

Title: NEON Sensor Command, Control and Configuration (C3) Document: PHENOLOGY CAMERA/SNOW DEPTH CAMERA		Date: 1/13/2016
NEON Doc. #: NEON.DOC.001423	Author: M. SanClements	Revision: B

## NEON SENSOR COMMAND, CONTROL AND CONFIGURATION (C3) DOCUMENT: PHENOLOGY CAMERA/SNOW DEPTH CAMERA

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## Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	6/29/2012	ECO-01633	Initial Release
B	1/13/2016	ECO-03566	Revise document using the new C3 document template, updated DP numbers to new format.

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## 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 should be identified.

### 1.2 Scope

The expectation is that the Stardot NetCam SC CAM-SEC5IR-B (NEON P/N: 0303510000) and associated Compact Outdoor Enclosure Model: ENC-OUTD3 (NEON P/N 0333710000) will be used to capture digital images (AD [04]). The reference document for the Stardot NetCam SC CAM-SEC5IR-B is RD [03]. The reference document for the Compact Outdoor Enclosure Model: ENC-OUTD3 is RD [04].

This document specifies the command, control, and configuration that are 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.

A complete set of the Level 0 data products generated in this document can be found in appendix.

The phenology camera/snow depth camera 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
0303510000	Camera, phenological, with 6.2 mm lens

Further detailed sensor info under each DGD is as following:

1. Under 0303510000:
  - a. NEON PN #: 0303510000
    - i. Sensor Descriptions:

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1. Subsystem, Above Canopy Phenological Camera, Tower
  - a. Firmware: v1.1.80
2. Subsystem, Understory / Snow Pack Phenological Camera, w/ Staff Gauge, Tower
  - a. Firmware: v1.1.80

## 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 (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.001104	Data Generating Device DGD List and Hierarchies
AD [06]	NEON.DOC.000809	NEON Above Canopy and Understory/snowpack phenology camera ATBD
AD [07]	NEON.DOC.001882	NEON Above Canopy and Understory/snowpack phenology camera SOP

### 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
RD [03]	StarDot Technologies (2010). NetCam SC User's Manual 4-2. Indd. StarDot Technologies. 6820-H Orangethorpe Ave Buena Park, CA 90620 U.S.A.	
RD [04]	StarDot Technologies (2009). Enclosure and Mounts Sheet. StarDot Technologies. 6820-H	

	Orangethorpe Ave Buena Park, CA 90620 U.S.A.
RD [05]	Tierney, G., B. Mitchell, A. Miller-Rushing, J. Katz, E. Denny, C. Brauer, T. Donovan, A. D. Richardson, M. Toomey, A. Kozlowski, J. Weltzin, K. Gerst, E. Sharron, O. Sonnentag, F. Dieffenbach. 2013. Phenology monitoring protocol: Northeast Temperate Network. Natural Resource Report NPS/NETN//NRR—2013/681. National Park Service, Fort Collins, Colorado.
RD [06]	Cory Teshera-Sterne, Elizabeth Felts, Stephen Klosterman, Andrew Richardson. Phenocam Installation Instructions. February 2013.
RD [07]	Step-by-step instructions for obtaining back-to-back RGB-IR imagery from StarDot IR-enabled cameras. <a href="http://phenocam.sr.unh.edu/pdf/IR_Cam_instructions.pdf">http://phenocam.sr.unh.edu/pdf/IR_Cam_instructions.pdf</a> . Original instructions/scripts by Julian P. Jenkins, Complex Systems Research Center, University of New Hampshire, Oct. '09 Updated and expanded by Cory Teshera-Sterne, Richardson Lab, Harvard University, Apr. '11 Modified and simplified by Andrew Richardson, September '11 Updated by Elizabeth Felts and Stephen Klosterman, Richardson Lab, April '12
RD[08]	PhenoCam Installation Tool (PIT) [ <a href="https://bitbucket.org/khufkens/phenocam-installation-tool">https://bitbucket.org/khufkens/phenocam-installation-tool</a> ]

### 2.3 Acronyms

Acronym	Explanation
ATBD	Algorithm Theoretical Basis Document
C <sup>3</sup>	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

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### 3 CAMERA, PHENOLOGICAL, WITH 6.2 MM LENS INTRODUCTION (0303510000)

The sensor configuration and sensor command and control described here are related to the phenological/snowpack data products. Level 0 Data products are presented in the Appendix. A description of how camera images shall be converted to related L1 data products (e.g. greenness index) is presented in the associated ATBD (AD[06]). Field maintenance procedures are presented in the associated SOP (AD[07]).

