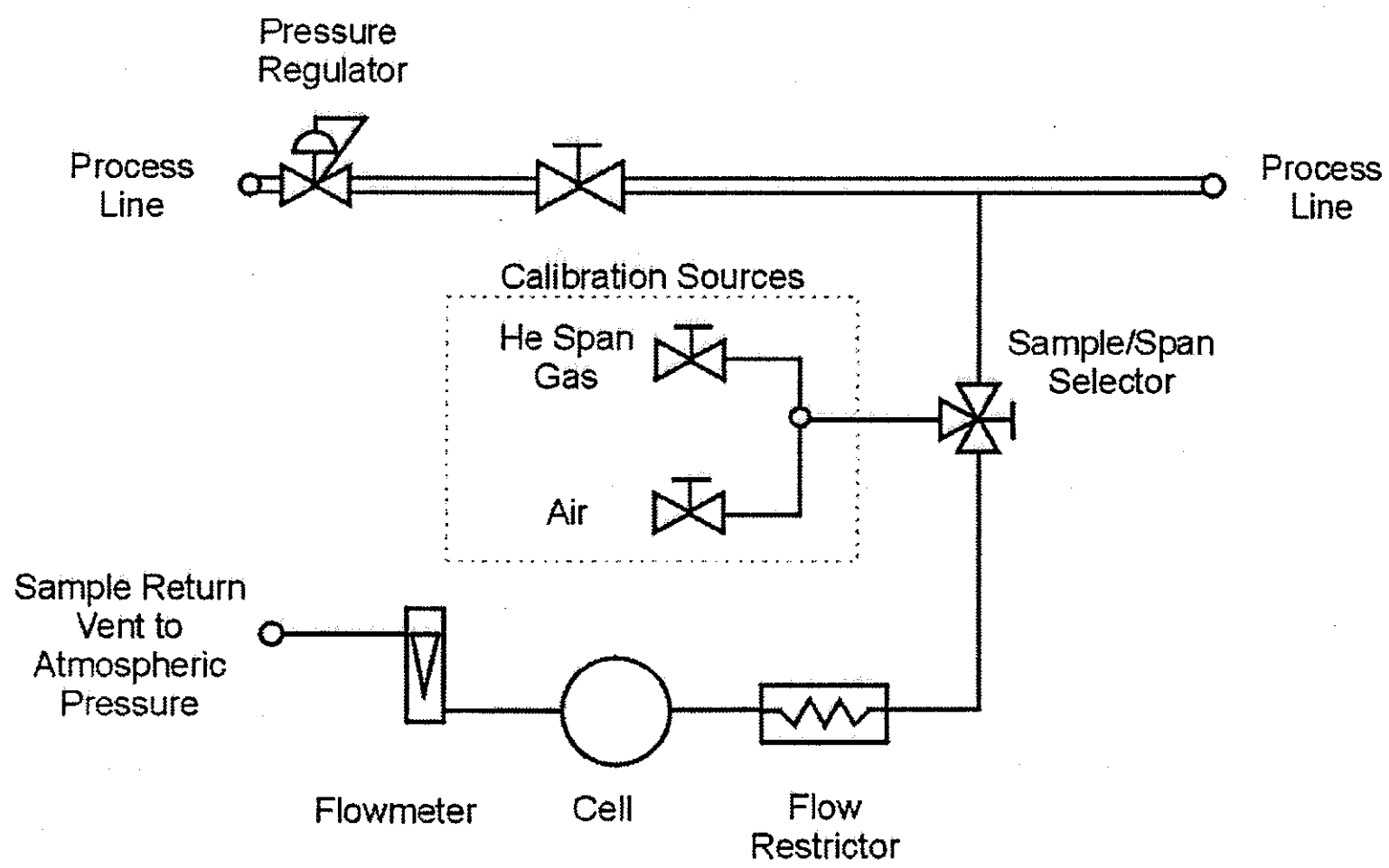

Figure 2-3: Typical Sample System with Provisions for Calibration

Installation

Installation of the analyzer includes:

- Unpacking the system
- Mounting the unit
- Installing the sensor
- Installing batteries (portable unit only)
- Making the gas and power connections
- Calibration and testing the installation

Also covered in this section are battery issues, replacing the battery and Replacing micro-fuel cells.

3.1 Unpacking the Analyzer

Except for installing the sensor and batteries (portable unit only), the **MIXCHEK** is shipped fully functional and ready to install. Carefully unpack the analyzer and inspect it for damage. Immediately report any damage to the shipping agent. Check that the sensor is not leaking and that there is no signs of physical damage.

3.2 Mounting the Analyzer

The **MIXCHEK** is designed to mount and operate in a general-purpose area only. The instrument is not designed to accept or handle hazardous gases.

CAUTION:

USING OR MONITORING OXYGEN LEVELS ABOVE ATMOSPHERIC COMPOSITION (20.9%) CAN BE HAZARDOUS. WHILE OXYGEN IS NOT COMBUSTIBLE OR EXPLOSIVE, ITS PRESENCE ACCELERATES AND PROMOTES COMBUSTION. HIGH LEVELS OF OXYGEN WILL MAKE MOST MATERIALS COMBUSTIBLE INCLUDING METALS. DO NOT USE OXYGEN LEVELS ABOVE 20.9% IN THE PRESENCE OF ANY FLAME OR IGNITION SOURCE.

Refer to Figure 3-1 and the Outline Drawing in the Appendix for mounting dimensions. The location should be close to the process line to avoid excessive run lengths of tubing. The plastic wall mount enclosure is not watertight. It should not be exposed to water or spray while in use due to the exposed external power adapter inlet. The AC adapter used on this instrument is not water resistant. Care must also be taken not to allow water entry into the power adapter inlet port.

CAUTION: POTENTIAL WATER DAMAGE COULD OCCUR IF THE POWER ENTRY ACCESS PORT IS EXPOSED.

Mount the instrument so that it does not restrict or cause the sample return line to kink. The sample return port must not be restricted and must be vented at atmospheric pressure.

