NEON PREVENTIVE MAINTENANCE PROCEDURE:

TIS & AIS DIGITAL NETWORK CAMERA

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See configuration management system for approval history.

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	10/19/2017	ECO-05057	Initial Release.

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1 DESCRIPTION

1.1 Purpose

Routine preventive maintenance is imperative to ensure the proper functional and operational capability of National Ecological Observatory Network (NEON) systems, and the preservation of NEON infrastructure. This document establishes the mandatory procedures and the recommended practices for preventive maintenance of the Terrestrial Instrument System (TIS) and Aquatic Instrument System (AIS) **Digital Network Cameras** and infrastructure to meet the objectives of the NEON project, and its respective stakeholders and end users.

1.2 Scope

The NEON project employs two Digital Network Cameras at our TIS sites, one to capture canopy phenology and one to capture snowpack levels using three staff gauges. It also employs a Digital Network Camera at our AIS in-stream sensor sites to capture water conditions and riparian phenology referencing a piece of AIS infrastructure in the field of view. This document addresses all three Digital Network Cameras for both TIS and AIS sites, and their respective staff gauges, as applicable.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

The following applicable documents (AD) contain mandatory requirements and/or supplementary information that are directly applicable to the topic and/or procedures herein. Visit the NEON Document Warehouse for electronic copies of these documents.

AD [01]	NEON.DOC.004300	Environmental, Health, Safety And Security (EHSS) Policy, Program and Management Plan
AD [02]	NEON.DOC.004301	EHSS Environmental Protection Manual
AD [03]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD [04]	NEON.DOC.001453	NEON Sensor Command, Control, and Configuration: AQU Digital Camera
AD [05]	NEON.DOC.001423	NEON Sensor Command, Control, and Configuration: Phenology Camera/Snow Depth Camera
AD [07]	NEON.DOC.001789	Algorithm Theoretical Basis Document (ATBD) Above Canopy and Understory/Snowpack Phenology Camera
AD [08]	NEON.DOC.001829	NEON Installation Procedure: Understory Phenology/Snow Depth Camera
AD [09]	NEON.DOC.001830	NEON Installation Procedure: Above Canopy Phenology Camera
AD [10]	NEON.DOC.001436	TIS Comm Interconnect Map
AD [11]	NEON.DOC.001972	AIS Comm Interconnect Map

2.2 Reference Documents

The reference documents (RD) listed below may provide complimentary information to support this procedure. Visit the NEON Document Warehouse for electronic copies of these documents.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	NEON.DOC.004257	All Systems Standard Operating Procedure: Decontamination of Sensors, Field Equipment, and Field Vehicles
RD [04]	NEON-9413	D11 - OAES and CLBJ Phenocam needs adjustment *https://neoninc.atlassian.net/browse/NEON-9413*

2.3 External References

The external references (ER) listed below may contain supplementary information relevant to maintaining specific commercial products that make up the infrastructure of the NEON project's TIS and AIS Digital Network Cameras. These documents are external to the NEON project and Battelle Ecology.

ER [01]	StarDot Technologies, NetCam SC User's Manual. *http://192.208.239.229/kb/index.php?View=download&EntryID=63*
ER [02]	PhenoCam Network: *https://phenocam.sr.unh.edu/webcam/*

2.4 Acronyms

		Met	Meteorological
A/R	As Required	OKSR	Oksrukuyik Creek
Comm	Communication	P/N	Product Number
CPER	Central Plains Experimental Range	Phenocam	Phenology Camera
CRAM	Crampton Lake	RGB	Red-Green-Blue
FOV	Field of View	S-1	Sensor Set 1 (Upstream Sensor Set)
GRSM	Great Smoky Mountains National Park, Twin Creeks	S-2	Sensor Set 2 (Downstream Sensor Set)
IR	Infrared	SOAP	Soaproot Saddle
LECO	LeConte Creek		

2.5 Terminology

The use of common names for NEON instrumentation and subsystems vary across departments and domains. This section aims to clarify and associate the common names with the technical names herein.

SYNONYMOUS COMMON NAME(S)	NEON TECHNICAL REFERENCE NAME
Phenocam, Phenology Camera, StarDot NetCam SC, Aquatic Digital Camera, Understory/Snowpack Camera, Snow Depth Camera, Above Canopy Camera	**Digital Network Camera**
Power Box, Comm Box, National Electrical Manufacturers Association (NEMA) Enclosure, Power/Comm Infrastructure	**Device Post**

3 SAFETY AND TRAINING

Personnel working at a NEON site must be compliant with safe fieldwork practices in AD [01] and AD [02]. The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop work in unsafe conditions.

All technicians must complete safety training and procedure-specific training to ensure the safe implementation of this protocol per AD [03]. Refer to the site-specific EHSS plan via the NEON Safety document portal for electronic copies and conduct the appropriate Job Safety Analysis (JSA) before conducting any procedures.

4 SENSOR OVERVIEW (SENSORS ONLY)

4.1 Description

The NEON project uses StarDot Technologies NetCam SC (referred to as Digital Network Cameras herein, but also referred to as a Phenocam[1]) to capture digital images of the surrounding vegetation, and staff gauges to measure snow depth at TIS sites and water conditions and riparian phenology at AIS sites. The Digital Network Cameras take both red-green-blue (RGB) and infrared (IR) digital images every 15 minutes.

