RDO® PRO

Process Optical Dissolved Oxygen Probe

Operator's Manual

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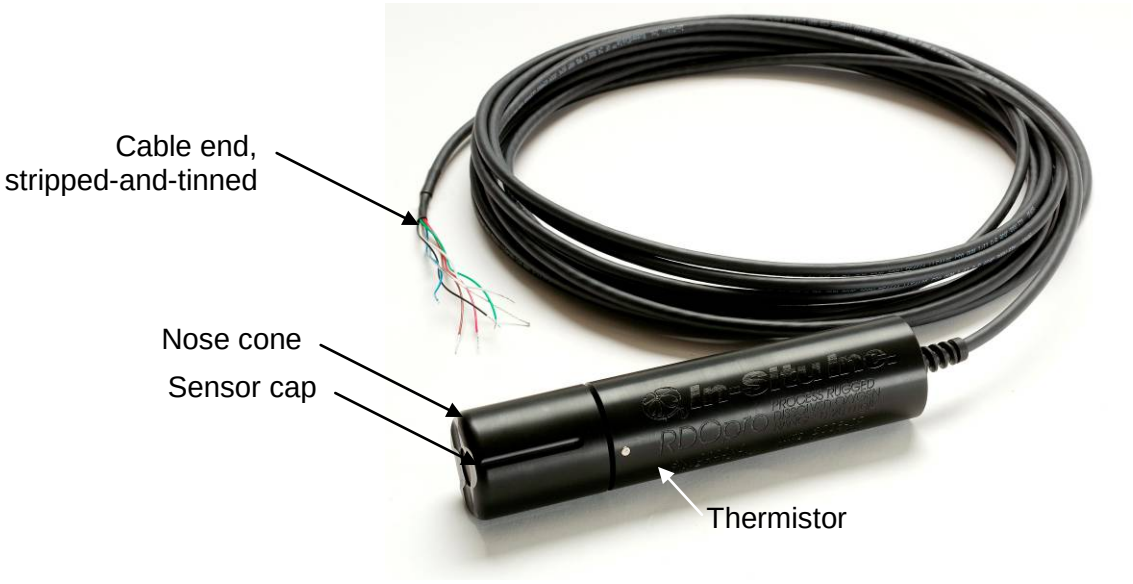
1.0 Introduction

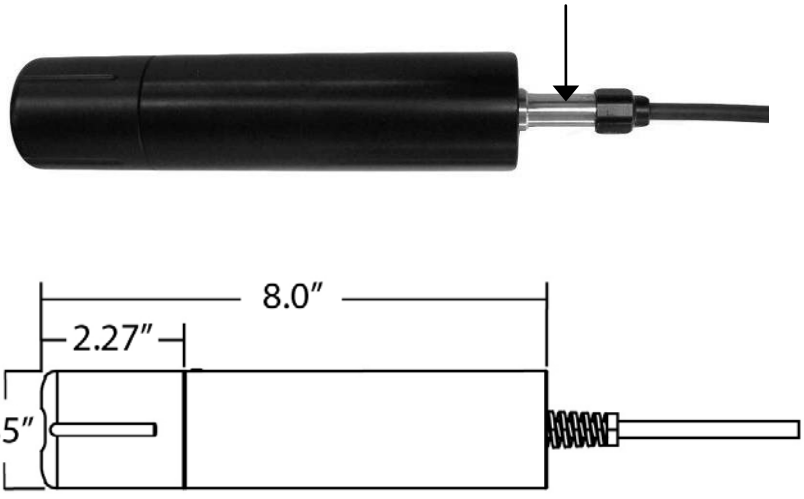
1.1 System Description

The RDO® Pro Probe is a rugged, reliable instrument designed to deliver accurate dissolved oxygen (DO) data across a wide measurement range and to reduce maintenance costs. The probe features the latest optical technology for DO measurement. The RDO PRO system consists of the following:

- RuggedCable® System
  - 10-m standard length with stripped-and-tinned ends
  - Customized lengths with titanium twist-lock connectors
- Black probe body with removable nose cone
- Optical DO sensor cap
- Titanium thermistor



With twist-lock connector and RuggedCable System:



1.2 Serial Numbers

The instrument serial number is engraved on the side of the unit. The cap serial number is programmed on the memory chip inside the cap.

1.3 Unpack the Probe

1. Remove the probe from the box and other packaging materials.
2. Unscrew the nose cone from the probe and remove the red protective dust cap from the sensor. Save the dust cap for later use.

Nose cone

Dust cap

3. Remove the RDO cap from the storage sleeve.

4. Align the arrow on the cap with the index mark on the probe and firmly press the cap onto the probe, without twisting, until it seals over the probe body.

Arrow

- ✓ *Do not allow moisture or atmospheric humidity inside the cap. Keep the cap in its sealed package until you are ready to install it. Install promptly. Ensure that the O-ring grooves are dry and the O-ring is not rolled or pinched inside the cap.*
- ✓ *The cap lifetime is one (1) year after the first reading has been taken. Install by the date printed on the package.*

5. Reattach the nose cone.

2.0 Calibrate the RDO PRO Probe

Calibrate the probe with the Comm Kit Software and the Communication Device, or calibrate the sensor directly with your controller. See Appendix A – Communication Device.

