INSTRUCTION MANUAL

CCFC Field Camera

June 2017

Guarantee

This equipment is guaranteed against defects in materials and workmanship. We will repair or replace products which prove to be defective during the guarantee period as detailed on your invoice, provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific

- Batteries

- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request. It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment, in support of this policy a "Declaration of Hazardous Material and Decontamination" form will be issued for completion.

When returning equipment, the Repair Reference Number must be clearly marked on the outside of the package. Complete the "Declaration of Hazardous Material and Decontamination" form and ensure a completed copy is returned with your goods. Please note your Repair may not be processed if you do not include a copy of this form and Campbell Scientific Ltd reserves the right to return goods at the customers' expense.

Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

Precautions

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND **TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC**. FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.eu or by telephoning +44(0) 1509 828 888 (UK). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical
- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, or 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

Elevated Work and Weather
- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance
- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

IR Warning

Infrared (IR) is emitted from the CCFC. Do not look directly at the IR LED when the CCFC is connected to power.

The CCFC utilizes 2 high intensity nonvisible IR (850nm) LEDs for night vision illumination.

Do not make physical contact with the IR LEDs or place any body part near the IR LEDs (less than 5cm) while the camera is powered on. When in close proximity with the illuminated IR LEDs, there is a potential skin burn hazard.

IR LEDs

See Section 6 *Cautionary Statements* for more information.

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CCFC Field Camera

1. Introduction

Figure 1-1 CCFC Camera

The CCFC (Figure 1-1 *CCFC Camera*) is designed to meet the stringent operational requirements necessary for remote battery powered installations, while producing HD video and photos of up to 5 megapixels. The CCFC can operate over a wide temperature range and has several advanced power saving modes to suit a variety of needs.

The CCFC incorporates an integrated rugged environmental enclosure to reduce cost and installation time. Communication options include: Wi-Fi, Ethernet, RS-232, and RS-485. The CCFC is fully web-enabled with HTTP, FTP, and email capabilities. Campbell Scientific's PakBus® protocol is supported by the CCFC for integration with Campbell Scientific dataloggers.

The camera contains an onboard camera memory that enables the camera to function as a powerful photo and video datalogger. The internal 16GB camera memory enables the CCFC to archive photos and video internally.

The CCFC can operate in a stand-alone mode with photo acquisitions triggered by the camera's own precision real time clock. Media (photo and video) acquisitions can also be triggered by events through an external trigger or motion detect.

2.   Specifications

Power Supply Operating
- 9 – 30 Vdc Input voltage

Current Draw Specifications
- Average current draw: 250 mA (excludes defroster and IR LEDs)
- Maximum momentary peak current draw: 400mA
- Current draw with defroster on: 1.5A
- Current draw with IR LEDs on: 700mA
- Quiescent *Off* power mode: < 1mA
- *Deep Sleep* power mode: < 6mA

General
- Operating Temperature: -40°C to + 60°C*
- Weight: 2.4 kg (5.25 lb)
- Clock Accuracy: ± 2 Minutes/Year (-40°C to +60°C)

   *Full functionality of the motorized zoom lens is available in the temperature range of -30°C to +60°C. Image and video capture can still occur but the motorized lens will remain in a fixed position at temperatures below -30°C.

Dimensions
- Length: 28.4 cm (11.2")
- Height: 13.0 cm (5.1")
- Width: 13.2 cm (5.2")

Lens
- Lens: 4.7 to 84.5 mm, 3° to 55° horizontal field of view

Photo or Video Capture Triggers
- Two Independent Self Timers
- Motion Detect
- Web Page Control
- External Trigger

Photo and Video Capture Times (from wake up to start of capture)
- *Fully On*: < 1 s (5 MP images take longer; using lens positions adds time)
- *Partially On*: 10 sec

- *Deep Sleep*: 10 sec
- *Off State*: 90 sec

Photo Resolutions (JPEG)
- 2592 x 1944
- 1200 x 960
- 1280 x 720
- 640 x 480
- 640 x 352
- 320 x 240
- 320 x 176

Video Recording
- MPEG4 720p
- MPEG4 320 x 240
  Video Frame Rate Options: 30, 15, and 7.5 frames per second (FPS)

External Trigger Signal
- Logic Low Level: < 0.65 V (-20 Vdc Absolute Min)
- Logic High Level: > 2.0 Vdc (+20 Vdc Absolute Max)

Communication Interfaces
- Ethernet 10/100
- RS-232 port or RS-485 port
- Wi-Fi (supports 802.11bgn in the 2.4 GHz ISM band on channels 1-11)

Communication Protocols
- Web interface via web browser
- FTP
- Email
- PakBus® (for Campbell Scientific dataloggers)

Modem Power Control
- Maximum Output Current: 750 mA
- 12 Vdc

RS-232 or RS-485
- Maximum Baud rate: 115.2 KBaud

Note	For RS-232: The maximum recommended cable length at 115.2 K BAUD rate is 15 m. The use of the 57.6 KBAUD rate has a recommended maximum cable length of 30 m (90 ft). For RS-485: A user-supplied (twisted pair) cable could be spliced onto the communication wires to extend to a maximum cable length of 305 m (1000 ft). Power wires still need to be kept to the 20 m (65 ft) factory length (or 0.7 Ohm user-supplied spliced cable) limit.

Camera Memory
- File Type : jpeg (photo) ; avi (video)
- Size: 16 GB

Zoom
- 18x Optical zoom

3.   Initial Inspection

- Upon receipt of the CCFC, inspect the packaging and contents for damage. File any damage claims with the shipping company. Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.

- The model number and cable length are printed on a label at the connection end of the cable (if a cable was purchased). Check this information against the shipping documents to ensure the expected product and cable length are received.

- The CCFC is shipped with a Quick Start Guide (Section 4), 2 screws, 2 lock washers, 2 flat washers, 4 Lens wipes, a ResourceDVD, and the Female DB9 to Terminal block adaptor (L28840).

4. Quick Start Guide

The CCFC comes with a Quick Start Guide to get you started with the camera.

4.1 Connect to CCFC via Wi-Fi

TABLE 4-1 Quick Set Up Guide	
Step	**Procedure**
1	Take the CCFC out and inspect it for any scratches or aesthetic flaws.
2	Connect the wired end of the power cord to a power source like a battery. Black and Clear wires are Ground; Red is 12V.
3	Plug the other end of the power cord into the camera. Be sure to line up the grooves and twist to lock. It will "click" in place.
4	Wait 90 seconds for the camera to power up. When the green light on the Setup Button starts flashing, the camera has power.
5	Boot up a computer/mobile device and connect to the camera via its Wi-Fi network. It will appear like "CCFC-9999" where 9999 will be the last 4 digits of your camera's serial number.
6	Once connected to the camera Wi-Fi, open a web browser and type http://10.0.0.1 into the address bar.
7	This opens the camera's web interface where the camera can be configured. The set up progress bar indicates the next steps to setup capture events and get started using the CCFC.

4.2 Connect to your camera via Ethernet cable

Complete steps 1 through 4 from the Wi-Fi connection instructions (Table 4-1 *Quick Set Up Guide*), then:

TABLE 4-2 Quick Set Up Guide	
Step	**Procedure**
5	Take the protective cap off the camera's ethernet connection port.
6	Plug a ethernet cable into the camera and into a computer. Be sure Wi-Fi is turned OFF on the computer.

7	Open a internet browser and type http://169.254.99.99/ into the address bar.
8	This opens the camera's web interface where the camera can be configured. The set up progress bar indicates the next steps to setup capture events and get started using the CCFC.

4.3   Quick Set Up to Take Photo Every 15 Minutes

Set up your CCFC to take an image every 15 minutes and save photo to CCFC camera memory.

TABLE 4-3 Quick Set Up	
Step	**Procedure**
1	Connect to Camera using the methods laid out in Section 4.1 or Section 4.2.
2	Click *Create Capture Modes* in the *Set Up Progress* bar at the top.
3	Click *Timed Capture* NEW.
4	Click the plus sign (+) to create a new timed capture profile.
5	Type a descriptive title, such as 'Picture every 15 minutes'.
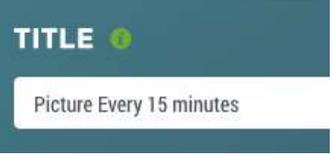
6	Under Schedule, Select *Continuous (24 hours)* and input '15' Minutes beside *Take Photo Every:*.
7	Under *Lens Position*, click the green *Position 1* link to adjust the lens position.
8	Type a descriptive title for the lens position, such as 'fully zoomed' or 'wide view'.
9	Slide the Zoom slider to your desired zoom length. The CCFC auto focus as you change zoom lengths. The CCFC may take a second to respond and display your image in the *Live Video* feed.
10	Click *Save Settings*. This will bring you back to your time capture set up and save your new lens position.
11	Click the *Enable Photo Capture* toggle and choose *Take a Single Photo*.
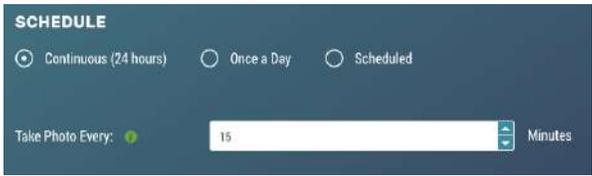
12	Click the *Save to Camera Memory* toggle. Keep the default Max Space size of 0MB which will auto-allocate memory.
13	Choose *Continuous Overwrite*, and Sub Folder Date Format of *YY/MM/DD* to store the pictures from each day in a separate sub-folder.
14	From the *Media Profile* drop down, select *Default (High Resolution).*
15	Save your *Timed Capture* profile by clicking the green *Save* button at the bottom of the page.
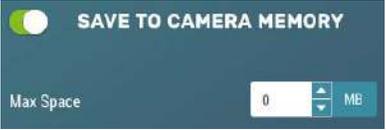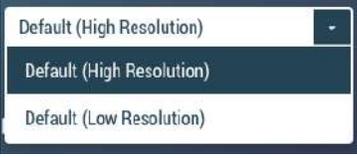
Note   In 15 minutes or less, use the *File Explorer* to select the desired photo, and download it to a computer/mobile device. The first picture will be taken at the next 15 minute interval. For example, if you save your settings at 1:07pm, the photo will be taken at 1:15pm, then again at 1:30pm, and so on.

For alternate set ups or more information, see Section 5.3 *Configuration Process.*

5.   Quick Notes

5.1   CCFC General

- When ordering the CCFC series, use the model numbers CCFC RS232 or CCFC RS485 (Section 14 *RS-232 Communications* and Section 15 *RS-485 Communications*).

- The *Setup Button's* Status LED (Section 8.2) will flash when the camera is in an *Active Power* State.

- When the Status LED is steadily on, the camera is booting up. Avoid interrupting this process.

- Briefly pressing the *Setup Button* always causes the camera to exit from any low powered quiescent states and enables the Ethernet interface for communications. The camera will remain in this state for 5 minutes.

- An active session to the camera with a web browser prevents the camera from entering a low powered state.

- Avoid removing power from the camera when it is in an active state. If the camera is in an active state (Status LED is flashing), properly shutdown the camera to avoid any memory corruption before removing power. The camera can be shut down by holding the *Setup Button* continuously for more than 10 seconds or by using the *Power Icon* on the web interface.

- Always ensure that all cable connectors and covers are securely in place.

- Record any changes to the IP settings of the camera. This information is important to gain access to the camera for focusing or reconfiguration.

- The camera configuration file can be imported or exported via the web interface. This feature can be found under *Import/Export*.

- Check the Campbell Scientific website http://www.campbellsci./ccfc for firmware updates that may apply.

5.2   Campbell Dataloggers Users

- If interfacing to a datalogger, ensure that the datalogger has the latest PakBus® operating system.

- Use either the CCFC built in-web interface, the *Device Configuration Utility,* or PakBus® Graph to change settings in the camera.

- Use the *Device Configuration Utility* to change settings in MD485 or other PakBus® devices.

- The *Device Configuration Utility* can also be used to set the datalogger memory and PakBus® parameters.

- Files (pictures or video) must be less than 2 MB for PakBus® transmissions.

- The datalogger instruction *SendVariables* can be used to send variables or text to the camera, for use in photo or video captions. The instruction can also be used to control the window defroster.

5.3   Configuration Process

1. Determine what will trigger the capture of a photo or video. Options include:

a. *Timed Capture* – Enable and configure Timed Capture 1, Timed Capture 2, or both. To set this up using the web interface, see Section 13.5.1 *Timed Capture.*

b. *External Trigger* – Enable and configure the External Trigger Capture. To set this up using the web interface, see Section 13.5.2 *External Trigger.*

c. *Motion Detect* – Enable and configure Motion Detect Capture. To set this up using the web interface, see Section 13.5.3 *Motion Detect.*

2. Select the *Power Mode* that best suits the requirements (see Table 5-1 *Power Mode Summary*). Options are:

a. *Fully On* – Used if no power constraints exist or if high performance is required.

b. *Partially On* – Provides substantial reduction in power (especially with the *Ethernet Power Mode* set to *Full Power Save*).

c. *Deep Sleep* – Provides very good power savings. The camera does not need to reboot when activated by a trigger. Recommended for use if more than 24 triggers are expected per day.

d. *Off Mode* – Offers the best power savings. Useful, if less than 24 photos or video captures are required per day. It takes about 90 seconds for the camera to wake up to start acquiring a picture.

TABLE 5-1 Power Mode Summary*				
Power Mode	**Ethernet Power Save Mode**	**Quiescent Current Draw Max.@12 Vdc**	**Time (Seconds) from wakeup to start of capture**	**Time (Seconds) in Fully On Mode (Active Current Draw)**
Fully On	Always On	250 mA	< 1	0 – Always Active
	Full Power Save Mode	200 mA	< 1	0 – Always Active
Partially On	Always On	90 mA	10	20
	Full Power Save Mode	10 mA	10	20
Deep Sleep	Always On	6 mA	15	25
	Full Power	6 mA	15	25

	Save Mode			
Off State	Always On	1 mA	90	120
	Full Power Save Mode	1 mA	90	120

* This table takes into account the camera power settings. It does not include the power draws associated with activating the IR LEDs (Section 13.9.4.4.1 *IR LED Power Control*) or Lens Defroster (Section 13.9.4.5.2 *Lens Defroster Control*).

3. Set the details of the media event

a. Set the photo settings

b. Set the video settings

4. Set other details related to Communications and I/O. These other parameters are located under:

a. Section 13.9.2 *Network.*

b. Section 13.9.4.5 *Digital I/0.*

c. Section 14 *RS-232 Communications* and Section 15 *RS-485 Communications.*

6.   Cautionary Statements

Although the CCFC is designed to be a rugged and reliable device for field use, care should be taken when handling or moving it to avoid aesthetic damage.

Other than the desiccant, there are no user-serviceable parts. Improper disassembly or re-assembly of the device will void the warranty. Contact Campbell Scientific Canada or the reseller for details.

The CCFC has three stickers on the bottom of the camera:

1. IR Warning Sticker.

2. FCC Information Sticker.
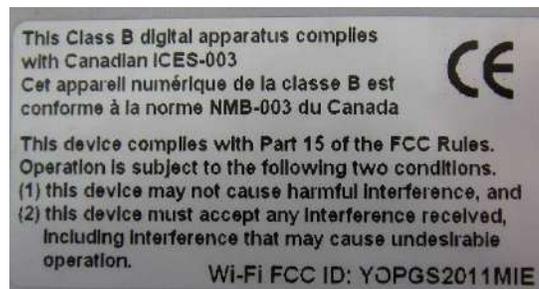
3. Model #, Serial #, and MAC Address Sticker.

7.   Factory Setup

Table 7-1 *CCFC Factory Default Configuration* outlines the CCFC factory settings that are relevant for initially communicating with the camera.

TABLE 7-1 CCFC Factory Default Configuration	
Configuration Setting	**Value**
Power Mode	Fully On State
Wi-Fi IP Address	10.0.0.1
Link Local IP	169.254.99.99
Ethernet Network IP Address	Acquired automatically using DHCP
Serial I/O Port	RS-232 or RS-485
RS-232 Baud Rate	115200
PakBus® Address	55

There are two methods for a user to configure the CCFC camera: using the web interface via Wi-Fi or Ethernet connection and using the RS-232 serial lines.

Using the web interface is the best way to set up the camera. Communicate with the camera via the Ethernet connection or Wi-Fi in order to facilitate focusing and targeting the camera when installed.

Setting up the camera using the RS-485 with a user-supplied converter to RS-232 serial lines on the Power I/O cable and using Campbell Scientific's Device Configuration software to change configuration parameters in the camera is an alternate to using the web interface. *Device Configuration Utility* is a free download from the Campbell Scientific (Canada) website www.campbellsci.ca/downloads. The use of RS-232 serial lines requires the use of the DB9 terminal block adapter (included in the box with the CCFC) in order to connect to a PC (Section 7 *Factory Setup*).

8. Camera Hardware

Ensure that the pigtail end of the power cable is properly terminated (Section 8.1 *Power I/O Connection*) before connecting the power cable connector to the camera. If the power supply has an on/off switch, it is recommended to switch the power off before connecting the power connector to the camera.

When power is first applied to the camera, the Status LED on the *Setup Button* (Figure 8-1 *CCFC Connector Layout*) will turn on and remain steadily on for about 90 seconds. Once the Status LED starts flashing, the camera has properly initialized and is ready for operation (Section 8.2 *Setup Button/Status LED*).
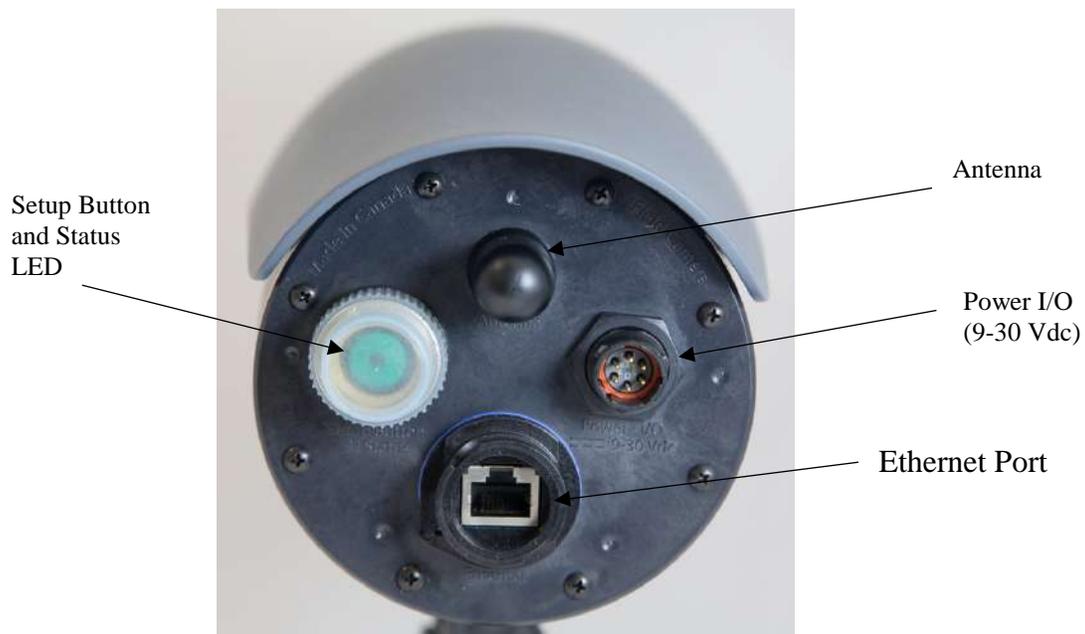
Figure 8-1 CCFC Connector Layout

8.1 Power I/O Connection

Connection to the Power I/O (9-30 Vdc) is necessary for camera operation, as it is the only means to supply power to the camera. The Power I/O cable provides a weather-tight connection and has an IP68 environmental rating when properly connected. Even when the camera is not in use, the power cable must be left connected, if the camera is to be left installed.

When connecting the cable to the camera, the notch positions must always line up.

8.2 Setup Button/Status LED

The *Setup Button* is located behind a protective cap on the camera (Figure 8-1 *CCFC Connector Layout*). The *Setup Button* also contains an integrated Status LED for user feedback.

- The *Setup Button's* Status LED will flash when the camera is in an *Active Power* State.

- When the Status LED is steadily on, the camera is booting up. Avoid interrupting this process.

Briefly pressing the *Setup Button* always causes the camera to exit from any low powered quiescent states and enables the Ethernet interface for communications. The camera will remain in this state for 5 minutes.

8.2.1 Status LED

The Status LED located in the centre of the *Setup Button* provides some useful diagnostic information about the camera. Table 8-1 *Setup Button Status LED* describes the Status LED behaviour. This assumes the power supply is between 9 - 30 Vdc.

TABLE 8-1 Setup Button Status LED		
Status LED	**CCFC State**	**Other**
Continuously Off	No power or the camera is in one of the following low powered modes: • *Partially On* • *Deep Sleep* • *Off Mode*	Pressing the *Setup Button* forces, the camera to exit any of the low powered modes and remain *Fully On* for a period of 5 min with the Status LED rapidly flashing.
Slow Flash 1 sec on, 3 sec off	Normal Operation in *Fully On* power mode.	
Rapid Flash	Exit from low power state. The camera is being kept on by: • Timeout (from the *Setup Button* press)	

	• Network Communications • Asserted External Trigger • Photo or video acquisition	
Continuously On	The camera is booting up - this process takes approximately 90 sec.	The camera will be required to boot up whenever: • Power is first applied to it. • The camera is exiting the *Off* Power mode to perform an operation.

8.2.2 Setup Button

The *Setup Button* (Figure 8-1 *CCFC Connector Layout*) can be used to wake the camera from any of the power saving modes. Once the *Setup Button* is pushed, the CCFC enters a fully powered mode for 5 minutes. During this interval, the camera can be accessed via Ethernet, Wi-Fi, or RS-232/485 to make any necessary configuration changes. If no communication occurs during the 5 minute window, the camera will return to its configured power saving mode and continue normal operation. Any button press, web interface, or FTP access resets the timer, keeping the camera awake for another 5 min, on both the wireless and Wi-Fi connections.

The secondary function of the *Setup Button* is to facilitate a power down procedure. If the button is held for 10 seconds, the camera will completely shut down for a period of 10 min. After the 10 min, the camera will power up again. This function is also available through the web interface via the power icon (green) in the top right corner on the desktop version. On the mobile version of the web interface, a *Power Off* navigation option appears at the bottom of the sidebar.

8.3 Camera Memory

The CCFC is equipped with 16GB of internal memory.

