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VISIFERM™ DO

智能光学溶氧传感器

光学溶氧传感器以及集成传感器

VISIFERM™ DO:智能，光学，溶氧
Optical oxygen measurement with built-in analyzer, in 12 mm format
12mm 规格内置检测器的光学溶氧传感器
With VISIFERM™ DO, HAMILTON is the first company to offer a self-contained oxygen measurement in the popular 12 mm format similar to standard process pH electrodes and classical sterilizable oxygen sensors. 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.
智能光学溶氧传感器（VISIFERM™ DO）的推出，使 HAMILTON 成为第一家能提供与标准在线 pH 电极和经典灭菌型溶氧电极相类似的 12mm 规格内置溶氧检测器的公司。智能光学溶氧传感器集成了以下优势：耐高温光电装置，微处理器，4 至 20 毫安模拟输出，支持 ModBus 模式的 RS485 数字接口，ECS 接口。

The Electro-Chemical Sensor (ECS) interface allows VISIFERM™ DO to be connected to existing classical measurement amplifiers designed for sterilizable oxygen sensors, such as the HAMILTON OXYFERM™. 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.
电化学传感器（The Electro-Chemical Sensor，ECS）接口实现了 VISIFERM™ DO 与现有用于灭菌传感器的变送器（如 HAMILTON OXYFERM™）连接。通过 4 至 20 毫安模拟输出装置或 RS485 数字接口可直接将检测信号输出到过程控制系统，而无需使用变送器。

Clear favorite in comparison

优点对比

HAMILTON has successfully manufactured steam-sterilizable, autoclavable,
CIP-compatible sensors for pH, oxidation/reduction, conductivity, and oxygen measurement
for many years. These classical oxygen sensors are based, as is common in the industry, on Clark Cell technology, in which oxygen diffuses through a membrane and is reduced electrochemically on a precious metal. The electrons involved in this process generate a very small current (nanoamperes) which is converted to an oxygen measurement signal by a measurement amplifier.
HAMILTON 已成功生产出用于检测 pH 值，氧化还原电位，电导率和溶解氧的优质传感器，具有蒸汽灭菌，耐高压，CIP 兼容的优点。溶氧传感器大都采用极谱技术，该技术的基本原理是氧气通过膜扩散并在阴极发生还原反应。在这个过程中电极产生微弱的电流，该电流信号再通过变送器转换成氧气浓度的信号。
Sensors such as these have served well for decades, but have their limitations. VISIFERM™ DO optical sensors demonstrate a number of substantial advantages. This is because users of the VISIFERM™ DO receive more than just a sensor based on a new measurement principle. VISIFERM™ DO is a symbiosis of sensor and measurement amplifier—an intelligent sensor.
虽然极谱式溶氧传感器已有几十年的应用历史，但是它们也存在一些不足之处。实践已证明

VISIFERM™ DO 光学溶氧传感器在技术上具有明显优势。因为 VISIFERM™ DO 的用户得到不仅仅是一种基于新型检测技术的传感器而是更多。VISIFERM™ DO 是传感器和变送器的组合体—智能传感器。

Application fields

应用领域

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

VISIFERM™ DO 传感器已被广泛应用于各种领域：

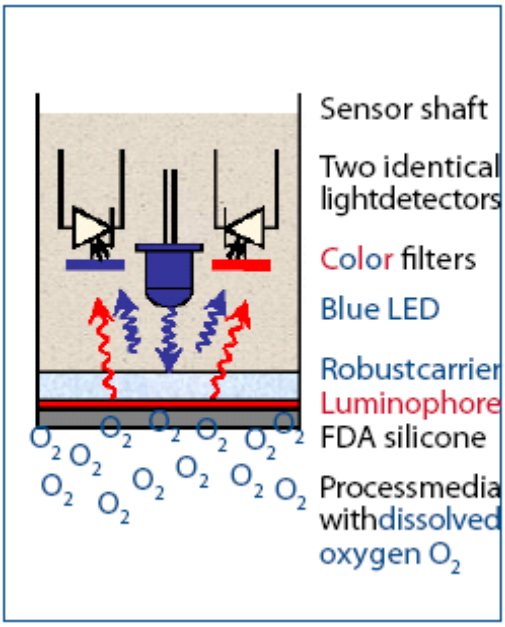
Biotechnology. VISIFERM™ DO sensors are developed to be steam sterilized and autoclaved without difficulty. CIP cleaning is also tolerated very well. These properties, along with the standard design form of a classical 12 mm sensor with PG 13.5 thread, make VISIFERM™ DO superior for use in fermenters and similar demanding applications.

