OPERATING INSTRUCTIONS FOR

MIXCHEK

HELIUM/OXYGEN MIXTURE ANALYZER

P/N M75030
Rev 2
ECO # 05-0138

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.

- **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 MIXCHEK ANALYZER ELECTRONICS ARE NOT WATER RESISTANT. DO NOT ALLOW 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.

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Introduction

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

There are two basic configurations available both of which offer oxygen analysis as an option. The wall-mountable unit is 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).

The portable instrument 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 wall-mount model is shown in Figure 1-1 and the portable instrument is shown in Figure 1-2.

NOTE: If your unit is equipped with a Helium only analysis please ignore all references to the oxygen sections of this manual.

1.1 Overview

The MIXCHEK analyzes the helium/oxygen 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 oxygen sensor 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.

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

The following features are included in the 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 (Optional)
- Convenient span calibration control for calibrating the oxygen cell
- ABS enclosure for wall-mounting—rugged water resistant plastic housing for portable model
- Low pressure power inflator hose sampling adapter

1.3 Options

- Oxygen analysis
- 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)

1.4 Applications

The MIXCHEK is specifically offered to the diving industry where specific mixtures of Helium and Oxygen 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

Setup

Installation of the analyzer includes:

- Unpack unit
- Mount unit
- Install sensor
- Install batteries (portable unit only)
- Make gas and power connections
- Calibrate and test the installation

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

2.1 Unpacking the Analyzer

The MIXCHEK is shipped fully functional and ready to install except for installing the oxygen sensor and batteries (portable unit only). Carefully unpack the analyzer and inspect it for damage. Check that the sensor is not leaking and that there is no sign of physical damage.

2.2 Mounting the Analyzer (Wall-Mount Unit)

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 2-1 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.

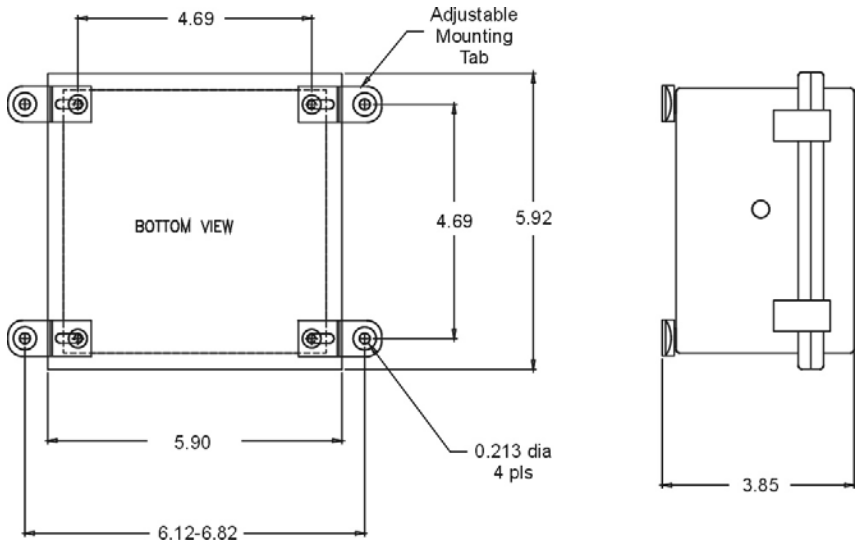

Figure 2-1: Mounting Dimensions

2.3 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 build up by touching any piece of grounded metal such as plumbing fixtures (not the instrument).
2. Remove the 4 cap nuts that secure the front panel. See Figure 2.2.

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

3. Rotate the front panel down 90 degrees and disconnect connector J1.
   (**Portable unit**) Turn over the front panel and disconnect connector J1. See Figure 2.3.
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.

