Atlas Scientific™
Environmental Robotics

V 1.0

Released 4/23

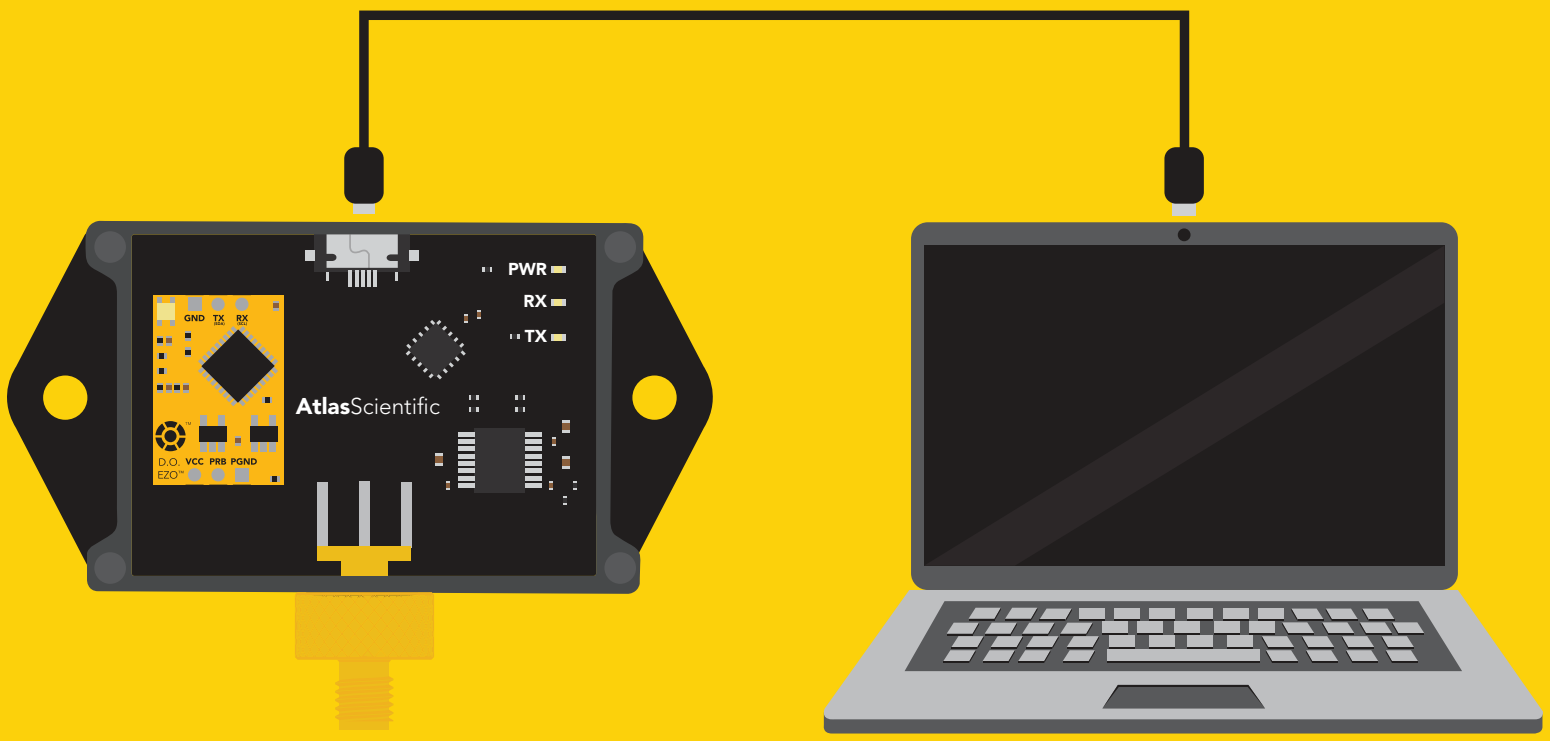
EZO Complete-DO™

USB Dissolved Oxygen meter

Users Guide

ISO 5814 Compliant

(determination of dissolved oxygen)



Reads	**Dissolved Oxygen**	DO reading time	**1 reading /sec**
Normal range	**0.00 – 100 mg/L** **0 – 350% saturation**	Supported probes	**Any galvanic probe**
		Calibration	**1 or 2 point**
Accuracy	**+/- 0.05**	Recalibration frequecy	**~8 – 12 months**
Resolution	**.01**	Temperature, salinity, and pressure compensation	**Automatic or manual**

