



OCEAN OBSERVATORIES INITIATIVE

SPECIFICATIONS FOR PARTIAL PRESSURE OF CARBON DIOXIDE ($p\text{CO}_2$) INSTRUMENTS ON FIXED PLATFORMS

Version 1-03

Document Control Number 1336-00012

2011-06-13

Consortium for Ocean Leadership, Inc.
1201 New York Ave NW, 4th Floor, Washington DC 20005
www.OceanLeadership.org

in Cooperation with

University of California, San Diego
University of Washington
Woods Hole Oceanographic Institution
Oregon State University
Scripps Institution of Oceanography
Rutgers University

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

Document Control Sheet

Version	Date	Description	Originator
0-01	05/10/2010	Initial Draft	Thien V. Dinh
0-02	05/24/2010	Extracted performance specs from earlier version	Rob DelCoco
0-03	08/13/2010	Revised per new spec template. Incorporates inputs received from Andrew Dickson	Arthur Salwin (Noblis)
0-04	08/17/2010	Minor edits per meeting with OL	Arthur Salwin (Noblis)
0-05	08/31/2010	Added operational depth range requirement. Provided document control number for the common spec.	Arthur Salwin (Noblis)
0-06	09/02/2010	Incorporates inputs received from Burke Hales	Arthur Salwin (Noblis)
0-07	09/08/2010	Removed sections with no specs. Added operational depth requirement and typical sampling frequency. Updated per feedback from 9/8 SWG.	Arthur Salwin (Noblis)
0-08	09/22/2010	Revised per OOI Systems Engineer inputs and posted for Stakeholder Review. Revisions to sections on precision, drift, response times, and operational depth range. Removed comments fields.	Arthur Salwin (Noblis)
0-09	10/04/2010	Corrected error in PC02-008. References to new requirements consistent with errata sheet. Referenced common specification in introduction and glossary.	Arthur Salwin (Noblis)
0-10	10/12/2010	Established consistency for pCO ₂ .	Ed Chapman
0-11	10/12/2010	Added operational depth and survivable depth.	Arthur Salwin (Noblis)
0-12	11/04/2010	Replaced placeholder references to requirements.	Arthur Salwin (Noblis)
0-13	11/15/2010	Incorporated comments from 5-day review	Arthur Salwin (Noblis)
1-00	11/16/2010	S.E. approval – no other changes	Arthur Salwin (Noblis)
1-01	03/07/2011	Added appendix table. S.E. approval	Arthur Salwin (Noblis)
1-02	05/27/2011	Administrative change to appendix table.	Arthur Salwin (Noblis)
1-03	06/13/2011	Removed survivable depth; S.E. approval	Arthur Salwin (Noblis)

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

Signature Page

This document has been reviewed and approved for release to Configuration Management.

OOI Senior Systems Engineer: _____

A handwritten signature in black ink, consisting of several loops and a long horizontal stroke, positioned over a horizontal line.

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

Table of Contents

1	General	1
1.1	Ocean Observatories Initiative (OOI) Overview	1
1.2	Document Scope and Purpose.....	1
1.3	Documents	1
1.3.1	Informational.....	1
1.3.2	Applicable.....	1
1.4	Definitions.....	1
1.4.1	Glossary and Acronyms	1
1.4.2	Conventions	1
2	Specifications.....	2
2.1	Measurement.....	2
2.1.1	Partial Pressure of Carbon Dioxide (pCO ₂) in Water	2
2.2	Operational.....	3
2.2.1	Operational Depth Range.....	3
2.2.2	Environmental	3
2.2.3	Service Requirements	3
2.2.4	Calibration Requirement.....	3
2.2.5	Maintenance.....	3
2.3	Mechanical/Physical	4
2.4	Electrical.....	4
2.5	Data Storage and Processing.....	4
2.6	Software/Firmware	4
2.7	Platform Interfaces	4
2.8	Compliance.....	4
2.9	Safety	4
2.10	Shipping and Storage	4
2.11	Identification	4
2.12	Quality	4
3	Appendices.....	4
A-1.	Specification Values by the Platform on Which the pCO ₂ in Water Instruments are Deployed.	4

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

1 General

1.1 Ocean Observatories Initiative (OOI) Overview

See “Common Specifications for Instruments on Fixed Platforms”

1.2 Document Scope and Purpose

This document provides specifications for instruments that measure the partial pressure of carbon dioxide (CO₂) in water.