- 生物技术：VISIFERM™ DO 传感器具有易消毒、耐蒸汽灭菌和 CIP 清洗的优点。使用 PG13.5 连接线的 12mm 口径标准规格和上述优点使 VISIFERM™ DO 在发酵罐和其它类似应用中优势格外突出。
- Waste water treatment.
- 污水处理
- Ground water monitoring.
- 地下水监测
- River water monitoring.
- 河水监测
- Breweries. VISIFERM™ DO is already being used to monitor carbon dioxide recovery, and is finding further application in the wort tank. Installations in the area of beer and beverage bottle filling are still in various test runs.
- 酿酒行业。VISIFERM™ DO 可用于监测二氧化碳回收及麦芽罐中的深入应用。用于罐装啤酒和饮料行业的检测设备目前正处在测试开发阶段。
- Cooling water cycles, found in power plants and other applications for trace measurements, are also performing reliably and well.
- 电厂和其它微量检测领域的循环冷却水也有许多成功案例。
- Gas monitoring applications depend on the composition of specific samples.
  All installations are satisfactory.
- 所有设备均满足基于特定样品组成的气体监测

Lightning bright optics

While other suppliers of optical oxygen sensors utilize fragile optical fibers, a single light channel, or two different LEDs, HAMILTON prefers a mechanically- and thermally-stable symmetrical design.

其它光学溶氧传感器生产商一般采用光纤、单光束或发光二极管技术，而 HAMILTON 热衷于机械和热稳定的对称设计。



Symmetrical dual channel optics for perfect function and diagnostics
优异功能和精确诊断的对称双通道光学系统

Comparison of optical dissolved oxygen (top) and a classical (bottom) Clark Cell sensor

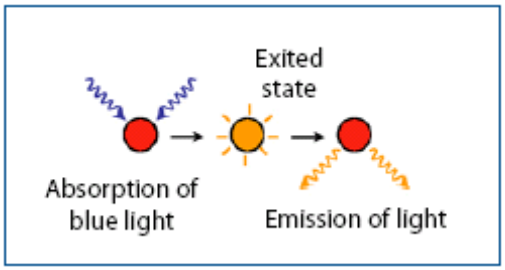
对比光学溶氧传感器（上部）和传统极谱溶氧传感器（下部）

VISIFERM™ DO

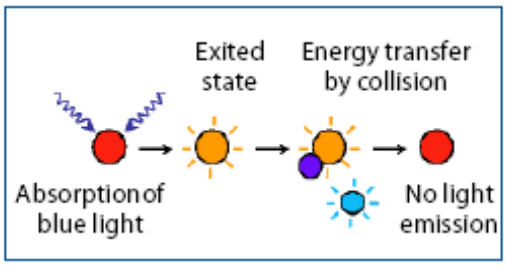
measurement principles
检测原理

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

VISIFERM™ DO 的独特设计使 HAMILTON 能够通过光敏二极管监控传感器兰光二极管的状态。带红光过滤器的光敏二极管通过由兰光激发后发光体所发的红光来检测氧的含量。电极被激发到更高能级，然后发射红光后回复到基态。



When the luminophore comes into contact with elemental oxygen, the O_2 molecules absorb the energy, resulting in reduced intensity of red light emission.
当发光体和氧原子碰撞，氧分子吸收能量并导致红光光强减弱。



