Atlas Scientific™
Environmental Robotics

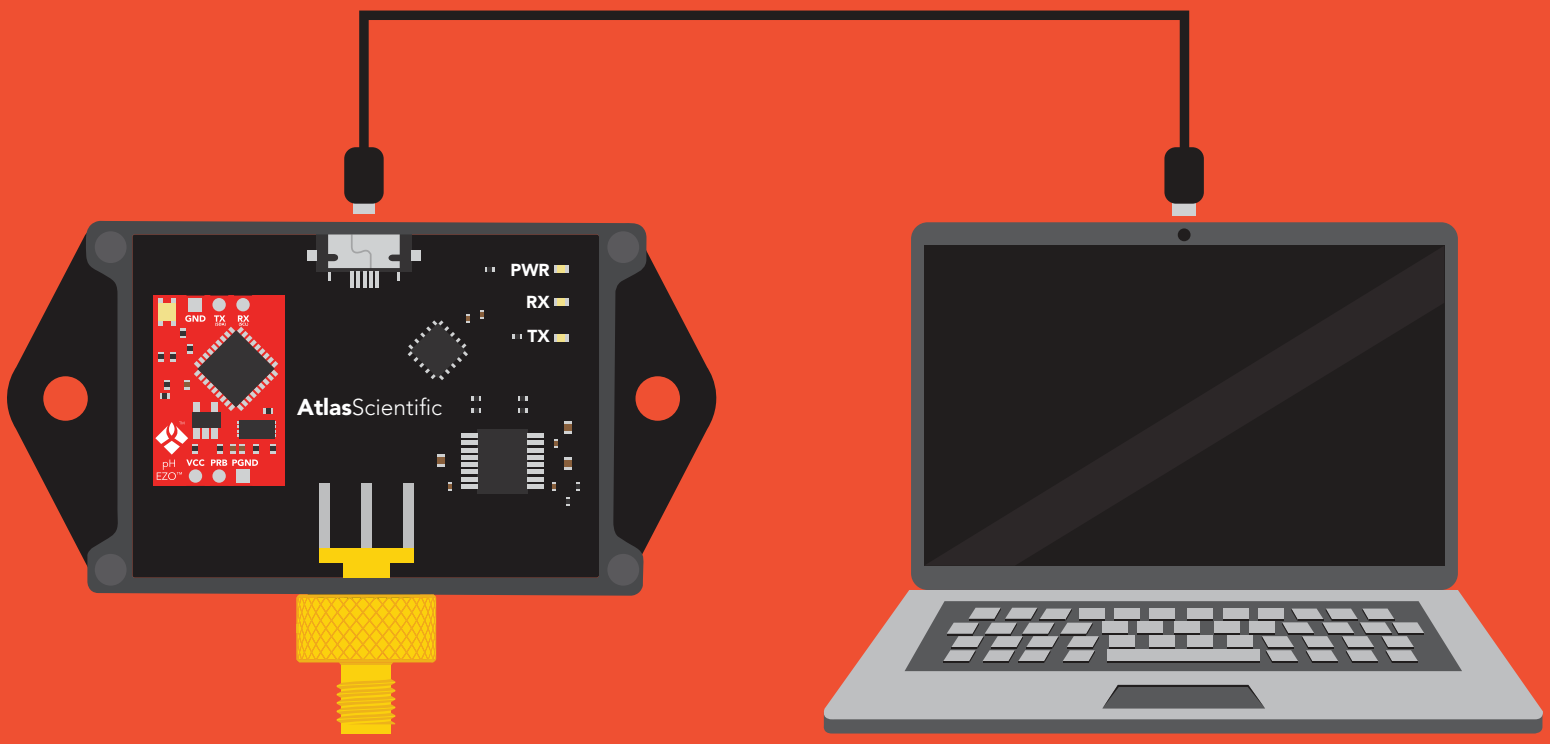
V 1.1
Revised 10/24

EZO Complete-pH™

USB pH meter

Users Guide

ISO 10523 Compliant
(determination of pH)



Reads	**pH**	pH reading time	**1 reading /sec**
Normal range	**.001 – 14.000**	Supported probes	**Any type & brand**
Extended range	**-1.600 – 15.600**	Calibration	**1, 2, 3 point**
Accuracy	**+/– 0.002**	Recalibration frequecy	**~8 – 12 months**
		Temp compensation	**Automatic or manual**

