NEON Sensor Command, Control and Configuration — Soil Heat Flux

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See Configuration Management System for Approval History.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	9 May 2013	ECO-00425	Initial Release

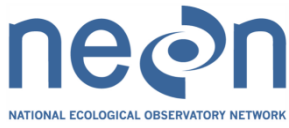|		
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1   DESCRIPTION

1.1   Purpose

This document specifies the command, control, and configuration details for operating the soil heat flux sensors.   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 should be identified.

1.2   Scope

The HFP01SC: Self-Calibrating Heat Flux Sensor™ [NEON P/N: 0300260000] will be used to measure soil heat flux, providing the information of how much energy is being stored in and lost from the soil. The sensor capable of operating under the environment extremes found across the NEON site. There is no firmware required for this sensor.

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 (NOD) 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

2.2   Reference Documents

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	HFP01SC Self Calibrating Heat Flux Sensor™ USER MANUAL HFP01SC Manual v0710	
RD [04]	Application and Specification of Heat Flux Sensors Version 9904	

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

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 HFP01SC is selected to measure soil heat flux applied in the soil arrays. The related soil heat flux Level 0 data products acquired from HFP01SC are listed in Table 1. A description of how sensor readings shall be converted to soil heat flux in units of W/m^2 is presented in the associated ATBD (AD [06]).

Table 1: L0 data products acquired form HFP01SC: Self-Calibrating Heat Flux Sensor™.

Parameters	L0 data products NEON.DOM.SIT.DPL.PRN.REV.SPN.HOR.VER.REP	Unit
Soil heat flux sensor voltage (V_s)	NEON.DOM.SIT.DP0.000069.001.001.00X.001.001	mV
Calibration heater flags	NEON.DOM.SIT.DP0.000069.001.002.00X.001.001	0/1
Voltage across the current sensing resistor (V_{cur})	NEON.DOM.SIT.DP0.000069.001.003.00X.001.001	mV

4   OVERVIEW OF SENSOR CONFIGURATION

The HFP01SC: Self-Calibrating Heat Flux Sensor™ configurations are presented in Table 2.

Table 2: The HFP01SC: Self- Calibrating Heat Flux Sensor™.

Parameter	Default Setting
Heater	Off
Soil heat flux sensor voltage (V_s): Acquisition rate	0.1 Hz
Voltage across the current sensing resistor (V_{cur}): Acquisition rate	0.1 Hz

5   COMMAND AND CONTROL

5.1   Error handling

Given that the soil heat flux sensor has no built-in error handling, no command and control interface is required for the sensor.

5.2   Automated calibration

The HFP01SC is a combination of a heat flux sensor and a film heater. The automated calibration is performed by activating the film heater that is mounted on top, resulting in a new calibration factor. The calibration cycle shall be carried out every 3.25 hours for 6 minutes. The calibration heater shall be turned on for 3 minutes at the start of calibration cycle. While the calibration heater is turned on, the voltage output of sensor (V_s: NEON.DOM.SIT.DP0. 000069.001.001.00X.001.001) and the voltage across the current sensing resistor (V_{cur}: NEON.DOM.SIT.DP0.000069. 001.003.00X.001.001) are measured. The V_s at time of 0, 180, and 360 second after the calibration heater is on and V_{cur} will be used in calculating the new sensor sensitivity. A description of how to calculate sensor sensitivity is presented in the associated ATBD (AD [06]). Table 3 specifies the command and control structure for the heater.

Table 3: Truth table for controlling calibration heater.

Control parameter(s)	Condition	Data acquisition system action	Output to CI NEON.DOM.SIT.DPL.PRN.REV.SPN.HOR.VER.REP
Automated Calibration	every 3.25 hours	Turn calibration heater on Measure sensor voltage and voltage across the current sensing resistor	Calibration Heater flags (NEON.DOM.SIT.DP0.000069.001.002.00X.001.001) V_s (NEON.DOM.SIT.DP0.000069.001.001.00X.001.001) V_{cur} (NEON.DOM.SIT.DP0.000069.001.003.00X.001.001)
Automated Calibration	calibration heater on for 3 minutes	Turn calibration heater off Measure sensor voltage and voltage across the current sensing resistor	Calibration Heater flags (NEON.DOM.SIT.DP0.000069.001.002.00X.001.001) V_s (NEON.DOM.SIT.DP0.000069.001.001.00X.001.001) V_{cur} (NEON.DOM.SIT.DP0.000069.001.003.00X.001.001)