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**MODEL  
329R  
OXYGEN DETECTOR  
INSTRUCTION MANUAL**

P/N M57726.02  
8/24/94

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### 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. The Micro-Fuel Cell warranty period begins on the date of shipment from Teledyne. 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 is intended to be used as a tool to gather valuable data. The information provided by the instrument may assist the user in eliminating potential hazards caused by the user's 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. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Teledyne when the order is placed.

The purchaser must be aware of the hazardous process conditions inherent in the process(es) he uses. He is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

TAI, 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.**

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## Introduction

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The Teledyne Analytical Instruments Model 329R Oxygen Detector measures the percent of oxygen in a wide range of gases and gas mixtures. Modular and compact design provide outstanding performance and reliable on-line monitoring and make the 329R virtually maintenance-free.

A special range on the 329R enables you to calibrate in ambient air. The Micro-Fuel Cell produces an output that corresponds linearly to the oxygen concentration; the absence of oxygen produces zero current. This means you can use ambient air (20.9% oxygen) to calibrate, eliminating the need for special span gases.

The Model 329R contains a main PC board and power supply/inter-connection board housed in a rack mount enclosure. The oxygen probe can be separated from the unit by as much as 6 feet, depending on the level of electromagnetic noise in the operating environment.

### Main Features

**1. Two Ranges of Analysis.** The Model 329R Oxygen Monitor features two analysis ranges: 0-3% and 0-10%. A 0-25% range is accessible only during calibration to allow calibration in air. Optional 0-1%, 0-25%, and 0-100% ranges are available.

**2. Liquid Crystal Display Digital Readout.** The digital front panel LCD continuously displays and updates O<sub>2</sub> monitoring levels and displays values when calibrating the instrument and setting the alarms.

**3. Percent of Range Alarms.** Three (3) alarm relays are provided: one high and one low alarm, which are user adjustable, and one low alarm, factory set as a cell fail alarm at 2% of full scale.

**4. Proven Sensor.** The 329R uses the Class E-2 Micro-Fuel Cell, warranted for 24 months, with a life expectancy of 48 months.

**5. Analog Voltage Output.** The Model 329R provides customer connections to external devices, such as computers, recorders, alarms, etc., at 0–10 VDC, negative ground, plus contact closures for range identification. Custom voltage outputs, either grounded or isolated, are available as options.

**6. Analog Current Output.** The Model 329R has a 4–20 mA current output suitable for connection to external devices that use a 4–20 mA input. A 0–20 mA current output, either grounded or isolated, is available as an option.

**7. Over-Range/Cell Failure Visual Indicator.** The model 329R has a LED (Light Emitting Diode) to the left of the Liquid Crystal Display. The LED will blink when the oxygen reading exceeds 105% of scale, or a cell failure alarm is activated.

### Micro-Fuel Cell

The Model 329R uses a Class E-2 Micro-Fuel Cell. The Micro-Fuel Cell measures the concentration of oxygen in a gas stream. The analysis is specific for oxygen; i.e. the measuring cell will not generate an output current unless oxygen is present in the sample gas. Therefore, the analyzer has an absolute zero, and requires no zero gas. Span calibration is performed with atmospheric air as the span gas.

To eliminate any inaccuracies due to the positive temperature coefficient of the Micro-Fuel Cell, a thermistor circuit and network of precision resistors produce a negative coefficient of matching characteristics. The variable element (thermistor) in the compensation network is in the same assembly as the Micro-Fuel Cell, exposing both devices to the same temperature conditions.

### Warranty Conditions

Customers having warranty claims must return the cell in question to the factory for evaluation. If it is determined that failure is due to faulty material or workmanship the cell will be replaced free of charge.

**CAUTION: Evidence of tampering or abuse will render the warranty null and void.**

If a cell is working satisfactorily, but fails short of its warranty period, the customer will receive credit, on a pro-rated basis, towards the purchase of a replacement cell.