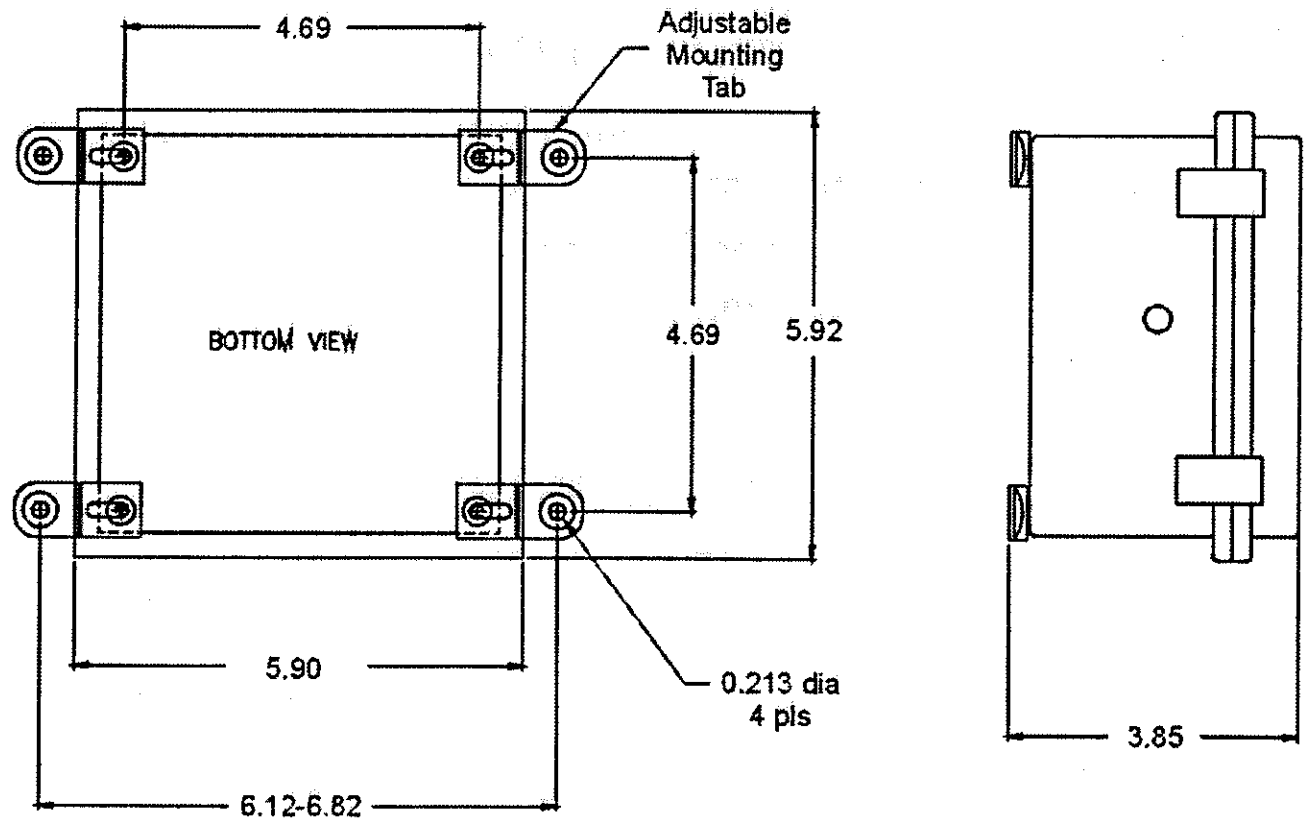

Figure 3-1: Mounting Dimensions

3.3 Installing the Oxygen Sensor

The R-33D1 high output micro-fuel cell oxygen sensor is packed separately from the analyzer and must be installed in the unit prior to

use. To install the sensor, carefully remove it from the shipping container and inspect it for damage.

CAUTION: **THE PC BOARD CONTAINS ELECTROSTATIC SENSITIVE COMPONENTS. OBSERVE PROPER ELECTROSTATIC DISCHARGE PRECAUTIONS WHEN WORKING ON OR NEAR THE PC BOARD.**

WARNING: ***THE O2 SENSOR USED IN THE MIXCHEK USES ELECTROLYTE WHICH CONTAIN TOXIC SUBSTANCES, MAINLY LEAD AND POTASSIUM HYDROXIDE. THESE SUBSTANCES CAN BE HARMFUL IF TOUCHED, SWALLOWED, OR INHALED. AVOID CONTACT WITH ANY FLUID OR POWDER IN OR AROUND THE UNIT. WHAT MAY APPEAR TO BE PLAIN WATER COULD CONTAIN ONE OF THESE TOXIC SUBSTANCES. IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES. CALL PHYSICIAN. (SEE APPENDIX, MATERIAL SAFETY DATA SHEET.)***

1. Discharge any static electricity by touching any piece of grounded metal such as plumbing fixtures (not the instrument).
2. Remove the 4 Phillips head screws that secure the front panel. See Figure 3.2.

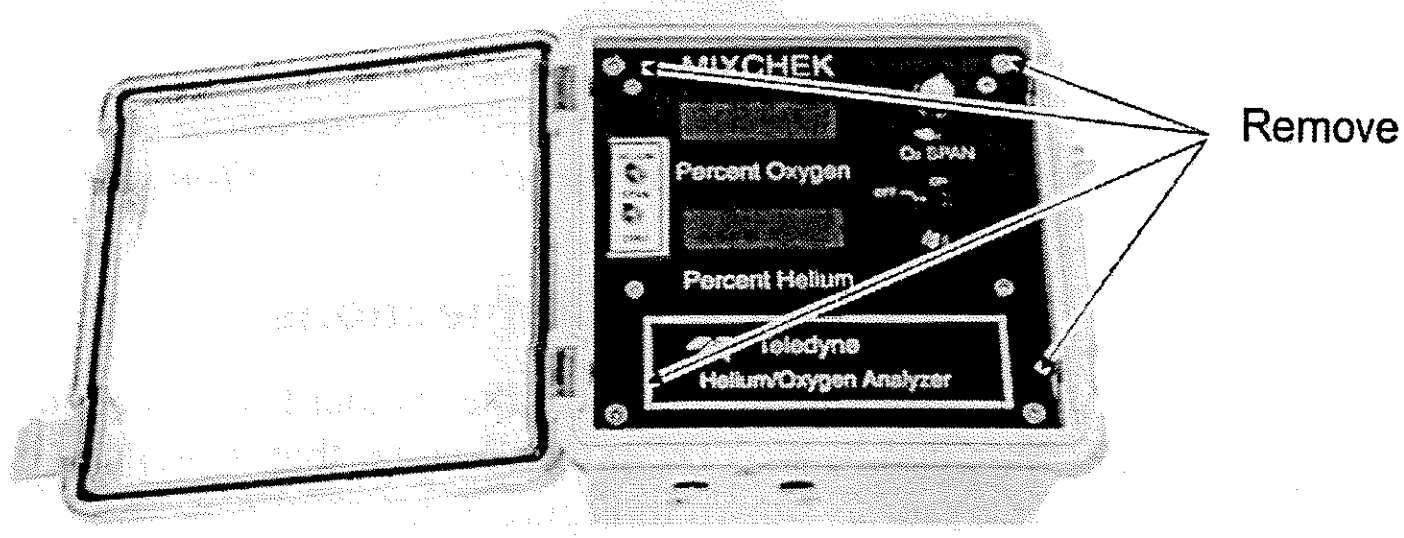

Figure 3-2: Removing the Front Panel
(Portable unit uses acorn nuts and washers)

3. **(Portable unit)** Turn over the front panel and disconnect connector J1. See Figure 3.3.
   (Wall mount unit) Rotate the front panel down 90 degrees and disconnect connector J1.
4. Remove the sensor from its packaging and check that the o-ring is properly seated.
5. Install the cell by screwing it into the sensor block clockwise.
6. Replace the front panel.