The NEON project works in collaboration with the PhenoCam Network to record, archive, analyze and display images of the surrounding vegetation at our TIS Tower sites. The PhenoCam Network also records, archives and displays the TIS staff gauge images for snow depth and AIS water conditions and riparian phenology images (note: the PhenoCam Network does not currently process these images as they do our TIS canopy images; it primarily stores and displays them for sharing and for potential future use). The PhenoCam Network provides an automated network of near-surface remote sensing of canopy phenology across the United States and Canada.

These Digital Network Cameras reside at TIS and AIS sites across the continental and outside the continental United States, which currently includes Alaska and Puerto Rico. See Table 2 in Section 5.2 for graphics/examples of each TIS and AIS Digital Network Camera location and subsystem.

4.1.1 TIS Network Digital Cameras

Digital Network Cameras mount to TIS Towers to capture RGB and IR images of canopy phenology and snowpack depth. These images directly transmit to the PhenoCam Network for analysis, archiving, and display. The snowpack depth Network Digital Camera uses three staff gauges to measure the depth of the snow. These cameras mount to the Tower legs and connect to the mid-level or base Comm boxes on the tower. (Digital Network Cameras do not connect to Grapes at TIS sites.)

4.1.2 AIS Network Digital Cameras

Digital Network Cameras at AIS sites capture the phenology of riparian vegetation and the water conditions of stream and/or lake sites. They require capturing at least one piece of AIS infrastructure in their field of view. These cameras mount to Unistrut and connect directly to device posts at both AIS stream and lake sites. (Digital Network Cameras do not connect to Grapes at AIS sites.) At AIS lake sites, the cameras use 300 ft. armored Ethernet cables to connect to power at the Met station Comm box/device post.

[1] "A phenocam is a digital camera that is used to track vegetation phenology, in terms of seasonal changes in the greenness of the canopy. This is done by recording time-lapse images of a fixed scene, over the course of a year, and then using simple image analysis techniques to extract quantitative color information from each image. Canopy greenness indices then provide information about the amount of foliage present, and its color." *Source: Richardson, Andrew. PhenoCam Frequently Asked Questions. August 18, 2017, https://phenocam.sr.unh.edu/webcam/faq/*

4.2 Sensor Specific Handling Precautions

Maintaining the camera position is essential to collecting high quality phenology data. Maintain awareness when servicing these cameras to ensure no accidental adjustments to alignment/positioning occur onsite. For onsite camera adjustments, please contact the following NEON personnel to record the adjustment in our NEON project records and notify the PhenoCam Network to re-establish a baseline photograph:

- Cove Sturtevant: csturtevant@battelleecology.org
- Morgan Jones: mjones@battelleecology.org

5 INSPECTION AND PREVENTIVE MAINTENANCE

5.1 Equipment

Table 1. Preventive Maintenance Equipment List

P/N	MX/NEON P/N	Description	Quantity
Tools			
GENERIC		Firm bristle paintbrush (to clean terrestrial snowpack staff gauge)	1
GENERIC		Extensible painter's pole (to clean terrestrial snowpack staff gauge)	1
GENERIC		Medium-stiffness Paint/tooth Brush (to remove snow from camera)	1
GENERIC		Small container or bucket (to catch contaminants)	1
Consumable Items			
GENERIC		Distilled or Deionized water (~22 oz. spray bottle) (to clean camera)	1
GENERIC		95% ethanol (~22 oz. spray bottle) (to clean camera)	1
34120	MX100642	Kimberly Clark Kimtech Wipes, Package Of 280 Sheets	A/R
GENERIC		Soft, Lint-Free or microfiber cloths (to dry camera from cleaning)	A/R
GENERIC		Clean cotton swabs (to clean camera)	A/R
GENERIC		Toothpicks (to clean camera)	A/R
GENERIC		0.1M acetic acid (to remove salt deposit buildup)	1
GENERIC		Can of compressed air (~10 oz. can) (to remove insects/nests/webs)	1
GENERIC		Powder-Free Nitrile Gloves (to use when handling alcohol/acid)	1 Pair
GENERIC		Paint pen/permanent marker (to redraw pitch/yaw marks)	1

5.2 Subsystem Location and Access

Table 2 below provides examples of the locations of a Digital Network Cameras at TIS and AIS sites.

Table 2. TIS and AIS Digital Network Camera Locations

TIS Tower Above Canopy: Figure 1 and Figure 2	
	
Figure 1. TIS Tower Above Canopy Camera (Domain 10, CPER)	**Figure 2. TIS Tower Above Canopy Camera (Domain 10, CPER)**

TIS Tower Snow Depth Camera & Staff Gauges: Figure 3 and Figure 4

Figure 3. TIS Snow Depth Camera &Staff Gauges (Domain 17, SOAP)

Figure 4. TIS Tower Snow Depth Camera (Domain 07, GRSM)

AIS Aquatic Stream Site Camera & AIS Infrastructure: Figure 5 and Figure 6

Figure 5. AIS Infrastructure: Instream Staff Gauge (Domain 18, OKSR)

Figure 6. AIS Aquatic Stream Camera (Domain 07, LECO)

