NEON SENSOR COMMAND, CONTROL, AND CONFIGURATION (C3) DOCUMENT: WET DEPOSITION

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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	9/23/2014	ECO-01455	Initial Release
B	01/13/2016	ECO-03566	Revise document using the new C3 document template, updated DP numbers to new format
C	05/26/2022	ECO-06832	• Revised NEON logo and fine print

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1 DESCRIPTION

1.1 Purpose

This document specifies the command, control, and configuration details for operating the wet deposition collection assembly (e.g., N-CON sampler and associated infrastructures). 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. Raw data from the sensor are compensated by the DAS, but received at HQ for further processing as a L0 unfiltered and uncorrected data product until its associated algorithms are applied to produce a quality-controlled and -assured L1 data product in standard scientific units.

1.2 Scope

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

A complete set of the Level 0 data products generated in this document can be found in appendix.
The wet deposition assembly will consist of following Data Generating Device (DGD) based on Data Generating Device DGD List and Hierarchies doc (AD [05]):

DGD Agile PN	DGD Agile Description
0335070000	Sensor, Wet Deposition Sampler, NEON Custom
AB03960000	Assembly, Cable, PRT Submersible, 6 Feet, NADP

Further detailed sensor info under each DGD is as following:

1. Under 0335070000:
    - Sensor, Wet Deposition Sampler, NEON Custom, NEON P/N 0335070000. Manufacture: N-Con Systems Company, Inc. Manufacture model number: NEON 00-127-7. This model has dual funnel and dual bottle design.
    - Other accessories:
        - Sensor Acsry, Thermoelectric Chiller, NEON Custom, for N-Con Atmospheric Deposition Sampler, NEON P/N 0345760001
        - 2 sets of Glass funnel, Glass anti-evaporation capillary, Glass sample bottle, Capacity: 2 liters, (NEON P/N 0303560003)
2. Under AB03960000:
    - Sensor Thermometrics Aquatic RTD Sensor 5.0 inch Probe with No Cable and No Connector, NEON P/N 0317690001

This dual bottle wet deposition collector is relatively new to the market. No official manual is available yet. But its operating principle is identical to the N-CON MDN model sampler (model 00-125-4).

Therefore, we can use N-CON MDN manual as the reference document RD [03], until such time as the TM model manual becomes available.

This C^3 document specifies the command, control, and configuration that are needed for operating this sensor and accessories. 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

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules and regulations.

AD [01]	NEON.DOC.000001	NEON Observatory Design Requirements
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.003495	Sensor Maintenance Procedures: Wet Deposition

2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms

2.3 External References

External references contain information pertinent to this document, but are not NEON configuration-controlled. Examples include manuals, brochures, technical notes, and external websites.

ER [01]	N-CON Atmospheric Deposition Sampler Manual Model 00-125-4

2.4 Acronyms

Acronym	Explanation
C^3	Command, Control, and Configuration Document
SOP	Standard Operating Procedures
QA/QC	Quality Assurance/Quality Control
L0	Level 0
L1	Level 1
ENG	NEON Engineering group
CI	NEON Cyberinfrastructure group
PRT	Platinum Resistance Thermometers
NADP	North American Deposition Program
BASIN	Biogeosphere-Atmosphere Stable Isotope Network
GNIP	Global Network of Isotopes in Precipitation

3 INTRODUCTION (DGD 0335070000, AB03960000)

The N-CON Trace Metal (or TM) sampler specifically modified to meet NEON needs is model NEON 00-127-7 (call wet deposition sampler below). It is the sensor that will collect the precipitation samples for the chemistry and water isotopic (^{18}O and DH) analysis at selected NEON sites. It is equipped with an infrared precipitation sensor that can detect precipitation drops and snowflakes, thus controlling the sampler lid to open and collect the "wet only" deposition samples during the precipitation or snow events, and close the lid thereafter. The dual-funnel/dual-bottle design allows a glass bottle with anti-evaporation capillary to collect samples for water isotopic analysis, and a polyethylene bottle to collect samples for precipitation chemistry analysis. Samples in both glass bottle and polyethylene bottle will be collected manually once every two weeks, indexed/asset tagged and sent to NEON contract labs for analysis following procedures from recognized international organizations (e. g., NADP, BASIN, GNIP, etc.), which will be described in a separate SOP (AD[05]).

