VisiTrace™ DO Sensor

Operating Instructions

HAMILTON®

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Hamilton Warranty

Please refer to the General Terms of Sales (GTS).

Important note

Contents of this manual can be modified without previous announcement. Technical modifications reserved. Greatest possible care was used on the correctness of the information in this manual. If errors should be discovered nevertheless, Hamilton Bonaduz AG is pleased to be informed about it. Regardless of this, Hamilton Bonaduz AG cannot assume liability for any errors in this manual or for their consequences.

1 General Information

1.1 Intended Use

The VisiTrace DO sensors are intended for the measurement of dissolved oxygen (DO) in aqueous solutions in ppb range from 0 - 2000 ppb.

It is not recommended to use the VisiTrace DO sensor in contact with gasous or liquid organic solvents. The resulting measurement accuracy and stability in those applications must be separately verified and validated by the customer.

The VisiTrace DO sensor has a built-in temperature sensor (NTC 22kΩ). This temperature sensor is to be used only for monitoring the sensor conditions, not for controlling the process temperature.

1.2 About this Operating Instruction

These Operating Instructions are designed to support the integration, operation and qualification of the VisiTrace DO sensors.

To achieve this, it will describe the features of VisiTrace DO and its integration in Process Control Systems (PCS). Both the hardware and the communication between the VisiTrace DO and Process Control Systems are described in this manual. After reading this manual the user should be capable of installing and operating VisiTrace DO sensors.

⚠ ATTENTION! Essential information for avoiding personal injury or damage to equipment.

NOTE: Important instructions or interesting information.

2 Liability

The liability of Hamilton Bonaduz AG is detailed in the document “General Terms and Conditions of Sale and Delivery”.

Hamilton is expressly not liable for direct or indirect losses arising from use of the sensors. It must in particular be insured in this conjunction that malfunctions can occur on account of the inherently limited useful life of sensors contingent upon their relevant applications. The user is responsible for the calibration, maintenance and regular replacement of the sensors. In the case of critical sensor applications, Hamilton recommends using back-up measuring points in order to avoid consequential damages. The user is responsible for taking suitable precautions in the event of a sensor failure.

3 Safety Precautions and Hazards

⚠ ATTENTION! Read the following safety instructions carefully before installing and operating the VisiTrace DO sensor.

3.1 General Precautions

For safe and correct use of VisiTrace DO, it is essential that both operating and service personnel follow generally accepted safety procedures as well as the safety instructions given in this document, the VisiTrace DO operating instruction manual.

The specification given in chapter 10 as regards temperature, pressure etc. may under no circumstances be exceeded. Inappropriate use or misuse can be dangerous.

Cleaning, assembly and maintenance should be performed by personnel trained in such work. Before removing the sensor from the measuring setup, always make sure that no process medium can be accidentally spilled. When removing and cleaning the sensor, it is recommended to wear safety goggles and protective gloves.

The sensor can not be repaired by the operator and has to be sent back to Hamilton for inspection.

Necessary precautions should be taken when transporting the sensors. For repair the sensor should be sent back in the original reusable packaging box. Every VisiTrace DO sent back for repair must be decontaminated.

If the conditions described in these operating instructions manual are not adhered to or if there is any inappropriate interference with the equipment, all of our manufacturer’s warranties become obsolete.

3.2 Operation of VisiTrace DO Sensor

VisiTrace DO sensors must be used for their intended applications, and in optimum safety and operational conditions. The specifications (such as temperature or pressure) defined in the section entitled ‘Technical Specification’ must not be exceeded under any circumstances (Chapter 10). VisiTrace DO sensor head is specified to maximal temperature of 100°C and therefore not autoclavable.

Make sure that the PG13,5 thread and the O-ring are not damaged when screwing the sensor into the process. O-rings are consumable parts which must be exchanged regularly (at least once per year). Even when all required safety measures have been complied with, potential risks still exist with respect to leaks or mechanical damage to the armature. Wherever there are seals or screws, gases or liquids may leak out undetected. Always make sure that no process medium can be accidentally spilled before removing the sensor from its measurement setup. Do not put stress on the system by vibration, bending or torsion.

⚠ ATTENTION! When unscrewing the PG13,5 thread connection never turn the sensor at the connector head because you can loosen the ODO Cap from the sensor shaft and fluid can reach the interior of the sensor.

The integrated 4–20 mA analog output has been configured according to factory defaults. You can find full details, including serial number and most important specifications, on the certificate provided with each sensor. Before use, verify that the sensor is properly configured for your application.

The ODO Caps are consumable parts of the VisiTrace DO. The operating lifetime of the ODO Caps depend strongly on the operating conditions of the process. Make sure that following cross sensitivities and resistances of ODO Caps are respected.

Cross sensitivities and resistances of ODO Cap L0	
Wetted parts resistant to	Standard cleaning solution (CIP, NaOH)
Wetted parts chemical stabilized against	Standard disinfectant solutions (active chlorine, chlorine dioxide)
Wetted parts not resistant to	Organic Solvents such as Acetone, Tetrahydrofuran THF*

If the sensor is used in contact with gaseous or liquid organic solvents, the resulting measurement accuracy and stability in those applications must be separately checked and validated by the customer.

⚠ ATTENTION! To avoid humidity problems, make sure that the ODO Cap is always attached firmly to the sensor shaft, and that the O-ring between the shaft and cap is undamaged.

3.3 Earthing

The sensor has to be mounted at the mounting location which has to be electrostatically conductive (< 1MΩ). It is recommended to assign the sensor shaft and/or M12 cable shield to ground or earth especially in electromagnetically noisy environments. This significantly improves noise immunity and signal quality. The M12 thread is connected to the metallic housing of the VisiTrace DO sensor. Two options for connecting the sensor to the process environment are available.

Option 1: The Metal tank is connected to earth

The sensor shaft is connected to the metal tank over the PG13,5 thread. Do not connect the green yellow shield wire of the M12 cable to earth. It must remain unconnected and can be cut off.