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## Installation & Operation

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### Precautions

1. **Read this chapter in its entirety before installing the unit.**
2. Upon receipt of the instrument, inspect the entire unit for damage. Notify the shipper if any damage is found. Check the unit, probe, and included accessories for broken or loose parts.
3. The sample **must** be free of entrained solids and water. A high humidity sample is ideal since it will prevent water loss from the cell electrolyte.
4. The Micro-Fuel Cell sensor electrolyte is caustic. Do not attempt to open or repair the sensor. Leaking or exhausted sensors should be disposed of in accordance with local regulations. Please refer to the Material Safety Data Sheet in the Appendix to learn about potential hazards and corrective action in case of accident.
5. Do not scratch, puncture, or damage the sensing membrane of the Micro-Fuel Cell sensor. Damage to the membrane will require replacement of the sensor.

### Location & Mounting

The unit is designed to be panel-mounted in a general purpose area, away from moisture and the elements. The unit should be installed at viewing level in a sheltered area.

Refer to the Outline diagram (dwg. C-57490) for the physical dimensions of the analyzer.

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The analysis unit should be installed in the process at a maximum distance of 6 feet away from the main unit, depending upon the level of electromagnetic noise in the operating environment.

### Analysis Unit Connection

The receptacle for the analysis unit cable is located in the lower left-hand corner of the rear panel. The 6-pin Minifit fitting is keyed to fit only one way in the receptacle; do not force it in. The other end of the cable is made of four separate wires; these should be connected to the terminal strip on the analysis unit as follows:

Red:	#1	
Black:	#2	
Green:	#3	} The green and white connectors can be interchanged, but be consistent.
White:	#4	

Refer to the probe interconnection dwg. A-58154.

Sample flow and pressure should not create significant backpressure past the sensor; **2 SCFH** (atmospheric pressure) is nominal.

### AC Power (International Ranges)

A 6-foot power cord is supplied with the Model 329R. Plug the female end of the power cord into the receptacle in the upper left-hand corner of the rear panel. The unit is now ready to be plugged into an AC power source (85-264 VAC, 47-440 Hz).

The ON/OFF switch is located to the right of the power cord receptacle.

### DC Power

If you have ordered the 9-36 VDC power option, install DC power via the terminal strip on the rear panel of the unit.

### Output Signals

Terminals for 4-20 mA, 0-10 VDC, and range identification are labeled on the rear panel of the analyzer, along with high alarm, low alarm, and sensor failure block terminals.

### Alarm Terminal Connection

SPDT relay contacts are provided for each of the 3 alarms. There are 9 terminals available on the back panel of the system for alarm circuit connection. The explanation for the relay terminals abbreviations is as follows:

NC= Normally closed

C = Common

NO= Normally open

The alarm relay circuits are designed for failsafe operation, meaning that the relays are activated (energized) during normal operation. If power fails, or if an alarm setpoint is exceeded, the relay will become de-energized.

### Sensor Installation or Replacement

**CAUTION:** The sensor electrolyte is caustic. Do not let it come in contact with skin. If it does, immediately flush affected area with water. Consult the Emergency First Aid procedures in the Material Safety Data Sheet in the Appendix.

Do not attempt to open or repair the sensor. Leaking or exhausted sensors should be disposed of in accordance with local regulations. Please refer to the Material Safety Data Sheet in the Appendix to learn about potential hazards and corrective action in case of accident.

To install the cell:

1. Turn the unit off by placing the power switch on the rear panel of the analyzer) in the OFF position.
2. Disconnect the red and black leads from the terminal strip. Remove the spent cell by pulling up on it and twisting slightly.
3. Remove the new Micro-Fuel Cell from its protective bag.

**CAUTION:** Do not scratch, puncture, or damage the sensing membrane of the Micro-Fuel Cell sensor. Damage to the membrane will require replacement of the sensor.

