# TED 190
# PORTABLE OXYGEN MONITOR
# INSTRUCTION MANUAL

26 MAY 1992

P/N MC54324 - (
02/04/92

TELEDYNE ELECTRONIC DEVICES

## Warranty

Teledyne warrants that the goods are free from defects of material and of constuction for a period of 2 years from the date of shipment from Teledyne. The Class T-7 Micro-Fuel Cell is warranted for one year from the date of shipment from Teledyne. The liability of Teledyne, if any, shall be limited solely to the replacement and repair of the goods and shall not include shipping costs or other incidental damages as defined in Section 2-715 of the U.S. Uniform Commercial Code.

This warranty is null and void if any goods are subjected to misuse, negligence, accident, or repairs other than those performed by Teledyne or an authorized service center.

**Caution: Federal law restricts this device to sale by or on the order of a physician.**

## Table of Contents

## Introduction

The Teledyne Electronics Devices 190 Portable Oxygen Monitor is an easy-to-use, portable instrument that provides fast and accurate oxygen monitoring and audio/visual alarm capability. The TED 190 is designed to monitor concentrations of up to 100% oxygen in medical gas mixtures.

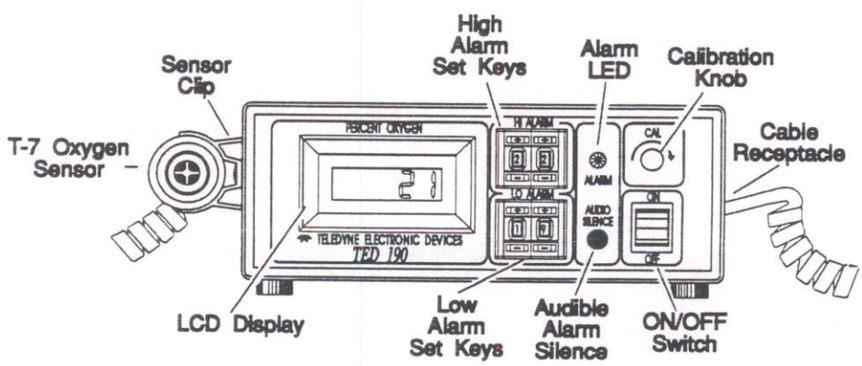


Figure 1: Front view of the TED 190

### 1.1 Applications

The TED 190 is designed for monitoring oxygen concentrations in a variety of medical gas mixtures. It is recommended that the instrument **is only used as a secondary measuring device** to verify the concentration of oxygen in gas mixtures prepared using a gas blender or similar apparatus. The use of this monitor as a primary or only means of preparing gas mixtures is **not** advised.

The monitor is capable of verifying oxygen concentrations in gas mixtures used in:

- Anesthesia
- Respiratory therapy
- Adult and neonatal intensive care

## Operations

**NOTE: UPON RECEIPT, INSPECT THE ENTIRE UNIT FOR DAMAGE. CHECK UNIT AND INCLUDED ACCESSORIES FOR BROKEN OR LOOSE PARTS. IF DAMAGED, DO NOT USE; NOTIFY THE SHIPPER; AND CONSULT TELEDYNE ELECTRONIC DEVICES.**

### 2.1 Set-Up

The TED 190 is suitable for use in many medical applications. The unit can be used on a table top or mounted on a pole using a mounting bracket (P/N B34102).

To set up and use your TED 190:

1. Install the batteries.
2. Install the sensor.
3. Calibrate the unit.
4. Set the alarms.

After the batteries have been installed, turn the unit on by pressing the ON/OFF rocker switch in the lower right-hand corner on the analyzer front panel.

The TED 190 has an analog output jack located on the rear panel next to the battery compartment. The 0–100 millivolt output can be used to drive an external recording device.