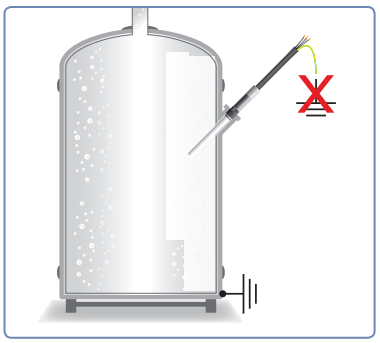


Figure 1: Metal tank with earth connection

NOTE: If the tank is not connected to earth, Option 2 has to be applied.

Option 2: Glass or plastic tank (not connected to earth)

The glass or plastic tank has no connection to earth and therefore it is necessary to connect the sensor shaft via a screw clamp to earth.

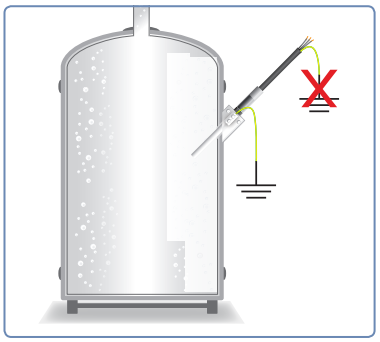


Figure 2: Glass or plastic tank with no earth connection

Below are shown several examples on how to connect the shaft of the sensor directly to earth as required in Figure 2.

Figure 3: Example clamps for connecting the earth to armature and metallic housing of the tank.

3.4 Electrical Safety Precautions

Do not connect the sensor to a power source of any voltage beyond the range stated in the power rating Technical Specifications (Chapter 10).

Always use Hamilton M12 cables for safe connection. Cables are available in a broad range of lengths (Chapter 11). Make sure the cable is intact and properly plugged to avoid any short circuit.

Keep VisiTrace DO away from other equipment which emits electromagnetic radio frequency fields, and minimize static electricity in the immediate environment of the optical measuring parts. Carefully follow all the instructions in chapter 5.3 to avoid electrical damage to the sensor. The contacts must be clean and dry before sensor is connected to the cable.

⚠ ATTENTION! Switch off the power supply and unplug the connector before dismounting the VisiTrace DO.

3.5 Chemical, Radioactive or Biological Hazard Precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with VisiTrace DO is the sole responsibility of the user.

If working with hazardous liquids observe and carry out the maintenance procedures, paying particular attention to cleaning and decontamination. If VisiTrace DO becomes contaminated with biohazardous, radioactive or chemical material, it should be cleaned. Failure to observe and carry out the maintenance procedures may impair the reliability and correct functioning of the measuring module.

4 Product Description

4.1 General Description

The VisiTrace DO sensors is intended for the measurement of dissolved oxygen (DO) in aqueous solutions in ppb rang from 0 - 2000 ppb. With their integrated transmitter, VisiTrace DO sensors enable direct connection to the process control system via 2 wire 4-20 mA standard signal. Wireless communication directly from the sensor may be used for monitoring, configuration, calibration and saves time without compromising the quality of the wired connection.

VisiTrace DO optical technology improves the measuring performance and simplifies maintenance. Improvements compared to conventional electrochemical (amperometric) sensors include flow independence, rapid start-up with no polarization time, and simplified maintenance.

With the transmitter integrated, VisiTrace DO sensors provide more reliable measurements directly to your process control system. The micro-transmitter located in the sensor head stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration and maintenance.

Key benefits include:

- Optical measurement in ppb range
- ODO Cap L0 Stabilized against disinfection solution with chlorine and chlorine dioxide.
- No separate transmitter needed
- Simple maintenance with robust industrial design
- Easy to install 2-wire connection
- Direct analog connection to the process control system via 2 wire 4-20mA standard signal.
- Full online wireless connection for easy monitoring, configuration and calibration

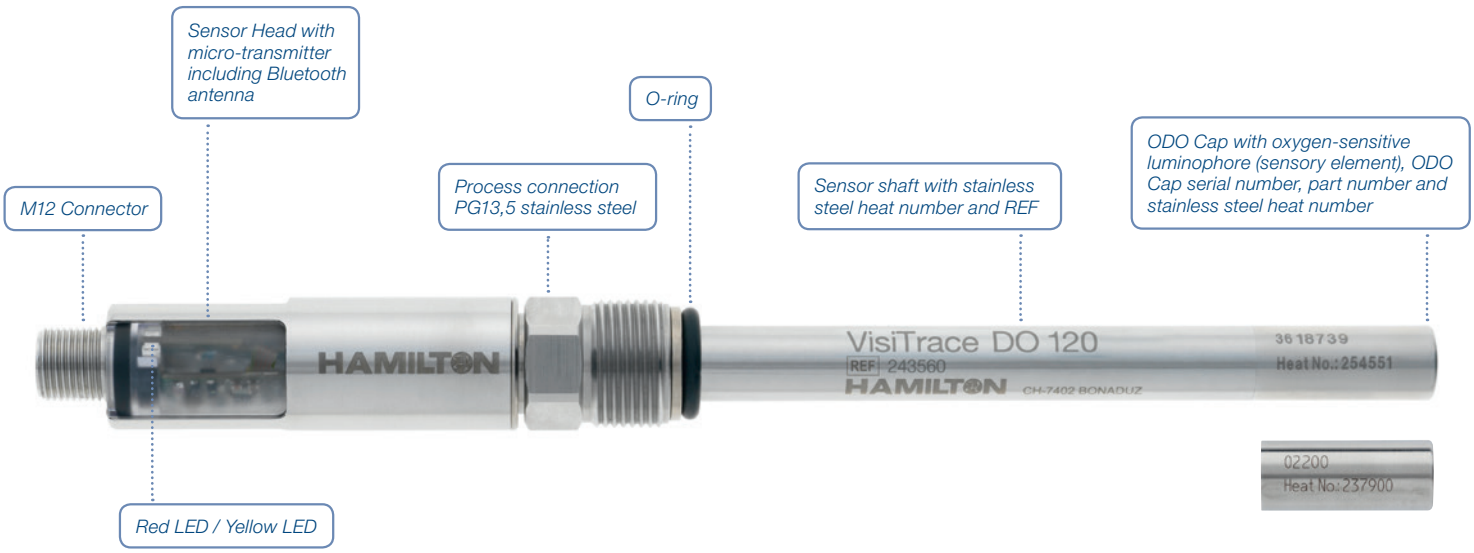


Figure 4: VisiTrace DO description

4.2 Hardware Description

The VisiTrace DO sensor consists of a sensor head with integrated electronic and a sensor shaft in contact with the measured medium. The sensor shaft is terminated by the optical dissolved oxygen (ODO) cap, carrying the oxygen sensitive luminophore. During development, special attention was paid to an optimum sanitary design.