RoHS COMPLIANT

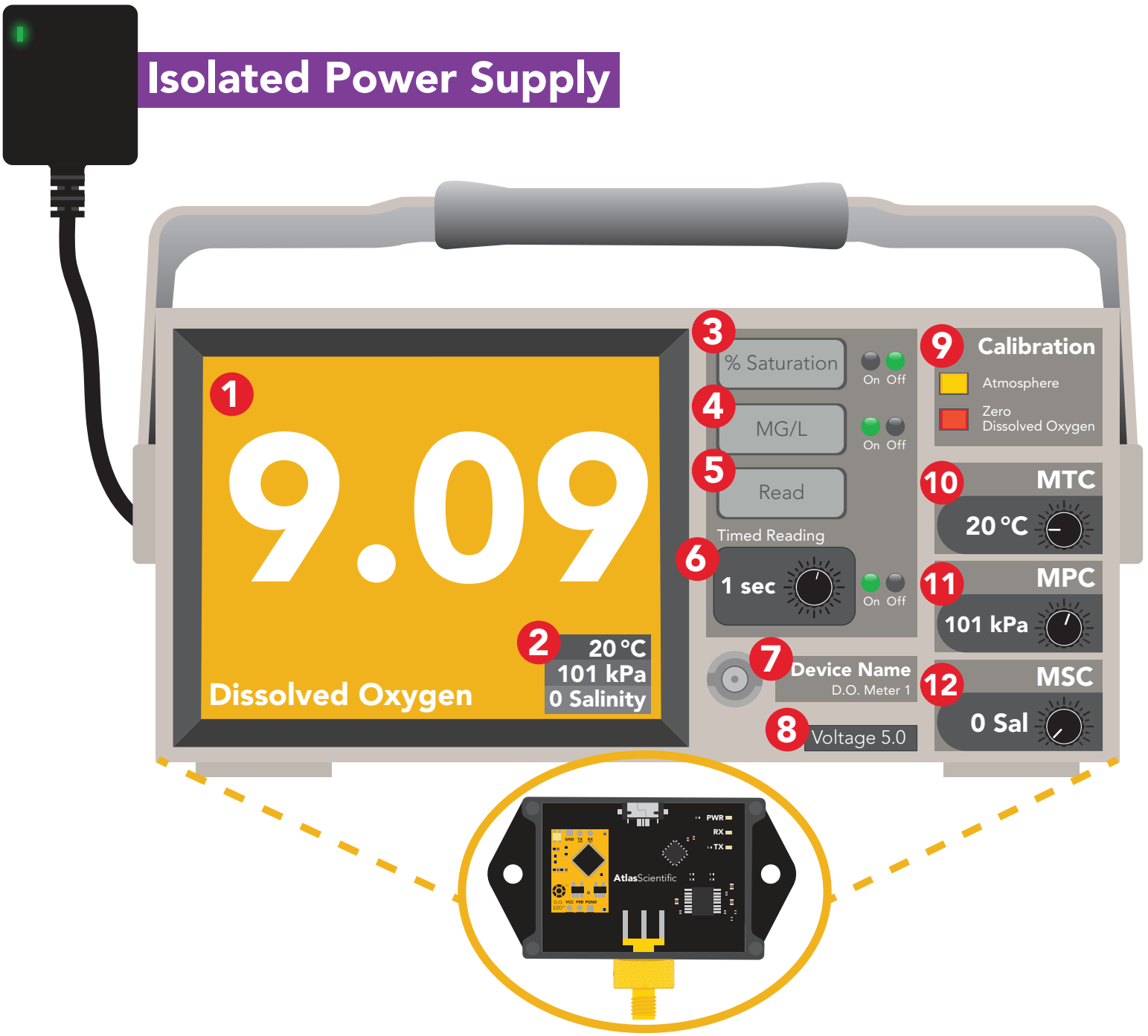
Written by Jordan Press
Designed by Noah Press

PATENT PROTECTED

This is an evolving document, check back for updates.

The EZO Complete-DO™ has all the features of this bench top meter.