AIS Aquatic Lake Site Camera & AIS Infrastructure: Figure 7 and Figure 8

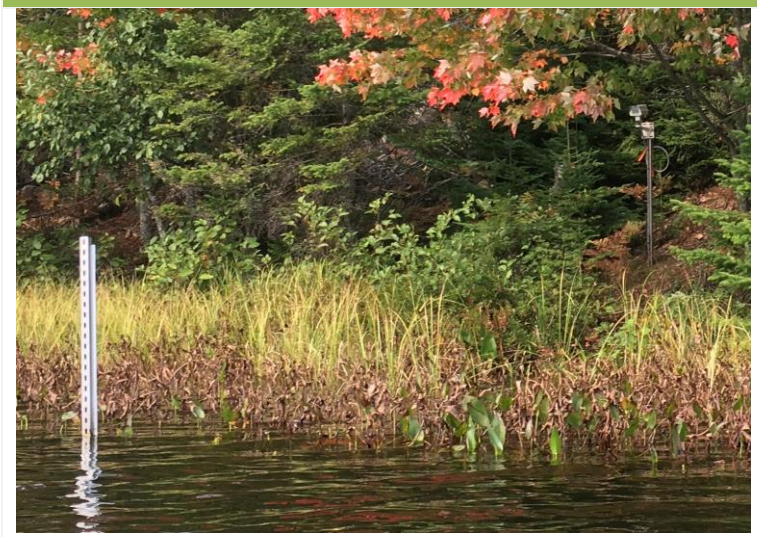


Figure 7. AIS Infrastructure: Lake Staff Gauge & Camera (Domain 05, CRAM)

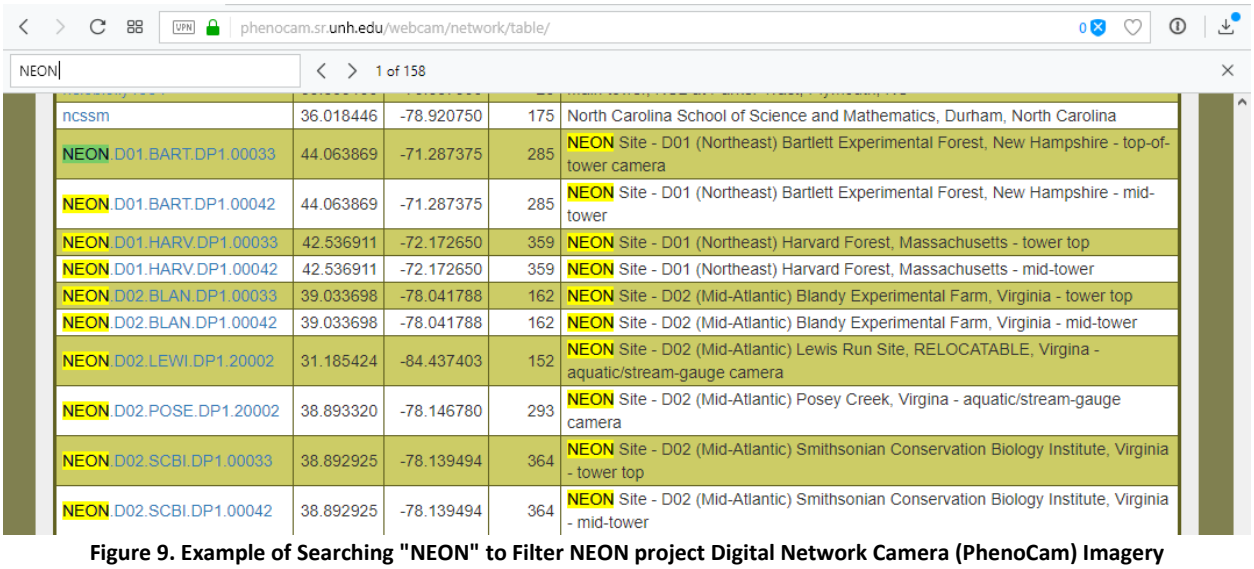
Figure 8. AIS Lake Camera (Domain 05, CRAM)

5.3 Maintenance Procedure

The following procedures are applicable to both TIS and AIS sites employing Digital Network Cameras.

5.3.1 Remote Monitoring: Image Quality

Visit the PhenoCam Network periodically to verify TIS/AIS streaming and image quality via https://phenocam.sr.unh.edu/webcam/network/table/. Conduct a search using the term "NEON" to filter for NEON project images (Figure 9 below is an example of conducting this search).



ncssm	36.018446	-78.920750	175	North Carolina School of Science and Mathematics, Durham, North Carolina
NEON.D01.BART.DP1.00033	44.063869	-71.287375	285	NEON Site - D01 (Northeast) Bartlett Experimental Forest, New Hampshire - top-of-tower camera
NEON.D01.BART.DP1.00042	44.063869	-71.287375	285	NEON Site - D01 (Northeast) Bartlett Experimental Forest, New Hampshire - mid-tower
NEON.D01.HARV.DP1.00033	42.536911	-72.172650	359	NEON Site - D01 (Northeast) Harvard Forest, Massachusetts - tower top
NEON.D01.HARV.DP1.00042	42.536911	-72.172650	359	NEON Site - D01 (Northeast) Harvard Forest, Massachusetts - mid-tower
NEON.D02.BLAN.DP1.00033	39.033698	-78.041788	162	NEON Site - D02 (Mid-Atlantic) Blandy Experimental Farm, Virginia - tower top
NEON.D02.BLAN.DP1.00042	39.033698	-78.041788	162	NEON Site - D02 (Mid-Atlantic) Blandy Experimental Farm, Virginia - mid-tower
NEON.D02.LEWI.DP1.20002	31.185424	-84.437403	152	NEON Site - D02 (Mid-Atlantic) Lewis Run Site, RELOCATABLE, Virgina - aquatic/stream-gauge camera
NEON.D02.POSE.DP1.20002	38.893320	-78.146780	293	NEON Site - D02 (Mid-Atlantic) Posey Creek, Virgina - aquatic/stream-gauge camera
NEON.D02.SCBI.DP1.00033	38.892925	-78.139494	364	NEON Site - D02 (Mid-Atlantic) Smithsonian Conservation Biology Institute, Virginia - tower top
NEON.D02.SCBI.DP1.00042	38.892925	-78.139494	364	NEON Site - D02 (Mid-Atlantic) Smithsonian Conservation Biology Institute, Virginia - mid-tower