Sensor status LED of the sensor:

LED Status	Case
Two yellow LEDs light permanently	RF connection is active and sensor is selected in the HDM
All LEDs light up shortly one by one in a circle	Power Up
Red LEDs are flashing	Minimum one error is active
Yellow LEDs are flashing	Minimum one warning is active

4.3 Optical DO measurement

The optical measurement principle is based on the so-called luminescence quenching. The luminescence of certain organic pigments (luminophore) is quenched in the presence of oxygen. The luminophore absorbs the excitation light and release a part of the absorbed energy by emission of fluorescence. In the presence of oxygen, energy transfer takes place from the excited luminophore to oxygen. The luminophore does not emit fluorecence and the measurable fluorescence signal decreases.

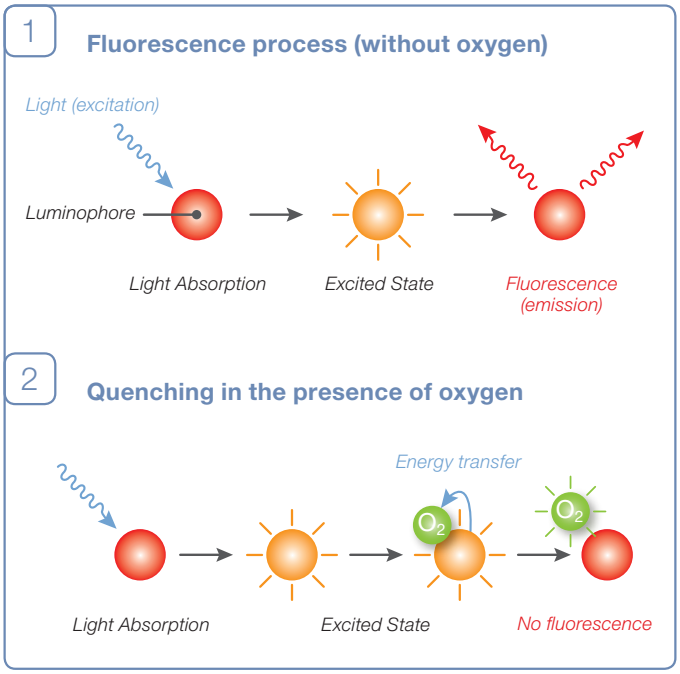


Figure 5: Fluorescence quenching by oxygen

4.4 VisiTrace DO with Micro-Transmitter inside

With the micro-transmitter integrated, VisiTrace DO sensors offer fully compensated 4-20 mA signal directly to the process control system. The micro-transmitter located in the sensor head stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration and maintenance.

5 Installation

5.1 Unpacking

1) Unpack carefully the VisiTrace DO sensor. Enclosed you will find the VisiTrace DO sensor, the Declaration of Quality, the VisiTrace DO Instruction Manual, and the Stainless Steel Inspection Certificate.
2) Inspect the sensor for shipping damages or missing parts.

Figure 6: VisiTrace DO delivery package

5.2 Configuring the VisiTrace DO with Hamilton Device Manager (HDM)

Two pieces of software are required to configure and set up the VisiTrace DO sensor. The Hamilton Device Manager (HDM) software is required as frame application based on FDT (Field Device Tool). The Device Type Manager (DTM Version > 1.4.5) file is required to configure and manage all VisiTrace DO sensors in HDM. To configure the VisiTrace DO sensor you will need the Wireless Converter BT and the Sensor Power Cable M12 (Chapter 11).

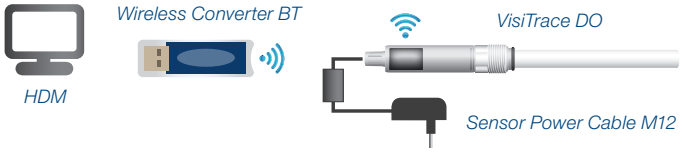


Figure 7: VisiTrace DO configuration with HDM

INSTALLATION

5.2.1 Installing the Hamilton Device Manager

1) Download the ZIP file “Hamilton Device Manager” from the Hamilton webpage www.hamiltoncompany.com (search for Hamilton Device Manager).
2) Unpack the downloaded ZIP-File.
3) Install the “Hamilton Device Manager” by double clicking “setup.exe” and follow the instructions on the screen.

5.2.2 Installing DTMs

1) Download the Zip File «Arc Sensor DTM Setup» from the Hamilton webpage www.hamiltoncompany.com (search for Hamilton DTMs).
2) Unpack the downloaded ZIP-File.
3) Do not plug the Wireless Converter BT before the installation of the DTM is completed.
4) Install the DTM and follow the instructions on the screen.
5) Plug your Wireless Converter BT to the USB-port of your computer. The driver installs automatically under Windows® 7. Use the “Found new Hardware” Wizard to install the drivers saved on the computer under Windows® XP.

5.2.3 Connecting a VisiTrace DO Sensor to HDM

1) Connect the sensor to the power supply using the Sensor Power Cable M12.
2) Start HDM.
3) Open “Device Catalogue” in View.
4) Update the DTM Device Catalogue by clicking “update”.
5) Add the selected “BT Wireless Port”. Right click on “My network” and select “Add” for the Device Type.
6) The BT Wireless Port is added to the “My network” list.
7) Double click on the “BT Wireless Port”. Set the appropriate COM Port and validate with “Apply”.
8) “Scan for devices”. The available sensors appear on the Network View.
9) Select the desired sensor. Right click and select “GO online”. The sensor is online if it shows in bold font and offline if it shows in normal font.