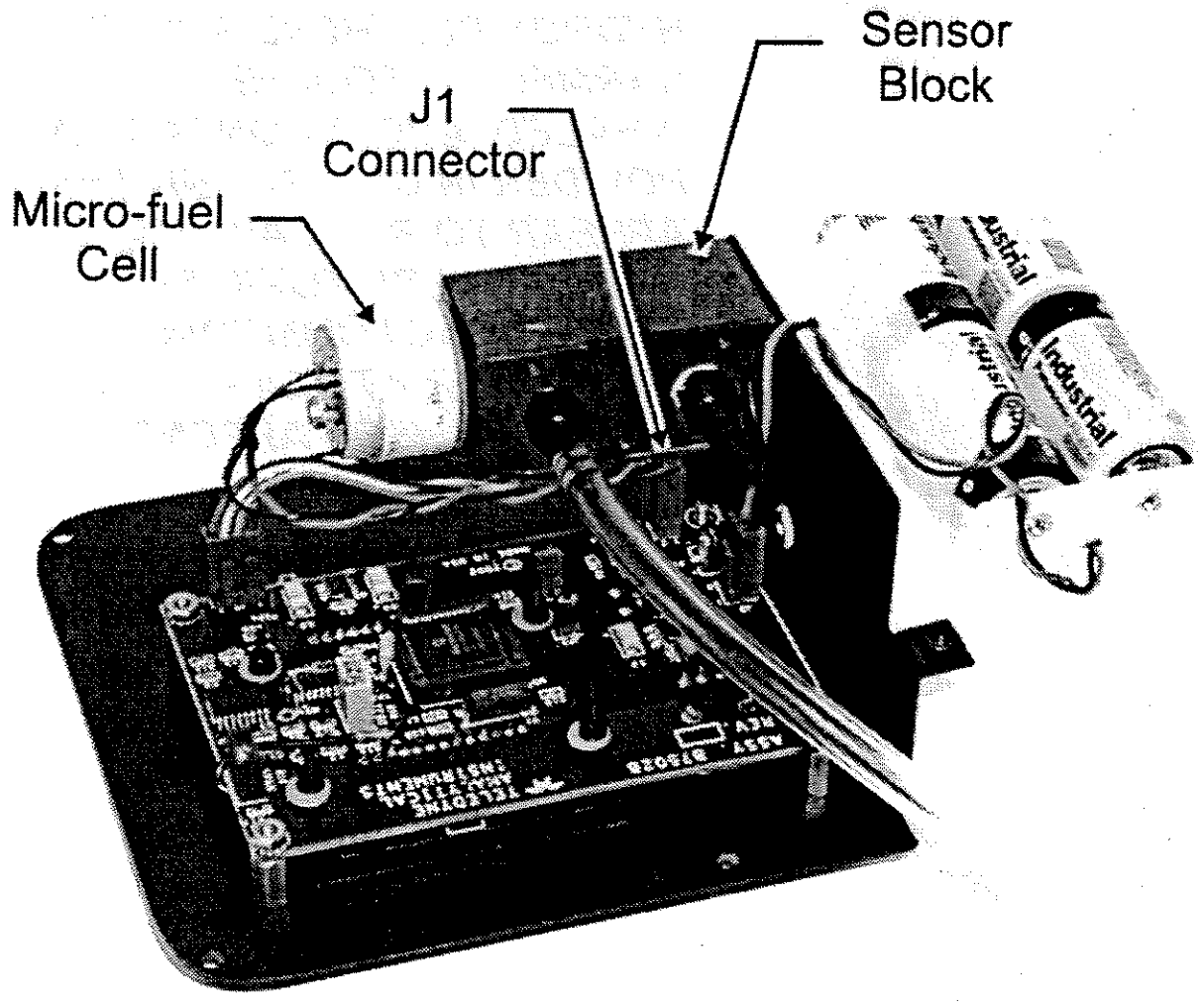

Figure 3-3: Installing the Sensor
(Portable model shown, wall-mount is similar)

3.4 AC Power Connections

Instrument power for the standard wall-mountable model is supplied by a 6VDC power adapter that is plugged into the side of the analyzer as shown in Figure 3-4.

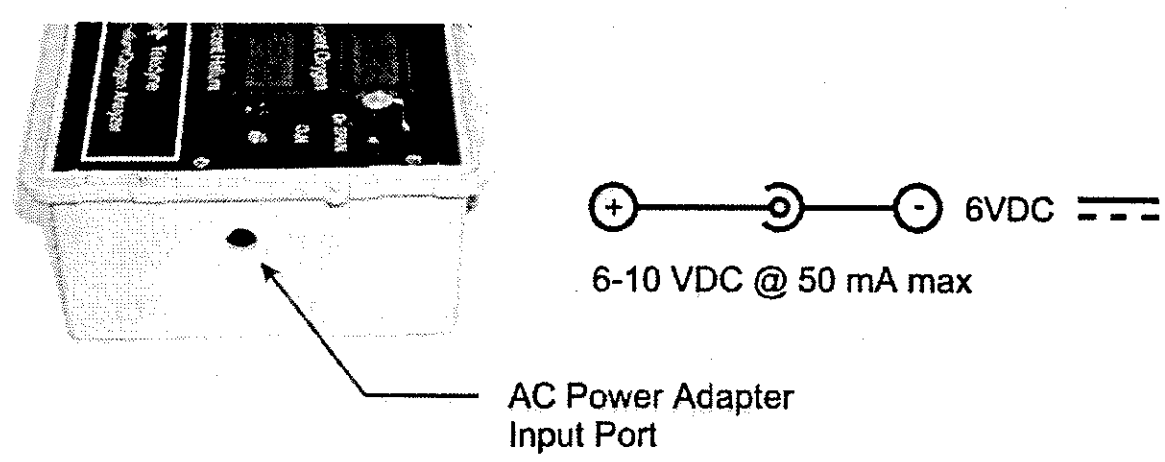

Figure 3-4: Power Adapter Port (Wall Mount)

The portable model is powered from 4 C-cell batteries which must be installed prior to placing the instrument in service. See Section 3.6. The portable unit can also be powered using the optional 6 VDC power adapter, P/N A558 (US) or A555 (CE). When using the adapter, insert the jack into the port on the side of the front panel near the ON/OFF/ BATT TEST switch as shown in Figure 3-5. This figure also shows the internal pressure vent port which allows the instrument to vent and return to atmospheric pressure before the lid is opened.

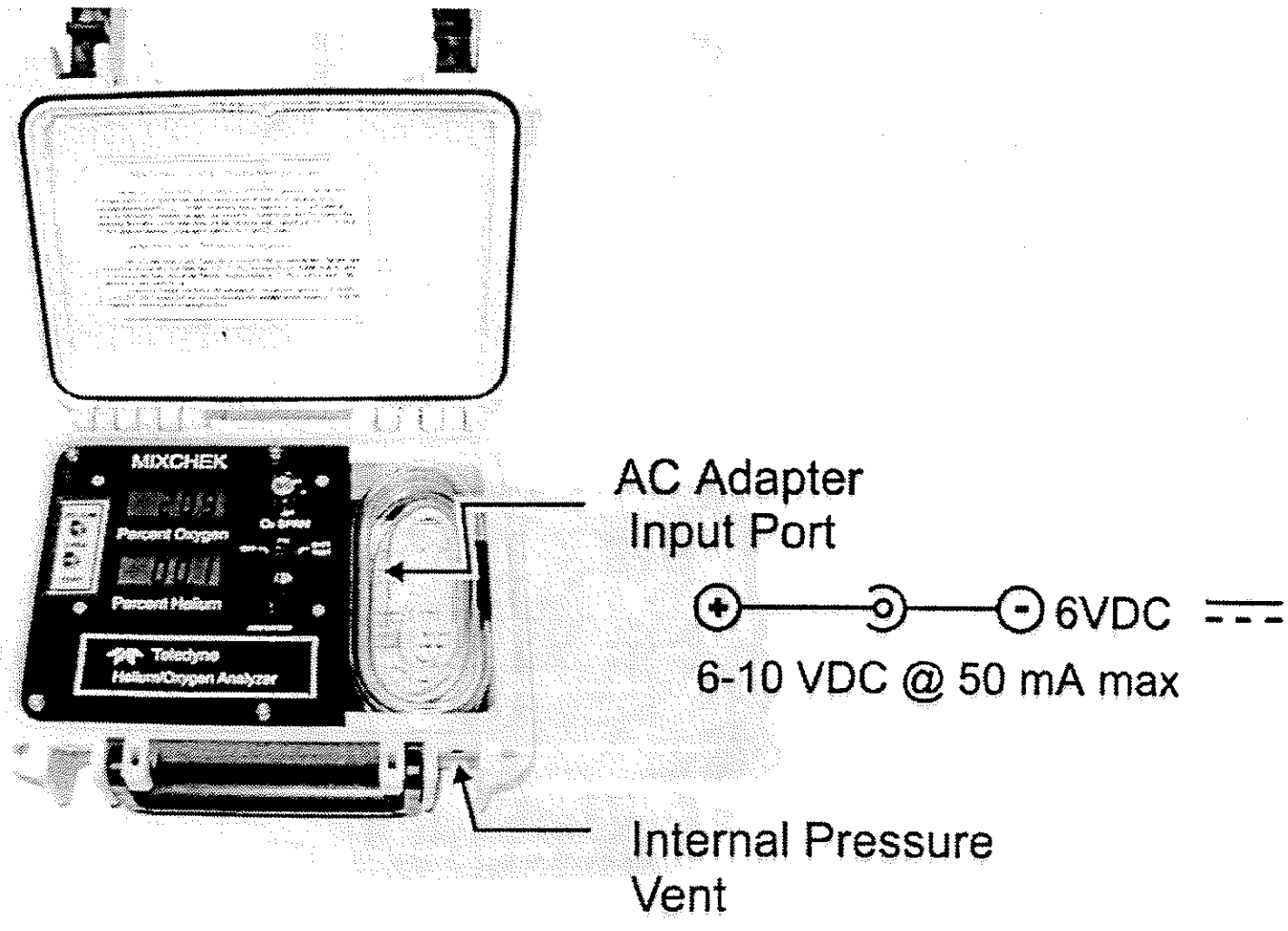

Figure 3-5: Power Adapter Port (Portable Model)

3.5 Battery Test (Portable Model Only)

A battery test function is available from the front panel and should be used prior to using the instrument. To test the batteries, turn the OFF-ON switch to the BATT TEST position. The Oxygen display will indicate the state of charge on the batteries. A fresh set of batteries will show a reading of 120. If the reading is 100 or below, you must change the batteries to maintain the accuracy of this instrument.

3.6 Battery Installation (Portable Model Only)

Before using the portable model for the first time, 4 C-cell batteries must be installed.

Note: Do not use rechargeable batteries. This type of battery does not provide the required voltage to power the instrument.