This difference in intensity is analyzed by the instrument’s self-monitoring system to pinpoint photobleaching (bleaching of the luminophore). High precision measuremet of the optical phase shift between the blue and red light pulses provides accurate indication of oxygen concentration. Normally, the luminophore’s excited electrons remain in this state for some time. However, in the presence of oxygen they return to their ground state more quickly. Between the pulsed excitation of the luminophore with blue light and the emission of red light, there is an oxygen-dependent time shift which can be measured as an angle of phase. Measurement, calculation, and output of the measured value occur entirely inside the sensor.
仪器的自动监测系统可通过分析光强的变化来确定光淬灭的量。兰光和红光相位移的精准测量可准备推算氧的浓度。一般发光体的激发态电极在一段时间内可保持这种状态。但是，在有氧条件下，激发态回到基态的时间会变的更短。由兰光激发的发光体和发射红光之间，存在和氧浓度有关的时间位移，该位移可称为相角。在传感器内检测、计算和输出是一气呵成的。

Notice that VISIFERM™ DO sensors measure the partial pressure of oxygen (pO2) just as classical sensors do. This can be displayed as % air saturation, concentration in mg/l, ppm, or even as ppb. The measurement range is currently limited to 0.05% to 300% air saturation (4 ppb to 25 ppm). For most applications this measurement range is more than adequate. When calibrating the sensor well, the limit is even below 1 ppb.
和其它传感器一样，VISIFERM™ DO 传感器也可检测氧的分压。分压可显示为饱和空气百分比，浓度可以 mg/L，ppm 甚至 ppb 表示。目前测量范围限制在 0.05% to 300%饱和空气(4 ppb to 25 ppm)。该测量范围适用于大多数应用。如果传感器校正完好，检测下限甚至低于 1 ppb。

Operational reliability is paramount
极为重要的操作稳定性
A comparison with classical measurement technology
和传统检测技术的对比
The most common malfunction of classical Clark Cells is caused by damage to the mechanically sensitive oxygen membrane. If a membrane is seriously damaged, the chances are good that a visual check will catch the problem. However, if a small, unnoticeable defect develops on the membrane, this becomes apparent only when the electrolyte starts to leak, and the sensor stops working.
极谱电极最常见的故障是由透氧膜机械灵敏性的损耗引起的。如果透氧膜严重损坏，肉眼就可察觉。但是，透氧膜如果只有细微的损耗的情况下，只有电极开始漏液、传感器停止工作时才用户才会发觉问题。
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 in demanding industrial environments, because of the risk of chaotic or non-reproducible signals caused by dirty or moist contacts from perspiration on fingers. In addition, vibrations and small fluctuations in temperature can alter cable resistance noticeably. Damp cables—and especially, damp connections—are often the cause of problems in oxygen and other measurements, such as pH.
VISIFERM™ DO 不会出现这种问题，因为它不采用脆弱的膜片和电解液，而是采用结实的固体传感器帽。在生产环境下，通过电缆传输非常低的极谱电流信号到变送器也存在故障隐患，因为和人体手指接触带来的污垢或汗水会产生噪音或随机信号。另外，温度的细微波动都会导致电缆电阻的明显变化。潮湿的电缆，尤其是潮湿的接口都会给溶氧检测和其它检测（如 pH 值）带来麻烦。
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.
VISIFERM™ DO 的检测结果可通过传感器输出为 4 至 20 mA 的模拟信号或数字信号。在复杂的过程处理环境下，这两种输出模式的稳定性大大优于传统极谱溶氧传感器的感应信号。

Signal availability

信号获取

A measuring point that delivers no signal can cause great damage. The signal for process control depends on all the components necessary for that signal. For classical oxygen measurement these are: sensor, sensor cable, measurement amplifier, its power source, and the cable from the measurement amplifier to process control. The weakest link contributes the most to system failure. In classical systems this is clearly the membrane-covered sensor first, and the cable to the measurement amplifier second. With VISIFERM™ DO, critical small currents are dispensed with, and a robust (milliamperes, not nanoamperes) analog or digital signal is supplied to the measurement amplifier in the sensor. Instead of a disturbance-vulnerable membrane, VISIFERM™ DO has a robust, replaceable Sensor Cap that is both sensitive and highly selective.
不能传输信号的检测点会造成严重后果。用于过程控制的信号取决于所有产生该信号的必要

