

TECHNICAL MANUAL PHYSEO Transmitter for analysing

**pH / Redox / Temperature
Conductivity (EC)
Dissolved Oxygen (DO)
Turbidity / TSS
Suspended solids, Turbidity and Sludge blanket**



PHYSEO transmitter

Table des matières

| | | |
|-----|---|----|
| 1 | Technical description of the proposal | 3 |
| 1.1 | Detailed description of the analyser | 3 |
| 1.2 | Summarized characteristics | 4 |
| 1.3 | pH / Redox / Temperature sensor | 5 |
| 1.4 | Conductivity (EC) sensor | 7 |
| 1.5 | Dissolved Oxygen (DO) sensor | 9 |
| 1.6 | Turbidity and TSS sensor | 11 |
| 1.7 | Suspended solids, Turbidity and Sludge blanket sensor | 13 |
| 2 | Recommendation for maintenance and routine checking | 15 |
| 2.1 | Soft checking recommendation | 15 |
| 2.2 | Calibration checking | 15 |
| 2.3 | Yearly preventive maintenance | 16 |
| 3 | Operational limits | 16 |
| 3.1 | Electromagnetic compliance | 16 |
| 3.2 | Temperature | 16 |
| 3.3 | Interference | 16 |

1 Technical description of the proposal

1.1 Detailed description of the analyser

1.1.1 Technology

PHYSEO is a compact transmitter allowing measurements of physicochemical parameters in water such as: pH, conductivity, dissolved oxygen, temperature, water level. Up to 4 parameters can be simultaneously monitored.

PHYSEO integrates a calculator insuring the supervision of the measurement functions which leads to very simple use.

Measurement results are dated and stored in a static memory with a capacity of 10,000 measurements. They can be transferred later via the RS232 or RS485 link on a PC without specific software.

PHYSEO allows measurement results transfer in the best adapted unit to its exploitation: in ppm DO2 or in % sat DO2 for the dissolved oxygen for example.

Its stainless steel 316L enclosure insures maximal protection of the instrument whatever the conditions of environment while insuring a perfect recyclability at the end of life.

1.1.2 Measurements recording and transmission

The RS232 link allows results downloading for a short distance. The transfer of the results for long distance is possible with the RS485 link.

4 analog current or voltage outputs are available without intermediate treatment. Alarm and Fault relays are also available.

1.1.3 Energy

PHYSEO is fed under 100 - 240 VAC, 50 Hz.

On request the supply voltage can be carried to 12 VDC.

1.1.4 Display

Measurements can be displayed on the screen showing all data stored in a form of list of values or graph.

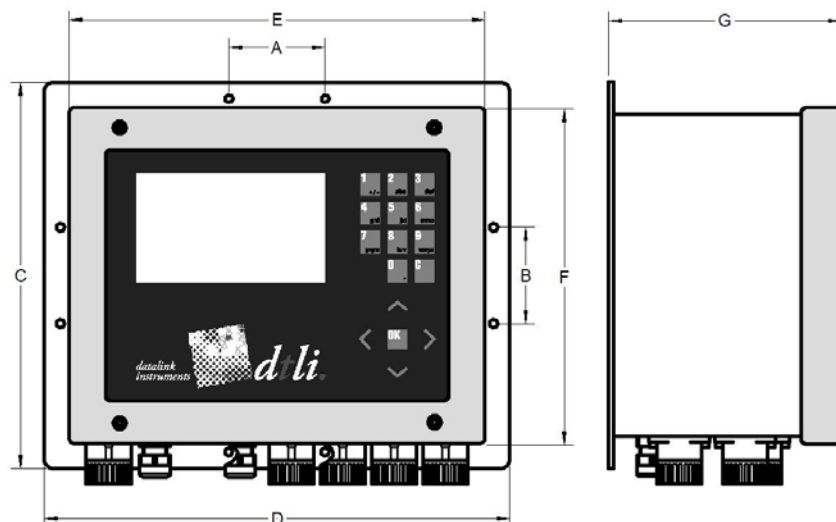
1.1.5 Parameter setting

Sensor operating parameters adjustment can be made either directly on the transmitter by using the keyboard or by the dedicated communication connection (RS232 or RS485).