To install the batteries, remove the 2 Phillips head screws securing the battery compartment lid. Lift out the compartment cover and install the batteries noting the polarity indicated on the label molded into the battery holder. See Figure 3-6 and Figure 5-3.

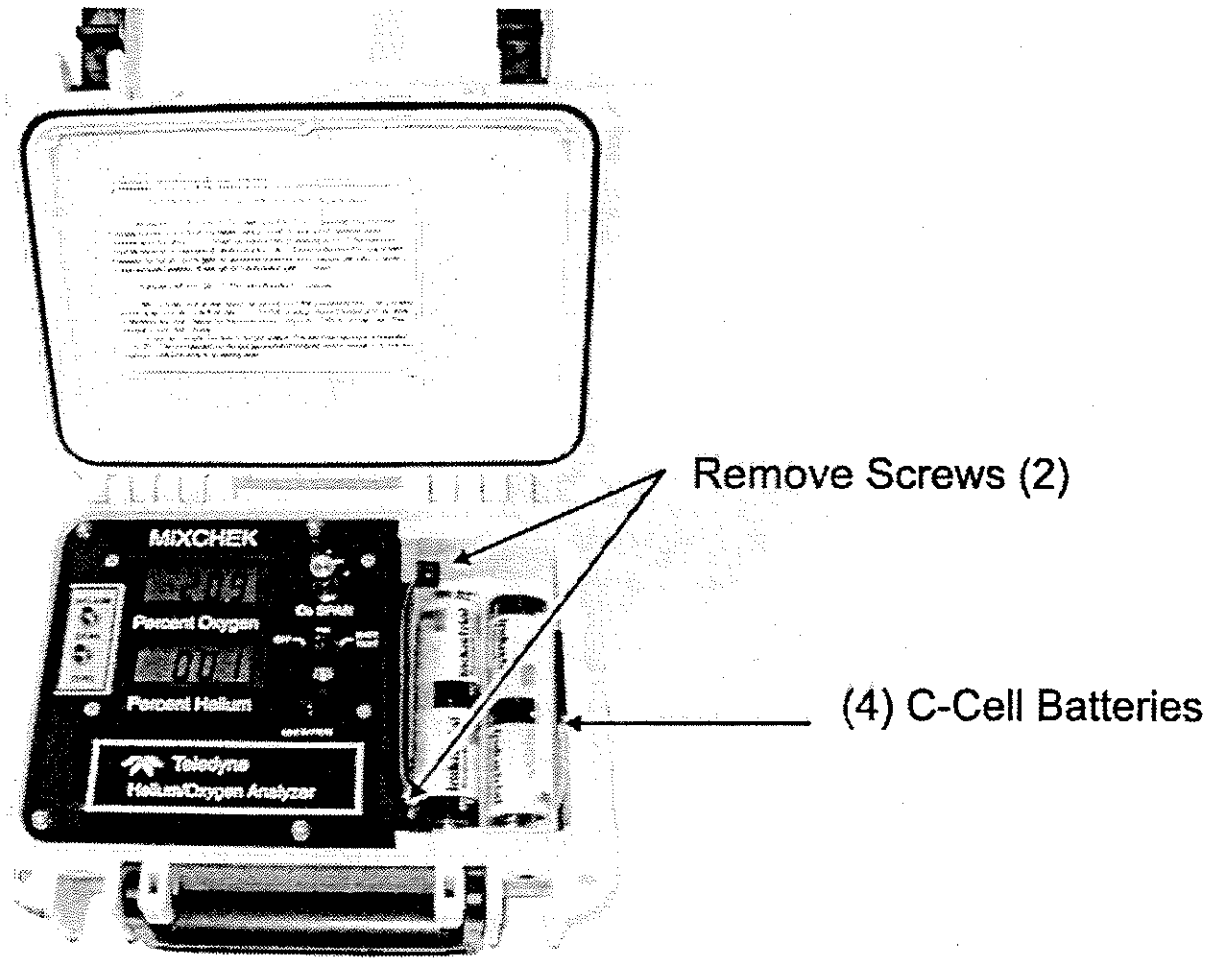

Figure 3-6: Battery Installation

When replacing batteries, for best results use only long-life high quality alkaline batteries, not rechargeable batteries. The monitor can be run for up to 150 hours on a fresh set of high quality batteries.
Discarding used batteries must be done in accordance with all local laws and restrictions.

3.7 Gas Connections

The **MIXCHEK** is equipped with an inlet and sample return port for connecting to the users sample system. The ports are designed to accept a 1/8" NPT fitting (male) and are located on the bottom panel of the wall mount enclosure.

Note: A restrictor device must be installed to limit the flow through the instrument. The restrictor should be sized to allow a 0.2-2.0 LPM sample flow through the analyzer at atmospheric pressure

Connect the inlet and return lines to the gas ports on the analyzer using 1/8" female NPT fittings. The portable model is supplied with a 3/16" vinyl hose connected to the inlet port. The sampled gas is vented within the enclosure.

3.8 Calibration

The analyzer is supplied fully calibrated from the factory but will require periodic calibration checks and recalibration to maintain the best accuracy.

Note: The sample gas must be flowing to accurately calibrate the oxygen analyzer. You may find that when the sample gas is not flowing the oxygen reading drops slightly. This is due to the oxygen sensor consuming the oxygen inside the sample block thereby reducing the oxygen level.

The oxygen cell has zero output when there is no oxygen present therefore the oxygen channel is automatically zeroed. For span calibration, it is usually more convenient to calibrate the oxygen analyzer with compressed air from a cylinder. Air has an oxygen content of 20.9%. To calibrate the oxygen cell, the sample flow rate should be set to 0.2 - 2LPM. The air is then attached to the sample line. After the reading stabilizes, adjust the oxygen reading to 20.9% with the Span

control. A typical sample system which provides for calibration gas switching is shown in Figure 2-3.

If using a calibration gas other than air, the concentration of oxygen in the calibration gas must be known and for best results, should be approximately 80-100% of the range of interest. For instance if the analyzer is to be used to typically measure oxygen levels close to 50% then the calibration gas should have an oxygen concentration between 40-50%.

CAUTION: USING OR MONITORING OXYGEN LEVELS ABOVE ATMOSPHERIC COMPOSITION (20.9%) CAN BE HAZARDOUS. DO NOT USE OXYGEN LEVELS ABOVE 20.9% IN THE PRESENCE OF ANY FLAME OR IGNITION SOURCE.

To successfully calibrate this instrument you should have the following items on hand:

- Calibration gases (air and 100% helium gas source)
- Means for controlling the calibration gas flow
- Trim pot tool (see Parts Listing in Appendix) or small screwdriver

To calibrate the oxygen analyzer:

Span Calibration (oxygen sensor)

1. Adjust the flow rate of the air source to 0.2–2 SLPM. prior to attaching it to the gas inlet of the analyzer.
2. When the oxygen display reading stabilizes (approximately 1 minute) adjust the oxygen display to read 20.9% using the O2 Span control on the front panel.

To calibrate the helium analyzer:

- The helium analyzer will typically provide 1% accuracy or better for 30 or more days without adjustment.
- The helium & air table can be used to check the accuracy of the helium analyzer section after the oxygen span has been set.
- Always calibrate the zero setting on the helium analyzer prior to calibrating the span setting.
- Always validate the calibration using the helium & air table after calibration at two or more points (ref. sec. A.3)

Zero Calibration (helium sensor)

Note: To zero the helium sensor, there must be no residual gases other than air in the sample line of the instrument. Step 1 below is designed to purge the sample line using air.

1. With the air source still attached make sure the flow is adjusted between 0.2 and 2 SLPM. Flow air for at least 2 minutes to purge all other gases from the sample line.
2. After 2 minutes and with air still flowing in the sample line, adjust the helium zero potentiometer on the front panel until a reading on the helium display reads slightly above zero, for instance, 4% helium.
3. Slowly rotate the potentiometer and watch the helium display as it slowly decreases toward zero. Once the helium reading changes from 0.2% to 0.1% stop the adjustment process.

The analyzer is now properly zeroed.

Note: This procedure is necessary to avoid producing "negative" readings. The display is incapable of displaying negative values and will read zero even if the potentiometer is turned additionally after the zero point is approached.