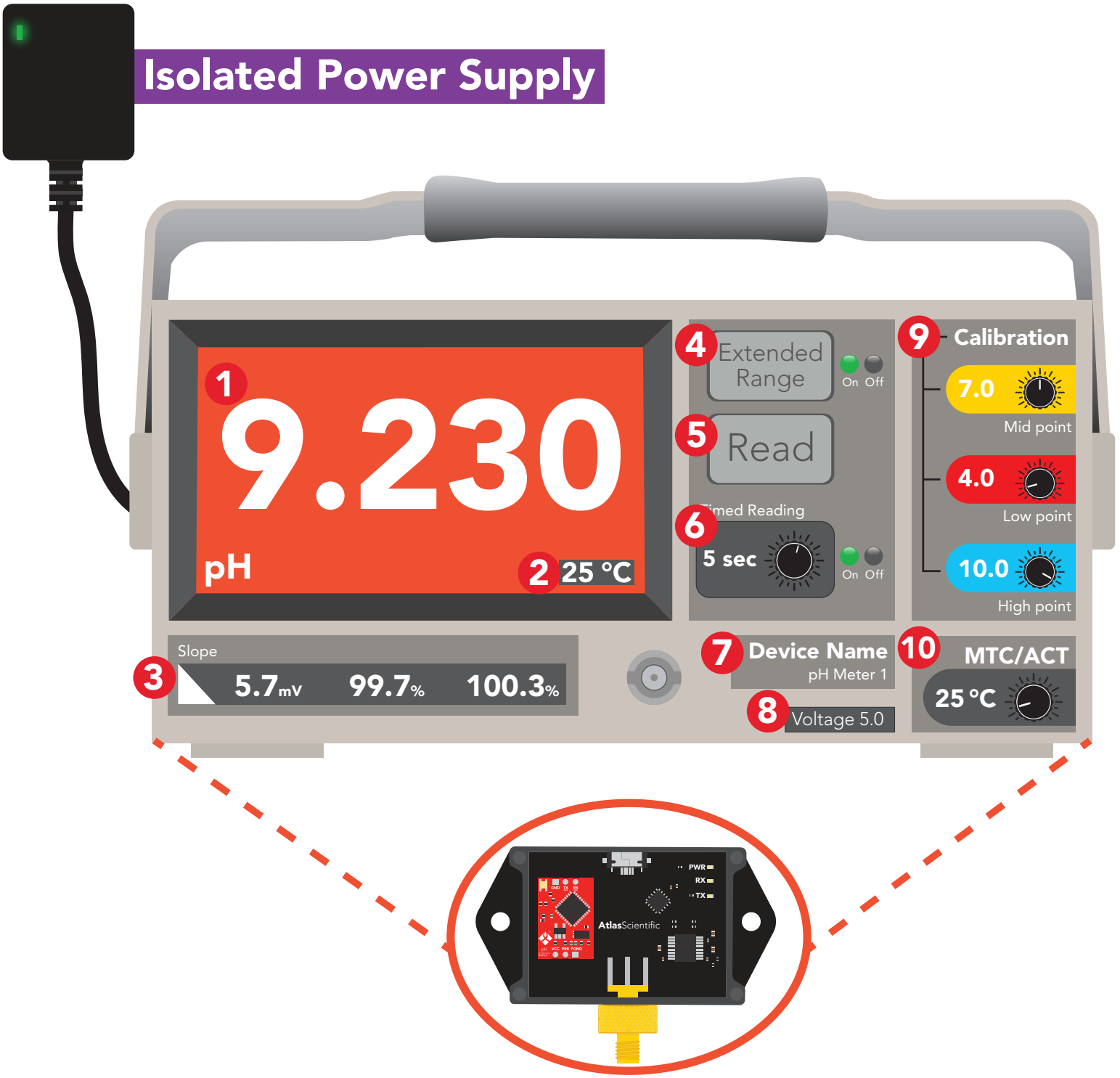
PATENT PROTECTED

Written by Jordan Press
Designed by Noah Press

This is an evolving document, check back for updates.

The EZO Complete-pH™ has all the features of this benchtop meter.

Isolated Power Supply

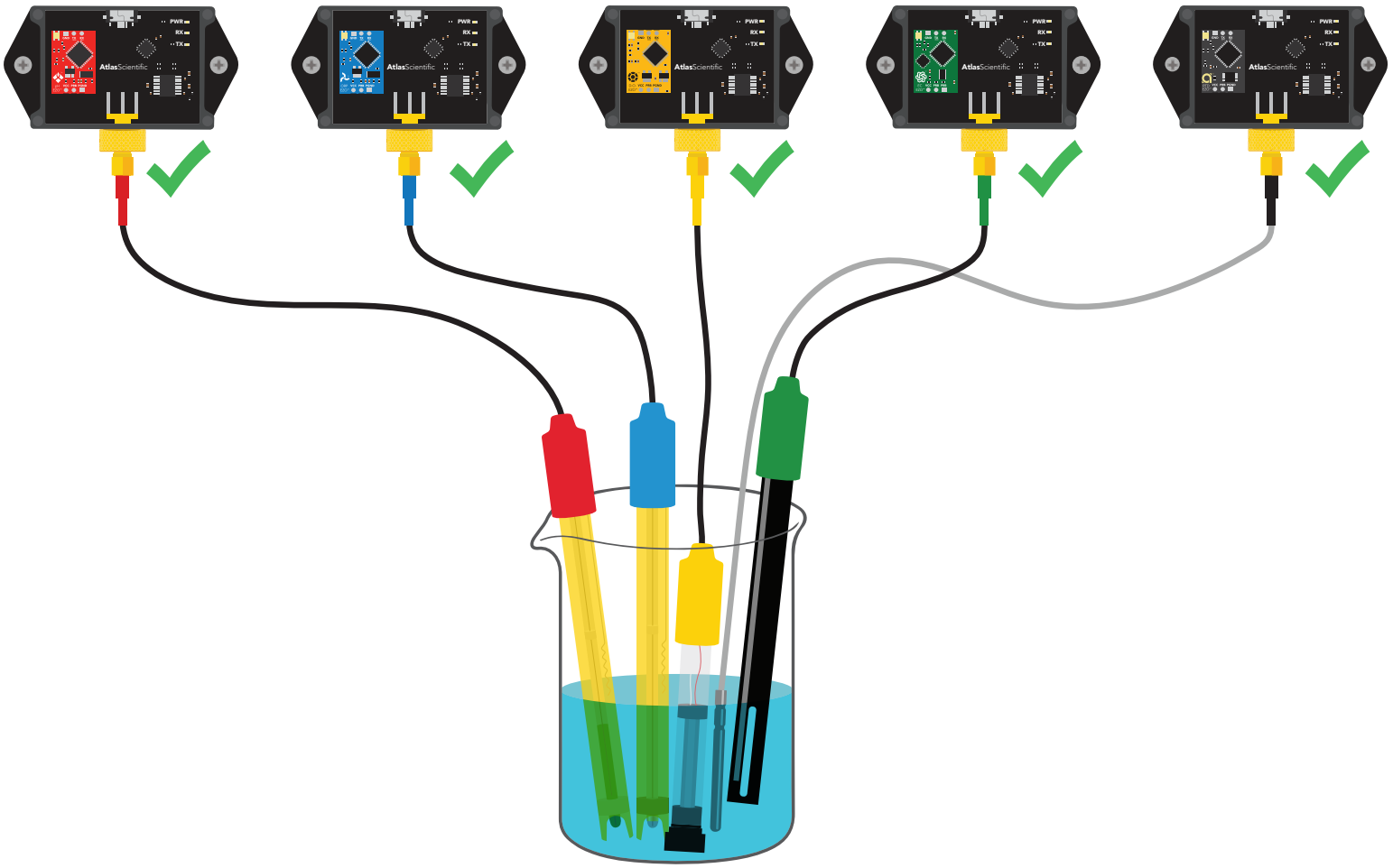


1 Three decimal pH reading
2 Temperature used for reading
3 Calibration slope
4 Extended range capability
5 Immediate reading
6 Timed readings
7 Set device name
8 Voltage usage
9 Multi-point variable calibration
10 Temperature compensation

The EZO Complete-pH™ is compatible with any brand of pH probe.