Photo files are stored on the camera memory as jpeg files and video files are stored as avi files. Individual photo and video files are uniquely named including a sequence number or a date and time stamp (Section 13.7 *Media Settings*). The *File Explorer* on

the user interface acts as a directory for the camera memory. The user inputted media file *Title* will be used to organize the photos in the directory. This is set up *Media Settings* (see Section 13.7).

The use of camera memory for media storage is entirely configurable to suit the needs of any given application. Individual photo or video capture can be configured to manage camera memory as either *Fill and Stop* or *Continuous Overwrite* (see Tables 13-5 under *Camera Memory*).

See Section 13.8 *File Explorer* for more information on photo and video retrieval from the camera memory. It is recommended to delete older files from the camera memory after downloading them to a permanent storage location.

8.3.1 Link to Most Recent Photo and Video

To view the most recent photo and video, type one of the links below into the computer or device browser. These links redirect to the actual files on the camera memory, which means that the downloaded file name will be the same as the file name on the camera memory to ensure continuity.

Note	The following are examples. The IP address will vary with the camera's network configuration.

- Timed Capture 1:
  - o http://1.2.3.4/stc1.jpg
  - o http://1.2.3.4/stc1.avi

- Timed Capture 2:
  - o http://1.2.3.4/stc2.jpg
  - o http://1.2.3.4/stc2.avi

- External Trigger:
  - o http://1.2.3.4/etc.jpg
  - o http://1.2.3.4/etc.avi

- Motion Detect:
  - o http://1.2.3.4/mdc.jpg
  - o http://1.2.3.4/mdc.avi

8.3.2 FTP Photo Collection from Camera Memory

If the camera is setup to store photos to the camera memory, it may be necessary to collect all the photos from the camera

memory. The web interface provides a user-friendly method of viewing and saving select files from the camera memory through the *File Explorer* (Section 13.8). However, if it is desired to collect a large number of files from an entire folder, using the web interface is cumbersome.

It is recommended to access the CCFC memory using the FTP file transfer process. On most Windows machines this is easily done by typing in the IP address assigned to the camera by the network. For example, ftp://1.2.3.4:21 into a supported web browser, where '1.2.3.4' is the IP address of the camera and '.21' is the port used for FTP access. The camera supports FTP access to the camera memory on port 21 of the camera. This requires a network connection.

Selecting a directory such as TimedCapture1 will begin the navigation into that directory. Whole directories or files can be saved just like any other Windows folder.

Note   Files cannot be deleted this way.
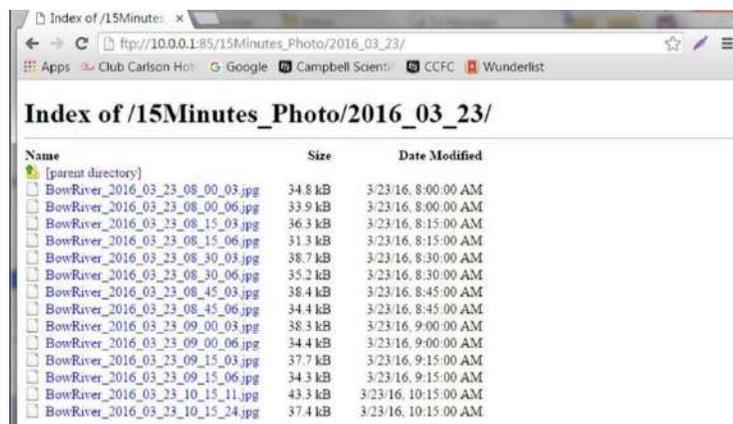
Figure 8-2 Photo Collection from Installed Camera Memory

Alternatively, an FTP client such as FileZilla (https://filezilla-project.org/) can be used to batch download multiple files at once.

It is recommended to set the timeout in FileZilla to 0 (unlimited).

8.4   Modem Power Control

Modem Power Control controls the power for a communication device. One common application is to have the camera control the power to a communication modem at a solar powered site. Refer to Section 13.9.4.5.1 *Modem Power Control* for configuration details via the web interface.

This power management feature can greatly reduce the system power requirements by only turning on the modem when required to transmit a photo or video. The *Modem Power Control* will turn on under the following conditions:

- The camera is in one of its low power modes and the *Setup Button* is pressed. The camera will exit the low power mode and stay awake for 5 minutes with the switched power output on.

- A capture event has occurred where communications are required including FTP or Email transfers. Events requiring camera memory storage will not turn on the switched power output, as these events do not require a modem for communications. It takes the camera approximately 90 secs to boot up after power is applied; immediately thereafter, the camera can capture and transfer files.

8.5   Lens

The CCFC lens contains the following features:

- Electronic zoom
- Automatic focus

The zoom and focus can be adjusted through the web interface (see Section 13.6 *Lens Position*).

8.5.1 Camera Lens and Field of View

The CCFC includes a 4.7 - 64.6 mm lens, which provides an approximate 4° horizontal field of view when fully zoomed in and a 67.3° horizontal field of view when fully zoomed out. The aperture size is F/1.6 to F/2.8.

8.5.2 Camera Auto Focus

The auto focus occurs before each capture to ensure photo quality and compensates for any variations due to temperature or other external factors. The auto focus can also be used through the web

interface's *Live Preview* for photo capture. The auto focus occurs with each manual zoom action, when adjusting the zoom position from the web interface. If the auto focus fails, the lens returns to the best position to ensure photo quality. If the camera is in an extremely dark environment, the auto focus will use the last position that was in focus to perform the capture.

The auto focus operation attempts to focus on the most distant object in the field of view. For example, in a scene with mountains in the background and a tree in the foreground, the camera will focus on the mountains.

8.5.3 Temperature Variations and Focus

The focus of the lens can change slightly with large variations in temperature. For example, if a lens is focused at +35°C, the lens may be slightly out of focus at -40°C. The change in focus will be less noticeable if the focus is adjusted closer to the camera's operating temperature.

Some lens options are unavailable when working in the extreme cold. The zoom function disables below -30°C and the focus function disables below -35°C. Note that these thresholds are based on camera internal temperatures, which can be several degrees warmer than ambient outdoor temperate. The camera will continue to capture photos and video as set up, but the zoom and focus features will not function. Check the internal temperature of the camera using the *Dashboard* of the web interface (see Section 13.4).

8.5.4 Lens IR Cut Filter

The CCFC is internally equipped with an IR cut filter. The filter is required to filter out near infrared light that can have an undesirable effect on the photos.

9. Cables/Wiring

9.1 Power & I/O Cable Connections

The wiring for the Power & I/O Cable connector assembly and which wires need to be connected for the intended camera application is as shown in Table 9-1 *Power & I/O Cable Connections*. The wires can be terminated directly on the control ports of a compatible datalogger (for compatible dataloggers see Section 18 *CCFC Compatibility*).

Note It is essential that the black ground wire be connected first when wiring the camera to the datalogger or other power supply.

TABLE 9-1 Power & I/O Cable Connections			
Colour	**Function**	**Connection**	**When Not Used**
Black*	Power Ground	System Ground (or Pin 5 of a computer (DTE) DB-9 Connector).	
Red*	Input Power	Power Source 9-30 Vdc.	
Green	RS-232 TX (Output)	RS-232 Input (RX control port of datalogger or Pin 2 of a computer (DTE) DB-9 Connector). RS-485A when configured to RS-485. Only needs be connected when RS-232 and RS-485 communications are used for PakBus® or the *Device Configuration Utility*.	Connect to an unused terminal block.

White	RS-232 RX (Input)	RS-232 Output (TX control port of a datalogger or Pin 3 of a computer (DTE) DB-9 connector). RS-485B when configured to RS-485. Only needs be connected when RS-232 and RS-485 communications are used for PakBus® or the *Device Configuration Utility*.	Connect to an unused terminal block.
Yellow	Modem Power Control (Output)	This line is intended to power a communication device. The camera switches the Input power voltage to this line. For solar powered sites the camera can remove power from the modem when communications are not required.	Connect to an unused terminal block.
Blue	External Trigger (Input)	Connect to external signal source (i.e. datalogger control port). The external signal wakes up or initiates photo/video acquisition. On a CSC datalogger, connect to a control port (5V) or switched-12V (SW12V) and be sure to provide a ground. Another device can also help keep the camera in the *Fully On* power mode by leaving the External Trigger Input activated.	Connect to ground if left in Factory Default settings
Clear*	Shield	Shield/Earth Ground.	
* Required			

Note	External trigger also turns on the Wi-Fi from any low power mode, when it is changed to *Active State* (see Section 13.9.4.1). The camera can be configured to turn on when a signal is set to high or low. This is a user selectable configuration. The blue wire needs to be connected to a 5 or 12 Vdc source.

9.2   Power & I/O Cable Details

The Power & I/O cable (CCFCCBL1-L) that is used for the CCFC camera has an outdoor environmentally rated connector on one end and discrete wire pigtails on the other that allow for flexible termination. When making the cable connection to the camera, the notch positions must always line up and care should be taken not to cross-thread the connector.

For information about the available cable options, see Appendix A *CCFC Camera Assessories*.

- 20-AWG 1 pair, 24-AWG 2 pair Shielded Cable with Santoprene jacket.
- IP-68 rated connector at the camera end.
- 10 inch pigtail for termination at the datalogger end.
- 3 Single Pole 16-20AWG Grey Push Operated Connector Terminals.
- Maximum recommended cable length is 20 m (65 feet).

Longer cable lengths can be used; however, a user-supplied heavier gauge of wire is suggested. It is recommended that the individual wire resistance on the 12 Vdc and Ground conductors not exceed 0.7 Ohms. Using a longer cable in conjunction with RS-232 communications requires slower BAUD rates. Depending on the cable length and type of cable, RS-232 may not be suitable for communications and the use of RS-485 should be considered. If there are any uncertainties, contact Campbell Scientific.

9.3   Ethernet Cables

Note

The CCFC does not support the PakBus® communication protocol over Ethernet.

The Ethernet connection can be used to configure the camera settings as well as for targeting and focusing the camera. The Ethernet port of the CCFC is auto MDIX; therefore, an Ethernet crossover cable is not required when connecting the camera to other devices.

A standard CAT5 (or better) Ethernet cable with RJ45 connectors can be used to interface to the camera in indoor conditions or for temporary connection outdoors when conditions permit. When an

Ethernet connection is required for permanent outdoor installations or when a connection to the camera is required in wet or harsh conditions, the Environmental Ethernet Cable (CCFCCBL2-L) assembly needs to be used. Campbell Scientific recommends the use of the environmentally sealed cable at all times when outdoors.

The Environmental Ethernet Cable assembly provides one end with an environmental connector that provides a weather proof connection when properly mated to the camera. The other end of the cable consists of a standard RJ45 connector. The Environmental Ethernet Cable is meant to provide an Ethernet connection between the CCFC and a local network, router, cellular modem, or laptop.

Details of the Environmental Ethernet Cable are:

- CAT5E Shielded cable with polyurethane jacket.
- IP68 environmentally rated RJ45 connector on one end and a rugged metal RJ45 connector on the other end.
- Maximum recommended cable length 70 m (230 feet).

Note   Ensure the protective dust cap is reengaged when the Ethernet cable is not in use to ensure the camera remains protected from the elements.

10. Using Device Configuration Utility

Configuration settings that can be done through the web interface, can be done using the *Device Configuration Utility*. Campbell Scientific provides a free software program called *Device Configuration Utility* that supports the configuration of a variety of equipment including the CCFC. Please visit the Campbell Scientific website http://www.campbellsci.ca/downloads for the most recent version of this utility.

When shipped, the CCFC factory default setting is with the communication lines configured for the RS-232 or RS-485 depending on the model specified at time or order. See Table 9-1 *Power & I/O Cable Connections* for wiring details.

TABLE 10-1 RS-232 Wiring Diagram

Colour	Connection
Black	Power Ground
Green	RS-232 TX (output)
White	RS-232 RX (input)

Note   If unable to connect to the camera via the web interface due to a loss of configuration information, use the *Device Configuration Utility* to restore connectivity to the camera.

The CCFC comes with a Female DB9 to Terminal block adaptor (L28840) accessory that facilitates the connection from the Power & I/O Cable to a 9 pin RS-232 connector. See Section 9.1 *Power & I/O Cable Connections* for wiring details.

Using the Device Configuration Utility:

- Connect the camera to the serial port of a PC using the DB9 FEMALE to Terminal Block Adaptor, as shown in Section 14 *RS-232 Communications*.
- Once the camera is powered up (this can typically take 90 seconds), the Status LED should be flashing. If the Status LED does not flash, the *Setup Button* needs to be pressed to exit the camera from a low powered mode.
- In the *Device Configuration Utility,* select the CCFC from the device list and press the *Connect* button to connect to the camera.
- Normally, the camera is set to 115200 BAUD. If the camera BAUD rate is set to something else, select the appropriate BAUD rate in the *Device Configuration Utility* using the control on the bottom left.
- Once connected to the CCFC, use the tabs to navigate and configure the camera.

Figure 10-1 CCFC shown in Device Configuration Utility

The camera has a large amount of variable information, so it may take about 30 secs for the connection process to complete. Once the settings are loaded, clicking the tabs located near the top of the page will allow navigation to the various settings.

11. Photo Quality

Lighting conditions have the greatest influence on photo quality. The CCFC camera produces the best photos under normal daylight conditions. Pictures taken in well-lit daylight conditions produce crisper and brighter photos.

Scenes that contain small variations in light intensities will produce better photos. In scenes with high variations in light intensities, such as a bright sky or a dark horizon, the photo may contain portions that are under-exposed and portions that are over-exposed, as with most cameras. The CCFC utilizes various techniques to produce the best photo possible under these lighting conditions.

12. Connecting to the Web Interface

The CCFC supports an automatic IP address configuration in situations where the camera is directly connected, via an Ethernet cable, to a computer. If using this method, input the IP address 169.254.99.99 into the Internet browser.

Refer to Section 12.2 *Setup Using Ethernet* for details on making the initial network connection to the camera. To establish communications with the camera, use one of the methods

previously discussed. Enter the appropriate IP address in the address bar of the browser. After typing the address, the homepage (*Dashboard)* of the CCFC camera should appear, as shown in Figure 13-1 *Dashboard - Desktop view*.

The camera ships with automatic network configuration via DHCP enabled. It is highly recommended to keep track of any changes made to the network settings.

12.1 Setup Using Wi-Fi

The CCFC is Wi-Fi enabled. While the camera is powering up, start the computer/mobile device and connect to the camera via its Wi-Fi network. The camera will appear as *CCFC-9999* (for example), where *9999* is the last four digits of the camera's serial number, on the Wi-Fi network.

Once connected to the camera Wi-Fi, open a web browser and enter the default Wi-Fi IP address into the address bar: http://10.0.0.1. This directs the user to the camera's web interface where the camera can be configured.

12.2 Setup Using Ethernet

12.2.1 Link Local IP Address Auto-Configuration

The CCFC supports an automatic IP address configuration in situations where the camera is directly connected, via Ethernet cable, to a computer without the need of a DHCP server.

This feature is automatically enabled in the camera and is transparent to its normal operation. In this situation, the camera will be accessible using the IP address 169.254.99.99. This address will be valid for accessing the camera in any network configuration.

Note In order to use Link Local, the computer connecting to the CCFC must be configured to use DHCP. If the computer is configured to use a static IP, one of the remaining interface arrangements will need to be used.

13. Camera Operation using the Web Interface

Review how to connect to the web interface with Section 12 *Connecting to the Web Interface.*

13.1 Installing MultiMedia Player

See Section 13.1.1 *RTSP Video Stream* for more information.

Note	The MultiMedia Player must be installed to view video in the latest versions of Firefox, Internet Explorer, and Safari. Chrome will display video at 640 x 480 only, with no plugin required.

The computer requires the use of a MultiMedia player to properly display video from the CCFC. The web interface is designed to use the VideoLAN VLC media player, which is a free, open-source software, which ensures that the proper video codecs are available on the computer. The download is available online at:

http://www.videolan.org/vlc/

Download and install the appropriate VLC media player to the PC that will be interfacing with the CCFC.

Note	Installing MultiMedia Player is not required for mobile devices such as tablets or smart phones.

13.1.1 RTSP Video Stream

The CCFC has a built-in RTSP server, which streams the live video from the camera to a compatible viewer. This is the same video stream that is used to display live video on the camera's web interface.

Note	The CCFC has limited bandwidth and can only support one viewer at a time. At high resolution, lower resolutions may allow more users, depending on network connectivity.

13.1.1.1 Sources

As shown in Table 13-1 *Video Stream Sources*, there are three different stream sources, which provide three different video resolutions from the camera.

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<table>
<tr><th colspan="2">TABLE 13-1 Video Stream Sources</th></tr>
<tr><th>Resolution</th><th>URL</th></tr>
<tr><td>320 x 240</td><td>rtsp://1.2.3.4/ipcam/mpeg4cif[*]</td></tr>
<tr><td>640 x 480</td><td>rtsp://1.2.3.4/ipcam/mjpeg[*]</td></tr>
<tr><td>720p</td><td>rtsp://1.2.3.4/ipcam/mpeg4[*]</td></tr>
<tr><td colspan="2">[*] where 1.2.3.4 is the CCFC IP address</td></tr>
</table>

13.1.1.2 Embedding

The following sample code can be used to embed the video stream into a web page. The width, height, and URL need to be changed according to the application needs. See https://wiki.videolan.org/Documentation:WEbPlugin/ for more information.

```
<embed id="vlcEmb"
  width="1280"
  height="720"
  target="rtsp://192.168.1.78/ipcam/mpeg4"
  pluginspage=http://www.videolan.org type="application/x-vlc-plugin">
```

Note   In the embed code, 192.168.1.78 needs to be changed to the IP address of CCFC being used.

13.1.2 UPnP Discovery

The CCFC supports UPnP for device discovery. Meaning, the CCFC will appear in the Windows Network panel with a name such as CCFC-*9999*, where *9999* is the actual serial number of the camera.

This feature makes it possible to find the camera after connecting it to an existing network using DHCP, regardless of whether the connection is wired via Ethernet or Wi-Fi.

13.2 Image Capture URL

The CCFC is able to preform an image capture and downloads the image through the browser using a single URL. This feature can be used by accessing the URL: http://1.2.3.4/capture.jpg were 1.2.3.4 is the CCFC IP address.

There are several parameters that can be configured before preforming the capture. These parameters can be set using a different URL prior to starting the capture and several parameters can be set in a single command using the structure: http://1.2.3.4/data.json?param1=val1&param2=val2

The valid paramters and values for changing the image capture URL settings are described in Table 13-2 *Image Capture Parameters.*

TABLE 13-2 Image Capture Parameters		
Parameter	**Description**	**Values**
Immediate_resolution	Sets resolution for the image	0　320x176 1　320x240 2　640x352 3　640x352 4　1280x720 5　1280x960 6　2592x1944
Immediate_quality	Sets the quality for the image capture. This affects the image file size.	0　Lossless 1　Very High 2　High 3　Medium 4　Low
Immediate_pos	Sets the lens position for the image capture (Section 13.4). Do not add numbers together for multiple len positions, use only the values in the "Values" column to the right.	0　Use the current position 1　Use position #1 2　Use position #2 3　Use position #3 4　Use Position #4
Immediate_af	Select whether or not to preform an auto focus prior to image capture. This is	0　No autofocus 1　Preform autofocus

	recommended.	
Immediate_banner	Select whether or not to add the image banner, containing time and temperature, to the captured image.	0 Disable 1 Imside top 2 Inside bottom 3 Outside top 4 Outside bottom

An example of the URL set with parameters in Table 13-2 are: http://1.2.3.4/data.jason?immediate_resolution=5&immediate_quality=2&immediate_af=1&immediate_pos=0. Once the parameters are set, use the image capture URL http://1.2.3.4/capture.jpg where 1.2.3.4 to capture the image using the parameters set.

Note   Once the parameters are set, the camera will save the set parameters for use on the next URL capture while you remain on the CCFC webpage. The parameters return to default after a rest/power down.