2.1 1-point Calibration

2.1.1 Water-Saturated Air Calibration

1. Remove the storage cap from the top of the calibration chamber and replace with the vented calibration cap.

1	Storage cap
2	Vented calibration cap

2. Place the sponge wafer in the bottom of the calibration chamber and saturate with approximately 10 mL of water.
3. Gently dry the probe and sensing element with a paper towel, ensure that no water or debris is on the probe or sensing element.
4. Place the probe in the calibration chamber so that the sensing element is about 2.5 cm (1 in.) above the water-saturated sponge.

    ✓ *Ensure that the sensor surface is dry when you place the probe into the calibration chamber*.

5. Wait 5 to 10 minutes for temperature stabilization prior to calibration. Do not leave the probe in the calibration chamber for more than 30 minutes. This can allow condensation to form on the surface of the sensing element, which will produce false low readings after calibration. If condensation does occur, remove the probe. Thoroughly dry the sensing element, the probe, and the thermistor before you perform the calibration procedure.

2.2 2-point Calibration

2.2.1 100% Calibration Point

Perform a water-saturated-air calibration as previously described.

2.2.2 0% Calibration Point

1. Remove the water-saturated sponge from the calibration chamber and fill the chamber to the fill line with approximately 60 mL of fresh sodium sulfite solution.

1	Fill line
2	Temperature sensor

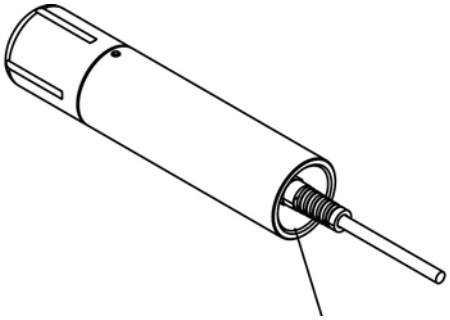
2. Place the probe into the solution. Leave at least 13 mm (0.5 in.) between the surface of the sensing element and the bottom of the chamber.
3. Ensure that the temperature sensor is completely submerged in the solution.
4. Wait at least 5 minutes for the temperature to stabilize prior to performing the calibration procedure.
5. Once the calibration is complete, remove the probe and thoroughly rinse to remove all of the sodium sulfite.

3.0 Sensor Deployment

The cable end of the RDO PRO Probe is internally threaded (1¼ – 11½ NPT) and can be attached to a male threaded pipe. When deployed, make sure that the nose cone and thermistor are completely submerged.

With 10-m cable

Twist-lock connector



1¼ NPT

4.0 Care and Maintenance

4.1 Clean the RDO Cap

1. The cap and nose cone must remain on the probe.
2. Rinse the sensor with clean water from a squirt bottle or spray bottle.
3. Gently wipe with a soft-bristled brush or soft cloth if biofouling is present. Use Alconox® to remove grease.
4. If extensive fouling or mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak in deionized (DI) water for 15 minutes.

   Do not use organic solvents—they will damage the sensing element. Do not remove the cap from the sensor prior to cleaning.

5. After cleaning, perform a 1- or 2-point user calibration or calibration check.

4.1.1 Clean the Optical Window

Clean the optical window only when you change the cap. See full instructions in the sensor cap replacement kit.

Remove the cap and gently wipe the lens with the supplied lens cloth. Do not wet the lens area with water or any solution.

Use only the supplied lens cloth for cleaning. Do not use any other cloth or material.

4.2 Clean the Probe

With the RDO cap installed on the probe, gently scrub the probe with a soft-bristled brush or nylon dish scrubber. Use Alconox to remove grease or other matter. Soak in vinegar and DI water to remove mineral deposits or extensive fouling as described in step 4, above.

4.3 RDO Cap Storage

Prior to installation: Store in factory supplied container.

Installed: Store in the calibration chamber with the storage cap attached (see section 2.1.1) and a few drops of clean water.

4.4 Replace the RDO Cap

The RDO cap has a 1-year life after the sensor takes its first reading. Replacement caps are available from In-Situ Inc. or your authorized In-Situ distributor.

1. Remove the probe nose cone.
2. Use a lint-free cloth to remove any moisture from the probe.
3. Pull the used RDO cap off of the sensor, without twisting.
4. Remove the existing O-rings from the sensor.

   Ensure that there is no moisture in the O-ring grooves.
   Do not touch or clean the lens with anything other than the supplied lens wipe.

5. Use your finger to apply a very thin layer of lubricant around the O-ring grooves.
6. Place the O-rings on the sensor. Apply another thin layer of lubricant to the O-rings and grooves.

   Do not transfer grease to the lens or sensor pins.

7. Clean the sensor lens with the wipe provided in the kit and allow it to thoroughly dry. Inspect for scratches or dirt.
8. Remove the new cap from its sealed packaging and attach it to the sensor, being careful to press firmly, without twisting, until it seals over the lens. Make sure that the O-rings are not pinched or rolled between the cap and sensor. Replace the nose cone.
9. Perform a 1- or 2-point calibration.

