

CCFC

Field Camera



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 (850 nm) 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 5 cm) while the camera is powered on. When in close proximity with the illuminated IR LEDs, there is a potential skin burn hazard.



See [Cautionary statements](#) (p. 1) for more information.

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1. Introduction



FIGURE 1-1. CCFC camera

The CCFC meets 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. The CCFC supports Campbell Scientific PakBus® protocol for integration with Campbell Scientific data loggers.

The camera can function as a powerful photo and video data logger. The internal 16 GB 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 own precision real time clock. Media (photo and video) acquisitions can also be triggered by events through an external trigger or motion detect.

2. 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.

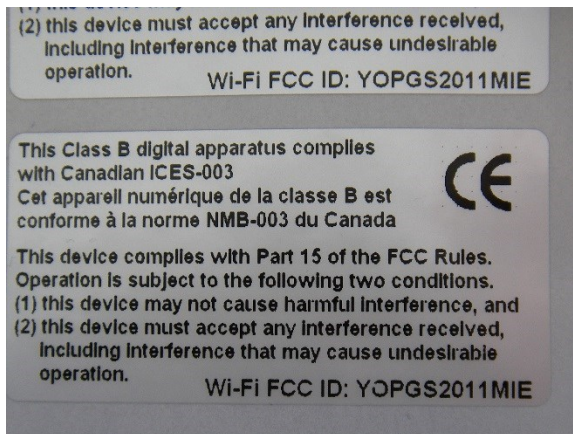
Other than the desiccant, there are no user-serviceable parts. Improper disassembly or re-assembly of the device will void the warranty. Contact Campbell Scientific or the reseller for details.

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.



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 ([QuickStart](#) (p. 3)), 2 screws, 2 lock washers, 2 flat washers, 4 lens wipes, and the Female DB9 to Terminal block adapter.

4. QuickStart

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

4.1 Connect to CCFC using Wi-Fi

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. Connect black and clear wires to G and red wire to 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 should click in place.
4	Wait 90 seconds for the camera to power up. A flashing green light on the Setup Button indicates the camera has power.
5	Start the computer/mobile device and connect to the camera using its Wi-Fi network. It will appear as CCFC-9999 where 9999 will be the last 4 digits of your camera serial number.

Step	Procedure
6	Once connected to the camera Wi-Fi, open a web browser and type http://10.0.0.1 in the address bar.
7	This opens the camera web interface where the camera can be configured. The set up progress bar indicates the steps to setup capture events and get started using the CCFC.

4.2 Connect your camera using Ethernet cable

Complete steps 1 through 4 from [Table 4-1](#) (p. 3), then:

Step	Procedure
5	Take the protective cap off the camera Ethernet connection port.
6	<p>Plug an Ethernet cable into the camera and into a computer. Be sure Wi-Fi is turned off on the computer.</p> <p>NOTE: Ensure the Ethernet port on the computer is configured for DHCP (that is, does not have a static TCP/IP address). Also, there should be a single Ethernet cable between the data logger and the computer (no hubs, switches, and so forth).</p>
7	Open an internet browser and type http://169.254.99.99/ in the address bar.
8	This opens the camera 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 an image every 15 minutes

Do the following to set up the CCFC to take an image every 15 minutes and save the photo to CCFC camera memory.

Table 4-3: Quick set up – taking an image every 15 minutes




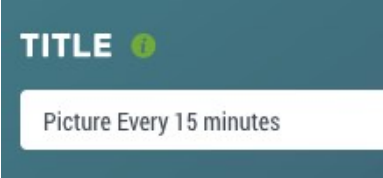
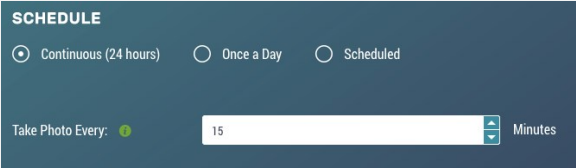
Step	Procedure
1	Connect to Camera using the methods laid out in Connect to CCFC using Wi-Fi (p. 3) or Connect your camera using Ethernet cable (p. 4).
2	Click Create Capture Modes in the Set Up Progress bar at the top. 
3	Click Timed Capture NEW . 
4	Click the plus sign (+) to create a new timed capture profile. 
5	Type a descriptive title, such as Picture every 15 minutes . 
6	Under Schedule , select Continuous (24 hours) and type 15 beside Take Photo Every . 
7	Under Lens Position , click the green Position 1 link to adjust the lens position.

Table 4-3: Quick set up – taking an image every 15 minutes




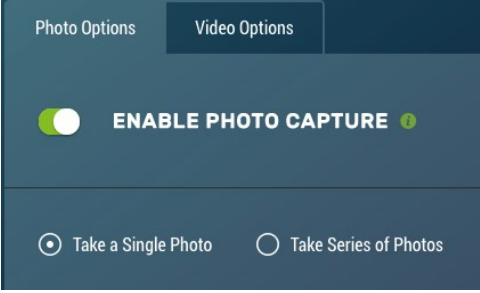
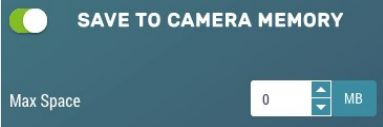
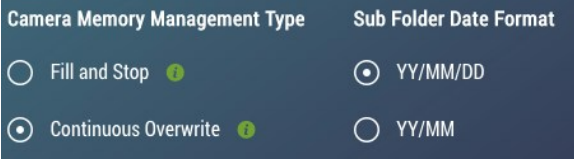
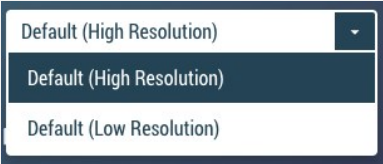

Step	Procedure
8	<p>Type a descriptive title for the lens position, such as fully zoomed or wide view.</p> 
9	<p>Slide the Zoom slider to the desired zoom length. The CCFC will auto focus as you change zoom lengths. The CCFC may take a second to respond and display your image in the Live Video feed.</p> 
10	<p>Click Save Settings. This will bring you back to your time capture set up and save your new lens position.</p> 
11	<p>Click Enable Photo Capture and choose Take a Single Photo.</p> 

Table 4-3: Quick set up – taking an image every 15 minutes

Step	Procedure
12	<p>Click Save to Camera Memory . Keep the default Max Space size of 0 MB, which will auto-allocate memory.</p> 
13	<p>Choose Continuous Overwrite, and Sub Folder Date Format of YY/MM/DD to store the pictures from each day in a separate sub-folder.</p> 
14	<p>From the Media Profile drop-down menu, select Default (High Resolution).</p> 
15	<p>Save the Timed Capture profile by clicking the green Save button at the bottom of the page.</p> 

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 1:07 pm, the photo will be taken at 1:15 pm, then again at 1:30 pm, and so on.

For alternate set ups or more information, see [Configuration process](#) (p. 11).

5. Specifications

Power supply operating: 9 to 30 VDC input voltage

Current drain

Average: 250 mA (excludes defroster and IR LEDs)

Maximum momentary peak: 400 mA

Defroster on: 1.5 A

IR LEDs on: 700 mA

Off power mode: < 1 mA

Deep Sleep power mode: < 6 mA

General

Operating temperature: -40 to 60 °C

NOTE:

The motorized zoom lens fully operates at -30 to 60 °C. At temperatures below -30 °C, the camera can capture images and videos, but the motorized lens will remain in a fixed position.

Weight: 2.4 kg (5.25 lb)

Clock accuracy: ± 2 minutes/year (-40 to 60 °C)

Dimensions

Length: 28.4 cm (11.2 in)

Height: 13.0 cm (5.1 in)

Width: 13.2 cm (5.2 in)

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 + NDVI 2592 x 1944 1200 x 960 1280 x 720 640 x 480 640 x 352 320 x 240 320 x 176

NOTE:

NDVI resolution is available only on OS 2.5 and newer; 2592 x 1944 + NDVI will store both a standard and NDVI image. See [NDVI](#) (p. 26) for more information.

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 to 11)
Communication protocols:	Web interface using web browser FTP Email PakBus® (for Campbell Scientific data loggers)
Modem power control	
Maximum output current:	750 mA at 12 VDC

RS-232 or RS-485

Maximum baud rate: 115200 bps

NOTE:

For RS-232: The maximum recommended cable length is 15 m (49 ft) when using the 115200 baud rate and 30 m (98 ft) when using the 57600 baud rate.

For RS-485: A user-supplied (twisted pair) cable spliced onto the communication wires can extend the maximum cable length to 305 m (1000 ft). Keep the power wires 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

6. Quick notes


6.1 CCFC general

- When ordering the CCFC series, use the model numbers CCFC-RS232 ([RS-232 communications](#) (p. 109)) or CCFC-RS485 ([RS-485 communications](#) (p. 111)).
- The **Setup Button Status** LED ([Setup Button/Status LED](#) (p. 15)) 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 using the web interface. This feature can be found under **Import/Export**.
- Check the Campbell Scientific website www.campbellsci.com/ccfc  for firmware updates that may apply.

6.2 Campbell Scientific data logger users

- Ensure that the data logger has the latest PakBus® operating system.
- Use either the CCFC built in-web interface, *Device Configuration Utility*, or *LoggerNet PakBus® Graph* to change settings in the camera.
- Use the *Device Configuration Utility* to change settings in MD485 or other PakBus® devices.
- Use the *Device Configuration Utility* to set the data logger memory and PakBus® parameters.
- Ensure that files (pictures or video) are less than 2 MB for PakBus® transmissions.
- Use the [SendVariables](#) data logger instruction to send variables or text to the camera used as photo or video captions. The instruction can also control the window defroster. Downloadable CRBasic examples are available at www.campbellsci.com/ccfc .

NOTE:

The camera supports only a limited subset of PakBus functionality.

6.3 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 [Timed Capture](#) (p. 43).
 - b. **External Trigger** – Enable and configure the **External Trigger** capture. To set this up using the web interface, see [External Trigger](#) (p. 49).

- c. **Motion Detect** – Enable and configure **Motion Detect** capture. To set this up using the web interface, see [Motion Detect](#) (p. 55).
2. Select the **Power Mode** that best suits the requirements (see [Table 6-1](#) (p. 12)). 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 6-1: Power mode summary¹

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 save mode	6 mA	15	25
Off State	Always on	1 mA	90	120
	Full power save mode	1 mA	90	120

¹This table takes into account the camera power settings. It does not include the power draws associated with activating the IR LEDs (refer to [IR LED power control](#) (p. 99)) or [Lens Defroster Control](#) (p. 101)).

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 described in the following sections:
 - a. [Network](#) (p. 77).
 - b. [Digital I/O](#) (p. 100).
 - c. [RS-232 communications](#) (p. 109) and [RS-485 communications](#) (p. 111).

7. Factory setup

[Table 7-1](#) (p. 13) 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

The following two methods are available for configuring the CCFC camera:

1. Using the web interface with a Wi-Fi or Ethernet connection
2. Using the RS-232 serial lines

Using the web interface is the best way to set up the camera. Communicate with the camera using an Ethernet connection or Wi-Fi 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 *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 website at www.campbellsci.com/downloads. The use of RS-232 serial lines requires the DB9 terminal block adapter (included in the box with the CCFC) to connect to a computer (Factory setup (p. 13)).

8. Camera hardware

Ensure that the pigtail end of the power cable is properly terminated ([Power I/O connection](#) (p. 15)) before connecting the power cable connector to the camera. If the power supply has an on/off switch, 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](#) (p. 14)) turns on and remains steadily on for about 90 seconds. Once the Status LED starts flashing, the camera has properly initialized and is ready for operation ([Setup Button/Status LED](#) (p. 15)).



FIGURE 8-1. CCFC connector layout

8.1 Power I/O connection

Connection to the power I/O (9 to 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 an IP68 environmental rating when properly connected. Even when the camera is not in use, keep the power cable connected, while the camera is 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 (p. 14)). The **Setup Button** also contains an integrated Status LED for user feedback.

- The **Setup Button 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 center of the **Setup Button** provides some useful diagnostic information about the camera. Table 8-1 (p. 15) describes the **Status** LED behavior. This assumes the power supply is between 9 to 30 VDC.

Status LED	CCFC state	Other
Continuously Off	No power or the camera is in one of the following low powered modes: <ul style="list-style-type: none">• 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.	

Status LED	CCFC state	Other
Rapid Flash	Exit from low power state. The camera is kept on by: <ul style="list-style-type: none"> • 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 restart whenever: <ul style="list-style-type: none"> • Power is first applied to it. • Camera is exiting the Off Power mode to perform an operation.

8.2.2 Setup button

The **Setup Button** (FIGURE 8-1 (p. 14)) is 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 minutes, 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 minutes. After the 10 minutes, 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 16 GB 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 ([Media Settings](#) (p. 65)). 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 in **Media Settings** (see [Media Settings](#) (p. 65)).