组件。对常见的溶氧检测，这些组件是：传感器，传感器电缆，变送器，电源以及传送器和过程控制器之间的连接线。系统失败多数情况下是由于连接问题。通常，透氧膜附在传感器上，然后通过电缆连接变送器。

Technology that sets new standards

技术新标准

Intelligent Sensor VISIFERM™ DO gives the designation “intelligent sensor” new significance: Innovative measurement optics

VISIFERM™ DO 赋予了“智能传感器”新的定义

- stable to 130° C, with symmetrically-oriented diagnostic and measurement design.
- 耐 130℃，对称导向诊断和检测设计。
- Temperature-resistant electronics built into a 12 mm shaft.
- 12mm 口径内置耐高温电路设计
- Replaceable Sensor Cap containing the sensing element.
- 可替换式传感器帽内置感应装置
- Digital or analog communication by proven VP 8.0 connector head, complete with PG 13.5 process thread connection.
- VP 8.0 连接头可传输数字或模拟信号，兼容 PG13.5 过程连接线。
- Monitoring of all sensor functions, including status diagnosis of the replaceable Sensor Cap, with corresponding signals to the 4 to 20 mA and digital interfaces.A history of self-monitoring is recorded in the sensor.
- 传感器可监测传感器帽的诊断状态、4 至 20mA 的响应信号和数字接口状态。传感器可存储历史监测数据。
- Configurable using the RS 485 interface with notebook, PC or by using the ModBus RTU connection from the process control system, or with HAMILTON VISICAL™.
- 可选配 RS485 接口，PC 接口或过程控制系统的 ModBus RTU 接口和 HAMILTON VISICAL 软件。

VISIFERM™ DO all-in-one sensor: function blocks
VISIFERM™ DO 集成传感器：功能模块

传感器帽
- 可替换
- 耐用，荧光感应
- 符合 FDA 标准材质

光学系统
- 双通道
- 自诊断
- 荧光信号模拟

处理器
- 可校准
- 自保护
- 密码保护
- 带监控器

存储器
- 校准数据
- 传感器帽耗损信息
- CIP 和 SIP 计数器
- 历史报警信息
- 标签号，序列号

接口
- ModBus 接口
- 4 至 20mA 接口
- ECS 接口
- 电源接口

Users love the VISIFERM™ DO:
VISIFERM™ DO 方便易用

Application:

应用：

- No fragile membrane—solid Sensor Cap, instead
- 固体传感器帽替代膜片
- Instantly stable values
- 稳定的即时数据
- Low drift,quick response
- 低漂移，快速响应
- Flow-independent
- 不受流速影响
- Electrolyte-free, so no leakage
- 无电解液，无漏液现象
- No H2S or CO2 effect
- 不受硫化氢或二氧化碳影响

Maintenance:

维护：

- Just one single, simple, replaceable spare part—the robust Sensor Cap
- 简单耐用的单一备件，更换方便：传感器帽
- Convenient calibration in the laboratory, because calibration data are stored in the sensor
- 传感器可存储校正数据，轻松校正。
- Precalibrated, ready-to-use sensors from stock minimize service time and costs
- 常备库存、已预校准、简单易用的传感器能最大限度的节省维护时间和费用

Installation:

安装

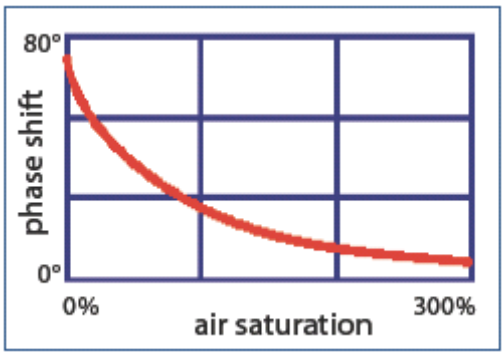
- Backwards compatible with classical oxygen sensors,operates with traditional transmitters and SOP’s, or...
- 与传统的传感器/ 变送器兼容
- Can be connected directly to a PLC or PCS using a 4 to 20 mA or Modbus RTU interface
- 通过 4-20 mA 或 ModBus 直接接入 **PLC** 或 **PCS**

Safe trace measurements

安全的微量检测

Trace measurements with classical sensors are not considered particularly accurate or safe, since in the absence of oxygen, no O2 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.