4.5 Maintaining Desiccant

Desiccant installed in a controller or transceiver protects probe electronics from condensation. A desiccant pack changes color from blue to pink as it becomes saturated with moisture.

It is extremely important to use the proper size desiccant for your deployment and to change desiccant often. Desiccant should be changed before the entire pack has turned pink, and you should use enough to effectively keep cables and instruments dry until your next scheduled maintenance. Desiccant lifespan is dependent on site conditions.

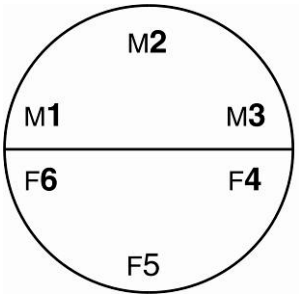
5.0 Controller Requirements and Connections

The RDO PRO Probe may be connected to a controller or logger for communication via:

- Analog (4-20 mA) provides a configurable 4-20 mA current loop output
- SDI-12
- RS485 Modbus
- RS232 Modbus

5.1 Wiring Overview

Refer to diagrams on the following pages. Trim and insulate unused wires. The shielded wire should be wired to a chassis ground or earth ground.

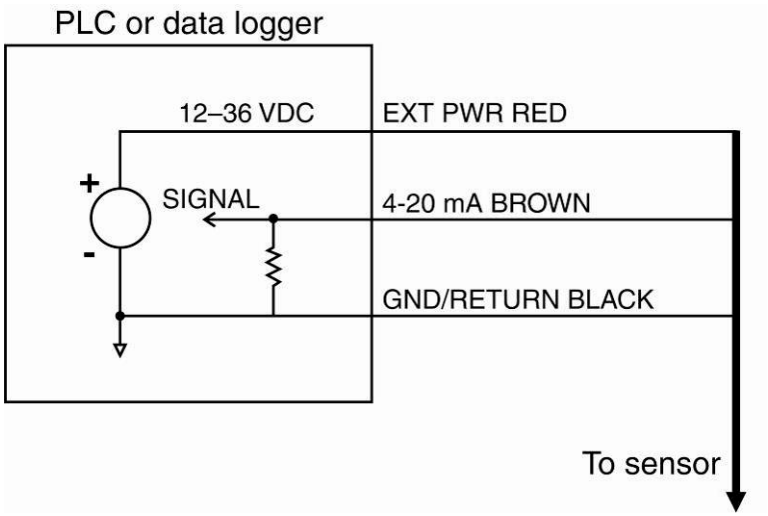


Signal	Color
Ground/Return	Black
External Power	Red
4-20 mA	Brown
RS485 (-)	Green
RS485 (+)	Blue
SDI-12	White

The inside of the controller must be kept free of moisture and humidity. Condensed moisture can migrate through the wiring and cause the probe to fail. Therefore, desiccant should be installed in the controller and be replaced on a regular basis.

5.2 Analog (4-20 mA) 3-wire

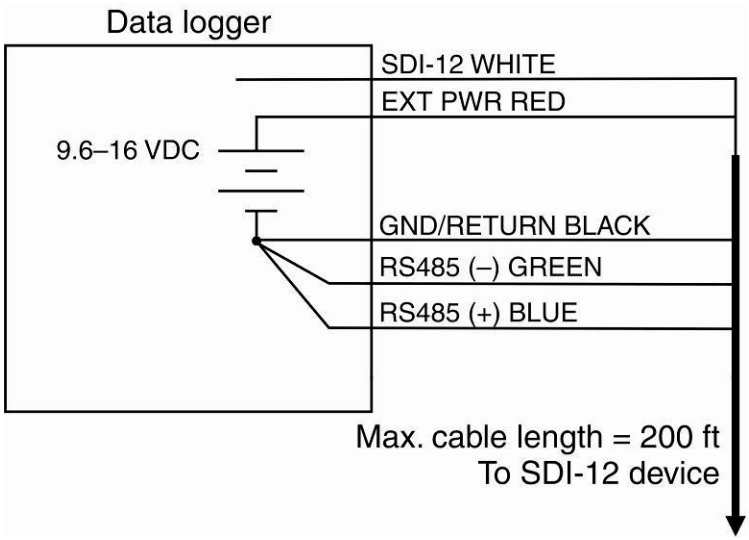
Signal	Color
Ground/Return	Black
External Power (12-36 VDC)	Red
4-20 mA	Brown



- ✓ Cable length must not exceed 1219 m (4000 ft.)
- ✓ Analog signal must be enabled in Win-Situ® 5 Software or the Comm Kit Software prior to use.