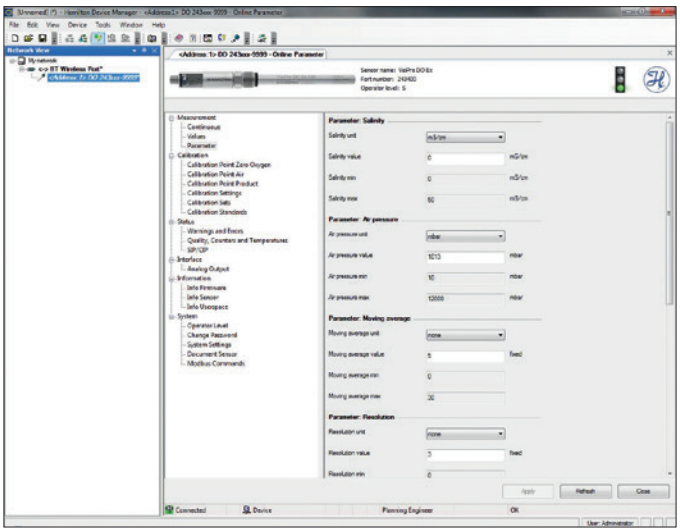


Figure 8: VisiTrace DO Sensor connected to HDM (symbolic figure).

5.2.4 Setting User Level

1) Select the desired sensor and check it is online. If not “Go online” with right click on the sensor.
2) Double click on the bold sensor name.
3) Set the appropriate operator level and press “Apply”.

Parameter Name	Description	Default password	Configuration	Location
User [U]	The Users can only read basic data from sensor	Not required	Not required	System
Administrator [A]	The Administrators can also calibrate sensors	18111978	Not required	System
Specialist [S]	Additionally the specialist can configure the sensors.	16021966	Must	System

5.2.5 Configuring the VisiTrace DO Sensor Parameters

1) Select the desired sensor and check it is online. If not “Go online” with right click.
2) Double click on the bold sensor name.
3) Set operator level to “S” and press “Apply” (Chapter 5.2.4).
4) Configure the measurement parameters.

INSTALLATION

Parameter Name	Description	Default Value	Configuration	Location
DO Unit	These are the measurement physical units: %vol., %sat., ug/l ppb, mg/l ppm, mbar, ppm gas*	ug/l ppb	Required	Measurement/ Values
T unit	These are the temperature physical units: K, °F, °C	°C	Required	Measurement/ Values
Salinity	The concentration of dissolve oxygen in saturated water is dependent on the salinity	0 mS/cm	Default parameter recommended	Measurement/ Parameter
Air pressure	The partial pressure of oxygen is proportional to the atmospheric pressure or the pressure of the air supply to the process	1013 mbar	Required, application dependent	Measurement/ Parameter
Measuring interval	The measuring interval can be set between 1-300 sec. The LED flashes once in the set measure interval	3 sec.	Recommended default parameter	Measurement/ Parameter
Standby interval	The standby interval can be set between 10-300 sec. The sensor switch to standby mode if the measurement is higher than 50mbar (2ppm @ 25°C and 1013mbar)	60 sec.	Recommended default parameter	Measurement/ Parameter
Moving average	The sensor uses a moving average 1-30 over the measuring points	10	Recommended default parameter	Measurement/ Parameter
Sensing Material	Sensing Material are different types of ODO Cap which can be set by entering the REF of the ODO Caps	243530	Must	Measurement/ Parameter
Resolution	The resolution interval can be set between 8-16. The measuring interval is on itself an average over 8-16 individual sub-measurements.	8	Recommended default parameter	Measurement/ Parameter

** humidity set to 0%*

*NOTE: If the measuring interval is higher than the standby interval and the measurement is above 50 mbar (2ppm @ 25°C and 1013mbar) the longer interval is valid.

5.2.6 Configuring the calibration settings

Parameter Name	Description	Default Value	Configuration	Location
Drift DO	Higher drift will interrupt the calibration process. Warning comes up "drift oxygen"	0.05%/min	Recommend default parameter	Calibration/ Calibration Settings
Drift T	Higher drift will interrupt the calibration process. Warning comes up "drift temperature"	0.5 K/min	Recommend default parameter	Calibration/ Calibration Settings

5.2.7 Configuring the temperature settings of SIP / CIP process

Parameter Name	Description	Default Value	Configuration	Location
Customer temperature range	User defines temperature range for DO reading. No DO reading above 85°C possible	-10°C – 85°C	Recommend default parameter	Status/ Operating indicators
SIP process definition	User defines conditions for the SIP counter	Temp. min: 120°C Temp. max. 140°C Time: 20min	Recommend default parameter	Status / SIP / CIP
CIP process definition	User defines conditions for CIP counter	Temp. min: 80°C Temp. max. 100°C Time: 20min	Recommend default parameter	Status / SIP / CIP

5.2.8 Configuring the analog interface for your process control system

Parameter Name	Description	Default Value	Configuration	Location
Interface Mode	The output of the 4–20 mA can be configure linear or with a fix value	4–20 mA linear	Recommended default	Interface/ Analog Output
Value at 4mA	Defined measurement value for 4 mA output	0 ppb	Must application dependent	Interface/ Analog Output
Value at 20mA	Defined measurement value for 20 mA output	2000 ppb	Must application dependent	Interface/ Analog Output
Mode in event of warning	Current output mode in case of warnings	No output	Recommended default parameter	Interface/ Analog Output
Mode in event of errors	Current output mode in case of errors	Continuous output	Recommended default parameter	Interface/ Analog Output
Output in event of warning	Current output in case of warnings	3.6 mA	Recommended default parameter	Interface/ Analog Output
Output in event of error	Current output in case of error	3.6 mA	Recommended default parameter	Interface/ Analog Output
Output for T out of limit	Current output in case of temperature out of limit	3.6 mA	Recommended default parameter	Interface/ Analog Output

5.2.9 Defining a measuring point name for identification of the process

Parameter Name	Value	Default Settings	Location	Descriptions
Measuring point	User can define a sensor name for better identification of the measuring point	243560 – 1234	Optional	Information / Info Userspace

5.3 Install VisiTrace DO in your Measuring Loop

5.3.1 Mechanical Process Connection

The VisiTrace DO mechanical design is compatible with all Hamilton process housings, including Flexifits, Retractexs, Retractofits and Hygienic Sockets.

Before installing the armatures, you should test that the seal is tight and the parts are all in working order. Ensure that there is no damage to the sensor or the armature. Check whether all O-rings are in place in the appropriate grooves and are free of damage. To avoid any mechanical damage to O-rings on assembly, they should be slightly greased.

