

Industrial ORP Transmitter

Reads	ORP
Range	-1900.0mV – 1900.0mV
Accuracy	+/- 1mV
Calibration	Single point remotely through PLC or directly on board
Supported probes	Any type & brand
Auto temp compensation	N/A
Mount	35mm Din rail
Output	4 – 20mA
Operating voltage	14VDC – 36VDC
Electrically isolated	Yes

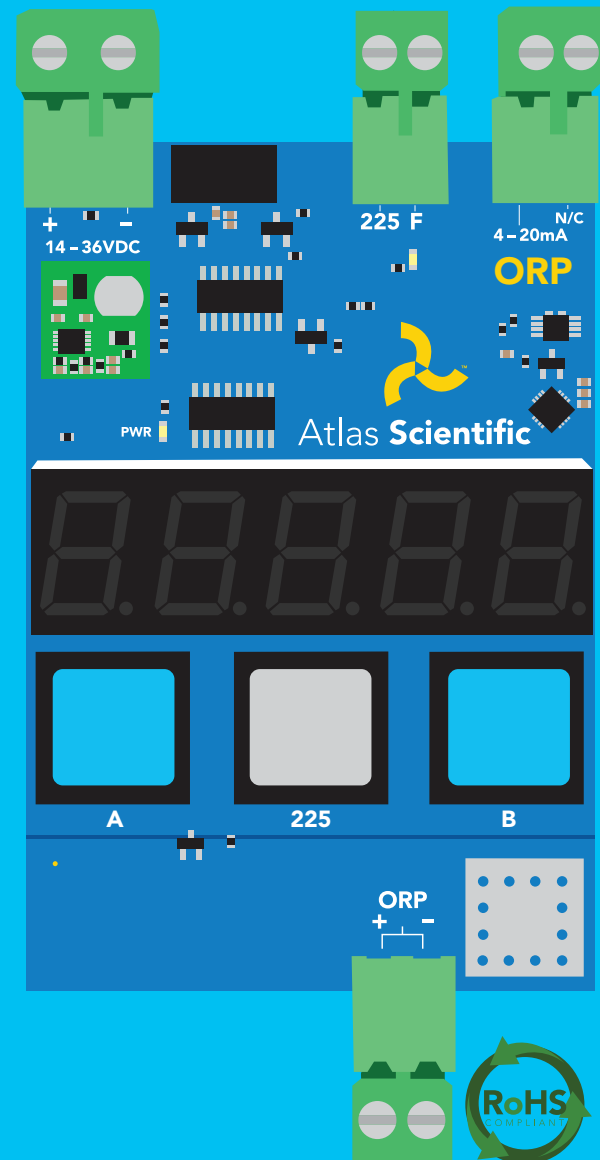
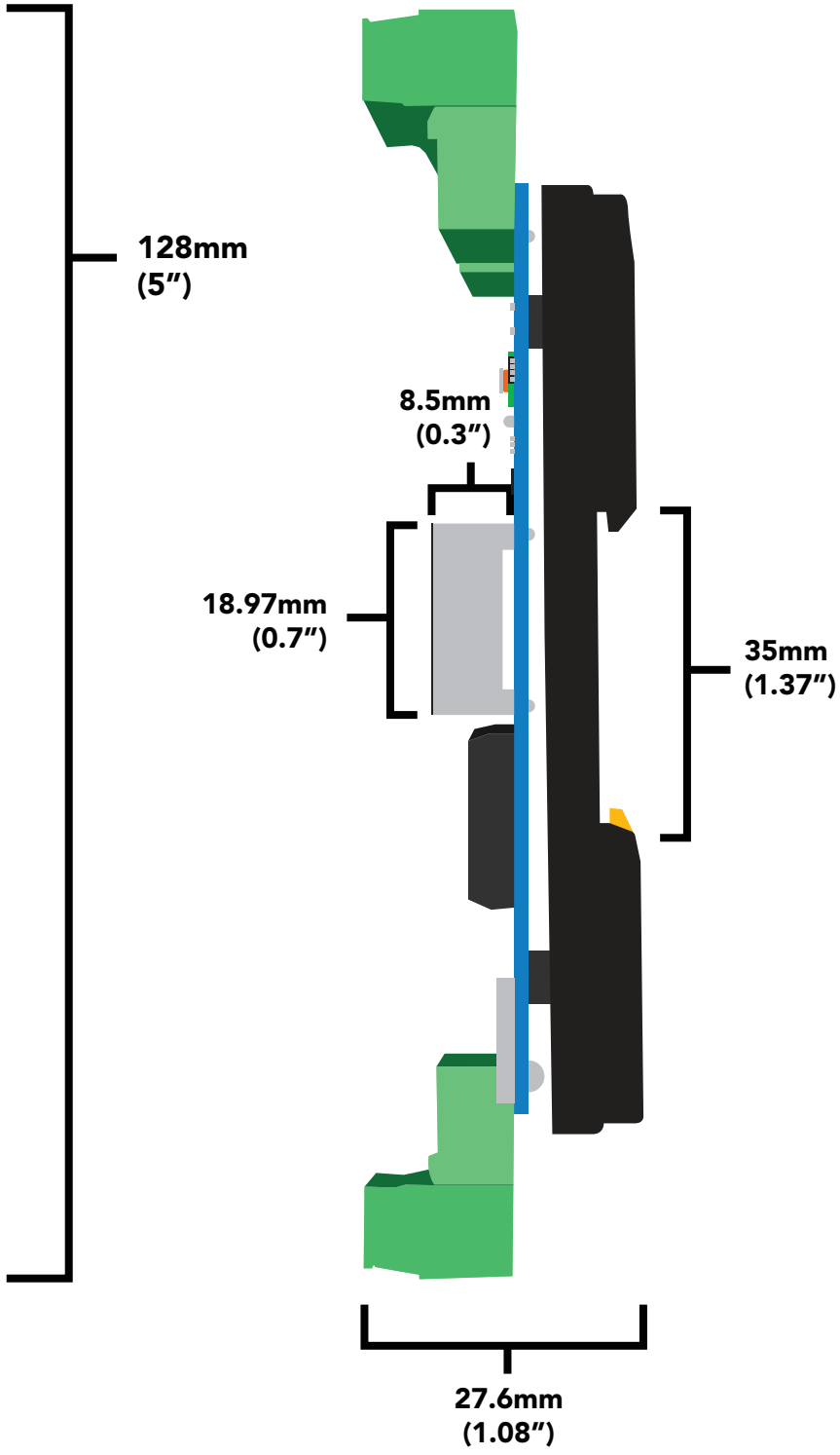
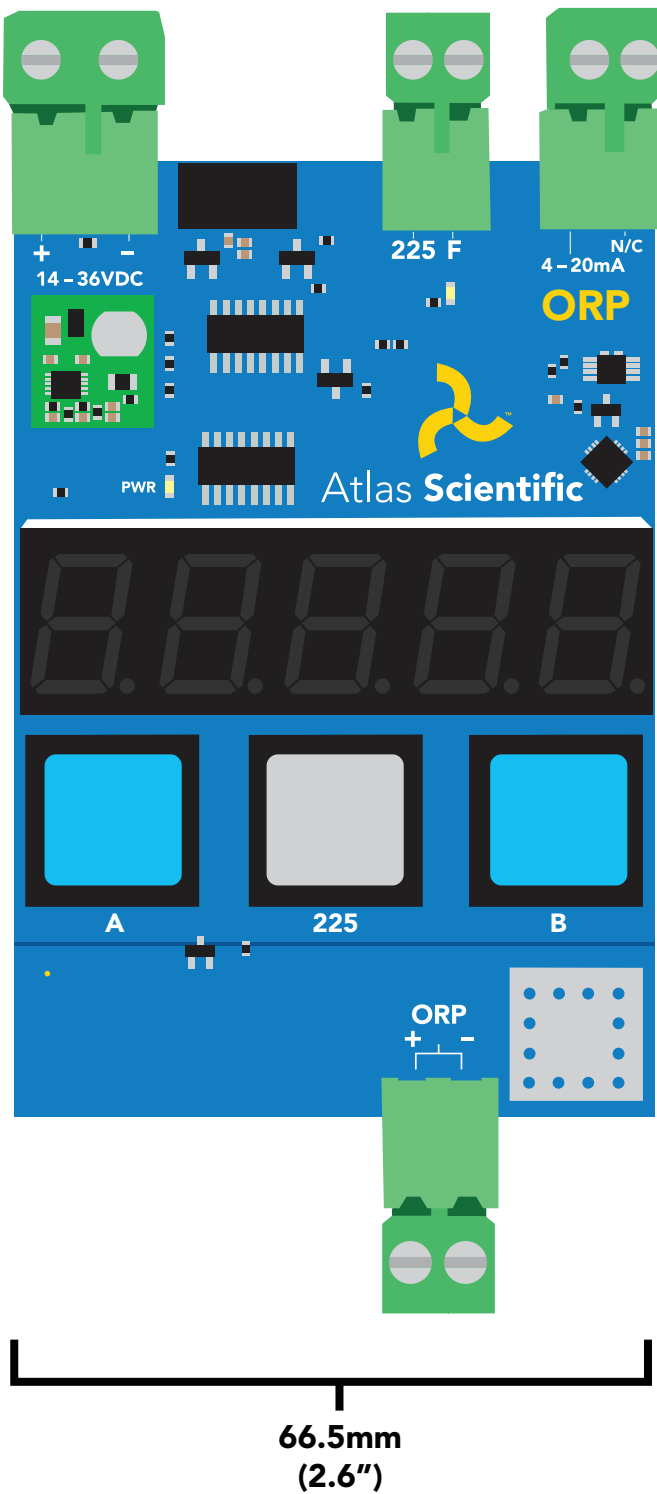


