

## Lab-on-Chip Phosphate Analyser

### Technology description

The lab on chip phosphate analyser is an autonomous submersible sensor which performs a colourimetric phosphate measurement on a microfluidic chip. A custom designed pump and multiple solenoid valves move and control environmental samples, standards, and chemical reagents within the device. A custom electronics package controls the system, logs data, and provides communications. The sensor can be housed in an air-filled water-tight housing for shallow deployments or fitted in a pressure-compensating deep sea housing for measurements at full ocean depth.



### Environments in which technology has been demonstrated

laboratory, estuaries, rivers, benthic landers, CTD casts, coastal & deep moorings, remote-operated vehicle, autonomous underwater vehicles

### Analytical performance

*The sensor is under continual development but has been demonstrated to the following specifications*

Sample rate:	6 minutes (un-calibrated), 28 minutes (calibrated)
Calibration method:	analysis of on-board standards
Limit of detection:	40 nM
Sample volume:	280 $\mu$ L per measurement
Range of linearity:	0.1-100 $\mu$ M
Deployment depth:	to 6000 m
Endurance:	2000 measurements with a standard reagent housing (pictured, below right)
Temperature range:	5-35°C

### Power and communications requirements

Voltage range:	10 V to 16 V
Power consumption:	1.8 W (typ.)
Current draw:	155 mA average, 385 mA maximum
Output interface :	RS232, RS485, USB
Connector type :	IE55 6-way

### Dimensions and weight

Dimensions:	17 cm long , 15 cm diameter (without reagent housing) 56 cm high, 20 cm diameter (sensor with reagent housing)
Weight in air:	3.6 kg (without reagent housing) 6 kg (sensor with reagent housing)
Weight in water:	0.85 kg



## Key Publications

- Clinton-Bailey, G.S., Grand, M.M., Beaton, A.D., Nightingale, A.M., Owsianka, D.R., Slavik, G.J., Connelly, D.P., Cardwell, C.L., Mowlem, M.C., A Lab-on-Chip Analyzer for in Situ Measurement of Soluble Reactive Phosphate: Improved Phosphate Blue Assay and Application to Fluvial Monitoring. *Environ. Sci. Technol.* 51, 2017. <https://doi.org/10.1021/acs.est.7b01581>
- Grand, M.M., Clinton-Bailey, G.S., Beaton, A.D., Schaap, A.M., Johengen, T.H., Tamburri, M.N., Connelly, D.P., Mowlem, M.C., Achterberg, E.P. A Lab-On-Chip Phosphate Analyzer for Long-term In Situ Monitoring at Fixed Observatories: Optimization and Performance Evaluation in Estuarine and Oligotrophic Coastal Waters. *Front. Mar. Sci.* 4, 2017. <https://doi.org/10.3389/fmars.2017.00255>