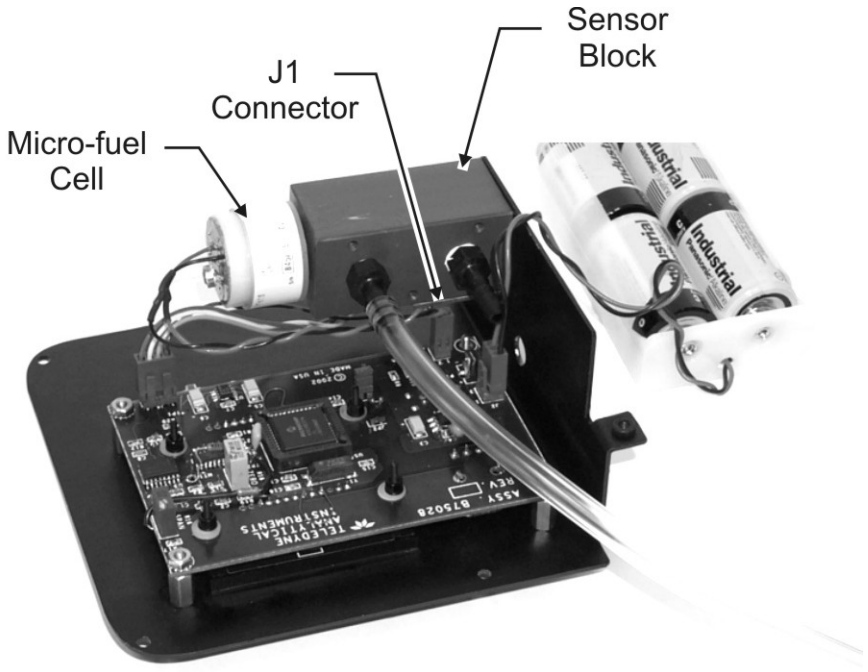

Figure 2-3: Installing the Sensor
(Portable model shown, wall-mount is similar)

2.4 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 2-4.

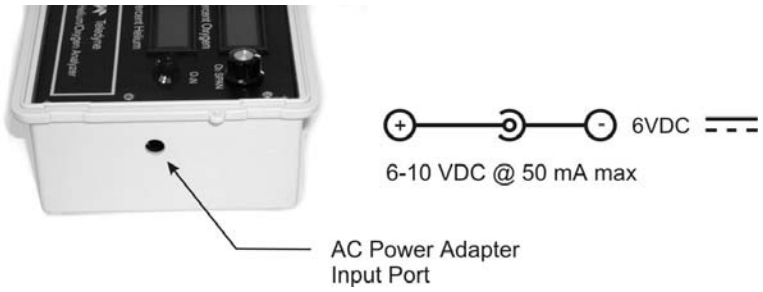

Figure 2-4: Power Adapter Port (Wall Mount)

The portable model is powered from 4 C-cell batteries, which must be installed prior to placing the instrument in service. See Section 2.6. The portable unit can also be powered using the optional 6 VDC power adapters, 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 2-5. 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.

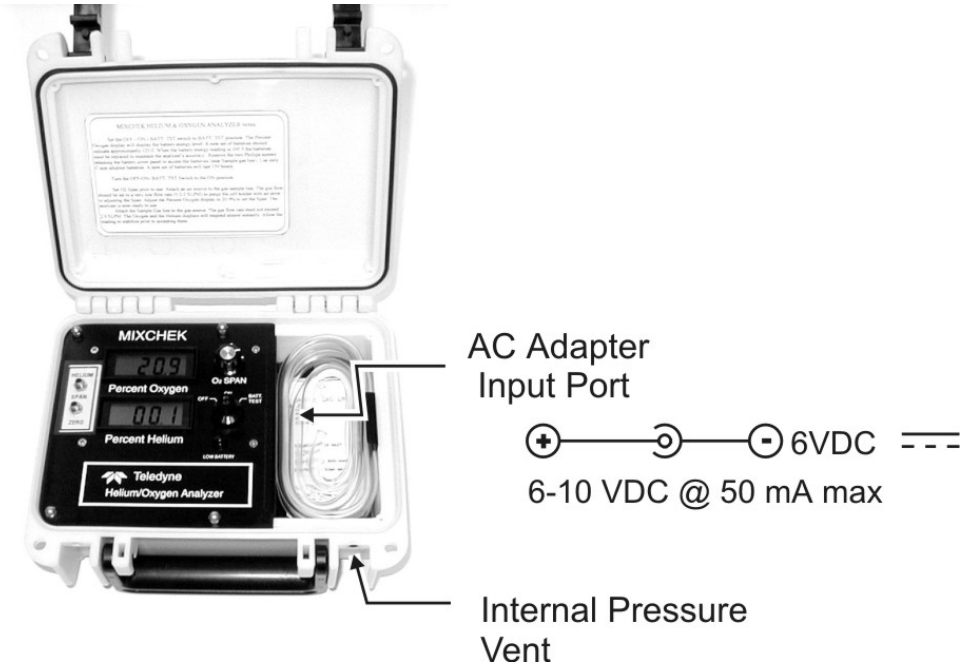

Figure 2-5: Power Adapter Port (Portable Model)

2.5 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.

2.6 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 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 2-6.