4. Attach the red lead of the new cell to terminal #1 and the black lead to terminal #2.
5. Replace the cell on the cell holder by pushing and twisting until it strikes bottom.

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### Setting Alarms

The alarms can be adjusted over the full scale range, and they are set as a percent of full scale. Thus, an alarm set to indicate 9.6 on the display while on the 10% O<sub>2</sub> range will activate at 9.6% O<sub>2</sub> on the 10% O<sub>2</sub> range and at 2.88% O<sub>2</sub> on the 3% O<sub>2</sub> range (96% of full scale). To set the alarms:

1. Place the range switch located below the front panel display in the 10% range position (or highest range available).
2. Place the power switch in the ON position.
3. To set the high alarm, hold down the SET HI ALARM button while turning the potentiometer to the right of the button until the display reads the desired concentration.
4. To set the low alarm, hold down the SET LO ALARM button while turning the potentiometer to the right of the button until the display reads the desired concentration.
5. Remember, the System/Cell Failure alarm is factory set at 2% of full scale; should this alarm trigger, the LED to the left of the front panel display will blink.





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## Maintenance

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### Replacing the Fuse

If the unit will not turn on when plugged in and switched ON (via the power switch), or you suspect a blown fuse, replace the fuse using the following procedure:

1. Disconnect the AC power and place the power switch located on the rear panel in the OFF position.
2. The fuse is located next to the power cord receptacle in the upper left-hand corner of the rear panel. Remove the power cord from the receptacle.
3. Insert a small flat-blade screwdriver into the slot in the receptacle wall nearest the fuse and gently pry open the fuse receptacle. The fuse holder will slide out. The fuse in use is visible in the clip. To open the spare fuse compartment, push on one end until it slides out.
4. Remove the bad fuse and replace it with a 5X20 mm 1A fast acting fuse (P/N F1189) for AC units or 1/2 A fast acting fuse (P/N F51) for DC units.

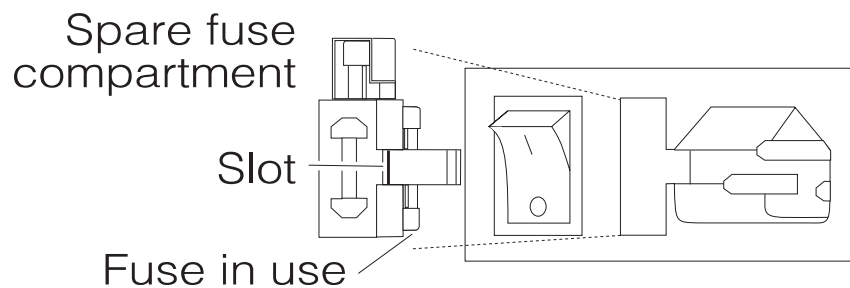


Figure 5-1: Replacing the fuse (AC power).

5. Replace the fuse holder into its receptacle, pushing in firmly until it clicks.

In units with DC power, the fuse is located on the rear panel above the ON/OFF switch. Open the fuse holder by unscrewing and removing the knob marked FUSE. The fuse will be located inside the knob.

### Replacing the Sensor

The characteristics of the Micro-Fuel Cell are similar to those of a mercury battery in that both provide an almost constant output through their useful life, and then fall off sharply towards zero at the end. If the sample being analyzed has a low oxygen concentration, cell failure will probably be indicated by the inability to properly calibrate the analyzer. You will find that very little adjustment of the span potentiometer will be required to keep the analyzer calibrated properly during the duration of a given cell's useful life. If large or many turn adjustments (clockwise) are required to calibrate the instrument, or calibration cannot be achieved within the range of the control, the cell needs replacing. Read the following section (Cell Warranty) before replacing the cell. Cell installation instructions are in Chapter 2: Cell Installation.

In addition, if the LCD displays "00.0" when the unit is plugged in, and the power switch is in the ON position, the sensor needs to be replaced.