Figure 9. Example of Searching "NEON" to Filter NEON project Digital Network Camera (PhenoCam) Imagery

The PhenoCam Network or personnel at the NEON project HQ may contact sites directly to adjust/clean cameras, if there is a degradation of image quality.

5.3.2 Onsite General Cleaning Procedure: Glass (Environmental Housing)

Preventative maintenance for NEON Digital Network Cameras primarily targets cleaning the protective glass on the camera's exterior environmental housing. Perform routine cleaning with a lint-free cloth and distilled or deionized water. This aims to remove any loose dust, dirt, or residue that may inadvertently scratch the glass surface.

Note: Always use gentle pressure when drying off the protective glass. Allow the liquid materials to clean the glass surface. Do not conduct any "dry" wiping on the glass surface to clean/remove residue, always use a liquid with a lint-free cloth.

Follow the distilled/deionized water cleaning with a solution of 95% ethanol. Dry-off using gentle pressure with a fresh lint-free cloth. The combination of these help ensure a clean and residue-free glass surface. Systematic guidance of this generic cleaning procedure is in Section 5.3.2.1 below. To address specific environmental conditions, see Section 5.3.3.

See *Section 6.2* to de-energize and remove the Digital Network Camera from TIS or AIS site infrastructure, if cleaning the camera's protective housing. Otherwise, the following procedure may occur with the power ON to clean the protective glass.

5.3.2.1 Cleaning Procedure

1. Place a small container or bucket underneath the housing glass to catch excess dirt, water, or ethanol runoff. This prevents contaminating the surrounding environment at TIS and AIS sites (this is most important for AIS sites).
2. Spray distilled or deionized water on the glass surface and allow water to run off. This aims to remove any loose dust, dirt, or residue that may inadvertently scratch the glass surface.
3. Spray a small amount of distilled or deionized water on one corner of a clean lint-free cloth.
4. Wipe the glass surface with the wet part of the cloth.
5. Wipe dry the glass surface with the dry and clean portion of the cloth. ***Always use gentle pressure when drying off the protective glass.***
6. Discard/dispose the dirty lint-free cloth.
7. Spray a small amount of 95% ethanol on a corner of a new and clean lint-free cloth.
8. Wipe the glass surface with the wet part of the cloth.
9. Wipe dry the glass surface with the dry portion of the cloth. ***Always use gentle pressure when drying off the protective glass.***

10. Discard/dispose the dirty lint-free cloth.
11. Gently wipe with a new and clean lint-free cloth until surface is completely dry; ensure there are no streaks or smudges on the protective glass surface. (This is assuming there is no residual dirt that may scratch the glass. If residue remains, repeat the cleaning process)
    a. Follow up Steps 7-9 until glass surface is clear of streaks or smudges.
12. Finish the cleaning process with several short "blasts" of compressed air from 4" to 6" away from the protective glass to remove any remaining lint or dust.

5.3.3 Specific Environmental Conditions Cleaning Procedures

5.3.3.1 Dew

1. Follow Section 5.3.2.1.

5.3.3.2 Frost

1. Temperature above freezing, follow Section 5.3.2.1.
2. Temperature below freezing, follow Section 5.3.2.1 with the exception of Step 2 and Step 3.
    a. Replace distilled or deionized water with 95% ethanol for Step 2 and Step 3 in Section 5.3.2.1.

5.3.3.3 Snow

1. Attempt to remove any excess snow with a medium-stiffness/firm paintbrush.
3. Follow Section 5.3.2.1 with the exception of Step 2 and Step 3.
    a. Replace distilled or deionized water with 95% ethanol for Step 2 and Step 3 in Section 5.3.2.1.

5.3.3.4 Ice

1. Place a small container or bucket underneath the Digital Network Camera.
2. Spray the camera's surface with 95% ethanol. Allow the 95% ethanol to melt the ice buildup.
3. Repeat Step 2 until the ice melts.
4. Follow Section 5.3.2.1 with the exception of Step 2 and Step 3.
    - Replace distilled or deionized water with 95% ethanol for Step 2 and Step 3 in Section 5.3.2.1.

5.3.3.5 Salt Deposits

Depending on site location, salt deposits may accumulate on the glass surface, specifically for coastal, agricultural and island sites. These deposits present as a thin white film, spots or accumulations. The procedure in Section 5.3.2.1 may remove light salt deposits; however, it may fail to remove heavier salt buildup. The cleaning procedures may require the use a solvent to remove heavier buildup, such as 0.1 M acetic acid, to dissolve the layers of salt deposits on the camera.