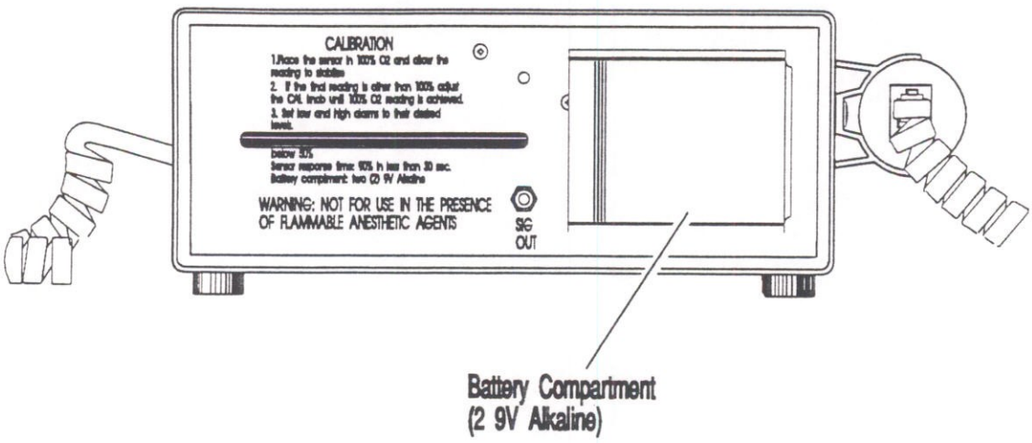


Figure 2: TED 190 rear view

### 2.1.1 Battery Installation or Replacement

**NOTE: Two 9-volt batteries must be installed in the unit before the TED 190 can be used.**

1. Turn the unit off (if it is on).
2. Pull open the battery compartment door from left to right.
3. Remove the batteries and unsnap them from the battery clip.
4. Install two new 9-volt batteries on the snap connectors. To insure proper polarity, the snap connectors are designed to accept the battery only one way, with the smooth half of the connector fitting into the crimped half.

**CAUTION: Improper installation of the batteries may result in heat damage to the batteries.**

5. Close the compartment door.

## 2.1.2 Sensor Installation or Replacement

**NOTE: The T-7 oxygen sensor must be installed before the TED 190 can be used. For sterilization procedures, see page 2.8: Sterilization.**

**CAUTION: Do not autoclave the sensor.**

1. Remove the new sensor from its protective bag. Inspect the sensor for damage or electrolyte leakage. If the sensor is damaged, obtain a replacement. Do not use the defective sensor as it may damage the unit.

**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. Consult the Material Safety Data Sheet in the Appendix.**

2. Plug one end of the coiled cable into the telephone jack receptacle on the end of the T-7 sensor. The jack will only fit one way, so if it does not fit, rotate it until it slides in easily.

3. Plug the other end of the coiled cable into the receptacle located on the right-hand side panel of the TED 190. This jack will only fit one way, so do not force it.

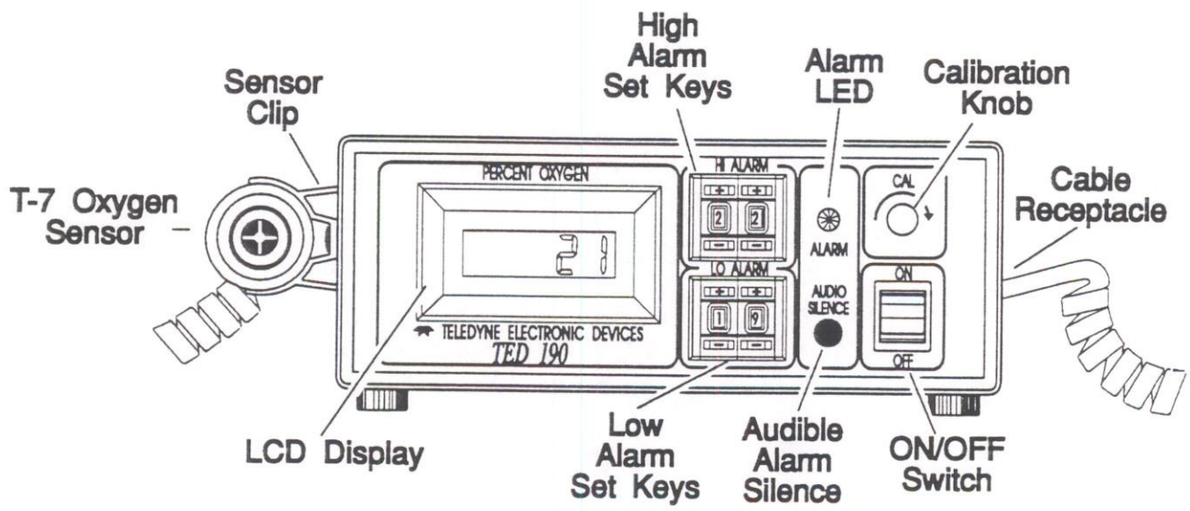


Figure 3: The TED 190 front panel.