**IMPORTANT:** After replacing the Micro-Fuel Cell, proceed to Chapter 2: Calibration.

To offset the possibility of not having a replacement cell available when needed, a spare cell can be ordered shortly after the instrument is in service, and each time after cell replacement thereafter.

**NOTE:** Do not stockpile cells, as the cell warranty begins on date of shipment.

Only one cell per instrument should be in reserve. The spare cell should be carefully stored in an area not subject to large variations in ambient temperature (75°F nominal), and in such a way to eliminate any possibility of damage. Under no circumstance should you disturb the integrity of the cell package until the cell is to be used. If the cell package

is punctured and air permitted to enter, the cell will immediately start to react to the presence of oxygen.

### **Warranty Conditions**

The Class E-2 cell used in the 329R is warranted for twenty-four (24) months of service from the date of shipment. Customers having warranty claims must return the cell in question to the factory for evaluation. If it is determined that failure is due to faulty material or workmanship, the cell will be replaced free of charge.

**CAUTION: Evidence of tampering or abuse will render the warranty null and void.**

If a cell was working satisfactorily, but fails short of its warranty period, the customer will receive credit, on a pro-rated basis, towards the purchase of a replacement cell.



## Appendix

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### Specifications

<b>Ranges:</b>	Standard: 0-3% and 0-10% O <sub>2</sub> with 0.01% O <sub>2</sub> resolution over full scale. Optional: 0-1% O <sub>2</sub> 0-25% O <sub>2</sub> 0-100% O <sub>2</sub>
<b>Air Calibration Range:</b>	0-25% O <sub>2</sub> with 0.1% O <sub>2</sub> resolution over full scale.
<b>Analog Output:</b>	Standard: 0-10 VDC, negative ground 4-20 mA, negative ground plus contact closures for range identification. Optional: 4-20 mA, isolated 0-20 mA, isolated 0-20 mA, negative ground User specified voltage output, isolated or neg. gr.
<b>Display:</b>	Digital 3½-digit LCD.
<b>Alarms:</b>	One high alarm, adjustable & fail-safe. One low alarm, adjustable & fail-safe. One low alarm, fixed at 2% full scale and fail-safe. Form "C" SPDT contacts rated at 5A, 230 VAC.
<b>Accuracy:</b>	±2% of full scale at constant temperature ±5% of full scale throughout operating temperature range.
<b>Response:</b>	90% of full scale in 20 seconds.
<b>Operating Temp. Range:</b>	32 °F to 122 °F (0 °C to 50 °C)
<b>Power:</b>	85-264 VAC, 47-440 Hz or 10-36 VDC.
<b>Enclosure:</b>	General purpose, panel mount

**Cell Type:** E-2  
**Cell Warranty:** 24 months  
**Cell Life (Expected):** 48 months  
**Max. Distance Between Control Module and Probe:** 6 feet  
 (Maximum distance depends on the level of electromagnetic noise in the operating environment.)

**Dimensions:** 2.75 "H × 6.0 "W × 2.75 "D  
 (63.5 mm × 152.4 mm × 63.5 mm)  
 Faceplate: 3.75 "H × 7.0 "W  
 (95.25 mm × 177.8 mm)  
 Probe unit: 4.0 "H × 6.0 "W × 2.5 "D  
 (101.6 mm × 152.4 mm × 63.5 mm)

#### Spare Parts List

QTY.	P/N	DESCRIPTION
1	C57304	PC board, main
1	A33748	Thermistor assembly
1	C57283-E2	Micro-Fuel Cell, E-2
4	F-1189	Fuse, 1A (AC)
4	F51	Fuse, ½A (DC)
1	A59264	Probe to analyzer cable, 6 feet

A minimum charge of US \$20.00 is applicable to spare parts orders.

**IMPORTANT:** Orders for replacement parts should include the part number and the model and serial number of the system for which the parts are intended.