Isolated Power Supply



1 Two decimal D.O. reading

2 Temperature, pressure, and salinity compensation value

3 Percent saturation

4 Milligrams per liter

5 Immediate reading

6 Timed readings

7 Set device name

8 Voltage usage

9 Multi point calibration

10 Temperature compensation

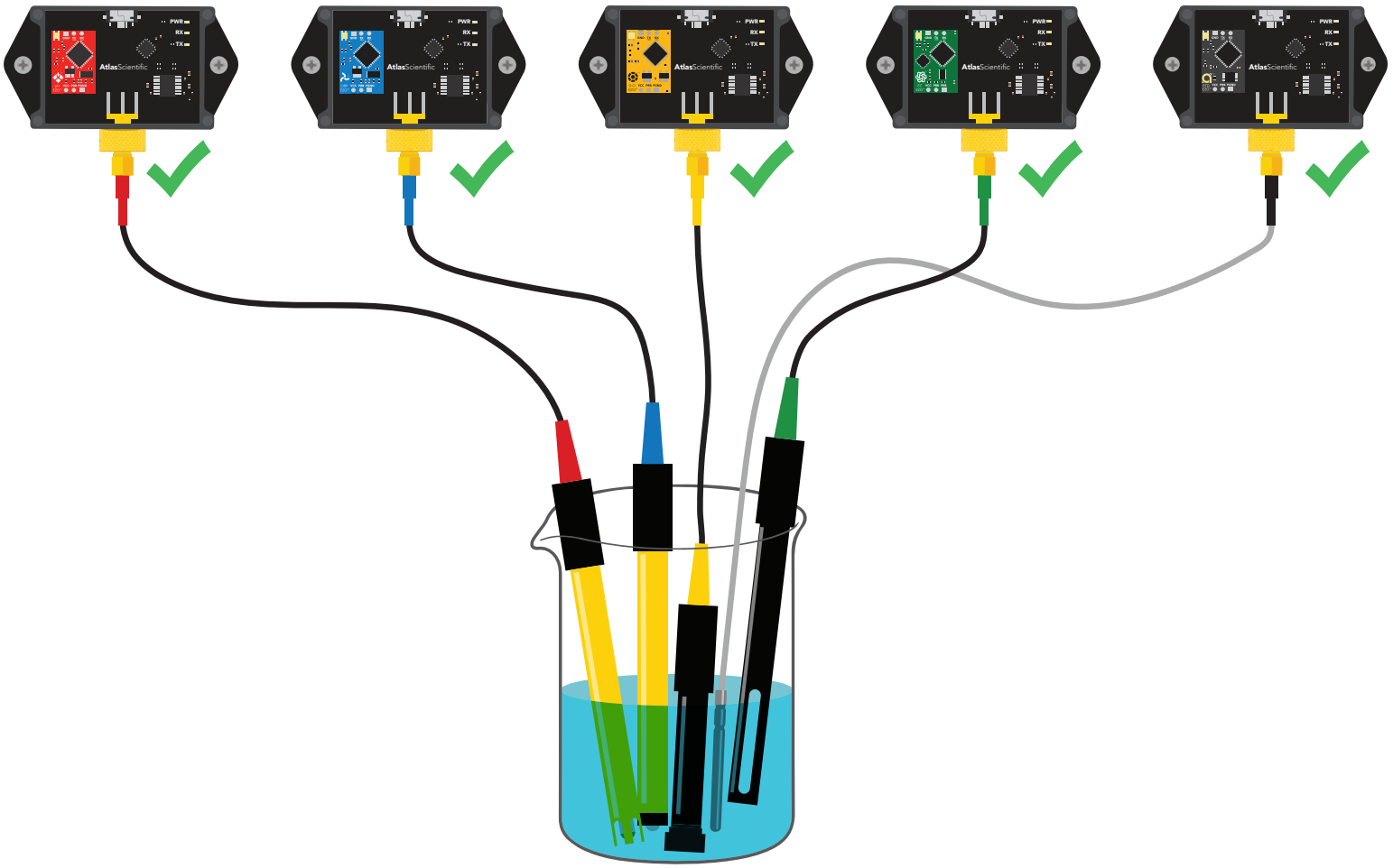
11 Pressure compensation

12 Salinity compensation

The EZO Complete-DO™ is compatible with any brand of galvanic D.O. probe.

Interference free

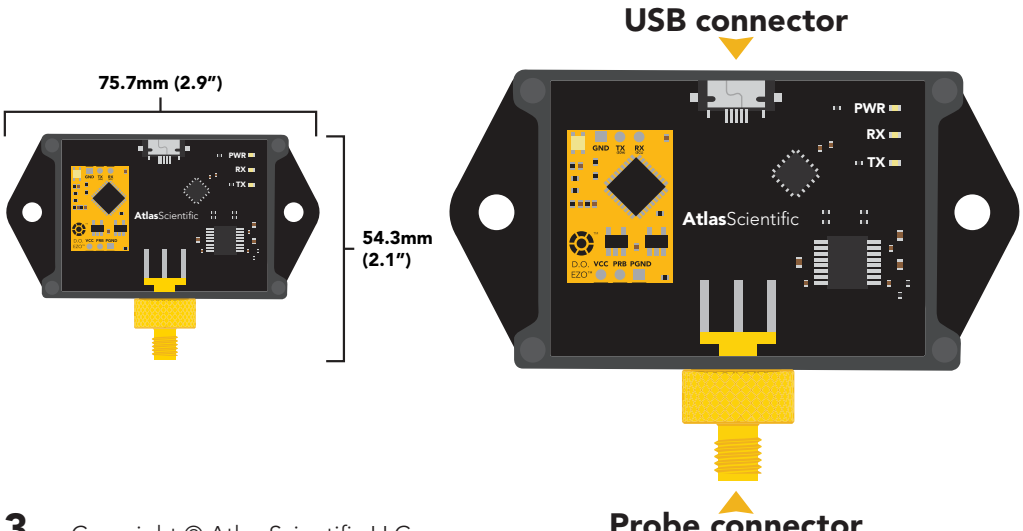
The EZO complete readings are unaffected by other sensors in the same water.



Ingress protection – IP62

The EZO Complete-DO™ is dust proof and resistant to splashing water.

Two areas of concern are the *USB connector* and the *probe connector.*



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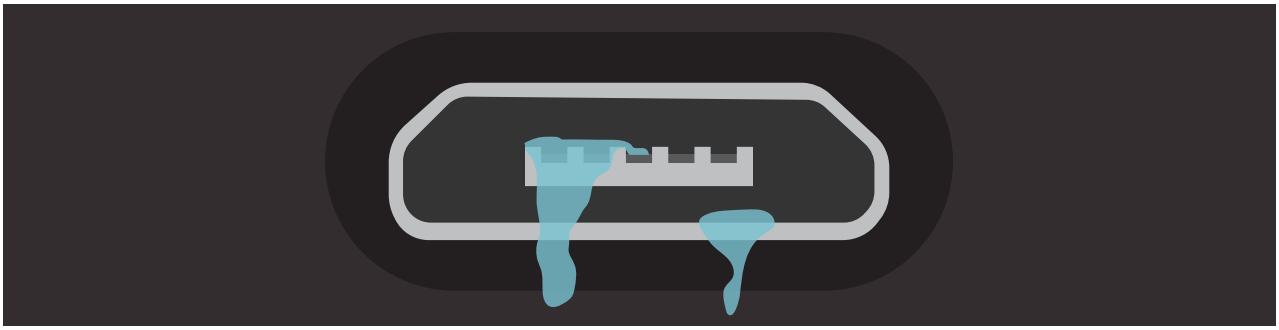
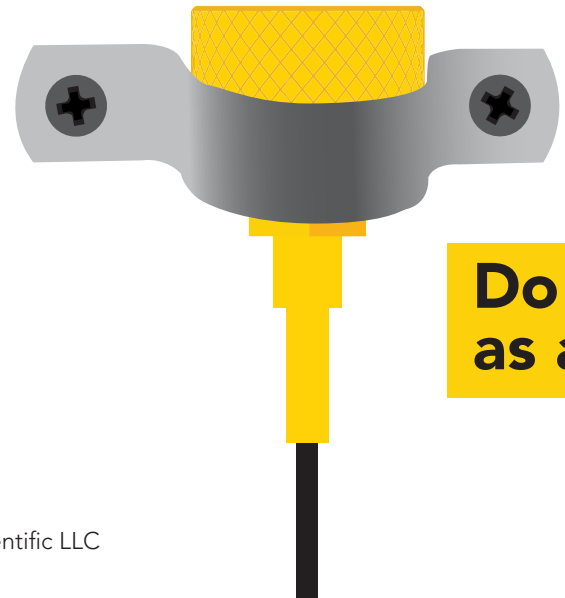
Ingress protection – IP62

An electrical short can occur if water enters the USB connector. A USB short could permanently damage the EZO-Complete. A USB short is not covered under warranty.