**NOTE: If the TED 190 is used for diffusion sampling (i.e., incubators, tents, etc.), the plastic flow diverter must be removed from the T-7 sensor. If the sensor is used in breathing circuits, etc., the diverter must be used, as shown in Figure 4.**

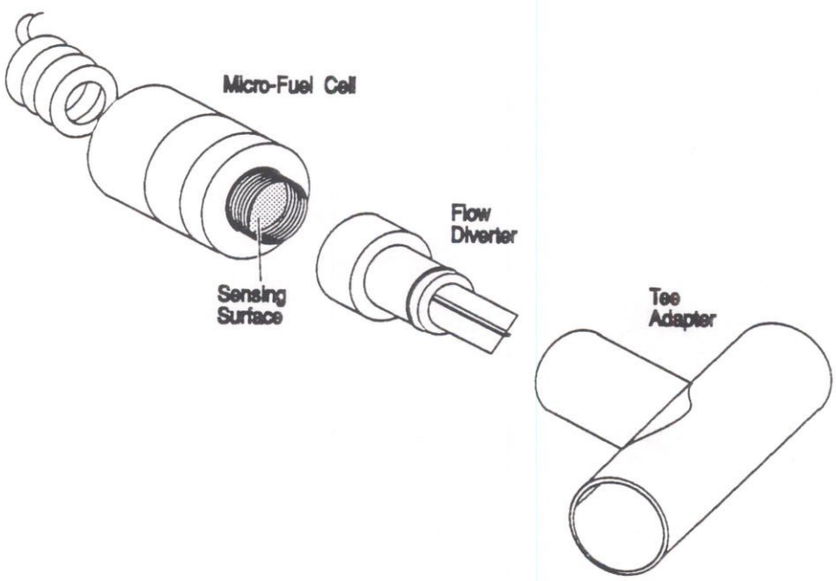


Figure 4: Mounting the sensor in the tee adapter.

### 2.1.3 Calibration

**NOTE: Never expose the sensor to varying temperatures (i.e., never hold the sensor in your hand) while calibrating.**

1. Switch the unit ON.

2. Place the sensor in 100% oxygen.

**NOTE: When calibrating in 100% oxygen TED recommends that the plastic flow diverter and tee adapter be installed into a flowing circuit with pure dry oxygen flowing past the sensor assembly. An accessory calibration assembly (P/N C53790) is available from TED for use where breathing circuits are not normally available.**

3. The CALIBRATE knob is located in the upper right-hand corner of the front panel. Turn the knob by pressing in on it slightly and twisting. Rotate until the display reads 100%.

4. Remove the sensor from 100% oxygen. If the flow diverter is attached, remove it and expose the sensor to room air. The LCD should display 20–22%.

**NOTE: Never calibrate the unit in humidified gas, as water vapor dilutes the oxygen concentration. This can produce errors in calibration. See Appendix: Humidity.**

5. A calibration check may be conducted at any time to assure proper operation. Remove the diverter and expose the sensor to room air, and verify that the reading is 20–22%. Expose the sensor to 100% oxygen (preferably using the diverter and tee adapter in a flow circuit) and verify that the reading is 99–101%.

It is important to perform the calibration carefully and thoroughly, making certain that uncontaminated calibration gases are used and that stable readings are achieved before the calibration is locked in. **The accuracy achievable by the monitor is only as good as the procedure used to calibrate it.**

### 2.1.4 Alarms

Use the + and — buttons on the front panel of the analyzer (see Figure 3 on page 2.3) to set the upper and lower limits of alarm triggering.

**NOTE: Although the LO alarm can be set to read 00, the alarm is pre-programmed to activate at any concentration below 18%.**

During an alarm condition, a HI ALARM or LO ALARM message will display on the LCD. To override the audible alarm, press the AUDIO SILENCE key. The override lasts about 90 seconds, after which the alarm will sound again, unless the triggering condition no longer exists. During alarm silence, the unit will continue monitoring and displaying the oxygen concentration.
To test the alarm, move the LO alarm setting above 21%. This should trigger the alarm.

## 2.2 Use

**NOTE: Prior to use, always test the batteries and alarms; check the calibration; check the sensor for leaks and damage, and check the alarm settings.**

The TED 190 can be used to monitor oxygen in gas mixtures in two basic modes:

1.) In breathing circuits or other instances where gases are flowing in tubing (e.g., breathing circuits).
2.) In confined volumes such as incubators or tents.

