

Eddy flux instrumentation

A range of high performance gas exchange instrumentation for ecophysiological research applications



OP-2
Open path CO₂ / H₂O analyzer



OPEC
Open path eddy covariance system



CPS12
CO₂ multi-point profiling system

Concerns over rising CO₂ concentrations

Rapidly rising atmospheric CO₂ concentration and its potential impact on future climates is an issue of global, economic and political significance.

Since the industrial revolution atmospheric CO₂ concentrations have risen from 280ppm to around 380ppm. This rise is down to the imbalance in CO₂ being consumed by sinks against the amount being produced by sources. It is widely accepted that man-made activity, by burning fossil fuels, accounts for about 50% of the total CO₂ released into the atmosphere. Natural biomass respiration and decay release the remainder. Around half of this CO₂ remains in the atmosphere.



This total carbon balance and the relationship between sources and sinks is currently subject to increasing scientific scrutiny, both on a regional and a global scale.

Much emphasis is being placed on the need to monitor direct and long-term measurements of CO₂ and H₂O between terrestrial ecosystems, oceans and the atmosphere. These relationships are being investigated across diverse ecosystems including: oceans, wetlands, crop canopies, forests and grasslands, with measurements being tower based, often several meters from ground level.

High performance instrumentation

The measurement of these gas exchanges requires high performance instrumentation that provide both an ultra fast response time (20Hz) and a high level of gas resolution. Eddy covariance is often the standard analytical technique employed. This requires, as a minimum, simultaneous fast response gas exchange together with wind speed and direction data.

ADC BioScientific is one of the world's leading developers of high performance gas exchange instrumentation for environmental research. Few manufacturers can claim such expertise and experience.

Our range of instrumentation specifically designed for atmospheric research is proving to be a vital investigative tool to flux networks throughout the world.

OP-2

The open path analyser for ecophysiological research



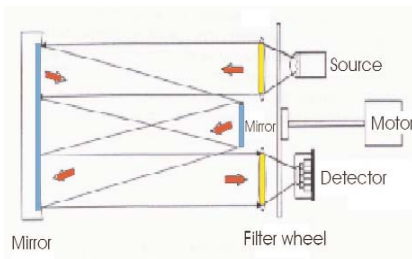
Open path analyzer

Eddy covariance measurements have traditionally been carried out using a “closed path” analyzer, such as the ADC2250. Although the ADC2250 itself has a very fast response time of 10Hz, there is always a lag between the sampling point and the analyzer that may be several meters of external tubing apart.

The “state of the art” OP-2 has been designed to overcome these delayed responses to ensure the fastest possible response times. The OP-2 is an open path analyzer allowing free air movement within the path length of the analyzer. A near immediate response time is therefore achieved.

Fast response, high resolution

A general principle of infrared gas analysis is that the longer the path length, the higher the possible resolution. With a path length of 80cm the OP-2 is able to resolve CO₂ to 0.02ppm, while the novel folded path design (4 x 20cm) maintains the compact nature of the instrument. Both the source and the detector are housed in the main body of the analyzer.



This field-robust analyzer has been designed to minimise the environmental impact on the overall performance. The OP-2 has excellent reliability and performance characteristics.

A linearised output is provided at 20Hz.

A calibration hood is provided that ensures that the whole of the path length is calibrated.

- Open path design
- Simultaneous CO₂ / H₂O
- 20Hz output
- 0.02ppm CO₂ resolution
- Operational in harsh environments
- 12V DC

Technical Specifications

Measurement technique:	Open path, absolute, infrared (NDIR) analyzer, simultaneous CO ₂ and H ₂ O.
CO ₂ :	0-600ppm, 0.02ppm resolution.
H ₂ O:	0-70mb, 0.05mb.
Optical path:	80cm (4 x folded 20cm path).
Optics:	All exposed optics are coated for weather and abrasion resistance.
Detector:	Thermoelectrically cooled lead selenide (PbSe).
Filters:	3 narrow bandpass filters. Sampling at 3000RPM (50Hz)
Analog outputs:	Nominal 20Hz, +5V, linearised, temperature compensated and calibrated to absolute densities.
Power requirements:	Nominal 12V DC (9.5 to 18) unregulated at 1.4A, 20W.
Construction:	Anodized aluminium. Entire assembly weatherproofed. Calibration hood included. Instrument cable 5.5m.
Mounting:	Flexible mounting system accepts standard hardware.
Temperature range:	-25°C to 40°C
Dimensions:	Cylindrical: 37cm length x 7.6 cm diameter.
Weight:	2.0kg

OPEC

Complete and fully integrated open path eddy covariance system



Fully integrated system

The ADC BioScientific OPEC (Open Path Eddy Covariance) system is designed for continuous, long-term, surface atmospheric flux determinations by eddy covariances over forest, grasslands or crop canopies.