1.2 Summarized characteristics

| | |
|--------------------------|--|
| Weight : | 6 Kg |
| Mains power : | 100 – 240 VAC / 50 - 60Hz / 30 VA |
| Analog voltage outputs : | Until 4 configurable and isolated measurement outputs : 0-10V, 12 bits resolution, 1000 Ω impedance minimum |
| Analog current outputs : | Until 4 configurable and isolated measurement outputs : 0-20mA (or 4-20 mA) 12 bits resolution, 15V max output voltage, 500 Ω impedance maximum |
| Outputs Relays | Double contact relay (48VAC or 48VDC max, 3AAC or 3ADC max, 150VA max) : 1 power supply default relay 4 measurement relays (multiple configuration) 4 cleaning relays (configurable in period and duration) |
| Communication | Port RS232 or RS485 for measurement results transfer and parameter setting |
| Enclosure : | stainless steel 316L enclosure index of protection IP65 |
| Operating temperature | -10 to + 60°C |

| | |
|---|--------|
| A | 60 mm |
| B | 60 mm |
| C | 240 mm |
| D | 290 mm |
| E | 259 mm |
| F | 209 mm |
| G | 145 mm |



1.3 pH / Redox / Temperature sensor

Features

- ✓ Combination pH/Redox/Temp sensor
- ✓ Calibration data inside
- ✓ pH/ORP Cartridge

Applications

- ✓ Urban wastewater treatment
- ✓ Industrial effluent treatment
- ✓ Surface water monitoring
- ✓ Sea water monitoring
- ✓ Drinking water



Description

The pH/ORP sensor has been designed to perform under hard conditions from pure mountains water, lakes and rivers, seawater and to wastewater.

This sensor has been designed also for handheld and in situ applications which have been the most difficult situations for a pH/ORP sensor in term of sensor resistance, quick time response, minimal flow dependence and low power consumption.

Specifications

| pH / ORP / Temperature sensor | Specifications |
|-------------------------------|---|
| Principle | <p>pH : Combined electrode (pH/ref) : special glass, Ag/AgCl ref. Gelled electrolyte (KCl) Redox : Combined electrode (Redox/reference) : Platinum tip, Ag/AgCl AgAgCl. Gelled reference (KCl) Temperature : CTN</p> |
| Measuring ranges | <p>pH : 0 - 14 pH Redox : -1000 to +1000 mV Temperature : 0 – +50°C</p> |
| Resolution | <p>pH : 0,01 pH Redox : 0,1 mV Temperature : 0,01°C</p> |
| Accuracy | <p>pH : +/- 0,1 pH Redox : +/- 2 mV Temperature : +/- 0,5°C</p> |
| Response time | < 5 s |
| Storage temperature | 0°C to + 60°C |
| Dimensions | Diameter : 27 / 21 mm; Length : 207 mm |
| Weight | 350 g (sensor + 3 m cable) |
| Material | PVC, special pH glass, platinum |
| Pressure | 5 bars |
| Cable length | Standard 3 m |
| Protection | IP68 |

1.4 Conductivity (EC) sensor

Features

- ✓ 4 electrodes (2 graphic, 2 platinum)
- ✓ Range 0 to 200 mS/Cm
- ✓ Robust and Watertight

Applications

- ✓ Urban wastewater treatment
- ✓ Industrial effluent treatment
- ✓ Surface water monitoring
- ✓ Sea water monitoring
- ✓ Drinking water



Description

The electrode works with a technology in 4 electrodes: an alternating current of constant-voltage is established between a primary's pair of electrodes in graphite. The secondary's electrodes in platinum allow of regulate the voltage imposed to primary's electrodes to reflect of the fouling. The voltage measured between the primary's electrodes is in function of the resistance of place and so, of the conductivity.

Specifications

| Conductivity sensor | Specifications |
|-------------------------------|---|
| Principle | Conductivity sensor with 4 electrodes (2 graphic, 2 platinum). |
| Measuring ranges conductivity | 0-200.0 μ S/cm 0 –2000 μ S/cm 0,00 –20.00 mS/cm 0,0 –200.0 mS/cm |
| Resolution | 0,01 to 1 according the range |
| Accuracy | +/- 1 % of the full range |
| Measuring range salinity | 5-60 g/Kg |
| Measuring range TDS –KCl | 0-133 000 ppm |
| Response time | < 5 s |
| Working temperature | 0°C to 50°C |
| Temperature compensation | Via CTN |
| Stocking temperature | -10°C to + 60°C |
| Response time | < 5 s |
| Dimensions | Diameter : 27 mm; Length : 177 mm |
| Weight | 350 g (sensor + 3 m cable) |
| Material | PVC, stainless steel |
| Pressure | 5 bars |
| Cable length | Standard 3 m |
| Protection | IP68 |