When monitoring for oxygen in breathing circuits, the diverter **must** be used. The diverter should be screwed onto the threaded front end of the T-7 sensor. A tee adapter (either plastic, P/N A268, or metal, P/N A283) should be placed into the circuit, and the above sensor assembly plugged into the tee adapter.

**Caution: Check the breathing circuit for leaks. Be certain that the circuit downstream of the sensor does not produce any back-pressure or restriction to gas flow, or errors in readings will result.**

When monitoring for oxygen in confined volumes such as incubators, hoods, etc., the flow diverter must be removed from the T-7 sensor so that it does not interfere with the rapid exchange of gases to and from the sensing surface of the T-7.

**Caution: Failure to remove the diverter in these applications will result in a marked slowing of the sensor response time.**

The T-7 sensor can be placed inside incubators, tents, etc. When it is necessary to thread the cable through a small hole in order to gain access to the inside of a chamber, the cable should be disconnected at the sensor, threaded through the hole, and reconnected inside the chamber.

A calibration check should be performed to assure proper operation. See the calibration procedure, page 2.4.

### 2.2.1 Anesthetic Gases

When using the T-7 sensor in the presence of anesthetic agents, the oxygen reading may fall (see the table below). The magnitude of this error will depend upon the level of oxygen and the duration of exposure.

The anesthetic agents listed in the following table (Halothane, Enflurane, Isoflurane, and Methoxyflurane) were vaporized into a stream of 100% oxygen, and the resulting drops in oxygen level after an exposure time of approximately two hours were noted. A level of 50% oxygen would be expected to have only half the error, etc.

Exposures in excess of two hours will produce slightly greater error. The errors listed are typical for all membrane-clad oxygen sensors such as the T-7. Exposing the sensor to air or gases that do not contain anesthetic agents for a period of time equal to or greater than the exposure interval will eliminate the reading error in most cases.

*Gases that induce reading error*

| Gas or Vapor | Test Level (balance oxygen) | Oxygen Reading Error * |
|---|---|---|
| Nitrogen | 80% | 0% |
| Helium | 80% | 0% |
| Nitrous Oxide | 80% | 0% |
| Carbon Dioxide | 10% | 0% |
| Halothane | 5% | -2% |
| Enflurane | 3% | -1% |
| Isoflurane | 5% | -2% |
| Methoxyflurane | 2% | -.5% |

*Errors are approximate and may vary based on exposure times and concentrations.

**CAUTION: The TED 190 should not be used in the presence of flammable anesthetics such as diethyl ether or cyclopropane.**

*Care after use in nitrous oxide*

The **T-7 sensor should not be left in nitrous oxide** mixtures any longer than absolutely necessary. After exposure to nitrous oxide mixtures, the sensor should be left in 100% oxygen overnight (e.g., left in a breathing circuit that has been flushed with pure oxygen). If the oxygen reading continues to drop after each use in nitrous oxide, the sensor should be removed from service. If the sensor can no longer be calibrated or if there is any sign of electrolyte leakage, the sensor should be disposed of in accordance with local regulations and the Material Safety Data Sheet (MSDS) located in **Chapter 4.0: Appendix**.

### 2.2.2 Sterilization

The T-7 sensor and interconnecting cable may be gas sterilized using low temperature ethylene oxide. A vacuum must not be drawn on the sensor during the sterilization process.

The TED 190 itself cannot be liquid sterilized or autoclaved. The surface of the case may be wiped with isopropyl alcohol and allowed to air dry. In extreme cases, a mild detergent may be used.

## 2.3 Do's and Don'ts

DO:

- Read all of the directions before using for the first time.
- Calibrate every 8 hours or before every use.
- Check the HI and LO alarm settings prior to each use.
- Replace batteries immediately when indicated.
- Keep the unit, sensor and connections dry.
- Install the sensor on the dry side of the breathing circuit.
- Recalibrate after replacing the batteries.
- Recalibrate after replacing the sensor.
- Use properly installed batteries.
- Make sure the T-7 sensor is properly attached.
- Visually inspect the sensor for leakage before each use.
- Use the plastic flow diverter only when using the tee adapter.
- Remove and save the plastic flow diverter when using the unit in chamber applications (incubators, tents, etc.)
- Perform an alarm test before each use. See section 2.1.4.
- Clean the case with isopropyl alcohol or mild detergent only.