The instrument shall meet the requirements in this document and those specified in the “Common Specifications for Instruments on Fixed Platforms”, document control number 1336-00000. Parameters specified in neither the “Common Specifications for Instruments on Fixed Platforms” nor in this document are not applicable. This instrument specification shall have precedence over the Common Specification for conflicting items.

1.3 Documents

1.3.1 Informational

The documents listed in this section are for informational purposes only and may not have been referenced in this specification.

- Consortium for Ocean Leadership, Inc. 2010, “Final Network Design”, Washington, D.C. [Online] Available: <http://www.oceanleadership.org/programs-and-partnerships/ocean-observing/ooi/network-design/>

1.3.2 Applicable

These documents contain requirements and specifications applicable to the instrument specified. The referenced section, requirement, or specification shall be met by the instrument specified herein.

- “Common Specifications for Instruments on Fixed Platforms”, document control number 1336-00000

1.4 Definitions

1.4.1 Glossary and Acronyms

- **pCO₂** – Partial Pressure of Carbon Dioxide
- See “Common Specifications for Instruments on Fixed Platforms” for other definitions.

1.4.2 Conventions

All values contained in this document are Threshold Values unless specifically stated otherwise.

The bidder shall ignore the references in angle brackets < > at the end of each specification. They are for internal OOI use only.

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

2 Specifications

The instrument shall meet the requirements specified in the “Common Specifications for Instruments on Fixed Platforms”, document control number 1336-00000. Parameters specified in neither the “Common Specifications for Instruments on Fixed Platforms” nor in this document are not applicable.

2.1 Measurement

Values provided are threshold unless otherwise stated.

2.1.1 Partial Pressure of Carbon Dioxide (pCO₂) in Water

a) Measurement with unit(s)

Partial pressure of carbon dioxide in water (µatm)

b) Minimum Value

PCO2-001 The instrument shall measure pCO₂ in water over a range with a minimum value of 100 µatm. <L2-SR-RQ-3505, L4-CG-IP-RQ-504, L4-RSN-IP-RQ-323>

c) Maximum Value

PCO2-002 The instrument shall measure pCO₂ in water over a range with a maximum value of 2,000 µatm. <L2-SR-RQ-3505, L4-CG-IP-RQ-504, L4-RSN-IP-RQ-323>

d) Accuracy

PCO2-003 The instrument shall measure pCO₂ in water with an accuracy within ±4 µatm of the true value for concentrations ≤400 µatm. <L2-SR-RQ-3712, L4-CG-IP-RQ-505, L4-RSN-IP-RQ-559>

PCO2-004 The instrument shall measure pCO₂ in water with an accuracy within ±1% of the true value for concentrations >400 µatm. <L2-SR-RQ-3713, L4-CG-IP-RQ-506, L4-RSN-IP-RQ-560>

PCO2-005 The instrument should measure pCO₂ in water with an accuracy within ±2 µatm of the true value for concentrations ≤400 µatm. This is an objective. <L2-SR-RQ-3714, L4-CG-IP-RQ-507, L4-RSN-IP-RQ-561>

PCO2-006 The instrument should measure pCO₂ in water with an accuracy within ±0.5% of the true value for concentrations >400 µatm. This is an objective. <L2-SR-RQ-3715, L4-CG-IP-RQ-508, L4-RSN-IP-RQ-562>

e) Precision

PCO2-007 For concentrations ≤400 µatm, the instrument shall measure pCO₂ in water with a precision of ±2 µatm. <L2-SR-RQ-3716, L4-CG-IP-RQ-509, L4-RSN-IP-RQ-563>