5.3 SDI-12 (3 wire)

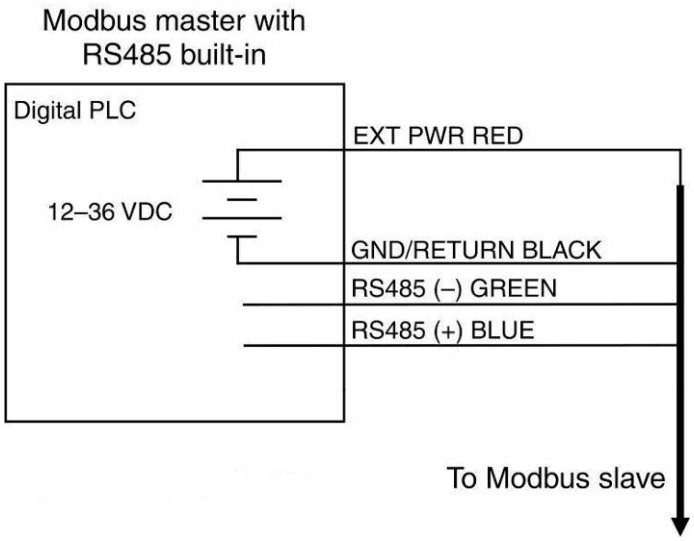
Signal	Color
Ground/Return	Black
External Power (9.6-16 VDC)	Red
RS485 (-)	Green
RS485 (+)	Blue
SDI-12	White



✓ Cable length must not exceed 60.96 m (200 ft.)

5.4 Modbus Master with Built-in RS485

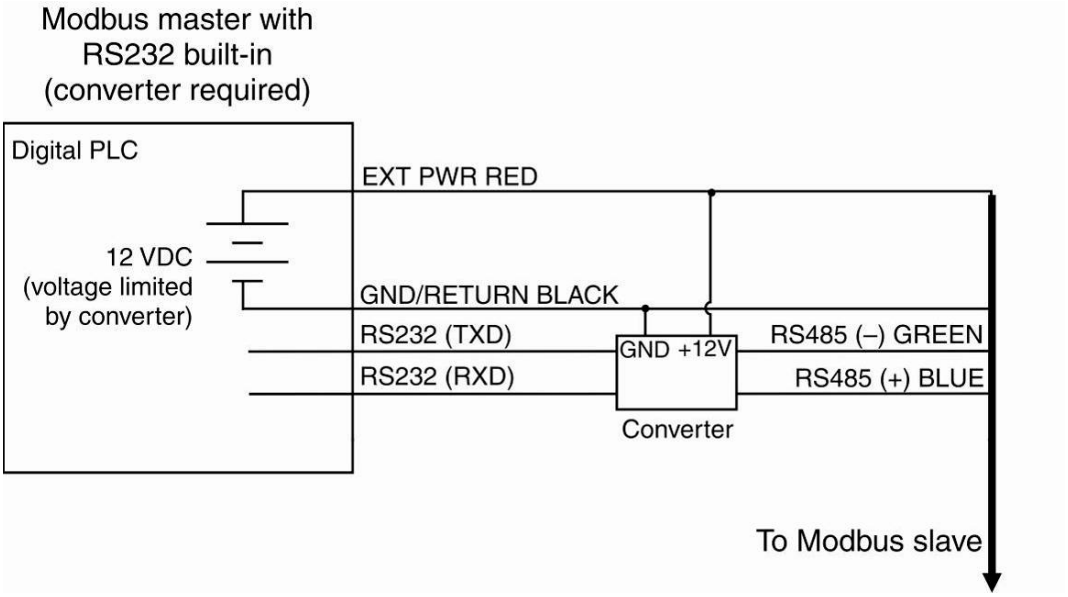
Signal	Color
Ground/Return	Black
External Power (12-36 VDC)	Red
RS485 (-)	Green
RS485 (+)	Blue



✓ Cable length must not exceed 1219 m (4000 ft.)

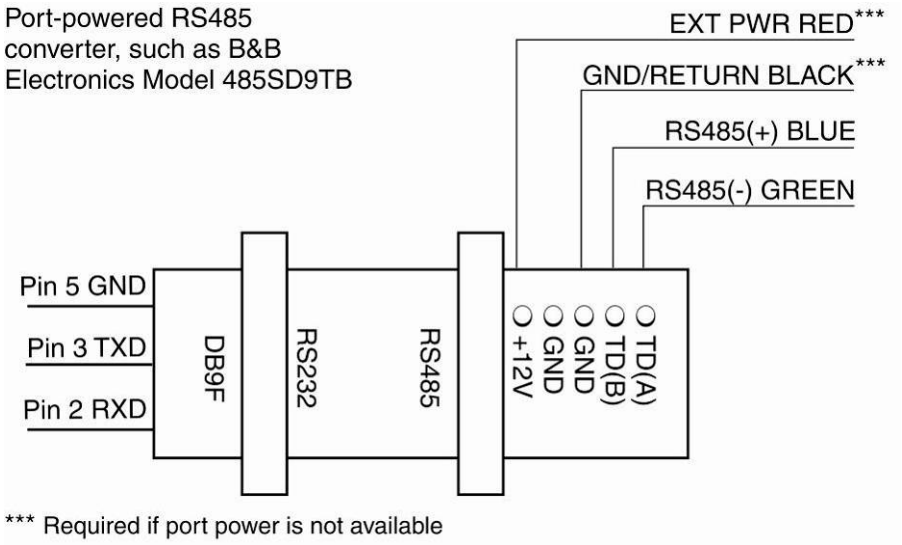
5.5 Modbus Master with Built-in RS232 (Converter Required)

Signal	Color
Ground/Return	Black
External Power (12 VDC, voltage limited by converter)	Red
RS485 (-)	Green
RS485 (+)	Blue



- ✓ Cable between converter and master must not exceed 60.96 m (20 ft.)
- ✓ Cable between master and slave must not exceed 1219 m (4000 ft.)