Send orders to:  
 TELEDYNE ANALYTICAL INSTRUMENTS  
 16830 Chestnut Street  
 City of Industry, CA 91749-1580  
 Telephone: (818) 961-9221  
 TWX: (910) 584-1887 TDYANYL COID  
 Fax: (818) 961-2538  
 or your local representative

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### Drawing List

C-57490	Outline diagram
A-58154	Probe interconnection diagram
C-57304	Electronic PCB assembly diagram
D-57302	Electronic PCB schematic diagram
C-57305	Power supply PCB schematic diagram
C-57307	Power supply PCB assembly diagram
B-58123	Analysis unit (probe) outline

**Note:** 329R analyzers with 25% and 100% range modifications incorporate the following changes:

100% range modified circuit changes:

1. JP2 - connects pins 1 and 2
2. R52 is 12.5K
3. R30 is 7.5K
4. R35 is 1.5K

25% range modified circuit changes:

1. JP2 - connects pins 1 and 2
2. R52 is 50K
3. R30 is 28K
4. R35 is 11K

## Material Safety Data Sheet

### Section I – Product Identification

**Product Name:** Micro-Fuel Cells  
 Mini-Micro-Fuel Cells, all classes  
 Super Cells, all classes except T-5F  
 Electrochemical Oxygen Sensors, all classes.

**Manufacturer:** Teledyne Analytical Instruments  
**Address:** 16830 Chestnut Street, City of Industry, CA 91749  
**Phone:** (818) 961-9221

Date Prepared or Last Revised: 08/08/91  
 Emergency Phone Number: (818) 961-9221

### Section II – Physical and Chemical Data

Chemical and Common Names: Potassium Hydroxide (KOH), 15% (w/v)  
 Lead (Pb), pure

CAS Number: KOH 1310-58-3  
 Pb 7439-92-1

	<b>KOH</b> (15% w/v)	<b>Pb</b> (pure)
Melting Point/Range:	-10 to 0 °C	328 °C
Boiling Point/Range:	100 to 115 °C	1744 °C
Specific Gravity:	1.09 @ 20 °C	11.34
pH:	>14	N/A
Solubility in Water:	Completely soluble	Insoluble
Percent Volatiles by Volume:	None	N/A
Appearance and Odor:	Colorless, odorless solution	Grey metal, odorless

### Section III – Physical Hazards

**Potential for fire and explosion:** The electrolyte in the Micro-Fuel Cells is not flammable. There are no fire or explosion hazards associated with Micro-Fuel Cells.

**Potential for reactivity:** The sensors are stable under normal conditions of use. Avoid contact between the sensor electrolyte and strong acids.

### Section IV – Health Hazard Data

<b>Primary route of entry:</b>	Ingestion, eye/skin contact
<b>Exposure limits:OSHA PEL:</b>	.05 mg/cu.m. (Pb)
ACGIH TLV:	2 mg/cu.m. (KOH)
<b>Effects of overexposure</b>	
<b>Ingestion:</b>	The electrolyte could be harmful or fatal if swallowed. Oral LD50 (RAT) = 3650 mg/kg
<b>Eye:</b>	The electrolyte is corrosive; eye contact could result in permanent loss of vision.
<b>Dermal:</b>	The electrolyte is corrosive; skin contact could result in a chemical burn.
<b>Inhalation:</b>	Liquid inhalation is unlikely.
<b>Signs/symptoms of exposure:</b>	Contact with skin or eyes will cause a burning sensation and/or feel soapy or slippery to touch.
<b>Medical conditions aggravated by exposure:</b>	None
<b>Carcinogenicity:</b>	NTP Annual Report on Carcinogens: Not listed LARC Monographs: Not listed OSHA: Not listed
<b>Other health hazards:</b>	Lead is listed as a chemical known to the State of California to cause birth defects or other reproductive harm.

## Section V – 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:** Liquid inhalation is unlikely.

## 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.

**Clean-up procedures:** Wipe down the area several times with a wet paper towel. Use a fresh towel each time.

### 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.