传统的传感器用于微量检测时无法做到非常准确和安全，因为在无氧条件下氧分子不会被还原也就不会产生电流。当电缆线断裂时也会出现上述问题。VISIFERM™ DO 不会遭遇上述情况，因为在氧浓度越低红光发射量越大，相漂移也越大。



Operational reliability and simple maintenance

运行稳定、维护简单

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. So 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.

用户友好有点对传感器来说也是至关重要的。减少冗余流程意味着增强操作的可靠性。维护简单也是大家一致的追求目标之一。所以，当夜班换岗、只有有限的人员可进行维护和校准时，VISIFERM™ DO 的优点就显而易见。只需更换传感器帽就可解决问题，就像开启苏打水的瓶盖一样简单快速：将旧的传感器帽拧下，再换上新的。问题就解决了。校准可以在空气、氮气或二氧化碳环境下进行。在实验室里进行传感器校准也很方便，而且校准状态可保留至下次使用。

Three options to connect

三种可选连接

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.

VISIFERM™ DO 具有通用的 Modbus RTU 接口，最多可连接 32 个传感器或其它设备，非常经济有效。Modbus 接口可提供多种信息，包括传感器的模拟信号和运行状态的输出信息。Modbus 接口兼容 Fieldbus 接口、Profibus 接口或其它接口。

Robust 4 to 20 mA current:

4 至 20mA 电流输出：

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

无需变送器，VISIFERM™ DO 可直接接入 PLC 或 PCS。

ECS:

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

ECS 接口能将 VISIFERM™ DO 和传统的变送器进行连接。通过 Visionfigurator 软件可设置 ECS 连接。

VISIFERM™ DO accessories

VISIFERM™ DO 附件

Sensor Cap

传感器帽

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. Furthermore, lifetime is seldom dramatically reduced—even in enviromental applications, the Sensor Cap lasts for 3 years and longer.

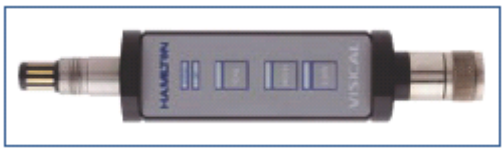
对于 VISIFERM™产品，消耗品只有一种。通常情况下，即使是经常进行蒸汽灭菌、消毒和 CIP 处理，传感器帽使用寿命也在一年以上。另外，即使在环保行业传感器帽的使用寿命也很少出现大大缩短的现象，一般能用 3 年或更长。

Sensor cable VP 8.0

VP8.0 传感器电缆

VISICAL™ calibration tool

VISICAL™ 校准工具



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.
当使用 4 至 20mA 接口或在实验室进行传感器预校准时，可采用简单的空气和零点校准。校准结果也同时显示传感器的整体状态信息，并在传感器帽需要更换时出现提示信息。

VISIFERM-D4 power adapter

VISIFERM-D4 电源适配器

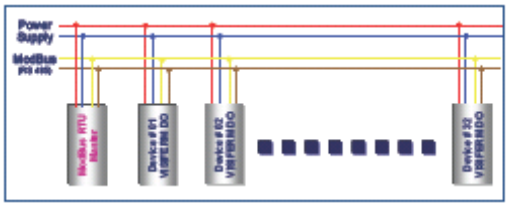
Connects VISIFERM™ DO in ECS mode to the cable of classical sterilizable oxygen sensor with four-pole plug (D4, T82) such as HAMILTON’s OXYFERM FDA. Includes a wall plug power supply.
在 ECS 模式下可用四孔插口（D4，T82）连接 VISIFERM™ DO 和传统灭菌溶氧传感器，例如 HAMILTON 的 OXYFERM FDA。包括通用电源插座。