Interference free

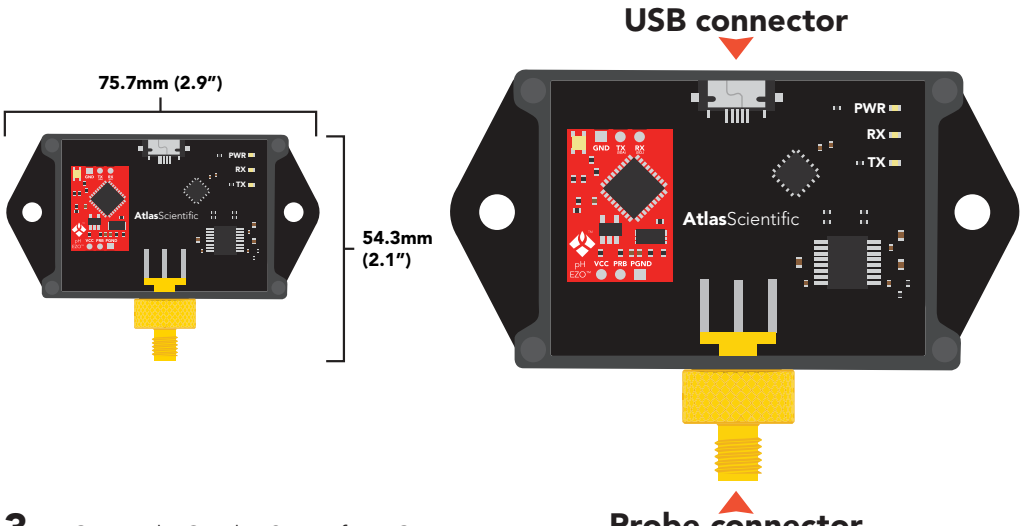
The EZO complete readings are unaffected by other sensors in the same water.



Ingress protection – IP62

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

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



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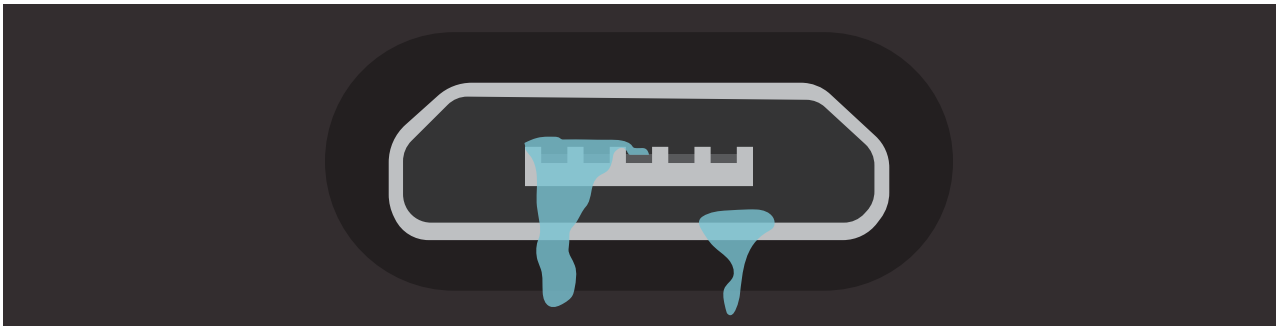
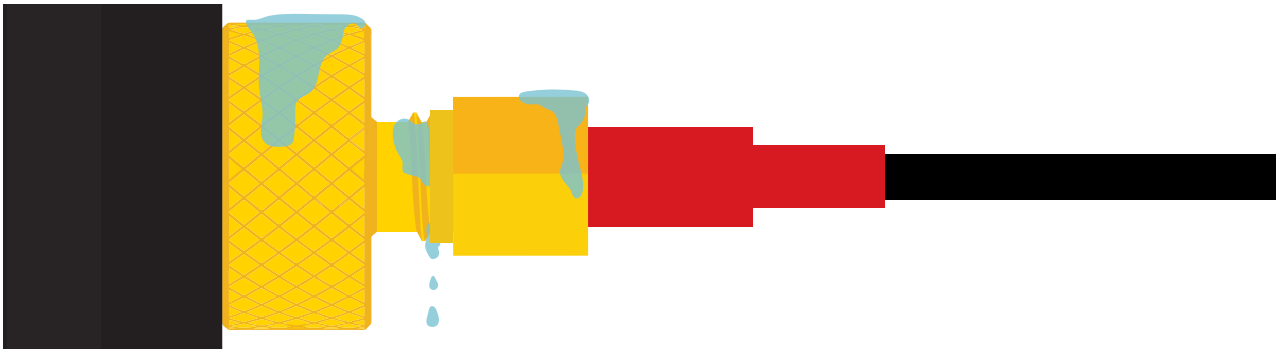
Ingress protection – IP62

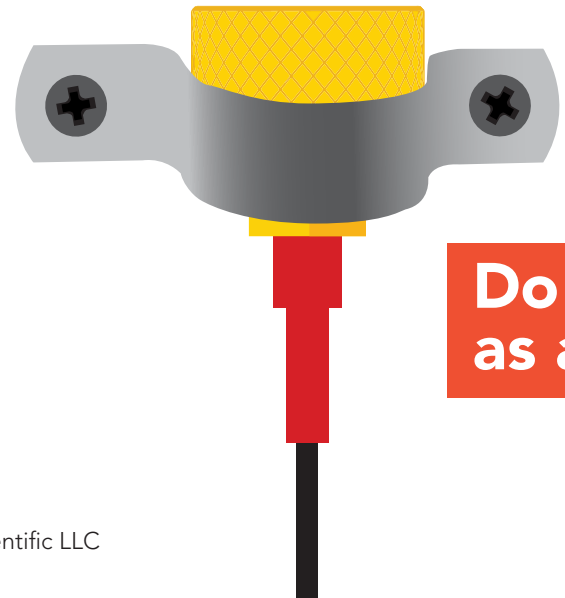
An electrical short can occur if water enters the USB connector. A USB short could permanently damage the EZO-Complete. A USB short is not covered under warranty.