Please note that O-rings are wetted parts and greasy compounds must comply to your FDA application needs.

5.3.2 M12 Pin Designation

The VisiTrace DO sensor is fitted with a M12 male, A coded connector. The four golden contacts are denoted as pin 1 to pin 4. For easy identification of each pin the M12 has a mark between pin 1 and pin 2. Always use Hamilton M12 sensor cables for safe connection, which are available in different lengths (Chapter 11).

Figure 9: Requirements for electrical connection of VisiTrace DO sensors

NOTE: Shaft potential is isolated from the 4-20mA + and – connection. Max isolation voltage is 500 V.

M12 PIN	Function	Color	Description
3	4-20 mA +	Blue	4-20 mA two-wire interface, functions as a current sink.
2	4-20 mA –	White	
4	n.c.	Black	–
1	n.c.	Brown	–
Housing	Shield	Green/ Yellow	Connected to the housing including the M12 female connector.

5.3.3 Required Power Supply

VisiTrace DO sensors are specified with a minimal power supply as follows:

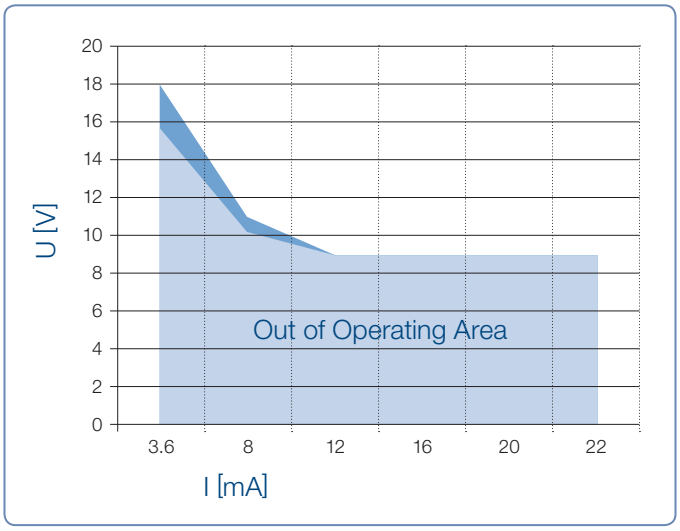
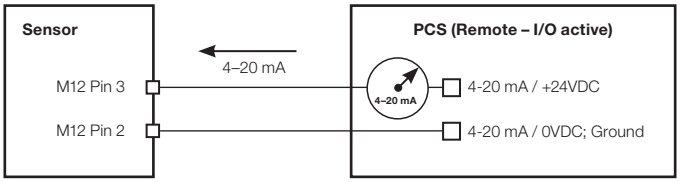


Figure 10: Minimal power supply as function of the output current.
Without digital communication *With digital communication*

5.3.4 Electrical Connection for Analog 4-20 mA

The 4–20 mA interface enables direct connection of the VisiTrace DO sensor to a data recorder, indicator, control unit or PCS with analog I/O. The VisiTrace DO works as a current sink sensor and is passive. Connect the sensor according to the pin designations (Chapter 5.3.2). The 4–20 mA interface of the VisiTrace DO sensors is pre-configured with default values for the 4-20 mA range, and measurement unit. Configure the 4-20 mA interface according to your requirements for proper measurement (Chapter 5.2.8).

A



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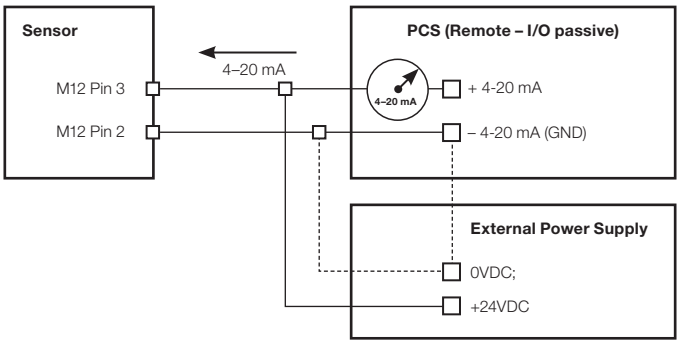

Figure 11: Two-wire loop wiring diagram for the 4-20 mA interface.
A: with an active current input card. B: with a passive current input card.

NOTE: If the current input card GND is internally connected to GND of the Power Supply you do not have to connect both GNDs externally.

6 Operation

WARNING: Only use the sensor within the specifications (Chapter 10). Failure to do so may lead to damages or measurement failure.

1) Remove the protective caps from the VisiTrace DO shaft, and from the M12 sensor head
2) Mount the O-ring on the sensor shaft and screw the ODO Cap firmly (Chapter 7.2)
3) Verify the functionality of the sensor including the ODO cap (Chapter 7.1)
4) Calibrate the sensor (Chapter 7.3)
5) Connect the sensor to the process control system (Chapter 5)
6) Verify the measurement in 1%vol. oxygen on your control system
7) Mount the sensor to the armature or process connection (Chapter 5.3)

NOTE: No oxygen measurement is performed at a temperature higher than 85°C to protect the optoelectronics and enhanced the sensor lifetime.

7 Maintenance

Periodic maintenance routines need to be run in order to ensure safe and reliable operation and measurement of sensor and the accessories.

MAINTENANCE

⚠ **ATTENTION! Avoid any contact of the equipment with corrosive media.**

7.1 Verify Sensor Status and ODO Cap Functionality

1) Power the sensor with the M12 Sensor Power Cable and connect the sensor to HDM.
2) Control the traffic lights (Figure 12).
3) Please refer to the troubleshooting (Chapter 8) for the next steps if the traffic light is not green.
4) Control the quality of the ODO cap in Sensor Status / Quality Counter and Temperature / Quality Indicator and change the ODO cap if required (Chapter 7.2).

The sensor is performing correctly.
No errors or warnings have been registered.

At least an error or a warning has been registered.
Verify the sensor errors and warnings in Sensor Status.

No communication between the sensor and the HDM.
This may be due to a hardware failure.