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 [Table 14-5](#) (p. 44) under Camera Memory).

See [File explorer](#) (p. 73) 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 network configuration.

- Timed Capture 1:
 - <http://1.2.3.4/stc1.jpg>
 - <http://1.2.3.4/stc1.avi>
- Timed Capture 2:
 - <http://1.2.3.4/stc2.jpg>
 - <http://1.2.3.4/stc2.avi>
- External Trigger:
 - <http://1.2.3.4/etc.jpg>
 - <http://1.2.3.4/etc.avi>
- Motion Detect:
 - <http://1.2.3.4/mdc.jpg>
 - <http://1.2.3.4/mdc.avi>

8.3.2 FTP photo collection from camera memory

If the camera is set up 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** ([File explorer](#) (p. 73)). However, if you desire to collect a large number of files from an entire folder, using the web interface is cumbersome.

Campbell Scientific recommends accessing the CCFC memory using the FTP file transfer process. For most Windows computers, type the IP address assigned to the camera by the network. For example, type 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.

Select a directory, such as TimedCapture1, to begin the navigation into that directory. Whole directories or files can be saved.

NOTE:

Files cannot be deleted this way.

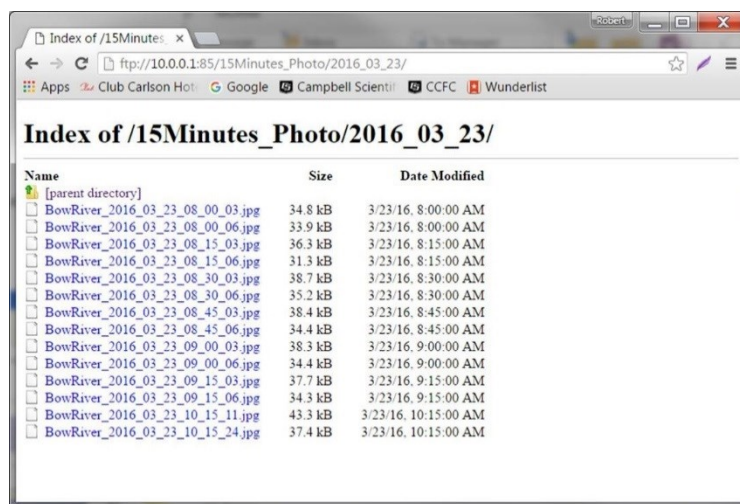


FIGURE 8-2. Photo collection from installed camera memory

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

Campbell Scientific recommends setting 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 [Modem Power Control](#) (p. 100) for configuration details using the web interface.

This power management feature can greatly reduce the system power requirements by only turning on the modem to transmit a photo or video. The **Modem Power Control** turns 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 that requires communications, 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 seconds 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 [Lens Position](#) (p. 62)).

8.5.1 Camera lens and field-of-view

The CCFC includes a 4.7 to 84.5 mm lens, which provides approximately a 3-degree horizontal field-of-view when fully zoomed in and a 55-degree 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 **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 uses 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 focuses 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 operating temperature.

Some lens options are unavailable when working in the extreme cold. The zoom and focus function remains at a fixed position at temperatures below –30 °C. Note that these thresholds are based on camera internal temperatures, which can be several degrees warmer than ambient outdoor temperature. The camera continues 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 [Dashboard](#) (p. 39)).

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. The IR filter is also used for NDVI photos.

9. Cables/wiring

9.1 Power and I/O cable connections

[Table 9-1](#) (p. 21) shows the wiring for the power and I/O cable connector assembly according to the camera application. The wires can be terminated directly on the control ports of a compatible data logger (for compatible data loggers see [CCFC compatibility](#) (p. 118)).

The cable comes with wire terminators/connectors attached to the green, yellow, and white wires (see the following figure). Use the wire terminators/connectors to individually isolate unused wires.

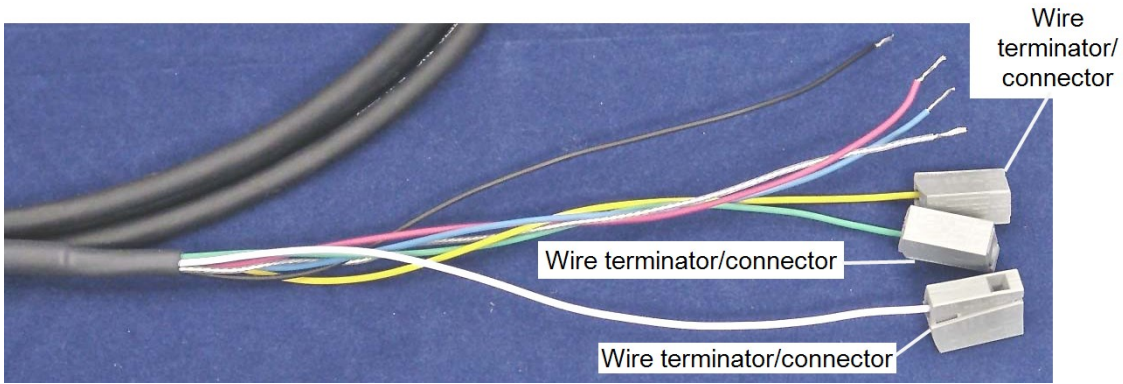


FIGURE 9-1. Wire terminators/connectors individually isolate unused wires

CAUTION:

First connect the black ground wire when wiring the camera to the data logger or other power supply.

Table 9-1: Power and I/O cable connections

Color	Function	Connection	When Not Used
Black ¹	Power Ground	System Ground (or Pin 5 of a computer (DTE) DB-9 Connector).	
Red ¹	Input Power	Power Source 9 to 30 VDC.	
Green ²	RS-232 TX (Output)	RS-232 Input (RX control port of data logger or pin 2 of a computer (DTE) DB-9 Connector). RS-485A when configured to RS-485. Only connect when RS-232 and RS-485 communications are used for PakBus® or the <i>Device Configuration Utility</i> .	Connect to wire terminator/connector (FIGURE 9-1 (p. 21))

Table 9-1: Power and I/O cable connections

Color	Function	Connection	When Not Used
White	RS-232 RX (Input)	<p>RS-232 Output (TX control port of a data logger or pin 3 of a computer (DTE) DB-9 connector).</p> <p>RS-485B when configured to RS-485.</p> <p>Only connect when RS-232 and RS-485 communications are used for PakBus® or <i>Device Configuration Utility</i>.</p>	<p>Connect to wire terminator/connector (FIGURE 9-1 (p. 21))</p>
Yellow	Modem Power Control (Output)	<p>Powers a communication device. The camera switches the input power voltage to this line.</p> <p>For solar powered sites the camera can remove power from the modem when communications are not required.</p>	<p>Connect to wire terminator/connector (FIGURE 9-1 (p. 21))</p>
Blue	External Trigger (Input)	<p>Connect to external signal source (data logger control terminal). The external signal wakes up or initiates photo/video acquisition. On a Campbell Scientific data logger, connect to a 5 V (5V) or switched 12 V (SW12V) terminal and be sure to provide a ground.</p> <p>Another device can also help keep the camera in the Fully On power mode by leaving the External Trigger Input activated.</p>	<p>Connect to ground if left in factory default settings</p>
Clear ¹	Shield	<p>Earth ground or \perp when the RS485 configuration is used.</p>	

¹ Required

² For the CR300 Series, 100 ohm resistor to the TX (green) line recommended when sending images to the data logger.

NOTE:

The external trigger also turns on Wi-Fi from any low power mode when it is changed to **Active State** (see [Camera Power Modes](#) (p. 92)). 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 must be connected to a 5 or 12 VDC source.

9.2 Power and I/O cable details

The Power and I/O Cable (CCFCCBL1-L) has an outdoor environmentally rated connector on one end and discrete wire pigtails on the other end that allow for flexible termination. When connecting the cable 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 [CCFC camera accessories](#) (p. 129).

- 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 data logger end
- Maximum recommended cable length of 20 m (65 feet)

A user-supplied cable with heavier wire gauge may support longer cable lengths. The individual wire resistance on the 12 VDC and ground conductors should not exceed 0.7 Ohms. Long cables used in conjunction with RS-232 communications requires slower baud rates. Depending on the cable length and type, 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.

Use the Ethernet connection to configure camera settings and target and focus the camera. The Ethernet port is auto MDIX; therefore, an Ethernet crossover cable is not required to connect the camera to other devices.

Indoor installations and temporary dry outdoor connections can use a standard CAT5 (or better) Ethernet cable with RJ45 connectors to interface the camera. Permanent outdoor and temporary connections in wet or harsh environments require the Environmental Ethernet Cable assembly. Campbell Scientific recommends the use of the environmentally sealed cable at all times when outdoors.

The Environmental Ethernet Cable Assembly (CCFCCBL3-L) has an environmental connector that provides a weatherproof connection with the camera. The other end of the cable is a standard RJ45 connector that connects to 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 of 70 m (230 feet)

NOTE:

Cameras with serial number 1276 and older use the CCFCCBL2-L Environmental Ethernet Cable. Cameras with serial number 1277 and newer use the CCFCCBL3-L Environmental Ethernet Cable.

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

Campbell Scientific *Device Configuration Utility* software can configure the same settings configured using the Web browser. Campbell Scientific *Device Configuration Utility* software is available as a download on www.campbellsci.com/downloads. It is included in installations of *LoggerNet*, *RTDAQ*, and *PC400*.

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. The following table show wiring for RS-232 communications.

Table 10-1: RS-232 wiring diagram

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

NOTE:

If unable to connect to the camera using 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 Adapter (pn 28840) that facilitates the connection from the Power and I/O Cable to a 9 pin RS-232 connector. See [Power and I/O cable connections](#) (p. 20) for wiring details.

Using the *Device Configuration Utility*:

1. Connect the camera to the serial port of a computer using the DB9 female to Terminal Block Adapter, as shown in [RS-232 communications](#) (p. 109).
2. The **Status** LED flashes once the camera is powered up (this can typically take 90 seconds), . If the Status LED does not flash, press the **Setup** button to exit the low powered mode.
3. In the *Device Configuration Utility*, select the CCFC from the device list and click **Connect** to connect to the camera.
4. Normally, the camera baud rate is set to 115200 bps. 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.
5. Once connected to the CCFC, use the tabs to navigate and configure the camera.

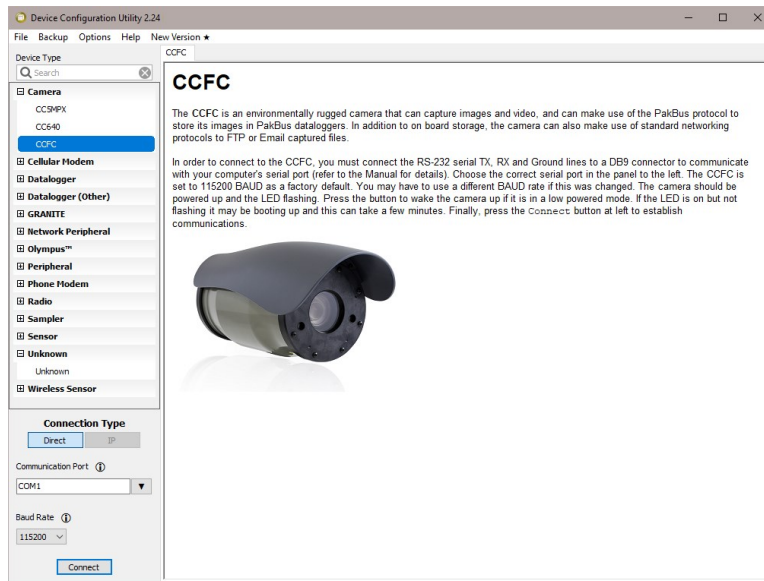


FIGURE 10-1. CCFC shown in Device Configuration Utility

The camera has a large amount of variable information, so it may take about 30 seconds for the connection process to complete. Once the settings are loaded, click the tabs at the top of the screen to navigate 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 uses various techniques to produce the best photo possible under these lighting conditions.

12. NDVI

Normalized Difference Vegetation Index (NDVI) is an image processing technique which combines an infrared image with a normal color image to give a representation of the health of

vegetation. This can be useful in agriculture for identifying stress in crops, precision farming, and in forestry for quantifying density, or leaf area.

The CCFC has a removable IR filter which allows it to capture two images in rapid succession in order to create an NDVI representation image.

NOTE:

Any motion in the frame will be apparent in the NDVI image since there is a small time lag between the image captures (less than one second).

NDVI creates a false color image, with non-vegetation appearing in shades of blue and vegetation appears in colors on a scale from green to yellow to red (see [FIGURE 12-1](#) (p. 27)). The NDVI image which the CCFC generates has a legend at the bottom which displays this scale. It also contains an estimation of the total percentage of vegetation in the image.