5.5.1 Converter



5.5.2 Power Connections

The red wire provides power for all system modes. Analog output is disabled by default. However, the 4-20 mA current loop output can be continuous in Modbus or SDI-12 mode as long as Modbus device register 9507 is set to 1.

5.5.3 Communications

The device automatically switches between Modbus and SDI-12 modes depending on which of the two interfaces has activity. Modbus and SDI-12 cannot be used at the same time—whichever one is currently in use will block communication on the other.

5.5.4 Additional Information

For additional information on Modbus and SDI-12 communications, including the SDI-12 commands and Modbus registers, see the In-Situ Modbus Communication Protocol technical note, available at ***www.in-situ.com***.

6.0 Modbus Registers

6.1 Common Registers

Register	Size (registers)	Mode & Access Level (R/W)	Data Type	Description
9001	1	R/W	ushort	Device Id (Device Id = 12 for RDO PRO)
9002	2	R/W	ulong	Device Serial Number
9004	3	R/W	time	Manufacture Date

6.2 Sensor Status Registers

Register	Size (registers)	Mode & Access Level (R/W)	Data Type	Description
0005	3	R1	time	RDO cap start time, 0 = no cap
0008	3	R1	time	RDO cap exp. time, 0 = no cap

6.3 Device Specific Measurement Registers

Register	Size (registers)	Mode & Access Level (R/W)	Data Type	Description
Dissolved Oxygen Concentration				
0038	2	R1	float	Measured value, C_0
0040	1	R1	ushort	Parameter Id = 20
0041	1	R1/W2	ushort	Units Id 117 = mg/L (default) 118 = µg/L
0042	1	R1	ushort	Data Quality Id
0043	2	R1/W3	float	Off line sentinel value (default = 0.0)
0045	1	R1	16 bits	Available Units = 0x0030 (48)
Temperature				
0046	2	R1	float	Measured value
0048	1	R1	ushort	Parameter Id = 1

0049	1	R1/W2	ushort	Units Id 1 = °C (default) 2 = °F
0050	1	R1	ushort	Data Quality Id
0051	2	R1/W3	float	Off line sentinel value (default = 0.0)
0053	1	R1	16 bits	Available Units = 0x0003 (3)
Dissolved Oxygen %Saturation				
0054	2	R1	float	Measured value
0056	1	R1/W2	ushort	Parameter Id = 21
0057	1	R1/W2	ushort	Units Id 177 = percent saturation (default)
0058	1	R1	ushort	Data Quality Id
0059	2	R1/W3	float	Off line sentinel value (default = 0.0)
0061	1	R1	16 bits	Available Units = 0x0001 (1)
Oxygen Partial Pressure				
0062	2	R1	float	Measured value
0064	1	R1	ushort	Parameter Id = 2 (pressure)
0065	1	R1/W2	ushort	Units Id 26 = torr (default)
0066	1	R1	ushort	Data Quality Id
0067	2	R1/W3	float	Off line sentinel value (default = 0.0)
0069	1	R1	16 bits	Available Units = 0x0200 (512)

6.3.1 Dissolved Oxygen Concentration Equations

DO concentration is internally calculated in mg/L. Conversion to other units is as follows:

µg/L = 1000 * mg/L

Oxygen concentration C_o (mg/L) is calculated as:

$$C_o = 31.9988 \times 1E6 \times (\rho P_o / k_o M)\ (1 - \Theta_o) \times S_c$$

Where:

P_o is the partial pressure of O_2 in atmospheres.

$$P_{torr} = 759.999876 \times P_{atm}$$

S_c is the salinity correction:

$$\ln S_c = S(B_0 + B_1 T_s + B_2 T_s^2 + B_3 T_s^3) + C_0 S^2$$

$$B_0 = -6.246090 \times 10^{-3}$$

$$B_1 = -7.423444 \times 10^{-3}$$

$$B_2 = -1.048635 \times 10^{-2}$$

$$B_3 = -7.987907 \times 10^{-3}$$

$$C_0 = -4.679983 \times 10^{-7}$$

T_s is the scaled temperature:

$$T_s = \ln [(298.15 - t) / (273.15 + t)]$$

t is temperature in degrees C.

S is the salinity in PSU.

k_o is Henry's constant:

$$\ln k_o = 3.71814 + (5596.17/T) - (1{,}049{,}668/T^2)$$

T is temperature in Kelvin.

Θ_o is the negative of the second pressure coefficient:

$$\Theta_o = 0.000975 - (1.426 \times 10^{-5} t) + (6.436 \times 10^{-8}\ t^2)$$

t is temperature in degrees C.

ρ is the density of water in g/cm^3:

$$\ln \rho = -0.589581 + (326.785/T) - (45{,}284.1/T^2)$$

T is the temperature in Kelvin.

Molar mass of water: M = 18.0152 g/mole

References:

Benson and Krause, Jr., 1980. The concentration and isotopic fractionation of gases dissolved in freshwater in equilibrium with the atmosphere. *Limnol and Oceanogr*, 25(4), 662-671.