Figure 12: Description of the traffic lights on the HDM

7.2 Replacing the ODO Cap

The exchange of ODO Cap is performed very easily:

1) Unscrew the ODO cap from the shaft (Figure 13).
2) Exchange the O-ring.
3) Screw firmly the new ODO Cap onto the sensor shaft again.
4) Perform sensor calibration (Chapter 7.3).

NOTE: If the ODO Cap is mounted very firmly on the shaft, and if you cannot obtain a good grip on the stainless steel with your fingers, a silicone tube between your fingers and metal may supply a better grip.

Figure 13: Replacing the ODO cap

7.3 Calibration

The VisiTrace DO sensors provide two kinds of sensor calibration: automatic standard calibration, and product calibration. The automatic standard calibration and the product calibration may be performed using HDM (see chapter 5.2).

7.3.1 Automatic Standard Calibration with HDM

VisiTrace DO sensors are calibrated at two points: in 1%vol. oxygen and in an oxygen-free environment. During calibration, the sensor controls automatically the stability of the oxygen and temperature signals.

NOTE: For greater measurement accuracy insure that temperature difference between calibration medium and process medium is minimal. Enter the current atmospheric pressure in the sensor (see chapter 5.2.5).

7.3.2 Zero Point Calibration (Point Zero Oxygen)

1) Power the sensor with the M12 Sensor Power Cable and connect it to HDM.
2) Select the sensor to calibrate in “Network View”.
3) Go in System and select “Operator Level”.
4) Log in an appropriate Operator Level (Administrator or Specialist). More details in chapter 5.2.4.
5) Change the DO unit to ppm gas under measurement variable (see chapter 5.2.5)
6) Go to Measurement and select “Parameters”.
7) Enter under “Air pressure value” the actual atmospheric pressure.
8) Go to Calibration and select “Zero Point”.
9) Immerse the sensor into an oxygen-free environment (Figure 14) for e.g. nitrogen gas with min. purity of 5.0 and nitrogen flow rate: 0.5 mL/min (no overpressure). Let the system equilibrate and ensure stable conditions for at least three minutes.
10) Select the calibration command “Auto” and press “Apply”.
11) Verify the Calibration status in Zero Oxygen. It should indicate “Calibration successful”.

MAINTENANCE

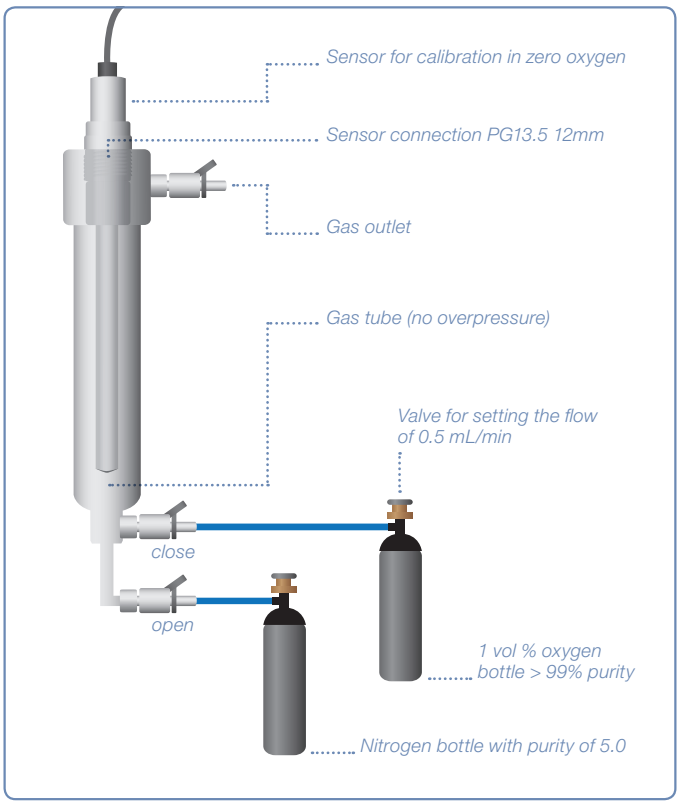

Fig. 14: Zero point calibration setup

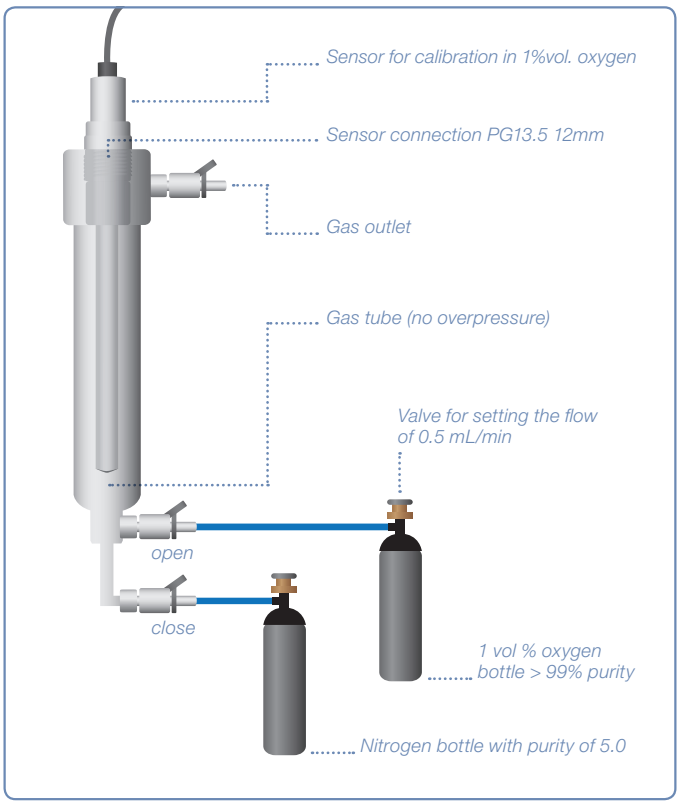

Figure 15: Calibration setup in oxygen point

7.3.3 Calibration Point Oxygen

1) Select the sensor to calibrate in “Network View”.
2) Go in System and select “Operator Level”.
3) Log in an appropriate Operator Level (Administrator or Specialist). More details in chapter 5.2.4.
4) Change the DO unit to ppm gas under measurement variable (see Chapter 5.2.5)
5) Go to Measurement and select “Parameter”.
6) Enter under “Air pressure value” the actual atmospheric pressure.
7) Go to “Calibration” and select “Calibration point oxygen”.
8) Immerse the sensor into an 1 vol % oxygen bottle (> 99% purity) environment (Figure 15) with flow rate: 0.5 mL/min (no overpressure).
9) Hold the sensor for at least three minutes under stable conditions.
10) Select the calibration command “Auto” and press “Apply”.
11) Verify the Calibration status 1% vol. oxygen. It should indicate “Calibration successful”.
12) For measuring in liquid set the correct DO unit (see Chapter 5.2.5).