A connector short can occur if water enters the SMA connector. A connector short will cause the DO readings to pin to 0, 35, or the probe will respond slowly to changes in DO. A connector short is reversible and will not damage the EZO-Complete. However, frequent shorts will eventually damage the DO probe.

The SMA connector is part of your probe; Nothing should be in contact with this part.



Do not use this as a mounting point!

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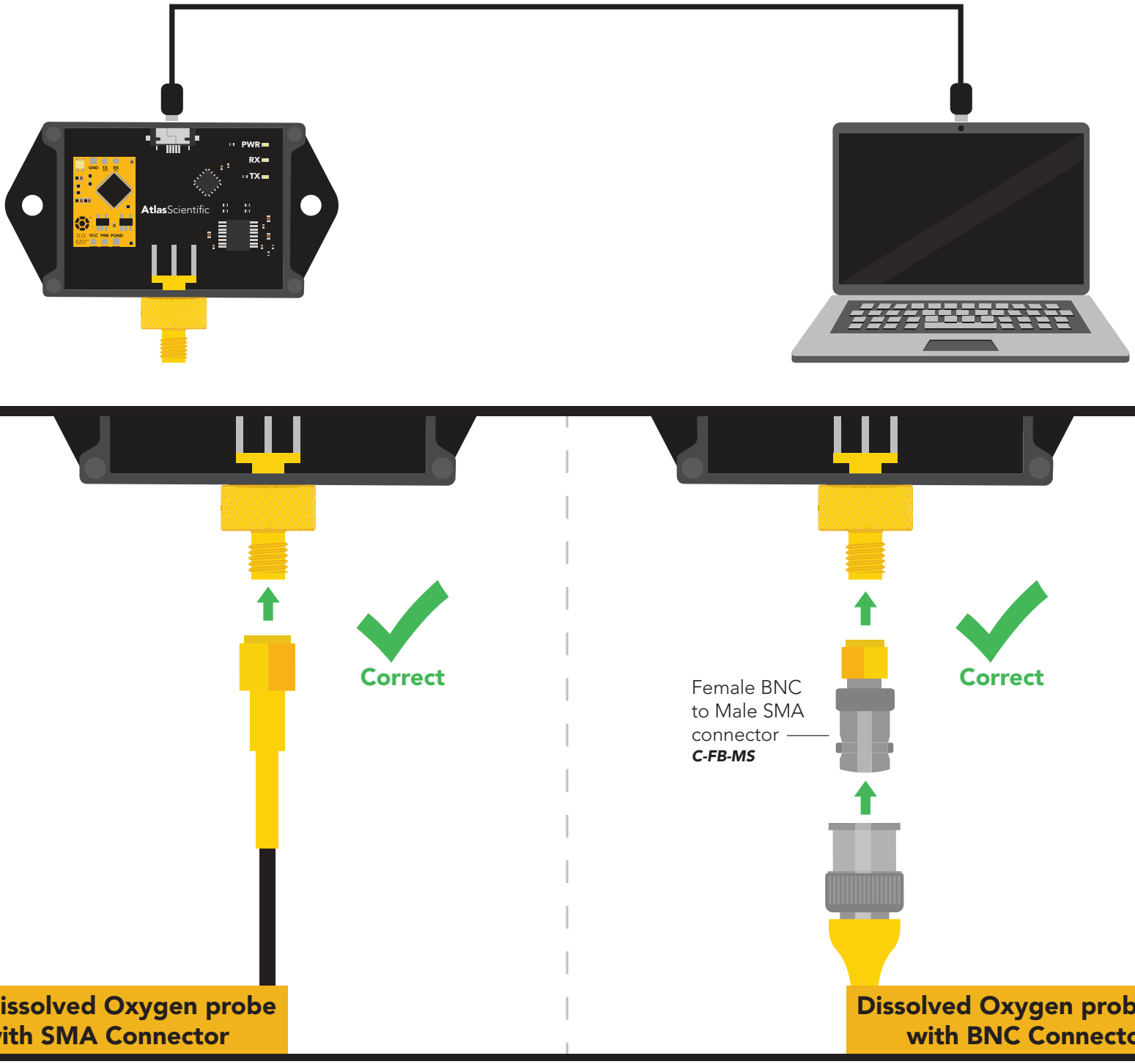
Setup



