

# Advanced Amperometric Oxygen Sensors

## Replacement Membranes and Polarization Modules

### OXYGOLD Membrane Kit

3 OXYGOLD membranes, spare o-ring, pipette. Electrolyte must be ordered separately.



### OXYFERM Membrane Kit

3 membrane bodies, Oxylyte, pipette, spare o-ring, polishing strip



### Membrane Kit CIP

As above, but with a special membrane for intensive CIP cleaning



### Membrane Kit FDA

FDA membrane material and rounded design to prevent accumulation of gas bubbles



### Polarization modules

These prepare replacement sensors not connected to an amplifier for immediate use



Name	Order No.
OXYGOLD MEMBRANE KIT	237 135
OXYFERM MEMBRANE KIT	237 123
MEMBRANE KIT CIP	237 126
MEMBRANE KIT FDA	237 140
POLARIZATION MODULE T for OXYFERM /~FDA/~XL	237 370
POLARIZATION MODULE G for OXYFERM VP, OXYGOLD G	237 350
POLARIZATION MODULE B for OXYGOLD B	237 360

### Accessories:

OXYGOLD OXYLYTE G 50 mL	237 139
OXYGOLD OXYLYTE B 50 mL	237 138
OXYFERM OXYLYTE 50 mL	237 118
OXYLYTE USD 50 mL	237 136

## OXYGOLD G

Dissolved oxygen sensor for general use in trace measurement

O<sub>2</sub>: 1 ppb to saturation or  
0.012% - 200% of air oxygen  
0 - 130°C, max. 12 bar  
TC: NTC 22 kOhm

- Developed for use in power plants, chemical, pharmaceutical and semiconductor industries
- Suitable for use at high temperatures, high pressures, during sterilization and CIP
- Easy to maintain
- Inner body can be replaced by user
- Little flow sensitivity
- Fast response time: t<sub>98%</sub> < 60 sec.
- Materials and inspection certificate
- 12 mm shaft diameter, VP plug



Name	Order No.
OXYGOLD G 120	237 395
OXYGOLD G 225	237 396

### Accessories:

OXYGOLD MEMBRANE KIT	237 135
OXYLYTE G 50 mL	237 139
POLARIZATION MODULE G	237 350
Replacement Cathode OxyGold G	237 427
HYGIENIC SOCKET™ (page 38)	
RETRACTEX™ (page 46)	
Connecting cable (page 37)	

## OXYGOLD B

Dissolved oxygen sensor for measurements in media containing acidic gases CO<sub>2</sub>, in beer

O<sub>2</sub>: 8 ppb to saturation or  
0.1% - 200% of air oxygen  
0 - 100°C, max. 12 bar  
TC: NTC 22 kOhm

- Absolutely no cross-sensitivity to CO<sub>2</sub>
- Developed for use in brewing, Cola, fruit-juice, sparkling wine and special chemical processes
- Pressure and CIP stable
- Easy to maintain
- Inner body can be replaced by user
- Shortest response time on the market from air to pure CO<sub>2</sub>: t<sub>98%</sub> < 60 sec
- Materials and inspection certificate
- Works with the same polarization voltages in calibration and measurement. So you don't get false measurement values when measuring in samples like beer.
- 12 mm shaft, VP plug



Name	Order No.
OXYGOLD B 120	237 180
OXYGOLD B 225	237 185

### Accessories:

OXYGOLD MEMBRANE KIT	237 135
OXYLYTE B 50 mL	237 138
POLARIZATION MODULE B	237 360
Replacement Cathode OxyGold B	237 437
HYGIENIC SOCKET™ (page 38)	
RETRACTEX™ (page 46)	
Connecting cable (page 37)	

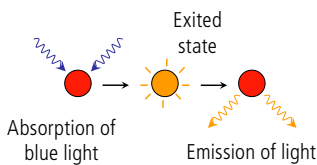
# HAMILTON VISIFERM™ DO Sensors

## Optical oxygen measurement with built-in analyzer, in 12 mm format

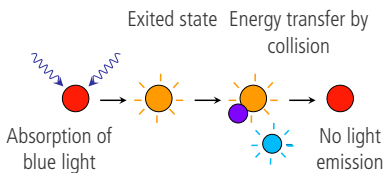
With VISIFERM™ DO, HAMILTON is the first company to offer self-contained oxygen measurement in the popular 12 mm format similar to standard process pH electrodes. Combined in the VISIFERM™ sensor shaft are: high-temperature-resistant optical electronics, microprocessor, 4 to 20 mA analog output, digital RS 485 interface with ModBus protocol, and ECS interface. ECS stands for Electro-Chemical Sensor. Use of the 4 to 20 mA analog output or the digital RS 485 interface (both integrated into the 12 mm shaft) makes an external measurement amplifier unnecessary, allowing measurement signals to be fed directly into a process control system.