13.3 Web Interface Overview

The web interface allows the user to:

- Fully configure the CCFC.
- View information, system status, date, and time.
- View live video.
- Retrieve photo and video files from the camera memory.
- Access all camera settings.
- Create zoom set points.
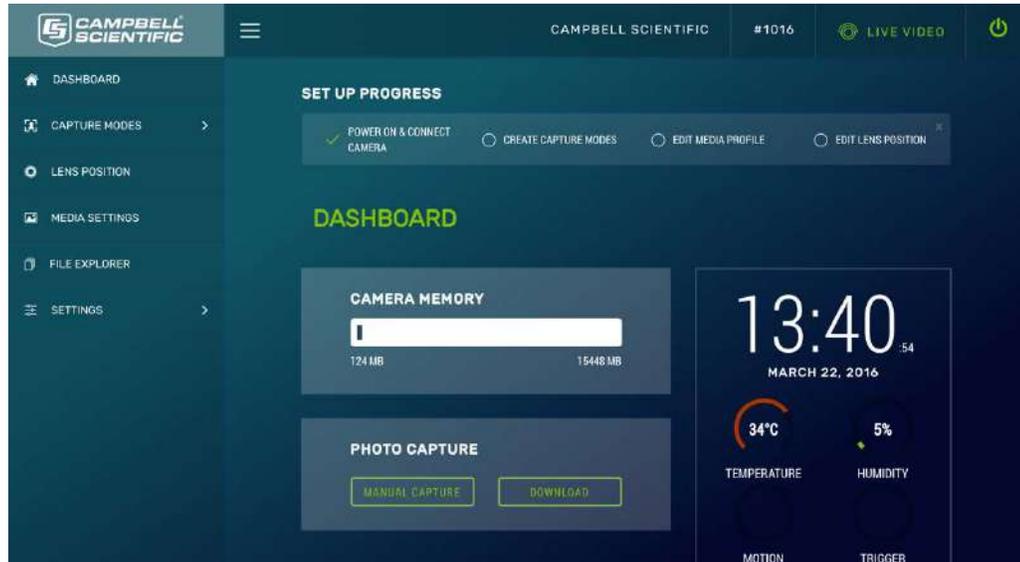
Figure 13-1 *Dashboard* **- Desktop view**
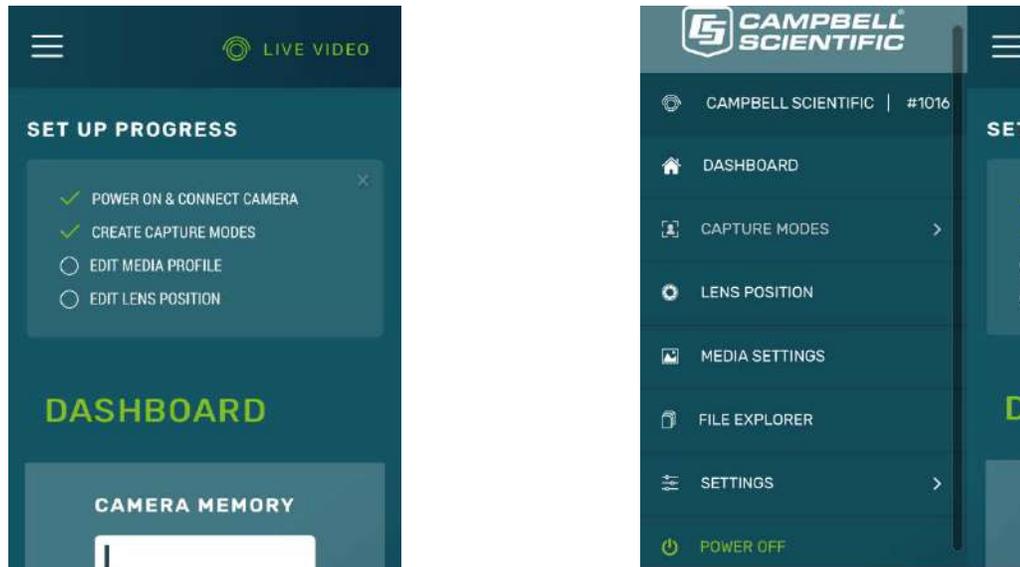
Figure 13-2 *Dashboard* **- Mobile view**

TABLE 13-3 Web Interface Components		
Title	**Parameter**	**Description**
Set Up Progress	Power On & Connect Camera	Completion of these parameters is indicated by a checkmark beside the appropriate task. Select the title to be linked to the appropriate page.
	Create Capture Modes	
	Edit Media Profile	
	Edit Lens Position	Once complete, click the 'X' in the top right corner to remove the Set Up Progress bar.
	SET UP PROGRESS — ✓ POWER ON & CONNECT CAMERA ✓ CREATE CAPTURE MODES ✓ EDIT MEDIA PROFILE ✓ EDIT LENS POSITION	
Top Navigation Bar – Desktop View	Campbell Scientific Logo	Brings user to *Dashboard*.
	Menu Key	Collapses or opens the left navigation sidebar.
	Camera Name	As set in *General Settings,* see Section 13.9.1 *General.*
	Camera Serial Number	From Campbell Scientific Canada.
	Live Video	By selecting *Live Video*, a modal opens with a live video. There is an opportunity to select a *Lens Preset* from a drop down and to adjust the *Zoom* using a slider. *Edit Positions* directs users to the *Lens Position* option. See Section 13.6 *Lens Positions* for detailed instructions.
	Power Icon	Provides a safe power down sequence. The camera will shut down for a period of 10 min to ensure the camera memory is not corrupted.
		After the 10 min period, the camera powers up again.
		In the mobile display, the Power icon appears in the left navigation sidebar.
	CAMPBELL SCIENTIFIC ≡ CAMPBELL SCIENTIFIC #1061 ◎ LIVE VIDEO ⏻	
Top Navigation Bar – Mobile View	Menu Key	Collapses or opens the left navigation sidebar.
	Live Video	By selecting *Live Video*, a modal opens with a live video. There is an opportunity to select a *Lens Preset* from a drop down and to adjust the *Zoom* using a slider. *Edit Positions* directs users

		to the *Lens Position* option. See Section 13.6 *Lens Positions* for detailed instructions.
Left Navigation Sidebar – Mobile View	Campbell Scientific Logo	Brings user to *Dashboard*.
	Camera Name	As set in *General Settings,* see Section 13.9.1 *General.*
	Camera Serial Number	From Campbell Scientific Canada.
	Power Icon	Provides a safe power down sequence. The camera will shut down for a period of 10 min to ensure the camera memory is not corrupted.
		After the 10 min period, the camera powers up again.
		In the mobile display, the Power icon appears in the left navigation sidebar.

The web interface is mobile compatible and works with current browser versions of Internet Explorer, Firefox, Safari, and Chrome.

Some general items to remember about the web interface are:

- The homepage of the camera is the *Dashboard*. There are no operational settings to change on the *Dashboard*. However, a manual photo capture can be initiated from this page using the *Manual Capture* button (Section 13.4).

- If any settings are changed or added, the *Save* button must be clicked to accept the changes. If the *Save* button is not selected, the changes will not be saved.

- Every web page contains a navigation sidebar on the left with options that allow navigation to the other CCFC web pages. On mobile devices or small screen PCs, the sidebar is automatically collapsed to allow more space for content. The sidebar can be reopened by clicking the menu key at the top left of the page.

- The top of every page includes a top navigation bar (Figure 13-3), which includes the *Camera Name* set in Section 13.9.1*General*, the camera serial number, a link to the *Live Video* modal (see Section 13.3.1), and the green power icon.
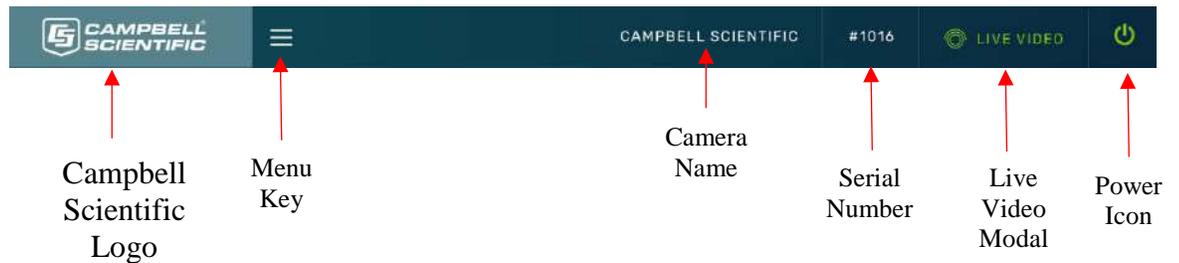
Figure 13-3 Top Navigation Bar – Desktop view

13.3.1 Live Video Modal

The web interface allows the user to view real-time video using the *Live Video* icon. The use of this feature aids in the installation of the camera and testing the photos.

When *Live Video* is selected, the video modal pops-up.
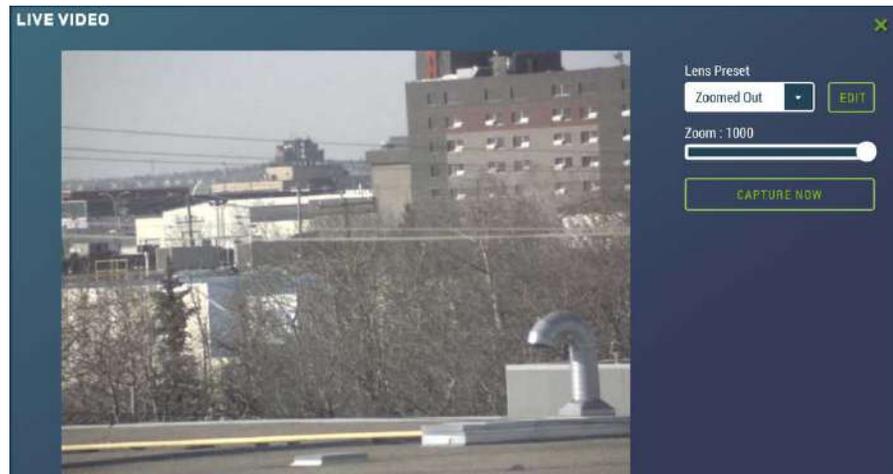
Figure 13-4 *Live Video* **Modal**

With the *Live Video* modal, a user can view the live video stream from the camera. They can choose the lens position they would like to view from, use the *Edit* button to go to *Lens Position* (see Section 13.6), or adjust the zoom level of the live stream video.

Using the *Capture Now* button allows a user to capture a 1280 x 960 photo with *Lossless* quality of what is being viewed through the live video modal.

13.3.2 Power Icon

The green power icon (see Figure 13-3 *Top Navigation bar – Desktop View*) on the top right of every page provides a safe power down sequence. If at all possible, the green power icon should be used any time the power needs to be removed from a camera that is actively collecting and storing photos or video. The camera will completely shut down for a period of 10 minutes and ensure the camera memory is not corrupted. Once selected, a notification will pop-up asking the user if they are sure they want to power down the camera, proceed accordingly.

An alternate way of shutting down the camera is to hold down the *Setup Button* on the camera for at least 10 seconds (Section 8.2 *Setup Button/Status LED*).

13.3.3 Set Up Progress Bar

The *Set Up Progress* bar is visible on every web page. When proceeding through the *Set Up Progress* workflow to configure the CCFC, the bar is updated with check marks.
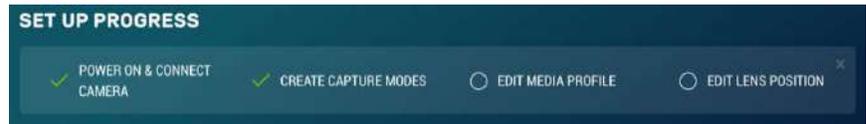
Figure 13-5 Set Up Progress bar

The text in this bar is selectable and links to the associated area required to complete setup.

Selecting the "x" in the top right corner, closes the progress bar. In order to get it back, the user must set the camera back to its factory default setting (Section 13.9.1 *General*).

13.4 Dashboard

The homepage of the web interface is the *Dashboard.*

Figure 13-6 CCFC *Dashboard*

It is important to note that any web server or FTP activity will reset the sleep timer in the camera, so the camera will stay awake for 5 min after the last access to the web page. When a user has the *Dashboard* open, it constantly accesses the web server on the camera loading the time, temperature, humidity, etc. The net

result is that when the *Dashboard* is open, the camera will not go to sleep.

Table 13-4 *Dashboard Components* provides information on the *Dashboard* features.

TABLE 13-4 Dashboard Components	
Parameter	**Description**
Camera Memory CAMERA MEMORY 10144 MB 15448 MB	Available camera memory (max of 16 GB).
Photo Capture PHOTO CAPTURE MANUAL CAPTURE DOWNLOAD	Manual Capture: capture a photo immediately using *Manual Capture* modal. There are two drop downs, one from resolution and one for where to save the image (*Download*: downloads image to the device, *View*: captures a photo to be viewed in the *Manual Capture* modal; see Figure 12-7 *Manual Capture Modal*). The quality of the capture is *Lossless*.
	Download: Navigates to the *File Explorer* to download captured photos.
Time and Date 13:51 :32 NOVEMBER 30, 2016	24 hour clock; current date. When the clock is running the camera is connected and is configurable. If the clock is static, the device browser is displaying a cached version of the camera web interface.
Temperature 0°C TEMPERATURE	CCFC internal temperature. As electronics output heat when in operation, this temperature will almost always be higher than the external temperature.
Humidity 11% HUMIDITY	CCFC internal humidity. Humidity over 50% for an extended period of time is cause for concern. If achieved, contact a Campbell Scientific Measurement Consultant.

Motion 	CCFC motion detect display. The circle displays as green when motion is detected.
Trigger 	CCFC external trigger display. The circle displays as green when an external trigger event occurs.
Capture Mode Summary 	Displays currently enabled capture modes and provides a shortcut to adding new capture modes (+).
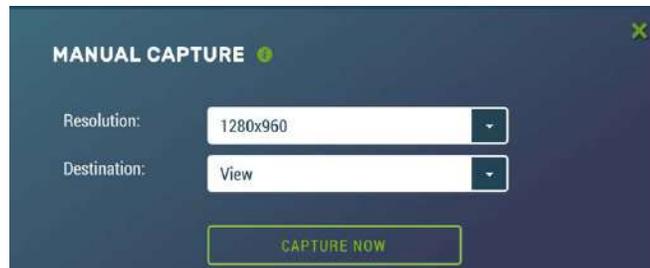
Figure 13-7 Manual Capture Modal

13.5 Capture Modes

Note	Any configuration changes made in the web interface must be saved by clicking the green *Save* button at the bottom of the screen or changes will be lost.

Capture Modes allows a user to set how the media event will be captured.

The *External Trigger* and *Motion Detect* configuration pages include an option labeled *Pre-Record In Seconds*. By entering a value between 1 and 30 in this field, the CCFC will begin buffering video in its camera memory. When an event occurs, the CCFC will store the set number of seconds of video to a file and continue recording the live video until the number of seconds has elapsed.

Video pre-recording allows the camera to record up to 30 seconds of video leading up to a related capture event. This feature can only be used with external trigger and motion detect capture events.

The use of pre-recording does impose some limitations on the functionality available in the CCFC:

- The pre-recording feature can only be used when the camera is in the *Fully On* power mode.
- If Wi-Fi is required for sending files, set the *Wi-Fi Power Mode* to *Always On.*
- If the file caption is *Enabled* in the *Media Settings*, it may be used as part of the Pre-Record configuration and the file caption will be visible in the *Live Preview* on the *Dashboard.*
- If both photo capture and video pre-recording are configured for the same event, photo capture takes precedence. Once the photo has been captured the video recording will occur.
- If *Motion Detect* and *External Trigger* are using the pre-record function, they both must use the same *Media Profile* (see Section 13.7).
- The *Video Duration* is the total recorded video capture length up to a maximum of 60 seconds. The *Pre-Record Duration* is included in that total. For example, if a *Pre-Record Duration* is set as 5 seconds and the total *Video Duration* is 10 seconds, the first 5 seconds of the video will be pre-recorded.

13.5.1 Timed Capture

Timed Capture is used to configure the camera to capture photos or video using the CCFC internal clock.

Figure 13-8 *Timed Capture*

When *Timed Capture* is enabled, the CCFC uses its internal clock as a trigger to initiate the capture of photos or video. In addition to the primary *Timed Capture* event, there is also a second independent *Timed Capture*. Each configuration is independent of the other, but overlapping events may delay or prevent one or the other from occurring. For example, 2 video recordings or photo captures cannot occur at the same time. In the event that there are two captures set for the same time, one will occur right after the other.

The first step in setting up the *Timed Capture* is to select the *Enable* (+) option for the capture method. Once *Enable* is selected, variables for the capture method can be edited. Tables 13-5 *Timed Capture Variables for Photos* and 13-6 *Timed Capture Variables for Videos* summarize all the variables associated with the *Timed Capture* for photos and videos, respectively.
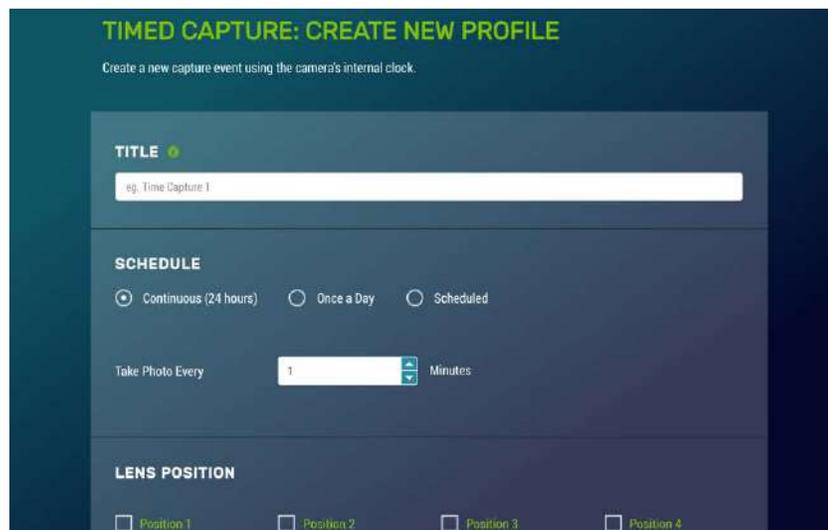
Figure 13-9 *Timed Capture:* **Create New Profile**

TABLE 13-5 Timed Capture Variables for Photos		
Variable	**Allowable Values**	**Description**
Enable	+	Opens *Timed Capture*: *Create New Capture* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* see Section 13.8.
Schedule	Continuous (24hours)	Allows media to be captured continuously (24 hours). Input a numerical value (in minutes) to dictate how often a timed capture event occurs. Minimum allowable value is 1, maximum is 1440.
	Once a Day	Takes one photo at a defined time.
	Scheduled	Schedule photo capture by entering a value in minutes in *Take Photo Every*. Minimum allowable value is 1, maximum is 1440. Input what time the capture event occurs between using the start and end time values.
Lens Position	Checkbox	Select 1- 4 lens positions for the capture (Section 13.6). Selecting the green position title opens the *Lens Position* modal to edit the selected lens position.
Enable Photo Capture	Toggle	Initiates the capture of photos and opens the photo capture settings.
	Take a Single	Set to capture one photo at the set time.

	Photo	
	Take a Series of Photos	Enter the *Number of Images* and *Interval in Seconds* (time between photos) to create a photo burst. Maximum allowable value is 60. This applies to each lens position, so with all 4 lens positions activated, it will take 240 photos. With multiple lens positions enabled during a photo burst, the camera may not be able to meet the timing requirements as configured but it will complete all image captures enabled in the event. The camera will not go to sleep in the middle of a photo burst capture.
Save to Camera Memory	Toggle	Selecting *Save to Camera* enables the photo to be stored to the camera memory.
	Max Space (MB)	Enter desired size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.
	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.
	Sub Folder Date Format	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via Email	Toggle	Enable to initiate sending photos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).

	Toggle	Enable initiates sending photo files via FTP.
Send via FTP	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	Displays current PakBus® Port number. Use the *Edit* button to edit current PakBus® settings via the *PakBus®* modal (Section 13.9.3.3).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).

TABLE 13-6 Timed Capture Variables for Videos		
Variable	**Allowable Values**	**Description**
Enable	+	Opens *Timed Capture: Create New Capture* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* (Section 13.8)*.
Schedule	Continuous (24hr)	Allows media to be captured continuously (24 hours). Input a numerical value (in minutes) to dictate how often a timed capture event occurs. Minimum allowable value is 1, maximum is 1440.
	Once a Day	Takes one video at a defined time.
	Scheduled	Schedule video capture by entering a value in minutes in *Take Photo Every*. Minimum allowable value is 1, maximum is 1440. Input what time the capture event occurs between using the start and end time values.
Lens Position	Checkbox	Select 1- 4 lens positions for the capture. See Section 13.6 *Lens Position.* Selecting the green position title opens the *Lens Position* modal to edit the selected lens position.
Enable Video Capture	Toggle	Enables video capture and opens the video capture settings.
	Video Duration	Set length of video capture event. Maximum is 60 seconds.

	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Save to Camera Memory	Toggle	Selecting the toggle *Save to Camera* enables the video to be stored to the camera memory.
	Max Space (MB)	Enter desires size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.
	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.
	Sub Folder Date Format	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
Send via Email	Toggle	Enable to initiate sending videos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).
Send via FTP	Toggle	Enable to initiate sending videos via FTP.
	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
Send via PakBus®	Toggle	Enabling initiates sending videos via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	PakBus® Port number is displayed. Use the *Edit* button to edit the PakBus® Settings via the *PakBus®* modal (Section 13.9.3.3).

13.5.2 External Trigger

Note   This section applies to use with a datalogger or other applicable trigger source.

External Trigger is used to configure the camera to capture photos or video using an external signal that is applied to the External Trigger input line. In order to activate the *External Trigger* capture, refer to the wiring Table 9-1 *Power & I/O Cable Connections* for information on which wires need to be connected.
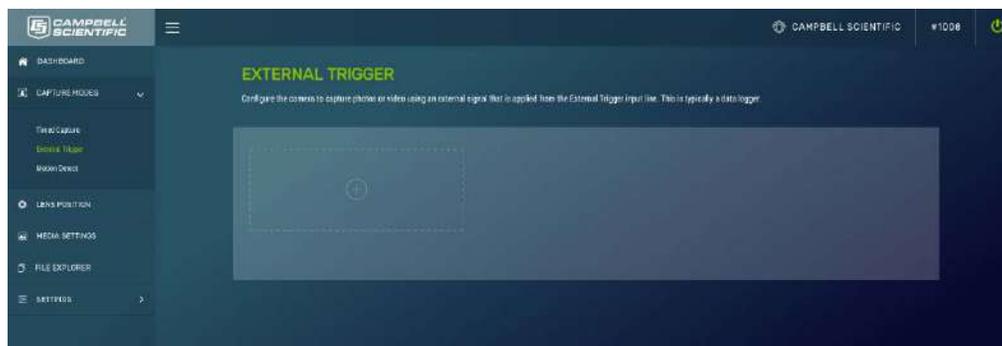
Figure 13-10 *External Trigger*

External Trigger can be configured to *Active High* or *Active Low*. When set to *Active High,* 0 volts is the Inactive state and a positive voltage is the Active state.

The CCFC is shipped from the factory with a pull down resistor connected to the *External Trigger* and the *External Trigger* is set to *Active High*. With this default setting, when no signal is applied to the input, the *External Trigger* is inactive. A positive voltage is required to change to the active state.

The *External Trigger* can be configured for an *Active High* signal or an *Active Low* signal. The capture is triggered by the transition from the inactive state to the active state. The minimum required pulse period is 10 milliseconds (msec). Preferably, pulses should be short in duration (milliseconds). No less than 1 sec between captures is recommended with no more than 5 in a 10 second period.

The voltage levels are:

- Low Level: <0.65 V (-20 Vdc Absolute Min)
- High Level: >2.0 Vdc (+20 Vdc Absolute Max)

Leaving the *External Trigger* signal in the active state prevents the camera from entering into a low powered state. If an external device is allowed to keep the camera in its *Fully On State*, power consumption will be greatly affected.

When the camera is fully on and no other process is occurring, the time from the transition of the signal from inactive to active, to the time a picture is captured or video is started, is typically less than 100 msec. The parameter descriptions for the *External Trigger* setup are outlined in Tables 13-6 and 13-7, respectively.

Figure 13-11 *External Trigger:* **Create New Profile**

TABLE 13-7 External Trigger Variables for Photos		
Variable	**Allowable Values**	**Description**
Enable	+	Opens *External Trigger:Create New Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* (Section 13.8).
External Trigger	Active High	Configures *External* Trigger to capture on a positive voltage.
	Active Low	Configures the *External Trigger* to capture with 0 volts.
Lens Position	Checkbox	Select 1- 4 lens positions for the capture. (Section 13.6). Selecting the green position title opens the *Lens Position* modal.
Enable Photo Capture	Toggle	Initiates the capture of photos and opens the photo capture settings.
	Take a Single Photo	Set to capture one photo at the set time.
	Take a Series of Photos	Enter the *Number of Images* and *Interval in Seconds* (time between photos) to create a photo burst. Maximum allowable value is 60. This applies to each lens position, so with all 4 lens positions activated, it will take 240 photos. With multiple lens positions enabled during a photo burst, the camera may not be able to meet the timing requirements as configured but it will complete all image captures enabled in the event. The camera will not go to sleep in the middle of a photo burst capture.
Save to Camera Memory	Toggle	Selecting *Save to Camera* enables the photo to be stored to the camera memory.
	Max Space (MB)	Enter desires size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.
	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.

