NEON Sensor Command, Control and Configuration – Aspirated Air Temperature - Single

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 DESCRIPTION

1.1 Purpose

This document specifies the command, control, and configuration details for operating the Aspirated Air Temperature - Single assembly and sensor. 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.

1.2 Scope

This document specifies the command, control, and configuration that is needed for operating the Aspirated Air Temperature - Single assembly. It does not provide implementation details, except for cases where these stem directly from the sensor conditions as described here. This document assumes that air temperature will be measured using a Thermometrics Climate PRT Probe (NEON P/N: 0303550001, 0303550002, or 0303550003 depending on required cable length) (AD[02]) and a Met One Instruments Fan Aspirated Radiation Shield (NEON P/N 0300220000).

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
AD [05]	NEON.DOC.xxxxxx ATBD for Aspirated air temperature – single (document number TBD)

2.2 Reference Documents

RD [01]	NEON.DOC.000008 NEON Acronym List
RD [02]	NEON.DOC.000243 NEON Glossary of Terms
RD [03]	
RD [04]	

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 sensor configuration and sensor command and control described here are related to the Air temperature-profile data product (FIU.0.0002). A description of how sensor readings shall be converted to the air temperature-profile data product is presented in the associated ATBD (AD[05]). The TIS assembly to generate this data product consists of 4 components: a temperature sensor, aspirated shield fans 1 and 2, and a heater. Configuration settings and the command and control structure are described separately for each component.

4 OVERVIEW OF SENSOR CONFIGURATION

4.1 Temperature sensor

Sensor configuration settings are shown in the table below.

Table 1: Temperature sensor configuration settings.

Parameter	Default Setting
Acquisition rate: Temperature	1 Hz
Raw data measurements	Temperature - ohms (FIU.0.0002.001)

4.2 Aspirated shield

The current assembly design includes two fans in the aspirated shield. Sensor configuration settings are shown in the tables below.

Table 2: Aspirated shield fan 1 configuration settings.

Parameter	Default Setting
Aspirator fan	On
Acquisition rate: Fan speed	1 Hz
Raw data	Fan speed (FIU.0.0002.002)

Table 2: Aspirated shield fan 2 configuration settings.

Parameter	Default Setting
Aspirator fan	Off
Acquisition rate: Fan speed	1 Hz
Raw data	Fan speed (FIU.0.0002.003)

4.3 Heater

The heater does not require any configuration.

5 COMMAND AND CONTROL

5.1 Heater control

The heater shall be used to melt ice that is restricting the flow of air through the aspirated shield. The command and control structure for the heater is shown in the figures below.

In Figures 1 and 2, y represents the fan speed when the assembly is not blocked and all components are working correctly (value TBD) and z represents the time period that the heater shall be switched on during a single heating event. Based on the assumptions in Appendix A, z = 448 seconds. If the design differs from these assumptions, a new value for z shall be calculated.