Gordon and Garcia, 1992. Oxygen Solubility in Seawater: Better Fitting Equations. *Limnol and Oceaongr*, 37(6), 1307-1312.

6.3.2 Dissolved Oxygen, % Saturation Equations

$O_2\%Sat = O_2Reading / O_2100\%Sat$

Where:

O_2 reading is the mg/L reading from the RDO Sensor.

O_2 100% Sat is the theoretical saturation value in mg/L and is derived as:

$$O_2100\%Sat = 31.9988 \times 10^6 \times \frac{\rho\,[0.20946 \times (P - P_{wv})]}{k_oM} \times (1 - \Theta_oP) \times S_c$$

Where:

ρ is the density of water in g/cm^3:

$$\ln \rho = -0.589581 + (326.785/T) - (45{,}284.1/T^2)$$

T is the temperature in Kelvin.

P is the atmospheric pressure in atm.

P_{wv} is the partial pressure of water vapor at saturation in atm:

$$\ln P_{wv} = 11.8571 - (3{,}840.70/T) - (216{,}961/T^2)$$

k_o is Henry's constant:

$$\ln k_o = 3.71814 + (5596.17/T) - (1{,}049{,}668/T^2)$$

T is the temperature in Kelvin.

Molar mass of water: M = 18.0152 g/mole

Θ_o is the negative of the second pressure coefficient:

$$\Theta_o = 0.000975 - (1.426 \times 10^{-5}t) + (6.436 \times 10^{-8}\,t^2)$$

t is temperature in degrees C.

S_c is the salinity correction:

$$\ln S_c = S(B_0 + B_1T_s + B_2T_s^2 + B_3T_s^3) + C_0S^2$$

$$B_0 = -6.246090 \times 10^{-3}$$

$$B_1 = -7.423444 \times 10^{-3}$$

$$B_2 = -1.048635 \times 10^{-2}$$

$$B_3 = -7.987907 \times 10^{-3}$$

$$C_0 = -4.679983 \times 10^{-7}$$

T_s is the scaled temperature:

$$T_s = \ln [(298.15 - t) / (273.15 + t)]$$

t is temperature in °C.

S is the salinity in PSU

References:

Benson and Krause, Jr., 1980. The concentration and isotopic fractionation of gases dissolved in freshwater in equilibrium with the atmosphere. *Limnol and Oceanogr*, 25(4), 662-671.

6.4 Calibration Registers

Register	Size (registers)	Mode & Access Level (R/W)	Data Type	Description
0118	2	R1/W3	float	Live salinity value (PSU)
0120	2	R1/W3	float	Default salinity value (PSU, default = 0.0)
0122	2	R1/W3	float	Live barometric pressure (mbar)
0124	2	R1/W3	float	Default barometric pressure (mbar, default = 1013.25)
0126	2	R1/W3	float	100% saturation calibration reading (mg/L)
0128	2	R1/W3	float	100% saturation temperature reading (°C)
0130	2	R1/W3	float	100% saturation salinity value (PSU)
0132	2	R1/W3	float	100% saturation barometric pressure (mbar)
0134	2	R1/W3	float	0% saturation calibration reading (mg/L)
0136	2	R1/W3	float	0% saturation temperature reading (°C)
0138	2	R1/W3	float	Calibration slope (default = 1.0)
0140	2	R1/W3	float	Calibration offset (default = 0.0)

Live Salinity Value

The live salinity value is used to correct the oxygen concentration value for salinity. Values must be written in Practical Salinity Units (PSU) in the range 0 to 42 PSU. This is not a measured parameter.

Default Salinity Value

The default salinity value is loaded into the live salinity value register when power is first applied to the probe. The default salinity value is used in calculations until a live salinity value is written. This is not a measured parameter.

Live Barometric Pressure

The live barometric pressure is used in the calculation of percent saturation and to determine the theoretical saturation point during calibration. Values must be written in millibars in the range 506.625 to 1114.675 mbar. This is not a measured parameter.

Default Barometric Pressure

The default barometric pressure is loaded into the live barometric pressure register when power is applied to the probe. The default barometric pressure is used in calculations until a live barometric pressure is written. This is not a measured parameter.

100% Saturation Calibration Values

These values represent the sensor conditions while the probe is in a 100% saturation calibration environment. These are not measured values, they are written by the controller during the calibration process.

Writes to these registers are only accepted if the probe is in the calibration mode. The probe will return exception 0x85 (invalid device command sequence) if an attempt is made to write these registers when the calibration mode is off.

0% Saturation Calibration Values

These values represent the sensor conditions while the probe is in a 0% saturation calibration environment. These are not measured values, they are written by the controller during the calibration process.

Writes to these registers are only accepted if the probe is in the calibration mode. The probe will return exception 0x85 (invalid device command sequence) if an attempt is made to write these registers when the calibration mode is off.

Calibration Slope and Offset

These values represent the slope and offset that will be applied to the raw concentration reading from the sensor to generate the final values reported by the sensor parameters. These registers may be written independently of the normal internal calibration procedure.