USB-RS485 Modbus converter

USB-RS485 Modbus 转换器

Connects a PC with a USB port to the world of Modbus.
通过 USB 接口连接 PC 和 Modbus。

The PC acts as a Master, using VisiConfigurator ™ freeware or any other Modbus terminal software.
通过 VisiConfigurator ™软件或其它任何 Modbus 终端软件可实现 PC 控制。



VisiConfigurator™ freeware

VisiConfigurator™免费软件

Technical data

技术参数：

Optical oxygen sensor with integrated optoelectronics, measuring-devices functionality, and self-diagnosis.
集成光电技术、功能检测模块和自诊断装置的光学溶氧传感器。
Steam-sterilizable, autoclavable, and CIP-resistant (tested with 1.0 M NaOH, 90° C, 60 minutes).
蒸汽灭菌，消毒和耐 CIP 处理（1.0 M NaOH, 90° C, 60 分钟）
Measurement principle: oxygen-dependent change of phase-angle of FDA silicone-protected luminophore.
检测原理：氧依赖的 FDA 硅基保护的荧光相移。
No minimum flow required, because sensor does not consume oxygen.
没有最低流速限制，因为传感器不消耗氧气。
Always immediately ready for measurement.
在线检测
Shaft diameter: 12 mm, PG 13.5 thread.
探针直径：12mm，PG13.5 接头。
Different lengths of shaft, from 120 mm (see part description: VISIFERM™ DO 120 where 120 indicates the shaft length).
不同探针长度选择，最小 120mm。
Replaceable Sensor Caps.
可替换的传感器帽。
Various modes of operation, adjustable by means of software. For example:
多种操作模式，软件调节。例如：
4 to 20 mA interface.
4 至 20mA 接口。
ECS interface.
ECS 接口。
Device address and transmission rate for operation with Modbus RTU fieldbus. Several sensors can be read by the same two RS-485 interface conductors, for a process control system or a personal system.
Modbus RTU 接口连接设备和调节传输速率。对于过程控制系统或其它个人系同，一些传感器通过相同的两个 RS485 接口进行连接。
Cross sensitivities and resistances:
选择性和耐用性：
Sensitive to: CO2, H2S, SO2, ethylene oxide, and gamma sterilization.
选择性：CO2，H2S，SO2，环氧乙烷，100 万级灭菌
Not harmed by: ethanol, methanol, H2O2.
抗乙醇，甲醇，过氧化氢腐蚀。
Not resistant to: chlorine gas and other organic solvents such as chloroform, toluene, acetone.

不抗氯气和其它有机溶剂例如氯仿，甲苯，丙酮
Specific data
其它参数
Storage temperature: -10 to 50°C.
保存温度：-10 to 50°C。
Operational temperature: -10 to 30°C; disconnection of optical oxygen measurement above 80°C as standard (others on request); electrical interfaces and temperature measurement active up to 130°C.
操作温度：-10 to 30°C；超过 80°C 光学溶氧检测器自动断开；电气接口和温度检测器可耐 130°C。
Process pressure: -1 to 12 bar (174 psi); pressure impulses up to 80 bar.
过程压力：-1 to 12 bar (174 psi)；最大耐压 80bar.
Range of measurement: 4 ppb, 0.05% to 300% oxygen/air saturation; measurement unit can be configured by software according to:
测量范围：4 ppb；0.05% to 300% 氧气/空气饱和度；测量单元可通过软件进行设置：
% oxygen/air saturation (% saturation).
%氧气/空气饱和度
Volume-% oxygen (Vol-%).
体积%氧气
mg/L or ppm.
Mg/L 或 ppm.
µg/L or ppb.
ug/L 或 ppb.
Resolution: 0.1 ppb
重复性：0.1 ppb
Response time at 25°C, air to nitrogen: t98% < 30 s.
25°C响应时间，空气比氮气：$t_{98\%}$ < 30 s。
Detection limit: 0.01 Vol-%.
检测下限：体积比 0.01%。
Drift: lower than 0.2 Vol-% oxygen per week in air at 30°C and constant conditions.
偏差：30°C 相同条件下，每周空气中氧气的体积比小于 0.2 %。
Electrical connection with VP 8.0 socket head:
VP 8.0 电气接口：
Operating voltage: 7 to 30 VDC, maximum 1000 mW.
运行电压：7 to 30 VDC，最大电流 1000mw
Continuous power: approximately 0.6 W.
持续电源：大约 0.6 W。
Start-up power: maximum 1 W (as of Firmware ‘Modbus_031’).
初始电源：最大 1W。
Freely scalable, 4 to 20 mA current interface (current sink) for a temperature-compensated oxygen-measurement signal. Fed by external24 VDC supply (for example), allowing a standard 4 to 20 mA current signal to be used for process control or recording. In the sensor,the current flows towards the ground of the operating voltage.
4 至 20mA 电流接口用于带温度补偿的溶氧检测信号。可接外部 24V DC，可用过程控制和