A connector short can occur if water enters the SMA connector. A connector short will cause the pH readings to pin to 0, 14, or the probe will respond slowly to changes in pH. A connector short is reversible and will not damage the EZO-Complete. However, frequent shorts will eventually damage the pH 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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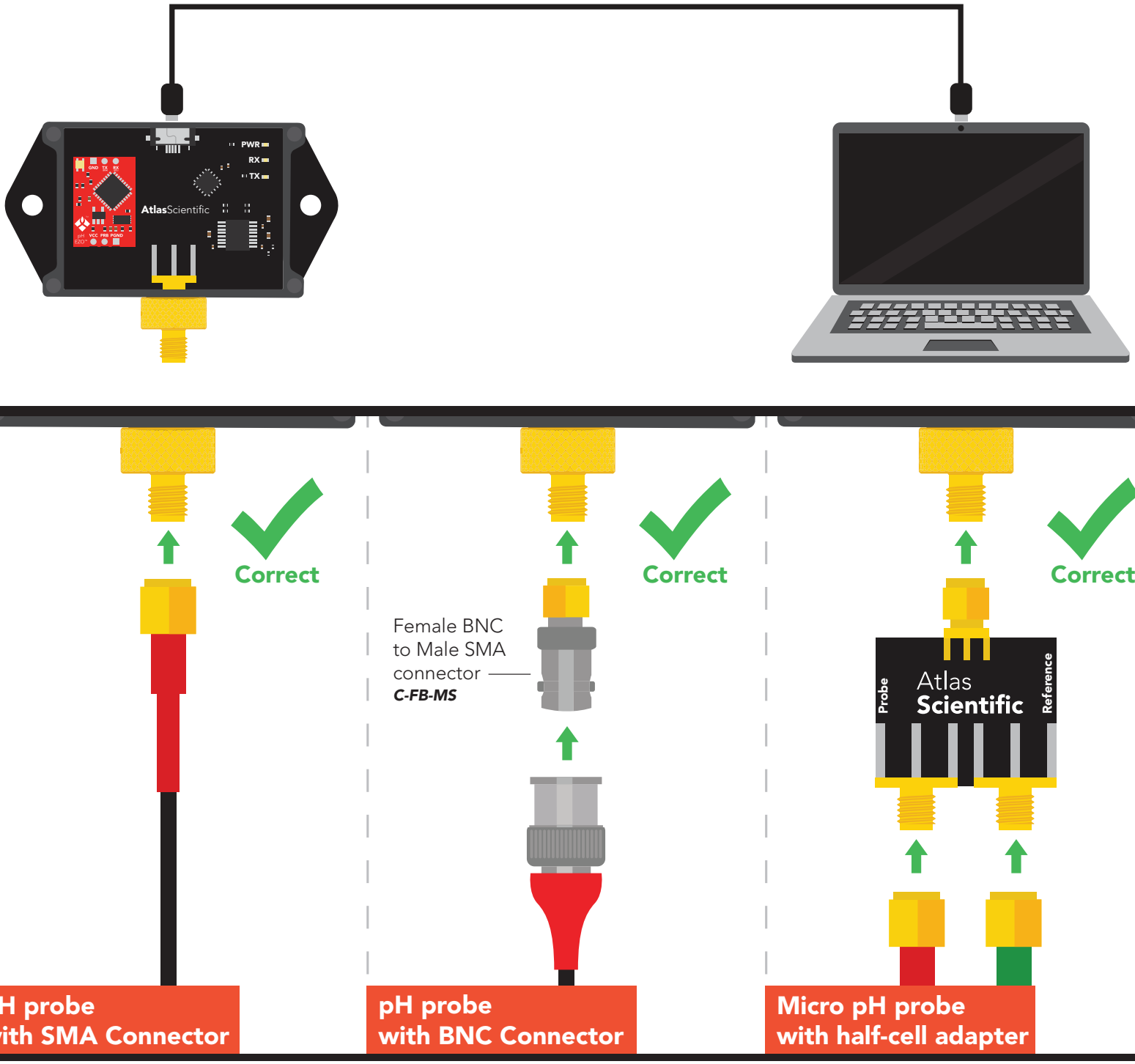
Setup