	Sub Folder Date Format	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via Email	Toggle	Enable to initiate sending photos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via FTP	Toggle	Enable initiates sending photo files via FTP.
	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	Displays current PakBus® Port number. Use the *Edit* button to edit current PakBus® settings via the *PakBus®* modal (Section 13.9.3.3).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).

TABLE 13-8 External Trigger Variables for Video		
Variable	**Allowable Values**	**Description**
Enable	+	Opens *External Trigger: Create New Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* (Section 13.8).
External Trigger	Active High	Configures *External* Trigger to capture on a positive voltage.
	Active Low	Configures the *External Trigger* to capture on a 0 voltage.
Enable Video Capture	Toggle	Initiates the capture of live video.
	Video Duration	Sets length of video capture event. Maximum is 60 seconds.
	Pre-Record Duration	Sets length of video to be recorded before capture event. Maximum is 30 seconds. Camera must be set to *Fully On*.
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Save to Camera Memory	Toggle	Selecting *Save to Camera* enables the video to be stored to the camera memory.
	Max Space (MB)	Enter desires size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.
	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.
	Sub Folder Date Format	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
Send via Email	Toggle	Enable to initiate sending videos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).

	Toggle	Enable to initiate sending videos via FTP.
Send via FTP	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
Send via PakBus®	Toggle	Enabling initiates sending videos via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	PakBus® Port number is displayed. Use the *Edit* button to edit the PakBus® Settings via the *PakBus®* modal (Section 13.9.3.3).

13.5.3 Motion Detect

Motion Detect is used to configure the camera to capture media using the *Motion Detect* capability of the camera.

Even if this feature is enabled, motion detect only operates when the camera is in the *Fully On* power mode.

Figure 13-12 *Motion Detect*

The CCFC implements an adaptive motion detect scheme in order to help avoid false motion detect triggers that can occur in normal outdoor scenes. The adaptive motion detect method automatically adjusts the motion detect threshold based on the average motion characteristics of a given scene.

The adaptive motion detect is a very good feature for most applications. The adaptive motion detect scheme sets its threshold values based on a 20 second moving average of the scene. For example, if a CCFC was focused on a ceiling fan that was off, the CCFC motion detect would be triggered if the fan was turned on. After a period of 20 seconds the motion detect would no longer be triggered as the continuous motion of the fan would automatically increase the required motion detect trigger level.

Another consideration with adaptive motion detect is that when a continuous level of motion is introduced into a scene, the motion detect sensitivity decreases. The result is that some motion may not be detected when a continuous dynamic scene exists. For example, a person walking through a scene with windblown trees may not trigger the motion detect capture that would normally be triggered when there is no wind and the trees are not moving.

The sensitivity level for motion detect is the only user configurable parameter for *Motion Detect* operation. A value of 1 provides the least sensitive motion detect threshold setting and a value of 99 provides the most sensitive motion detect threshold setting. Motion detect can be a complicated feature to implement. It is recommended to start off with a motion detect threshold setting of 50 and experiment with the performance based on the application.
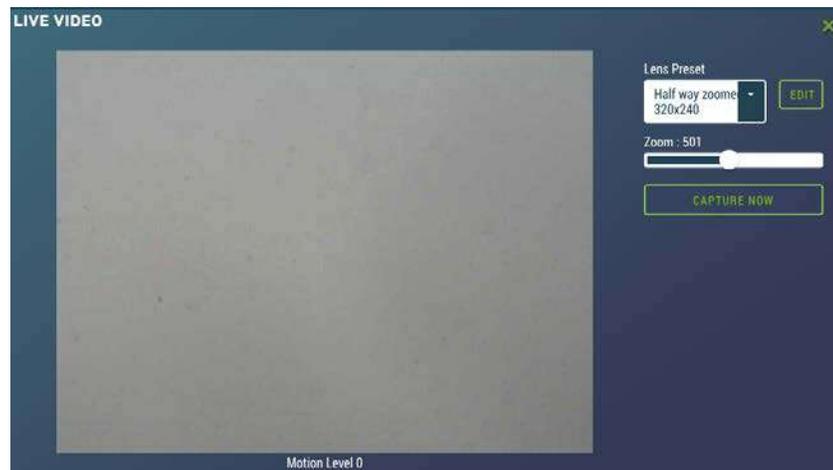
Figure 13-13 Live Video Motion Detect Level

If the camera is not detecting motion that is desired, then the motion detect sensitivity level should be increased. If the camera produces too many false triggers, the motion detect level should be decreased. Note that there is always a possibility that the camera can either produce false motion detects or not detect desirable motion due to too many scene variables. In some cases where motion detect of a small object is required, it may be necessary to set a motion detect level that will also produce frequent false triggers.

Motion Detect Notes:

- If a moving object that requires detection occupies a large percentage of the photo scene, the motion detect tends to be more reliable. Zooming in or moving the camera closer to the moving objects helps improve performance.
- Objects moving slowly within the photo scene require a higher sensitivity setting compared to fast moving objects.
- Sudden changing light levels can falsely trigger motion detect. Sources of false triggers include rapidly changing light levels at sunrise or sunset or during the movement of clouds.
- Good lighting of the photo scene produces the best results**.**
- The motion detect feature uses the full 4:3 ratio frame to capture motion. Still photos in the 320 x 176, 640 x 352, and 1280 x 720 formats and video in the 720p format will crop a portion of the top and bottom of the photo or video.
- Motion detect is paused when video is being recorded.
- The delay from motion occurring to photo capture is typically 1 second (10 seconds for a 5MP photo).
- Motion detect is disabled when the light level is too low, or when the IR LEDs are active.

Figure 13-14 *Motion Detect:* **Create New Profile**

	TABLE 13-9 Motion Detect Settings for Photo Options	
Variable	**Allowable Values**	**Description**
Enable	+	Opens *Motion Detect: Create New Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* (Section 13.7).
Sensitivity	1 to 99	Experimenting with values is the best method for determining where to set the level for the desired application. A Value of 1 is the least sensitive, but less prone to false triggers. A Value of 99 is the most sensitive and is most susceptible to false triggers.
Schedule	Continuous (24hr)	Allows photos to be captured continuously (24 hours).
	Scheduled	Scheduled by entering a value in minutes in *Take Photo Every*.
Lens Position	Checkbox	Select 1- 4 lens positions for the capture. See Section 13.6 *Lens Position.* Selecting the green position title opens the *Lens Position* modal.
Enable Photo Capture	Toggle between On and Off	Initiate the capture of photos.
	Take a Single Photo	Take a photo at a defined time.
	Take a Series of Photos	Enter the *Number of Images* and *Interval in Seconds* (time between photos) to create a photo burst. Maximum allowable value is 60. This applies to each lens position, so with all 4 lens positions activated, it will take 240 photos. With multiple lens positions enabled during a photo burst, the camera may not be able to meet the timing requirements as configured but it will complete all image captures enabled in the event. The camera will not go to sleep in the middle of a photo burst capture.
Save to Camera Memory	Toggle	Selecting *Save to Camera* enables the still photos to be stored to the camera memory.
	Max Space (MB)	Enter desired size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.

	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.
	Sub Folder Date Format	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
	Media Profile	Dropdown to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via Email	Toggle	Enable to initiate sending photos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via FTP	Toggle	Enable initiates sending photo files via FTP.
	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	Displays current PakBus® Port number. Use the *Edit* button to edit current PakBus® settings via the *PakBus®* modal (Section 13.9.3.3).
	Media Profile	Drop down to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).

TABLE 13-10 Motion Detect Settings for Video Options		
Variable	**Allowable Values**	**Description**
Enable	+	Opens *Motion Detect: Create New Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. Also acts as a directory name in the *File Explorer* see section 13.8 *File Explorer.*
Sensitivity	1 to 99	Experimenting with values is the best method for determining where to set the level for the desired application. A Value of 1 is the least sensitive, but less prone to false triggers. A Value of 99 is the most sensitive and is most susceptible to false triggers.
Schedule	Continuous (24hr)	Allows videos to be captured continuously (24 hours).
	Scheduled	Scheduled by entering a value in minutes in *Take Photo Every.*
Lens Position	Checkbox	Select 1- 4 lens positions for the capture. See Section 13.6 *Lens Position.* Selecting the green position title opens the *Lens Position* modal.
Enable Video Capture	Toggle	Initiate the capture of live video.
	Video Duration	Set length of video capture event. Maximum length is 60 seconds.
	Pre-Record Duration	Set length of video to be recorded before capture event. Maximum is 30 seconds. Camera must be set to *Fully On.*
	Media Profile	Dropdown to select a configured media profile. Use the *Edit* button to setup *Media* profiles via the *Media Settings* modal (Section 13.7).
Save to Camera Memory	Toggle	Selecting *Save to Camera* enables the video to be stored to the camera memory.
	Max Space (MB)	Enter desired size (MB) out of 15185 MB. Entering a value of '0" will auto allocate as much space as possible.

	Camera Memory Management Type	*Fill and Stop* will stop recording additional photos once the camera memory is full or the allocated memory size is reached. *Continuous Overwrite* management will start deleting the oldest files once the camera memory is full or the allocated memory size (max space setting from above) is reached.
	Sub Folder Options	An option is given to store photos in a sub folder named by *YY/MM* or *YY/MM/DD*. Selecting the *YY/MM/DD* option has some performance advantages when a large number of photos are taken. Reducing the number of files in a folder speeds up the storing and file management process. Speed advantages are only noticeable if the number of files in the *YY/MM* folder will exceed 1000.
Send via Email	Toggle	Enable to initiate sending videos via email.
	Destination	Drop down to select a configured email settings profile. Use the *Edit* button to setup *Email* profiles via the *Email Settings* modal (Section 13.9.3.2).
Send via FTP	Toggle	Enable to initiate sending videos via FTP.
	Destination	Drop down to select a configured FTP profile. Use the *Edit* button to setup *FTP* profiles via the *FTP Settings* modal (Section 13.9.3.1).
Send via PakBus®	Toggle	Enabling initiates sending videos via the *PakBus®* modal (Section 13.9.3.3).
	PakBus® Port	PakBus® Port number is displayed. Use the *Edit* button to edit the PakBus® Settings via the *PakBus®* modal (Section 13.9.3.3).

13.6 Lens Position

The camera comes pre-configured with four default lens positons, which can be edited to suit a user's requirements. These positions are saved to the camera memory to optimize media capture events. If no lens position is set for the event, the camera will continue to use the current position.

Figure 13-15 *Lens Position*
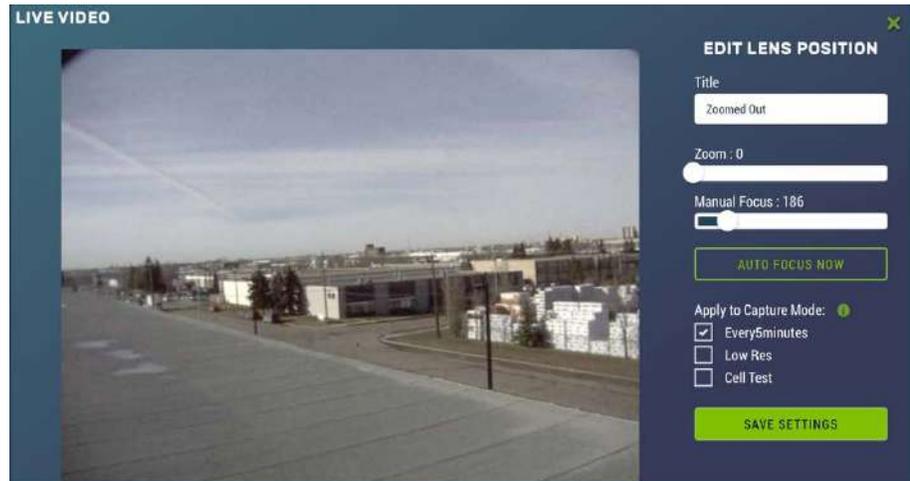
Figure 13-16 Lens Position Modal
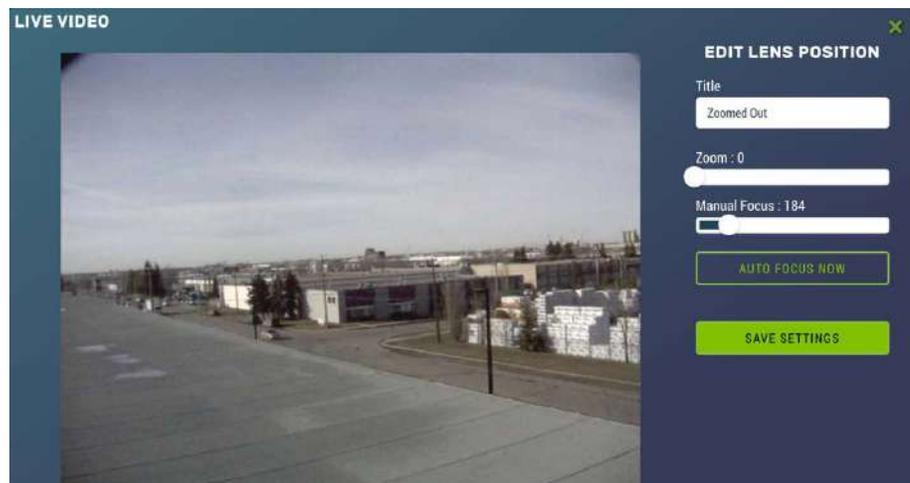
Figure 13-17 Lens Position Modal (in Capture Modes)

TABLE 13-11 Lens Positions Modal		
Variable	**Allowable Values**	**Description**
Edit	Button	Opens *Live Video* to view and edit current lens position.
Title	Text	Name the lens position in order to navigate to it at a later date.
Zoom	Slider	Zooms the camera lens in and out (close-up to wide angle).
Manual Focus	Slider	Slider automatically updates when the Zoom slider is moved, as the camera automatically focuses on the centre of the screen. The Manual Focus slider will only be used to adjust the focus on an item that is not in the centre of view.
Auto Focus Now	Button	Select for auto focus.
Apply to Capture Mode	Checkboxes	Select to associate the lens position to an existing capture mode.
Save Settings	Button	Saves *Lens Position.*

To ensure a clear photo, please refer to the table below referring to the zoom level and minimum focal length.

TABLE 13-12 Minimum Focal Length	
Zoom Position	**Minimum Focal Length (centimetres)**
0	10
100	10
200	10
300	10
400	10
500	10
600	10
700	75
800	500
900	300
1000	80

When multiple lens positions are selected for a capture event the captures will always occur in the same order: starting with lens position 1, then 2, 3 and 4. If both photos and videos are enabled for the capture event the photo capture will occur first and then the video capture.

13.7 Media Settings

The camera comes with four default *Media* Settings which can be edited. *Media Settings* dictate how the media (photo or video) file will operate. *Media Settings* are separated into photo and video. Two different media profiles can be set up for each the photo and video.
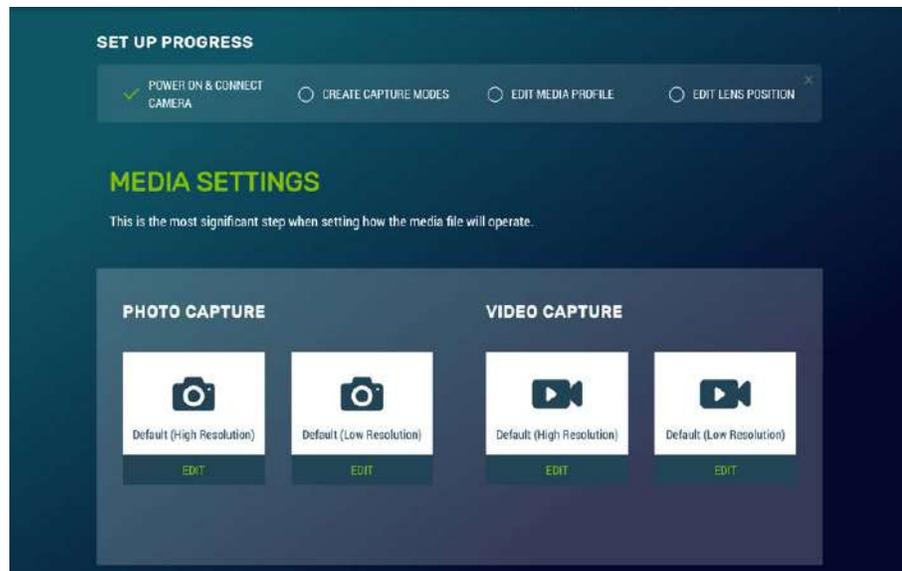
Figure 13-18 *Media Settings*

13.7.1 Photo Capture

The *Photo Capture* settings are significant in determining how the camera will operate. The description of the parameters for the *Photo Capture* setup are outlined in Table 13-13 *Photo Capture Variables*.
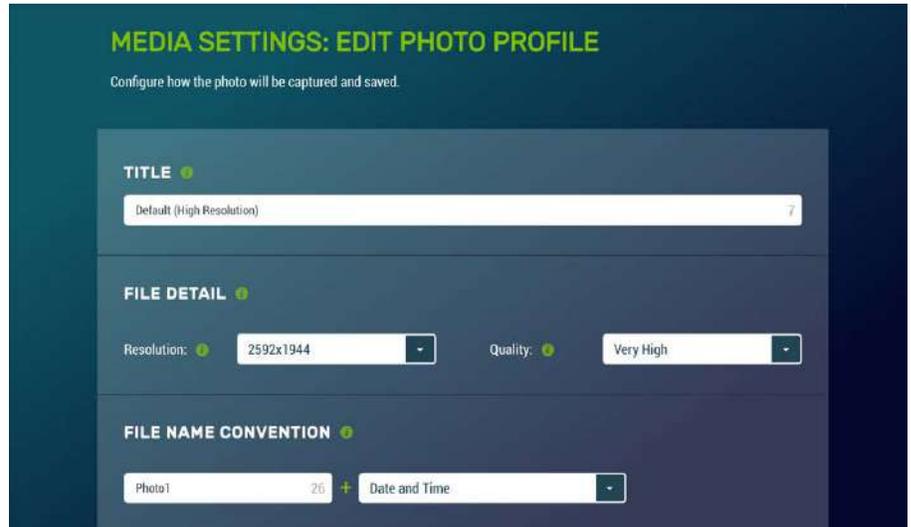
Figure 13-19 *Media Settings*: **Edit Photo Profile**
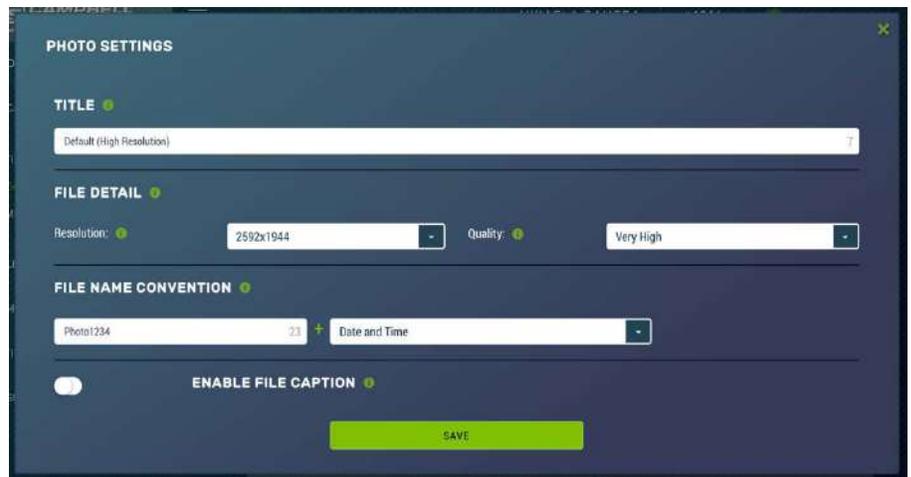
Figure 13-20 *Photo Settings* **Modal**

TABLE 13-13 Photo Capture Variables		
Variable	**Allowable Values**	**Description/Options**
Edit	Button	Opens *Media Settings: Edit Photo Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. This title will appear in the drop down when setting up a *Capture Modes* (Section 13.5).

File Detail	Resolution	320 x 176 320 x 240 640 x 352 640 x 480 1280 x 720 1280 x 960 2592 x 1944
	Quality	Lossless Very High High Medium Low
File Name Convention	Text	Title
	Drop down	None Date and Time Numerical Increment (from 1+). Enter the number to start the increment from.
Enable File Capture	Toggle	When viewing the photo, this information will be displayed.
	Position	Inside Top: (inside referring to overlaying the text on the photo). Displays text, timestamp, and/or serial and temperature. Inside Bottom: Displays text, timestamp, and/or serial and temperature at the bottom of the video. Outside Top: (outside referring to displaying text outside the photo). Displays text, timestamp, and/or serial and temperature. Outside Bottom: Displays text, timestamp, and/or serial and temperature at the bottom of the video.
	Time Stamp	Off YYYY/MM/DD/HH/MM/SS MM/DD/YYYY/HH/MM/SS MM/DD/YYYY/HH/MM MM/DD/YYYY
	Text	Text to be displayed on the photo. (e.g. site location information). Character limits in Table 13-14 are based on photo resolution.

	Serial & Temperature	*Enable* or *Disable* Serial: serial number of the camera. Temperature: internal temperature of the camera.

TABLE 13-14 Photo Resolution Details				
Resolution	**Size with Outside Banner**	**Maximum Characters in Banner**	**Quality**	**Typical File Size* (kB)**
320 x 176	320 x 192	45	Lossless	32
			Very High	16
			High	12
			Medium	8
			Low	6
320 x 240	320 x 256	45	Lossless	40
			Very High	20
			High	15
			Medium	10
			Low	8
640 x 352	640 x 384	64	Lossless	120
			Very High	40
			High	28
			Medium	20
			Low	16
640 x 480	640 x 512	64	Lossless	132
			Very High	48
			High	32
			Medium	25
			Low	18
1280 x 720	1280 x 752	98	Lossless	448
			Very High	128
			High	75

			Medium	54
			Low	40
1280 x 960	1280 x 992	98	Lossless	580
			Very High	164
			High	96
			Medium	68
			Low	48
2592 x 1944	2592 x 1984	136	Lossless	1900
			Very High	500
			High	264
			Medium	190
			Low	150
*actual file size varies based on lighting conditions and subject matter				

13.7.2 Video Capture

By selecting the *Video Capture,* the *Media Setting: Edit Video Profile* web page appears. There are two subtabs that provide two independent types of video to be recorded.