1. Place a small container or bucket underneath the Digital Network Camera.
2. Attempt a routine cleaning in Section 5.3.2.1 to determine if a solvent is necessary.
3. If the salt deposits remain, spray a small amount of 0.1 M acetic acid and allow the solvent to "soak in" for a minute or two before wiping clean. Allow the solvent to do the heavy lifting (break up the salt deposits).
4. Use a clean lint-free cloth with gentle pressure to wipe the camera clean. Repeat Step 3, as necessary, until the lens is free of salt deposits.
5. Post-removal of the salt deposits, follow cleaning procedures in Section 5.3.2.1.

5.3.3.6 Insect Nests

Spiders or other insects may form nests on or around the camera housing, and may block or obscure the camera's field of view (FOV).

1. Use a brush/cotton swab and/or a few blasts of compressed air to remove as much of the insect nest or spider webbing, as possible.
2. Follow Section 5.3.2.1.

5.3.3.7 Animal Excrement

1. Place a small container or bucket underneath the housing glass to catch runoff. This prevents contaminating the surrounding environment at TIS and AIS sites.
2. Spray the sensor's surface with distilled or deionized water allowing it to "soak in" and loosen the debris.
    a. Continue spraying with distilled or deionized water, attempting to loosen and remove the debris with the water.
3. If excrement remains, use a cotton swab to aid in loosening and removing it. ***Apply gentle pressure when loosening/removing excrement, specifically when applying force on the protective lens.***
    b. Continue spraying the affected area with water until the excrement is gone.
4. Post-removal of the animal excrement, follow the cleaning procedures in Section 5.3.2.1.

5.3.4 Physical Inspection: Camera Positioning

The positioning of the Camera is imperative for capturing consistent quality phenology data. Periodically verify the camera is in alignment with site-specific science requirements. *Refer to site-specific As-Built documentation in the NEON SharePoint Document Warehouse.*

1. Following preventive maintenance procedures examine the marks on both halves of the pitch and yaw swivel on the mounting infrastructure.
2. Ensure both marks align to confirm the camera did not shift during maintenance.
3. If the marks are showing signs of fading, re-draw them with a permanent marker/paint pen.

5.3.5 TIS Snow Depth Staff Gauge Maintenance

The terrestrial staff gauge requires regular cleaning so that the measurement lines are distinguishable for image analysis. Figure 10 provides a picture of the measurement lines on the staff gauges in Domain 17, Soaproot Saddle (SOAP). Figure 10 is also an example of foliage obstructing the measurement lines on the staff gauge. Periodically inspect the TIS staff gauges to ensure there is nothing blocking the measurement lines from the camera view. This includes foliage, debris and other environmental/weather-related obstructions. Submit a ticket in the Issue Management/Reporting System if the growth/obstruction is questionable and requires science guidance for removal.

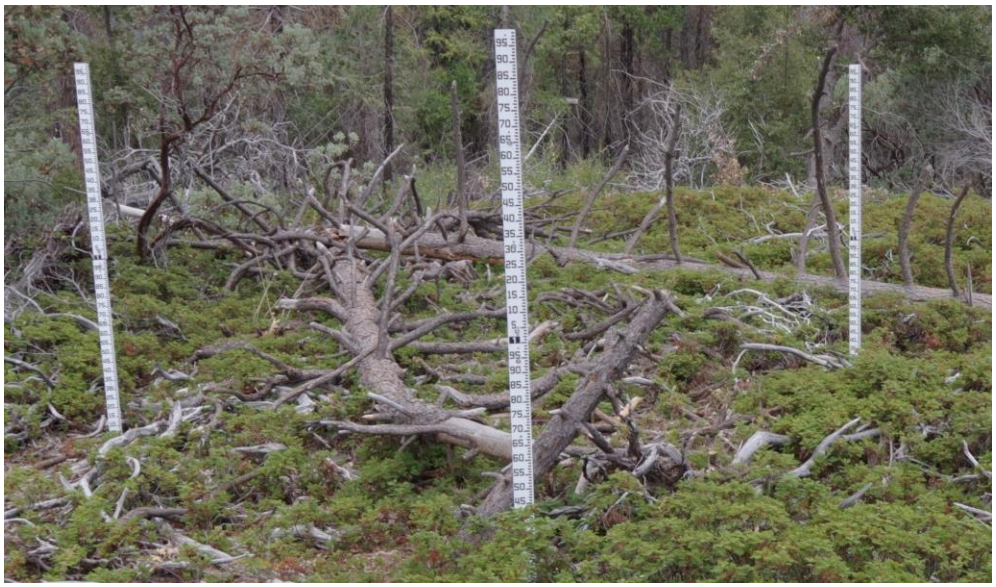


Figure 10. TIS Snow Depth Staff Gauges (Domain 17, SOAP)

Note: The closest distance that one may approach the measurement stick is 1 meter. The cleaning of the measurement stick must therefore be from a distance of at least 1 meter.

1. Attach a firm bristle paintbrush to the end of an extensible painter's pole.
2. From >1 meter distant, brush clean the surface of the measurement stick. ***Do not to disturb the surface snow.***

6 REMOVAL AND REPLACEMENT (SUBSYSTEM ONLY)

There are no calibration and/or validation requirements for the Digital Network Camera, nor its subsystem, at this time.