This wet deposition sampler is equipped with its own heating and cooling control system, and does not require external commands and controls. A PRT sensor will be used to monitor the chamber temperature.

The data products that are automatically output from this sampler include power status and lid open/close status (see section 4 and Section 7.1 for details). The data products output from the PRT temperature sensor will be temperature in degrees Celsius (see Section 7.1).

4 OVERVIEW OF SENSOR CONFIGURATION (DGD 0335070000, AB03960000)

The PRT sensor here is just used to monitor the temperature inside the sampler chamber and track the function of heater/cooling system. This PRT sensor will stay with assembly until failure. No annual calibration is required. Sensor drift will be monitored by field technicians following the SOPs (AD[05]). The temperature output will be streamed back to CI. Sampling frequency should be 0.1 Hz. See L0 DP in Section 7.1.

Digital signals for power status, lid open/close status, and PRT temperature are assumed to be digital and be output through Ethernet.

Manual Sensor Configuration 1: Heater and chiller settings should be pre-configured, and should not be changed during field operations.

For all units NEON will purchase, the heater and chiller are included in the package. Heating system includes an AC heater to control chamber temperature. Chiller is used to control temperature at hot environments. The heater and chiller are controlled by the embedded thermostats inside the chamber, which must be preset at installation and periodically checked during each manual sample collection. Therefore, no external command and control is applied to the operation of the heating and cooling systems. The set-points for the thermostats should be: 3 °C for the heater (i.e., turn on heater when chamber temperature is lower than 3 °C), and 25°C for chiller (i.e., turn on chiller when chamber temperature is above 25 °C). No data outputs from heater and chiller will be streamed back to CI.

Table 1. Heater and chiller configuration settings

Parameter	Default Setting	Notes
Heater thermostat	3°C	turn on heater when temperature is below 3 °C
Chiller thermostat	25°C	turn on chiller when temperature is above 25 °C

When chamber temperature is out of range (<3°C or >25°C), an out of range flag will be generated at HQ as a L1 DP. Because there is no need of this flag for any command and control function, it is not required to generate it as a L0 DP at site by DAS.

Manual Sensor Configuration 2: settings for infra-red precipitation sensor should be pre-configured and should not be changed during field operations.

The precipitation sensor is an infra-red transmitter and receiver. It is an integral part of the wet deposition sampler that detects precipitation drops or snowflakes, and in turn, controls the sampler lid operation (open lid on 5 drops of onset of precipitation, and close lid at 25 seconds of end of sensed precipitation). During each manual sample collection, quick tests by waving fingers between the precipitation sensor heads should be carried out to ensure the precipitation sensor and lid movements work properly. This procedure will be described in a separate SOP document (AD [05]).

The data streamed to CI include the lid status and the power status. The data will be recorded only when the status changes. See L0 DP list in Section 7.1.

5 COMMAND AND CONTROL

5.1 Error Handling

Table 2. Truth table for power status error handling

Control parameter(s)	Condition	Data acquisition system action	Output to CI
Power status	No power to instrument	Send trouble ticket	None
chamberTemperatrue	Running average of 30 min <3°C or >25°C over 2 hours in row	Send trouble ticket	None

5.2 Sensor <device> Controls Specification

N/A

6 ASSEMBLY INTEGRATION

N/A

7 APPENDIX

7.1 List of Level 0 Data Product

Table 3. List of Level 0 data product associated with DPName: Wet Deposition

DGD Agile PN	DPNumber	fieldName	description	Acquisition frequency (Hz)	dataType	units
0335070000	NEON.DOM.SITE.DP0.00013.001.01819.HOR.VER.000	powerStatus	Power status of the instrument (0= powered; 1=no power)	When status changes	integer	NA
	NEON.DOM.SITE.DP0.00013.001.01820.HOR.VER.000	lidStatusWetDep	Lid status of the wet deposition collector (0=lid closed; 1=lid open)	When status changes	integer	NA
AB03960000	NEON.DOM.SITE.DP0.00013.001.01818.HOR.VER.000	chamberTemperature	Temperature of the wet deposition chamber	0.1	real	celsius

7.2 Assembly schematic drawing

N/A

8 BIBLIOGRAPHY

N-CON Atmospheric Deposition Sampler Manual Model 00-125-4