The video resolution and frame rate are the two factors that determine the video file size. Table 13-14 *Typical Video File Sizes* shows the approximate file size for every second of recorded video: the largest file sizes are produced by the 720p 30FPS video, which is 500Kbytes (0.5 MB) per second of video. The smallest video files are produced by the 320 x 240 7.5 FPS video, which is 9 Kbytes per second of video.
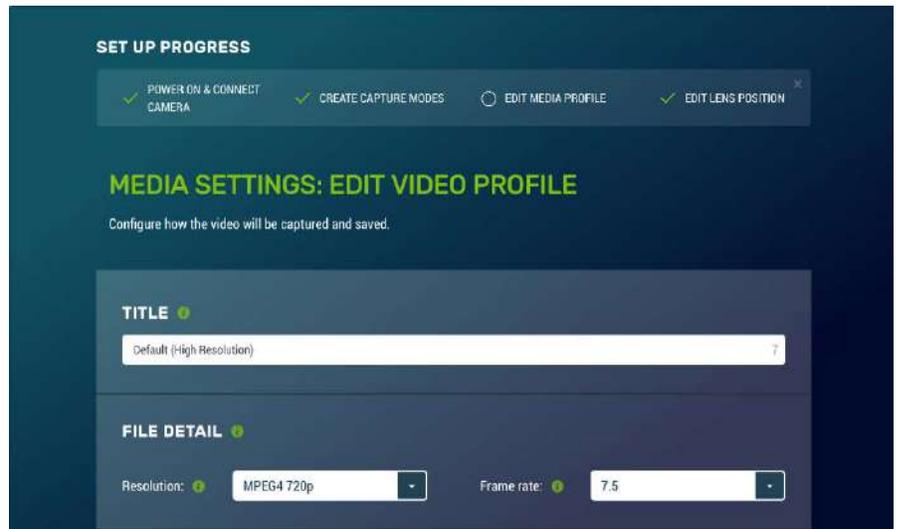
Figure 13-21 *Media Settings:* **Edit Video Profile**
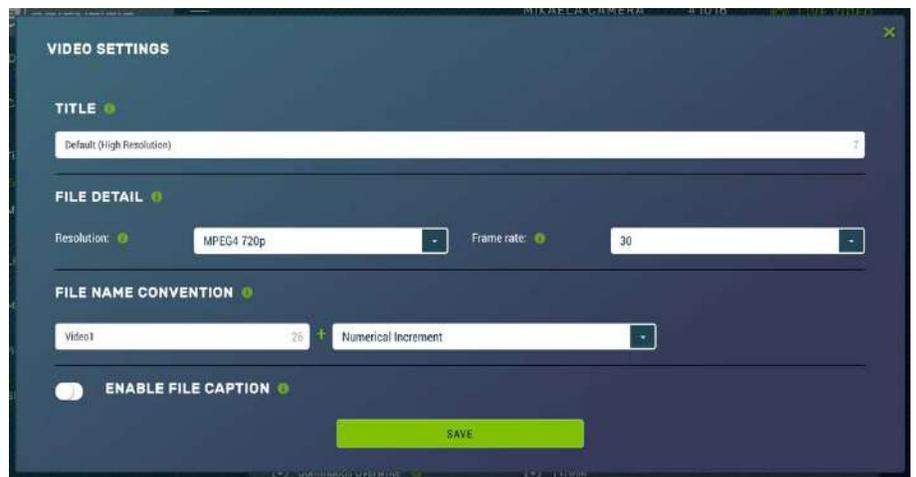
Figure 13-22 *Video Settings* **Modal**

TABLE 13-15 Video Capture Variables		
Variable	**Allowable Values**	**Description**
Edit	Button	Opens *Media Settings: Edit Video Profile* to add parameters.
Title	Text	Name the setting in order to navigate to it at a later date. This title will appear in the drop down when setting up a *Capture Mode* (Section 13.5).
File Detail	Resolution	MPEG4 320 x 240 MPEG4 720p

	Frame Rate	7.5, 15, or 30 frames per second (fps). Lower frame rates can reduce file sizes, but will also reduce fluidness of the video.
File Name Convention	Title	Names the media file.
	File name suffix	*None*: the same file name will be overwritten in the camera memory every time a video is recorded *Date and Time:* each file will have a timestamp appended to it. Ex: Video1_2011_01_28_14_22_10.avi *Numerical Increment:* a unique number is appended to each file. When selected an additional box appears allowing a starting number to be entered (from 1+). Ex: Video1_0000001994.avi.
Enable File Caption	Toggle	When viewing the video, this information will be displayed.
	Position	Inside Top: Displays text and timestamp at the top of the video. Inside Bottom: Displays text and timestamp at the bottom of the video.
	Time Stamp	Off YYYY/MM/DD/HH/MM/SS MM/DD/YYYY/HH/MM/SS MM/DD/YYYY/HH/MM MM/DD/YYYY
	Text	Text to be displayed on the video. (e.g. site location information). Character limits for video are visible in Table 13-14 and are based on resolution.

TABLE 13-16 Typical Video File Sizes		
Resolution	**Frames Per Second**	**Kbytes per Second**
720p	7.5	125
	15	250
	30	500
320 x 240	7.5	10
	15	20
	30	65

13.8 File Explorer

File Explorer allows users to access the media files saved to the camera memory. The web interface provides a method of viewing, downloading, or deleting photos and video from the camera memory via the *File Explorer*. It is possible to delete either complete or portions of directories or subfolders, as well as individual photos or videos. Be cautious when using the *Delete Selected* function.

Each capture event is allocated a set amount of space on the camera memory based on the inputted *Capture Mode* under *Save to Camera*, *Max Space*. The *File Explorer* list displays the *Size Used* and *Size Allocated* for each capture event. As more space can be allocated on the event configuration page than is available on the camera memory, the camera automatically scales the allocated space to fit the camera memory. This page shows the actual space available for each capture event, as well as the space currently being used.

FILE EXPLORER

Explore all media files currently saved to the camera memory.

CAMERA MEMORY DETAILS

Event	Size Used	Size Allocated
Timed Photo 1	3.8 MB	14.9 GB
Timed Video 1	96.1 MB	99.5 MB
Timed Photo 2	0 bytes	0 bytes
Timed Video 2	0 bytes	0 bytes
Trigger Photo	0 bytes	0 bytes
Trigger Video	0 bytes	0 bytes
Motion Photo	0 bytes	0 bytes
Motion Video	0 bytes	0 bytes

Figure 13-23 *File Explorer:* **Camera Memory Details**

Figure 13-24 *File Explorer:* **File Details**

There is a possibility of nine main directories that are created for media storage on the camera. There is a photo and video directory for each type of capture method and a directory for manually captured photos. A directory will not be created by the camera if a capture method is not used.

The directory names are dictated by the title of the *Capture Modes* (Section 13.5).

Clicking on one of the main folders displays the contents inside. Another set of subfolders will be displayed within the main folder. The camera creates subfolders that are named by date. The date subfolders can be configured to store photos in folders named either by Year_Month or Year_Month_Day.

| Note | Video files are unable to be downloaded from the *File Explorer* in iOS mobile devices, as per Apple regulations. |

13.9 Settings

13.9.1 General

The *General* Settings page has three configuration sections:

- Camera Name
- Date and Time Settings
- Default Factory Reset
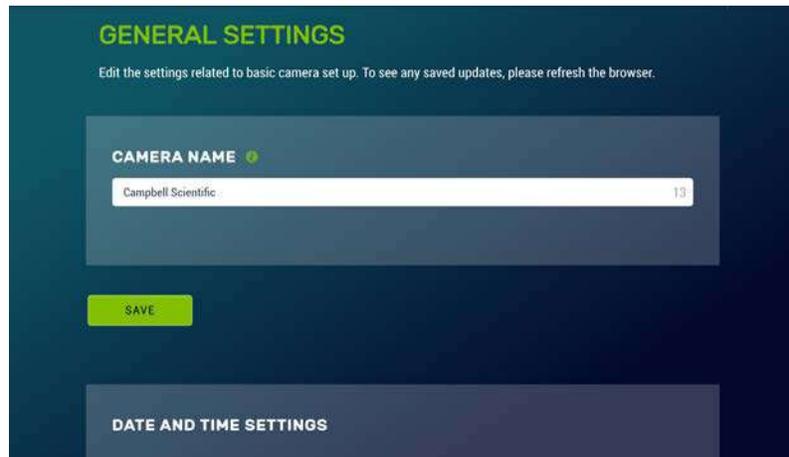
Figure 13-25 *General Settings*

TABLE 13-17 General Settings Variables		
Variable	**Allowable Values**	**Description**
Camera Name	Text	Sets the name to be used as the web page heading. By default, the *Camera Name* is set to Campbell Scientific. This provides an easy way of confirming that the camera is connected to the web interface. Limited to 32 characters.
Date and Time Settings	Date and Time	Displays the current *Date and Time* of the CCFC.
	Set Date and Time	*Synch with Local Time*: when selected, the local time and date are displayed for verification. *Set Manually*: input date and time values in drop down menus provided. *Synch with SNTP Server*: a means of synchronizing the CCFC onboard clock with a specified SNTP server to ensure the CCFC clock is always accurate. A time zone offset can be configured for the CCFC. See Section 13.9.1.1 *SNTP* for more details.
	Local Time	Displays the local time.
	Timezone	Select desired timezone from drop down options. This option is only available if *SNTP* is chosen from the *Update Source* drop down.
	Adjust for DST	Select, if desired. This option is only available if *SNTP* is chosen from the *Update Source* drop down.

Automatic Updates (optional)	Update Source	*None* *PakBus® Port*: normally this is a datalogger. The actual time update occurs only when a file transfer occurs to the datalogger from the camera. *SNTP Server*: A network connection is required for this option. Automatically update the time from an external server.
	Variance	Time variance (in seconds) to perform clock update. Select the minimum allowable variance that will result in the camera's time being changed.

13.9.1.1   SNTP

Selecting *Sync with SNTP Server* from the drop down opens the SNTP Server Address box where the server automatically receives time updates, which can be configured. See http://www.pool.ntp.org/en/ for a list of publicly available time servers.

The configuration of an SNTP server provides a means of synchronizing the onboard clock of the CCFC with the specified SNTP server. This ensures that the camera clock is always accurate. It is also possible to configure a time zone offset for the camera.

Other than the address of the SNTP server, the time zone needs to be selected and the *Adjust for DST* (daylight savings time) can also be selected.
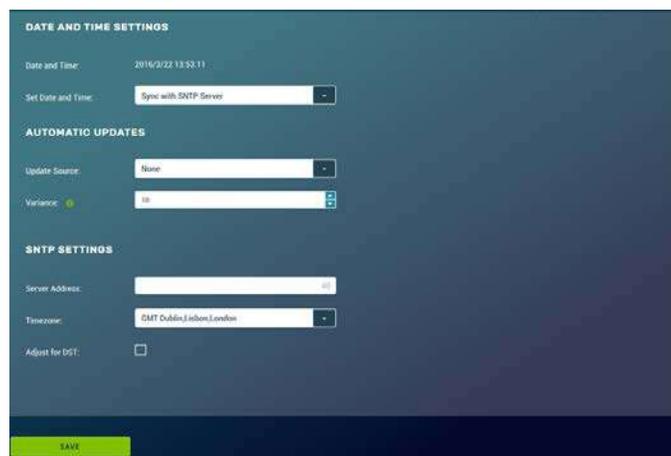
Figure 13-26 Date and Time Settings: Sync with SNTP Server

13.9.2 Network

The *Network* page allows for media files to be sent through the Internet. Additionally, the *Network* page allows the user to configure settings that are related to the CCFC network connectivity.

If changes are made to the camera that affect the access to the web interface, the browser must be restarted with the new configuration.

For example, if the IP address of the camera is changed, the changes will be accepted by clicking on the *Save* button. The new IP address will be in effect and access to the camera will be lost. To regain access, enter the new IP address into the web browser.

Figure 13-27 *Network*

| **Note** | Any changes made to this page require confirmation via a browser pop-up. |
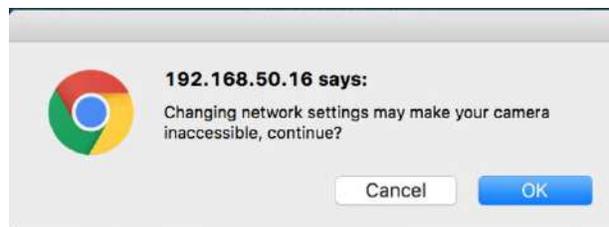
Figure 13-28 Network Pop-up on Google Chrome

13.9.2.1 Ethernet Settings

The CCFC default is to use the static IP address 1.2.3.4. As required, the CCFC can be configured for a DHCP Network. The available network settings are displayed on the *Ethernet Settings* page. These settings are summarized in Table 13-18.

Figure 13-29 Wired Ethernet Settings

TABLE 13-18 Ethernet Settings		
Variable	**Allowable Values**	**Description**
Configure Automatically	Checkbox	Enables DHCP operation of the network interface. Operates as a Static IP address if Disabled (unchecked).
IP Address	1.2.3.4	Only set if DHCP is Disabled. Gain IP address from a network administrator.
Netmask	255.255.255.0	Only set if DHCP is Disabled. Gain Netmask from a network administrator.
Default Gateway	192.168.1.1	Only set if DHCP is Disabled. Gain Default Gateway from a network administrator.
Primary Name	192.168.1.1	Only set if DHCP is Disabled. Gain Primary

Server		Name Server from a network administrator.
HTTP Port	80 or values between 1025 and 65535	Alternate ports can be used for the http interface. Gain HTTP Port from a network administrator.

13.9.2.2 Wi-Fi Settings

The onboard Wi-Fi connection allows the camera to transmit files without the need for a wired Ethernet connection. The Wi-Fi acts as a way to connect to the camera to configure the settings. The camera does not relay network traffic between the Wi-Fi and wired Ethernet connections, meaning a computer connected to the camera's Wi-Fi access point will not be able to access the wired network.

The Wi-Fi on the camera can connect to an existing network or become a Wi-Fi access point. By default, the camera Wi-Fi will be set up as an access point with a name such as *CCFC-9999,* where *9999* is the serial number of the camera. This allows the user to quickly find and connect to the camera on the first power up.

Note The CCFC does not currently support Wi-Fi protected setup (WPS) as a configuration mechanism.
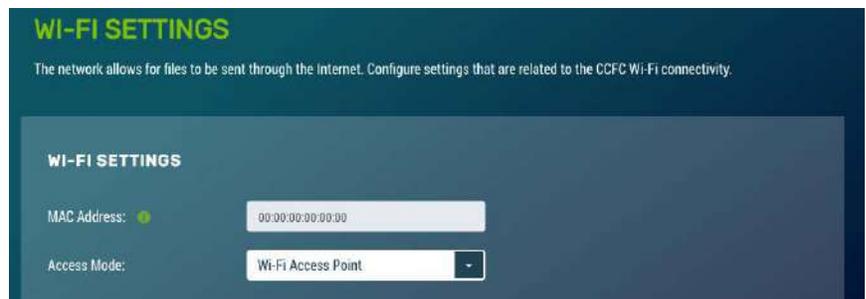
Figure 13-30 *Wi-Fi Settings*

As shown in Table 13-19 *Wi-Fi Set* there are two items on the *Wi-Fi Settings* page: *Wi-Fi Settings* and *Access Point Settings.*

<table>
<tr><th colspan="3">TABLE 13-19 Wi-Fi Settings</th></tr>
<tr><th>Variable</th><th>Allowable Values</th><th>Description</th></tr>
<tr><td>MAC Address</td><td>Text</td><td>Provides the address of the Wi-Fi controller on the camera. This address is different for existing network and access point modes.</td></tr>
<tr><td rowspan="3">Access Mode</td><td></td><td>Allows for control over the access points to the camera through the Wi-Fi. Default setting is *Wi-Fi Access Point.*</td></tr>
<tr><td>Existing Network</td><td>Connect to one of the three settings in order to set up and communicate with the camera.</td></tr>
<tr><td>Wi-Fi Access Point</td><td>Sets the camera up as a wireless access point in order to access all Internet programs and functions.</td></tr>
</table>

13.9.2.3   *Wi-Fi Access Mode*

13.9.2.3.1 **Wi-Fi Access Point**

When the camera is configured as a Wi-Fi Access Point (AP), the AP Settings are revealed, allowing the user to customize the way the AP works. Typically, AP mode would be used in an installation where the camera was not sending files out via the Wi-Fi interface to an external network and Wi-Fi was only used when connecting to the camera to change the configuration, to view the live video, or download media to the connected device.

The camera has a built-in DHCP server that runs when the Wi-Fi is configured in AP mode. It is responsible for supplying configuration information to clients that connect to the camera access point. By default, the camera will be accessible at http://10.0.0.1 when connecting to the Wi-Fi Access Point.

There are seven Access Point settings for the Wi-Fi AP mode, the first four should be configured for all installations, the last three only need to be changed if there is a specific reason (Table 13-20).

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Figure 13-31 *Access Point Settings*

Note	When troubleshooting network connectivity, use the *Show Password* checkbox to ensure the password entered is correct.	

TABLE 13-20 Access Point Settings		
Variable	**Options**	**Description**
AP Name*	Text	A user friendly name that will show up when searching for networks.
AP Channel*	Drop down	Select from 1 – 11. Wi-Fi channel to be used for the AP. Can be changed to reduce interference from other nearby Wi-Fi networks.
IP Address*	Number (e.g. 10.0.0.1)	Camera IP address when acting as an access point.
Netmask*	Number (e.g. 255.0.0.0)	Network mask of the Wi-Fi network to be used.
DHCP Start	Number (e.g. 10.0.0.10)	Start of the address range to give to connecting clients.
DHCP End	Number (e.g. 10.0.0.19)	End of the address range to give to connecting clients.
AP Security	None WEP WPA – Personal WPA2 - Personal	The type of encryption used to secure the network. It is strongly recommended to use WPA2 for the highest possible security.
AP Password	Text	Used when AP Security is activated. This password will be used when connecting to the camera via Wi-Fi (see Section 12.1 *Setup Using Wi-Fi*).
*Required		

Note	If you find you are able to connect to the camera's Access Point, but cannot access the web interface, it is recommended to disable then re-enable the connected device's Wireless Network Connection. Alternately, try restarting the connected device.

13.9.2.3.2 Existing Network

The Wi-Fi settings information appears when the camera Wi-Fi is configured to operate with an existing network. Typically, this mode would be used when the camera is regularly connected to an existing Wi-Fi network to transfer files or to eliminate the need to connect a wired Ethernet cable.
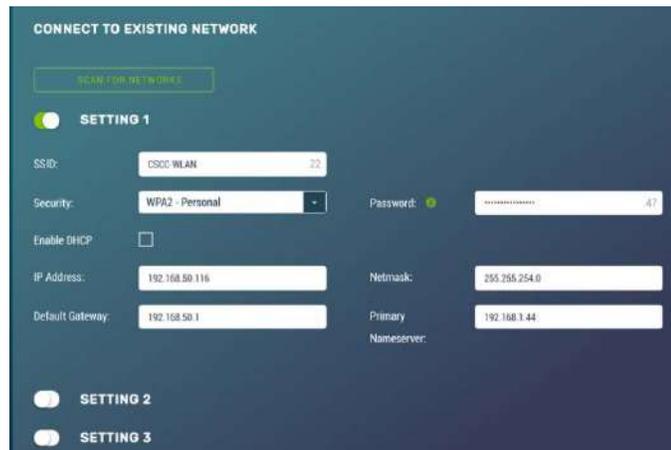
Figure 13-32 *Connect to Existing Network*

The *Scan For Networks* button appears when the *Access Mode* is in *Existing Network*. This button searches for nearby Wi-Fi access points and displays a list. The list includes the name, address, channel, signal strength, network, and encryption types. There are also buttons which copy the selected AP information into the configuration section for ease of use, which appear when the *Connected to Existing Network* option is selected.

After performing a scan for Wi-Fi networks, the user can quickly copy the selected network information into one of three client settings by pressing the button in the result table. After this step, if the Wi-Fi network is using encryption, the password must be entered into the password box in order to connect.

Typically, this is all that is required to connect to a Wi-Fi network, as nearly all networks supply configuration information using DHCP. However, if necessary, the process can be done manually.

When the camera tries to connect to a Wi-Fi network, it will perform a scan and connect to the first network that is configured in the list. For example, if networks in both settings 1 and 2 are present, the camera will use settings 1.

There are also eight settings associated with each Wi-Fi client connection as shown in Table 13-21 *Existing Network Settings for Wi-Fi Clients*.

TABLE 13-21 Existing Network Settings for Wi-Fi Clients	
Variable	**Description**
SSID	The friendly Wi-Fi network name to connect to.
Security Type	The encryption method used by the Wi-Fi network.
Password	The password used for encrypted communication.
Use DHCP	Enable if the Wi-Fi network has a DHCP server (likely yes).
IP Address	The IP address of the camera. Used if no DHCP server is present or for custom configurations.
Netmask	The network mask to use when connecting to the Wi-Fi network.
Default Gateway	The network gateway to use for Internet traffic.
Primary Name Saver	The DNS server to use for address resolution.

The *Status* page is used for troubleshooting connectivity.

Figure 13-33 *Network Status* **Page**

If the CCFC is experiencing connectivity difficulty, send the information from this page to a Measurement Consultant.

13.9.3 File Transfer

When performing multiple captures and transfers off the camera in rapid succession, the camera will queue file transfers in order to allow more captures to proceed immediately. File queueing separates the transfer functions from the capture events, so they both work in parallel.

The camera can queue up to 60 files for each transfer method. 60 FTP, 60 Email, and 60 PakBus® transfers can all be queued while one of each is being transferred.

13.9.3.1   FTP

Note | This section is only necessary when using an external server to store media files.

The *File Transfer Protocol (FTP)* allows media files to be stored on a third-party server. The CCFC allows for two external servers for media storage to be setup.

Figure 13-34 *FTP Settings*

Figure 13-35 *FTP Settings* **Modal**

These settings configure the parameters that the camera will use to connect to the server. The FTP transfers must be enabled in the *Capture Modes* (Section 13.5). When specifying an FTP connection, the user can select between active and passive mode file transfers. The default setting is passive mode, which allows a camera to connect through a firewall to transfer files properly through the firewall to the remote server.

In the event of an FTP transfer failure, the CCFC will retry sending the file to the FTP server up to two times before aborting the file transfer.

The CCFC also acts as an FTP server to enable photos and video to be transferred from the camera memory for external storage, processing, or anything required of media files.