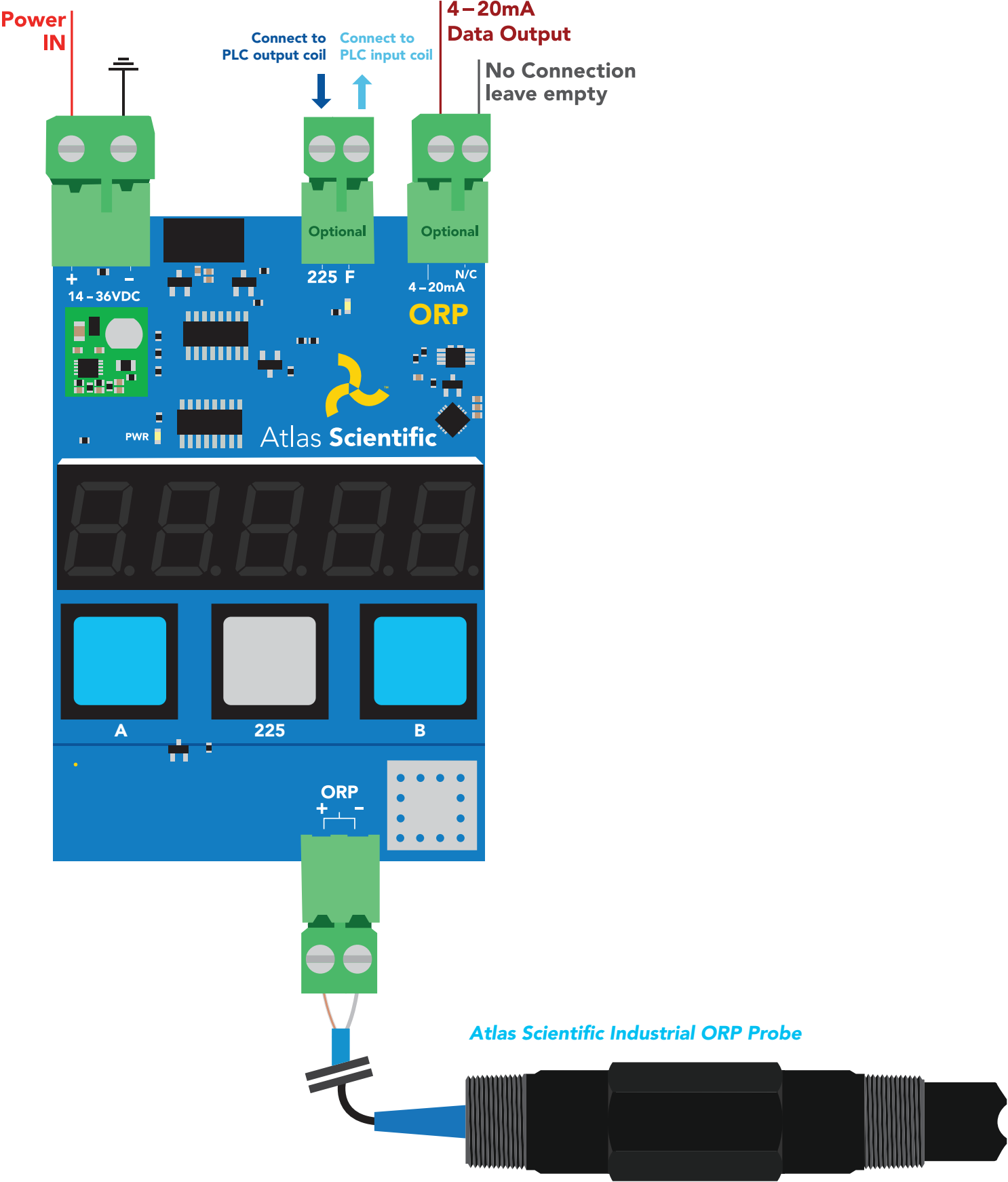
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Transmitter dimensions



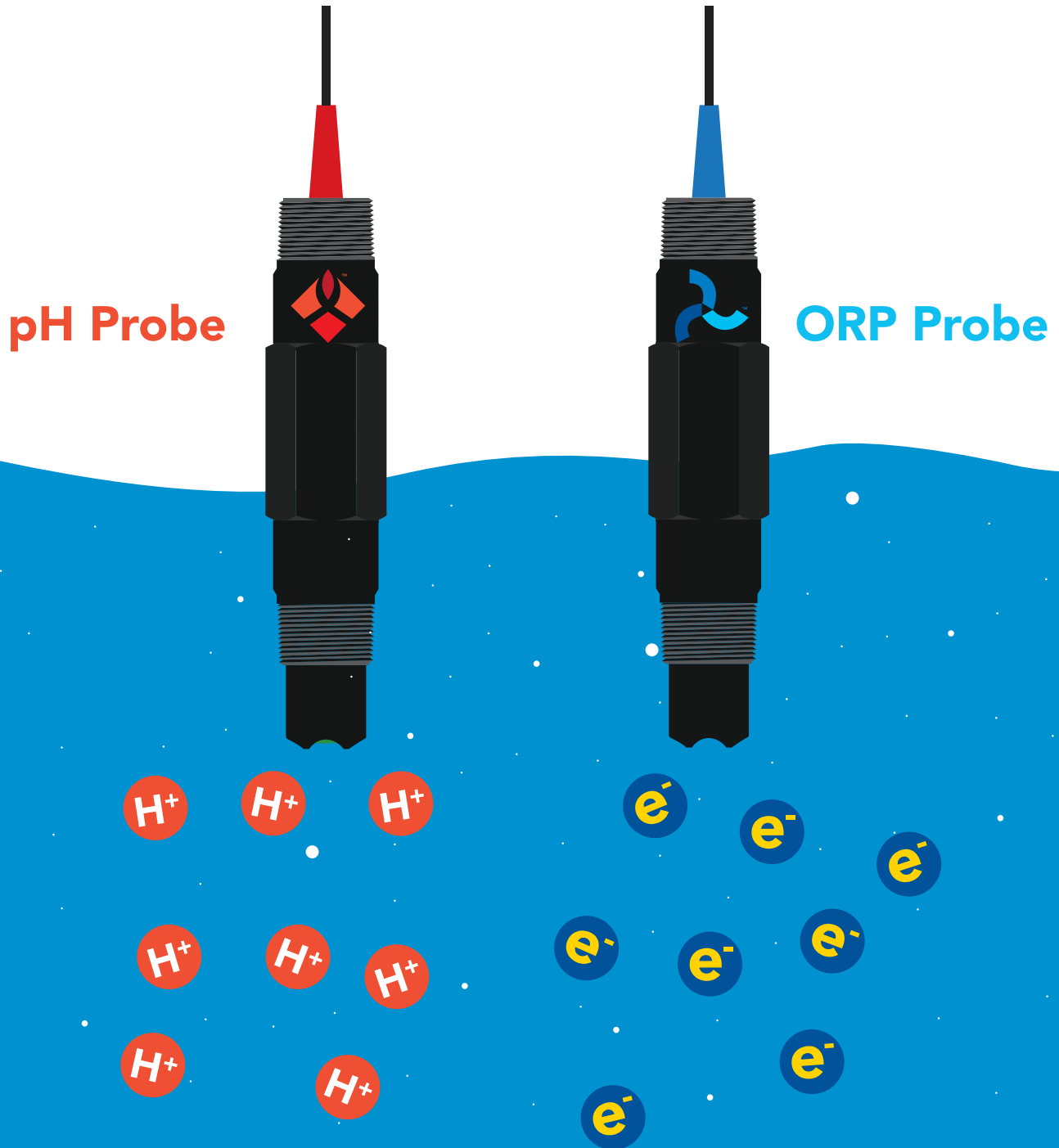
Wiring diagram



Operating principle

ORP stands for **oxidation/reduction potential**. Oxidation is the loss of electrons and reduction is the gain of electrons. The output of the probe is represented in millivolts and can be positive or negative.

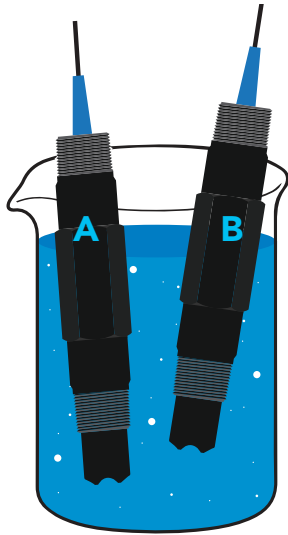
Just like a pH probe measures hydrogen ion activity in a liquid; an ORP probe measures electron activity in a liquid. The ORP readings represents how strongly electrons are transferred to or from substances in a liquid. Keeping in mind that the readings do not indicate the amount of electrons available for transfer.



When reading the ORP of a liquid that has very few electrons available for transfer, ORP readings can appear to be inconsistent.