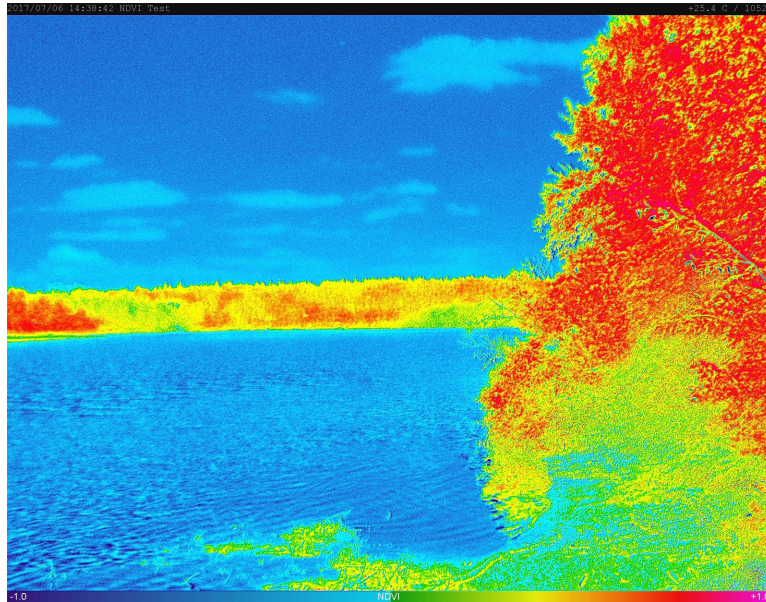


FIGURE 12-1. NDVI image example



FIGURE 12-2. NDVI source image example

To enable the NDVI option simply go to **Media Settings: Edit Photo Profile** ([Photo Capture](#) (p. 65)) and from the **Resolution** dropdown, select **NDVI**. There is also an option to select **2592x1944 + NDVI**, this will capture and save two images, one real color image ([FIGURE 12-2](#) (p. 28)) and one NDVI ([FIGURE 12-1](#) (p. 27)).

The manual capture feature on the home page for the CCFC also has the NDVI option ([Dashboard](#) (p. 39)).

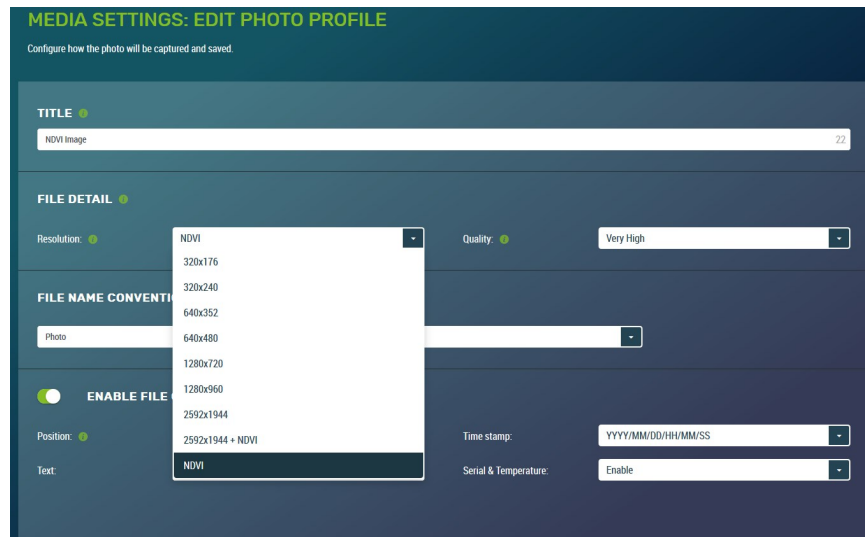


FIGURE 12-3. NDVI dropdown

13. Connecting to the web interface

The CCFC supports an automatic IP address configuration when the camera is directly connected, using an Ethernet cable, to a computer. If using this method, type the IP address, **169.254.99.99**, into the Internet browser.

Refer to [Setup using Ethernet](#) (p. 29) for details on making the initial network connection to the camera. To establish communications with the camera, use one of the methods previously discussed. Type the appropriate IP address in the address bar of the browser. After typing the address, the homepage (**Dashboard**) of the CCFC camera will appear as shown in [FIGURE 14-1](#) (p. 34).

The camera ships with automatic network configuration using DHCP enabled. Campbell Scientific recommends keeping track of changes made to the network settings.

13.1 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 using its Wi-Fi network. The camera will appear as **CCFC-*nnnn*** (where *nnnn* is the last four digits of the camera serial number) on the Wi-Fi network.

Once connected to the camera Wi-Fi, open a web browser and type the default Wi-Fi IP address in the address bar: **http://10.0.0.1**. This directs you to the camera web interface where the camera can be configured.

13.2 Setup using Ethernet

13.2.1 Link local IP address auto-configuration

The CCFC supports an automatic IP address configuration when the camera is directly connected, using an 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 is accessible using the IP address 169.254.99.99. This address is valid for accessing the camera in any network configuration.

NOTE:

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 must be used.

14. Camera option using the web interface

Review how to connect to the web interface with [Connecting to the web interface](#) (p. 29).

14.1 Installing MultiMedia Player

See [RTSP video stream](#) (p. 30) 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 codes are available on the computer. The download is available online at:

www.videolan.org/vlc 

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

NOTE:

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

14.1.1 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 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.

14.1.1.1 Sources

As shown in [Table 14-1](#) (p. 31), there are three different stream sources, which provide three different video resolutions from the camera.

Resolution	URL
320 x 240	rtsp://1.2.3.4/ipcam/mpeg4cif ¹
640 x 480	rtsp://1.2.3.4/ipcam/mjpeg ¹
720p ²	rtsp://1.2.3.4/ipcam/mpeg4 ¹

¹where 1.2.3.4 is the CCFC IP address

²Video Codec is used for streaming mpeg4 at 720p; this can result in lower quality resolution than the original video.

14.1.1.2 Embedding

Use the following sample code to embed the video stream into web page HTML. Change the width, height, and URL according to the application needs. See