Note   When troubleshooting network connectivity, use the *Show Password* checkbox to ensure the password entered is correct.

TABLE 13-22 FTP Settings		
Variable	**Toggle, Drop Down, Numerical, or Text**	**Description**
Profile Name	Text	Enter connection name. This name will appear in the drop down when setting up a *Capture Mode* (Section 13.5).
Server Address	Text	For example, ftp.company.com.
Port	Numerical	Select the Port number (this is often 21).
User Name	Text	Enter a user name (if applicable).
Password	Text	Enter a password (if applicable).
Upload Path	Text	The file upload path specifies the directory on the destination FTP server where the media will be saved.
Transfer Mode	Active	In active mode, the client establishes the command channel but the server establishes the data channel.
	Passive	In passive mode, the client establishes both channels. In that case, the server tells the client which port should be used for the data channel. This is the default setting.

13.9.3.2 Email

Email displays the email settings. The CCFC can send photos or video via email. There are two separate servers which can be set up.

Many SMTP servers are capable of using Transport Layer Security (TLS) encryption to securely communicate with email clients. Some SMTP servers, such as Gmail, require secure connections in order to allow access. Support for TLS encryption is available in the CCFC SMTP program. If the CCFC connects to an SMTP server that supports TLS encryption, it will automatically be used, otherwise it will return to a normal, unencrypted connection. Encrypted connections are more secure.

In the event of a SMTP transfer failure, the CCFC will retry sending the file to the mail server up to two times before aborting the file transfer.
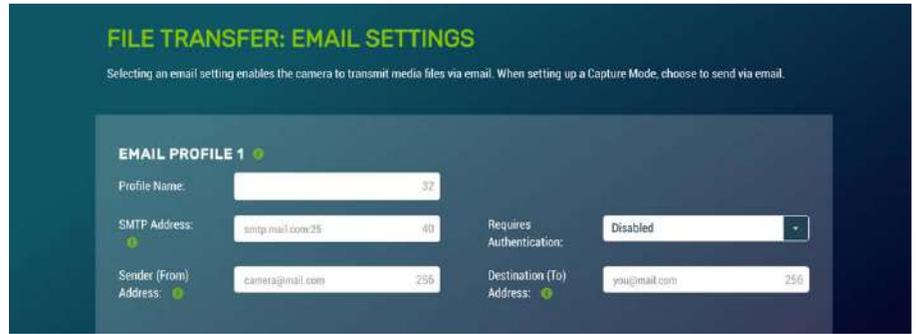
Figure 13-36 *Email Settings*

Figure 13-37 *Email Settings* **Modal**

TABLE 13-23 Email Settings		
Variable	**Toggle, Drop Down, or Text**	**Description**
Profile Name	Text	Enter a name. This name will appear in the drop down when setting up a *Capture Mode* (Section 13.5).
SMTP Address	Text	Enter the SMTP server address that is being used. Enter the SMTP server port number as part of the SMTP address, if required. The camera will default to Port 25 if a value is not included. Ex: mail.server.com:587.
Requires Authentication	Drop down	*Enable* when email server requires authentication. If *Enabled,* an *Account* and *Password* are required. *Disabled* is the default setting.
Sender (From) Address	Text	The Email address associated with the account is normally used here. The CCFC cannot receive emails.
Destination (To)	Text	Recipient's Email address. Multiple email addresses can

Address		be entered. To use multiple email addresses, separate them by a comma or semi-colon (ex: test1@somewhere.com;john@email.com).
Account (only required if authentication is used)	Text	An email address.
Password (only required if authentication is used)	Text	Password associated with the email account.

Note	When troubleshooting email connectivity, use the *Show Password* checkbox to ensure the password entered is correct.

13.9.3.3 PakBus®

PakBus® is used to enable media files to be sent to a PakBus® compatible device (Campbell Scientific dataloggers). Ensure the PakBus® device is set up to receive (see LoggerNet Manual, which is available for download at http://www.campbellsci.eu/loggernet). Maximum file size that can be sent is 2 MB.
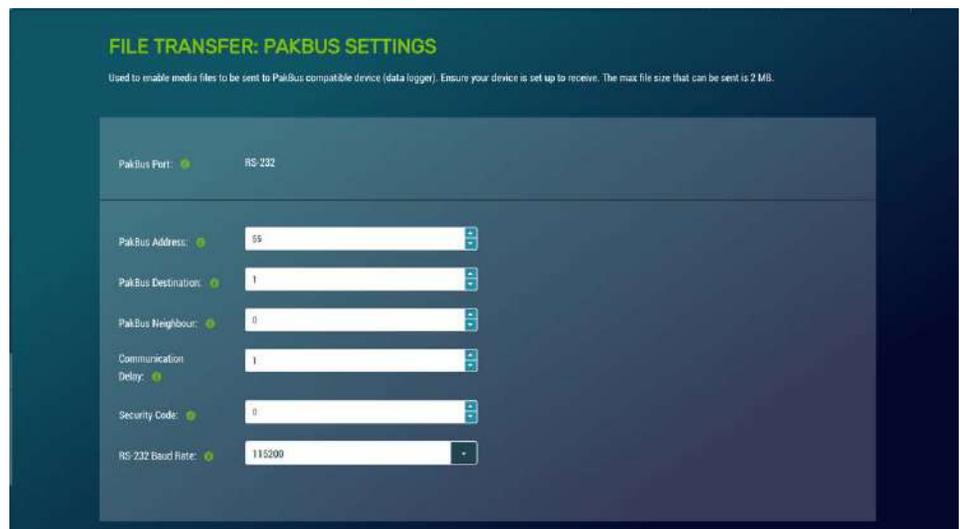
Figure 13-38 *PakBus® Settings*

Figure 13-39 *PakBus®* **Modal**

Communications using the PakBus® protocol enables remote retrieval and/or storage of photos or video to external devices such as compatible Campbell Scientific dataloggers. Meaning, photos can be stored on the datalogger, which allows for remote retrieval using the datalogger's communication device. Both RS-232 and RS-485 are available. The preferred setting is determined at the time of ordering. Contact Campbell Scientific for more information.

Additionally, the PakBus® neighboring address allows for communication with devices that are several hops away on the PakBus® network. Further information on PakBus® is available in Section 15 *Send via PakBus® : PakBus® Communications.*

		TABLE 13-24 PakBus® Settings
Variable	**Allowable Values**	**Description**
	Not editable.	Displays as RS-232 or RS-485, depending on the option selected at the time of purchase. (Section 14 and Section 15). This value will appear when setting up a *Capture Mode* (Section 13.5).
PakBus® Address	1 to 4095	Enter PakBus® Address from 1 to 4095. The factory default is 55. This should be a unique address in the PakBus® network.
PakBus® Destination	1 to 4095	The PakBus® address of the device the camera will communicate with or send files to.
PakBus®	0 to 4095	Physically enter the address of the PakBus® device to connect to

Neighbour		the CCFC PakBus® communication lines. This allows the neighbor to relay communication between the CCFC and the final destination for the data. 0 is autodetect.
Communication Delay	1 to 16	Extra delays may be required for certain communication links such as satellite.
Security Code	0 to 65535	The factory default is 0. If a security code is not required by the PakBus® destination device, set this parameter to 0. Otherwise set the security code as required by the destination service.

13.9.4 Camera Operation

13.9.4.1 Camera Power Modes

Figure 13-40 *Camera Power Modes*

The combination of the *Camera Power Mode* and *Ethernet Power Modes* dictates the camera's power draw. There are four *Camera Power Mode* options:

- *Fully On State:* used if no power constraints exist or if high performance is required.
- *Partially On State:* provides substantial reduction in power.
- *Deep Sleep State:* provides very good power savings. Recommended for use if more than 24 triggers are expected per day.
- *Off State:* offers the best power savings. Useful if less than 24 images or video captures are required per day.

TABLE 13-25 Camera Power Modes		
Power Mode	**Ethernet Power Save Mode**	**Operating Characteristics**
Fully On	Always On	Camera is always on. Highest power consumption. Ethernet is on and always available for incoming communications.
	Moderate Power Save Mode	Not recommended.
	Full Power Save	Camera is always on. Average power consumption is reduced by 50mA @ 12 Vdc. The Ethernet is normally turned off and is only enabled when outgoing communications are required (email or FTP). User needs to push the *Setup Button* to temporarily enable the Ethernet port for web page access.
Partially On	Always On	The camera is effectively off in a low powered state. Typical power consumption is 90 mA @ 12 Vdc. Ethernet is on and always available for incoming communications. The camera will temporarily wake up to the fully on power mode when traffic occurs on the network. **Warning:** In situations where there is constant network traffic, the camera may effectively be in the *Fully On* power mode.
	Moderate Power Save Mode	The camera is effectively off in a low powered state. Typical power consumption is 60 mA @ 12 Vdc Ethernet is enabled only for outgoing communications such as FTP or email. Disconnecting and connecting the camera to another Ethernet device will momentarily wake up the camera to allow it to process incoming communications. The camera will go into the low powered mode again – if no communications occur.
	Full Power	The camera is effectively off in a low powered state.

	Save Mode	Average power consumption is typically 10 mA @ 12 Vdc.
		The Ethernet is normally turned off and is only enabled when outgoing communications are required (email or FTP).
		User needs to push the *Setup Button* to temporarily enable the Ethernet port for web page access.
		The camera can respond to RS-232 or RS-485 communication in this mode.
Deep Sleep	Always On	The Deep Sleep power consumption (6mA typically) is not affected by the Ethernet Power Mode.
		Ethernet, RS-232 or RS-485 communications are non-responsive in *Deep Sleep* mode.
	Moderate Power Save Mode	Not recommended.
	Full Power Save Mode	The Deep Sleep power consumption (6 mA typically) is not affected by the Ethernet Power Mode.
		If Ethernet communications are not used this can reduce the power consumption of the camera by 50mA when the camera exits the *Deep Sleep* state.
Off State	Always On	The Off State power consumption (1 mA typically) is not affected by the Ethernet Power Mode.
		Ethernet, RS-232 and RS-485 communications are non-responsive in the *Off* State.
	Moderate Power Save Mode	Not recommended.
	Full Power Save Mode	The *Off State* power consumption (1 mA typically) is not affected by the Ethernet Power Mode.
		If Ethernet communications are not used, this can reduce the power consumption of the camera by 50 mA when the camera exits the *Deep Sleep* state.

Note   See Section 12.8.4.2 *Ethernet Power Mode* for other settings that influence power consumption.

TABLE 13-26 Capture Response Time	
Power Mode	**Typical Capture Time from Trigger Event (seconds)**
Fully On	< 1
Partially On	10
Deep Sleep	10
Off State	90

Capture response time shows typical response times from when a trigger occurs to the time that a photo or video is taken. The *Off State* takes the longest, as the main processor is not powered on in this state and it must completely boot up to operate again from the *Off State.*

When the camera is configured in a sleep mode and a Timed Capture event is configured, the camera will wake up early in order to capture at the exact time specified in the capture event. For Partially On and Deep Sleep modes, the camera will wake up 20 seconds before the capture time. And in Off Mode, the camera will wake up 100 seconds early.

The camera will not go to sleep unless there is sufficient time between captures for it to sleep and wake up again. In Partially On and Deep sleep mode there must be at least 20 seconds for the camera to sleep, in Off Mode there must be at least 120 seconds.

13.9.4.2   Ethernet Power Mode

Ethernet Power Mode dictates the Ethernet power draw. To reduce power consumption, the CCFC includes the ability to control the power characteristics of the Ethernet port.

The specific behaviour of the camera's Ethernet power save is also influenced by the Power mode of the camera. Table 13-27 *Ethernet Power Modes* outlines the Ethernet power saving features versus various camera power modes.
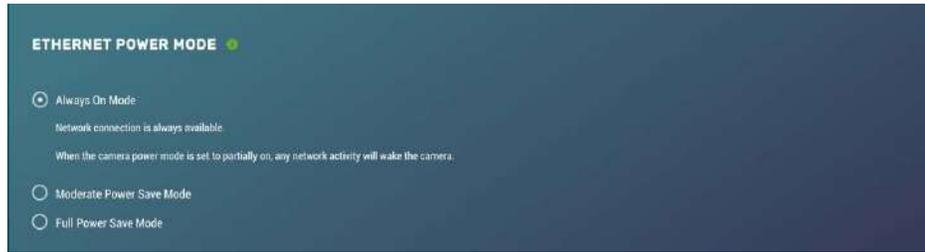
Figure 13-41 *Ethernet Power Modes*

TABLE 13-27 Ethernet Power Modes	
Power Mode	**Operating Characteristics**
Always On	This power mode offers the maximum availability of the Ethernet port. If the camera is in the *Fully On* power state or the *Partially On* power state, then the Ethernet port will always be on and available for communications.
Moderate Power Save Mode	This power mode offers some power savings on the Ethernet port. This mode is only recommended if the camera is in *Partially On* power mode. If the camera is in the *Partially On* power mode, then incoming data packets will wake up the camera for communications.
Full Power Save Mode	This power mode should be used if the lowest power consumption is desired and incoming Ethernet communications are not required. File transfers after a capture still function properly.

13.9.4.3   Wi-Fi Power Mode

Wi-Fi Power Mode allows a user to select how much power the camera uses when the camera set to *Wi-Fi Access Point* in the network settings. There are three power mode options to choose from.

Figure 13-42 *Wi-Fi Power Mode*

The default setting for the *Wi-Fi Power Mode* is *Always On*.

TABLE 13-28 Wi-Fi Power Modes	
Power Mode	**Operating Characteristics**
Always On	Wi-Fi connection is always powered on.
Low Power Save Mode	Wi-Fi will only power up to transmit files after a capture event. A button press enables the Wi-Fi for 5 min. Attaching the external trigger wire (blue) to a power source (>2.5 Vdc, maximum 30 Vdc) turns the Wi-Fi on until power is removed.
Disabled	Wi-Fi connection is disabled (does not power up). Files cannot be transmitted over Wi-Fi. A button press will enable the Wi-Fi for 5 min, network activity will not reset this timer. Holding the External Trigger in the active state enables the Wi-Fi. Deactivating the External Trigger Input will immediately power off the Wi-Fi.

One of the main factors in determining which power mode to use is the power consumption budget available for the camera.

If the camera is operating from an AC main power supply, the camera will have the best performance characteristics in the *Fully On State*. On the other hand, if the camera needs to operate from a battery for long periods of time, then the *Off State* is more suitable.

There are two methods to wake the Wi-Fi up when it is configured for a low power mode. First, pressing the *Setup Button* on the back of the camera will wake the Wi-Fi out of *Low Power Save Mode* and *Disabled* for 5 min. Any network activity on the web interface will also reset the timer in *Low Power Save Mode*. Network activity will not reset the timer in *Disabled Mode.* Second, by holding the *External Trigger Input* in the active state, the Wi-Fi will wake out of any low power mode after a period of 10 sec. Similarly, network activity will reset the 5 min timer in *Low Power Save Mode*, but not in *Disabled Mode.*

13.9.4.4   Night Mode

The CCFC is optimized for nighttime media captures. During times of reduced light, the camera automatically increases its exposure time and can lower the frame rate in order to increase brightness in photos. The CCFC will also increase frame rate when capturing videos, which results in videos that appear darker than photos captured at the same time. The CCFC is equipped with Infrared LEDs in order to capture photos in complete darkness. IR illumination can be turned on or off to suit low light needs. The CCFC has an integrated IR filter that automatically switches in and out of to suit the lighting conditions. This optimizes photo quality in low light and daytime light. Additionally, if enabled, the IR filter will switch out in the dark without turning on the IR LEDs.
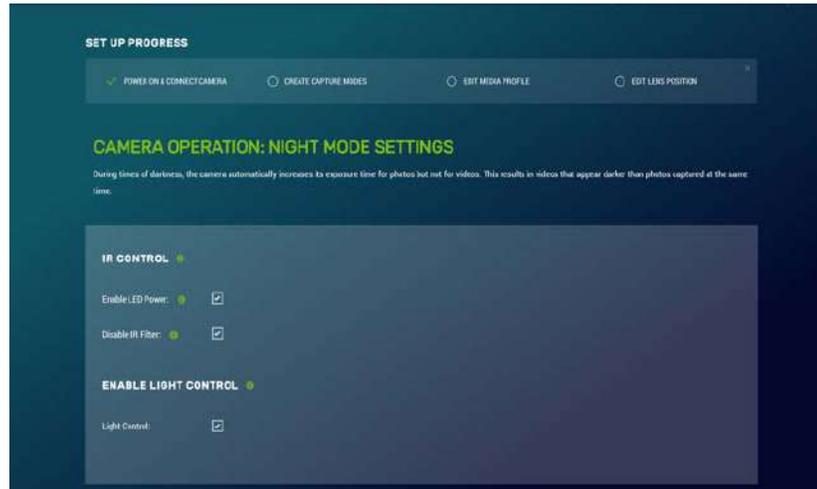
Figure 13-43 *Night Mode*

13.9.4.4.1 IR LED Power Control

Warning	**The IR LEDs emit a very bright light that is nearly invisible to the human eye. Do not look directly at the front of the camera when the LEDs are on, as they can cause severe eye damage.**

The infrared (IR) LEDs on the camera are used to take pictures and video at night. To enable the IR LEDs, select the *Night Mode* page.

When the IR LEDs are enabled, the camera will automatically switch them on and off during photo or video capture when the ambient light level drops too low. Generally, this happens shortly after sunset outdoors. The IR LEDs remain on while the camera is awake. If the camera is configured to use a low power mode, the IR LEDs will turn off when the camera goes to sleep.

The IR LEDs and the lens defroster are multiplexed together, so only one will operate at a time. In a situation where both the IR LEDs and the defroster should be on, the IR LEDs take priority as they also provide a significant amount of heat to the lens.

The IR LEDs emit light at 850 nm wavelength in a 12° cone from the centerline. This is a fairly narrow beam angle, which concentrates the light on the centre of the photo, allowing distant objects up to 36m (120 ft) away to be illuminated.

13.9.4.4.2 Filter Control

Outdoor photos contain a great deal of IR light from the sun. The photo sensor in the CCFC is sensitive to this IR light and will pick it up causing the photo to look improperly colored. The lens on the CCFC is equipped with a switchable IR filter to counteract this effect.

The setting for the IR filter allows it to be enabled all the time or disabled when the camera is in night mode, giving the camera extra sensitivity in dark scenes without having to use the IR LEDs.

When the IR LEDs are enabled and switched on, the IR filter automatically switches off regardless of the IR filter setting.

13.9.4.4.3 **Light Power Control**

The Power Control wire can be used to control an external light source or a relay that activates an external light source. The camera can be configured to switch the external 12 Vdc (yellow wire) on, based on the available light in the scene.

The light will only come on when capturing from a timed capture or when an external trigger occurs while the camera is in sleep mode. The light does not turn on for motion detect capture. The light turns off after the capture is complete.

During a photo burst event, the light power output will remain active for the duration of the event. For example if a burst is set to capture 5 images with a 10 second interval, the light power output will stay on for 50 seconds.

13.9.4.5 Digital I/O

Note

The light and communication power control output are in parallel on the same wire on the connector. If both powers are enabled, the output remains on from the start of capture to when the file transfer is complete.

The *Digital I/O* page allows the configuration of the *Modem Power Control* and *Lens Defroster Control*.
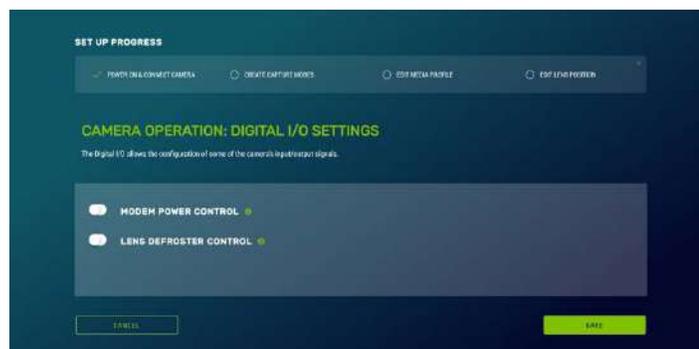
**Figure 13-44** *Digital I/O Settings*

13.9.4.5.1 Modem Power Control

The *Modem Power Control* setting controls the yellow Power I/O signal line of the CCFC camera.

The yellow wire, or switch output, is intended to manage the power to a communication device such as a cell modem. This is useful in a solar powered site when there is a need to limit power consumption of communication devices.

This option enables the CCFC to supply up to a maximum of 750 mA of current. The voltage level will be the same as the camera's input power (i.e. 12 Vdc).

Some modems require a warm up time or a period of time to register on a network. The *Early Power On* option is there for this purpose. Enter a value in seconds; the maximum value that can be entered is 300. The default is 120 seconds.
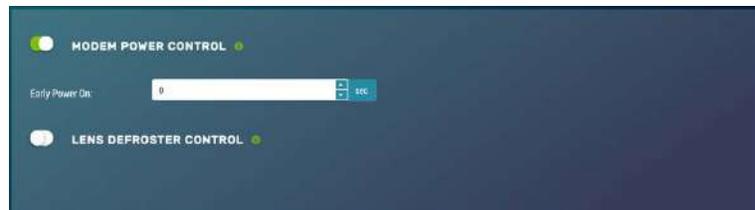
Figure 13-45 *Modem Power Control*

In order to communicate via cell modem, set the CCFC's wired Ethernet settings to the appropriate values as per the cell modem's manual. The required values are IP Address, Netmask, Default Gateway and Primary Nameserver. If the cell modem has a firewall enabled, set up port forwarding to the camera. For accessing the camera's webpage, forward the HTTP port (default 80). To access the camera's FTP server through the cell modem, forward the camera's FTP server port (21) and the port range 1024-1043.

13.9.4.5.2 Lens Defroster Control

The *Lens Defroster Control* controls the operation of the lens defroster. When enabled, the camera only turns on the lens defroster if the internal temperature is below the threshold setting. The temperature threshold values are limited between -40°C and +25°C.

If *Always On* is selected, the heater will be on whenever the temperature is below the threshold and the camera is not in a low power state.

Figure 13-46 *Lens Defroster Control: Always On*

If *Prior to Capture* is selected, the camera will wake up prior to any of the *Timed Capture* schedules and turn on the heater, if the temperature is below the threshold settings. This feature does not work in *Motion Detect* or *External Trigger* modes.

This is useful for a remote site that may be prone to riming and frost. A camera that is setup to take hourly pictures can be configured to turn on the defroster several minutes prior to the scheduled picture to defrost the lens using the *Prior to Capture* drop down option and inputting a value in minutes.