### VISIFERM™ DO measurement principles

The unique design of VISIFERM™ DO enables HAMILTON to monitor the status of the sensor's blue LED using one of the photodiodes. The other photodiode with the red filter measures the oxygen-dependent red light generated on the luminophore through luminescence (fluorescence) caused after excitation by the blue light. Electrons are excited to a higher energy level, and return to their original level after emission of red light.

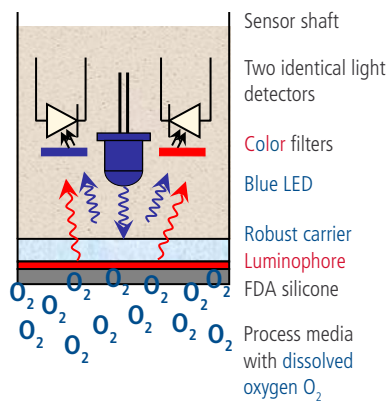


When the luminophore comes into contact with elemental oxygen, the O<sub>2</sub> molecules absorb the increased energy, thus preventing the emission of red light. Therefore, the amount of Oxygen is inversely proportional to the intensity and duration of the luminescence.



### 2-channel optics for optimal function and diagnostics

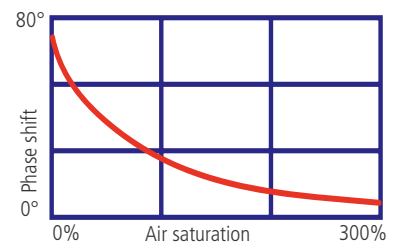
HAMILTON chose a mechanically- and thermally-stable symmetrical design directly in the sensor casing.



High precision measurement of the optical phase shift between the blue and red light pulses provides accurate indication of oxygen concentration.

The difference in intensity is analyzed by the instrument's self-monitoring system to pinpoint photobleaching (bleaching of the luminophore).

Measurement, calculation, and output of the measured value occur entirely inside the sensor.



Notice that VISIFERM™ DO sensors measure the partial pressure of oxygen (pO<sub>2</sub>) just like classical sensors. This can be displayed as % air saturation, concentration in mg/l, ppm, or even as ppb.

The measurement range is from 0.05% to 300% air saturation (4 ppb to 25 ppm).

### Application fields

VISIFERM™ DO sensors have been evaluated in a variety of applications:

- Biotechnology. VISIFERM™ DO sensors are developed to be steam-sterilized, autoclaved and cleaned in place (CIP) without difficulty. Therefore VISIFERM™ DO is ideal for use in fermenters and similar demanding applications.
- Waste water treatment.
- Ground water monitoring.
- River water monitoring.
- Breweries.

With the standard design form of a classical 12 mm sensor with PG 13.5 thread VISIFERM™ DO can be used with existing armatures.



Comparison of VISIFERM™ DO (top) and a classical DO sensor (bottom)

# Optical, Sterilizable Oxygen Sensor

## Operational reliability is paramount

A comparison with classical measurement technology

The most common malfunction of classical Clark Cells is caused by damage to the mechanically sensitive oxygen membrane. VISIFERM™ DO does not suffer from this problem, because it has no fragile membrane and no electrolyte; instead, it has a robust, solid Sensor Cap.

Cable transmission of very low Clark Cell currents to amplifiers represents a further problem. Measurement results of VISIFERM™ DO can be sent from the sensor as robust 4 to 20 mA analog, or digital signals. Both are far more tolerant of difficult process conditions than the sensitive (nA) signals of a classical electrochemical dissolved oxygen sensor.



Blue light: A decisive part of the VISIFERM™ measurement principle.

## Technology that sets new standards

### Intelligent Sensor

VISIFERM™ DO gives the designation 'intelligent sensor' new meaning, with respect to its integrated functionality:

- Precise measurement optics, stable up to 130°C, built into a 12 mm shaft.
- Easily replaceable Sensor Cap containing the sensing element.
- Monitoring of all sensor functions, status of the replaceable Sensor Cap.
- Configurable using the RS 485 interface with notebook, PC or by using the Modbus RTU connection from the process control system.
- Saving of all process relevant information: Sensor and calibration data, operating hours, cleaning and sterilization cycles, etc.
- Compatible with new ARC System products:
  - ARC View Handheld
  - ARC Wi Sensor Adapter
  - ARC Sensor Configurator



VISIFERM™ with different shaft lengths.

# VISIFERM™ DO – All-in-One Sensor

## Three options to connect

### Fieldbus:

VISIFERM™ DO offers the widely-used Modbus RTU interface, enabling up to 32 sensors or other devices to be wired onto the same bus, in a highly cost-effective installation. The Modbus interface offers users comprehensive information, including input from the sensor's diagnostics and health indicator. Numerous gateways are available to interface Modbus to Foundation Fieldbus, Profibus, and others.

### Robust 4 to 20 mA current:

Connects VISIFERM™ DO directly to a PLC or PCS, with no transmitter.

### ECS:

The Electro-Chemical Sensor interface connects VISIFERM™ DO to traditional transmitters/analyzers for electrochemical oxygen sensors. ECS option can be selected using the ARC Sensor Configurator™.