When replacing batteries, for best results use only long-life alkaline batteries. The monitor can be run for up to 150 hours on a fresh set of batteries.

Figure 2-6: Battery Installation

2.7 Calibration

The analyzer is supplied fully calibrated from the factory but will require calibration checks and recalibration every 30 days or less 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 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 2-7.

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%.

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.

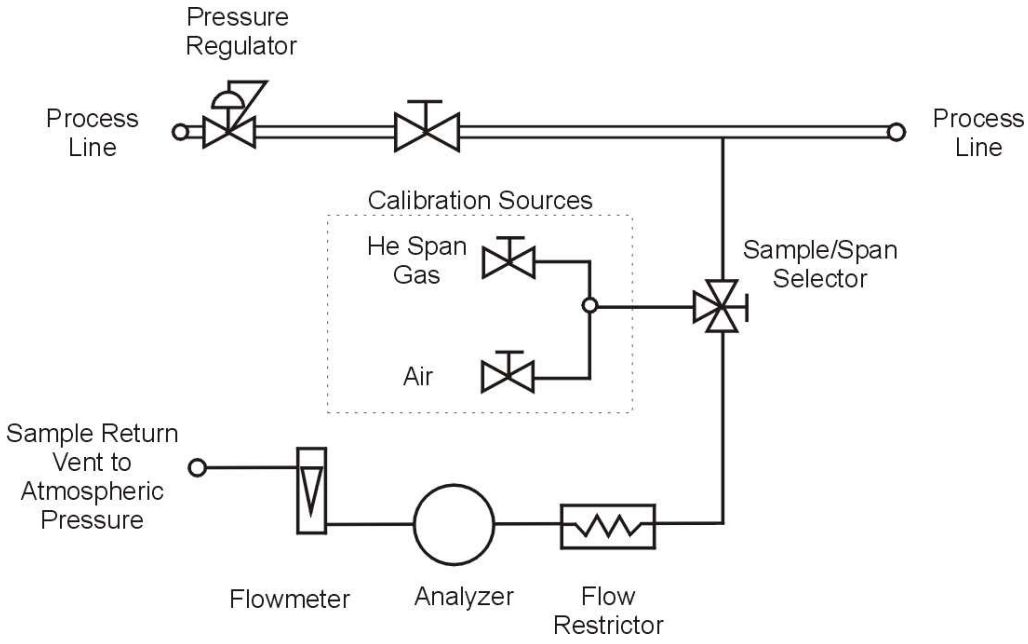

Figure 2-7: Typical Sample System with Provisions for Calibration

Operation

3.1 Operation/Start-up

Using the MIXCHEK analyzer basically involves three steps:

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

3.1.1 Powering Up

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.

3.1.2 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 2.7 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, and 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.

3.1.3 Attaching the Sample Gas

See Figure 3-1. 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.