6.5 Entering Calibration Registers

The sensor is calibrated using the following procedure:

1. **Optional:** Read the Sensor Data Cache Timeout register 9463 and store the value.
2. Write the Sensor Data Cache Timeout register 9463 to a value less than your intended sample rate and greater than 1000 milliseconds. This will ensure that you get new sensor readings during the stabilization process.
3. **Optional:** Read the temperature units register 0049 and saturation units register 0041 and store their values.
4. Write the temperature units register 0049 to its default value (1) and write the saturation units register 0041 to its default value (117).
5. Write the Calibration Mode On command (0xE000) to the sensor command register 9305.
6. Update the live salinity and barometric pressure registers if necessary.
7. Place the probe in a 100% saturation environment.
8. Read the DO concentration and temperature parameters. When these values have reached equilibrium, record them in their respective 100% saturation calibration registers. Write the current live salinity and barometric pressure readings to their respective calibration registers.
9. Prompt the user to place the sensor in a 0% saturation environment. When these registers have reached equilibrium, record them in their respective 0% saturation calibration registers. If a zero calibration is not to be performed, these registers can be set to zero or left at their previous values. **Note: If you have a version of RDO PRO firmware that is earlier than 1.15, and you are not doing the zero calibration, you must set the 0% calibration registers to zero.**
10. Write the Calibration Update command (0xE001) to the sensor command register. The sensor will calculate a new slope and offset, write the current time to the last user calibration time register, and set the next user calibration time register to zero (disabled). If the concentrations at 100% and 0% saturation are equal, the probe will return an exception response with code 0x97 (invalid calibration) and not attempt to compute a new slope and offset due to possible division by zero. If the slope does not calculate between 0.85 and 1.20 inclusive, or if the offset does not calculate between -0.2 and +0.2 inclusive, then the probe will return an exception response with code 0x97 (invalid calibration).The slope and offset will be available for read but will not be committed to flash.
11. **Optional:** Read the last user calibration time register, add the next calibration interval, and write the result to the next user calibration time register.

12. Write the Calibration Mode Off command (0xE002) to the sensor command register to place the sensor in normal operation. If the calibration mode is turned off without a calibration update command, or the calibration command returned an exception, the previous calibration shall be restored.
13. **Optional:** If you saved the temperature and saturation parameter units at the start of the process, write the original values back.
14. **Optional:** If you saved the Sensor Data Cache Timeout register 9463 at the start of the process, write the original value back.

6.5.1 Calibration Calculations

Calibrated oxygen reading:

$$O_{2RC} = c_o + c_1 \times O_{2RU}$$

Where:

$$c1 = (O_2100\%Sat)/(O_{2RUS} - O_{2RUZ})$$

$$c_o = -c_1 \times O_{2RUZ}$$

Where:

$O_2100\%Sat$ is the theoretical 100% saturation point

O_{2RUS} is the un-calibrated reading at 100% saturation

O_{2RUZ} is the un-calibrated reading at 0% saturation

References:

Standard Methods for the Examination of Water and Wastewater, 20th Ed, 2008. 4500-0 C. Azide Modification. American Public Health Association. USA.

7.0 Specifications

	Optical RDO PRO Dissolved Oxygen Probe
Sensor type	Optical (luminescent) dissolved oxygen sensor
RDO PRO Probe	Range: 0 to 50 mg/L concentration; 0 to 200% saturation
	Accuracy: ±0.1 mg/L, 0 to 8 mg/L ±0.2 mg/L, 8 to 20 mg/L ±10% of reading, 20 to 50 mg/L
	Resolution: 0.01 mg/L
	Response time: T90 < 45 sec; T95 < 60 sec @ 25°C
	Storage conditions: -5° to 60° C (23° to 140° F)
RDO sensor cap	Usage life: 1 year from first instrument reading
	Shelf life: 24 months from date of manufacture (install within 12 months of manufacture)
	Storage conditions: 1° to 60° C (33° to 140° F), in factory container
Temperature sensor	Range: 0° to 50° C (32° to 122° F)
	Accuracy: ±0.1° C typical
	Resolution: 0.01° C
Transmitter/local display	Optional, or use with Con TROLL® PRO System
Communications options	Modbus/RS485, 4-20 mA, SDI-12
Max. power consumption	50 mA at 12 VDC
Measure current	6 mA typical at 24 VDC
Idle current (no measurement or communication)	160 µA typical at 24 VDC
Maximum cable length	Up to1219 m (4000 ft) (for Modbus and 4-20 mA) or up to 60.96 m (200 ft) (for SDI-12)
Cable options	10-m fixed stripped-and-tinned; Twist-lock connector with user-selectable cable length
Internal mounting thread	1¼ - 11 ½ NPT
IP rating	IP-67 with cap off, IP-68 with cap installed
Compliance	Heavy industrial, IEC 61000-6-2:2005
Salinity compensation	Fixed or real-time capable (using Con TROLL PRO or controller)
Barometric pressure	Fixed or real-time capable (using Con TROLL PRO or controller)
Maximum pressure	150 psi from 0 to 50° C; 300 psi @ 25° C
Warranty	3 years from date of shipment
Methods	Standard Methods 4500-O; In-Situ Methods 1002-8-2009,1003-8-2009, 1004-8-2009 (EPA approved)

8.0 Accessories and Replacement Parts

Accessory	Order No.
RDO PRO Sensor Cap Replacement Kit	0084230
RDO PRO Calibration Kit	0088890
Manual, RDO PRO Probe	0089662
RDO PRO Communication Device Kit	0081100

9.0 Warranty and Service

9.1 Warranty Provisions

In-Situ Inc. provides a 3-year limited warranty on the RDO PRO Instrument. Complete warranty provisions and the return material authorization (RMA) form are located on the In-Situ website.