<https://wiki.videolan.org/Documentation:WebPlugin/>  for more information.

```
<embed id="v1cEmb"
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, change 192.168.1.78 to the IP address of the CCFC being used.

14.1.2 UPnP discovery

The CCFC supports UPnP for device discovery. Therefore, 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.

14.2 Image capture URL

The CCFC is able to preform an image capture and download the image through the browser using a single URL. Use this feature by accessing the URL: `http://1.2.3.4/capture.jpg` where 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¶m2=val2`

The immediate capture will use the light settings set in **Night Mode**.


[Table 14-2](#) (p. 32) describes the the valid parameters and values for changing the image capture URL settings.

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

Parameter	Description	Values
Immediate_pos	Sets the lens position for the image capture (Lens Position (p. 62)). Do not add numbers together for multiple lens positions; use only the values listed in the 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 recommended.	0 No autofocus 1 Preform autofocus
Immediate_banner	Select whether or not to add the image banner, containing time and temperature, to the captured image.	0 Disable 1 Inside top 2 Inside bottom 3 Outside top 4 Outside bottom

An example of the URL set with parameters in [Table 14-2](#) (p. 32) is:

`http://1.2.3.4/data.json?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 is the IP address of the camera) to capture the image using the parameters set.

Download an example CRBasic program illustrating the use of the **HTTPGet** instruction to set these parameters and initiate an image capture from www.campbellsci.com/downloads/ccfc-program-examples .

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.

14.3 Web interface overview

Use the web interface 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

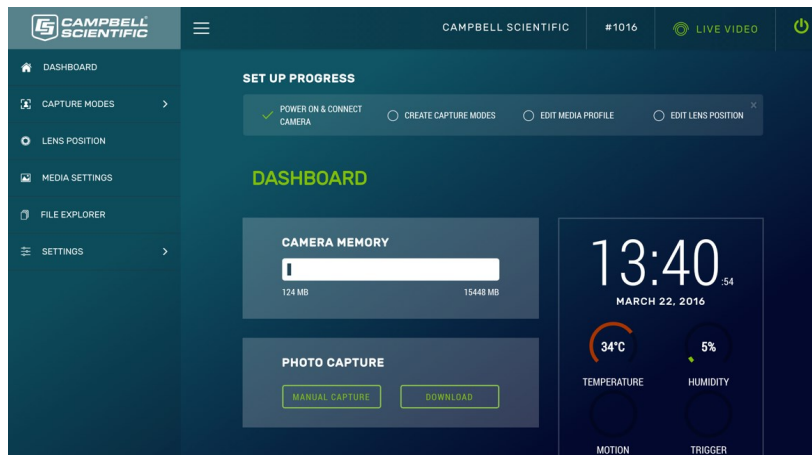


FIGURE 14-1. Dashboard – desktop view

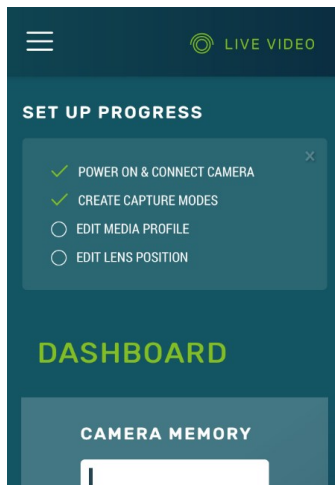


FIGURE 14-2. Dashboard – mobile view

Table 14-3: Web interface components

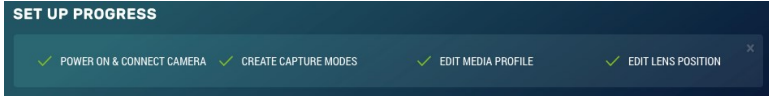

Title	Parameter	Description
Set Up Progress	Power On and Connect Camera	Completion of these parameters is indicated by a check mark beside the appropriate task. Select the title to be linked to the appropriate page. Once complete, click the X in the top right corner to remove the SET UP PROGRESS bar.
	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 General Settings (p. 75).
	Camera Serial Number	From Campbell Scientific.
	Live Video	Select Live Video to open a modal with a live video. You can select a Lens Preset from a drop down and adjust the Zoom using a slider. Edit Positions directs you to the Lens Position option. See Lens Position (p. 62) 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.
		

Table 14-3: Web interface components


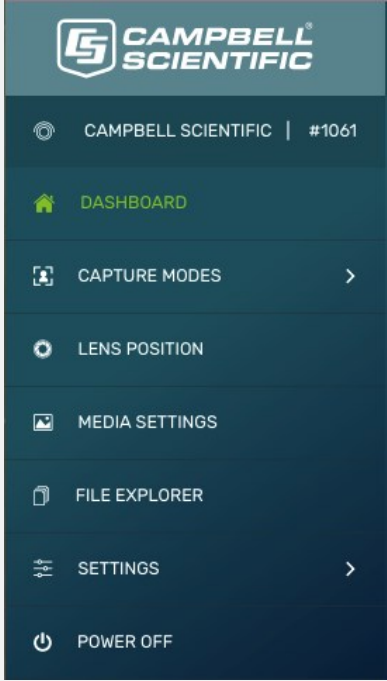
Title	Parameter	Description
Top Navigation Bar – Mobile View	Menu Key	Collapses or opens the left navigation sidebar.
	Live Video	Select Live Video to open a modal with a live video. You can select a Lens Preset from a drop down and adjust the Zoom using a slider. Edit Positions directs you to the Lens Position option. See Lens Position (p. 62) for detailed instructions.
		

Table 14-3: Web interface components

Title	Parameter	Description
Left Navigation Sidebar – Mobile View	Campbell Scientific Logo	Brings user to Dashboard .
	Camera Name	As set in General Settings , see General Settings (p. 75).
	Camera Serial Number	From Campbell Scientific.
	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 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 ([Dashboard](#) (p. 39)).

- If any settings are changed or added, **Save** must be clicked to accept the changes. If **Save** is not clicked, 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 computers, the sidebar is automatically collapsed to allow more space for content. Reopen the sidebar by clicking the menu key at the top left of the page.
- The top of every page includes a top navigation bar (FIGURE 14-3 (p. 38)), which includes the **Camera Name** set in [General Settings](#) (p. 75), the camera serial number, a link to the **Live Video** modal (see [Live Video modal](#) (p. 38)), and the green power icon.

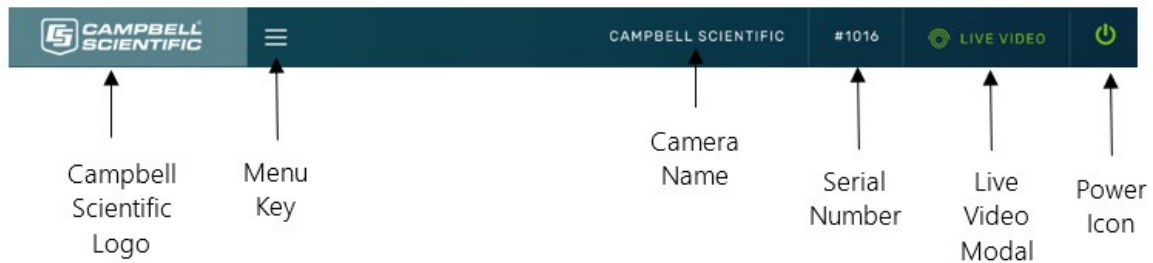


FIGURE 14-3. Top navigation bar – desktop view

14.3.1 Live Video modal

The web interface allows you 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.

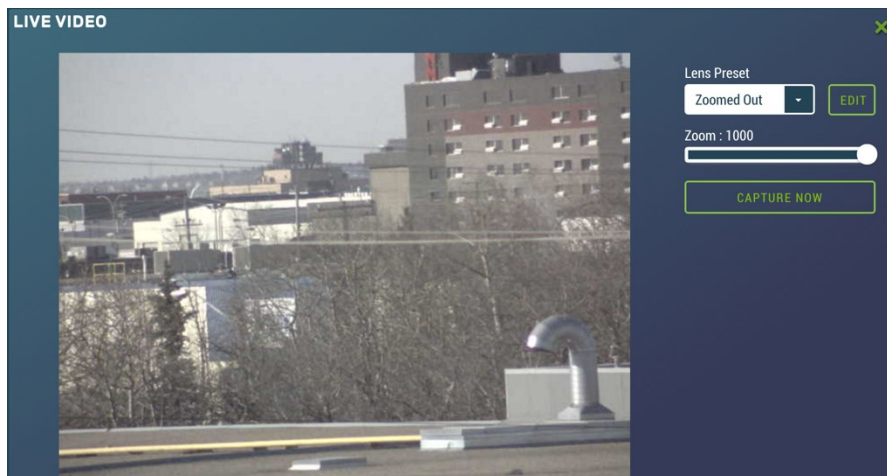


FIGURE 14-4. Live Video modal

With the **Live Video** modal, you can view the live video stream from the camera. You can choose the lens position you would like to view from, use the **Edit** button to go to **Lens Position** (see [Lens Position](#) (p. 62)) or adjust the zoom level of the live stream video.

Use the **Capture Now** button to capture a 1280 x 960 photo with **Lossless** quality of what is being viewed through the **Live Video** modal.

14.3.2 Power icon

The green power icon (see [FIGURE 14-3](#) (p. 38)) 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 ([Setup Button/Status LED](#) (p. 15)).

14.3.3 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.

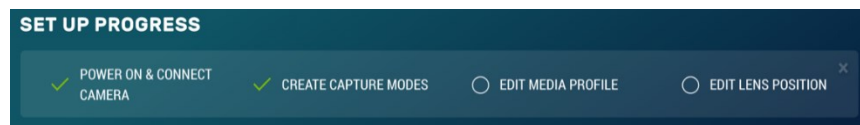


FIGURE 14-5. Set Up Progress bar

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 ([General Settings](#) (p. 75)).

14.4 Dashboard

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

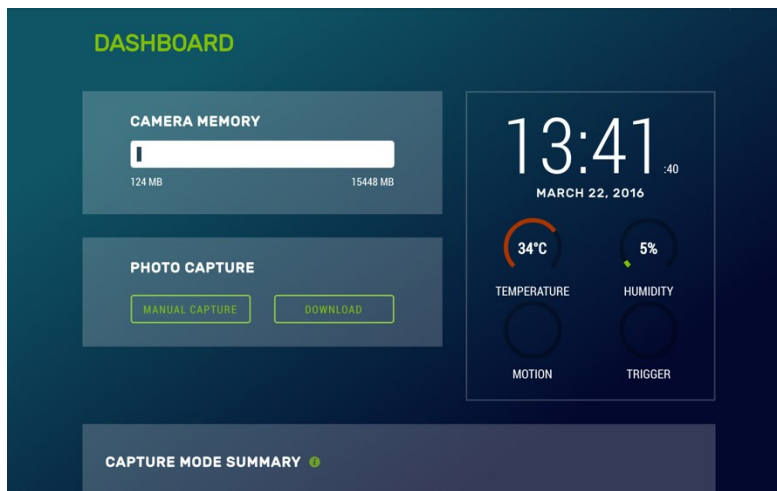


FIGURE 14-6. CCFC Dashboard

Any web server or FTP activity will reset the sleep timer in the camera, so the camera will stay awake for 5 minutes after the last access to the web page. When a user has the **Dashboard** open, it constantly accesses the web server as the camera loads the time, temperature, and humidity. The net result is that when the **Dashboard** is open, the camera will not go to sleep.

Table 14-4 (p. 40) provides information on the **Dashboard** features.

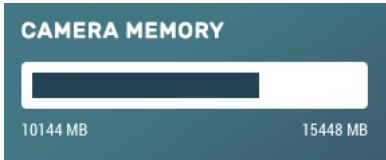
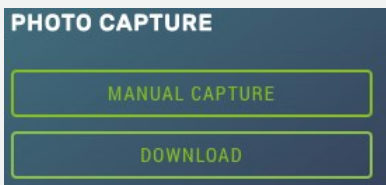
Table 14-4: Dashboard components	
Parameter	Description
Camera Memory 	Available camera memory (max of 16 GB).
Photo Capture 	<p>Manual Capture: capture a photo immediately using Manual Capture modal. There are two drop downs, one for resolution and one for where to save the image (Download: downloads image to the device, View: captures a photo to be viewed in the Manual Capture modal; see FIGURE 14-7 (p. 42)). The quality of the capture is Lossless.</p> <p>Download: Navigates to the File Explorer to download captured photos.</p>

Table 14-4: Dashboard components




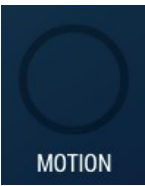
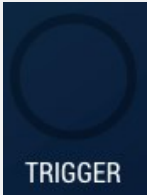

Parameter	Description
<p>Time and Date</p> 	<p>24 hour clock; current date. When the clock is running the camera is connected and is configurable. If the clock is static, the device browser is displaying a cached version of the camera web interface.</p>
<p>Temperature</p> 	<p>CCFC internal temperature. As electronics output heat when in operation, this temperature will almost always be higher than the external temperature.</p>
