

# CPEC200

## Closed Path Eddy Covariance Flux System



The CPEC200 is a closed path eddy covariance (EC) flux system for long-term monitoring of atmosphere-biosphere exchanges of carbon dioxide, water vapor, heat, and momentum. This complete, turn-key system includes a closed-path gas analyzer (EC155), sonic anemometer (CSAT3A), datalogger (CR3000), sample pump, and optional valve module for automated zero and span.

The gas analyzer's small sample cell volume (5.8 ml) minimizes the sample residence time (50 ms at the system's nominal flow rate, 7 LPM). This gives excellent frequency response (5.8 Hz half-power bandwidth) with low total system power (12 W).

### Features

- Complete System includes:
  - Sonic anemometer (CSAT3A)
  - Closed path gas analyzer (EC155)
  - Datalogger (CR3000)
  - Enclosure with control electronics (CPEC200 enclosure)
  - Pump module
  - Mounting hardware, tubing, cables
- Excellent system frequency response (Fig. 3)
  - Gas analyzer sample cell volume is 5.8 ml
  - 7 LPM sample flow rate gives 50 ms residence time
  - Fundamental measurement frequency is 100 Hz for sonic anemometer and gas analyzer
  - User selectable output bandwidths (5, 10, 12.5, 20, or 25 Hz)
- Low power
  - 12 W continuous for complete system
  - Solar power available for remote installations
  - Automatic power management functions reduce power consumption if the battery voltage drops below a preset level
- Options available:
  - Valve Module provides automatic field zero and span
  - On-board data storage using CompactFlash cards; maximum 2 GB or ~2 months at 10 Hz measurement frequency
  - Remote data collection, including direct (Ethernet, RS-232, short haul modem, land-line\*) and wireless (RF, cellular\*, satellite\*)



Figure 1: CPEC200 Closed Path Eddy Covariance Flux System.

- Low cost
  - Integrated EC150-series electronics module measures both the sonic anemometer and the gas analyzer
- Ease of use
  - Datalogger program requires minimal input from station operator
  - Active system flow control; EC and zero/span flows set by datalogger program variables
  - System operates continuously during inclement weather
  - Heated sample intake prevents condensation
  - Installation requires minimal tools

\*Only online statistics can be collected using land line, cellular, or satellite.

## Science Measurements

CO<sub>2</sub> and H<sub>2</sub>O are measured with an EC155 Closed-Path Gas Analyzer. Three-dimensional wind speed and sonic air temperature are measured with a CSAT3A sonic anemometer head.

## CPEC200 System Enclosure

A 16 in. by 18 in. fiberglass enclosure houses the datalogger, optional data storage peripheral, optional valve module, and the electronics that interface with the CPEC200 pump module. The CPEC200 system enclosure can be mounted to a tripod mast, CM106 tripod leg base, tower legs, or a large diameter pole.

## CPEC200 Pump Module

The pump module, a standard component of the CPEC200 system, consists of a small dual-head diaphragm pump with a brushless DC motor mounted inside a fiberglass enclosure. An integral cable connects the pump module to the CPEC200 system enclosure, which provides power, temperature measurement and control, pressure measurement, and pumping speed measurement and control.

## Valve Module (Optional)

Campbell Scientific offers two valve module versions. The basic three-valve module (pn 27559) enables the CPEC200 system to automatically perform zero, CO<sub>2</sub> span, and H<sub>2</sub>O span measurements. The six-valve module (pn 26578) includes three additional valves to allow more CO<sub>2</sub> span tanks to be measured. The valve module is housed inside the CPEC200 system enclosure. The outlet of the manifold has a proportional valve to automatically control the flow of zero/span gas.

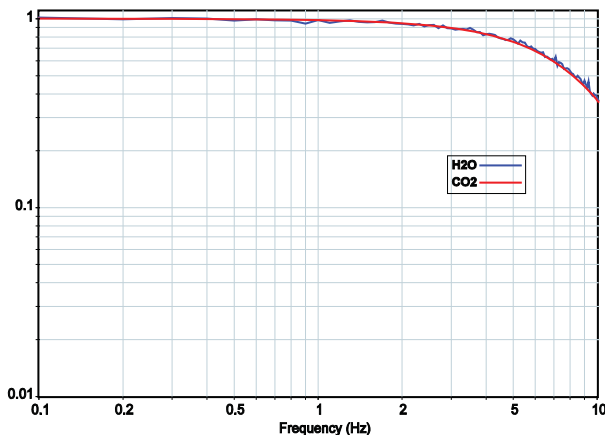


Figure 3: CPEC200 frequency response.



Figure 2: EC155 gas analyzer with CSAT3A sonic anemometer.

## Specifications\*\*

### System Enclosure

<b>Temperature:</b>	-30° to +50°C
<b>Dimensions:</b>	52.1 x 44.5 x 29.7 cm (20.5 x 17.5 x 11.7 in.)