DON'T:

- Use the TED 190 if you suspect any malfunction.
- Use the TED 190 in the presence of flammable gases.
- Autoclave or freeze the T-7 sensor or TED 190 unit.
- Open or try to repair a leaking or broken sensor.
- Immerse the unit or sensor in any liquid.
- Pass hot or cold gas mixtures over the sensor.
- Expose the unit to devices that produce high levels of radio, short wave, microwave, x-ray, or high frequency interference.
- Use cleaning agents or liquids in the cable receptacles or around the battery compartment.
- Place the TED 190 unit itself in a water vapor-saturated environment.
- Expose the LCD to excessive sunlight.
- Expose the TED 190 to a condensing water environment such as a mist tent.

## Maintenance and Troubleshooting

### 3.1 Maintenance: Batteries

**DO:** Replace batteries immediately when indicated.
**DO:** Recalibrate after replacing batteries.

When the battery voltage becomes low, a LO BATT message will display until the batteries are replaced.

Even though the unit is protected against reverse insertion of the batteries, doing so will render the unit inoperative.

**NOTE: If the TED 190 will not be used for a period of 30 days or more, the batteries should be removed prior to storage.**

Remember, the unit must be calibrated after the batteries are replaced.

### 3.2 Maintenance: Sensor

**DO:** check the sensor for damage or leaks before use.
**DO:** recalibrate after replacing the sensor.
**DON'T:** immerse the T-7 sensor in liquid.
**DON'T:** autoclave the T-7 sensor.
**DON'T:** open or try to repair the sensor.

Before every use, the sensor, cable and connections should be checked. Check the sensor for leaks and water condensation on the sensing surface. Check the cable for splitting or cracked insulation. Make sure the connections are tight and dry.

In the event that the sensor has been damaged, consult the Material Safety Data Sheet in the Appendix for handling guidelines.

### 3.3 Maintenance: TED 190 unit

The TED 190 unit itself requires very little maintenance, other than changing the batteries and cleaning of the plastic housing, which can be done with isopropyl alcohol. Should any part of the instrument malfunction or fail to perform, the unit should be removed from service.

### 3.4 Troubleshooting Table

| Symptom | Why | What to Do |
|---|---|---|
| A new sensor will not calibrate in air. | A) A new sensor must be allowed to stabilize prior to calibration. | A) Wait 1–2 minutes and try again.<br>B) Oxygen concentration at the sensor is significantly higher than 21%. Take the instrument to a well-ventilated area and repeat the calibration. |
| The unit will not calibrate in 100% oxygen.<br><br>Drifts off calibration setting. | A) The sensor must be allowed to stabilize in 100% oxygen before calibration is attempted.<br>B) The oxygen concentration at the sensor is less than 100%. | A) Wait 1–2 minutes or until the oxygen concentration reading is stable.<br>B) Make sure that at least 12" (30 cm.) of tubing is attached to the exhaust side of the tee adapter to prevent backfilling. $O_2$ flow rate should not exceed 5 l/min.<br>C) Prevent dilution of gas with $H_2O$ vapor by removing humidifiers, nebulizers, etc. Check for leaks or open circuits. |
| Drift in oxygen reading during or immediately after calibration. | A) Holding the sensor in your hand will cause the ambient temperature compensation circuit to activate. | A) Do not hold sensor while calibrating.<br>B) Try calibrating a known good sensor; if this fails, see symptom "Reading drifts over 2–3%..."<br>C) Repeat calibration.<br>D) Replace sensor. |
| The TED 190 does not react to changes in oxygen concentration, or the readings are unstable and drifting. | A) Holding the sensor in your hand will cause the ambient temperature compensation circuit to activate.<br>B) This is typical of all $O_2$ sensors when they become flooded. See Appendix: Humidity.<br>C) Radio frequency interference (RFI). | A) Remove T-7 sensor from tee adapter and unscrew the plastic flow diverter. Using absorbent tissue or cotton swab, gently wipe off sensing surface inside threaded portion of sensor assembly. Flow dry gas over sensing surface or allow sufficient time for sensor to dry completely.<br>B) Relocate unit away from sources of RFI. |