### 4 CAMERA, PHENOLOGICAL, WITH 6.2 MM LENS OVERVIEW OF SENSOR CONFIGURATION 0303510000)

The sensors shall be follow default PhenoCam network configurations (RD[08]) unless otherwise specified (Table 1).

**Table 1.** Sensor configuration settings. The cameras shall utilize the default settings unless an adapted setting is specified.

Parameter	Default Setting	Adapted Setting
IP (ip address of the camera)	NA	10.1DD.XX.YY where, DD= Domain, XX = Site Number * 16, YY = 40 (below canopy) or 41 (above canopy)
USER (user name)	admin	
PASSWORD	admin	
CAMERA (name of camera)	NA	[4 LETTER SITE NAME] e.g., CPER
TIME_OFFSET (difference in hours from UTC of the time zone in which the camera resides; always use + or - signs to denote differences from UTC)	0	Configured at LC
TZ (a text string corresponding to the local time zone)	EST	Configured at LC
CRON_START (start of the	NA	*

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scheduled image acquisitions)		
CRON_END (end of the scheduled image acquisitions)	NA	*
CRON_INT (interval at which to take pictures)	30	15
ftp address	ftp://phenocam.sr.unh.edu/data/'sitename'/	10.1DD.XX.2 where, DD = Domain, XX =( Site Number * 16)+1

The primary incoming images shall be unfiltered and uncorrected beyond the internal camera processing to create the minimally compressed jpegs described in this document. Level 0 data products output by this sensor can be found in the Appendix (Section **Error! Reference source not found.**).

## 5 CAMERA, PHENOLOGICAL, WITH 6.2 MM LENS COMMAND AND CONTROL (0303510000)

### 5.1 Error handling

This sensor provides no direct error notification (i.e. data stream for error status), nor does the associated Compact Outdoor Enclosure. However, imagery will be subject to plausibility testing as described in the associated ATBD (AD[05]).

### 5.2 Sensor controls specification

The Stardot NetCam SC CAM-SEC5IR-B is housed in a Compact Outdoor Enclosure. The Compact Outdoor Enclosure requires no heating as the camera generates sufficient heat to keep the system ice-free (Andrew Richardson; personal communication (2013)).

The Stardot NetCam SC CAM-SEC5IR-B requires regular calibration and validation to monitor the health of the camera sensor and the color balance of images. Quarterly calibrations will be conducted by imaging a color card, which resides on the assembly's reference panel, for a minimum of 2 hours around solar noon each quarter. Additional details regarding the color cards may be found in AD[07] and RD[06].



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## 6 ASSEMBLY INTEGRATION

N/A

## 7 APPENDIX

### 7.1 List of Level 0 data product

The applicable Level 0 data products produced by the phenological / snow depth camera are outlined in **Error! Not a valid bookmark self-reference.**

**Table 2.** List of Level 0 data product associated with DPName: Phenology Images and Snow Depth Images

DGD Agile PN	DPNumber	fieldName	description	Acquisition frequency (min)	dataType	units
030510000	NEON.DOM.SITE.DP0.00033.001.01796.HOR.VER.000	rawIRImage	Phenology Images	15	binaryFile	NA
	NEON.DOM.SITE.DP0.00033.001.01797.HOR.VER.000	rawRGBImage	Phenology Images	15	binaryFile	NA
	NEON.DOM.SITE.DP0.00033.001.02051.HOR.VER.000	IRmetadata	Phenology Images	15	text	NA
	NEON.DOM.SITE.DP0.00033.001.02052.HOR.VER.000	RGBmetadata	Phenology Images	15	text	NA
	NEON.DOM.SITE.DP0.00042.001.01796.HOR.VER.000	rawIRImage	Snow depth from images	15	binaryFile	NA
	NEON.DOM.SITE.DP0.00042.001.01797.HOR.VER.000	rawRGBImage	Snow depth from images	15	binaryFile	NA
	NEON.DOM.SITE.DP0.00042.001.02	IRmetadata	Snow depth from	15	text	NA

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	051.HOR.VER.000		images			
	NEON.DOM.SITE.DP0.00042.001.02 052.HOR.VER.000	RGBmetadata	Snow depth from images	15	text	NA

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## 7.2 Assembly schematic drawing

N/A

## 8 BIBLIOGRAPHY

See *Reference Documents*