This complete, fully integrated and robust system provides researchers with a “plug in, ready to use” solution for their eddy flux programs. The OPEC system combines high quality component parts already proven and respected within the ecophysiology research community across the world.

- **OP-2** - Open path CO₂/H₂O analyzer
- **WindMaster** - Sonic anemometer
- **EDDYSOFT** - Data processing software
- Fully integrated
- Simultaneous sensor output

Simultaneous data output

Setting up the system is relatively quick and simple. Using an open path analyzer means that no complex gas circuit connections are required.

The OP-2 and WindMaster and any other required environmental sensor outputs are electrically connected, thus guaranteeing the simultaneous data output of all sensors.

The OPEC system is supplied complete with mounting rig and clamps allowing the system to be positioned on a flux tower.

WindMaster Ultrasonic Research Anemometer

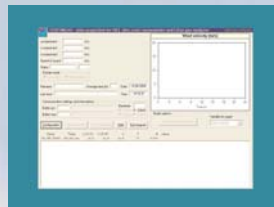


- 20Hz Data rate
- Wind turbulence measurements
- Speed of sound and sonic temperature outputs
- Operates in precipitation
- Maintenance free
- Robust construction

Gill Instruments' highly respected 20Hz research sonic anemometer.

The robust and easy to use sensor is ideally suited for research of large eddies at high mast levels. Data output is fully synchronised with the OP-2.

EDDYSOFT



- 50Hz acquisition
- Extensive data acquisition functions
- Comprehensive data processing
- Real time presentation

Windows based software package for the acquisition and post processing of eddy covariance data. Developed by Prof. Olaf Kolle at the Max Planck Institute, this comprehensive package is being used in a host of CO₂ flux sites throughout the world.



ADC OPEC system at CFERN site, Da Gang Shan field station, Jianxi Province China.

CPS12

Vertical CO₂ profiling system



The ADC CPS12 CO₂ profiling system is a modular package consisting of:

- ADC2250 differential CO₂ analyzer
- Multiplexer: 4, 8, 12, 16, 20 or 24 sampling points
- All throttles, interconnecting tubing and pumps

- High performance CO₂ IRGA
 - 0.1ppm resolution
 - 10Hz response
- 0-2000ppm CO₂
- 12 sampling points
- Versatile experimental programming
- Integral data storage

Determination of vertical CO₂ profiles

As part of an eddy flux program, researchers often require to know the changes in CO₂ concentration within a forest canopy or up the entire length of an eddy tower. This data can be used to calculate total carbon storage.

The ADC BioScientific CPS12 system enables the continuous monitoring of CO₂ concentrations at multiple points. The system provides the researcher with full experimental programming capabilities including airflow control, total test duration and individual sampling times.

This complete stand-alone system includes integral data storage. Alternatively, data may be logged externally from the system in an industry standard format.

The standard CPS12 system can monitor 12 sampling points. Systems may also be supplied for 4, 8, 16, 20 or 24 sampling points.

High performance analyser

The ADC CPS12 system features the ADC2250 high performance gas exchange system.



- 0.1 ppm CO₂ resolution
- 10Hz response
- Advanced data management
- Scalable environmental inputs

This infrared gas analyzer provides high resolution, fast response and accurate gas exchange data.

Full programming of the complete CPS12 system is provided through the ADC2250 via a "QWERTY" keypad and fast keys.

For more extensive studies, external sensors such as temperature, soil heat flux and PAR can be directly connected to the system. All parameters are displayed on the large colour graphic display.

Full system integration means that data displayed and recorded by the ADC2250 will have an associated channel number to indicate the correct sample point being measured.



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