Span Calibration (helium sensor)

Note: The span is set using the helium display

1. Attach the 100% helium gas to the sample inlet and adjust the flow to between 0.2 and 2.0 SLPM.
2. While helium is purging the sample line, watch the oxygen display. When the oxygen concentration decreases to 0.2–0.0%, adjust the helium span potentiometer on the front panel to set the display (helium) to 100.0% ±0.2% helium.

The instrument is now calibrated

You should verify that the analyzer reads 20.9% O_2 and 00.0 ±0.2% He with air flowing through the instrument and 0.00 ±0.2% O_2 and 100.0% ±0.2% He when flowing 100% He.

For additional calibration notes, see Section A.3 in the Appendix. The analyzer is now ready to be placed in service.

Operation

The **MIXCHEK** is used primarily to validate gas mixtures containing helium, oxygen, nitrogen, and air. It can be used to monitor or measure gas mixtures containing oxygen and air only, or helium and nitrogen only as well. The wall mount unit is designed to be included in a gas sampling system such as in Figure 2.3. These analyzers can be used to spot check gas mixtures in cylinders or to continually monitor a gas stream in real time. The **MIXCHEK** gas analyzer provides two separate 3 1/2 inch digital displays to continuously display both the helium and oxygen concentration in real time. Both readings are updated every fraction of a second. The analyzer has a response time of less than eight seconds.

4.1 Operation/Start-up

Using the **MIXCHEK** analyzer basically involves three steps:

- Powering up the instrument
- Set the O2 Span
- Attach a sample gas

4.1.1 Powering Up

Prior to turning the instrument on, you must install the AC adapter or install batteries. If using batteries, use the battery test function to make sure that the batteries are not low. See Section 3.5.

Turn the instrument on using the power switch and allow it to operate for 30 seconds. If your instrument has an oxygen sensor installed, it should indicate an oxygen reading of 17% to 25% oxygen when exposed to flowing air. If the reading is not within this range, verify that the oxygen sensor is installed and that it is exposed to air.

4.1.2 Setting the O2 Span

The **MIXCHEK** is shipped calibrated from the factory. The helium section will rarely require any further calibration. If the helium

sensor is replaced, then calibration of the helium sensor is required. Refer to Section 3.8 for calibrating the helium sensor.

The oxygen section, however, must be calibrated before use. It should be calibrated each day prior to use. To calibrate the unit, turn the instrument on and let it operate for 30 seconds. Make sure that the analyzer is exposed to flowing air, then adjust the O2 SPAN control until the oxygen display indicates 20.9% oxygen. See also Section A.3 in the Appendix. The analyzer is now ready for service.

4.1.3 Attaching the Sample Gas

On the portable unit, attach the sample tube to the gas source and adjust the flow rate to 0.2—2.0 SLPM. For the wall mount unit, attach the sample gas to the sample in port and adjust the flow to 0.2—2.0 SLPM. The actual sample flow rate is not critical, but it is important that the flow rate does not exceed 2.0 SLPM. The instrument incorporates small gas passages inside the sample block. A high gas flow rate will pressurize the sensor and will cause the oxygen sensor to indicate an abnormally high value and the helium sensor to indicate an incorrect gas concentration.

The analyzer display reading should become stable in less than a minute. Most of the time required for the analyzer's reading to stabilize is caused by gas sampling propagation delays. This is the time required for the gas sample to purge through the regulators, gas lines and fittings. Depending on the sample system employed, it may require several minutes for the gas sample to reach the analyzer and become stable.

Maintenance

The **MIXCHEK** requires very little maintenance, other than calibration, checking and changing the batteries and oxygen sensor, and cleaning the plastic housing. Routine maintenance consists of periodic cleaning of the front panel and displays and leak checking the gas lines. Should any part of the instrument malfunction or fail to perform, the unit should be removed from service and returned for repair and calibration. This unit contains no user-serviceable parts except the oxygen sensor and batteries.

5.1 Micro-Fuel Cell Replacement

The R-33D1 high output micro-fuel cell is a sealed electrochemical transducer with no electrolyte to change or electrodes to clean. When the cell reaches the end of its useful life, it is replaced. The spent fuel cell should be discarded according to local regulations. This section describes fuel cell care as well as how to replace it.

CAUTION: **THE PC BOARD CONTAINS ELECTROSTATIC SENSITIVE COMPONENTS. OBSERVE PROPER ELECTROSTATIC DISCHARGE PRECAUTIONS WHEN WORKING ON OR NEAR THE PC BOARD.**

WARNING: ***THE O2 SENSOR USED IN THE MIXCHEK USES ELECTROLYTE WHICH CONTAIN TOXIC SUBSTANCES, MAINLY LEAD AND POTASSIUM HYDROXIDE. THESE SUBSTANCES CAN BE HARMFUL IF TOUCHED, SWALLOWED, OR INHALED. AVOID CONTACT WITH ANY FLUID OR POWDER IN OR AROUND THE UNIT. WHAT MAY APPEAR TO BE PLAIN WATER COULD CONTAIN ONE OF THESE TOXIC SUBSTANCES. IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES. CALL PHYSICIAN. (SEE APPENDIX, MATERIAL SAFETY DATA SHEET.)***

To remove and replace the micro-fuel cell:

1. Discharge any static electricity by touching any piece of grounded metal such as plumbing fixtures (not the instrument).
2. Remove the 4 Phillips head screws that secure the front panel.
3. **(Portable unit)** Turn over the front panel and disconnect connector J1. See Figure 5-1.
   (Wall mount unit) Rotate the front panel down 90 degrees and disconnect connector J1.
4. Unscrew the micro-fuel cell counterclockwise from the end of the sensor block and remove the spent micro-fuel cell.
5. Before inserting the new cell, make sure that the o-ring on the new cell is properly installed.
6. Install the new cell by screwing it into the sensor block clockwise.
7. Replace the front panel.