6.1 Equipment

See AD [08], AD [09] and AD [05] for the installation and configuration of the TIS Tower Digital Network Cameras and staff gauges, as applicable.

See AD [04] for the configuration of the AIS Digital Network Camera and staff gauge.

6.2 Removal and Replacement Procedure

The Field Operations (FOPS) Domain Manager is responsible for managing the removal and replacement of the sensors onsite for preventive maintenance and/or sensor swaps and manages field calibration and validation of sensors, as appropriate. The NEON project Calibration, Validation and Audit Laboratory (CVAL) is responsible for the calibration and validation of select sensors and manages Domain sensor refresh (swap) schedules. There are no calibration and/or validation requirements for the TIS and AIS Digital Network Camera, nor its subsystem, at this time.

See AD [08], AD [09] and AD [05] for the installation and configuration of the TIS Tower Digital Network Cameras and staff gauges, as applicable.

See AD [04] for the configuration of the AIS Digital Network Camera and staff gauge.

Note: Always shutdown the power prior to removing or replacing any components. Do not hot-swap[2] any component connections at TIS or AIS sites.

6.2.1 Seasonal/Inclement Weather

In the event of inclement/seasonal weather[3], that exceeds the operating and storage parameters of the sensor (reference Figure 11 below for the Digital Network Camera), consult with NEON science with proposed site-specific sensor removal timeframes/dates. After removal, store the camera at the Domain Facility or environmentally controlled storage unit. The next sections address the necessary steps to prepare for inclement or seasonal weather at TIS and AIS sites.

[2] Hot-swap: Power is ON for components.

[3] Submit a ticket in the NEON Issue Reporting/Management system to help determine if/when a camera at a site requires removal. Consult with AIS science stakeholders for Stream and Lake Sites and TIS science stakeholders for Tower Sites in the Fundamental Instrument Unit (FIU) department.

TECHNICAL SPECIFICATIONS	
Image Sensor	All Models: RGB, CMOS, Frame Transfer, Up to 30 FPS 5MP: 2592x1944 / 3MP: 2048x1536 / 1.3MP: 1296x976
Sensitivity	0.3 lux Color (with ƒ1.2 iris), 0 lux in IR mode (w/ IR illuminator)
Exposure	Auto exposure with brightness adjustment and grid exposure selection or manual exposure (1/48,000 second ~ 1.3 seconds)
Imaging Features	Auto/manual color balance (including skew override), contrast enhancement (haze subtraction, gamma correction) and sharpening, defective pixel replacement
Image Compression	Industry Standard JPEG and Motion-JPEG (adjustable quality/compression)
Frame Rate	10/12 FPS ~ 30+ fps, depending on resolution
Typical File Sizes	320x240 (8~20KB) 640x480 (25~70KB) 1296x960 (50~200KB) 2592x1944 (150-300KB)
Network Connection	1 x 100-baseT Ethernet, PoE (802.3af)
Network Protocols Supported	TCP/IP, HTTP, FTP, DHCP, PING, TELNET, DAYTIME, NTP, SMB, NFS
Serial Connection	1 x RS-232 Ports, DB9, up to 115.2Kb/sec
I/O Connectors	1 x Fully Isolated Digital Alarm Input 1 x Fully Isolated Relay, 28VDC 2A or 125VDC 0.5A
Internal Memory	32MB DRAM, 4MB Flash Memory, 32MB Imaging Buffer
Internal Operating System	uClinux
Security	Separate password-protected user accounts for administering the server and viewing the images, additional user accounts can be added
Operating Temperature	-40°F to +120°F (-40°C to +48°C)
Dimensions	3.23" wide (82 mm) x 2.25" high (57 mm) x 4.4" long (112 mm), BNC adds 0.7" to length
Weight	14 ounces (397 grams)
EMI Approval	FCC Class A, CE (EN55024/1998, EN55022/1998)
Power Requirements	PoE (48VDC) or 10VDC - 20VDC (500mA@12V) or 24VAC

Figure 11. Stardot NetCam SC Technical Specifications (User Manual, Page 52)

6.2.1.1 Equipment

Note: When working on power systems, use tools with insulated handles.

Table 3. Seasonal/Inclement Weather Removal Equipment List

P/N	MX/NEON P/N	Description	Quantity
Tools			
GENERIC		Flush cutters/Scissors (to remove zip-ties)	1
GENERIC		Wrench (to remove U-bolts from Tower leg)	1
GENERIC		Phillips-head screwdriver (to access Tower ML power box)	1
GENERIC		Flathead screwdriver (to access AIS device posts)	1

GENERIC		Gloves (PPE depending on where cables route)	1 pair
GENERIC		Hex key/wrench set (to remove grounding strap on Camera mount/remove camera from Unistrut clamp)	1
GENERIC		Level	1
Consumable Items			
GENERIC		Cardboard Box/Packaging (for Storage)	A/R
GENERIC		Paint pen/Sharpie Marker (to mark Camera location)	1
		Amphenol caps (for Ethernet cables)	2-4
0719752		7” Zip-ties (to redress cables, as applicable)	A/R
0719793		14”Zip-ties (to redress cables, as applicable)	A/R
1HAB2	MX104219	Grainger Red Inspection Tag, Paper, Rejected, PK1000	A/R

6.2.1.2 TIS Seasonal/Inclement Weather Removal

6.2.1.2.1 De-energize the Tower Measurement Level (ML)

Power down the ML power box with the Comm box providing power to the Digital Network Camera requiring removal.