Click here to download

AtlasDesktop™ 2.0

Monitoring Software

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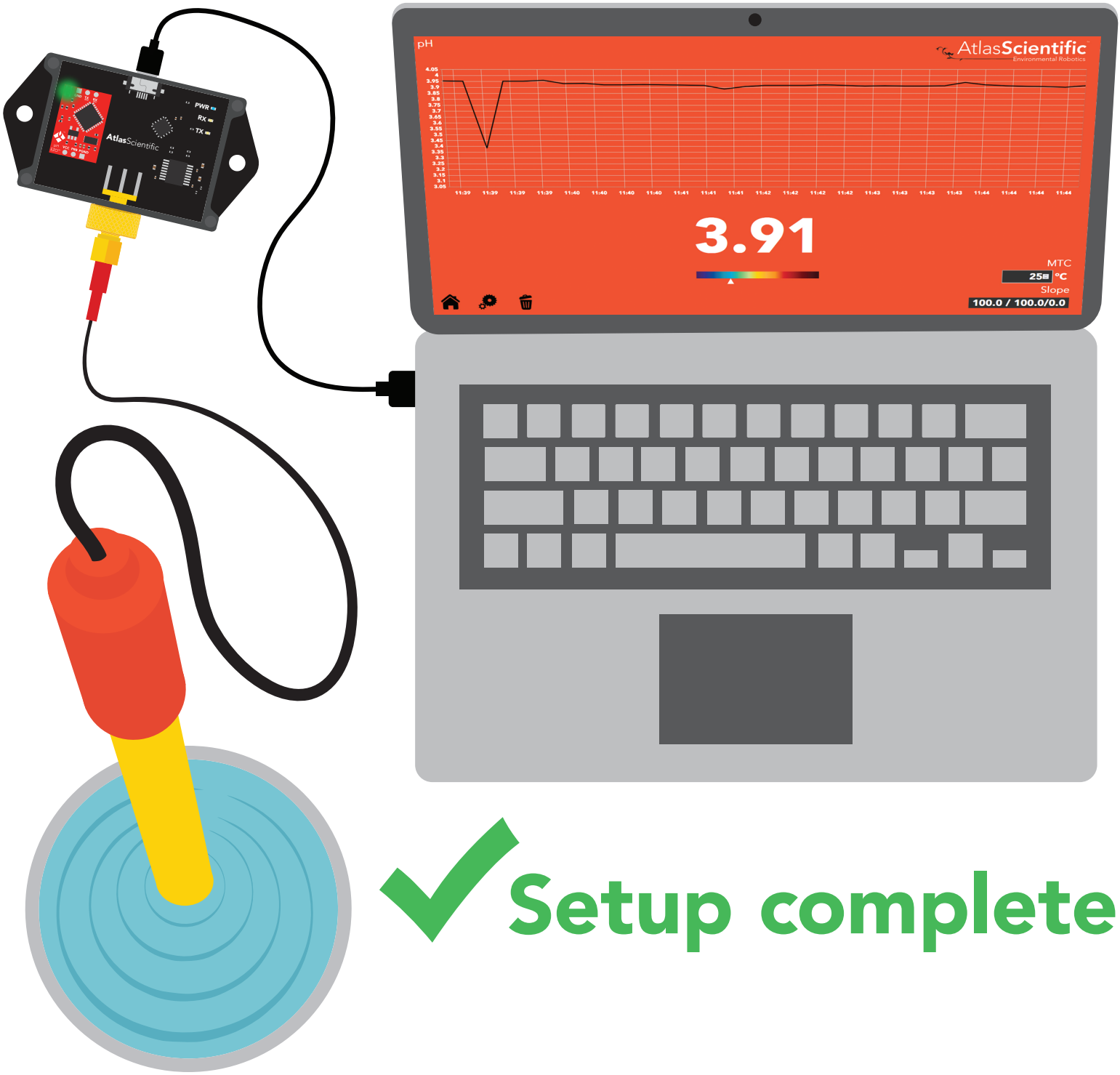
Setup

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



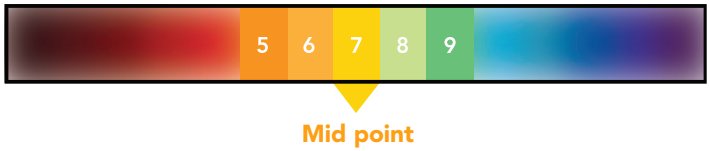
Setup complete

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).

Single, Two point, or Three point calibration accuracy

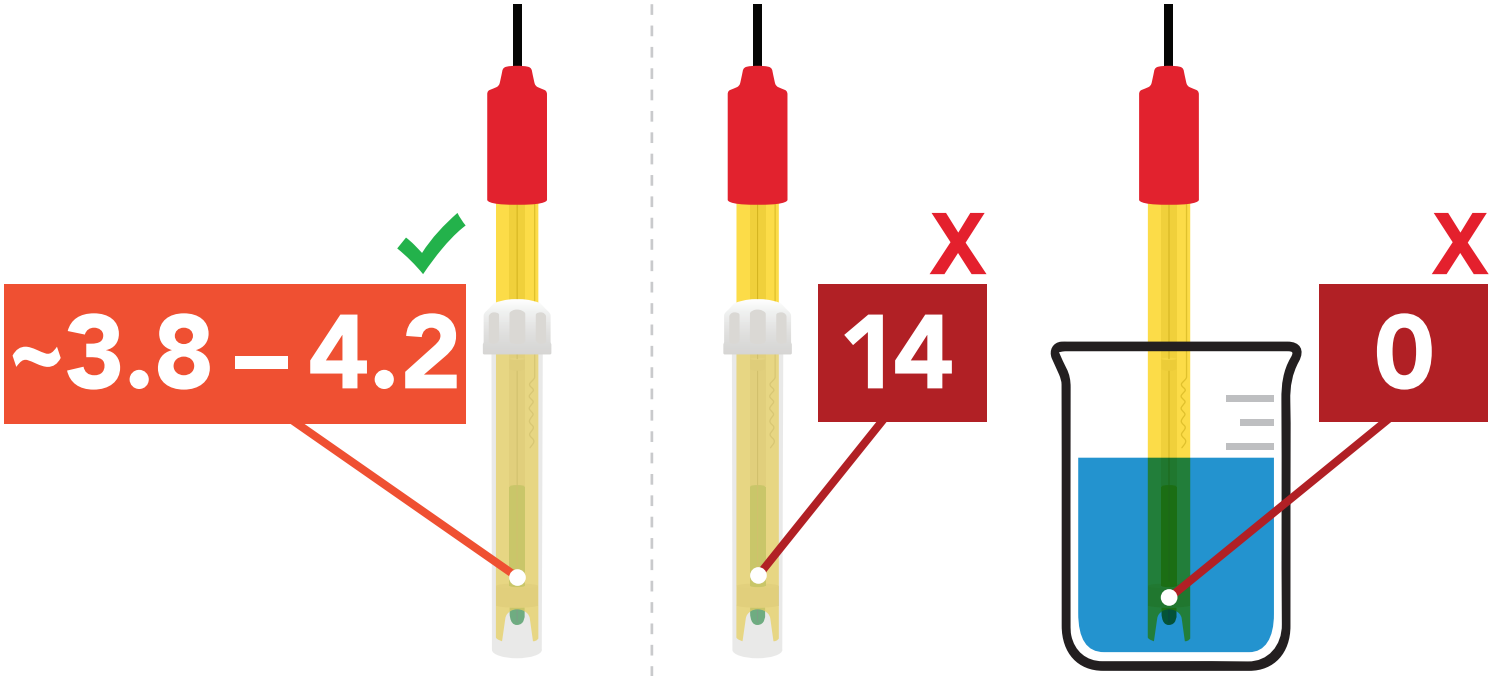
Single point calibration



Two point calibration

Three point calibration

Confirm the pH probe is working correctly



A new Atlas Scientific pH probe, still in its soaker bottle will read a pH of ***~3.4 – 3.8***

If your pH probe gives a reading of ***zero***, ***seven*** or ***14*** continuously and that reading cannot be changed no matter what solution the probe is in, your probe cannot be calibrated and may be damaged.