### Weight

<b>Basic System:</b>	11.6 kg (25.5 lb)
<b>CR3000:</b>	1.6 kg (3.7 lb)
<b>CFM100/NL115:</b>	0.2 kg (0.4 lb)
<b>Three-Valve Module:</b>	1.5 kg (3.3 lb)
<b>Six-Valve Module:</b>	1.9 kg (4.2 lb)

### Pump Module

<b>Pump Operating Temperature:</b>	-30° to +50°C
<b>Cable Length:</b>	3.0 m (10 ft)
<b>Inlet Connection:</b>	3/8-in. Swagelok®
<b>Pressure Sensor Range:</b>	15 to 115 kPa
<b>Pumping Speed:</b>	3 to 9 LPM (automatically controlled at the setpoint, typically 7 LPM)
<b>Dimensions:</b>	35.6 x 29.2 x 13.5 cm (14.0 x 11.5 x 5.3 in.)
<b>Weight without mounting bracket:</b>	5.4 kg (11.8 lb)

### Valve Module

<b>Valve Operating Temperature:</b>	-30° to +50°C
<b>Inlets</b>	
<b>Three-Valve Module:</b>	Zero, CO <sub>2</sub> span, and H <sub>2</sub> O span
<b>Six-Valve Module:</b>	Zero, CO <sub>2</sub> span 1 to CO <sub>2</sub> span 4, and H <sub>2</sub> O span
<b>Outlets:</b>	Analyzer and H <sub>2</sub> O Bypass
<b>Connections:</b>	1/4-in. Swagelok®
<b>Dimensions:</b>	14.0 x 12.7 x 14.0 cm (5.5 x 5.0 x 5.5 in.)
<b>Weight</b>	
<b>Three-Valve Module:</b>	1.5 kg (3.3 lb)
<b>Six-Valve Module:</b>	1.9 kg (4.2 lb)

\*\*Refer to the EC155 and CSAT3A product brochures for closed-path gas analyzer and sonic anemometer specifications.

# Ordering Information

## Closed Path Eddy Covariance System

**CPEC200** Closed Path Eddy Covariance System w/ EC155 Analyzer and Pump Module

### Datalogger Options

- DW** Wired for CR3000
- D3** CR3000 with a low-profile base

### Communication Options (must choose one)

- NCM** No communications module
- NL** NL115 module that supports ethernet and CF cards
- CF** CFM100 module that supports CF cards

### Valve Module Options

- NV** No valve module
- 3V** Three valve module
- 6V** Six valve module

### Sonic Sensor Options

- NS** No sonic sensor
- SS** Sonic sensor (choose a carrying case option; see below)

### Sonic Carrying Case Options

- NC** No Sonic Case
- SC** Sonic Carrying Case

### Pressure Sensor Options

- BB** Basic Barometer
- EB** Enhanced Barometer

### EC155 Carrying Case Options

- NG** No EC155 Case
- GC** EC155 Carrying Case

### System Mounting Options

- NM** No Enclosure Mounting
- MM** Tripod Mast Mounting
- LM** CM106 Tripod Leg Base Mounting
- TM** Tower Legs Mounting
- PM** Pole Mounting, 4 to 10 in

### Pump Mounting Options

- NP** No Pump Mounting
- MP** Pump Tripod Mast Mounting
- LP** Pump CM1XX Leg Base Mounting
- TP** Pump Tower Legs Mounting
- PP** Pump Pole Mounting, 4 to 10 in

## Cables

For the following cables, enter the length, in feet after the -L, and choose -PT for the cable termination option.

**CABLEPCBL-L** Two-conductor, 16-AWG cable with a Santoprene® jacket is used to power the CPEC200.

**CABLE4CBL-L** Four-conductor, 22-AWG cable with drain wire and Santoprene jacket is used to attach the SDM connector on the CPEC200 electronics box.

## CompactFlash Cards

**CFMC1G** 1 GB CompactFlash® Memory Card (-40° to +85°C)

**CFMC2G** 2 GB CompactFlash Memory Card (-40° to +85°C)

## Tubing Assemblies

For the following tubing, enter the length, in feet after the -L.

**26504-L** CPEC200 Pump Tubing Assembly with 0.375" O.D tubing. Maximum tubing length is 50 ft.

**26503-L** CPEC200 Pump Tubing Assembly with 0.5" O.D tubing. Maximum tubing length is 500 ft.

**21823-L** Calibration Gas Tubing Assembly. When used with the CPEC200, choose -NT for the Tee Connection option

## Replacement Parts

**26072** EC155 Replacement Heated Intake Filter

**26511** EC155 chemical bottle assembly. Two bottles are included.



Figure 4. EC100 electronics connected to the CPEC200 system enclosure.