NEON SENSOR COMMAND, CONTROL AND CONFIGURATION (C3) DOCUMENT: HUMIDITY AND TEMPERATURE SENSOR

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See configuration management system for approval history.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	10/09/2014	ECO-01304	Initial release
B	05/16/2022	ECO-06813	Revised logo
C	06/19/2023	ECO-07029	Added information about firmware, including version 1.24, 1.26 and 1.29 Updated DP0 data product numbering conventions Added L0 data product table

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1 DESCRIPTION

1.1 Purpose

This document specifies the command, control, and configuration details for operating the Vaisala HUMICAP® Humidity and Temperature Probe HMP155. 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 QA/QC'd L1 data product in Standard Scientific Units.

1.2 Scope

The Vaisala HUMICAP® Humidity and Temperature Probe HMP155 (NEON P/N: 031565000) will be used to make measurements of relative humidity and temperature at the top level of the tower and the soil array. The quantity calculated by HMP155, (i.e., the dew point/frost point temperature) will be used as a reference for NEON's sensors heating control. The sensor is operated with software version of 1.01 and digital signals from sensor are outputted through RS-485 connections. The sensor will be operating under firmware versions 1.24, 1.26 or 1.29. The reference document for the Vaisala HUMICAP® Humidity and Temperature Probe HMP155 is RD [03].

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)
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.000254	NEON Data Product Naming Convention
AD [06]	NEON.DOC.000849	NEON Sensor Command, Control and Configuration-Net Radiometer
AD [07]	NEON.DOC.000778	NEON Sensor Command, Control and Configuration-Soil Longwave Radiation

2.2 Reference Documents

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	Vaisala. 2012. User's Guide: Vaisala HUMICAP® Humidity and Temperature Probe HMP155, Manual Code: M210912EN-C	

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 Vaisala HUMICAP® Humidity and Temperature Probe HMP155 is selected to measure relative humidity and temperature at the top level of the tower and the soil array. The related Level 0 data products acquired from sensor are listed in **Table 1**. A description and formulas that sensor used for calculating the dew point/frost point temperature are presented in the RD [03].

Table 1. L0 data products acquired form Vaisala HUMICAP® Humidity and Temperature Probe HMP155.

Parameters	L0 data products	Unit
Relative humidity (RH)	NEON.DOM.SIT.DP0.00098.001.01357.HOR.VER.001	%
Temperature (T)	NEON.DOM.SIT.DP0.00098.001.01309.HOR.VER.001	°C
Dew point/frost point temperature ($T_{H2O/ICE}$)	NEON.DOM.SIT.DP0.00098.001.01358.HOR.VER.001	°C
Sensor error message	NEON.DOM.SIT.DP0.00098.001.01359.HOR.VER.001	NA

4   OVERVIEW OF SENSOR CONFIGURATION

The relative humidity, temperature, and dew point/frost point temperature data from sensor shall be unfiltered and uncompensated. Sensor configuration settings are shown in **Table 2**.

Table 2. Sensor configuration settings.

Parameter	Default Setting
Heater	Off
Pressure compensation	1.013 (No compensation)
Filtering	1.0 (no filter)
Chemical purge	Off
Measure mode	Run
Relative humidity: Acquisition rate	1 Hz
Temperature: Acquisition rate	1 Hz
Dew point/frost point temperature: Acquisition rate	1 Hz

5   COMMAND AND CONTROL

5.1   Error Handling

In an error state, the sensor outputs stars asterisks (***) instead of measured values. If the error occurs constantly, the sensor must be stopped and it is recommended to make a diagnosis by querying the error messages. The error messages of HMP155 shall be manually retrieved via the serial interface by using the ERRS command and the possible error messages are listed in **Table 3**.

5.2   Sensor Heating Controls Specification

This sensor has no heating control.

6   ASSEMBLY INTEGRATION

The dew point/frost point temperature (NEON.DOM.SIT.DP0.00098.001.01359.HOR.VER.001) retrieved from Vaisala HUMICAP® Humidity and Temperature Probe HMP155 will be used for heating control for NEON's sensors (e.g., Net Radiometer AD [06] and Soil Longwave Radiation AD [07]).

7   APPENDIX & BIBLIOGRAPHY

7.1   Sensor Error Messages

Table 3. The error messages and description of sensor (RD [03]).

Error Message	Description	Action
T MEAS error	Error in temperature measurement	Check the HUMICAP® sensor.
T REF error	Error in temperature measurement	Contact Vaisala Service Center, see page 55.
TA MEAS error	Error in T-probe measurement	Check the additional temperature probe.
TA REF error	Error in T-probe measurement	Contact Vaisala Service Center, see page 55.
F MEAS error	Error in humidity measurement	Check the HUMICAP® sensor.
F REF1 error	Error in humidity measurement	Contact Vaisala Service Center, see page 55.
F REF3 error	Error in humidity measurement	Contact Vaisala Service Center, see page 55.
Program flash checksum error	Internal error	Contact Vaisala Service Center, see page 55.
Parameter flash checksum error	Internal error	Contact Vaisala Service Center, see page 55.
INFOA checksum error	Internal error	Contact Vaisala Service Center, see page 55.
SCOEFS checksum error	Internal error	Contact Vaisala Service Center, see page 55.

7.2   LIST OF L0 DATA PRODUCTS

Table 4. List of L0 Data Products

Agile PN	Data Stream ID	Field Name	Description	Sample Frequency	Units
031565000	NEON.DOM.SITE.DP0.00098. 001.01325.HOR.VER.000	sensorTemp	Temperature	1 Hz	°C
031565000	NEON.DOM.SITE.DP0.00098. 001.01325.HOR.VER.000	RH	Relative Humidity	1 Hz	%
031565000	NEON.DOM.SITE.DP0.00098. 001.01325.HOR.VER.000	dewPoint		1 Hz	°C
031565000	NEON.DOM.SITE.DP0.00098. 001.01325.HOR.VER.000	RHStatus	Status code of Instrument	1 Hz	NA