The water is unreactive and has only trace amounts of electron movement. *These readings are equivalent to the readings you see with an unconnected multimeter.*

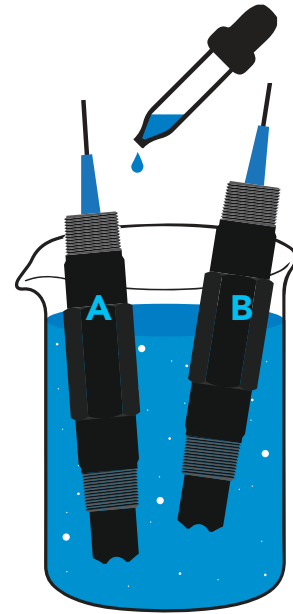
-234.6
Reading A



Tap water

24.2
Reading B

606.9
Reading A

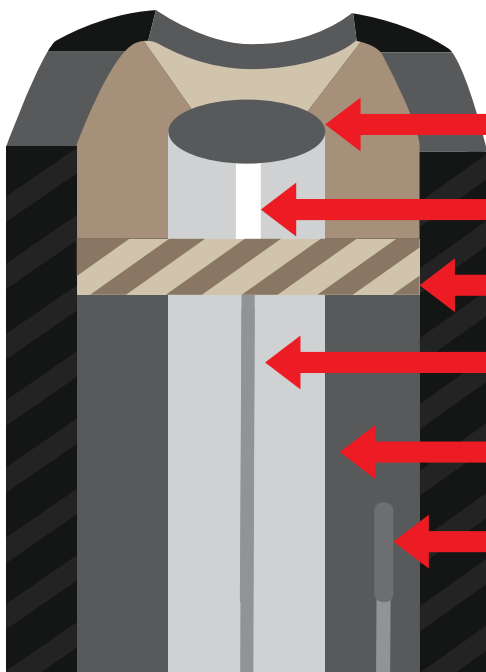


Tap water

**Add just a drop of bleach
(which is an oxidizing agent)**

605.3
Reading B

An ORP probe has a platinum tip that is connected to a silver wire, surrounded by silver chloride. That silver wire is then connected to a KCL reference solution. Because platinum is an unreactive metal it can “silently observe” the electron activity of the liquid without becoming apart of whatever reaction is occurring in the liquid.



Platinum Disk

Silver wire

Ceramic junction

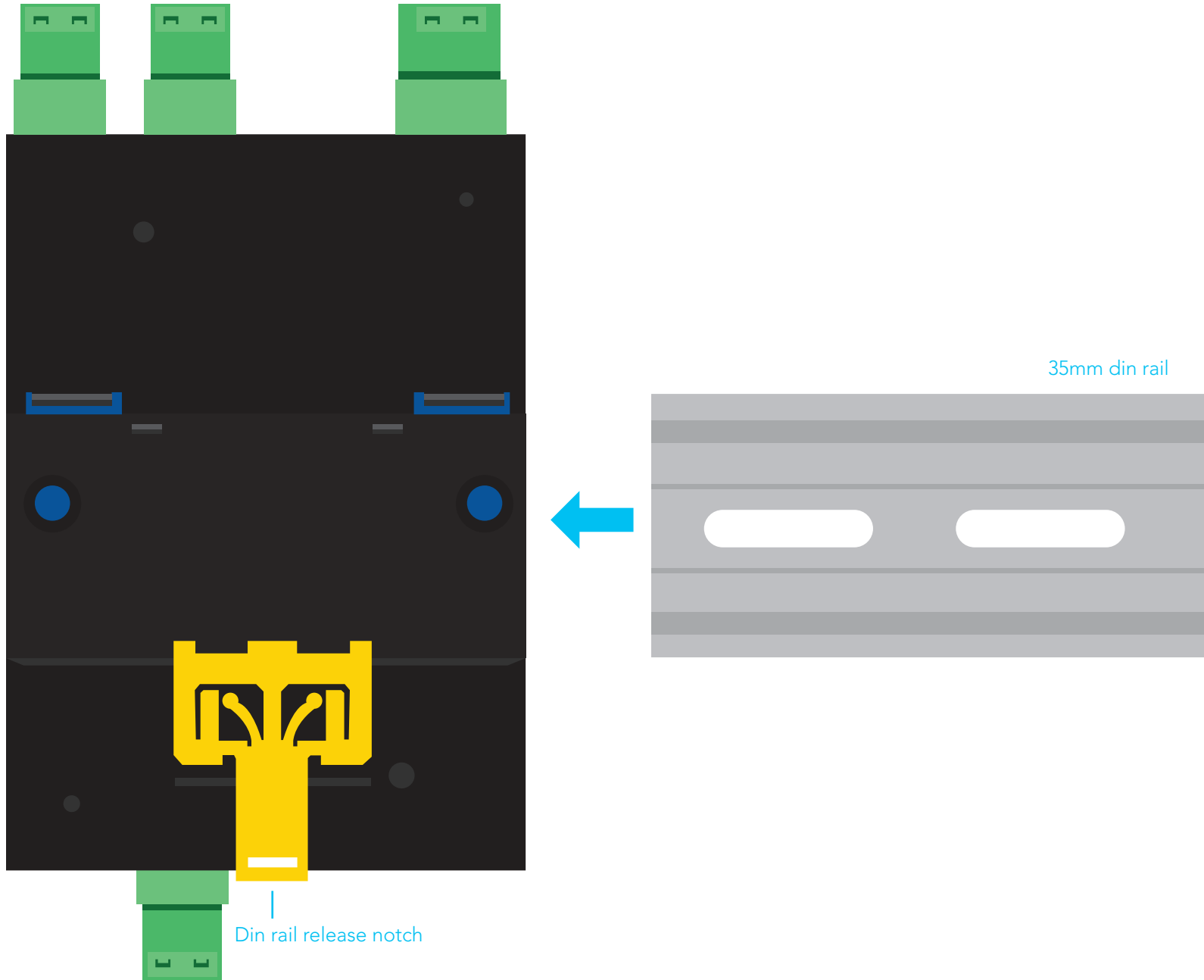
Silver chloride

4M KCL reference solution

Reference wire

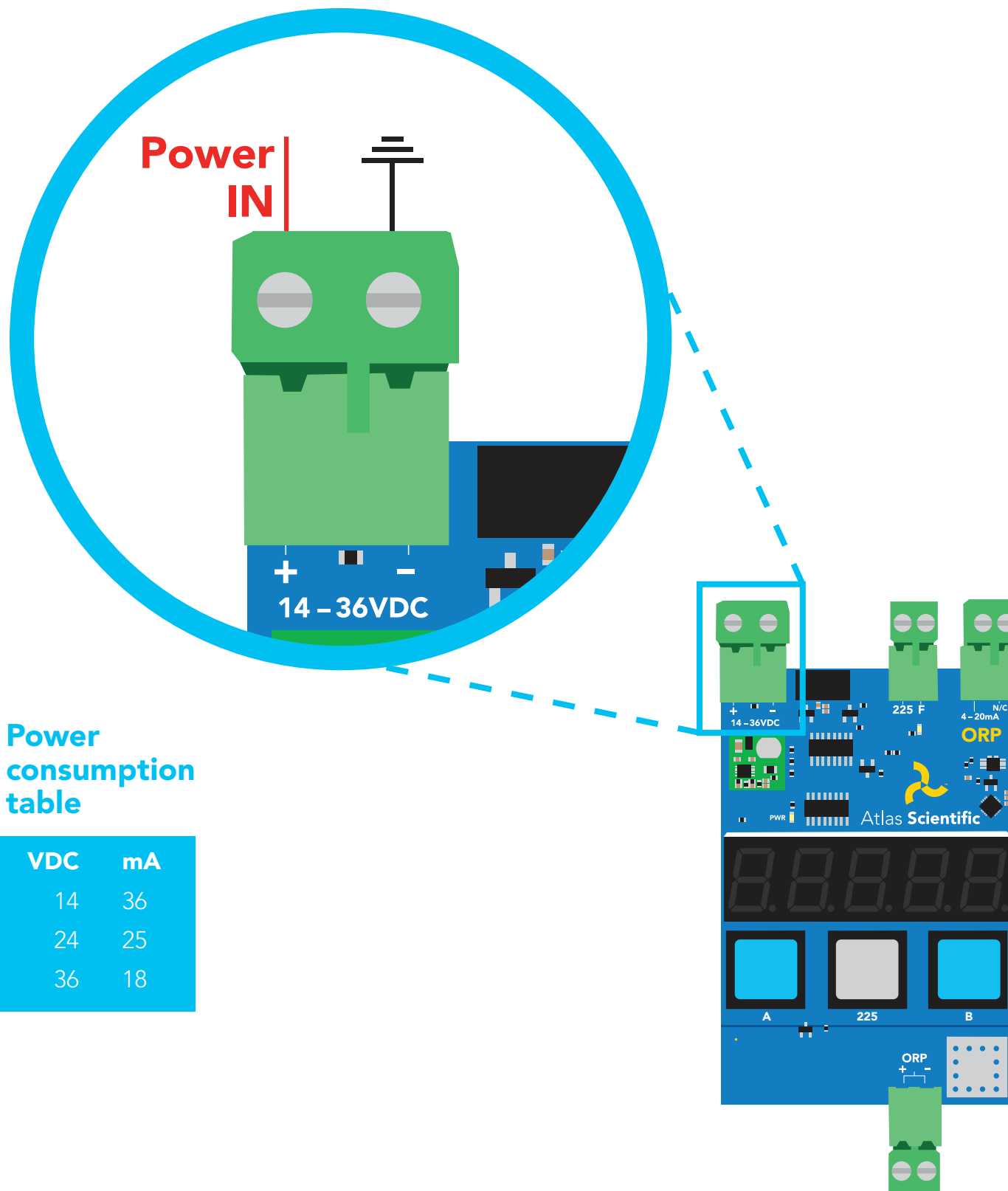
Mounting

The Industrial ORP Transmitter is specifically designed to be mounted to a 35mm din rail. To detach the transmitter from the din rail, pull down on the din rail release notch.