## 3.0 Maintenance and Troubleshooting

| Symptom | Why | What to Do |
|---|---|---|
| The oxygen reading fluctuates or appears to be incorrect. | Like all $O_2$ sensors, the T-7 detects the changes in the partial pressure of $O_2$. See Appendix: Pressure. | A) During calibration, make sure there are no restrictions on exhaust side of sensor. If the reading changes with flow, the sensor is pressurized or there may be a leak in the system.<br>B) If humidified gas is used to ventilate the patient, water vapor actually dilutes the gas. See Appendix: Humidity, Temperature.<br>C) If a blender is used, check its calibration. See Appendix: Discrepancy in Readings. |
| No display. | A) Batteries expired.<br>B) Bad battery connection. | A) Check/replace batteries.<br>B) Check battery connections. |
| Unit reads 00 and alarms sound/flash continually. | A) Sensor is not plugged in.<br>B) Sensor cable is not plugged in or bad connection. | A) Check and reconnect, then calibrate.<br>B) Replace cable or sensor (depending upon location of bad connection). |
| Reading drifts over 2–3% over a period of 3–4 hours. | A) Intermittent cable connection.<br>B) Intermittent sensor connection.<br>C) Expired sensor | A) Replace cable.<br>B) Replace sensor.<br>C) Replace sensor. |
| Alarms continually activate when oxygen concentration is less than 18. | | The TED 190 is designed to automatically set off the alarms for concentrations lower than 18. |

**NOTE: In the event that none of these procedures produce desired results, remove the batteries and return the unit to Teledyne for repair.**

## Appendix

### Specifications

| | |
|---|---|
| **Range:** | 0-100% oxygen |
| **Accuracy:** | ±2% of full scale for 8 hours at constant temperature |
| **Response Time:** | 90% in less than 10 seconds (typically 6–8 sec.) |
| **Display Resolution:** | Nearest whole number |
| **Battery Type:** | 9-volt |
| **Battery Life:** | Approximately 1,000 hrs. continuous use in non-alarm conditions (two 9-volt batteries required) |
| **Humidity range:** | 0–95% RH |
| **Expected Sensor Life:** | 1 year in most applications |
| **Sensor Type:** | Class T-7 (Galvanic) |
| **Dimensions:** | 7" W × 5" D × 2-1/2" H (178 mm × 127 mm × 63½ mm) |
| **Weight:** | 1.5 lbs. |
| **Cable Length:** | Retracted: 2 ft.<br>Extended: 10 ft. |
| **Storage Temp.:** | 0-50°C (Recommended Temp. 10-30°C) |
| **Operating Temp.:** | 0-40°C |
| **Alarm Indicators:** | Audible (with silencer)/Visible |
| **Analog Output:** | 0–100 mV |

# 4.0 Appendix

## Spare Parts List

| QTY | PART NO. | DESCRIPTION |
|---|---|---|
| 1 | A51327 | Micro-Fuel Cell T-7 with flow diverter P/N A50057 |
| 1 | B326 | 9-volt battery |
| 1 | C885 | Cable assembly |
| 1 | A268 | Tee adapter (22 mm) |

## Optional Accessories

| | | |
|---|---|---|
| 1 | B34102 | Mounting clamp |
| 1 | A51589 | T-7 adapter cap, female (22 mm) |
| 1 | A51588 | T-7 adapter cap, male (22 mm) |
| 1 | C53790 | Calibration assembly |
| 1 | A284 | Universal adapter set for pediatric circuits (15mm) |
| 1 | A274 | Tee adapter, autoclavable |
| 1 | A283 | Tee adapter, metal |

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

**IMPORTANT: Orders for replacement parts should include the model number, serial number, and range of the analyzer for which the parts are intended.**

Orders should be sent to:

TELEDYNE ELECTRONIC DEVICES
16830 Chestnut Street
City of Industry, CA 91749-1580
Phone (818) 961-9221
FAX (818) 961-2538
TWX (910) 584-1887 TDYANLY COID
or your local representative

## Pressure

Virtually all gas sensors and analyzers measure the partial pressure, not the precentage, of the gas that they sense. The only time that these instruments can accurately read percentages is when the total pressure does not vary over time between calibration and use. This is why it is important to calibrate the TED 190 oxygen sensor at regular intervals. **It is recommended that the unit be calibrated prior to each use or every 8 hours.**

When the sensor is connected to a ventilator circuit, the alternating "breathing" pressure cycles generated by the ventilator will be sensed as an increase in the oxygen percentage (especially if the sensor is fast enough to sense the changes, as is the T-7). In reality, the percentage of oxygen in not changing; it is the total pressure that is increasing, producing a corresponding increase in the partial pressure of oxygen. A hundred-centimeter water pressure pulse will produce a .11 atmosphere, or an 11% increase in the total and therefore partial pressure of oxygen. Assuming that the sensor is fast enough to track this pressure pulse, an unpressurized reading of 50% oxygen will increase to 55.3% if the sensor is subjected to a pressure cycle of 100 cm $H_2O$. The reading will rise proportionally less for smaller pressures.