Contact Atlas Scientific customer support for assistance.

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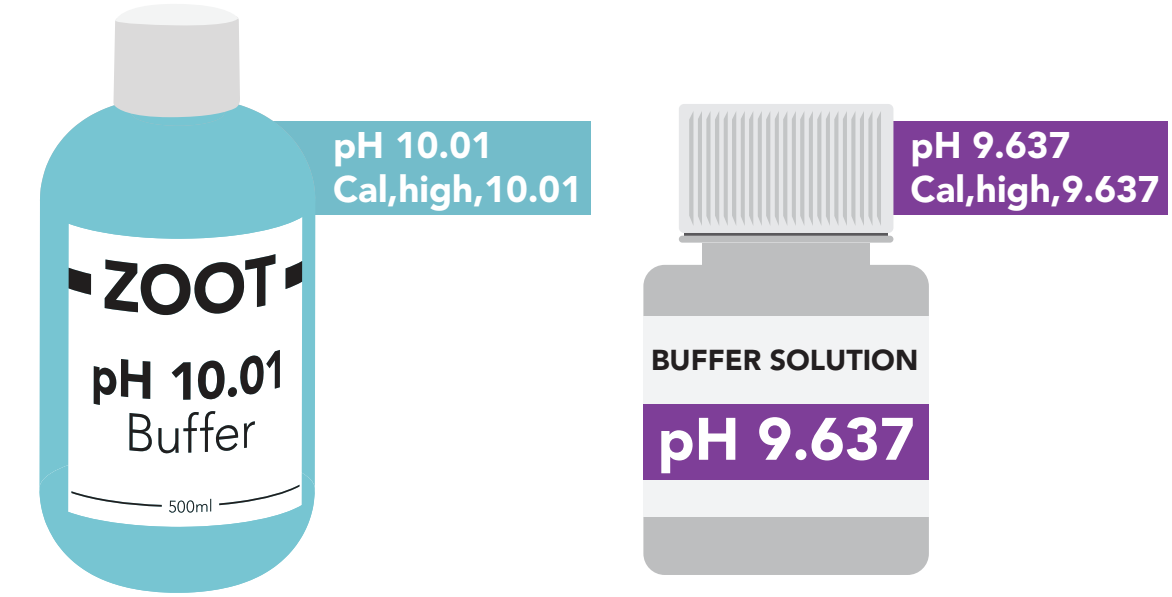
Calibration order

If this is your first time calibrating the EZO Complete-pH, we recommend following this calibration order.

1 **Mid point** 2 **Low point** 3 **High point**

Calibration solutions

The Atlas Scientific EZO Complete-pH can work with any brand or value of calibration solution. ***We recommend using calibration solutions that have simple values.***



✓ **Simple value** X **Complex value**

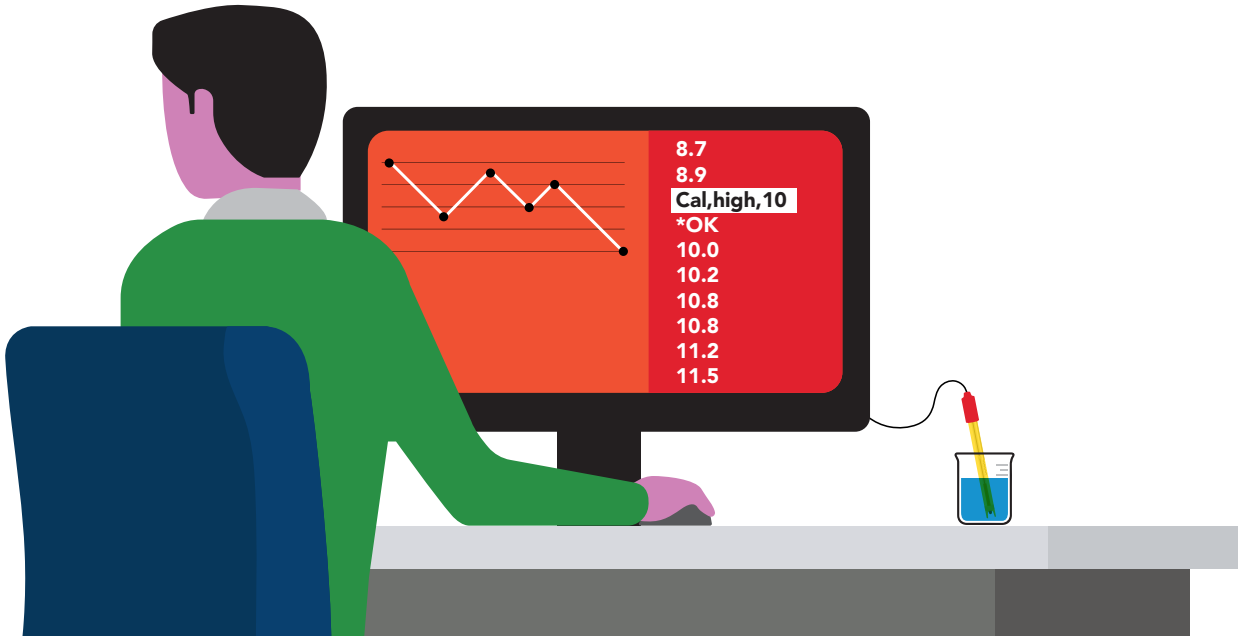
While you can use calibration solutions with complex values, we recommend avoiding unnecessary complexity. ***Unusually specific calibration values should be treated with suspicion.***

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.



Best practices for calibration

Avoid extended stabilization time.