Power connection

Any DC voltage from 14V – 36V can be used to power the Industrial ORP Transmitter. The power connector is keyed differently and is larger than the other connectors.

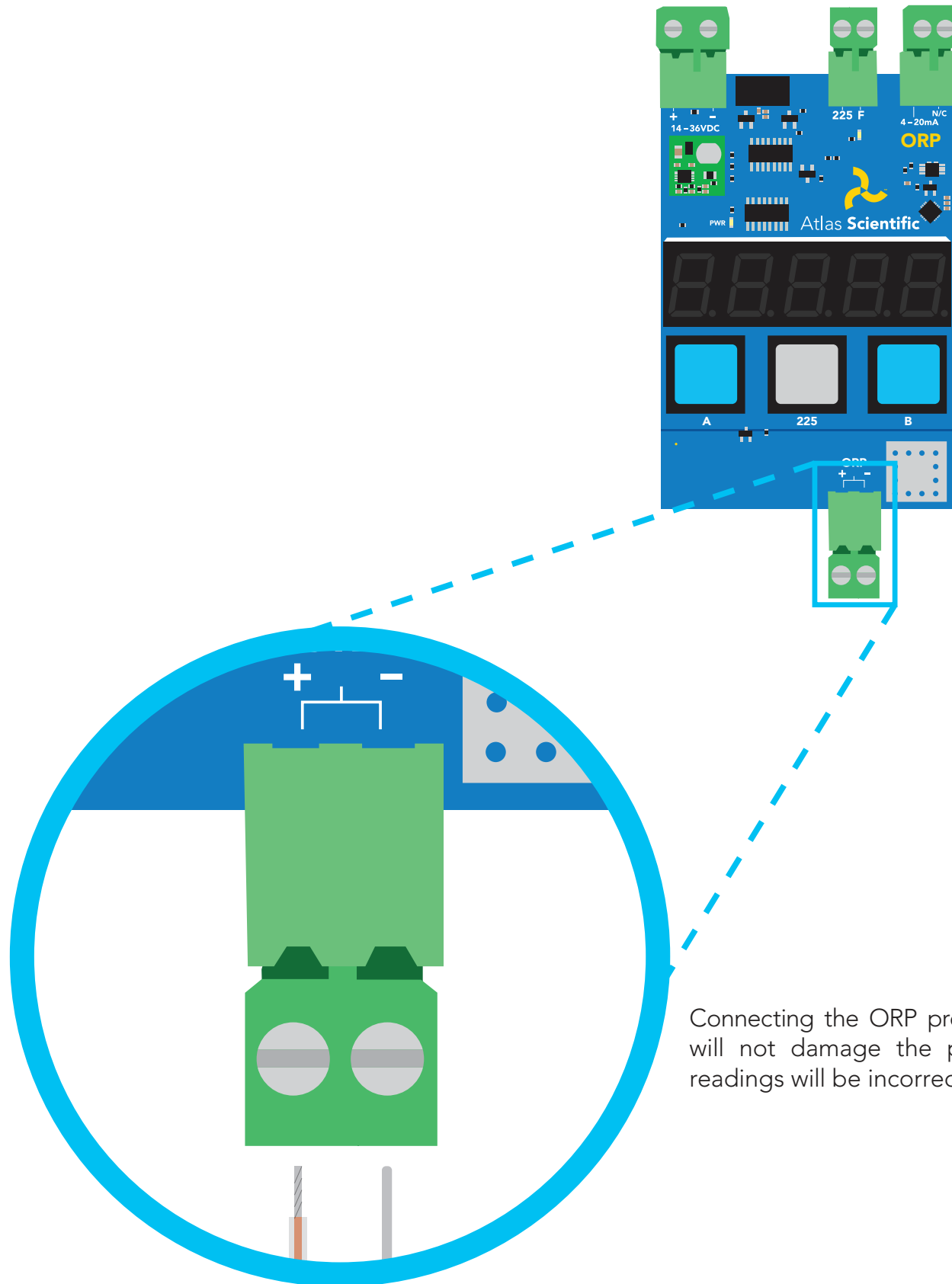


Power consumption table

VDC	mA
14	36
24	25
36	18

ORP connection

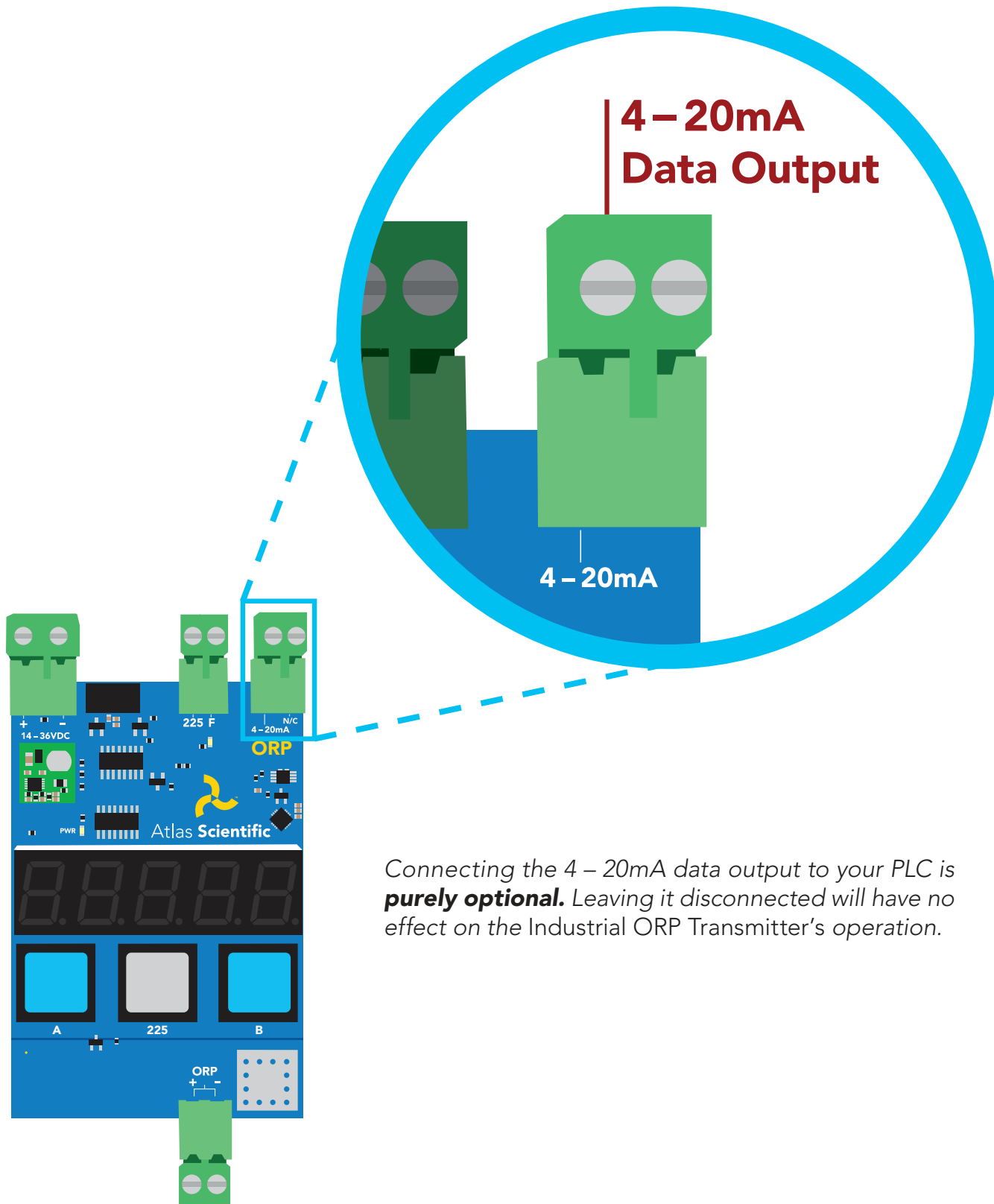
Any off the shelf two wire ORP probe can be used with the Industrial ORP Transmitter.



Connecting the ORP probe in reverse order will not damage the probe however, the readings will be incorrect.

