



# SWALE OCEANOGRAPHIC

## Surface Sea Water pCO<sub>2</sub> Measuring System

The 8050 pCO<sub>2</sub> Measuring System is an autonomous analytical system for measuring carbon dioxide in oceanic surface water.

The system is modelled after instruments previously built by Craig Neill / University of Bergen and over 70 systems have been commissioned. It may be used on a ship underway or, on a variety of at-sea platforms. The present pCO<sub>2</sub> system operates fully automatically and consists of:



- An equilibrator that balances the CO<sub>2</sub> in seawater with a headspace gas that is analysed.
- An infrared analyser to quantify the CO<sub>2</sub> concentration in the equilibrator headspace and marine air.
- A network of valves and pumps that select, control, and monitor flows of seawater, equilibrator headspace, marine air, and CO<sub>2</sub> gas standards.
- A deck enclosure that provides a GPS signal, atmospheric pressure measurement and satellite data transfer.
- An integrated computer, interface, and software to control valves and pumps and to log parameter data.

## Overview

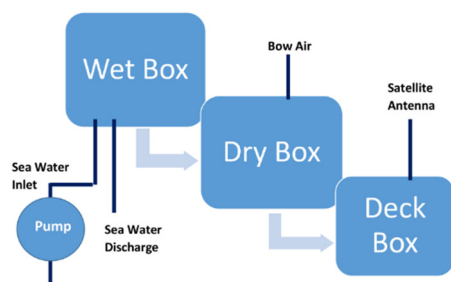
The system consists of three enclosures: the dry box, the wet box, and the deck box.

The dry box contains a Licor CO<sub>2</sub> analyser, valves to control the gas flow through the analyser, a gas flow sensor, computer and interface with solid-state relays. There are up to eight gas inlets. Each inlet has a needle valve to adjust the flow rate. A three-way solenoid valve directs the gas exiting the analyser towards a vent or the equilibrator (when analysing the equilibrator headspace). The dry box communicates with the other boxes via an RS485 module and cables.

The wet box contains main and vent equilibrating chambers, valves, pressure gauge & regulator, reusable water filter, water flow sensor, barometer, temperature probe, condenser unit, two Naphion drying tubes, and three air pumps. After entering the wet box, seawater passes through the filter, which can be automatically back-flushed with fresh water. An adjustable regulating valve after the filter sets the water pressure that is delivered to the equilibrators.

The vent equilibrator keeps the CO<sub>2</sub> concentration in gas that exchanges with the vent on the main equilibrator close to the concentration in the main headspace. The barometer and temperature probe are attached to the main equilibrator. Seawater drains from the wet box.

One of the air pumps in the wet box pulls the headspace gas from the main equilibrator and pushes it through the condenser, a Naphion drying tube and then the CO<sub>2</sub> analyser. Another pump pulls air from an exterior inlet provided and located by the user and pushes the air through a condenser. After the condenser, this gas stream is split towards a vented chamber and towards a drying tube and then the CO<sub>2</sub> analyser. The reduced-humidity air in the vented chamber is pulled through the drying tubes as counter-flow gas by the third air pump.

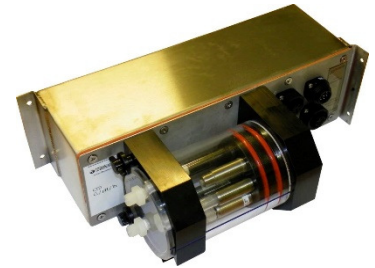


The weather resistant satellite deck box contains the modem for Iridium satellite communication, a high-precision barometer, a power supply, and data communication modules. A GPS transducer is attached to deck box and data modules. A ten-conductor cable connects the deck box to the dry box (a 25 metre cable is provided; a cable can be up to 1000 metres long, an extra connector is provided for making a cable for a permanent installation). There is a bulkhead tube fitting for connecting a Gill pressure port to the barometer (pressure port not provided).



## Options

The following options are available for the 8050 pCO<sub>2</sub> measuring system. The model I8050-7 Idronaut multi-parameter flow-through sensor module is designed to be integrated into the wet box of the pCO<sub>2</sub> system. The instrument is used for the measurement of Conductivity, Temperature, Oxygen, pH and Redox. This advanced instrument is the result of 25 years' experience in the design of high technology water quality probes and offers long term sensor stability for unattended data collection, in either fresh or sea water environments. Data can be stored either internally within the probe or directly onto a PC.



The model I8050-7 Sensor Module comes complete with two thermometers. The first is fitted near the water sampling port to accurately measure the temperature of the surface waters, while the second is fitted inside the measuring cell to allow salinity calculations.

The unit is housed in a small (102 x 102 x 318 mm) stainless steel unit with an adjacent parallel transparent sensor chamber which can be easily removed for cleaning. The sample volume of the chamber is only 250ml which ensures that the system maintains a fast response time. A pressure sensor inside the cell acts as an accurate flow meter. For ease of maintenance, the flow through conductivity sensor features Idronaut's well accepted large diameter seven-ring quartz cell. This does not require black platinum coating and can therefore be easily cleaned in the field, without the need for recalibration.

### Sensor Specifications

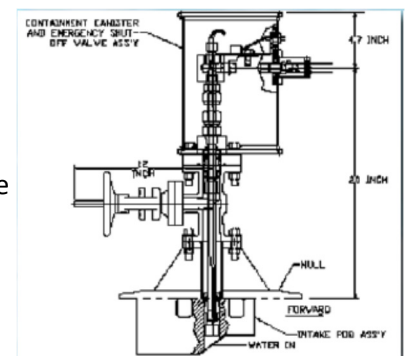
	Range	Accuracy	Resolution	Time Constant
<b>Pressure (Flow)</b>	0.....10 dbar	0.2 % full scale	0.03%	50 ms
<b>Temperature</b>	-3....+50 °C	0.003 °C	0.0005 °C	50 ms
<b>Conductivity</b>	0.....64 mS/cm	0.003 mS/cm	0.001 mS/cm	50 ms
<b>Oxygen</b>	0.....25 ppm	0.1 ppm	0.01 ppm	3 s
	0....250% sat	1% sat	0.1% sat	3 s
<b>pH</b>	0.....14 pH	0.01 pH	0.001 pH	3 s
<b>Redox</b>	-1000 to +1000 mV	1 mV	0.1 mV	3 s

## Pump Option

General Oceanics is able to recommend or supply the proper seawater intake pump that best suits your needs.

## Through Hull Intake Water Plumbing Option

This package is a Lloyd's approved below water line module, self-contained with all exposed parts either stainless steel or plastic. The unit includes a guillotine shut off valve in case of catastrophic failure. The unit collects water a few inches from the hull through the intake pod assembly. Options include an external sea surface temperature sensor, and chlorine gas generator to eliminate growth of any micro-organisms.



### Dimensions:

Wet Box: Length 66 cm Width 66 cm Depth 27 cm  
 Dry Box: Length 61 cm Width 64 cm Depth 26 cm  
 Deck Box: Length 36cm Width 27cm Depth 20cm

Note: The system requires the following items:

- Main water intake pump and plumbing, see pump and through hull intake plumbing option above.
- Calibration gases and connecting lines.
- Co<sub>2</sub> analyzer (Licor 6262 or 7000 recommended)

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