Figure 13-47 *Lens Defroster Control: Prior to Capture*

If the defroster is set to Prior to Capture mode and a photo burst capture is in progress the defroster will turn on prior to each individual photo capture when below the temperature threshold set in the configuration. Therefore the defroster will stay on for the duration of the photo burst.

13.9.5 Advanced

13.9.5.1   GPS

Photos created by the CCFC can be geotagged - GPS coordinates can be embedded in the photo files metadata.
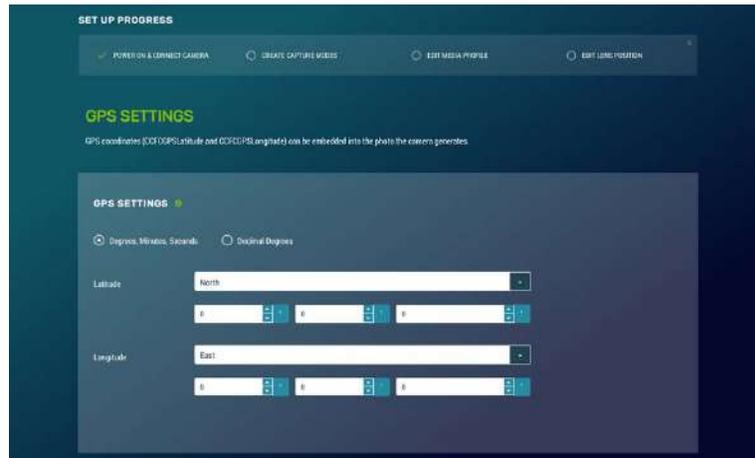
Figure 13-48 *GPS*

Options for GPS Settings are: *Degrees, Minutes, Seconds* or *Decimal Degrees.*

When *Degrees, Minutes, Seconds* is selected, Latitude (North or South) and Longitude (East and West) must be selected from the drop down and numerical values for degrees, minutes, and seconds must be inputted.

Figure 13-49 *GPS: Degrees, Minutes, Seconds*

When *Decimal Degrees* is selected, Latitude (-90.0000 to 90.0000) and Longitude (-180.0000 to 180.0000) values are inputted.

Figure 13-50 *GPS: Decimal Degrees*

13.9.5.2   Import/Export

The *Import/Export* tool is used to maintain continuity between cameras. It has the ability to import and export settings to and from the CCFC camera. Additionally, *Import/Export* allows for configuration settings to be uploaded or downloaded via the web interface. The .xml configuration files are also compatible with the *Device Configuration Utility.*

Figure 13-51 *Import/Export Camera Settings*

TABLE 13-29 Import/Export Settings		
Variable	**Options**	**Description**
Upload Configuration File	Choose file	Uploads selected file from the computer. This file can be found on the Campbell Scientific website http://www.campbellsci.ca/ccfc
	Update IP address settings Checkbox	If selected, it updates IP address information from the file. Not selecting this will not update the IP address information. This is useful, as having two cameras with the same IP address is not desirable.
	Update Wi-Fi settings Checkbox	If selected, it updates Wi-Fi settings from file. Not selecting this will not change the Wi-Fi settings.
	Update PakBus® network settings Checkbox	If selected, it updates the PakBus® settings (Section 13.9.3.3). Not selecting this will not update the PakBus® settings. This is useful, as having two cameras with the same IP address is not desirable.
	Update Lens Position Settings	If selected, it updates the lens poition settings (Section 13.5) If selected, review lens positions to ensure proper focus. Not selecting this will not update the lens position settings.
	Upload Button	Send the file with the selected update settings to the camera and changes will be applied. It may be necessary to reconnect to the camera if network settings were changed.
Download Configuration File	Download Button	Downloads the configuration file to the connected device. Downloading the configuration file is useful when setting up multiple cameras with the same function. The option to download the configuration file allows easy transfer of data from one camera to the other without having to duplicate work.

Save Configuration File to Internal Memory	Save Button	Saves the Configuration file to the camera memory. Saving configuration files to camera memory can be useful for keeping a record of previous configuration versions.

13.9.5.3 Update

Update provides the ability to update the firmware in the camera. It is recommended to regularly check for firmware updates on the Campbell Scientific website https://www.campbellsci.ca/downloads to ensure that the camera has the most recent version of firmware.
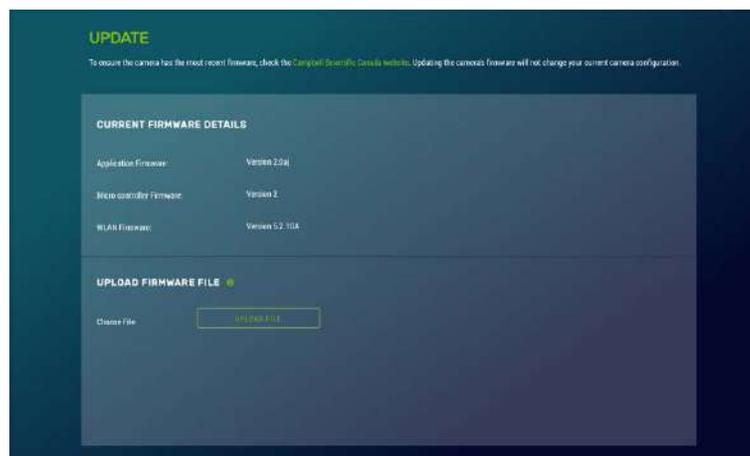
Figure 13-52: *Update*

Once a file is downloaded, click on the *Browse* button to select the new firmware update with the tar.gz file extension. Once the proper file is selected, click on the *Upload* button and the process begins.

Once the firmware update process is completed, the *Dashboard* will be displayed indicating that the process is complete. The camera will reboot itself. It will take a few minutes for the camera to operate normally. If connecting to the camera via Ethernet, the web interface will automatically refresh when the camera is up and running again. If connected to the camera via Wi-Fi, the connection will need to be reestablished before connecting to the camera by refreshing the browser.

The firmware update process normally keeps all configuration settings in the camera. However, it is recommended to verify the settings after an update.

13.9.5.4 Users

Note   The first user added will always have admin permissions.

Users allows users, with various access levels, to be added to the camera. *Users* enables a security login feature, which requires a user name and password authentication. Without this activated, the camera is open to the Internet. A total of 10 users can be added to the CCFC.

By default, cameras are shipped with the security authentication disabled. When *Authentication* is set to *Enable*, users will be prompted for a *User Name* and *Password* before access is given. Ensure that a record of user names and passwords are kept. In the event that this information is lost and access to the camera is no longer possible, the settings can be viewed or changed by connecting the camera to a computer with the *Device Configuration Utility*, using the RS-232 or RS-485 port, depending on the CCFC model that was ordered.
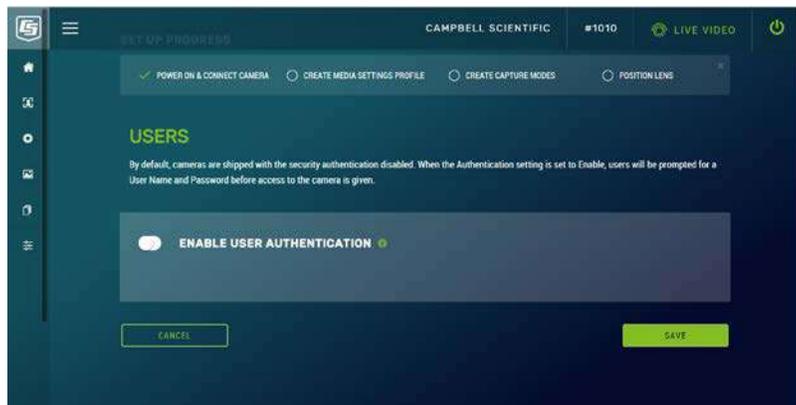
Figure 13-53 *Users and Security Settings*

TABLE 13-30 Users		
Variable	**Toggle, Drop Down, or Text**	**Description**
Enable	Toggle	Used to enable a username/password security level when first logging in to use the CCFC.
User Name	Text	4 – 32 characters in length. Used to log into the web interface.
Access Level	Admin	Full camera access. Can create and edit users to disable security. First user is automatically Admin.
	Operator	Full camera access. Only restriction is managing *Users* and *Security Settings*.
	Viewer	Only have access to the *Dashboard* and read-only access to the *File Explorer*. Cannot change settings.
Password	Text	4 – 32 characters in length. Used to log into the interface.
Confirm Password	Text	Must be identical to the password.

If a user needs to be removed from the User List, this must be done by a user with *Admin* access. Remember that any deletion or changes will only be saved when the *Save* button is selected.

Note	Logged in user access level is displayed beside the *Logout* navigation option.

13.9.5.5   History

The *History* page provides a log of system events. One of the most common recorded events is the indication that the camera is correctly powered. The message confirms that the camera memory is functioning and it also indicates the size of the camera memory.

Other types of event messages and log files include:

•   The camera memory or the allocated memory is full (when fill and stop memory management is used).

•   Communication and file transfer errors that include:
   o   FTP
   o   Email
   o   PakBus®

Figure 13-54 *History*

14. RS-232 Communications

The RS-232 serial communications are used with the camera for two purposes: to configure and setup the camera using *Device Configuration Utility* software that Campbell Scientific provides and to send photo files from the camera to other devices using the PakBus® protocol.

This value is displayed on the web interface under *Settings>File Transfer>PakBus®* .
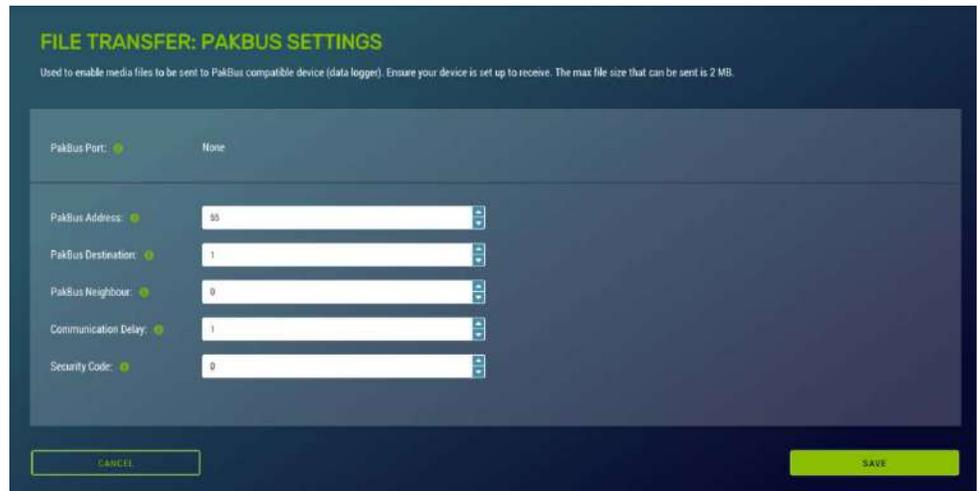
Figure 14-1 *PakBus® Settings*

The CCFC Power I/O port is configured by default to provide a 3-wire RS-232 connection (Tx, Rx, Ground), as well as power. The wires can be terminated directly on the control ports of a compatible datalogger. For connection to a computer's 9 pin serial port, use the L28840 DB9 FEMALE to Terminal Block Adaptor, which facilitates the connection of the cable pigtail end to a computer 9-pin serial port. The adaptor is included with the CCFC.

Figure 14-2 L28840 DB9 FEMALE to Terminal Block Adapter

TABLE 14-1 CCFC Connections to RS-232 Port		
Wire Colour	**Function**	**Connection Required**
Red	Power	9 to 30 Vdc
Black	Shield	Pin 5 and Power Ground
White	Rx (input)	Pin 3
Green	Tx (output)	Pin 2

The required RS-232 connections to a datalogger are shown in Table 14-2.

TABLE 14-2 Datalogger Connections to RS-232 Port		
Wire Colour	**Function**	**Connection Required**
Red	Power	12 V
Black	Shield	Datalogger G (Ground)
White	Rx (input)	Control Port Tx
Green	Tx (output)	Control Port Rx
Blue	Ext Trigger	Control Port (optional)
Yellow	Switched PWR	Do no connect

15. RS-485 Communications

The optional RS-485 communication interface of the CCFC can be used in conjunction with the MD485 to interface a datalogger to one or more cameras. Refer to the MD485 Manual for additional information.

This value is displayed on the web interface under *Settings>File Transfer>PakBus®* .

The MD485 is useful for connecting more than one camera to a datalogger or if long cable lengths are involved. If multiple cameras are connected to an MD485, it would be beneficial to

offset the capture times of the photos so that only one camera is attempting to transmit a file at any given time.

The camera can download photos or video via an RS-485 port using the PakBus® protocol. An MD485 is required to interface the camera to a datalogger. The following items are required for RS-485 PakBus® communications and can be confirmed by either the web interface of the *Device Configuration Utility*:

- Confirm that the PakBus® port parameter of the Communications Setting is reading RS-485.
- Set the RS-485 BAUD rate to match the BAUD rate of the device being connected to the camera.
- Set the parameter PakBus® Address of Communication Settings to a unique value in the PakBus® network.
- Set the parameter PakBus® Destination Address of the device that the camera needs to send photos to.
- Include PakBus® Security Code, as required.

16. Send Via PakBus® : PakBus® Communications

The CCFC camera uses the PakBus® protocol to send photo or video files from the camera to a Campbell Scientific datalogger or other PakBus® compatible devices. The LoggerNet Tool PakBus® Graph can be used to change the configuration of a camera. The use of the PakBus® Graph is discussed in Section 15.2 *Send Via PakBus® : PakBus® Graph Operations.* Refer to the LoggerNet literature or software for more details.

PakBus® can also be used to control specific operational parameters and to transfer variables or text between the datalogger and camera. When a photo or video file is ready to be transmitted, the camera will initiate communications and send the photo or video via the selected serial interface.

The CCFC is capable of producing video files that exceed 30MB. Trying to send such a large file to a datalogger using PakBus® can be problematic. For this reason, the CCFC is setup to not send any files using PakBus® that are larger than 2MB.

The camera is a PakBus® Leaf node and is not capable of performing any routing. However, the CCFC has the ability to

communicate with devices that are several hops away on the PakBus® network.

16.1 Send Via PakBus® : Concurrent PakBus® Communications

PakBus® allows the camera to download photos to a datalogger simultaneously with other datalogger communications. A communications task will take longer if the datalogger is communicating with multiple devices at the same time.

It is beneficial to set the system timing up to avoid photo transfers when other communications are scheduled.

For example, longer connect times on long distance telephone connections can be avoided by scheduling photo transfers from the camera to the datalogger outside the scheduled data collection time. If a station is called on the hour to retrieve data, photo acquisitions could be initiated before the scheduled call (15 minutes prior) to shorten the connect times.

16.2 Send Via PakBus® : PakBus® Graph Operations

The CCFC supports configuration via PakBus® Graph over the serial port. A datalogger or other type of PakBus® relay device is required to interface PakBus® Graph to the camera.

16.2.1 Datalogger Settings

The datalogger must be configured as a router (i.e. *Is Router* must be set to true) and the camera PakBus® address must be in the list of allowed neighbors for the datalogger port used. The camera and the datalogger must be set to use the same baud rate to communicate properly.

16.2.2 Discovery

After starting the PakBus® graph, the camera may not be visible immediately. To discover the camera, right click on the green box marked as *[4094]* in the graph and click on *Search for Neighbours*. This will open the *Search for Neighbours* dialog box, press the *Start* button and the graph should display all the devices within the PakBus® network.

16.3 Setting Up Datalogger to Work with CCFC: PakBus® Variable Control

The camera is capable of receiving variables, commands, or text from a datalogger. The specific operational parameters that can be altered or controlled include:

- File Captions
- Camera Window Defroster
- Camera Shutdown
- GPS Coordinates

The use of the *Send Variable* instruction allows the datalogger to transfer values or text that can be used in the photo or video banners. The *Send Variable* instruction is also used to toggle the camera window defroster on/off, or safely shut the camera down.

To update the *File Caption* information with values from a datalogger the variable is a String and must be limited to 255 characters (including null terminator).

The camera variable names are:

- CCFCStillBanner1
- CCFCStillBanner2
- CCFCVideoBanner1
- CCFCVideoBanner2

The variable for controlling the window defroster is numeric and needs to be declared as a Long in CRBasic. Sending any true or non-zero value will activate both of these functions. The variable for controlling camera power is a Boolean, which needs to be declared in CRBasic. The names of the camera variables are:

- CCFCDefroster
- CCFCShutdown

Two PakBus® variables allow the datalogger to send the GPS coordinates to the camera where they are embedded in the media file metadata.

- CCFCGPSLatitude
- CCFCGPSLongitude

The GPS coordinates must be sent as floating point values. Positive latitude and longitude represent northern and eastern hemispheres, respectively. While negative values represent southern and western hemispheres, respectively. Values are not saved through a power cycle or in *Off Mode*, but do need to be updated every time a photo is sent. When using PakBus® variables for GPS, coordinates must be entered in decimal coordinates.

16.3.1 PakBus® Control of Window Defroster Function

Users are advised to only use one type of control to avoid unexpected operation of the defroster. The two options are:

1. *Automatic Mode* set via the web interface or *Device Configuration Utility.*
2. Using one-shot mode via the PakBus® *SendVariables* command.

To turn on the defroster, a non-zero numeric value (i.e. 1) should be sent to the camera. When a non-zero value is sent to the camera, the heater will turn on and a 65 second countdown timer will start. After 65 seconds, the defroster will automatically turn off (unless the defroster is turned on via the *Automatic Mode* settings). If an additional non-zero is sent before the defroster is turned off, then the timer will be reset and will begin the countdown again from 65. Sending a zero value using this variable will not turn off the defroster regardless of which method was used to turn it on.

The defroster commands should be sent to the camera every 60 seconds or less to ensure continuous operation.

The defroster will not be allowed to turn on at internal temperatures above +25°C.

16.3.2 PakBus® Control of CCFC Power

The ability to shut the camera down safely using a PakBus® command is available in the CCFC. By writing a value of 1 (or any value not equalling zero) to the public Boolean variable *CCFCShutdown* the camera initiates a shutdown and power down cleanly. The shutdown process can take up to 30 seconds. The camera will turn back on after 10 minutes or can be externally triggered.

Following is an example of the CRBasic command that will shut down a camera with PakBus® address 55:

SendVariables (SendVarResult,Com1,0,55,0000,400, "Public", "CCFCShutdown",1,1)

16.3.3 Example Program – SendVariable Instruction – Datalogger

The following example illustrates the use of the *SendVariable* instruction to alter Still Photo Banner #2, as well as toggle the camera window defroster.

Note	Please download the program directly from: http://www.campbellsci.ca/ccfc.

```
'DATALOGGER Series Datalogger

'Declare Public Variables
Public PTemp, batt_volt
Public TurnDefrosterOn As Boolean
Public TurnDefrosterVal As Long
Public SendVarResult As Long
Public BannerString As String * 60
Public tempstring As String * 60

'Define Data Tables
DataTable (Test,1,-1)
  DataInterval (0,60,Sec,10)
  Minimum (1,batt_volt,FP2,0,False)
  Sample (1,PTemp,FP2)
EndTable

'Main Program
BeginProg

  SerialOpen (Com1,115200,4,0,2000)

  Scan (10,Sec,0,0)
    PanelTemp (PTemp,250)
    Battery (batt_volt)

    'Enter other measurement instructions
    tempstring = FormatFloat(PTemp,"%2.2f")
    BannerString = "Panel Temp " + tempstring

    If TimeIntoInterval (0,5,Min) Then

SendVariables(SendVarResult,Com1,0,55,0000,400,"Public","CCFCStillBanner2",BannerStr
ing,1)
    EndIf

    If TurnDefrosterOn = true Then
      TurnDefrosterVal = 1

SendVariables(SendVarResult,Com1,0,55,0000,200,"Public","CCFCDefroster",TurnDefroste
rVal,1)
      TurnDefrosterOn = false
    EndIf
```

```
    CallTable Test
  NextScan
EndProg
```

16.3.4 Example Program – Adding GPS Coordinates to the Photo Banner – Datalogger

The following example illustrates the use of the *CCFCGPSLatitude* and *CCFCGPSLongitude* instructions, which can be used with compatible dataloggers (see Section 17).

Note   Please download the program directly from: http://www.campbellsci.ca/ccfc.

```
'DATALOGGER Series Datalogger

'Declare Public Variables
Public sendGps As Boolean
Public gpsLat, gpsLong As Float
Public sendVarResult

'Main Program
BeginProg
  sendGps = false
  gpsLat = 50.0
  gpsLong = -139.0
  SerialOpen (Com1,115200,4,0,2000)

  Scan (1,Sec,0,0)
    If sendGps Then
      sendGps = false

SendVariables(sendVarResult,Com1,0,55,0000,0,"Public","CCFCGPSLatitude",gpsLat,1)
      SendVariables
(sendVarResult,Com1,0,55,0000,0,"Public","CCFCGPSLongitude",gpsLong,1)
    EndIf

  NextScan
EndProg
```

16.4 PakBus® Neighbouring Address

The PakBus® protocol allows devices to relay data in a network. The CCFC has the ability to communicate with devices that are several hops away on the PakBus® network. To configure this new feature, a setting has been added to the PakBus® configuration screen on the web page.

Physically entering the address of the PakBus® device connected to the CCFC PakBus® communication lines allows the neighbor to relay communication between the CCFC and the final destination for data. Leave PakBus® set to zero (0) if the CCFC is directly connected to the final destination.

17. Power Calculations and Timings

The CCFC was specifically designed for operation in power-constrained systems such as solar powered sites. It is critical in such systems that the camera be properly configured to meet the constraints of the intended application. This section outlines the power consumption of the camera for purposes of power supply design for a system.

- An active session to the camera with a web browser prevents the camera from entering a low powered state.

- Avoid removing power from the camera when it is in an active state. If the camera is in an active state (Status LED is flashing), properly shutdown the camera to avoid any memory corruption before removing power. The camera can be shut down by holding the *Setup Button* continuously for more than 10 seconds or by using the *Power Icon* on the web interface.

17.1 Standalone Operation

In standalone mode, the camera operates as a self-contained photo and video recorder. Files will be stored onto the internal camera memory.

The current draw of the camera is mainly dictated by the quiescent current draw of the *Power Mode*, plus the current draw when the camera enters the *Fully On* power mode (Active Current Draw) to acquire a photo or video. Table 16-1 shows some total power consumption (standalone) figures in Amp-Hours per day depending on the *Power Mode* and frequency of photos.

One thing to note is that the *Off State* will only consume less power than the *Deep Sleep* state if fewer than 24 pictures are taken per day. This is due to the boot-up time that the camera requires when exiting the *Off State*. The extra boot-up time means

that the camera consumes the Active Current for a longer time (120 seconds).