4–20mA connection

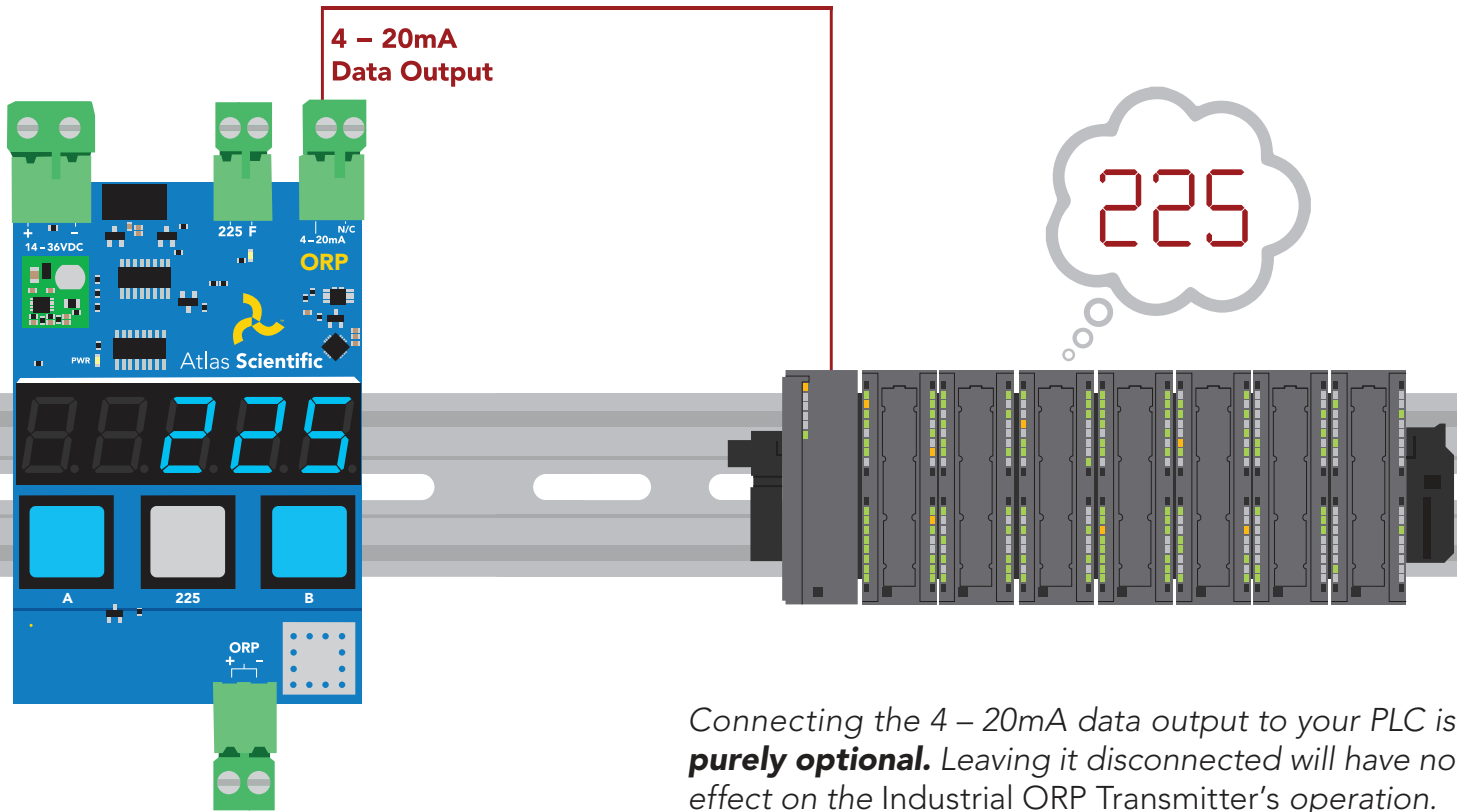
Connecting the 4–20mA data output to your PLC, allows the Industrial ORP Transmitter to communicate with your PLC.



Connecting the 4 – 20mA data output to your PLC is **purely optional**. Leaving it disconnected will have no effect on the Industrial ORP Transmitter's operation.

4 – 20mA ORP transmission

The ORP value that is visible on the seven segment LED screen is also, simultaneously transmitted through the 4 – 20mA data output.



Connecting the 4 – 20mA data output to your PLC is **purely optional**. Leaving it disconnected will have no effect on the Industrial ORP Transmitter's operation.

ORP to 4–20mA equation

$$\left(\left(\frac{ORP}{1900} \right) * 8 \right) + 12 = mA$$

Advanced

4 – 20mA max load resistance

$$R_{max} = \frac{(V_{in} - 1)}{0.026}$$

R = the total resistive load on the line.
V = the voltage powering the transmitter.

ORP	mA
-1900	4
-500	9.89
-225	11.05
0	12
225	12.95
500	14.10
1900	20

PLC ADC Resolution

10 BIT	= 3.71
12 BIT	= 0.92
16 BIT	= 0.05

Reading 4–20mA output with a multimeter

To debug the Industrial ORP Transmitter output, first connect it to a multimeter as shown. (make sure the multimeter is set to "mA"). Once properly connected, set the Industrial ORP Transmitter to calibrate to **225**. Compare the reading on the multimeter to the chart below.

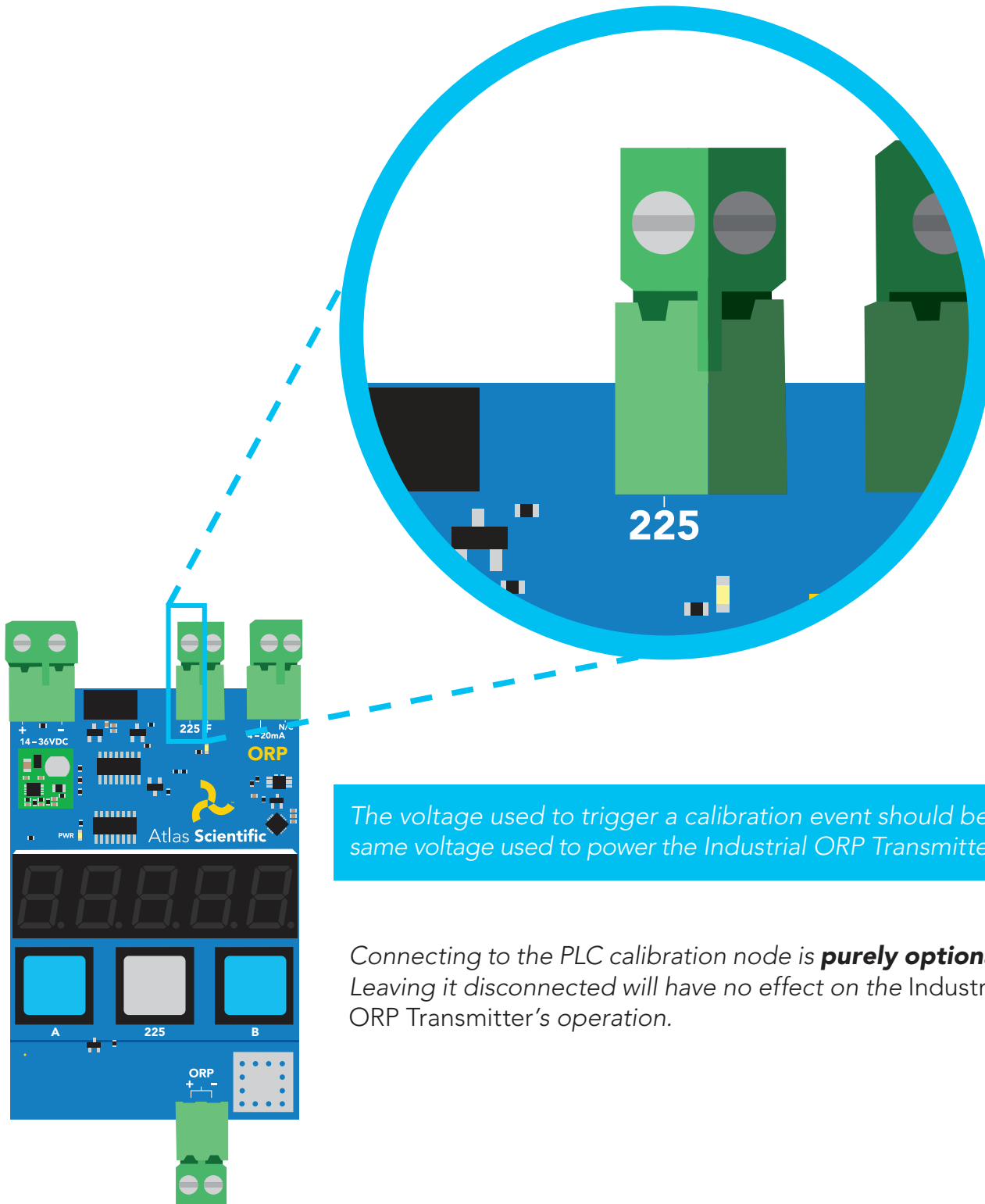


ORP	mA
225	12.95

PLC calibration node

Using the input connection marked "225" it's possible to use a PLC to fully calibrate the Industrial ORP Transmitter. This is particularly beneficial when using a PLC touch screen.

Sending an output signal from the PLC to the ORP Transmitters 225 input connection will calibrate the device.