Click here to download

AtlasDesktop™

Monitoring Software

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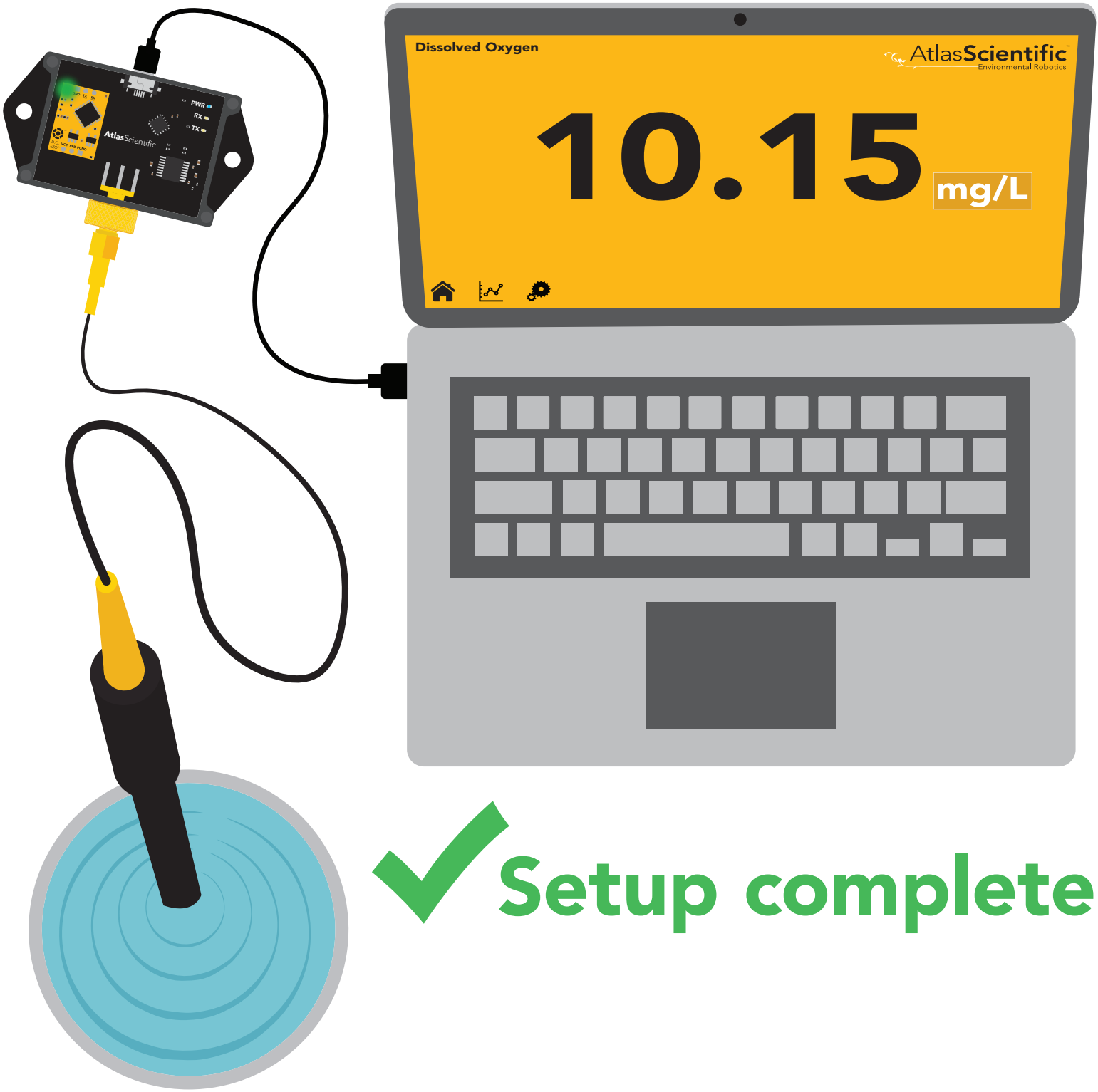
Setup

Once you have installed the AtlasDesktop monitoring software, you can begin monitoring and logging your readings.



Setup complete

Calibration theory

The accuracy of your readings is directly related to the quality of your calibration.
(Calibration is not difficult, and a little bit of care goes a long way).

Confirm the D.O. probe is working correctly

Take readings in air first.

Readings > 10

Readings < 5 or > 25

Refer to probes datasheet for instructions.

Calibrate first, compensate later

Compensating for temperature, pressure, and salinity will change your calibrated readings to a value that cannot easily be predicted. This makes it difficult to know if the probe has been calibrated correctly.

Default compensation values	Known calibration value
Temp = 20 °C **Pressure = 101 kPa** **Salinity = 0**	**9.09 Mg/L**
Temp = 29 °C **Pressure = 93 kPa** **Salinity = 5** *(too many variables)*	**???** **(6.84 Mg/L)**

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Best practices for calibration