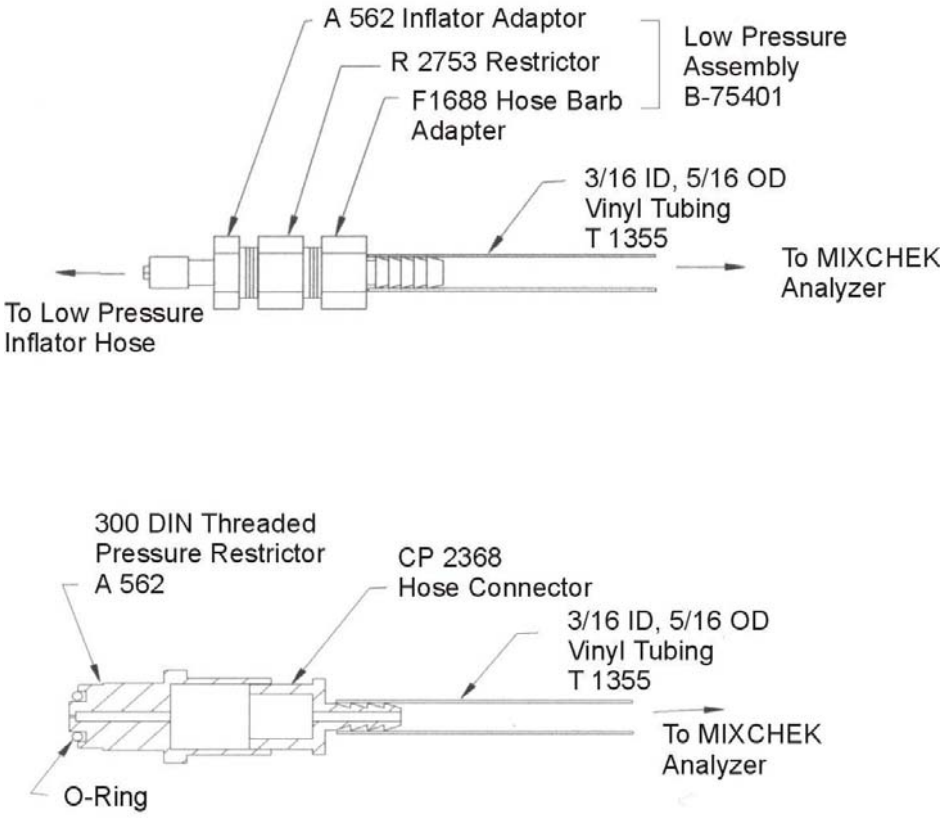

Figure 3-1: Typical Setup Flow Diagram

Note: The wall-mounted version requires the tubing and a 1/8" NPT male barb fitting.

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.

4.1 Micro-Fuel Cell Replacement

The sensor has an expected life of 36 months in air. When the sensors lifetime is exhausted, its output will fall off and will no longer be able to hold calibration.

To remove and replace the micro-fuel cell see Section 2.3.

4.1.1 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.

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.

4.2 Battery Replacement

Figure 4-1 shows the battery compartment and indicates the battery disposition as they are replaced. Refer to Section 2.6 and Figure 2-6 for battery replacement procedure.

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

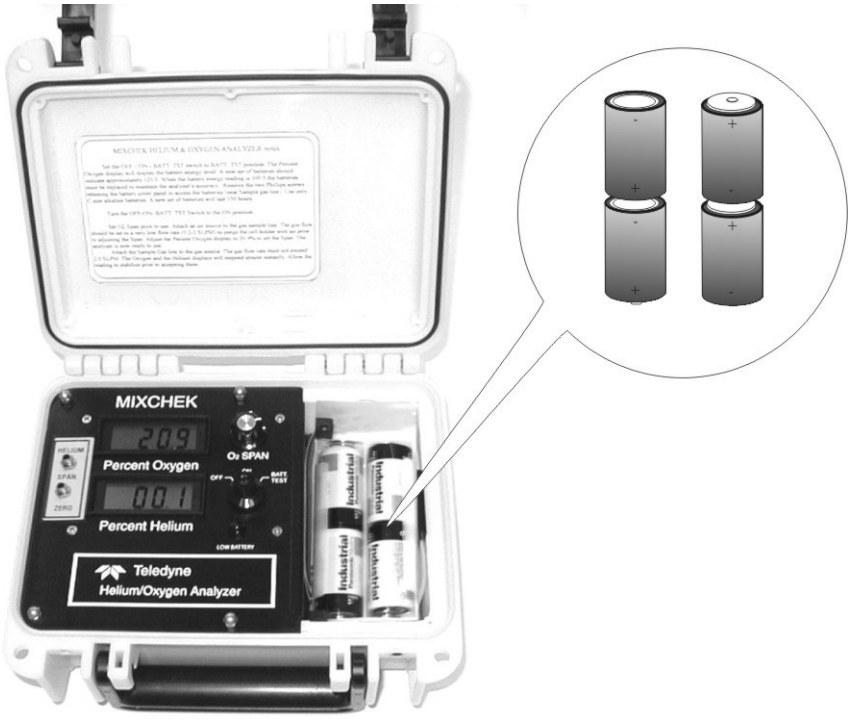

Figure 4-1: Battery Disposition

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:	**O2**: ±1% + 2 counts at constant temp & pres **He**: ±1% at constant temp & press **O2**: ±5% + 2 counts at const press over operating temp range (0-40°C) equilibrated **He**: ±4% at const press over operating temp range (0-50°C) equilibrated
Resolution:	**O2**: 0.1% **He**: 0.1-0.2%
Response Time:	90% in less than 5 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:	**Wall Mount:** (6.2 L x 5.9 W x 3.7 D)in (157.5 x 149.9 x 94.0)mm
	Portable: (8.7 L x 7.5 W x 3.8 D)in (221 x 190.5 x 96.5) mm
Storage Temp.	0 to +50°C
Operating Temp:	0-40°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
1	A75813	300DIN Tank Sampling Adapter Kit

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.

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 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

Consult Teledyne for a copy of the MSDS sheet for this product or visit our website at www.teledyne-ai.com.

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