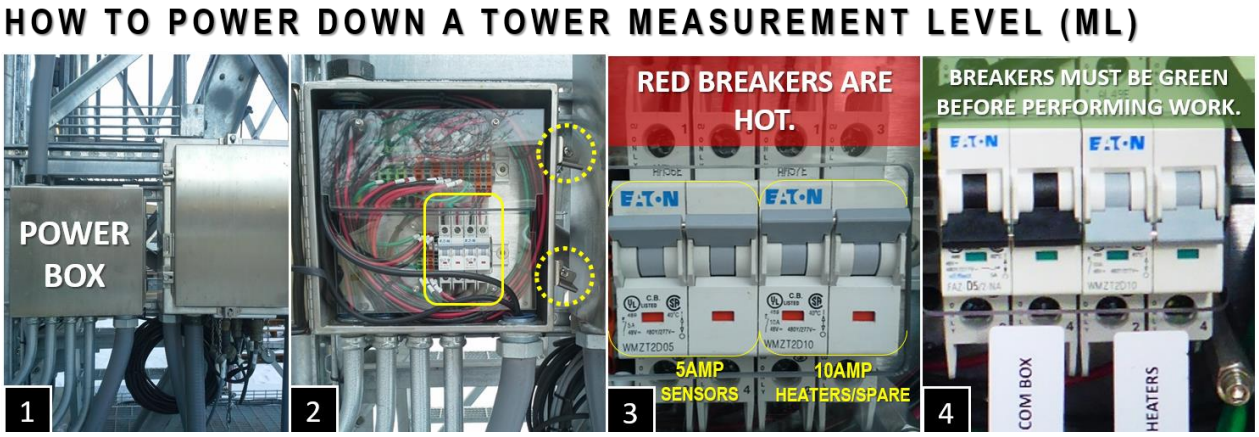


Figure 12. How to Power Down a Tower ML

To power down a Tower ML to conduct preventive maintenance and/or to swap sensors and subsystems, conduct the following steps in accordance with Figure 12.

1. Locate the ML power box.
    a. ***Connections may reside on multiple levels if ports are unavailable. Please ensure this procedure occurs for all applicable power boxes for the ML.***
2. Open the power box using a Phillips-head screwdriver on the two clasps on the right. Figure 12 identifies the location of the two clasps and the location of the breakers in image number 2.
3. Locate the breakers. A 5 Amp breaker is on the left and A 10 Amp breaker is on the right.
    a. The 5 Amp breaker turns the power on/off to the sensors (via their Comm box).

b. The 10 Amp breaker turns the power on/off for sites employing heaters. If a site does not employ a heater, then it is a spare breaker.

c. Red breakers indicate the power is ON – live voltage.

4. Flip the breakers down on the 5 Amp and the 10 Amp breakers to de-energize the ML.

    a. The color on the breaker is green, signifying the power is OFF – ***go ahead and proceed*.**

6.2.1.2.2 Remove the Digital Network Camera(s) from the Tower

1. Mark the Digital Network Camera location on the tower leg to aid in re-installation.
2. Undress the cables (use flush cutters or scissors to cut zip ties).
3. Disconnect the Ethernet Cable connecting to the Comm box and to the Camera.

    a. The TIS Tower Digital Network Cameras do not connect to a Grape; the Cameras connect to the applicable Tower Comm box per AD [10].

    b. Cap and coil the cable to package with the Camera.

4. Disconnect the grounding cable with a hex key/wrench.
5. Remove the two U-bolts securing the Camera to the tower leg using a wrench (see Figure 13).

    a. The size of the tower leg diameter is site specific; therefore, the U-bolts securing the Cameras are site specific. *Refer to site-specific As-Built documentation in the NEON SharePoint Document Warehouse.*

6. Package the camera and its associated equipment and store at the Domain Office or environmentally controlled storage unit until the seasonal or inclement weather ends.

For TIS Digital Network Camera re-installation/replacement and configuration, reference AD [08], AD [09] and AD [05], as applicable.

Figure 13. Camera U-bolts and Grounding Cable on TIS Tower Leg

6.2.1.3 AIS Seasonal/Inclement Weather Removal

Per NEON.AIS.4.1314, aquatic-based sensor infrastructure shall be removed from select lake and wadeable stream sites prior to ice formation that could result in structural damage.

6.2.1.3.1 De-energize the Aquatic Site Device Post

Power down the Aquatic Site S-1/S-2 or Met Station Device Post/Comm box providing power to the Digital Network Camera requiring removal.

1. Use a flathead screwdriver to open the Device Post/Comm box.
2. Flip the 5-Amp breaker(s) to de-energize the sensors.

6.2.1.3.2 Remove the Digital Network Camera from the AIS Site

Note: For stream sensor sites, the camera may reside at S-1 or at S-2, depending on site-specific requirements. Refer to site-specific As-Built documentation in the NEON SharePoint Document Warehouse.

1. Mark the Digital Network Camera location on the Unistrut to aid in re-installation.
2. Undress the cables (use flush cutters or scissors to cut zip ties).
3. Disconnect the Ethernet Cable connecting to the S-1/S-2 or Met Station Device Post/Comm box and to the Camera.
    a. The AIS Digital Network Camera does not connect to a Grape; the Camera connects to the Device Post/Comm box per AD [11].
4. Cap the ends of the cable with Amphenol caps.
    a. Depending on the severity of the weather/seasonal event, move, drape or completely remove the cables. This action is at the discretion of the Domain Manager, and HQ, as applicable.
    b. If Amphenol caps are not readily available, completely remove the cable from the site.
5. Remove the Digital Network Camera from the Unistrut in Figure 14 via the mounting clamp using a hex key/wrench.