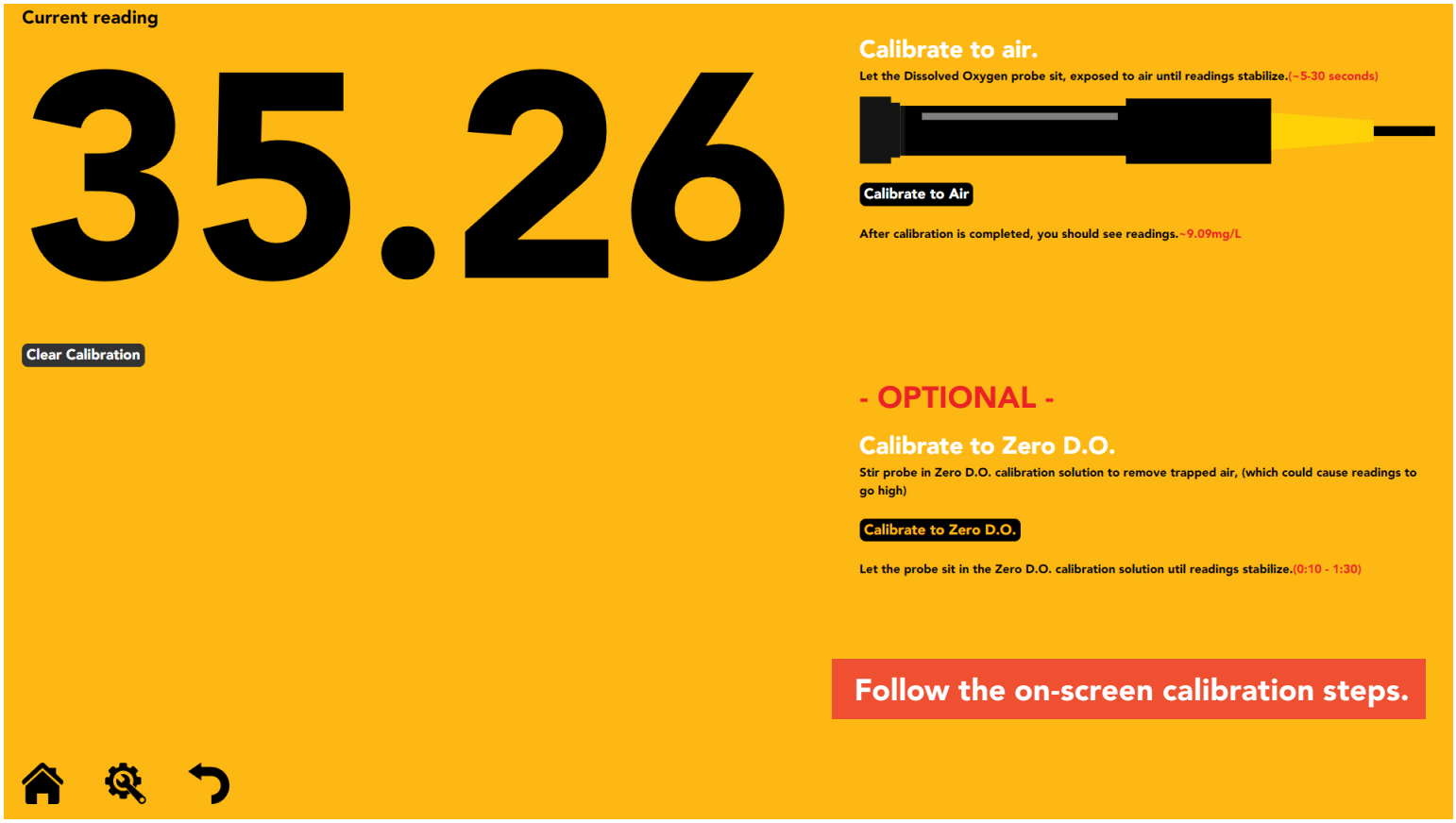
Always watch the readings throughout the calibration process.
Issue calibration commands once the readings have stabilized.

⚠ Never do a blind calibration! ⚠

Issuing a calibration command before the readings stabilize will result in drifting readings.

Calibration procedure

Within the AtlasDesktop monitoring software, click on the "gear" icon.



Follow the on-screen calibration steps.

Advanced calibration

Probe temperature calibration

Probe temperature calibration ≠ Temperature compensation.

When a Dissolved Oxygen probe is calibrated, it is calibrated to the oxygen level and ambient temperature. As a D.O. probe is heated or cooled, its response curve will change. A small temperature change *(≤ 5 °C)* will not affect the probe. However, a large temperature change will be noticeable.