9.2 Obtain Repair Service

The RDO PRO contains no user-serviceable parts. Do not attempt to open the instrument case or service the unit yourself.

If you suspect that your probe is malfunctioning and repair is required, you can help assure efficient servicing by following these guidelines:

Call In-Situ Technical Support: 800-446-7488 or 970-498-1500 (option 3), or email: support@in-situ.com.

1. Have the product model and serial number handy. The probe serial number is engraved on the probe housing.
2. Be prepared to describe the problem, including how the instrument was being used and the conditions noted at the time of the malfunction.
3. If Technical Support determines that service is needed, they will ask that your company pre-approve a specified dollar amount for repair charges. When the pre-approval is received, Technical Support will assign an RMA (Return Material Authorization) number.
4. Clean the instrument, sensor, and cable. Pack in the original shipping box, if possible. Include any supporting information.
5. Mark the RMA number clearly on the outside of the box with a marker or label.
6. Send the package, shipping prepaid, to

    In-Situ Inc.
    ATTN: RMA (your RMA number here)
    221 East Lincoln Ave.
    Fort Collins, CO 80524

The warranty does not cover damage during transit. We recommend that the customer insure all shipments. Warranty repairs will be shipped back prepaid.

10.0 Appendix A – Communication Device

The Communication Device is an accessory product that can be used to calibrate and set up RDO probes.

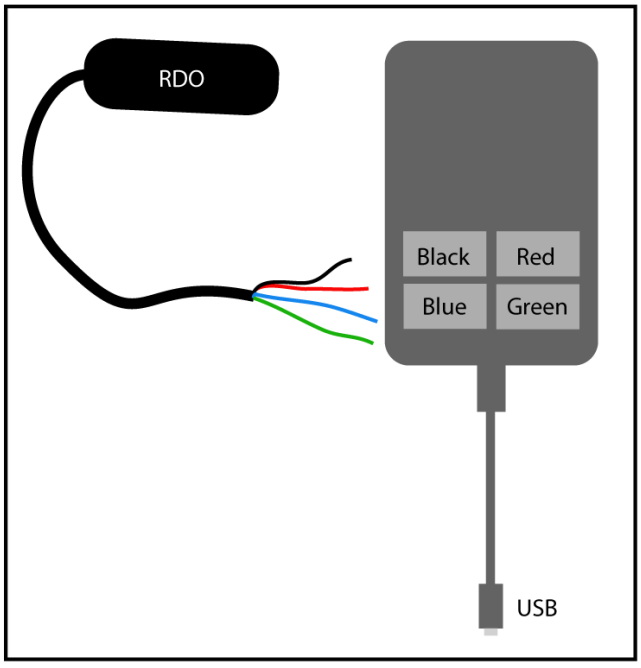
10.1 Install and Open the Software

The Comm Kit Software must be installed on a computer before you connect to the probe.

10.2 Connect the Probe to the Communication Device

The Communication Device connects a stripped-and-tinned probe to a computer via USB connection.

1. Disconnect the instrument from the PLC.
2. The communication device includes an electrical connection diagram label. To attach the instrument to the communication device, depress a lever and insert the appropriate wire in the location specified by the diagram.
3. Attach the USB connector to a USB port on the computer. Follow the directions provided in the Communication Device Kit to set up the probe.



11.0 Declaration of Conformity

Manufacturer: In-Situ, Inc.
221 East Lincoln Avenue
Fort Collins, CO 80524
USA

Declares that the following product:

Product name: RDO PRO Optical Dissolved Oxygen Sensor
Model: RDO PRO Optical Dissolved Oxygen Sensor
Product Description: The RDO PRO measures dissolved oxygen and temperature in natural groundwater and surface water.

is in compliance with the following Directives:

2004/108/EC for Electromagnetic Compatibility (EMC) Directive
73/23/EEC for Safety Directive

and meets or exceeds the following international requirements and compliance standards:

- **Immunity**

  EN 61000-6-2, Electromagnetic Compatibility (EMC) – part 6-2: Generic standards – Immunity for industrial environments

- **Emissions**

  Class A requirements of CISPR 11: 2004, Specification for limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment

Supplementary Information:
The device complies with the requirements of the EU Directives 2004/108/EC and 73/23/EEC, and the CE mark is affixed accordingly.

Bob Blythe
President and CEO
In-Situ Inc.
October 2, 2008

The presence of the Waste Electrical and Electronic Equipment (WEEE) marking on the product indicates that the device is not to be disposed via the municipal waste collection system of any member state of the European Union.

For products under the requirement of WEEE directive, please contact your distributor or local In-Situ Inc. office for the proper decontamination information and take back program, which will facilitate the proper collection, treatment, recovery, recycling, and safe disposal of the device.