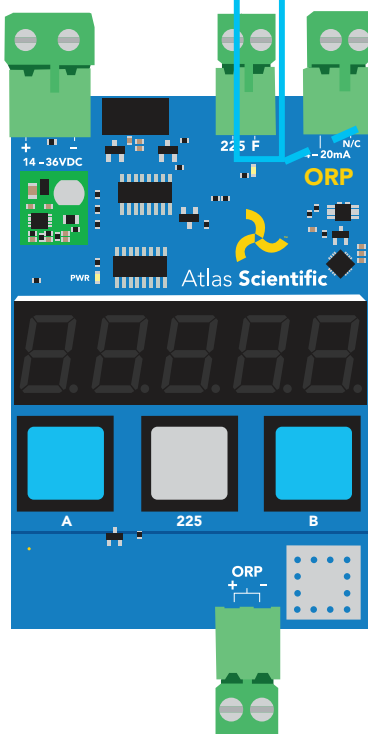
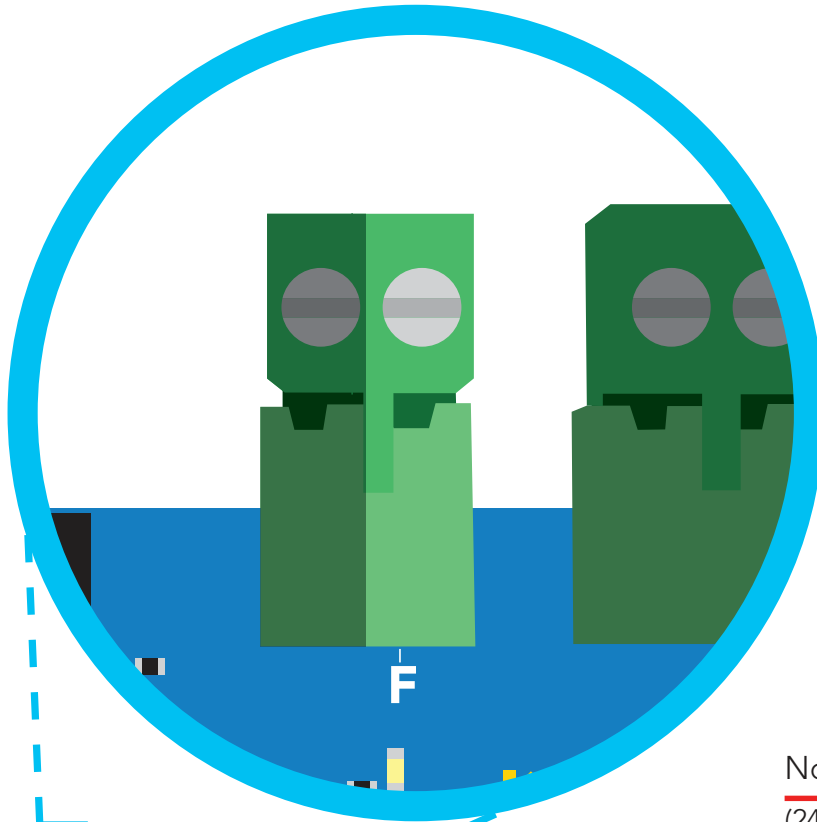


The voltage used to trigger a calibration event should be the same voltage used to power the Industrial ORP Transmitter.

Connecting to the PLC calibration node is **purely optional**. Leaving it disconnected will have no effect on the Industrial ORP Transmitter's operation.

Fault detect line

The connection marked "F" is the fault detect line. During normal operation the fault detect line will output a voltage equal to the voltage used to power the device. If the Industrial ORP Transmitter detects a problem the fault line will drop to 0 volts. When a fault is detected the fault LED will turn on.



Normal operation

(24V typical)



Fault

0 Volts

Example

The Industrial ORP Transmitter is powered with 24V the "F" line will output 24V during normal operation.

Events that will trigger the fault line to go to 0 volts

- disconnected 4–20mA output.
- calibration in process.
- loss of power.

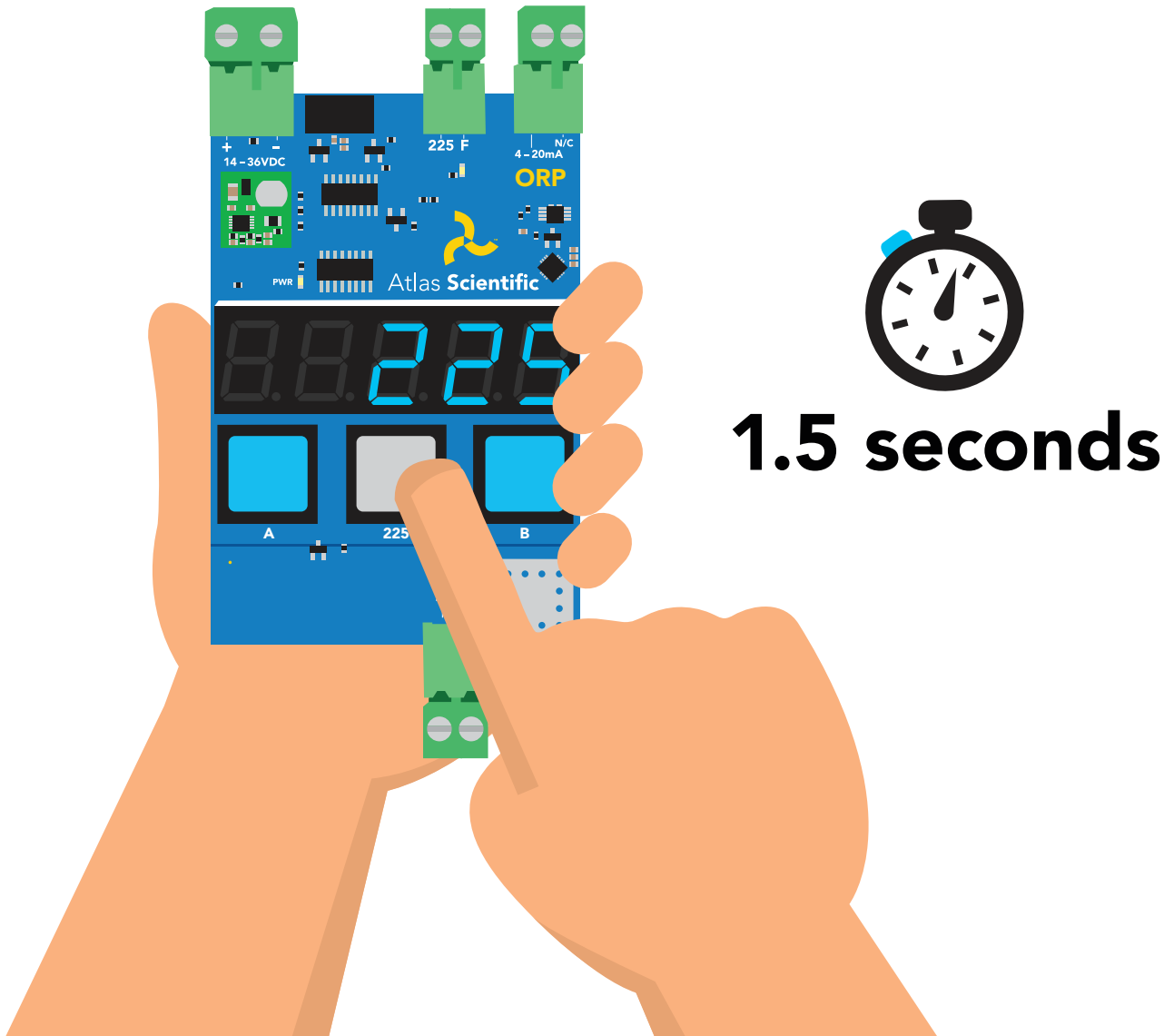
Connecting to the fault detect line is **purely optional**. Leaving it disconnected will have no effect on the Industrial ORP Transmitter's operation.

Calibration theory

The Atlas Scientific Industrial ORP Transmitter has a simple **single point** calibration protocol. Place the probe in the 225mV calibration solution (*chemically known as Zobell's Solution*). Wait for the readings to stabilize, then calibrate the transmitter. **The calibration data is stored in the EEPROM, and will be retained even if the Transmitter is powered off.**

On-board calibration

To begin the on-board calibration process, press and hold the middle **gray** button marked **"225"**, for 1.5 seconds to calibrate to an ORP of 225mV.



The display will flash: **225**, after a few seconds the display will then flash: **done**.

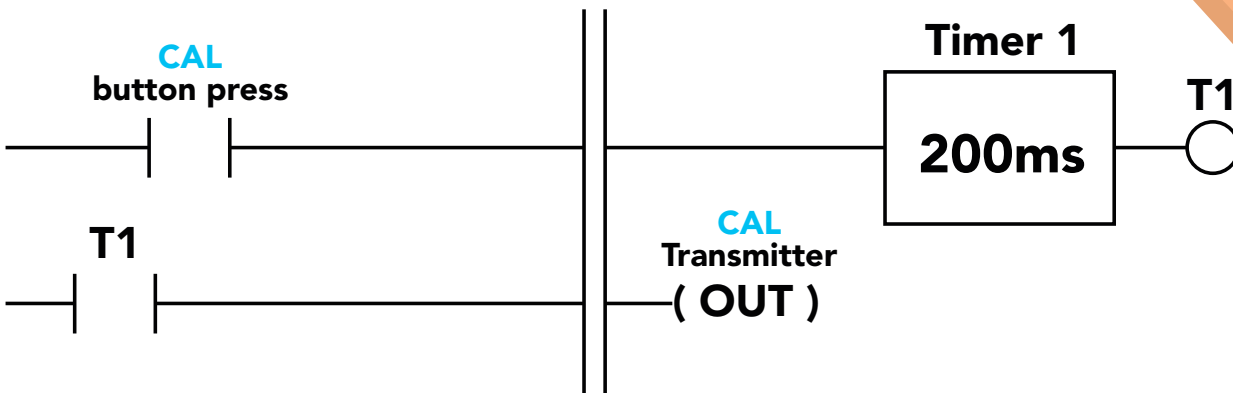
PLC calibration

Using the input connection marked **"225"** it's possible to use a PLC to fully calibrate the Industrial ORP Transmitter. Setting the PLC's output to 200ms or more will trigger a calibration event.

This is particularly beneficial when using a PLC touch screen.