1.5 Dissolved Oxygen (DO) sensor

Features

- ✓ Optical technology without calibration
- ✓ No drift, reduced maintenance
- ✓ Robust, for field applications

Applications

- ✓ Urban wastewater treatment
- ✓ Industrial effluent treatment
- ✓ Surface water monitoring
- ✓ Sea water monitoring
- ✓ Drinking water



Description

The OPTOD (Optical Dissolved Oxygen technology) is based on luminescent optical technology. The OPTOD sensor is approved by the ASTM International Method D888-05. Without calibration requirements and thanks to an ultra-low power technology, the OPTOD sensor meets the demands of field works and short or long term campaigns. Without oxygen consumption, this technology allows you an accurate measure in all situations and especially in very low oxygen concentrations

Specifications

| Dissolved oxygen sensor | Specifications |
|--------------------------|---|
| Principle | Optical measurement by luminescence |
| Measuring ranges | 0.00 to 20.00 mg/L 0.00 to 20.00 ppm 0 –200 % |
| Resolution | 0.01 |
| Accuracy | +/- 0.1 mg/L +/- 0.1 ppm +/- 1 % |
| Response time | < 10 s |
| Water move | No necessary move |
| Temperature compensation | Via CTN |
| Stocking temperature | -10°C to + 60°C |
| Dimensions | Diameter : 25 mm; Length : 146 mm |
| Weight | 450 g (sensor + 3 m cable) |
| Material | Stainless steel 316L |
| Pressure | 5 bars |
| Cable length | Standard 3 m |
| Protection | IP68 |

1.6 Turbidity and TSS sensor

Features

- ✓ IR optical sensor without optical fibre
- ✓ Ranges : 0 to 4000 NTU or 0 to 4500 mg/L
- ✓ Robust and waterproof (IP68)
- ✓ Ultra low-power consumption
- ✓ ISO 7027 compliance (Nephelometry)

Applications

- ✓ Urban wastewater treatment (inlet / outlet)
- ✓ Sanitation network
- ✓ Industrial effluent treatment
- ✓ Surface water monitoring
- ✓ Drinking water



Description

The measuring principle is based on IR nephelometry / 880 nm (ISO 7027). The sensor can be calibrated with a formazine standard solution.

The NTU sensor integrates a low-cost optical technology, with a very few maintenance and no consumables.

Specifications

| Dissolved oxygen sensor | Specifications | |
|--------------------------|--|--|
| Principle | Diffusion IR at 90° | |
| Measuring ranges | 0 to 4000 NTU in 5 ranges: ✓ 0 – 50 NTU ✓ 0 – 200 NTU ✓ 0 – 1000 NTU ✓ 0 – 4000 NTU ✓ AUTOMATIC | 0 to 4500 mg/L Calibration : ✓ Range 0-500 mg/L according to NF EN 872 ✓ Range >500 mg/L according to NF T 90 105 2 |
| Resolution | 0,01 to 1 NTU - mg/L | |
| Accuracy | < 5% of the reading | |
| Working temperature | 0°C to 50°C | |
| Temperature compensation | Via CTN | |
| Stocking temperature | -10°C to + 60°C | |
| Response time | < 5 s | |
| Dimensions | Diameter : 27 mm; Length : 170 mm | |
| Weight | 300 g (sensor + 3 m cable) | |
| Material | PVC, DELRIN, Quartz, PMMA, Polyamide | |
| Pressure | 5 bars | |
| Cable length | Standard 3 m | |
| Protection | IP68 | |

1.7 Suspended solids, Turbidity and Sludge blanket sensor

Features

- ✓ Optical sensor based on IR absorptiometry
- ✓ Ranges :
 - Suspended Solids : 0-50 g/L
 - Sludge blanket 0-100 %
 - Turbidity 0-4000 FAU
- ✓ Robust and waterproof (IP68)
- ✓ Ultra low-power consumption
- ✓ Strong sensor

Applications

- ✓ Urban Waste water treatment : Inlet/ sewage water (Suspended Solids, Turbidity), Aeration basin (Suspended Solids), Outlet (Turbidity).
- ✓ Treatment of industrial effluents : Aeration basin (Suspended Solids), Clarifier (Sludge blanket), Outlet (Turbidity)
- ✓ Sludge treatment (Centrifugation)
- ✓ Dredging site (Turbidity)



Description

The measuring principle is based on the mitigation of the Infra-Red signal in 870 nm through an optical path of 5 mm. The sensor delivers measures in Suspended Solids (g/l), Turbidity (FAU) and Sludge Blanket detection in % of transmission IR. For a better precision, the optics of the sensor are regulated in temperature.