## Humidity

Humidity does not directly affect the accuracy of the sensor's measurement. However, when a nebulizer or other device is used to increase moisture levels in gas mixtures, the moisture actually dilutes the mixture. This dilution effect decreases the oxygen concentration.

For example, if an 80% oxygen gas mixture is humidified to saturation at room temperature, the resulting gas mixture will contain only 77.5% oxygen. Your TED 190 oxygen monitor accurately measures decreases in the oxygen concentration due to the dilution effects of moisture added to gas mixtures.

As with all oxygen sensors, excessive condensation on the sensing surface of the T-7 will block the diffusion of oxygen to the sensor, rendering it inoperative. TED recommends installing the sensor on the dry side of the breathing circuit at all times.

Water condensate on the exposed cable contacts at the rear of the sensor may affect the oxygen reading and should be removed by shaking out the condensed water and allowing the sensor to air dry.

# 4.0 Appendix

## Temperature

The T-7 oxygen sensor adjusts for ambient temperature changes in the range of 0–40°C (32–106°F). Since the thermistor that compensates for these changes is located in the rear of the sensor assembly, it is important that gas mixtures, flowing over the front of the sensor, be at room temperature. Reading errors may occur if hot gases from a heated humidifier are directed past a sensor teed into a breathing circuit.

A small thermal tracking error may be encountered in applications where the entire sensor assembly is placed in the gas mixture to be analyzed (e.g., incubators). No adjustments should be made during this period (about 1 to 2 hours), since this error will be eliminated when both the thermistor and sensing electrode have had sufficient time to come to thermal equilibrium.

## Discrepancy in Readings

The TED 190 is intended to be used as a **secondary** oxygen monitor, meaning that it is intended to verify the accuracy of and check the oxygen concentration leaving another oxygen mixing device or primary life support system (i.e., a blender or anesthesia machine). Whenever there is a significant difference in the oxygen readings between the primary and secondary monitors, the discrepancy must be resolved immediately. The information obtained from the TED 190 should never be used to make adjustments to the primary life-support system, but should only be used as an indication that the primary device **may** require service and/or calibration.

The LO BATT message immediately tells you if the batteries need replacing. The TED 190 should momentarily be removed from the application area and the batteries replaced. If the TED 190 can be calibrated, the unit can be assumed to be in good working order and capable of providing readings to specification. If, after reinstalling the TED 190, the discrepancy in oxygen readings persists, the problem is most likely elsewhere (i.e., flow blockage, primary device error, etc.). Further investigation should be made until the discrepancy in readings is resolved.

If it is found that replacing the sensor and/or batteries does not give proper calibration results, the troubleshooting section of this manual should be consulted.

## 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
Oxygen Sensors, all classes.

**Manufacturer:** Teledyne Electronic Devices
**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 Hydoxide (KOH), 15% (w/v)
Lead (Pb), pure
CAS Number: KOH 1310–58–3
Pb 7439–92–1

| | KOH | Pb |
|---|---|---|
| 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

| | |
|---|---|
| **Primary route of entry:** | Ingestion, eye/skin contact |
| **Exposure limits:** OSHA PEL: | .05 mg/cu.m. (Pb) |
| ACGIH TLV: | 2 mg/cu.m. (KOH) |
| **Effects of overexposure** | |
| **Ingestion:** | The electrolyte could be harmful or fatal if swallowed.<br>Oral LD50 (RAT) = 3650 mg/kg |
| **Eye:** | The electrolyte is corrosive; eye contact could result in permanent loss of vision. |
| **Dermal:** | The electrolyte is corrosive; skin contact could result in a chemical burn. |
| **Inhalation:** | Liquid inhalation is unlikely. |
| **Signs/symptoms of exposure:** | Contact with skin or eyes will cause a burning sensation and/or feel soapy or slippery to touch. |
| **Medical conditions aggravated by exposure:** | None |
| **Carcinogenity:** | NTP Annual Report on Carcinogens: Not listed<br>LARC Monographs: Not listed<br>OSHA: Not listed |
| **Other health hazards:** | 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 Electronic Devices shall not be held liable for any damage resulting from handling or from contact with the above product.**