记录的标准 4 至 20mA 电流信号。在传感器内电流可接地。
ECS interface for the simulation of a classical, electrochemical sensor (cathode, anode, NTC 22 kΩ temperature sensor) for operation with classical measuring devices.
ECS 接口可用于模拟传统电化学传感器（电极，阳极，NTC 22kΩ 温度传感器）。
Fieldbus interface: digital, serial, 2-wire, RS-485 interface, with Modbus RTU protocol.
Fieldbus 接口：数字的，连续的，双线，RS-485 借口，支持 Modbus RTU 协议。
Modbus:
Modbus RTU; 2-wire RS-485; maximum of 32 addresses.
Modbus RTU；双线 RS-485；最大有 32 接口。
Transmission / baud rate: 4800 to 115000 (factory standard: 19200 Bd).
传输/波特速率：4800 至 115000（工厂标准：19200 Bd）
Wetted parts materials: SS 316L / DIN 1.4435, EPDM (FDA), silicone (FDA).
浸入部分材质：SS 316L / DIN 1.4435, EPDM (FDA), silicone (FDA)。

VISIFERM™ DO—ordering information

VISIFERM™ DO—订购信息

订货号	产品描述
242450	VISIFERM™ DO 120
242451	VISIFERM™ DO 160
242452	VISIFERM™ DO 225
242453	VISIFERM™ DO 325
242454	VISIFERM™ DO 425
242427	VISIFERM™ DO replacement Sensor Cap (spare part)
242410	VISICAL™ calibration tool
242411	USB-RS-485 Modbus converter
242412	4-20 mA galvanic isolating amplifier M1
242413	VISIFERM™-D4 power adapter
355194	Demo cable (1m, open end, power pack)
238999-2766	Demo cable (1m, for Sartorius fermenter, power pack)
238999-2767	Demo cable (1m, e.g. for Applikon fermenter, BNC plug, power pack)
238999-2768	Demo cable (1m, for New Brunswick fermenter, power pack)
238999-2394	Sensor cable VP 8.0, 1m
238999-1953	Sensor cable VP 8.0, 3m
238999-2395	Sensor cable VP 8.0, 5m
238999-2396	Sensor cable VP 8.0, 10m
238999-2403	Sensor cable VP 8.0, 15m
238999-2505	Sensor cable VP 8.0, 20m

For armatures, pH and conductivity sensors, patented and certified DURACAL™ pH buffers, and conductivity standards, please check the HAMILTON website, or consult your HAMILTON process sensors distributor.

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技术咨询：sensors@hamilton.ch

HAMILTON Bonaduz AG
Via Crusch 8
CH-7402 Bonaduz, Switzerland
Toll-Free: 00800-660-660-60
Telephone: +41-81-660-60-60
Fax: +41-81-660-60-70
sensors@hamilton.ch

HAMILTON Company
4970 Energy Way
Reno, Nevada 89520, USA
Toll-Free: 800-648-5950
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实验室自动设备的应用：
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