The voltage used to trigger a calibration event should be the same voltage used to power the Industrial ORP Transmitter.

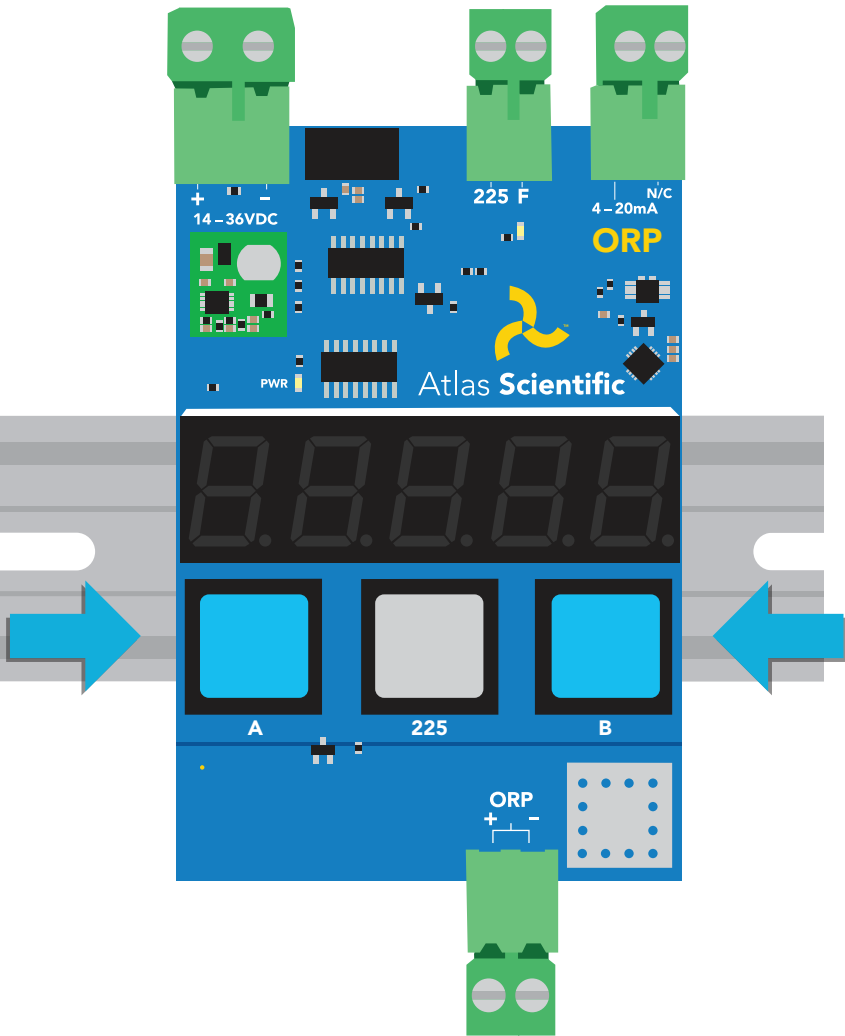


A calibration event will only trigger if the corresponding input pin has been held high for 200ms. *Holding the line for more than 200ms will have no effect.*

4 – 20mA calibration

To ensure that the PLC is receiving the most accurate 4 – 20mA signal the current output from the Industrial ORP Transmitter can be adjusted. The 4mA signal and the 20mA signal can both be adjusted independently.

To enter 4 – 20mA calibration mode press and hold the two **blue** buttons marked **"A"** and **"B"** simultaneously for 1.5 seconds.

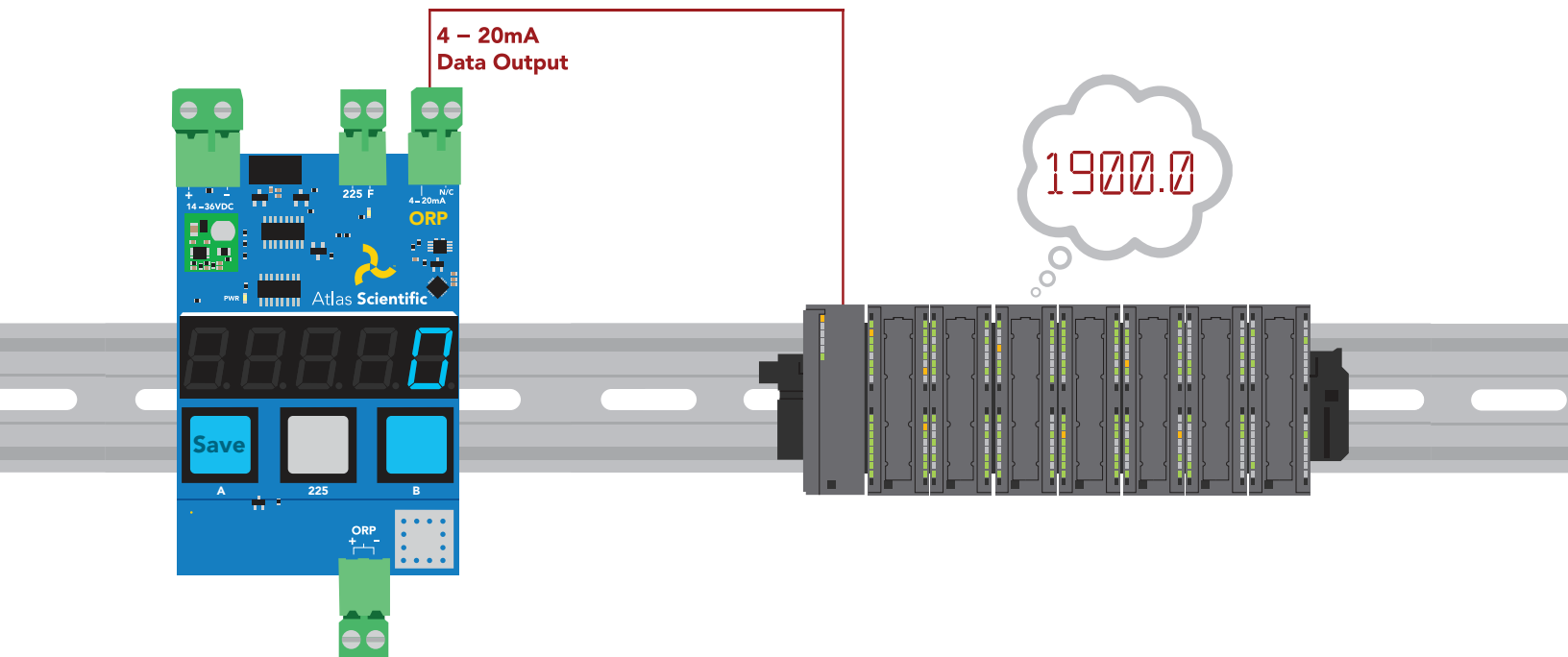
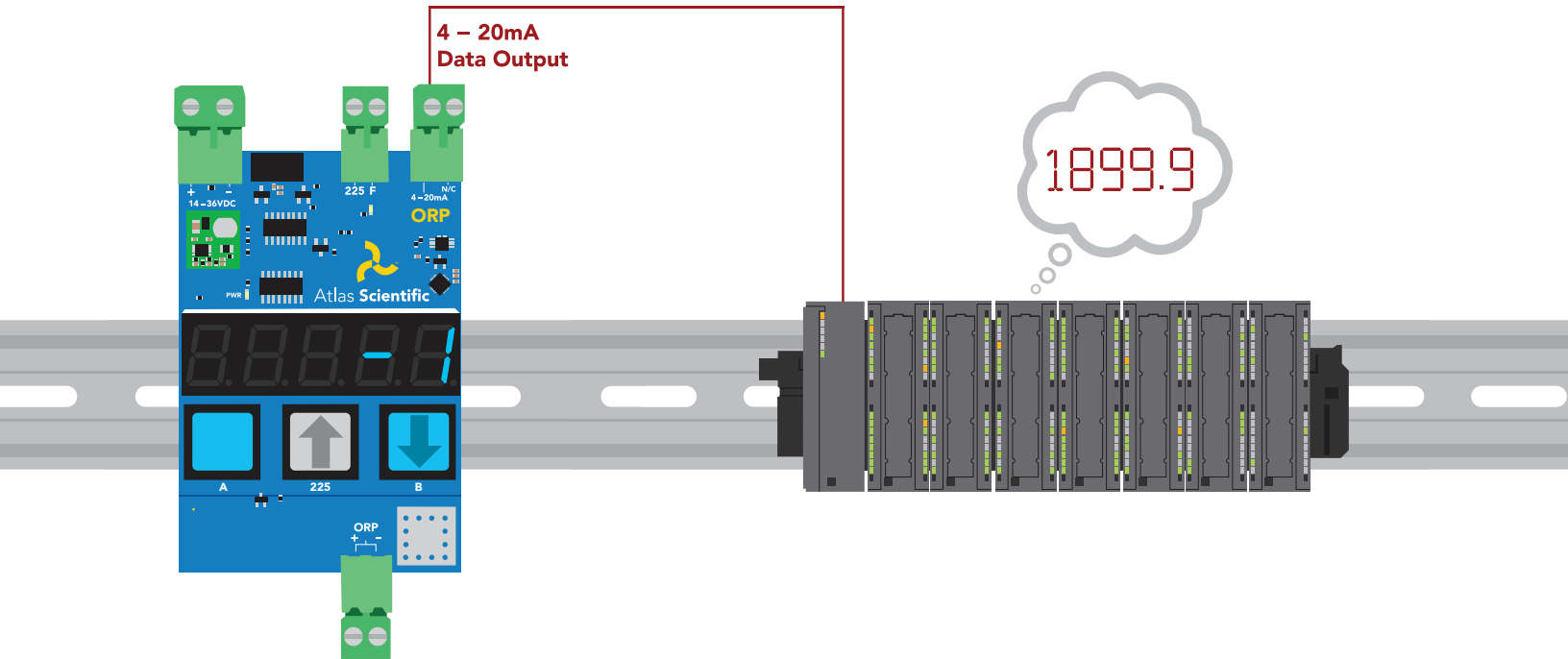


1.5 seconds

4 – 20mA High

The display will flash: **4-20H** (the “H” stands for high) The Industrial ORP Transmitter will now output exactly 20mA, and your PLC should show an ORP of 1900. Use the **gray (up)** and **blue B (down)** buttons to adjust the 20mA output so the ORP moves to 1899.9, then move it back up, so it is just hits 1900. When you have finished making adjustments, press the **blue A (save)** button to confirm.

