NEON SENSOR COMMAND, CONTROL AND CONFIGURATION (C3) DOCUMENT: PRIMARY SHORTWAVE RADIATION

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See configuration management system for approval history.

The National Ecological Observatory Network is a project solely funded by the National Science Foundation and managed under cooperative agreement by Battelle. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	09/05/2013	ECO-00500	Initial Release
B	05/16/2022	ECO-06815	• Revised logo and fine print

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1 DESCRIPTION

1.1 Purpose

This document specifies the command, control, and configuration details for operating a NEON sensor used for instrumental observations. It includes a detailed discussion of all necessary requirements for operational control parameters, conditions/constraints, set points, and any necessary error handling. All Level 0 Data Products generated by the sensor are identified. The raw data are compensated by the DAS, but received at HQ for further processing as L0 unfiltered and uncorrected data product until its associated algorithms are applied to produce a QA/QC'd L1 data product in Standard Scientific Units.

1.2 Scope

The expectation is that the Kipp & Zonen CMP22 Pyranometer (NEON P/N: 0303050000; no firmware required) and associated Kipp and Zonen CVF 3 Ventilation Unit (NEON P/N 0309850000; no firmware required) will be used to make the measurements of primary shortwave radiation (AD [04]). The reference document for the Kipp & Zonen CMP22 Pyranometer is RD [03]. The reference document for the Kipp & Zonen CVF 3 Ventilation Unit is RD [04].

This document specifies the command, control, and configuration that is needed for operating this sensor. It does not provide implementation details, except for cases where these stem directly from the sensor conditions as described here.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

AD [01]	NEON.DOC.000001	NEON Observatory Design
AD [02]	NEON.DOC.000291	NEON Configured Sensor List
AD [03]	NEON.DOC.005003	NEON Scientific Data Products Catalog
AD [04]	NEON.DOC.005005	NEON Level 0 Data Products Catalog
AD [05]	NEON.DOC.XXXXXX	NEON Primary Shortwave Radiation ATBD (TBW)

2.2 Reference Documents

RD [01]	NEON.DOC.000008 NEON Acronym List
RD [02]	NEON.DOC.000243 NEON Glossary of Terms
RD [03]	Kipp & Zonen B.V. (2010). CMA Series Albdedometer, CMP Series Pyranometer Instruction Manual Version 1007. Kipp & Zonen B.V. Delftechpark 36, 2628 XH Delft, The Netherlands.
RD [04]	Kipp & Zonen B.V. (1999). CV 2 Ventilation Unit Instruction Manual. Kipp & Zonen B.V. Delftechpark 36, 2628 XH Delft, The Netherlands.

2.3 Acronyms

Acronym	Explanation
ATBD	Algorithm Theoretical Basis Document
C^3	Command, Control, and Configuration Document
SOP	Standard Operating Procedures
QA/QC	Quality Assurance/Quality Control
TIS	Terrestrial Instrument System
L0	Level 0
L1	Level 1
ENG	NEON Engineering group
CI	NEON Cyberinfrastructure group
DPS	NEON Data Products group
CVAL	NEON Calibration, Validation, and Audit Laboratory
SW	Short wave
TB	Sensor body temperature °C
TD	Dew point temperature °C derived from Licor LI7200 IRGA NEON.DXX.XXX.DP1.XXXXX.00X.00X.001.00N.001
PTR	Problem tracking and resolution

2.4 Verb Convention

"Shall" is used whenever a statement expresses a convention that is binding. The verbs "should" and "may" express non-mandatory provisions. "Will" is used to express a declaration of purpose on the part of the design activity.

3 INTRODUCTION

The sensor configuration and sensor command and control described here are related to the Pyranometer data products; primary incoming SW radiation (Volts x 10^{-6}), sensor body temperature (ohms), fan tachometer speed (Hz), and device heater flag listed below and in (AD[03]). A description of how sensor readings shall be converted to primary incoming shortwave radiation in W m^{-2} is presented in the associated ATBD (AD[05]). Data products are listed in **Table 1**; "N" refers to the top level of the tower.

Table 1. L0 Data Products

L0 Data Product	NEON	DOM	SIT	DPL	PRN	REV	SPN	HOR	VER	REP
Primary Incoming SW Radiation	NEON.	DXX.	XXX.	DP0.	00022.	001.	001.	001.	00N.	001
Sensor Body Temperature	NEON.	DXX.	XXX.	DP0.	00022.	001.	002.	001.	00N.	001
Fan Tachometer Speed	NEON.	DXX.	XXX.	DP0.	00022.	001.	003.	001.	00N.	001
Heater Flag	NEON.	DXX.	XXX.	DP0.	00022.	001.	004.	001.	00N.	001

4 OVERVIEW OF SENSOR CONFIGURATION

The primary incoming shortwave radiation, sensor body temperature, and ventilation unit fan tachometer data products shall be unfiltered and uncorrected, with the thermopile output in mV, Pt100 temperature sensor output in ohms, and fan tachometer in Hz.

Table 2. Sensor configuration settings

Parameter	Default Setting
Incoming SW radiation measurement: Acquisition rate	0.2 Hz
Data acquired from sensor	Incoming SW radiation (Volts x 10^{-6}); Sensor Body temperature (ohms); Fan tachometer output (Hz); Diagnostic Flag-heater: (0 or 1)
Measurement mode	NA
Sensor error message	NA

5 COMMAND AND CONTROL

5.1 Error Handling

This sensor provides no direct error notification, however, the associated device (i.e. Kipp and Zonen CVF 3 Ventilation Unit) will be subject to plausibility testing as described in the associated ATBD (AD[05]). Errors shall be reported to PTR.

5.2 Sensor <device> Controls Specification

Ventilation and heater control is recommended to prevent dew, frost, rime ice, and snow to form or accumulate on the sensor, resulting in inaccurate data. A Kipp and Zonen CVF 3 Ventilation Unit will be used for ventilation and heating of the Kipp & Zonen CMP22 Pyranometer. The Kipp and Zonen CVF 3 Ventilation Unit has two independent 5W heaters (designated here as heaters A and B) can operate at two heating levels; 5W (heater A only) and 10W (heaters A and B operating simultaneously). Five Watt heating shall be used to raise the temperature of the dome slightly above ambient to prevent the formation of dew and frost, while 10 Watt heating shall be used in more extreme conditions to melt and prevent the accumulation of snow and ice. The heater on/off commands shall be determined by a combination of dew point (T_D) derived from the HMP155 Relative Humidity Sensor NEON.DOM.SIT.DP0.000106.001.003.000.00X.001 and pyranometer sensor body temperature (T_B) (i.e. NEON.DXX.XXX.DP0.00022.001.002.001.00N.001). **Table 3** specifies the command and control structure for the heater.

Table 3. Truth table for controlling sensor <unit>

Control parameter(s)	Condition	Data acquisition system action	Output to CI
Temperature and dew point	$T_D \geq (T_B\text{-}3)$ and $T_B > 5°C$	Turn heater A on; heater B remains off	Heater flag NEON.DXX.XXX.DP0.00022.001.004.001.00N.001
Temperature and dew point	$T_D < (T_B\text{-}4)$ and $T_B > 5°C$	Turn heater A off; turn heater B off	Heater flag NEON.DXX.XXX.DP0.00022.001.004.001.00N.001
Temperature	$T_B \leq 4°C$	Turn heater A on; turn heater B on	Heater flag NEON.DXX.XXX.DP0.00022.001.004.001.00N.001

6 ASSEMBLY INTEGRATION

N/A

7 APPENDIX & BIBLIOGRAPHY

N/A