<p>Humidity</p> 	<p>CCFC internal humidity. Humidity over 50% for an extended period of time is cause for concern. If achieved, contact a Campbell Scientific Support Engineer.</p>
<p>Motion</p> 	<p>CCFC motion detect display. The circle displays as green when motion is detected.</p>

Table 14-4: Dashboard components

Parameter	Description
<p>Trigger</p> 	<p>CCFC external trigger display.</p> <p>The circle displays as green when an external trigger event occurs.</p>
<p>Capture Mode Summary</p> 	<p>Displays currently enabled capture modes and provides a shortcut to adding new capture modes (+).</p>

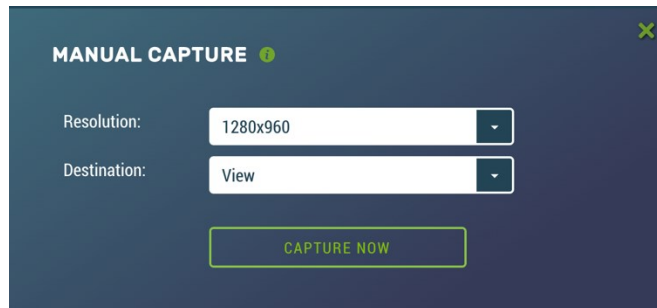


FIGURE 14-7. Manual Capture modal

14.5 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 [Media Settings](#) (p. 65)).
- 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.

14.5.1 Timed Capture

Use **Timed Capture** to configure the camera to capture photos or video using the CCFC internal clock.

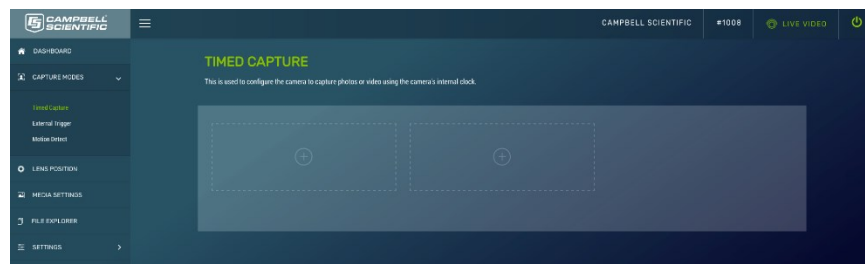


FIGURE 14-8. Timed Capture

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. [Table 14-5](#) (p. 44) and [Table 14-6](#) (p. 47) summarize all the variables associated with the **Timed Capture** for photos and videos, respectively.

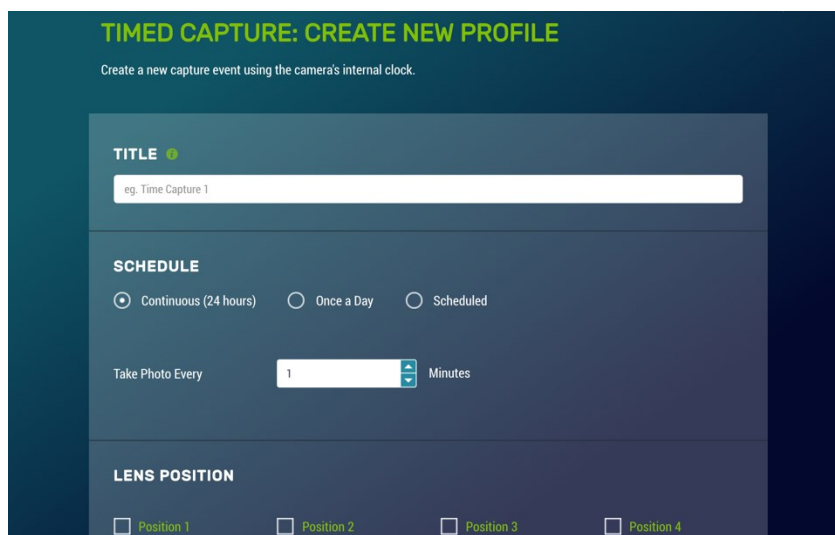


FIGURE 14-9. Timed Capture: Create New Profile

Table 14-5: 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 File explorer (p. 73)).

Table 14-5: Timed Capture variables for photos

Variable	Allowable values	Description
Schedule	Continuous (24 hours)	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 (Lens Position (p. 62)). 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 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.

Table 14-5: Timed Capture variables for photos

Variable	Allowable values	Description
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. Enter a value of zero (0) to 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 exceeds 1000.
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
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 (Email (p. 87)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-5: Timed Capture variables for photos

Variable	Allowable values	Description
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 (FTP (p. 85)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-6: 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 (see File explorer (p. 73)).
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.

Table 14-6: Timed Capture variables for videos

Variable	Allowable Values	Description
Lens Position	Checkbox	Select 1- 4 lens positions for the capture (Lens Position (p. 62)). 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 (Media Settings (p. 65)).
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. Enter a value of zero (0) to 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 exceeds 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 (Email (p. 87)).

Table 14-6: Timed Capture variables for videos

Variable	Allowable Values	Description
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 (FTP (p. 85)).
Send via PakBus®	Toggle	Enabling initiates sending videos via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).

14.5.2 External Trigger

NOTE:

This section applies to use with a data logger 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](#) (p. 21) for information on which wires need to be connected.

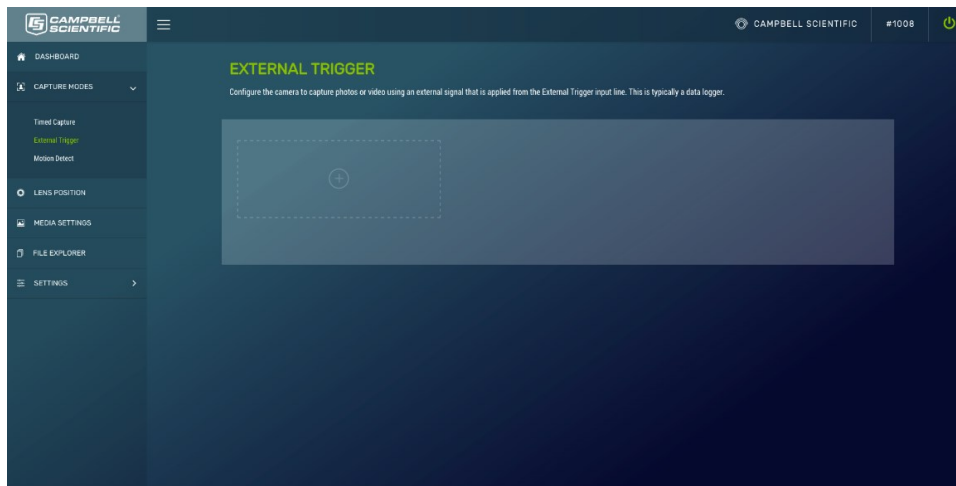


FIGURE 14-10. External Trigger

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** 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.

A 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 [Table 14-7](#) (p. 51) and [Table 14-8](#) (p. 53), respectively.

EXTERNAL TRIGGER: CREATE NEW PROFILE

Create a new capture event using an external signal that is applied from the External Trigger input. This is typically a datalogger.

TITLE ⓘ

eg. Trigger Capture 1

External Trigger: ⓘ Active High

LENS POSITION

Position 1 Position 2 Position 3 Position 4

FIGURE 14-11. External Trigger: Create New Profile

Table 14-7: 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 (see File explorer (p. 73)).
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 (Lens Position (p. 62)). 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 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.

Table 14-7: External Trigger Variables for Photos

Variable	Allowable Values	Description
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. Enter a value of zero (0) to 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 exceeds 1000.
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
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 (Email (p. 87)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-7: External Trigger Variables for Photos

Variable	Allowable Values	Description
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 (FTP (p. 85)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-8: 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 (see File explorer (p. 73)).
External Trigger	Active High	Configures External Trigger to capture on a positive voltage.
	Active Low	Configures the External Trigger to capture with 0 volts.

Table 14-8: External Trigger variables for video

Variable	Allowable values	Description
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 (Media Settings (p. 65)).
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. Enter a value of zero (0) to 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 exceeds 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 (Email (p. 87)).
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 (FTP (p. 85)).

Table 14-8: External Trigger variables for video

Variable	Allowable values	Description
Send via PakBus®	Toggle	Enabling initiates sending videos via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).

14.5.3 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.

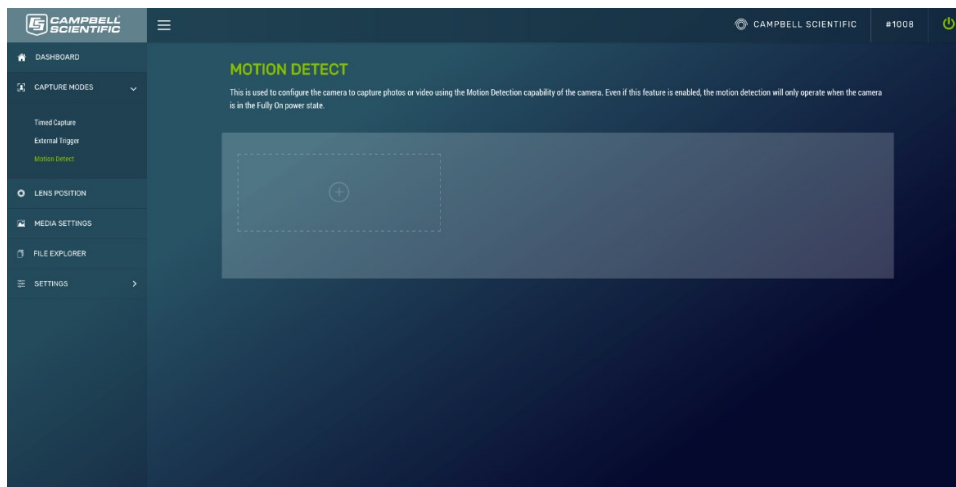


FIGURE 14-12. Motion Detect

The CCFC implements an adaptive motion detect scheme 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 works 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 is the least sensitive motion detect threshold setting and a value of 99 is the most sensitive motion detect threshold setting. Motion detect can be a complicated feature to implement. Campbell Scientific recommends initially setting the motion detect threshold to 50 and adjust it to get the best setting for the application.

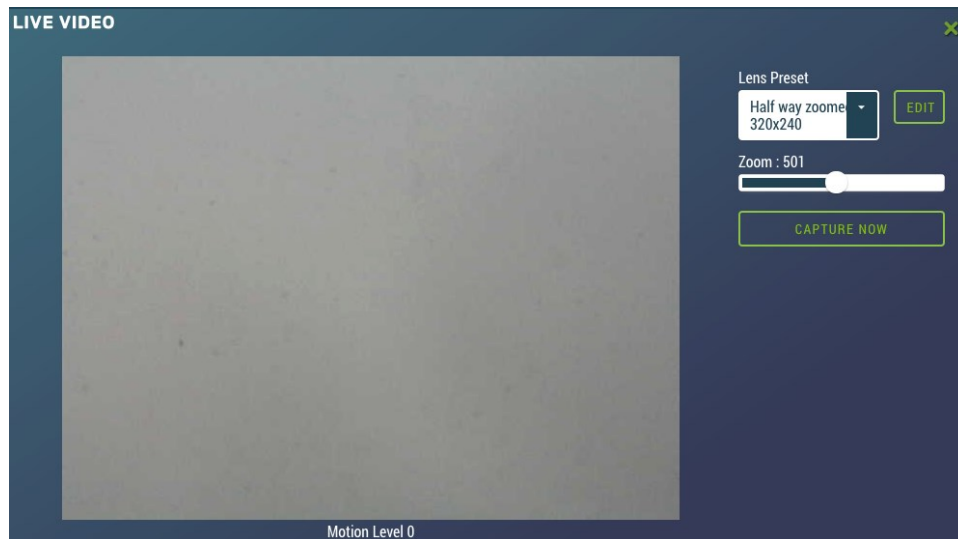


FIGURE 14-13. Live Video Motion Detect Level

If the camera is not detecting the desired motion, increase the motion detect sensitivity level. If the camera produces too many false triggers, decrease the motion detect sensitivity level. Note that the camera can falsely detect or not detect motion due to too many 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.

MOTION DETECT: CREATE NEW PROFILE

Configure the camera to capture photos or video using the Motion Detection capability of the camera. Even if this feature is enabled, the motion detection will only operate when the camera is in the Fully On power state.

TITLE ⓘ

eg. Motion Capture 1