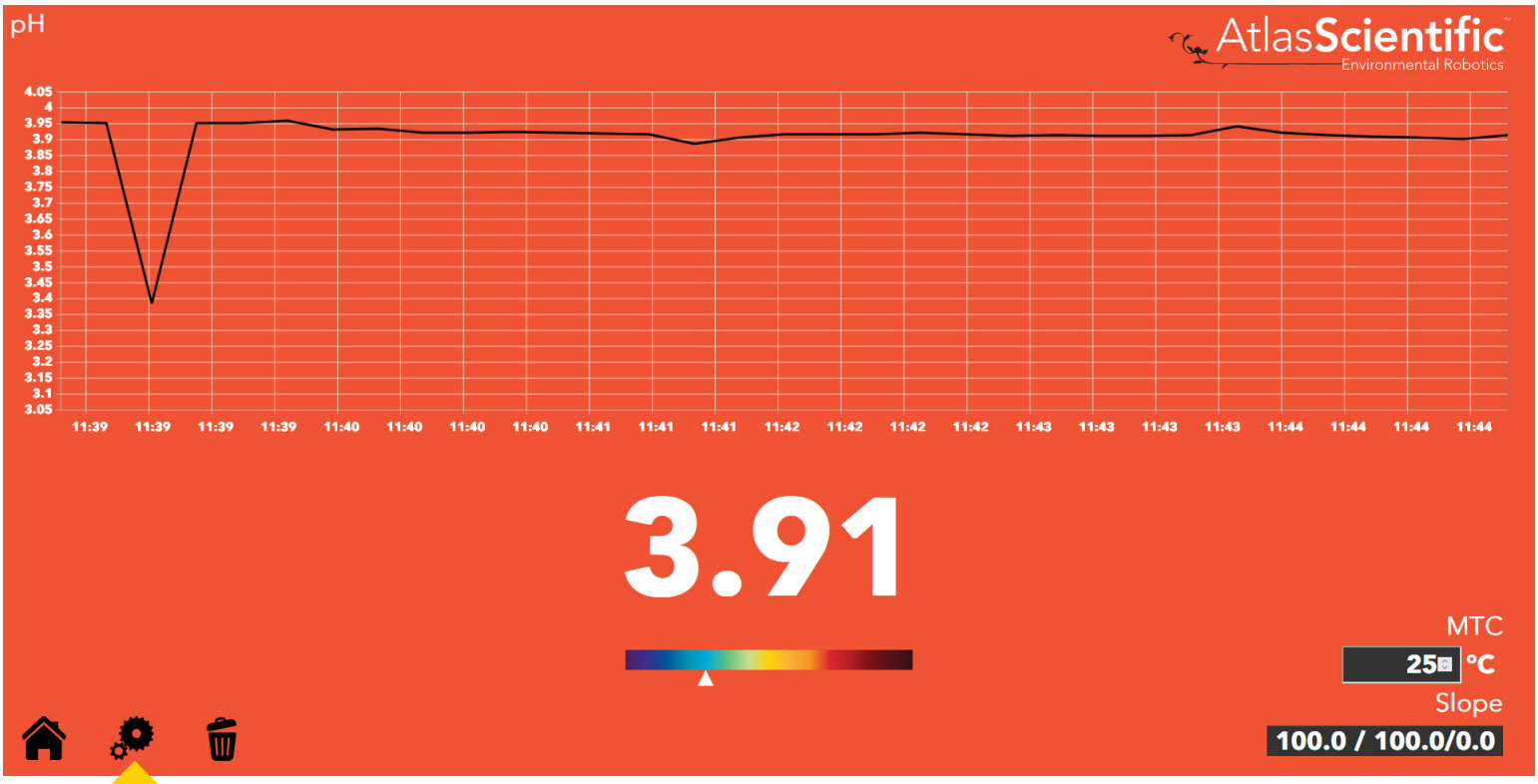
Letting the probes pre-calibrtion readings stabilize over an extended period will cause your calibrated readings to take a long time to stabilize.

Avoid frequent recalibrations.

if it ain't broke, don't fix it.

pH probes lose accuracy slowly. Frequent recalibrations (to ensure high accuracy), will often have the opposite effect. It is far more likely that you will misscalibrate the probe than improve its accuracy.

Calibration procedure



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

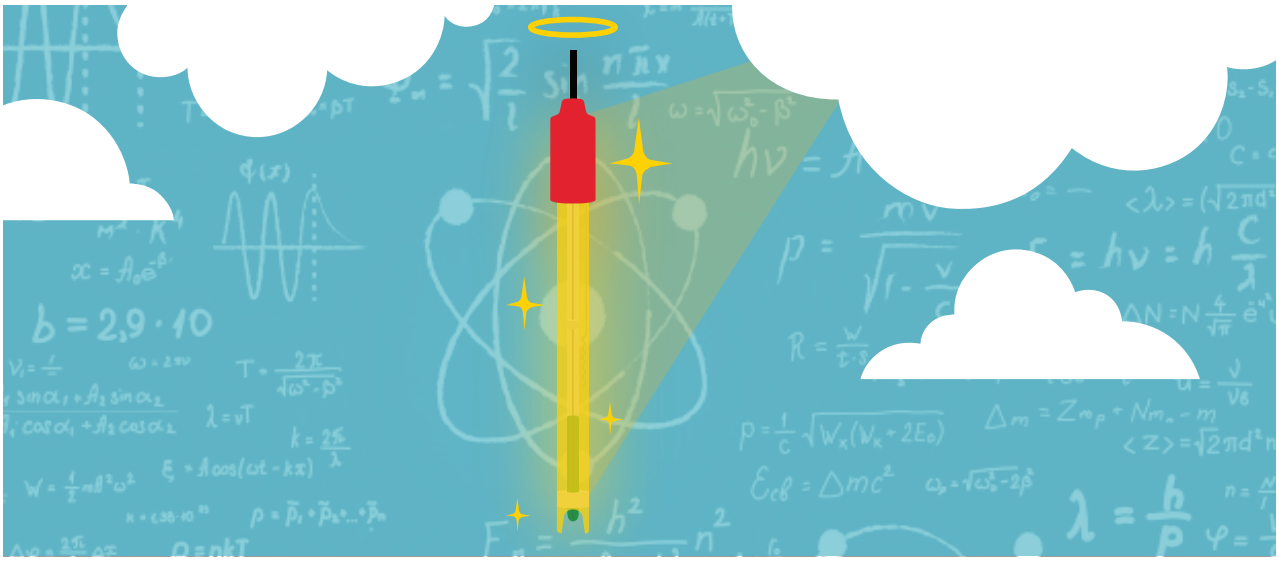
Follow the on-screen calibration steps.

Understanding pH slope

The slope function is a powerful tool used to verify calibration and determine the overall health of a pH probe. By evaluating the slope of a pH probe's response curve, you can determine how well a pH probe was calibrated or when that probe is reaching end of life.