NOTE: A two point calibration in nitrogen (with purity of 5.0) and 1 vol % oxygen is required to achieve the highest measurement accuracy over the whole measurement range.

7.4 Product Calibration

The product calibration is an in-process calibration procedure in order to adjust the measurement to specific process conditions. Product calibration is an additional calibration procedure to a standard calibration.

If product calibration is activated, the VisiTrace DO calibration curve is calculated from the data of last calibration at point 1 and from the data of the product calibration (Figure 16). In order to restore the original standard calibration curve, the product calibration can be at any time by selecting on the Product calibration command “cancel”. A new standard calibration cancels a product calibration as well.

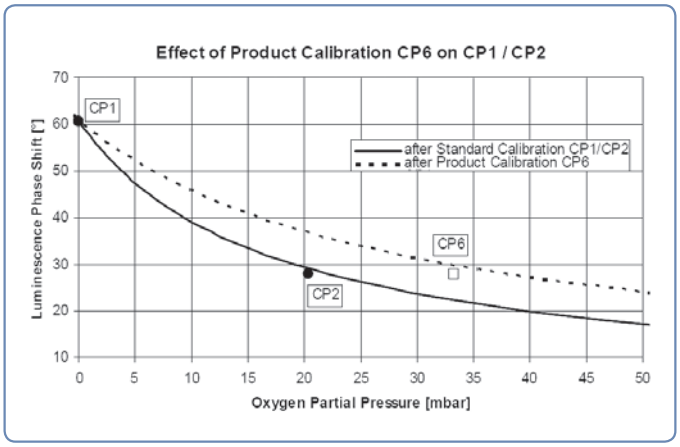

Figure 16: Effect of a product calibration (CP6) on an existing standard calibration function based on the Zero Point Calibration (CP 1) and the 1%vol. oxygen point (CP 2).

NOTE: The product calibration is possible for DO values in the range of 2 ppp to 2000 ppb.

A product calibration is performed as follows:

1) Connect the sensor to HDM.
2) Select the sensor to calibrate in “Network View”.
3) Go in System and select “Operator Level”.
4) Log in an appropriate Operator Level (Administrator or Specialist). More details in chapter 5.2.
5) Go to Calibration and select “Calibration Point Product”.
6) Select under product calibration command Initialize and press Apply.
7) Perform an initial measurement while taking a sample from the process.
8) Perform a laboratory measurement of the sample at the same temperature as it was measured in the process.
9) Assign the laboratory value in the HDM to the value of the Initial measurement (Product value to assign). This new DO value is accepted and automatically active, if the difference between initial measurement and laboratory values is not greater than +/- 20 %.
10) Verify the Calibration status in product calibration. It should say active + assigned.

NOTE: Alternatively, the product calibration may be performed with a field device at the measuring point.

8 Troubleshooting

8.1 Sensor Self-Diagnostic

VisiTrace DO sensors provide a self-diagnostic functionality to detect and identify the most common sensor malfunctions. The analog 4–20 mA may provide warning and error messages. The analog 4–20 mA interface can be configured according to the NAMUR recommendations to indicate an abnormal event (See chapter 5.2.3). Use HDM for monitoring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

8.1.1 Warnings

Warning	Cause / Solution
DO reading below lower limit	The oxygen reading is too low (DO < 0%-sat). Make a new zero-point calibration (Chapter 7.3.2)
DO reading above upper limit	The oxygen reading is too high DO > 2000 ppb (5 % vol.). Standby interval is active if this warning appears.
DO reading unstable	If continuously happening, use a new cap or check the process regulation. If the problem still appears, call our Technical Support.
T reading below lower limit	The temperature is below the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
T reading above upper limit	The temperature is above the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
Measurement not running	The measurement interval is set to 0 or the measurement temperature is out of the range.
DO calibration recommended	Perform a calibration in order to ensure reliable measurement.(Chapter 7.3)
DO last calibration not successful	The last calibration failed. The sensor is using the old successful calibration values. In order to ensure reliable measurement perform a new calibration (Chapter 7.3)
DO replace sensor cap	Replace the ODO Cap and calibrate the sensor. This warning remains active as long as the sensor quality is below 35%
4-20 mA value below 4 mA	The measurement value is below the lower limit of the 4–20 mA interface output. Reconfigure the 4-20mA interface (Chapter 5.2.8)

Warning	Cause / Solution
4-20 mA value above 20 mA	The measurement value is above the upper limit of the 4–20 mA interface output. Reconfigure the 4-20mA interface (Chapter 5.2.8)
4-20 mA current set-point not met	The 4–20 mA interface is not able to regulate the current requested for the current measurement value according to your 4–20 mA interface configuration. Check the 4–20 mA wiring and supply voltage (Chapter 5.3.2)
Sensor supply voltage too low	The sensor supply voltage is too low for the sensor to operate correctly. Ensure stable supply voltage within the sensors specifications (Chapter 5.3.3)
Sensor supply voltage too high	The sensor supply voltage is too high for sensor to operate correctly. Ensure stable supply voltage within the sensors specifications (Chapter 5.3.3)

8.1.2 Errors

Errors (failures)	Cause / Solution
DO reading failure	Sensor cap is missing or the sensor is broken.
DO p(O2) exceeds air pressure	Measured partial pressure of oxygen is higher than the air pressure set by the operator. Reconfigure the air pressure parameter (Chapter 5.2.5)
T sensor defective	The internal temperature sensor is defect, please call our Technical Support.
DO sensor cap missing	The DO sensor cap has been removed. Do not immerse the sensor in a measurement solution. Mount an ODO Cap and calibrate the sensor prior measurement (Chapter 6).
Red channel failure	Measurement channel failure. Please call our Technical Support.
Sensor supply voltage far too low	The sensor supply voltage is below 6 V. Please check your power supply (Chapter 5.3.3)
Sensor supply voltage far too high	The sensor supply voltage is above 40 V. Please check your power supply (Chapter 5.3.3)
Temperature reading far below min	The measured temperature is below the operation temperature.
Temperature reading far above max	The measured temperature is above the operation temperature.