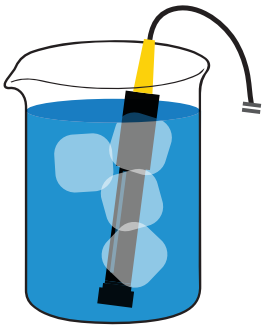
Calibrated probe

Air temperature

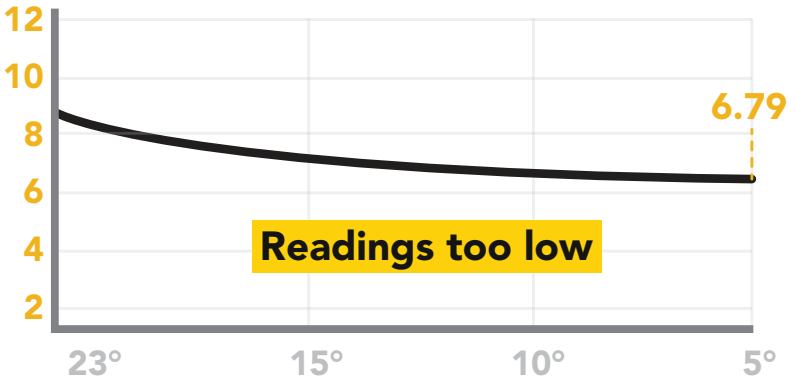
23°C

Air Reading

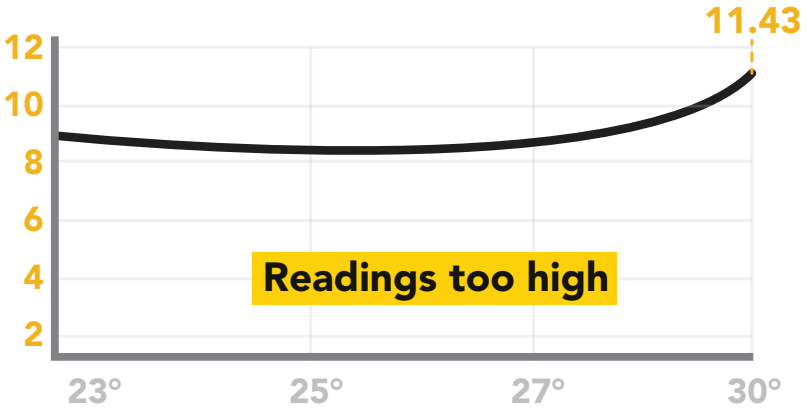
9.10 mg/L



5°C



30°C



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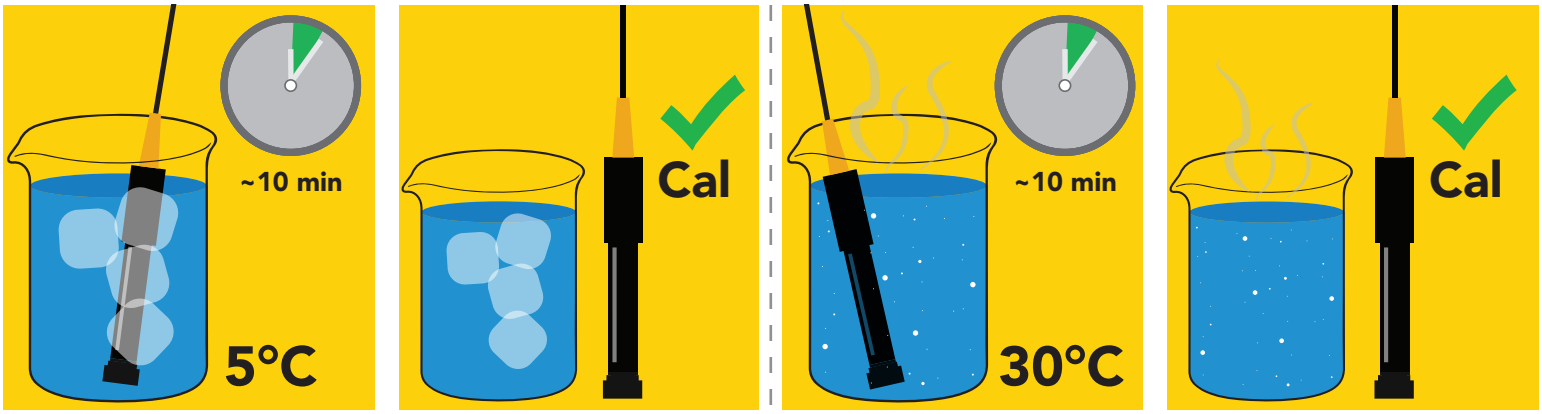
Advanced calibration

What to do:

After the Dissolved Oxygen probe has been properly calibrated, another calibration can be done to account for the probe temperature.

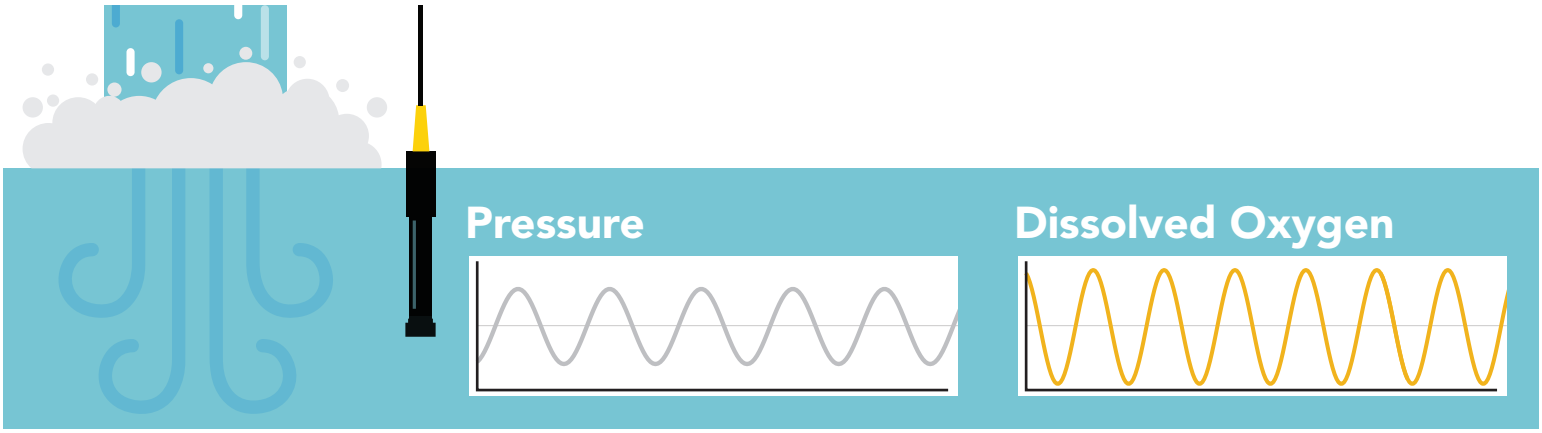


Let the probe acclimate to its operating temperature and then recalibrate. Once the probe has been calibrated at its intended operating temperature, using temperature compensation will give accurate readings.

Understanding D.O. measurements

Most chemical sensors do not directly measure the parameter they are designed for. Dissolved oxygen is no exception. A galvanic D.O. probe is actually an oxygen pressure sensor. It only measures the partial pressure of oxygen.

Keep this in mind when choosing a spot to place the probe.



It just so happens that partial pressure of oxygen is the same in water as it is in air.

(While the pressure is the same, the amount is not. Pure water at sea level can only hold ~9 mg/L of oxygen, while the atmosphere holds ~300mg/L)

By comparing oxygens pressure to its solubility in water, the mg/L are derived.

There are three factors that affect waters ability to hold oxygen.