TABLE 16-1 Power Consumption (Standalone Operation)						
Power Mode	**Ethernet Power Save Mode**	**Quiescent Current Draw Max.@12Vdc**	**Active Current Draw Max.@12Vdc Active Duration**	**Amp-Hr Per Day 2 JPG/Day**	**Amp-Hr Per Day 1 JPG/Hr**	**Amp-Hr Per Day 5 Min JPG**
Fully On	Always On	250 mA	250 mA 0 Sec/JPG	6.0	6.0	6.0
	Full Power Save Mode	200 mA	200 mA 0 Sec/JPG	4.8	4.8	4.8
Partially On	Always On	80 mA	250 mA 20 Sec/JPG	1.92	1.94	2.2
	Full Power Save Mode	10 mA	200 mA 20 Sec/JPG	0.24	0.27	0.54
Deep Sleep	Always On	6 mA	250 mA 25 Sec/JPG	0.15	0.18	0.63
	Full Power Save Mode	6 mA	200 mA 25 Sec/JPG	0.15	0.18	0.53
Off State	Always On	1 mA	250 mA 120 Sec/JPG	0.041	0.22	2.4
	Full Power Save Mode	1 mA	200 mA 120 Sec/JPG	0.037	0.18	1.93

Note	When the Wi-Fi is powered up and connected via an Access Point (AP) or connected to an *Existing Network* (see Section 13.9.2 *Network),* an extra 40 mA is added to the current power draw. When the camera is transmitting large amounts of data (e.g. when viewing live video), an extra 10 mA is added to the power draw.

17.2 Operation with Communications

The power calculations are more complicated when communications are involved, as the amount of time the camera is in the *Fully On* active state is increased by the amount of time it takes for the camera to transfer a photo or video.

The transfer times are influenced by two main factors: the size of the photo or video and the transfer speed used to send the file. The amount of time the camera is on will be increased as the size of the file becomes larger or as the communication rate slows down.

To properly determine the power consumption when using communications, the additional time the camera consumes the *Fully On* current draw needs to be accounted for in the power calculation. Refer to Table 16-2 as a guideline for determining the amount of time it takes to transfer files using RS-232 or RS-485 PakBus® communications.

TABLE 17-1 File Transfer Times Using PakBus®	
Communication BAUD RATE	**Time (seconds) per 100Kbytes**
9600	240 seconds 0.0123 A-Hrs
19200	120 seconds 0.0076 A-Hrs
38400	60 seconds 0.0054 A-Hrs
57600	40 seconds 0.0044 A-Hrs
115200	30 seconds 0.0038 A-Hrs

To estimate the power consumption of the system, look up the parameters in Table 16-1, along with the communication times to calculate the power consumption as follows:

- Determine the Active Time in minutes:

  Active Minutes = Number of pictures per day * (Active Duration + Communication Time)/60

  For a camera in the *Deep Sleep* state sending 24 photos per day at 115200 BAUD that are 100 Kbytes in size:

  Active Minutes =24*(25 seconds + 30 seconds)/60 = 22 minutes/day of Active Time

- Determine the total time in Quiescent Low Powered State

  Quiescent minutes = 1440 minutes per day – Active minutes
  Quiescent minutes = 1440 – 22 = 1418 minutes

- Determine the power consumed by the Quiescent state in Amp-Hours.

  Quiescent power = Quiescent minutes * Quiescent Current Draw/60
  Quiescent power = 1418 minutes*6 mA/60 = 141.8 mA-Hour or **0.1418 Amp-Hours/Day**

- Determine the power consumed by the Active state in Amp-Hours.

  Active power = Active minutes * Active Current Draw/60
  Active power = 22 minutes*250 mA/60 = 91.67 mA-Hour or **0.0917 Amp-Hours/Day**

- Total power consumption is the sum of the Active and Quiescent Power
  Total power = Quiescent Power + Active Power
  Total power = 0.1418 Amp-Hours/Day + 0.0917 Amp-Hours/Day
  Total power = 0.2335 Amp-Hours/Day

18. CCFC Compatibility

As shown in Table 18-1 *CCFC Compatibility with Contemporary and Retired Dataloggers*, The CCFC is compatible with several contemporary and retired Campbell Scientific dataloggers.

TABLE 18-1 CCFC Compatibility with Contemporary and Retired Dataloggers	
Contemporary Dataloggers	**Retired Dataloggers**
CR200/200X	CR510[*]
CR300	CR10X[*]
CR800/CR850	CR23X[*]
CR3000	
CR6	
CR1000X	
[*]Must be the -2M versions and must use the PakBus® operating system.	

19. Campbell Datalogger Interface Guide

The CCFC can interface with approved Campbell dataloggers (see website) using the RS-232 (default) or RS-485. The RS-232 configuration is the simplest option as it does not require an additional hardware interface (see Section 13 *RS-232 Communications*). The pigtail end of the CCFC Power & I/O cable can be terminated directly to the datalogger wiring panel control ports (COM1-4). Refer to Section 9 *Cables/Wiring* for wiring details.

The CCFC RS-485 interface can also be used, but does require the use of an MD485 interface to provide conversion of the RS-485 signal (see Section 15 *RS-485 Communications*). The MD485 can connect to the datalogger using the CS I/O port or the RS-232 port. Refer to the MD485 manual for additional information.

19.1 Datalogger Memory Setup

To facilitate the storage of photos, a CFM100 allows the use of a compact flash card on the datalogger. Memory can also be allocated from the datalogger internal memory to create a virtual user drive – USR. Entering a non-zero value for the parameter *USR:drive size* allocates internal memory for the drive. The amount of memory required varies depending on each application. A good number to start with is approximately 1048 Kbytes, which is 25% of the 4M bytes available on a standard datalogger.

The following methods can be used to set the drive size of the USR:

- The *Device Configuration Utility*
- PakBus® Graph
- Editing the parameter from the Status Table
- datalogger optional keypad and display

| **Note** | The CCFC will not send any files using the PakBus® that are greater than 2 MB. |

19.2 Datalogger Files Manager

The *Files Manager* setting on the datalogger facilitates the management of jpeg and avi files that are received from the camera. *Files Manager* allows the user to specify a name for the files and the number of files kept in a ring memory type fashion.

Once *Device Configuration* is opened, selected the *Advanced* tab. This displays the *Files Manager.*
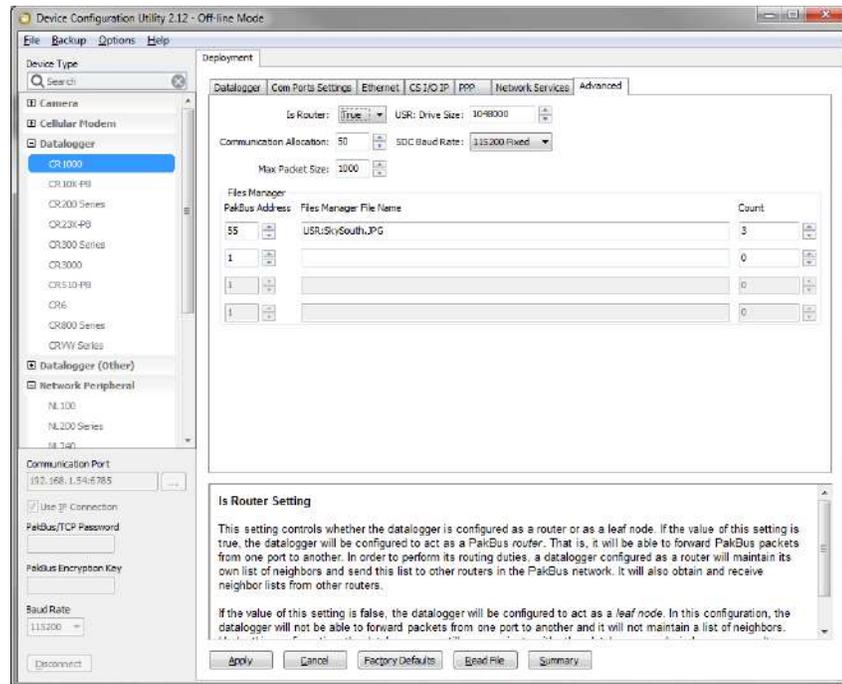
Figure 18.1 Datalogger Files Manager

For the *PakBus® Address* use address of the camera. Default is 55.

Under *Files Manager File Name* use the format listed below.

(DDD:NAME.EXT)

- DDD – destination drive on the datalogger. USR for the user drive. In figure 18.1 this value is *USR*. CRD for the compact flash memory card.

- NAME – any name string that will be used to name the files. In Figure 18.1 this value is *SkySouth*. The file name will automatically produce an incrementing number. For example, the first file will be named *SkySouth1.jpg*. Entering a zero for this parameter will disable the automatic numbering and produce a fixed file name. In this example, the *Files Manager File Name* would be USR:0.JPG.
- EXT – the file extension of the incoming file must match. In the case of the camera, this must always be either jpg or avi. In Figure 18.1 this value is *JPG*.

   Count dictates the maximum number of files stored with this file name. If the datalogger processes more files than specified, the datalogger will delete the oldest file.

19.3 Datalogger COM Port (Control Port) Communications

On the datalogger, a pair of control ports can be configured to function as RS-232 communication (COM) ports. Any of these 4 COM ports can be configured as PakBus® ports and used to communicate with the camera.

The COM ports can be activated as PakBus® ports using the *Device Configuration Utility* or by using the SerialOpen instruction in the datalogger program.

The following SerialOpen instruction configures COM Port 2.

- *SerialOpen(Com2,115200,4,0,1000)*
- BAUD rate - 115200
- PakBus® Port – 4
- Transmit delay – 0
- Buffer size – 1000

20. Remote Photo Retrieval

Once the camera has transferred a photo or video to a datalogger, existing LoggerNet communications can be used to remotely retrieve the photos and video from the datalogger memory.

There are also permanent links available in the CCFC web interface to download the most recently captured photos or video files that have been saved to the camera memory (see Section 7.3.1 *Link to Most Recent Photo and Video*).

20.1 LoggerNet File Retrieval

LoggerNet (version 4.0 or newer) includes the *File Retrieval* setup that facilitates the photo and video file retrieval from PakBus® dataloggers (CR800 series, CR1000, and CR3000, CR300, CR6). The *File Retrieval* tab is located in the *Setup* Screen as part of the datalogger configuration. Once configured, *File Retrieval* is used to retrieve photos and video from a datalogger.
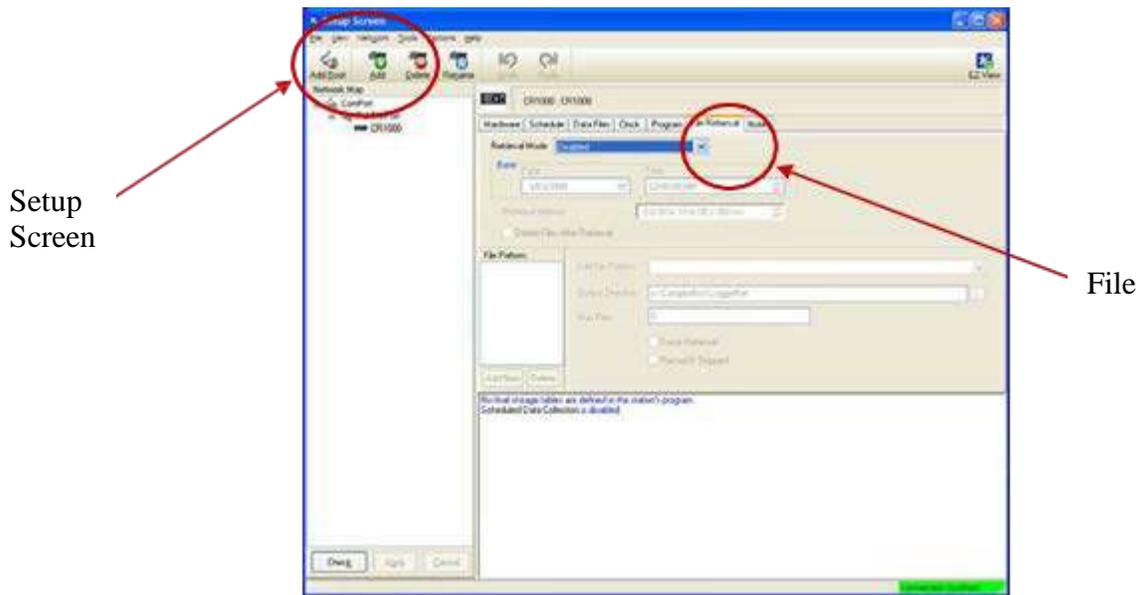
Setup
Screen

File

Figure 20-1 File Retrieval Setup Screen

Select the required *Retrieval Mode* for the application. The *Follow Scheduled Data Collection* option uses the scheduled configuration in the *Schedule* tab. If the *New Schedule* option is selected, the Base Date and Time, and Retrieval Interval parameters need to be configured.

It is possible to configure the *File Retrieval* to delete files once retrieved from the datalogger. If datalogger memory capacity is a concern, it is recommended to use this feature.

To add a file retrieval process, start by selecting *Add New* under *File Pattern*. Once added, the *Edit File Pattern, Output Directory,* and *Max Files* parameter become available to fill out. Each *File Pattern* added will need to be individually configured.

Under the *Edit File Pattern* parameter, it is necessary to select from the directory location options in order to specify the photo or video to be retrieved. By default, the jpg and avi names are a wild card (*), which means all jpg or avi files in the specified directory will be retrieved. If specific file names in the camera configuration have been used, those file names can be specified in the *Edit File Pattern* parameter. It is possible to configure multiple *File Patterns* to collect photos or video on different schedules or from multiple directories.

Note

If LoggerNet File Retrieval does not list the avi files as an option under File Edit Pattern, force the filename and format.

The default Output Directory is C:\Campbellsci\LoggerNet. If required, the preferred location can be found by browsing. The *Max Files* parameter specifies the maximum number of files that can be retrieved during each scheduled event. The newest files will be retrieved.

When the *Force Retrieval* box is selected, a file that matches the file pattern will be retrieved regardless of the file's timestamp or whether the file has already been retrieved. When the *Record If Skipped* box is selected, the names and dates of any files that are not retrieved because of the *Max Files* parameter will be recorded and they will not be retrieved later. If this box is not selected, the skipped files can be retrieved in a later attempt.

20.2 Using LoggerNet File Control

Photos or video that are in the datalogger memory can be viewed or collected on demand by using *File Control* that is available from the *Connection* Screen menu. The use of *File Control* requires a communications connection to the datalogger. Using the *File Control* can also be useful for debugging purposes.
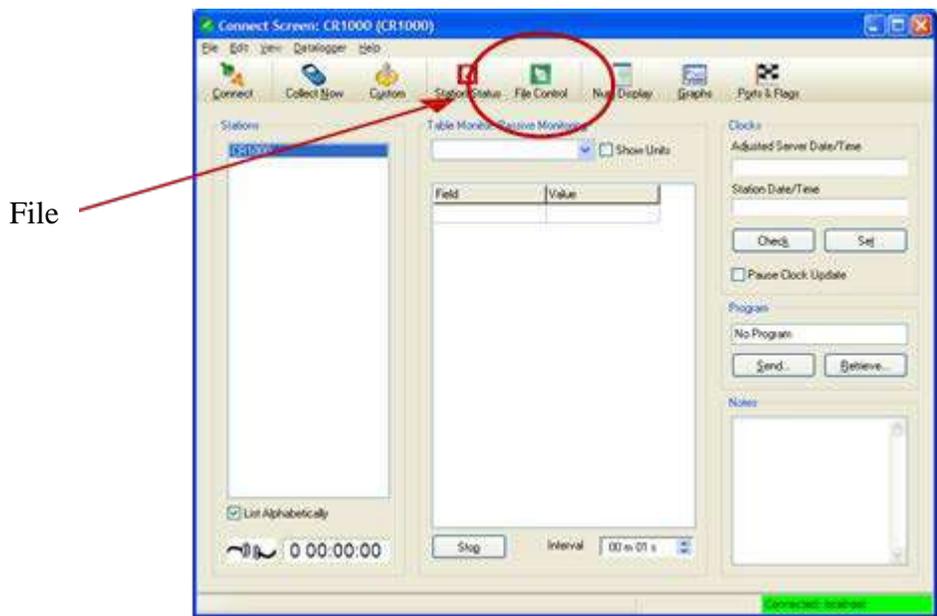
File

Figure 20-2 LoggerNet Connection Screen

In dataloggers such as the CR1000, the *Device Map* can include the CPU, USR, and the CRD (compact flash module). The devices show up in the left hand side of the *File Control* panel. To view files of a certain device, simply click on the desired device listed in the panel (Figure 20-3 *USR Drive View in File Control*). Use the *Retrieve* button to download the photo from the datalogger.
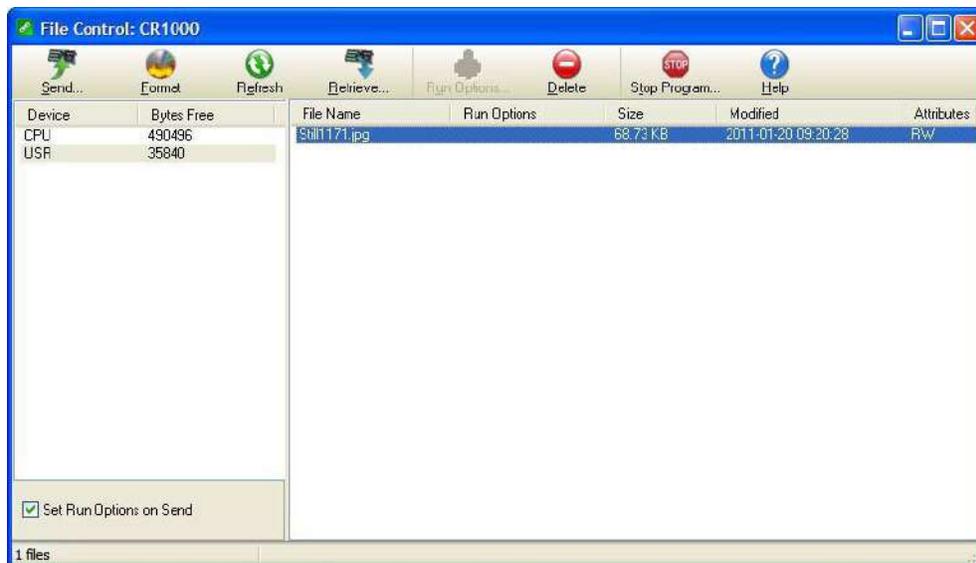
Figure 20-3 USR Drive View in File Control

21. Mounting

The camera enclosure is designed to be environmentally sealed for outdoor installations. The enclosure provides protection from moisture or high humidity. It is not intended for operation under water. All that is required is an appropriate mounting fixture.

Figure 21-1 CCFC Mounting Kit

The camera is equipped with a set of three ¼-20 threaded mounting holes (see Figure 21-2). These mounting holes are centered along the bottom of the camera and are spaced 1.0" (25.4 mm) apart from one another. At least two of the ¼-20 threaded holes are required for mounting the camera.

Figure 21-2 CCFC Mounting Holes

When using the optional Mounting Kit, align the outer holes of the CCFC with the centre hole and the 180° slot of the mount. Loosely secure the two together with the two ¼-20 x 0.5" Hex bolts included with the kit. It is now possible to mount the CCFC to either a cross arm or other mounting surface with the included U-bolt.

With the hardware loose, the camera and the mount can be pivoted to allow a full range of motion when aiming the camera. The hardware should be secured once the camera is properly aimed at the intended target.

Figure 21-3 CCFC Mounted to Cross arm

22. Maintenance

The CCFC requires little maintenance. Keeping the camera lens window clean is important for the longevity of the camera and photo and video quality.

22.1 Lithium Battery

The camera is equipped with a Lithium Thionyl Chloride battery. The battery maintains the clock functionality for periods when power is not connected to the camera. The expected battery life is 10 years. It is recommended that the battery be replaced by a certified repair facility.

22.2 Window and Lens Cleaning

If the enclosure window or lens requires cleaning, it is very important that only a proper lens cloth or lens tissue be used. The use of inappropriate materials to clean the lens or window can permanently damage the surface and reduce the clarity.

23. System Limitations

This section outlines some system limitations that exist in the CCFC camera.

23.1 High Resolution 5 Megapixel Photos

The capturing of 5 Megapixel (MP) pictures results in longer capture times than other photo resolutions. When a 5 MP photo is captured, the continuous video stream is paused, the photo sensor is reconfigured, and then the 5MP photo is captured. This longer delay time would be noticeable when capturing photos from the external trigger. 5 MP photos would take several seconds from the external trigger signal being asserted. All other still photo captures are less than 1 second.

23.2 Simultaneous Processes

The CCFC cannot capture 2 events simultaneously. For example, the CCFC cannot capture a photo while video is being recorded. Also other processes such as downloading files from the camera memory can add additional delays to the capture process.

Appendix A. CCFC Camera Accessories

A.1 CCFCCBL1-L Power & I/O Cable

The CCFCCBL1-L Power & I/O cable is used to supply power and serial communications to the CCFC/ This cable can also be used to provide power to an external communication device or trigger the CCFC to initiate photo or video capture.

Ordering part number:
1. CCFCCBL1-L (-L is length in feet)

Details:

- 20-AWG 1 pair twisted, 24-AWG 2 pair individually shielded cable with Santoprene jacket
- 6-pin Bayonet style environmental connector
- Maximum length 19.2 m (65 ft)
- Includes 3 single pole 16-20AWG grey push operated connector terminals for unused wires
- RoHS Compliant

Figure A-1 CCFCCBL1-L Power & I/O Cable

A.2 CCFCCBL2-L Environmental Ethernet Cable

Ordering part numbers:
1. CCFCCBL2-L (-L is length in feet)
Details:

- 26-AWG 4 Pair (8 conductor) Shielded CAT5E Cable with polyurethane Jacket
- RJ45 Environmental Connector on one end and rugged Metal RJ45 connector on the other end
- Maximum length 70 m (230 ft)
- RoHS Compliant

Figure A-2 CCFCCBL2-L Environmental Ethernet Cable

A.3 L18549 Mounting Kit

Details:

- Mounting kit with U-bolt and fasteners

Figure A-3 L18549 Mounting Kit

The L18549 can mount up to a 1.5" O.D. pipe.

A.4 L28840 DB9 FEMALE To Terminal Block Adaptor

Details:

- DB9 FEMALE to terminal block interface with hood and hardware kit

Figure A-4 L28840 DB9 FEMALE To Terminal Block Adaptor

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