Slope and calibration are directly related. The slope is updated when a calibration command is given. The slope does not update automatically.

Generally speaking, all pH probes behave the same way. This means a probe's response to calibration can be compared to a simulated pH probe that is mathematically perfect in all ways.



The slope is broken into three sections; acid, base, and neutral.
Each section is evaluated separately.

Acid (pH 1 – 6.9)
Base (pH 7.1 – 14)
Neutral (pH 7)

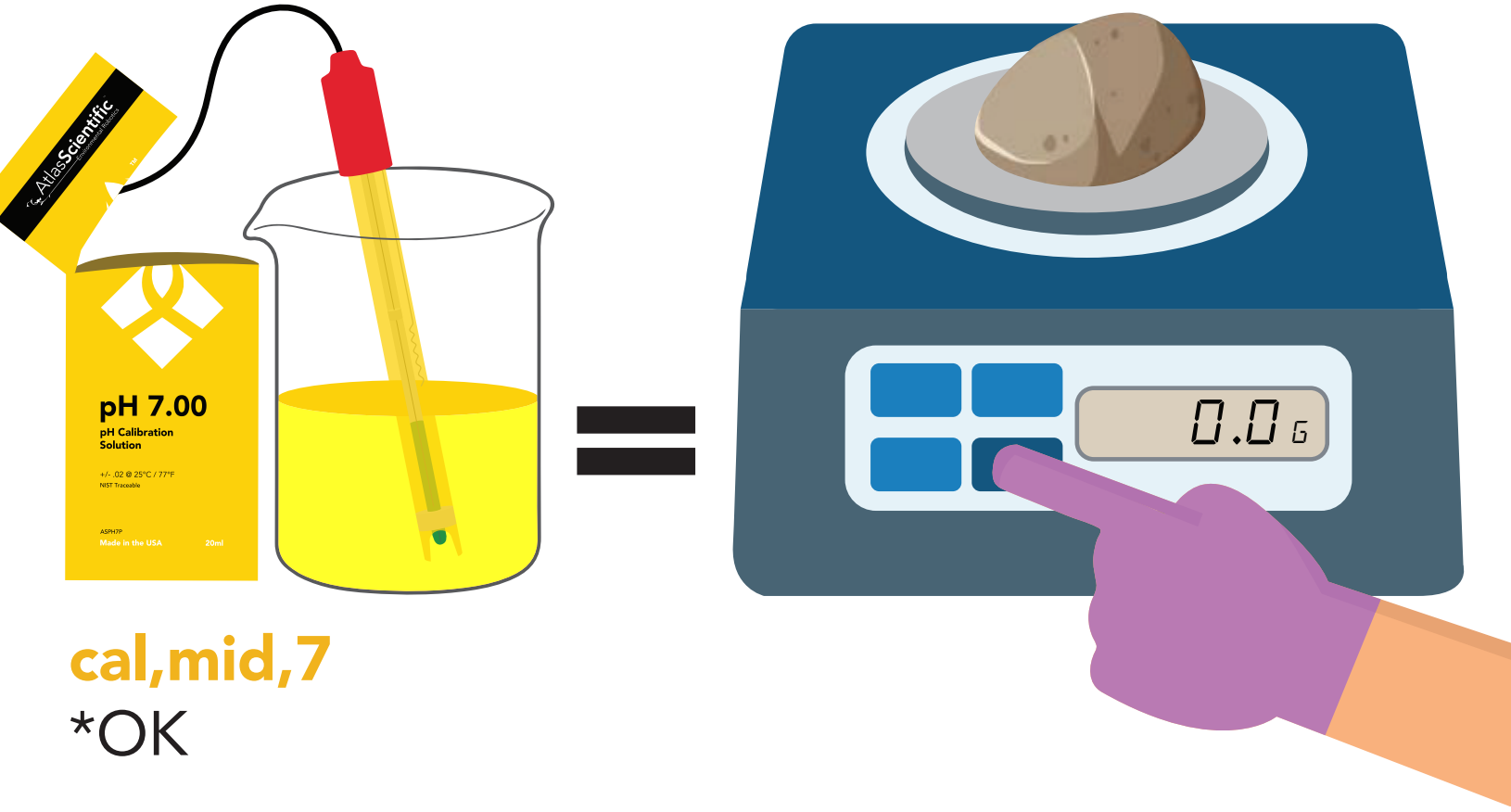
An uncalibrated pH probe will have a mathematically perfect slope. Because no pH probe is mathematically perfect, the slope can be used to determine if the pH was calibrated.

Uncalibrated slope: 100, 100, 0 (acid, base, neutral)
% % mV

The first two numbers are percentages, and the third is millivolts. The slope shows that the probe's response to acid and base is 100% correct, and it detects 0 mv in a pH 7. Because such perfection does not exist in the real world, we know this probe was not calibrated.

Understanding pH slope

pH 7 is the absence of pH; it is not an acid or a base. Therefore it should always be your first calibration point. It is equivalent to the tare function on a scale because it establishes the probe's zero point.



cal,mid,7
*OK

After pH 7 calibration, use the slope command to see how the probe performed during calibration.

The slope after pH 7 calibration: 100, 100, -1.2

Here we see the probe reads -1.2mV in pH 7. The closer this number is to 0, the better. A new pH probe should give a millivolt offset no greater than -5mV to 5mV. Over time this number's distance to 0 may increase; the larger the number, the lower the accuracy. A reading >10mV will result in noticeable performance issues.

It is important to remember that a high number is not definitive evidence that the probe is inaccurate or malfunctioning. It is very common to see a high number if the calibration solution was contaminated and not actually its stated value.

Understanding pH slope

The next two calibration points *(pH 4 and pH 10)* report their slope in percentage. A new pH probe should have a slope of >95%.

The slope after pH 4 calibration: 98.2, 100, -1.2

The slope after pH 10 calibration: 98.2, 97.8, -1.2

Tips:

Throughout this explanation, we have looked at the slope after each calibration event. This is unnecessary; in reality, it is best to fully calibrate the probe and look at the slope once calibration has been completed.

To gain a deeper understanding of how slope affects the stability and accuracy of a pH probe, intentionally miscalibrate the probe and see how it affects the slope.