8.2 Getting Technical Support

If a problem persists even after you have attempted to correct it, contact Hamilton`s Customer Support: Please refer to the contact information at the back of this Manual.

8.3 Returning VisiTrace DO for Repair

Before returning a VisiTrace DO sensor to Hamilton for repair, contact our Customer Service (see Chapter 14.2) and request: a Returned Goods Authorization (RGA) number.

Do not return a VisiTrace DO sensor to Hamilton without an RGA number. This number assures proper tracking of your sensor. VisiTrace DO sensors that are returned without an RGA number will be sent back to the customer without being repaired.

Decontaminate the VisiTrace DO sensor and remove health hazards, such as radiation, hazardous chemicals, infectious agents etc. Provide complete description of any hazardous materials that have been in contact with the sensor.

9 Disposal

The design of Hamilton sensors optimally considers environmental compatibility. In accordance with the EC guideline 2002/96/EG Hamilton sensors that are worn out or no longer required must be sent to a dedicated collection point for electrical and electronic devices, alternatively, must be sent to Hamilton for disposal. Sensors must not be sent to an unsorted waste disposal point.

10 Technical Specifications

4-20 mA accuracy	< 0.3% current value ± 0.05 mA
4-20 mA current range	3.5 to 22 mA
a-length	120 mm / 225 mm
Accuracy at 25 °C	± 0.5 ppb or 2% whichever is greater
Analog Interface	Two wire sink needs to be powered by external power supply
Analog Interface 1	4–20 mA for DO, programmable
Autoclavable	No
Certificate	Yes, with parameter settings and materials used
CIP	Yes
Configurable Values	DO: mbar; %-sat; %-vol; µg/l; mg/l; ppm (gas); ppb/ppm (dissolved oxygen); Temperature: °C, K, F
Diameter	12 mm
Drift at Room Temp. under Constant Conditions	< 1 % per week @ 100 ppb
Electrical Connector	M12
Electrolyte	None
Measurement Principle	Oxygen dependent luminescence quenching
Measuring Range	0 to 2 ppm (0 to 50 mbar)
Wetted Parts	Stainless steel 1.4435
O-ring material	EPDM (FDA approved)
Process Temperature	-10 – 140 °C (Analog output 0 – 85 °C / Digital output -10 – 140 °C)
Operating Voltage	18 to 30 VDC
Oxygen Consumption	None
Pressure Range	0 to 12 bar
Process Connection	PG13,5
Protection Rating	IP 68
Required Flow	None
Response Time t90%	< 20 sec. in Gas < 90 sec. in Water
Serial Number	Yes
Steam Sterilizable (SIP)	Yes, max. temperature 140°C
Surface Quality of Steel	Ra < 0.4 µm (N5)
Temperature Sensor	NTC 22 kOhm

11 Ordering Information

Parts below may only be replaced by original spare parts.

11.1 VisiTrace DO

Ref	Description
243560	VisiTrace DO 120
243561	VisiTrace DO 225*

**The VisiTrace DO 225 have, in reality, a shaft length of 215 mm.*
This ensures optimal rinsing in replaceable armatures, such as Retractex.

11.2 Parts and Accessories

Ref	Description	Wetted Materials
243530	ODO Cap L0	Stainless steel 1.4435 Silicone

Application: For low ppb ranges in breweries and soft drink processing.

Ref	Product Name	Materials
243575	Calibration Station	Peek material with aluminium holder

Application: Specify for two point calibration with two test gases connection e.g. 1%vol. and nitrogen with 5.0 purity.

ORDERING INFORMATION

Ref	Product Name
243499	Wireless Converter BT

Description: Designed for wireless communication between HDM and VisiTrace DO sensor.

Ref	Product Name	Length
355283	Sensor Cable M12	3m
355284	Sensor Cable M12	5m
355285	Sensor Cable M12	10m

Description: The Sensor Cable M12 – open end is designed for connection to a data recorder, indicator, control unit or PCS (Process Control System) with analog I/O.

Ref	Product Name
355288	Sensor Power Cable M12

Description: This cable includes a power adapter to supply the sensor with operation power.

11.3 Services

Ref	Training sessions
243999-12	On-site training (half-day)

Description: Imparting of fundamental knowledge about pH/ORP/Conductivity/DO/cell density sensor measuring technology incl. documents and participation confirmation, excl. travel costs

Ref	Service packages
243999-17	PREMIUM service package DO sensor
243999-20	BASIC service package DO sensor

Ref	Service tools
238999-4456	DO service case

Ref	Initial operation and calibration
243999-05	Initial operation per sensor measuring point

Description: Sensor parametrization, connection of the sensor cable, calibration of the measuring chain (without transmitter/SPS), check and certification, provision of the measuring and testing equipment as well as orientation of the operator personnel

243999-06	Every further initial operation of the same kind per sensor measuring point

Ref	Qualification (IQ/OQ)
243999-07	IQ/OQ per sensor measuring point

Description: Documentation of the initial operation and calibration of the measuring system, provision of the measuring and testing equipment, check and certification (without travel costs)

243999-08	Every further IQ/OQ of the same kind per sensor measuring point
243999-14	IQ/OQ Documentation per sensor gauge incl. report documents and instructions for qualification

Ref	Maintenance
243999-10	Maintenance per DO measuring point

Description: Check of the response behavior, calibration with air and nitrogen 5.0, replacement of the electrolytes, cleaning of the internal body, check of the temperature probe, check of the sensor quality with Visiferm DO, incl. calibration certificate

243999-13	Every further maintenance of the same kind per sensor measuring point

NOTE: These services are only available in the following locations: Europe, Africa and China.

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To find a representative in your area, please visit www.hamiltoncompany.com.

This guide may be available in other languages.
Visit www.hamiltoncompany.com for more information.