MOTION DETECTION ⓘ

Sensitivity ⓘ 1

Continuous (24 Hour) Scheduled

LENS POSITION

Position 1 Position 2 Position 3 Position 4

FIGURE 14-14. Motion Detect: Create New Profile

Table 14-9: 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 (see File explorer (p. 73)).
Sensitivity	1 to 99	<p>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.</p> <p>NOTE: A larger range of sensitivity (-99999 to +99999) can be used when the standard range of 1 to 99 does not suit requirements.</p>
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 (Lens Position (p. 62)). Selecting the green position title opens the Lens Position modal to edit the selected lens position.
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.

Table 14-9: Motion Detect settings for photo options

Variable	Allowable values	Description
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. Enter a value of zero (0) to 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 exceeds 1000.
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
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 (Email (p. 87)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-9: Motion Detect settings for photo options

Variable	Allowable values	Description
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 (FTP (p. 85)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
Send via PakBus®	Toggle	Enable to initiate sending photo files via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).
	Media Profile	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).

Table 14-10: 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 File explorer (p. 73)).
Sensitivity	1 to 99	<p>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.</p> <p>NOTE: A larger range of sensitivity (-99999 to +99999) can be used when the standard range of 1-99 does not suit requirements.</p>

Table 14-10: Motion Detect settings for video options

Variable	Allowable Values	Description
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 (Lens Position (p. 62)). Selecting the green position title opens the Lens Position modal to edit the selected lens position.
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	Drop down to select a configured media profile. Use the Edit button to setup Media profiles via the Media Settings modal (Media Settings (p. 65)).
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. Enter a value of zero (0) to 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 exceeds 1000.

Table 14-10: Motion Detect settings for video options

Variable	Allowable Values	Description
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 (Email (p. 87)).
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 (FTP (p. 85)).
Send via PakBus®	Toggle	Enabling initiates sending videos via the PakBus® modal (PakBus® (p. 89)).
	PakBus® Port	Displays current PakBus® Port number. Use the Edit button to edit current PakBus® settings via the PakBus® modal (PakBus® (p. 89)).

14.6 Lens Position

The camera comes pre-configured with four default lens positions, 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.

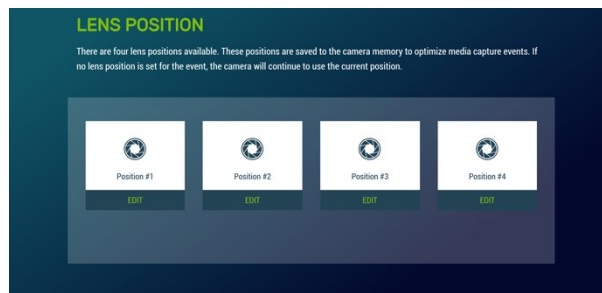


FIGURE 14-15. Lens Position

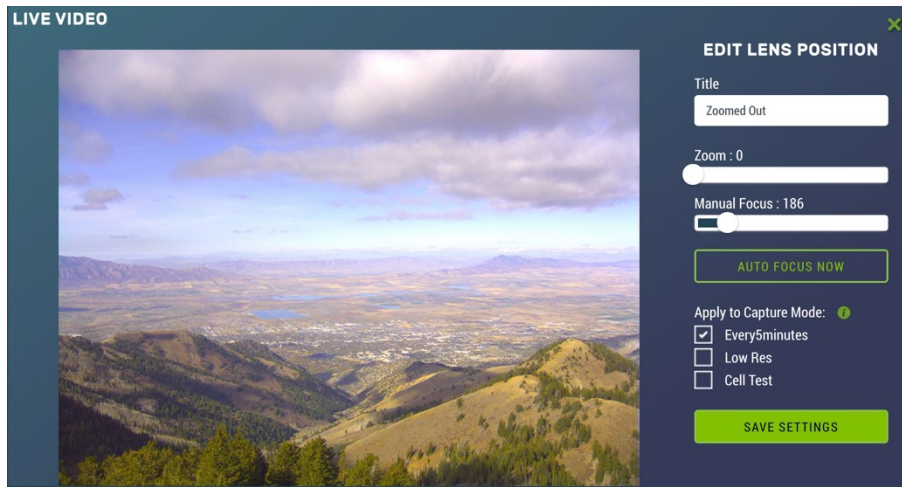


FIGURE 14-16. Lens Position Modal

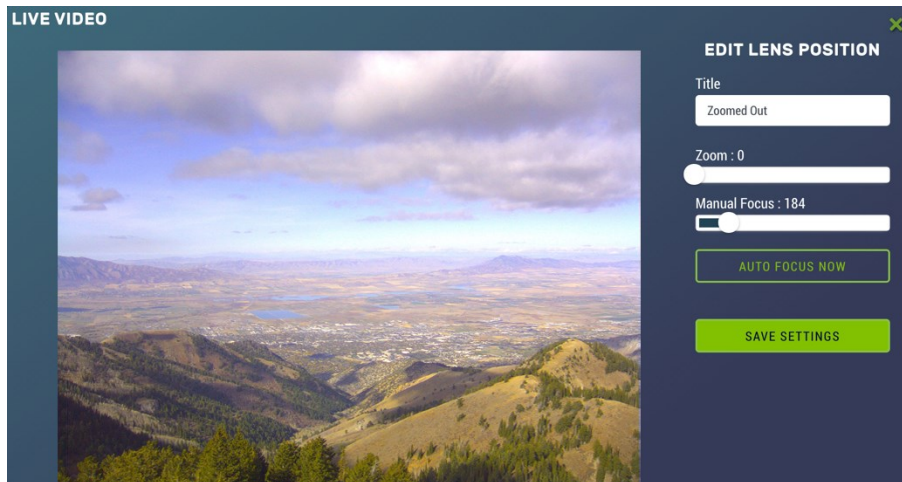


FIGURE 14-17. Lens Position Modal (in Capture Modes)

Table 14-11: 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).

Table 14-11: Lens Positions Modal

Variable	Allowable Values	Description
Manual Focus	Slider	Slider automatically updates when the Zoom slider is moved, as the camera automatically focuses on the center of the screen. The Manual Focus slider will only be used to adjust the focus on an item that is not in the center 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 [Table 14-12](#) (p. 64) referring to the zoom level and minimum focal distance.

Table 14-12: Minimum focal distance

Zoom position	Minimum focal distance (centimeters)
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.

14.7 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 both the photo and video.

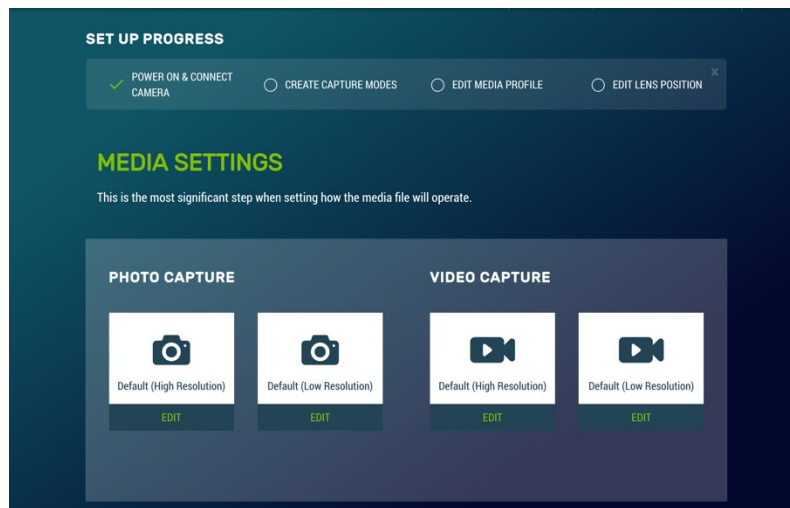


FIGURE 14-18. Media Settings

14.7.1 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 14-13](#) (p. 66).

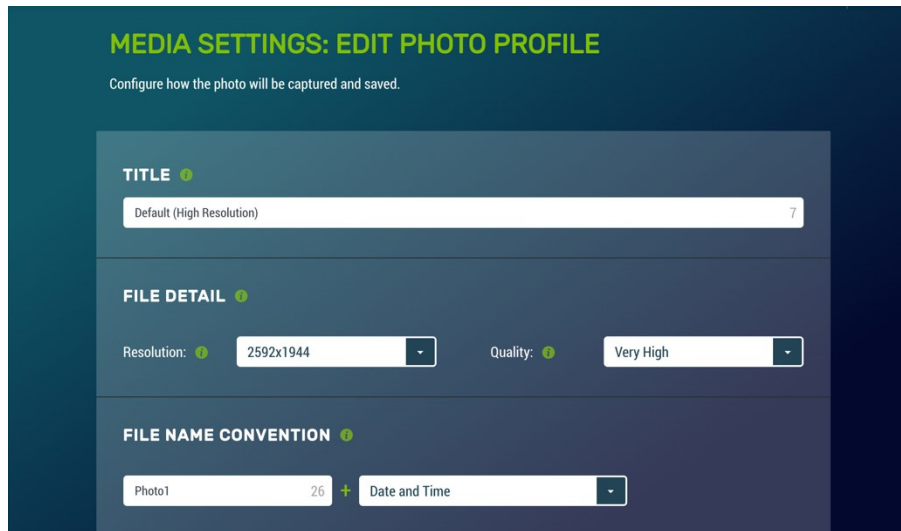


FIGURE 14-19. Media Settings: Edit Photo Profile

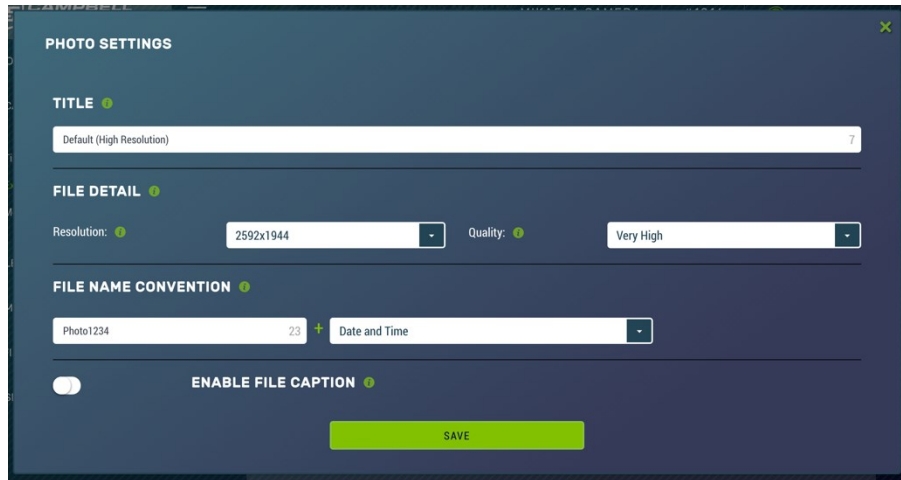


FIGURE 14-20. Photo Settings modal

Table 14-13: 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 (Capture modes (p. 42)).

Table 14-13: Photo Capture variables

Variable	Allowable values	Description/options
File Detail	Resolution	320 x 176 320 x 240 640 x 352 640 x 480 1280 x 720 1280 x 960 2592 x 1944 2592 X 1944 + NDVI NDVI (NDVI (p. 26))
	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.

Table 14-13: Photo Capture variables

Variable	Allowable values	Description/options
Enable File Capture	Toggle	When viewing the photo, this information will be displayed.
	Position	<p>Inside Top: (inside referring to overlaying the text on the photo). Displays text, timestamp, and/or serial and temperature.</p> <p>Inside Bottom: Displays text, timestamp, and/or serial and temperature at the bottom of the video.</p> <p>Outside Top: (outside referring to displaying text outside the photo). Displays text, timestamp, and/or serial and temperature.</p> <p>Outside Bottom: Displays text, timestamp, and/or serial and temperature at the bottom of the video.</p>
	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 14-14 (p. 69) are based on photo resolution.
	Serial and Temperature	<p>Enable or Disable</p> Serial: serial number of the camera. Temperature: internal temperature of the camera.

Table 14-14: Photo resolution details

Resolution	Size with outside banner	Maximum characters in banner	Quality	Typical file size ¹ (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

Table 14-14: Photo resolution details

Resolution	Size with outside banner	Maximum characters in banner	Quality	Typical file size ¹ (kB)
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
NDVI	2592 x 1984	136	Lossless	3800
			Very High	1000
			High	528
			Medium	380
			Low	300

¹ Actual file size varies based on lighting conditions and subject matter

14.7.2 Video capture

By selecting **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 14-16](#) (p. 73) shows the approximate file size for every second of recorded video: the largest file sizes are produced by the 720p 30FPS video, which is 500 KB (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 KB per second of video.

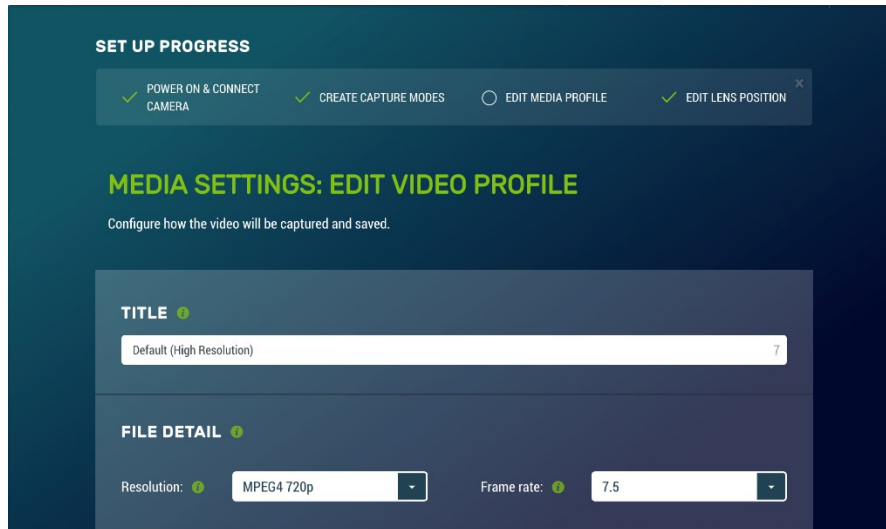


FIGURE 14-21. Media Settings: Edit Video Profile

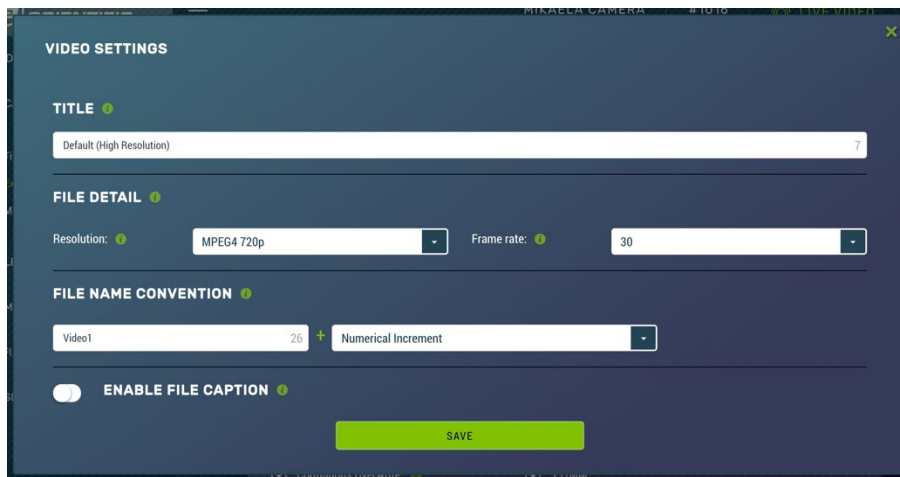


FIGURE 14-22. Video Settings Modal

Table 14-15: 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 (Capture modes (p. 42)).
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 14-16 (p. 73) and are based on resolution.

Resolution	Frames per second	KB per second
720p	7.5	125
	15	250
	30	500
320 x 240	7.5	10
	15	20
	30	65

14.8 File explorer

Use **File Explorer** 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.

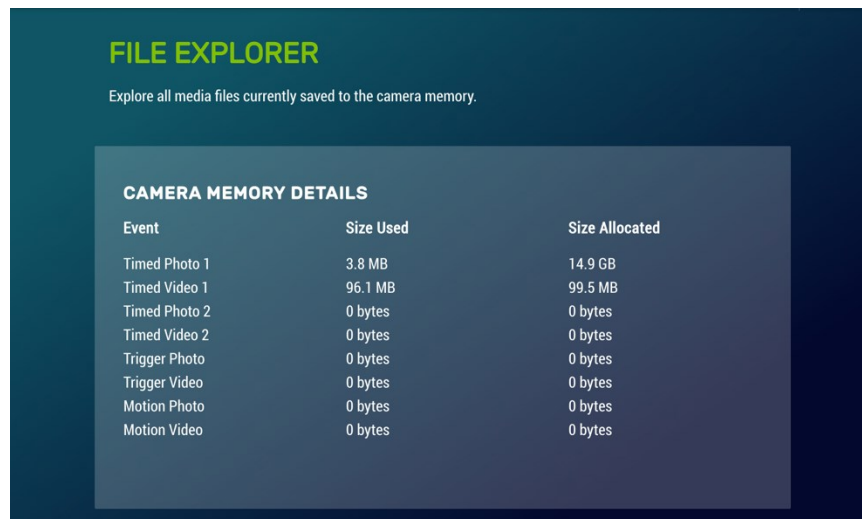


FIGURE 14-23. File Explorer: Camera Memory Details