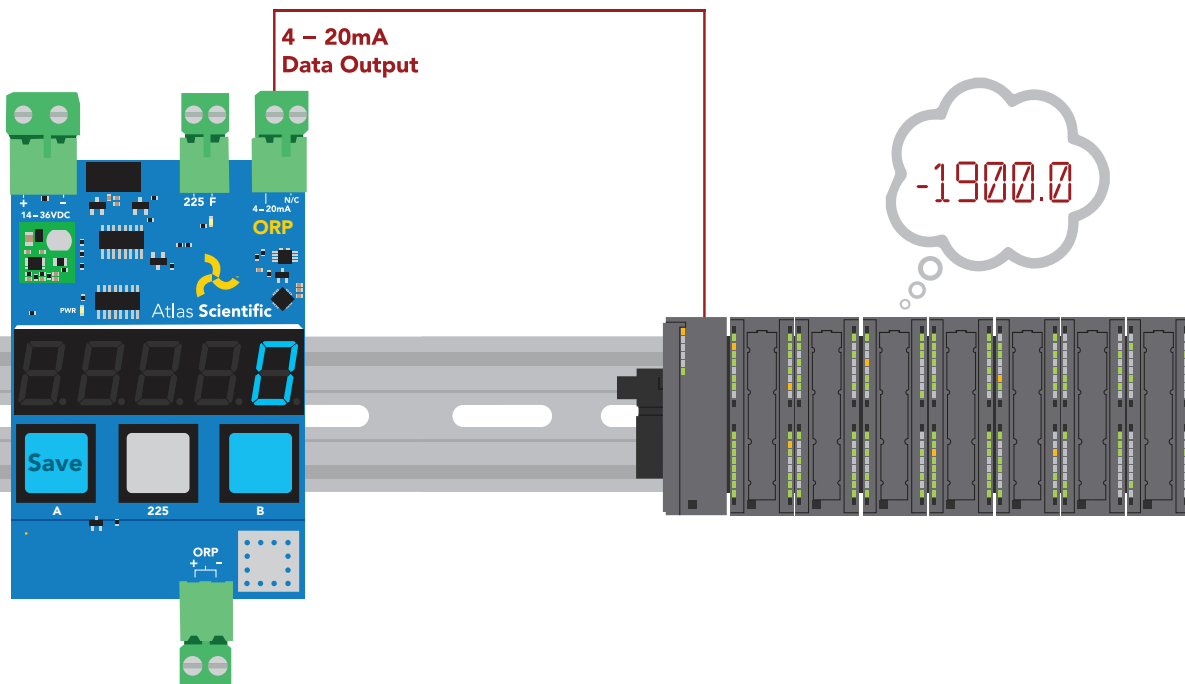
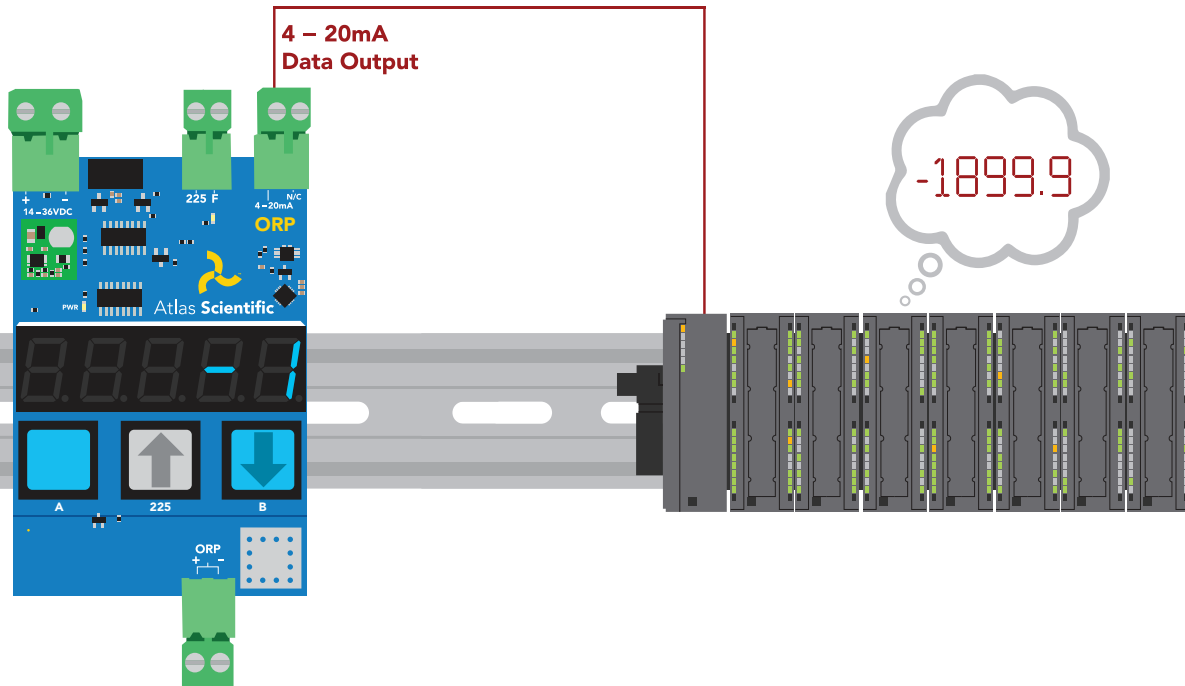
The 20mA offset will be permanently stored in memory.



4 – 20mA Low

The display will flash: **4-20L** (the "L" stands for low) The Industrial ORP Transmitter will now output exactly 4mA, and your PLC should show an ORP of -1900. Use the **gray (up)** and **blue B (down)** buttons to adjust the 4mA output so the ORP moves to -1899.9, then move it back, so it is just hits -1900. When you have finished making adjustments, press the **blue A (save)** button to confirm.

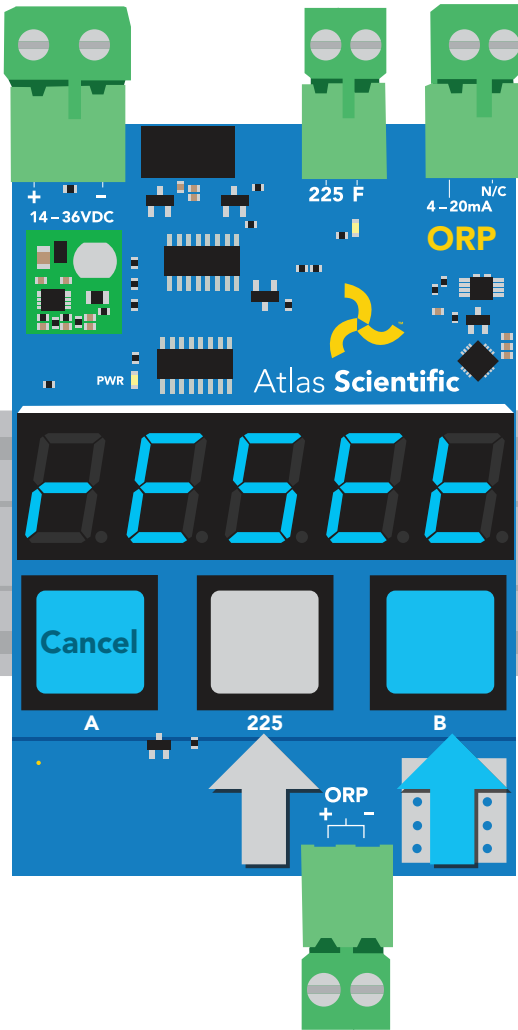
The 20mA offset will be permanently stored in memory.



Factory reset

The Industrial ORP Transmitter can be reset to its default settings. To issue a factory reset, press and hold the **gray** and **blue B** buttons for three seconds.

The display will flash: *rESEt*



3 seconds

Press and hold the **gray** and **blue B** buttons again to confirm the factory reset. To cancel a factory reset, press the **blue A** button.

Datasheet change log

Datasheet V 1.6

Revised art to reflect V1.3 changes.

Datasheet V 1.5

Revised illustration on pg 16.

Datasheet V 1.4

Added 4 – 20mA max load resistance formula on pg 11.

Datasheet V 1.3

Revised math equation on pg. 11

Datasheet V 1.2

Added info about calibration data saved to EEPROM on pg 15.

Datasheet V 1.1

Corrected typo on pg 16.

Datasheet V 1.0

Revised entire datasheet.