Figure 14. Remove Digital Network Cable from Unistrut at an AIS Site

6. Package the camera and its associated equipment and store at the Domain Office or environmentally controlled storage unit until the seasonal or inclement weather ends.

Use the reverse order of this procedure for re-installation and reference AD [04] for the configuration of the AIS Digital Network Camera.

Note: Ensure the camera mount is level upon re-installation of the camera mount onto the Unistrut. Refer to site-specific As-Built documentation in the NEON SharePoint Document Warehouse for camera site positioning requirements.

6.3 Cleaning & Packaging of Returned Sensor

Field Operations staff clean, package, and ship the sensors back to the CVAL at the NEON project HQ (Battelle Ecology) for annual sensor swap/calibration requirements. (Please note: if a sensor is defective, submit a trouble ticket and affix a red tag with the trouble ticket number on it.) Since there are no calibration and/or validation requirements for this sensor and subsystem, this section only applies to corrective action, which is outside the scope of this procedure. Regardless, always conduct field decontamination per RD [03] on the Digital Network Camera prior to packaging and shipping to HQ.

For any Non-CVAL initiated sensor returns, please notify CVAL of the return.

7 ISSUE REPORTING OUTPUTS

FOPS must report issues encountered while conducting preventive maintenance in the NEON project Issue Management/Reporting System. To ensure a quick response and remedy to an issue, please include as much information and detail, as possible. This includes, but is not limited, to the following:

- Domain and Site name
- Date and Time
- Technician Full Name
- Issue Narrative (detailed narrative of the issue, specific location of issue on tower infrastructure, relevant 2nd/3rd order effects to infrastructure, possible cause [e.g., weather event, obstruction, human activity])
- Multiple Photographs (to capture vantage points/perspectives for remote diagnostic)
- Provide Part Number/Manufacturer Information, EPROM ID, Asset Tags, IP Address, MAC Address, etc.
- Provide Diagnostic Information (from firmware, if applicable), such as error codes, values, etc. Provide screenshots.

Table 4: Digital Network Camera Metadata Output Checklist

Issue Reporting Datasheet		
Datasheet field	**Entry**	
NEON Site Code		
Maintenance Date		
Maintenance Technician		
Digital Network Camera Location		
Preventive Maintenance	**Issue Noted**	**Issue Summary**
Camera Cables & Connectors - Condition Check	☐	
Camera - Condition Check	☐	
Camera – Configuration/Alignment Check (Reference Site As-Built Documentation)	☐	
Camera – Clean	☐	
Camera – On Network (Verify via PhenoCam Network)	☐	
Environmental Information	☐	
Notes:		

For the Digital Network Camera subsystem corrective actions, ensure proper tracking of the asset via the NEON issue management and tracking system (e.g., JIRA) to establish a chain of custody of the asset between Engineering Repair Laboratory and CVAL.

Conduct the following tasks to ensure the proper management of the asset between sites:

For each issue where NEON, HQ is replacing a defective instrument/subsystem at a TIS or AIS site, please create a sub-task in the NEON Issue Management and Reporting System for the defective asset from the reported issue. Resolution of an issue does not occur with the installation of a replacement, but with the root cause analysis of the issue deriving from the defective asset. FOPS may resolve the ticket upon installation of the replacement if a sub-task exists for the defective asset for NEON HQ to conduct root cause analysis.

1. Ship all defective equipment/assets with a red “Rejected” tag. Figure 15 displays the minimum information requirements for each tag.

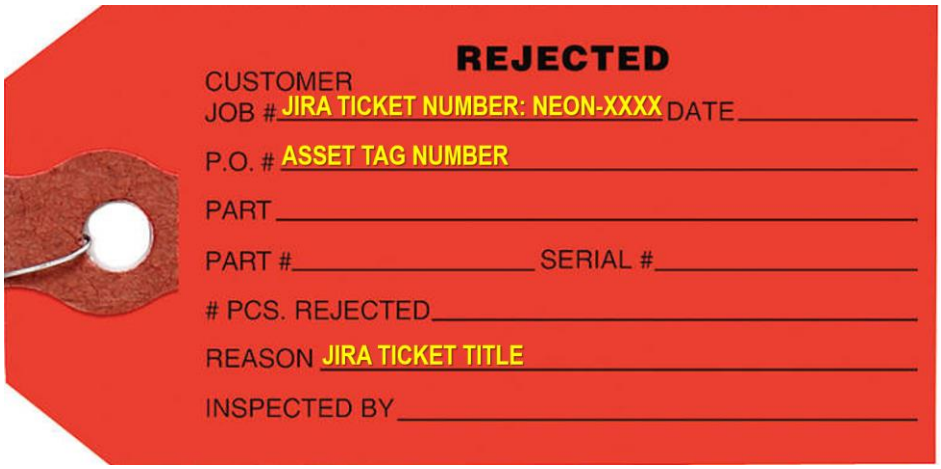


Figure 15. Red Rejected Tag for Defective Assets (MX104219)

8 SOURCES

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