Temperature
Salinity
Atmospheric Pressure

Temperature

Water temperature has the largest effect; the colder the water, the more oxygen it holds. As water heats up, its ability to hold oxygen goes down.

Pure water at 1°C can hold 14.2 mg/L

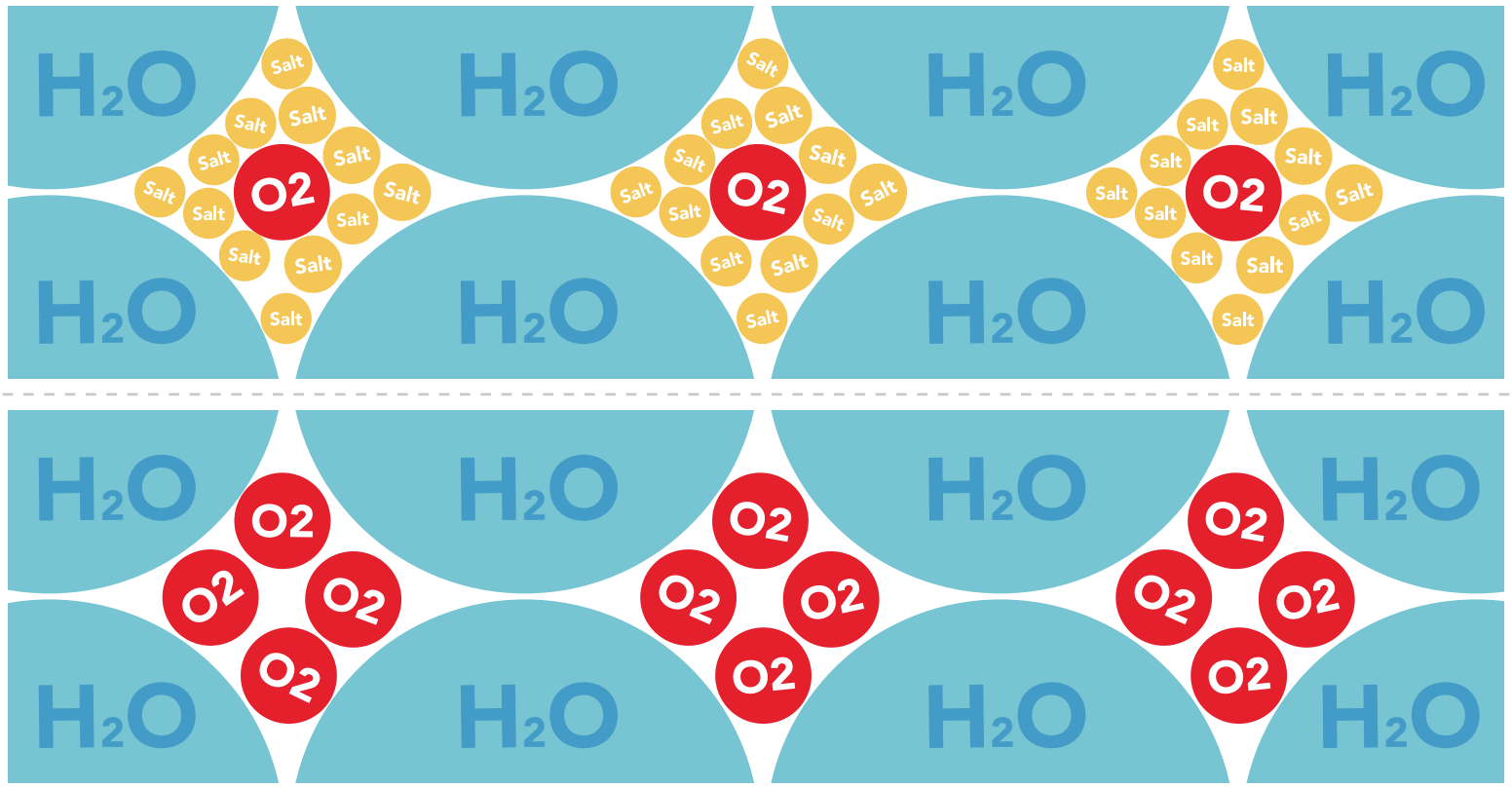
And at 40°C it can only hold 6.4 mg/L

Understanding D.O. measurements

Salinity

When salt is added to water, it drives out oxygen by competing for the same space.

Sea water at 1°C can only hold 10.7 mg/L
Pure water at 1°C can hold 14.2 mg/L



Atmospheric Pressure

A D.O. probe is an oxygen pressure sensor.

Dissolved oxygen pressure cannot be higher than atmospheric oxygen pressure. This is why the probe is calibrated to the atmosphere; it defines the probe's response to the maximum oxygen pressure available. However, oxygen pressure does not tell us how much oxygen is available to dissolve in the water. That information is derived from atmospheric pressure (where atmospheric pressure = altitude).

As altitude increases, oxygen concentration decreases, and because D.O. readings are expressed in Mg/L, the oxygen concentration must be known.

At sea level, 1°C pure water can hold 14.2 mg/L

At 1,500 meters, 1°C pure water can hold 11.7 mg/L

At -1,200 meters, 1°C pure water can hold 16.2 mg/L

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Hyper saturation with pure oxygen

Dissolved oxygen measurements are based on natural occurring oxygen levels. However, some applications may require pure oxygen to achieve extremely high saturation levels. Because injecting pure oxygen into water is not a naturally occurring event, you will need to change some compensation parameters to achieve extremely high readings.

To reach 100mg/L and a saturation of 350%

Set pressure compensation to: **202 kPa**
Set temperature compensation to: **1°C**