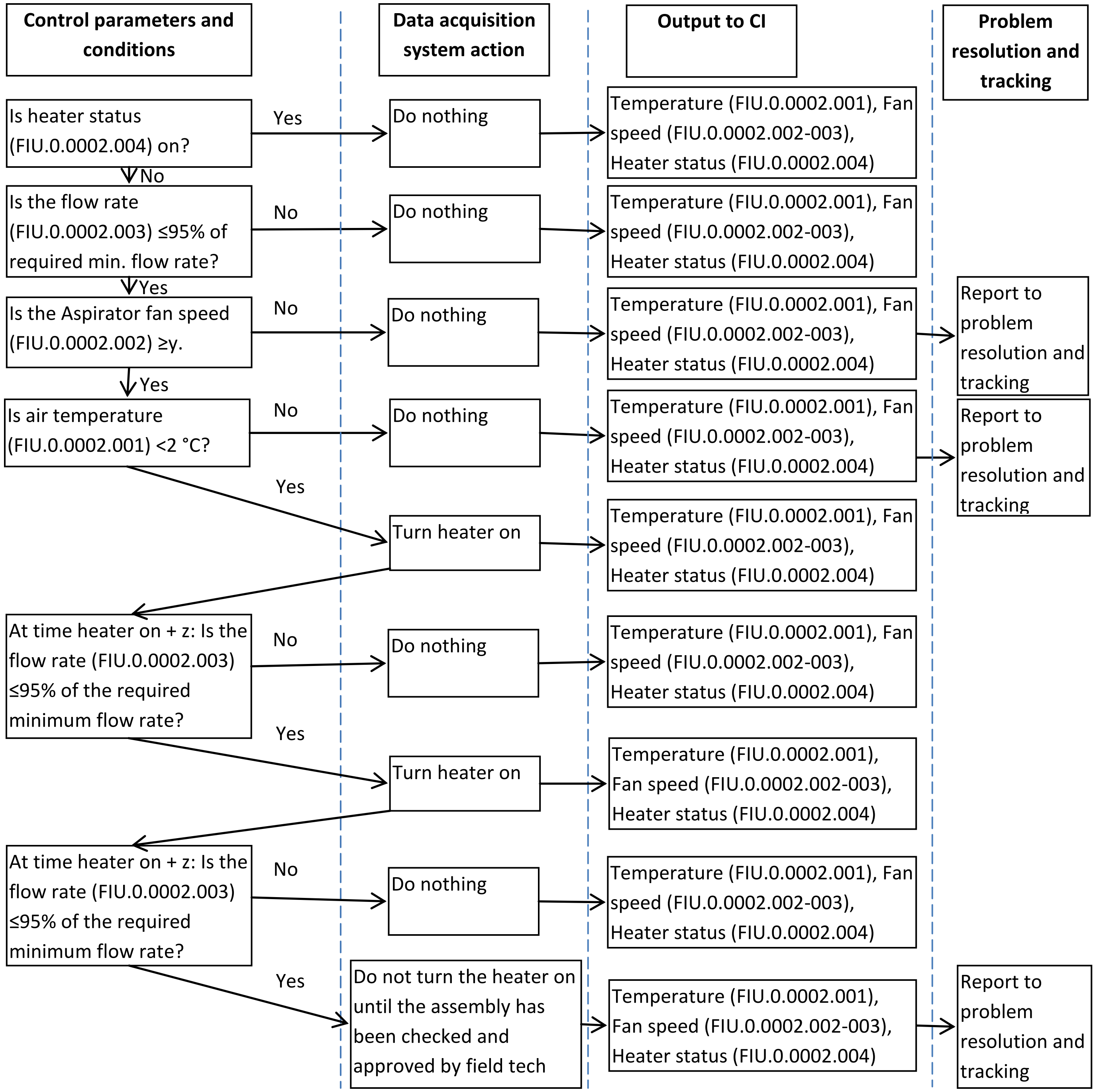

Figure 1: Command and control for turning the heater on.

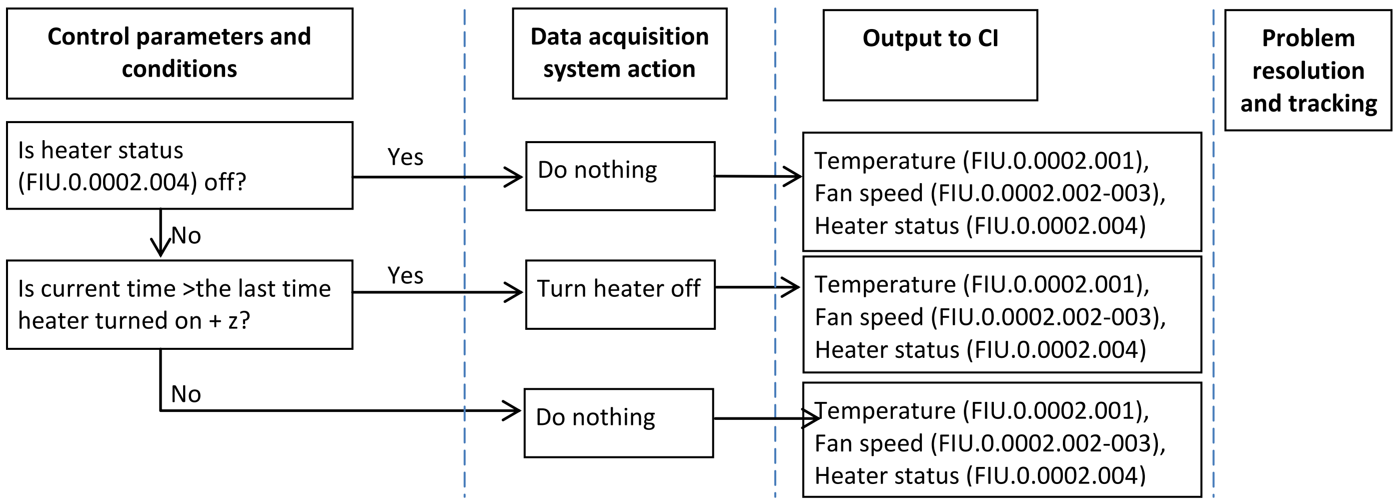

Figure 2: Command and control for turning the heater off.

6 APPENDIX A – RATIONALE FOR HEATING TIME

The heater shall be sufficient to melt ice that is 0.31 cm (0.125 inches) thick on the outside of the inlet tube of the aspirated shield over a length of 20.32 cm (8 inches). The diameter of the aspirated shield inlet is 8.90 cm (3.5 inches).

The volume of the 20.32 cm length of the aspirated shield inlet is 1264.14 cm^3:

The volume of the 20.32 cm length of the aspirated shield inlet covered in 0.31 thick ice is 1446.40 cm^3:

Therefore, the volume of ice covering the aspirated shield is 182.26 cm^3:

If we assume a density of 0.92 g cm^{-3} for ice, the weight of the ice is 167.68 g:

The enthalpy latent heat of fusion for ice is 334 J g^{-1} (i.e., 334 W s g^{-1}). Therefore, the energy required to melt the ice is 56,005 W s:

If we assume a 250 W heater is used, the heater would need to be on for 224 seconds to melt the ice:

To provide additional heat to ensure melting, the time is doubled to give a heating time (z) of 448 seconds.