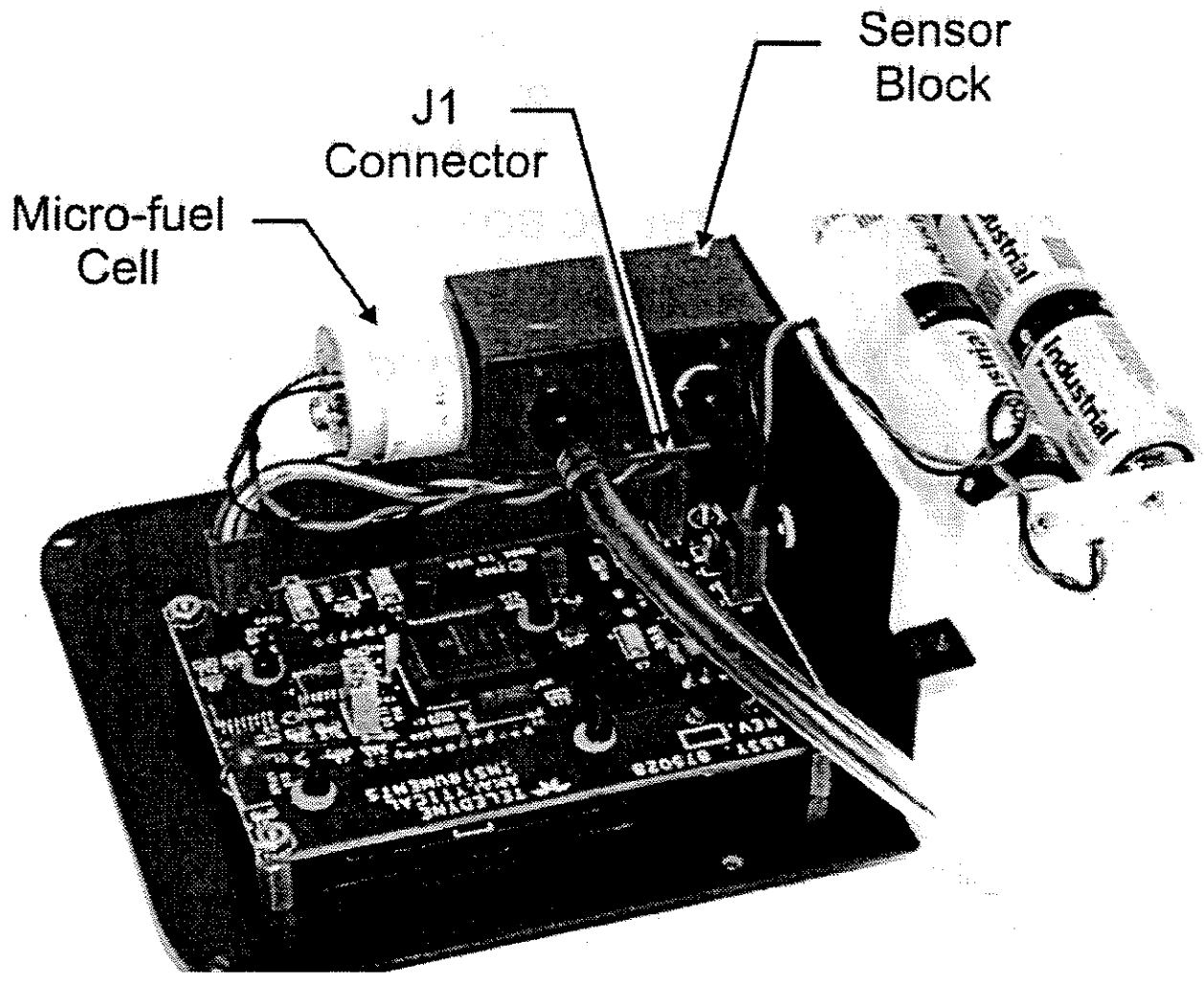

Figure 5-1:Replacing the Micro-Fuel Cell

5.1.1 Storing and Handling Replacement Cells

To have a replacement cell available when it is needed, TAI recommends that one spare cell be purchased after commissioning the instrument shortly before the end of the cell's two-year warranty period.

CAUTION: DO NOT STOCKPILE CELLS. THE WARRANTY PERIOD STARTS ON THE DAY OF SHIPMENT.

The spare cell should be carefully stored in an area that is not subject to large variations in ambient temperature (75 °F nominal) or to rough handling.

5.2 Battery Replacement

To replace the batteries in the **MIXCHEK** the battery cover must be removed. The cover is secured by 2 Phillips head screws as shown in Figure 5-2. After removing the screws and cover, note the polarity of the old batteries and replace with a fresh set of 4 C-cell batteries. Figure 5-3 shows the battery compartment and indicates the battery disposition as they are replaced.

Note: Do not use rechargeable batteries. When replacing the batteries, replace all four at once. It is false economy to replace individual batteries.

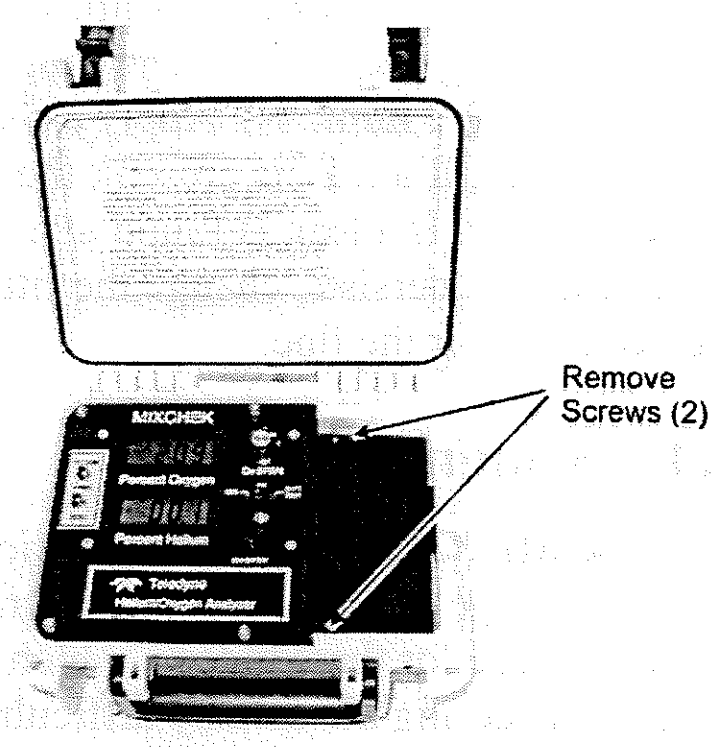

Figure 5-2: Removing Battery Cover

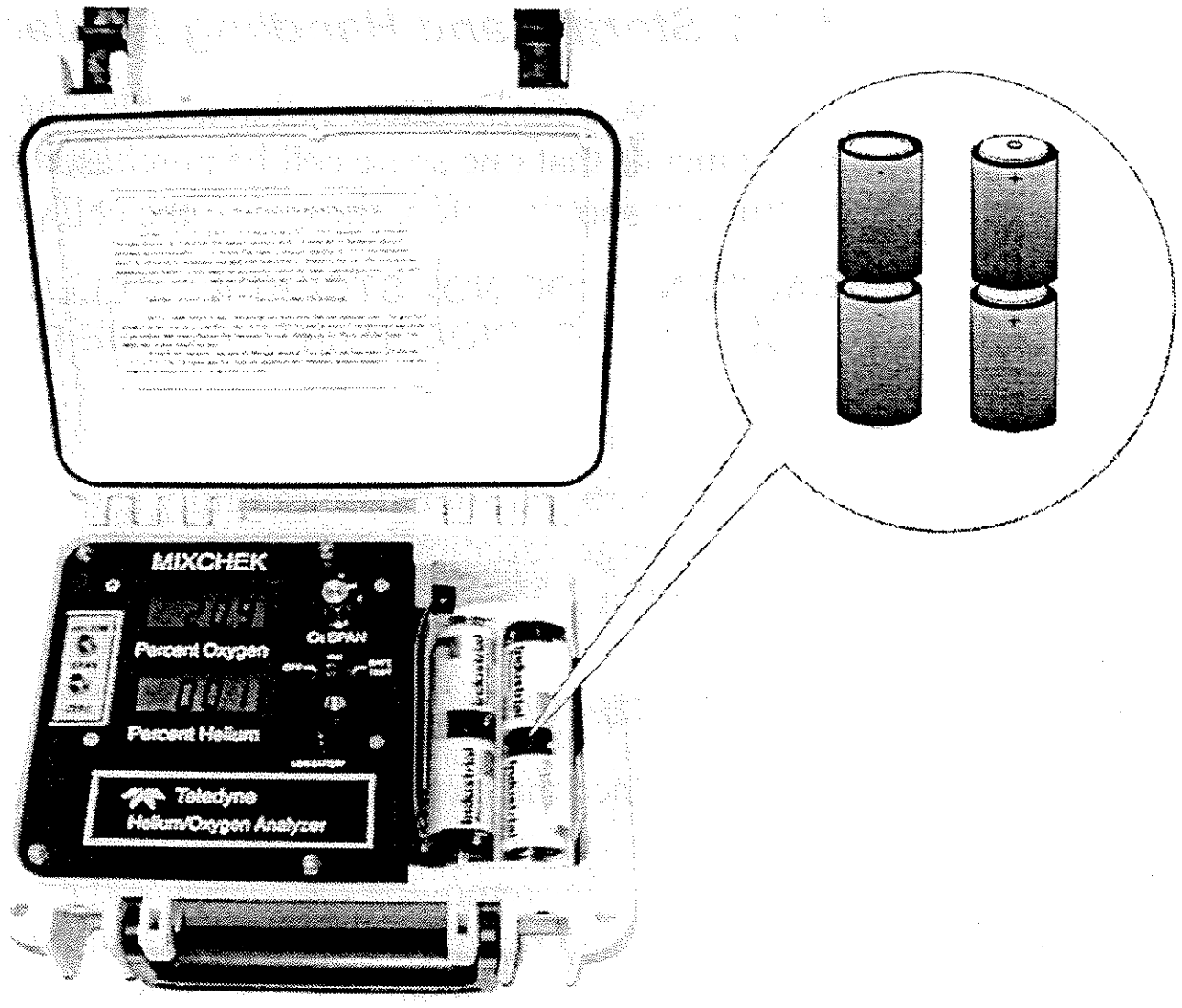

Figure 5-3: Replacing the Batteries

5.3 Leak Checking

Periodically check all gas lines to ensure that they are tight. To check for leaks, use air to slightly pressurize the sample lines (1-4 psi for a maximum or 2 minutes). Apply a soap solution to all fittings and exposed lines. If a leak is present, the soap solution will froth and bubble at the leak site. If a leak is found at a fitting, tighten the fitting and retest. If the leak still persists, change the fitting. If a leak is found in a gas line, replace or repair the line.