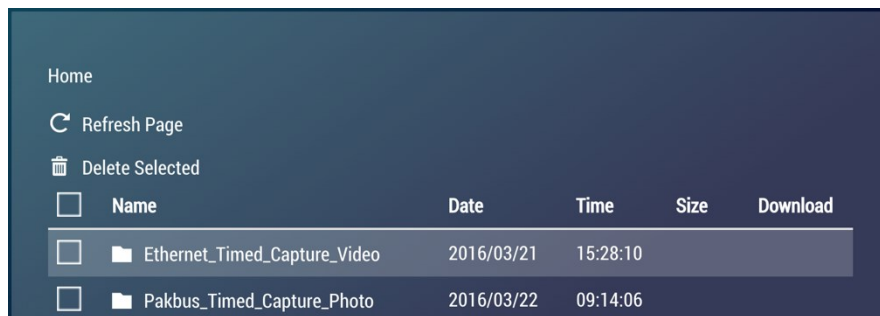


FIGURE 14-24. File Explorer: File Details

Up to nine main directories may be 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 ([Capture modes](#) (p. 42)).

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 cannot be downloaded from the File Explorer in iOS mobile devices, as per Apple regulations.

14.9 Settings

14.9.1 General Settings

The **General Settings** page has three configuration sections:

- Camera Name
- Date and Time Settings
- Default Factory Reset

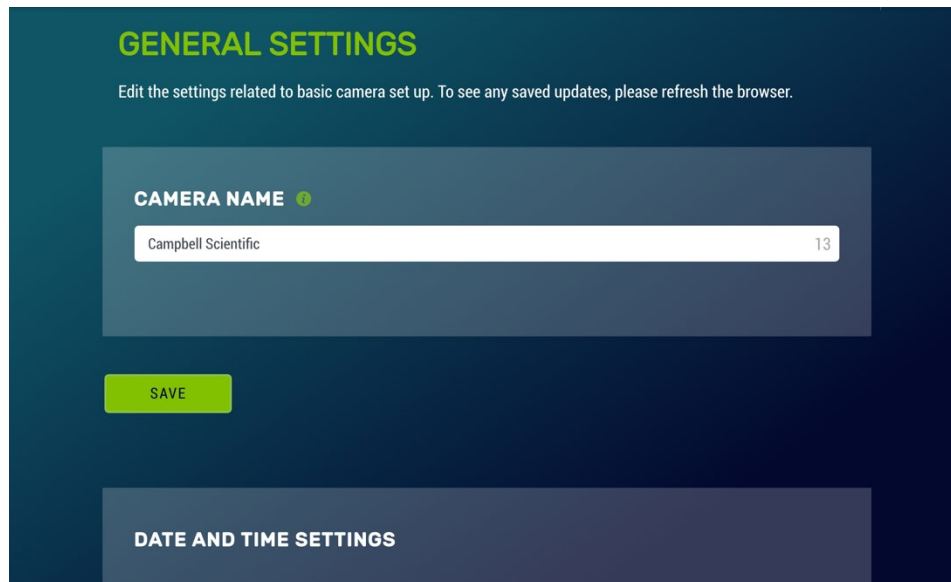


FIGURE 14-25. General Settings

Table 14-17: General Settings variables

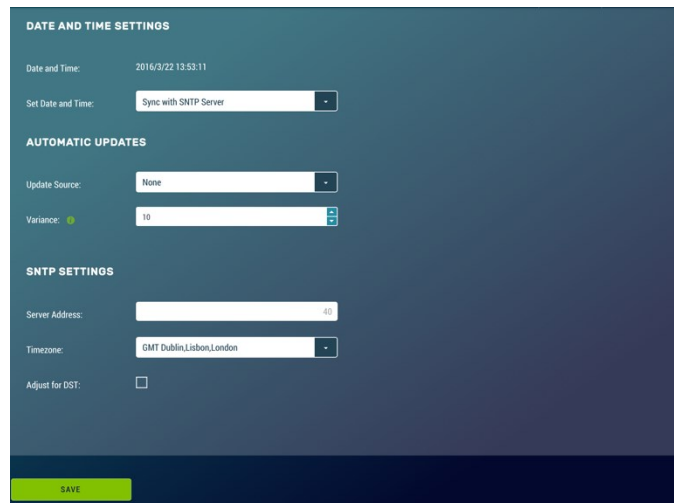
Variable	Allowable values	Description
Camera Name	Text	Sets the name to be used as the web page heading. By default, the Camera Name is set to Campbell Scientific. This provides an easy way of confirming that the camera is connected to the web interface. Limited to 32 characters.
Date and Time Settings	Date and Time	Displays the current Date and Time of the CCFC.
	Set Date and Time	Sync 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. Sync 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 SNTP (p. 77) 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 to adjust for daylight saving time. 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 data logger. The actual time update occurs only when a file transfer occurs to the data logger 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 time being changed.

14.9.1.1 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 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. You can also configure a time zone offset for the camera.

In addition to 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.



The screenshot displays the 'DATE AND TIME SETTINGS' interface. At the top, it shows the current date and time as '2016/3/22 13:53:11'. Below this, the 'Set Date and Time' dropdown menu is set to 'Sync with SNTP Server'. The 'AUTOMATIC UPDATES' section includes an 'Update Source' dropdown set to 'None' and a 'Variance' input field set to '10'. The 'SNTP SETTINGS' section features a 'Server Address' input field with '10' entered, a 'Timezone' dropdown set to 'GMT Dublin, Lisbon, London', and an unchecked 'Adjust for DST' checkbox. A green 'SAVE' button is located at the bottom of the form.

FIGURE 14-26. Date and Time Settings: Sync with SNTP Server

14.9.2 Network

Use the **Network** page to send media files through the Internet and 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.

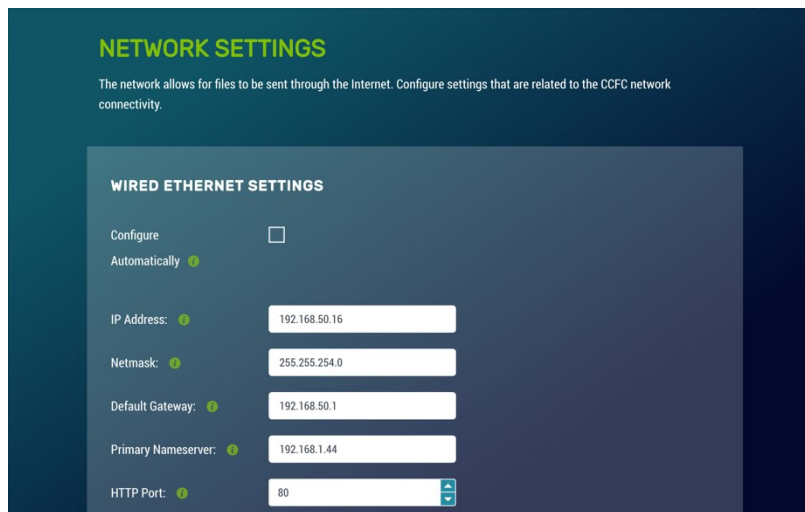


FIGURE 14-27. Network

NOTE:

Any changes made to this page require confirmation via a browser pop-up.

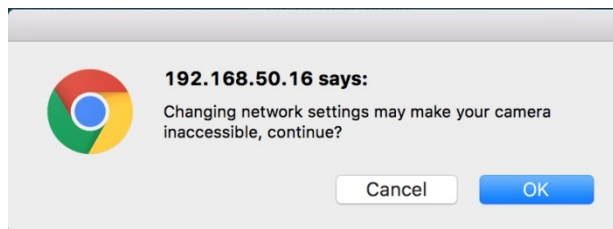


FIGURE 14-28. Network Pop-up on Google Chrome

14.9.2.1 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 14-18](#) (p. 79).



FIGURE 14-29. Wired 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. Obtain IP address from a network administrator.
Netmask	255.255.255.0	Only set if DHCP is Disabled. Obtain Netmask from a network administrator.
Default Gateway	192.168.1.1	Only set if DHCP is Disabled. Obtain Default Gateway from a network administrator.
Primary Name Server	192.168.1.1	Only set if DHCP is Disabled. Obtain Primary Name Server from a network administrator.
HTTP Port	80 or values between 1025 and 65535	Alternate ports can be used for the http interface. Obtain HTTP Port from a network administrator.

14.9.2.2 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 provides 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 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 is set up as an access point with the name *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.

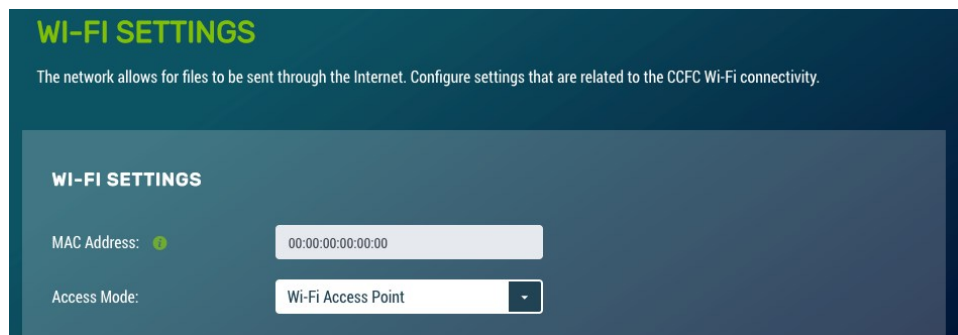


FIGURE 14-30. *Wi-Fi Settings*

Table 14-19 (p. 81) shows the two items on the **Wi-Fi Settings** page: **Wi-Fi Settings** and **Access Point Settings**.

Variable	Allowable Values	Description
MAC Address	Text	Provides the address of the Wi-Fi controller on the camera. This address is different for existing network and access point modes.
Access Mode		Allows for control over the access points to the camera through the Wi-Fi. Default setting is Wi-Fi Access Point .
	Existing Network	Connect to one of the three settings in order to set up and communicate with the camera.
	Wi-Fi Access Point	Sets the camera up as a wireless access point in order to access all Internet programs and functions.

14.9.2.3 Wi-Fi Access Mode

Wi-Fi Access Point

When the camera is configured as a Wi-Fi Access Point (AP), the AP Settings are displayed, allowing the user to customize the way the AP works. Typically, AP mode is used in an installation where the camera is not sending files out using the Wi-Fi interface to an external network and Wi-Fi is 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 is 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. Only change the last three if there is a specific reason ([Table 14-20](#) (p. 82)).

ACCESS POINT SETTINGS

AP Name:

AP Channel:

IP Address:

Netmask:

DHCP Start:

DHCP End:

AP Security:

FIGURE 14-31. Access Point Settings

NOTE:

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

Variable	Options	Description
AP Name ¹	Text	A user friendly name that will show up when searching for networks.
AP Channel ¹	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 ¹	Number (e.g. 10.0.0.1)	Camera IP address when acting as an access point.
Netmask ¹	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.

Table 14-20: Access Point Settings		
Variable	Options	Description
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 Setup using Wi-Fi (p. 29)).
¹ Required		

NOTE:

If you can connect to the camera Access Point but cannot access the web interface, disable the connected device Wireless Network Connection then re-enable the connected device Wireless Network Connection. Alternately, try restarting the connected device.

Existing network

The Wi-Fi settings information appears when the camera Wi-Fi is configured to operate with an existing network. Typically, this mode is 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.

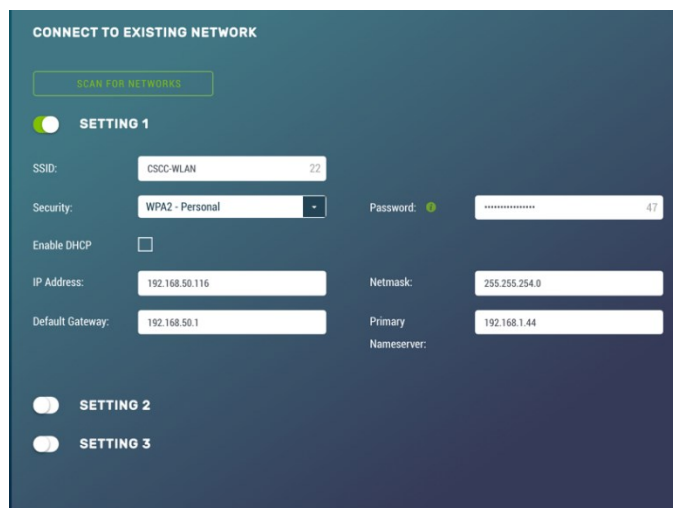


FIGURE 14-32. Connect to existing network

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 to 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, click the button in the results table to quickly copy the selected network information into one of three client settings. After this step, if the Wi-Fi network is using encryption, enter the password into the **Password** box to connect.

Typically, this is all that is required to connect to a Wi-Fi network, as most 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 setting 1.

The following eight settings are associated with each Wi-Fi client connection [Table 14-21](#) (p. 84).

Table 14-21: 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 Server	The DNS server to use for address resolution.

14.9.2.4 Status settings

Use the **Status** page to troubleshoot connectivity.



FIGURE 14-33. Network Status page

If the CCFC is experiencing connectivity difficulty, send the information from this page to your regional Campbell Scientific support team.