## Safe trace measurements

Trace measurements with classical sensors are not considered particularly accurate or safe, since in the absence of oxygen, no O<sub>2</sub> molecules are reduced, so no electrical current can flow. The same happens when a cable breaks.

VISIFERM™ DO does not suffer from these problems because it is at low oxygen concentrations that the greatest amount of red light is emitted, and the measured phase shift is at its greatest.

## Operational reliability and simple maintenance

User friendliness is a critical quality in a sensor. Every procedure made redundant signifies an increase in operational reliability. Achieving simple maintenance is of particular value.

When a problem occurs during the night shift, with only limited personnel available to perform maintenance and calibration, VISIFERM™ DO really helps. All you have to replace is a Sensor Cap, and it is as quick and easy as opening and closing a bottle of soda: the Sensor Cap twists off, and the new one twists on. Job done. You need only perform calibration in air, although ideally, also in nitrogen or carbon dioxide. The sensor can be conveniently calibrated in the laboratory and remains calibrated for the next process run.

**Interfaces**

- Modbus Fieldbus
- 4-20 mA (Namur)
- ECS (Clark cell simulation)
- Power supply

**Memory**

- Calibration data
- Cap wear
- CIP & SIP counter
- Alarm history
- TAG#, Serial#, ...

**Processor**

- Calibration
- Sensor health
- Password check
- Watch dog

**Optics**

- Dual channel
- Self diagnostics
- Diagnostics for luminophore

**Cap**

- Replaceable
- Robust, sensing Luminophore
- FDA conform materials only

VISIFERM DO 120  
HAMILTON P/N: 242450

# Optical, Sterilizable Oxygen Sensor

## VISIFERM™ DO accessories

### Sensor Cap



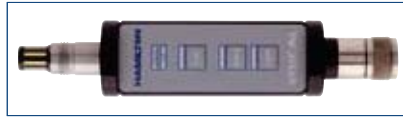
With VISIFERM™, there is only one consumable. Under normal conditions, even with frequent steam sterilizing, autoclaving, and CIPs, the Sensor Cap has a lifetime of more than one year.

### Sensor cable VP 8.0



Various lengths available, see page 37.

### VISICAL™ calibration tool



Simplifies air and zero point calibration when using the 4 to 20 mA interface, or when precalibrating the sensor in a laboratory. It also displays overall sensor status, and indicates when a Sensor Cap needs to be replaced soon.

### VISIFERM-D4 power adapter

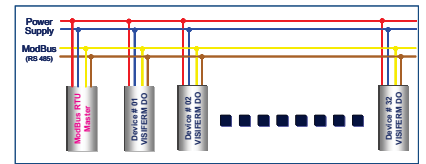


Connects VISIFERM™ DO in ECS mode to the cable of classical sterilizable oxygen sensor with four-pole plug (D4, T82) such as HAMILTON's OXYFERM FDA. Includes a wall plug power supply.

### USB-RS485 Modbus converter

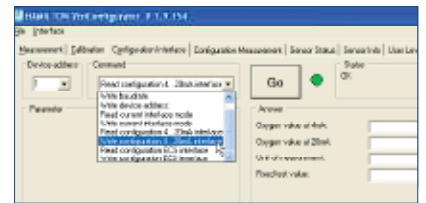


Connects the VISIFERM™ DO to a PC with USB port.



The PC acts as a Master, using ARC Sensor Configurator™ freeware or any other Modbus terminal software.

### ARC Sensor Configurator™ freeware



## Why users are excited about VISIFERM™ DO:

### Application:

- No fragile membrane – with a solid Sensor Cap
- Instantly stable values, low drift, quick response
- Flow-independent
- Electrolyte-free, so no leakage
- No H<sub>2</sub>S or CO<sub>2</sub> effect

### Maintenance:

- Just one single, simple, replaceable spare part – the robust Sensor Cap
- Convenient calibration in the laboratory, because calibration data is stored in the sensor
- Precalibrated, ready-to-use sensors from stock minimize service time and costs

### Installation:

- Backwards compatible with classical oxygen sensors, operates with traditional transmitters and SOPs, or -
- Can be connected directly to a PLC or PCS using a 4 to 20 mA or Modbus RTU interface

## Name

VISIFERM™ DO 120  
 VISIFERM™ DO 160  
 VISIFERM™ DO 225  
 VISIFERM™ DO 325  
 VISIFERM™ DO 425

OX:

01: Mode 4 - 20mA

02: Mode ECS

## Accessories:

VISICAL™ calibration tool 242 410  
 USB-RS485 Modbus converter 242 411  
 4-20 mA galvanic isolation amplifier 242 412  
 VISIFERM™-D4 power adapter 242 413  
 VISIFERM™ replacement sensor cap 242 427

## Connecting cables:

Demo cable (1m, open end) 355 194  
 Demo cable (1m, BNC plug, e.g. for Applikon) 238999-2767  
 Demo cable (1m, for New Brunswick-Fermenter) 238999-2768  
 Sensor cable VP 8.0, various lengths View page 37

## Order No.