5.4 Routine Cleaning

The **MIXCHEK** should be periodically cleaned using a damp cloth then wipe dry. Do not use solvents or abrasive cleansers. This is especially true for the windows which could pit, scratch or partially dissolve rendering the display difficult to read.

Appendix

A.1 Specifications

CE Conformity:	This Teledyne Analytical instruments **MIXCHEK** Analyzer meets or exceeds all requirements of the Commonwealth of Europe (CE) for Radio Frequency Interference and Electromagnetic Interference (RFI/EMI) protection.
Gas Concentrations:	1 SLPM nominal 2.5 SLPM maximum (0.5 psig/3.4 kPa max)
Range:	0-100% oxygen 0-100% helium in oxygen and/or nitrogen
Accuracy:	±1% of full scale at constant temperature (25°C) and atmospheric pressure
Response Time:	90% in less than 8 seconds
Display:	3 1/2" Dual LCD
AC Power:	**Standard:** 6 VDC power adapter powered from 120 VAC 60 Hz. **Optional:** AC power adapter 100-240 VAC 50/60 Hz International CE version
DC Power:	6V Nominal (5.2-10VDC) @ 50 mA max.
Battery Power:	4 C-cell alkaline batteries ANSI-14A, IEC-LR14
Battery Life:	Approximately 150 hr. continuous use (portable unit)
Sensor Type:	Class R33D1 (oxygen) Solid state thermal conductivity (helium)
O2 Sensor Warranty:	24 months

O2 Sensor Expected Life:	36 months in air
Enclosure:	**Wall Mount:** ABS plastic housing **Portable:** Water resistant polyethylene
Dimensions:	6" W × 3" D × 6" H (66 mm × 33-mm × 66 mm)
Storage Temp.	0 to +50°C
Operating Temp:	0-45°C
Humidity:	Environmental, 95% non-condensing max.
Pollution Degree:	2
Over Voltage Category:	1

A.2 Spare Parts List

QTY	PART NO	DESCRIPTION
1	C74069-R33D1	Micro-Fuel Cell R33D1
1	A558	6 VDC 115 VAC 60 Hz power adapter (US version)
4	B90	C-cell alkaline battery
1	A555	6VDC International Power Adapter 100-240 VAC 50/60 Hz (CE version)
1	B75401	Low pressure inflator hose sampling adapter (2 SLPM)
1	P1244	Trim Pot Tool

A minimum charge is applicable to spare parts orders.

Note: Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.

Orders should be sent to:

TELEDYNE Analytical Instruments
16830 Chestnut Street
City of Industry, CA 91749-1580

Phone (626) 934-1500, Fax (626) 961-2538
Web: www.teledyne-ai.com

or your local representative.

VANDAGRAPH LTD.
15 Station Road, Cross Hills,
Keighley, W.Yorkshire, BD20 7DT
Tel. +44 (0)1535 634900
Fax. +44 (0)1535 635582

A.3 Helium/Air Chart

The helium/air chart allows the user to verify the proper functioning and calibration of a helium and oxygen analyzer. This chart provides the helium and oxygen percentages for a gas mixture containing helium and air only. To use the chart, the user must have a flowing source of helium and air. It is preferred to have a gas cylinder of helium and a separate cylinder of compressed air. The gas cylinders must be equipped with regulators, and control valves. Fittings, tubing and connectors are also required. The cylinders need to share a common manifold or delivery line so that the air and the helium can be mixed together and supplied to the analyzer at a low flow rate and pressure. It is best to have a separate control valve or gas flow restrictor between the analyzer and the gas mixing system.

The procedure is to first calibrate the oxygen sensor with air at a flow rate of 0.1 to 2 SCFH by setting the span to 20.9% oxygen. It is important that the oxygen span be set accurately, and that the flow rate does not exceed 2 SCFH during any phase of the testing.

After the oxygen section is calibrated, it will become the standard for checking the helium section. The only other concern is that the flow rate does not exceed 2SCFH.

Low flow rates do not typically cause an issue, but it should be noted that the oxygen sensor does consume oxygen. If the gas is not flowing the oxygen reading will drop as the sensor consumes the oxygen around it.

To check the helium section, adjust the helium and the air to a low flow rate. Connect the gas to the analyzer and allow the oxygen reading to stabilize. Note the oxygen and helium readings. Use the chart to look up the oxygen reading. The helium reading from the analyzer should match the chart within +/-2% or better. Readjust the gas mixture and repeat the process. Typically, it is adequate to check one high helium reading, and one low reading on a **MIXCHEK** analyzer (these analyzers use two point calibration). Helium concentrations of 10% and 90% are good targets to shoot for. The actual concentrations are not important.

A more practical and portable helium and oxygen analyzer validation system can be made by using two small gas cylinders of mixed gas—one with a mixture of approximately 10% helium and air, and the other with approximately 90% helium and air. These two gas

cylinders can be kept on hand to validate the analyzer at any time. The mixed gas cylinders do not need to be very large. For this system you will need one additional cylinder of air to calibrate the oxygen analyzer. This method will require a regulator and a gas flow control and sampling device. Scuba equipment can be used to build this system. Pony tanks are suitable, and a standard primary regulator can be used as well. A power inflator sample adapter is a convent method to sample the gas cylinders at the correct flow rate. To use this system, the regulator is first attached to the air cylinder to calibrate the oxygen section (set the span to 20.9%). The next step is to sample each of the other cylinders. The results are compared to the Air /Helium chart.

The most important issues are:

- Accurately calibrating the oxygen analyzer using air to 20.9 % before the test
- Ensuring that the other cylinders contain a mixture of air and helium only.

The use of the power inflator sample adapter will ensure that the sample flow rate is correct.

If the analyzer fails the test, first verify that the oxygen span has been correctly set, and that it was done with standard air. Standard air has an oxygen content of 20.9%.

Helium & Air Chart

Percent Helium	Percent Oxygen	Percent Helium	Percent Oxygen
100	0.00	50	10.45
99	0.21	49	10.66
98	0.42	48	10.87
97	0.63	47	11.08
96	0.84	46	11.29
95	1.05	45	11.50
94	1.25	44	11.70
93	1.46	43	11.91
92	1.67	42	12.12
91	1.88	41	12.33
90	2.09	40	12.54
89	2.30	39	12.75
88	2.51	38	12.96
87	2.72	37	13.17
86	2.93	36	13.38
85	3.14	35	13.59
84	3.34	34	13.79
83	3.55	33	14.00
82	3.76	32	14.21
81	3.97	31	14.42
80	4.18	30	14.63
79	4.39	29	14.84
78	4.60	28	15.05
77	4.81	27	15.26
76	5.02	26	15.47
75	5.23	25	15.68
74	5.43	24	15.88

Percent Helium	Percent Oxygen	Percent Helium	Percent Oxygen
73	5.64	23	16.09
72	5.85	22	16.30
71	6.06	21	16.51
70	6.27	20	16.72
69	6.48	19	16.93
68	6.69	18	17.14
67	6.90	17	17.35
66	7.11	16	17.56
65	7.32	15	17.77
64	7.52	14	17.97
63	7.73	13	18.18
62	7.94	12	18.39
61	8.15	11	18.60
60	8.36	10	18.81
59	8.57	9	19.02
58	8.78	8	19.23
57	8.99	7	19.44
56	9.20	6	19.65
55	9.41	5	19.86
54	9.61	4	20.06
53	9.82	3	20.27
52	10.03	2	20.48
51	10.24	1	20.69

A.4 Material Safety Data Sheet

Section I - Product Identification

Product Name: Oxygen Sensor

Micro-fuel Cells and Super Cells, all classes except A-2C, A-3, and A-5

Mini-Micro-fuel Cells, all classes

Electrochemical Oxygen Sensors, all classes except R-19

Manufacturer: Teledyne Electronic Technologies
Analytical Instruments

Address: 16380 Chestnut Street,
City of Industry, CA 91749

Phone: (626) 961-9221

Technical Support: (626) 934-1673

Environment, Health and Safety: (626) 934-1592

Date Prepared: 05/24/02

Section II – Hazardous Ingredients/Composition

Material or Component	C.A.S. #	Quantity	OSHA PEL	ACGIH
Lead (Pb)	7439-92-1	5-20 gms	0.05 mg/m^3	0.15 mg/m^3
Potassium hydroxide (KOH)	1310-58-3	1-5 ml (10% KOH in water)	2 mg/m^3 (ceil)	2 mg/m^3 (ceil)

Section III – Health Hazard Data

Routes of Entry:

Inhalation: Highly unlikely.