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

- PCO2-008 For concentrations >400 µatm, the instrument shall measure pCO₂ in water with a precision of ±0.50%. <L2-SR-RQ-3717, L4-CG-IP-RQ-510, L4-RSN-IP-RQ-564>
- PCO2-009 For concentrations ≤400 µatm, the instrument should measure pCO₂ in water with a precision of ±1 µatm. This is an objective. <L2-SR-RQ-3718, L4-CG-IP-RQ-511, L4-RSN-IP-RQ-565>
- PCO2-010 For concentrations >400 µatm, the instrument should measure pCO₂ in water with a precision of ±0.25%. This is an objective. <L2-SR-RQ-3719, L4-CG-IP-RQ-512, L4-RSN-IP-RQ-566>
- f) Resolution
Not specified.
- g) Drift
Not specified.
- h) Response Times
Not specified.
- i) Sampling Frequency
- PCO2-011 The instrument shall be capable of measuring pCO₂ in water at a sampling frequency of one time per hour. <L2-SR-RQ-3507, <L4-CG-IP-RQ-203, L4-RSN-IP-RQ-325>
- The typical sampling frequency will be one time per hour.
- j) Dependencies
Not specified.

2.2 Operational

2.2.1 Operational Depth Range

OPER-001 The instrument shall be capable of operating at a depth of 600 m.

2.2.2 Environmental

See “Common Specifications for Instruments on Fixed Platforms”

2.2.3 Service Requirements

See “Common Specifications for Instruments on Fixed Platforms”

2.2.4 Calibration Requirement

See “Common Specifications for Instruments on Fixed Platforms”

2.2.5 Maintenance

See “Common Specifications for Instruments on Fixed Platforms”

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

2.3 Mechanical/Physical

See “Common Specifications for Instruments on Fixed Platforms”

2.4 Electrical

See “Common Specifications for Instruments on Fixed Platforms”

2.5 Data Storage and Processing

See Appendix A-1 for data storage specifications.

See also “Common Specifications for Instruments on Fixed Platforms” for additional data storage and processing specifications.

2.6 Software/Firmware

See “Common Specifications for Instruments on Fixed Platforms”

2.7 Platform Interfaces

See “Common Specifications for Instruments on Fixed Platforms”

2.8 Compliance

See “Common Specifications for Instruments on Fixed Platforms”

2.9 Safety

See “Common Specifications for Instruments on Fixed Platforms”

2.10 Shipping and Storage

See “Common Specifications for Instruments on Fixed Platforms”

2.11 Identification

See “Common Specifications for Instruments on Fixed Platforms”

2.12 Quality

See “Common Specifications for Instruments on Fixed Platforms”

3 Appendices

A-1. Specification Values by the Platform on Which the pCO₂ in Water Instruments are Deployed.

The following table describes the performance and operational constraints, limits, etc. that are different between the different OOI platforms.

Specifications for Partial Pressure of Carbon Dioxide (pCO₂) Instruments on Fixed Platforms

pCO ₂ Series	Cabled	Location	Operational Depth Range (m)	Required Sampling Frequency Capability	Typical Sampling Frequency	Deployment Interval (months)	Internal Batteries Required	Internal data Storage Required (# of samples)
A	C	C	0 - 600	1/hr	1/hr	13	N	N
B	U	C	0 - 600	1/hr	1/hr	7	See note 1	Y (5200)

Key:

Cabled:

- C denotes platforms attached to the electro-optic cable in the Pacific Northwest (cabled)
- U denotes platforms that have no cable connection to shore for power or data (uncabled)

Location:

- O is open ocean
- C is coastal

Some Series A instruments may be deployed on a cabled open ocean shallow profiler.

Note 1: Internal batteries are optional on some of the pCO₂ Series B platforms. These batteries shall be capable of providing power for the specified Deployment Interval while sampling at the indicated Typical Sampling Frequency.