For a measure of Suspended Solids, the sensor is directly calibrated on the material to be measured (sample of sludge).

In Turbidimeter version the sensor delivers measures on a range 0-4000 FAU (Formazine Attenuation Unit) and is calibrated with solutions of Formazine.

A handle in DELRIN material assures the mechanical dress of the sensor and the sealing seals of the cable.

The probe includes a temperature sensor which delivers measurements and regulates the optics.

Specifications

| Dissolved oxygen sensor | Specifications |
|--------------------------|---|
| Principle | Optical IR (870 nm) based on IR absorption. |
| Measuring ranges | Suspended Solids : 0-50 g/L Turbidity : 0-4000 FAU Sludge blanket : 0-100 % |
| Resolution | Suspended Solids : 0.01 g/L Turbidity : 0.01 to 1 FAU Sludge blanket : 0.01 to 0.1 |
| Accuracy | Suspended Solids < 10 % Turbidity : +/- 5% (range 200-4000 FAU) Sludge blanket : +/- 2% |
| Response time | < 35 s |
| Working temperature | 0°C to 60°C |
| Temperature compensation | Via CTN |
| Stocking temperature | -10°C to + 60°C |
| Dimensions | Diameter : 64 mm; Length : 261 mm |
| Weight | 750 g (sensor) |
| Material | Delrin |
| Pressure | 5 bars |
| Cable length | Standard 3 m |
| Protection | IP68 |

2 Recommendation for maintenance and routine checking

2.1 *Soft checking recommendation*

2.1.1 Description

Any automatic analysis system requires a minimum checking operation even if it is not necessary to adjust any parameter. The automatic operation ensures the daily and repetitive measurements and cleaning, but a human control still remains necessary.

PHYSEO has its own self checking facility which produces the fault relay switching in the case of a measurement problem.

The low level check-up of the analyser just consists in the control of correct measurement conditions:

- ✓ Visual control of sensor dirtying.
- ✓ To clean the sensors if it is necessary.
- ✓ To run a measurement cycle on the process water.

2.1.2 Periodicity

Once a month.

2.1.3 Duration

Less than 15 minutes.

2.1.4 Operator

Local operator.

2.2 *Calibration checking*

2.2.1 Description

This operation is to be added to the previous one. It consists in making:

- ✓ To check the pH and Redox sensor with standard buffer solutions.
- ✓ To check the conductivity sensor with a standard solution or a known sample.
- ✓ To check on air the dissolved oxygen sensor.
- ✓ To check the Turbidity / TSS sensor with a standard solution or a known sample.

In the case of difference between the measurement and the expected value, a calibration should be run.

2.2.2 Periodicity

Every 3 months.

2.2.3 Duration

Less than 30 minutes.

2.2.4 Operator

Local operator.

2.3 Yearly preventive maintenance

2.3.1 Description

This maintenance is not necessarily required but is strongly recommended. If the check-up operations described above are correctly made, the measurement performance of the analyser will be kept on long term. However, a dirtying of pipes and pumps can be observed. The replacement of these parts could be necessary depending on operation conditions.

From our experience, we observed that the analysers that are yearly controlled give better reliability than others.

2.3.2 Periodicity (*facultative*)

Once a year, after the two years warranty period.

2.3.3 Duration

1 day (trip not included).

2.3.4 Operator

DTLI technician or DTLI representative.

3 Operational limits

3.1 Electromagnetic compliance

The PHYSEO transmitter design was improved and controlled in test bench. The electromagnetic compliance was fully checked in industrial environment. The current standards concerning the electromagnetic compatibility are respected. The 4-20mA and relays wiring should be made using shielded cables. The shield should be connected to the housing of the analyser.

3.2 Temperature

The sensors are designed for use on liquid water whose temperature is necessarily maintained in the 1 – 50°C range. If the temperature is higher than 50°C the measurement will be not reliable.

3.3 Interference

The principle measurement did not put in evidence of particular interferences.