Ingestion: May be fatal if swallowed.

Skin: The electrolyte (potassium hydroxide) is corrosive; skin contact may cause irritation or severe chemical burns.

Eyes: The electrolyte (potassium hydroxide) is corrosive; eye contact may cause irritation or severe chemical burns.

Acute Effects:	The electrolyte is harmful if swallowed, inhaled or absorbed through the skin. It is extremely destructive to tissue of the mucous membranes, stomach, mouth, upper respiratory tract, eyes and skin.
Chronic Effects:	Prolonged exposure with the electrolyte has a destructive effect on tissue. Chronic exposure to lead may cause disease of the blood and blood forming organs, kidneys and liver, damage to the reproductive systems, and decrease in fertility in men and women, and damage to the fetus of a pregnant woman. Chronic exposure from the lead contained in this product is extremely unlikely.
Signs and Symptoms of Exposure:	Contact of electrolyte with skin or eyes will cause a burning sensation and/or feel soapy or slippery to touch. Other symptoms of exposure to lead include a loss of sleep, loss of appetite, metallic taste and fatigue. For additional exposure information refer to 29 CFR 1910.1025, Appendix A—Substance Data Sheet for Occupational Exposure to Lead.
Carcinogenicity:	Lead is classified by the IARC as a class 2B carcinogen (possibly carcinogenic to humans).
OSHA:	Where airborne lead exposures exceed the OSHA action level, refer to OSHA Lead Standard 1910.1025
NTP:	NA
Medical Conditions Generally Aggravated by Exposure:	Lead exposure may aggravate disease of the blood and blood forming organs, hypertension, kidneys, nervous and possibly reproductive systems. Those with preexisting skin disorders or eye problems may be more susceptible to the effects of the electrolyte.

Section IV - Emergency and First Aid Procedures

Eye Contact:	Flush eyes with water for at least 15 minutes and get immediate medical attention.
Skin Contact:	Wash affected area with plenty of water and remove contaminated clothing. If burning persists, seek medical attention.
Ingestion:	Give plenty of cold water. DO NOT INDUCE VOMITING. Seek medical attention. Do not administer liquids to an unconscious person.
Inhalation:	If inhaled, remove to fresh air and obtain medical attention immediately.

Section V – Fire and Explosion Hazard Data

Flash Point: NA **Flammable Limits:** NA LEL: NA UEL: NA

Extinguishing Media:	Use extinguishing media appropriate to surrounding fire conditions. No specific agents recommended.
Special Fire Fighting Equipment:	Wear NIOSH/OSHA approved self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Unusual Fire and Explosion Hazards:	Not applicable

Section VI - Handling Information

NOTE: The oxygen sensors are sealed, and under normal circumstances, the contents of the sensors do not present a health hazard. The following information is given as a guide in the event that a cell leaks.

Protective clothing:	Rubber gloves, chemical splash goggles, apron, face shield.
Clean-up procedures:	Wipe down the area several times with a wet paper towel. Use a fresh towel each time. Contaminated paper towels are considered hazardous waste.
Protective measures during cell replacement:	Before opening the bag containing the sensor cell, check the sensor cell for leakage. If the sensor cell leaks, do not open the bag. If there is liquid around the cell while in the instrument, put on gloves and eye protection before removing the cell.
Disposal:	Should be in accordance with all applicable state, local and federal regulations.

NOTE: The above information is derived from the MSDS provided by the manufacturer. The information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Teledyne Analytical Instruments shall not be held liable for any damage resulting from handling or from contact with the above product.

Section VII – Physical and Chemical Data

Chemical and Common Names:	Potassium Hydroxide (KOH), Lead (Pb), pure	
CAS Number:	KOH 1310-58-3 Pb 7439-92-1	
	KOH	Pb (pure)
Melting Point/Range:	360 °C	328 °C
Boiling Point/Range:	1320 °C	1744 °C
Specific Gravity:	2.04	11.34
pH:	>14	N/A
Solubility in Water:	Completely soluble	Insoluble
Percent Volatiles by Volume:	None	N/A
Appearance and Odor:	White or slightly yellow, odorless	Grey metal, solid, odorless

Section VIII –Stability and Reactivity

Stability:	Stable
Incompatibilities:	Aluminum, organic materials, acid chlorides, acid anhydrides, magnesium, copper. Avoid contact with acids and hydrogen peroxide > 52%.
Hazardous Decomposition:	Toxic fumes.
Hazardous Polymerization:	Will not occur.

Section IX – Toxicological Information

Toxicity to Animals:	Acute oral toxicity (LD50): 2730 mg/kg (Rat) (Calculated value for the KOH solution)
Mutagenicity:	Lead tested positive as a mutagen in the Ames test.

Section X – Ecological Information

Ecotoxicity: The LC50 of lead for the daphnia magna is 3.6 mg/l, and 5.1 mg/l for the daphnia pulex.

Environmental Fate: Lead is bioaccumulative in most aquatic life and mammals. It is highly mobile as lead dust or fume, yet forms complexes with organic material which limits its mobility.

Section XI – Disposal Considerations

Waste must be disposed of in accordance with Federal, State, and Local environmental control regulations. If discarded in its purchased form, this product is hazardous by its characteristics of toxicity and corrosivity under RCRA.

EPA Waste Number: D008, D002

DOT Information: Waste corrosive liquid, basic, inorganic, n.o.s. (lead, potassium hydroxide), 8, UN 3266, II.

Follow all Federal, State and Local regulations.

Section XI - Regulatory Information

US Federal Regulations

1) OSHA—Hazardous by definition of Haz Com Std. CFR 1910.1200

2) SARA Title III

Sec 302 (40 CFR Part 355)

Chemical Name	CAS #	%	TPQ lbs	RQ
None	NA	NA	NA	NA

Sec 311 & 312

Chemical Name	Acute Health Haz	Chronic Health Haz	Fire Hazard	Sudden Release of Pressure Haz	Reactive
Lead	Yes	Yes	No	No	No
Potassium hydroxide	Yes	Yes	No	No	No

Sec 313 (40 CFR Part 372): This product contains the following toxic chemicals subject to the reporting requirements of Section 313, of Title III of the Superfund Ammendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS #	Lead Content
Lead	7439-92-1	5-20 gms

3) TSCA (Toxic Substances Control Act)

Components of this product are listed on the TSCA inventory

4) CERCLA Section 102 (A) (40 CFR Part 302)—Hazardous Substances and Reportable Quantities

Chemical Name	CAS #	RQ
Lead*	7439-92-1	10 lbs.
Potassium hydroxide (solid)	1310-58-3	1000 lbs.

* No reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

State Regulations

California Proposition 65: WARNING: This product contains lead, a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Massachusetts: Potassium hydroxide is a listed chemical

Pennsylvania: Potassium hydroxide is a listed chemical

International Regulations

Canada: Canadian Environmental Protection Act (CEPA): Potassium hydroxide, liquid, is on the Domestic Substances List (DSL) and is acceptable for use under the provisions of CEPA.

WHMIS: Potassium hydroxide (liquid)

Class D-2A: Material causing other toxic effects (VERY TOXIC)

Class E: Corrosive liquid.

Lead

Class D-2A

EEC: Potassium hydroxide (liquid)
R35—Causes severe burns.
R42—May cause sensitization by inhalation
R36/37/38—Irritating to eyes, respiratory system and skin.

Section XII - Other Information

All chemicals may pose unknown hazards and should be treated with caution. While the information contained in this Material Safety Data Sheet is believed to be correct and is offered for your information, consideration and investigation, Teledyne Analytical Instruments assumes no responsibility for the completeness or accuracy of the information contained herein.

Index

Teledyne Analytical Instruments
A Business Unit of Teledyne Electronic Technologies

SENSORS • ANALYZERS • SYSTEMS

SCIENTIFIC SOLUTIONS

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