14.9.3 File transfer

When performing multiple captures and transfers off the camera in rapid succession, the camera queues file transfers in order to allow more captures to proceed immediately. File queuing 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.

14.9.3.1 FTP

NOTE:

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

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 set up.

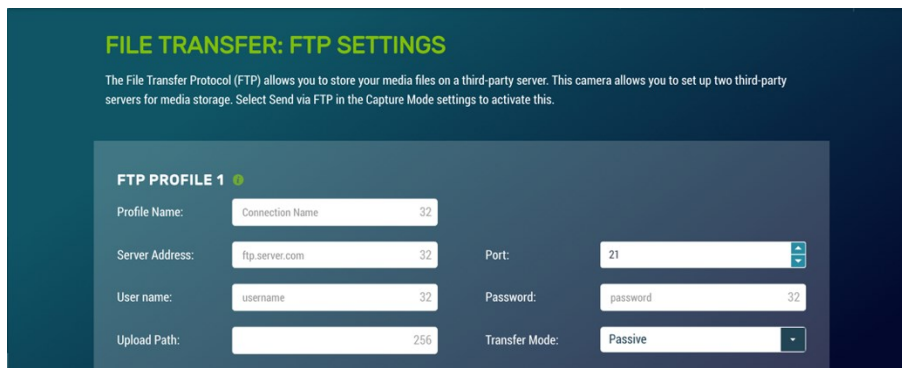


FIGURE 14-34. FTP Settings

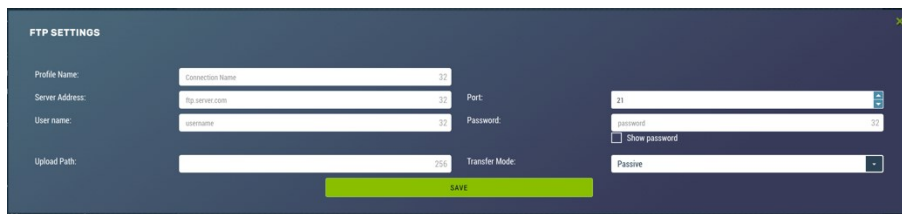


FIGURE 14-35. FTP Settings modal

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** ([Capture modes](#) (p. 42)). When specifying an FTP connection, select either active or 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.

If an FTP transfer failure, the CCFC resends the file to the FTP server for 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 14-22: 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 (Capture modes (p. 42)).
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.

14.9.3.2 Email

Email displays the email settings. The CCFC can send photos or video via email. Two separate servers 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 retries sending the file to the mail server up to two times before aborting the file transfer.

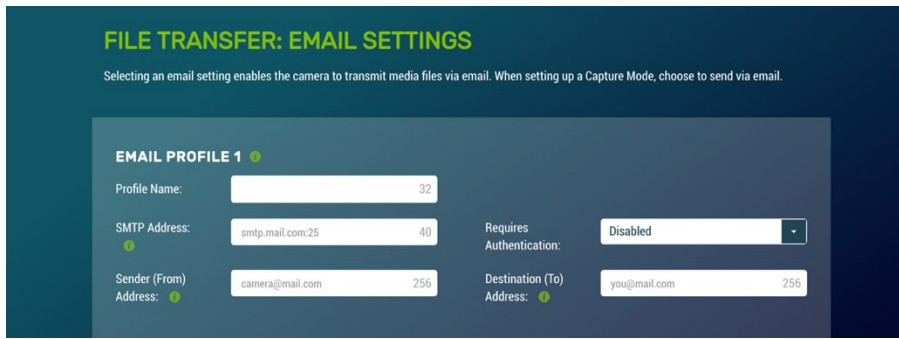


FIGURE 14-36. Email Settings

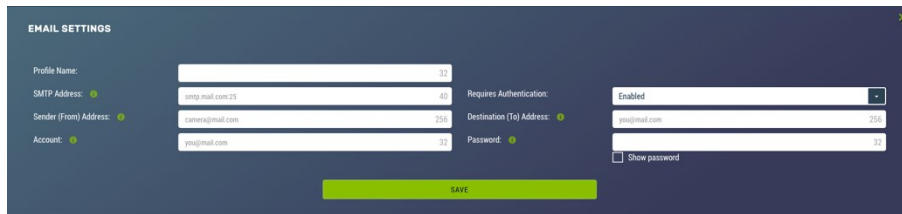


FIGURE 14-37. Email Settings modal

Variable	Toggle, drop down, or text	Description
Profile Name	Text	Type a name. This name will appear in the drop down when setting up a Capture Mode (Capture modes (p. 42)).
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.


Table 14-23: Email settings

Variable	Toggle, drop down, or text	Description
Destination (To) Address	Text	Recipient's email address. Multiple email addresses can 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 network connectivity, use the **Show Password** checkbox to ensure the password entered is correct.

NOTE:

If using Gmail with two-step verification, you must generate an app password, <https://support.google.com/accounts/answer/185833?hl=en> .

14.9.3.3 PakBus®

PakBus® is used to enable media files to be sent to a PakBus® compatible device (Campbell Scientific data loggers). Ensure the PakBus® device is set up to receive (see LoggerNet Manual, which is available for download at www.campbellsci.com/loggernet ). Maximum file size that can be sent is 2 MB.

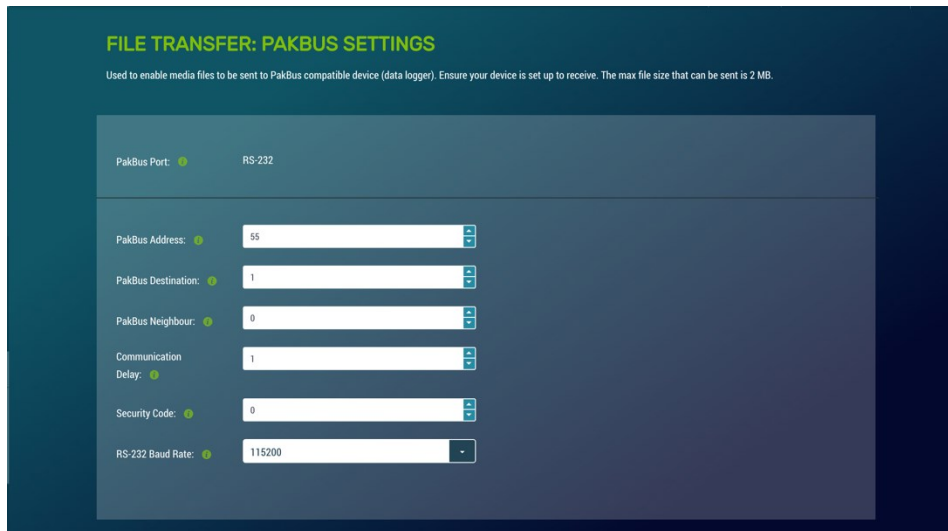


FIGURE 14-38. PakBus® settings

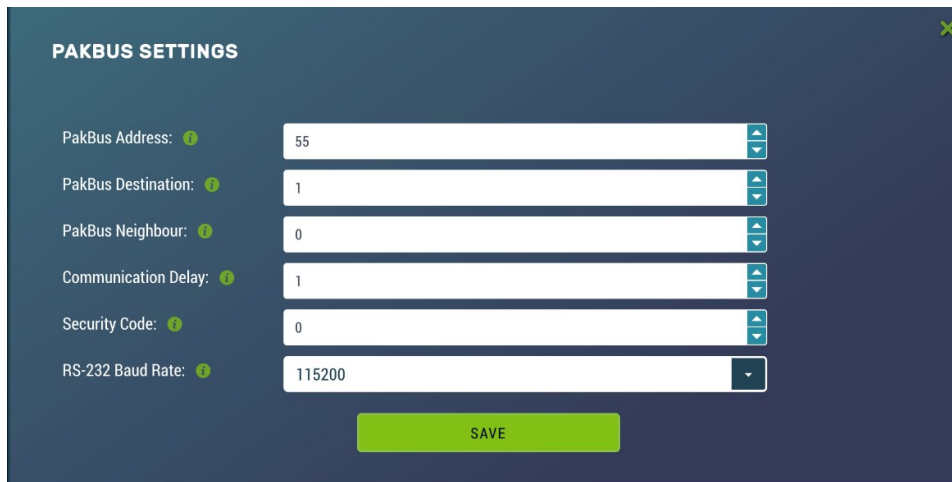


FIGURE 14-39. PakBus® modal

Communications using the PakBus® protocol enables remote retrieval and/or storage of photos or video to external devices such as compatible Campbell Scientific data loggers. Meaning, photos can be stored on the data logger, which allows for remote retrieval using the data logger'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 [Send via PakBus®: PakBus® communications](#) (p. 111).

Table 14-24: 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. This value will appear when setting up a Capture modes (p. 42).
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® Neighbour	0 to 4095	Physically enter the address of the PakBus® device to connect to 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.

14.9.4 Camera operation

14.9.4.1 Camera Power Modes

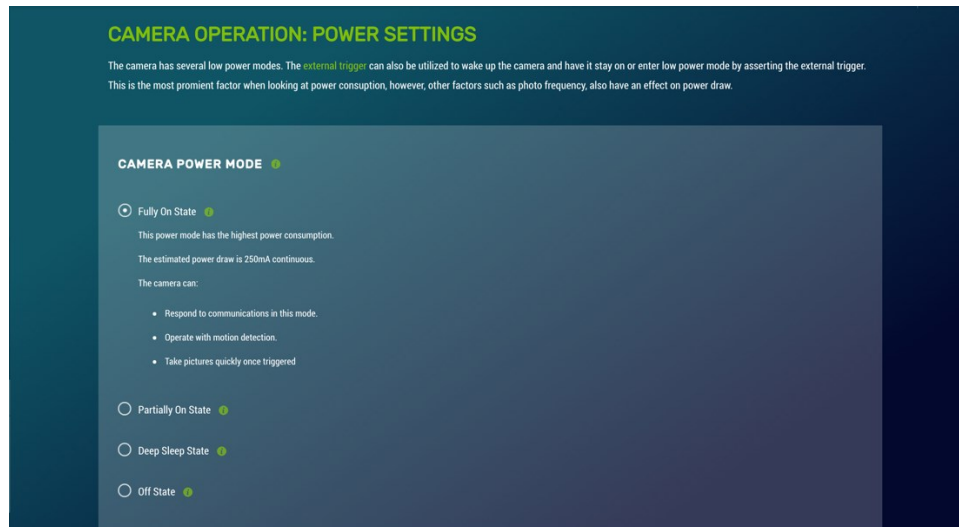


FIGURE 14-40. Camera Power Modes

The combination of the **Camera Power Mode** and **Ethernet Power Modes** dictates the camera 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 14-25: 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 50 mA @ 12 VDC. The Ethernet is normally turned off and is only enabled when outgoing communications are required (email or FTP). User pushes the Setup Button to temporarily enable the Ethernet port for web page access.

Table 14-25: Camera Power Modes

Power mode	Ethernet Power Save Mode	Operating characteristics
Partially On	Always On	<p>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.</p> <p>The camera will temporarily wake up to the fully on power mode when traffic occurs on the network.</p> <p>WARNING: In situations where there is constant network traffic, the camera may effectively be in the Fully On power mode.</p>
	Moderate Power Save Mode	<p>The camera is effectively off in a low powered state. Typical power consumption is 60 mA @ 12 VDC</p> <p>Ethernet is enabled only for outgoing communications such as FTP or email.</p> <p>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.</p>
	Full Power Save Mode	<p>The camera is effectively off in a low powered state. Average power consumption is typically 10 mA @ 12 VDC.</p> <p>The Ethernet is normally turned off and is only enabled when outgoing communications are required (email or FTP).</p> <p>User pushes the Setup Button to temporarily enable the Ethernet port for web page access.</p> <p>The camera can respond to RS-232 or RS-485 communication in this mode.</p>

Table 14-25: Camera Power Modes

Power mode	Ethernet Power Save Mode	Operating characteristics
Deep Sleep	Always On	The Deep Sleep power consumption (6 mA 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 50 mA 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 [Ethernet Power Mode](#) (p. 96) for other settings that influence power consumption.

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 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. In **Off State**, 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 and in **Off State** there must be at least 120 seconds.

14.9.4.2 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 behavior of the camera Ethernet power save is also influenced by the **Power Mode** of the camera. [Table 14-27](#) (p. 97) outlines the Ethernet power saving features versus various camera power modes.

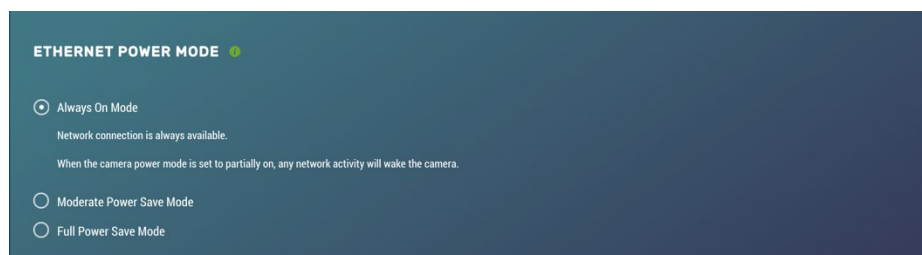


FIGURE 14-41. Ethernet Power Modes

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, 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, 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.

14.9.4.3 Wi-Fi Power Mode

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

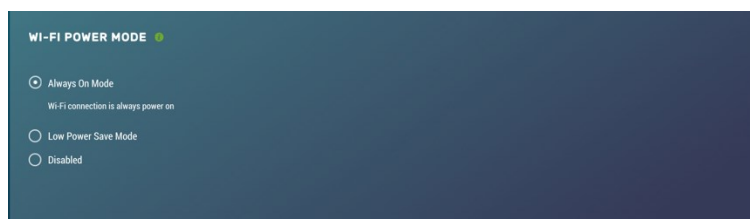


FIGURE 14-42. Wi-Fi Power Mode

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

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.

Table 14-28: Wi-Fi Power Modes

Power Mode	Operating Characteristics
Disabled	Wi-Fi connection is disabled (does not power up). Files cannot be transmitted over Wi-Fi. A button press enables 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 immediately powers 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, 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** or **Disabled** for 5 min. Any network activity on the web interface also resets the timer in **Low Power Save Mode**. Network activity does 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 resets the 5 min timer in **Low Power Save Mode**, but not in **Disabled Mode**.

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 also increases 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 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.

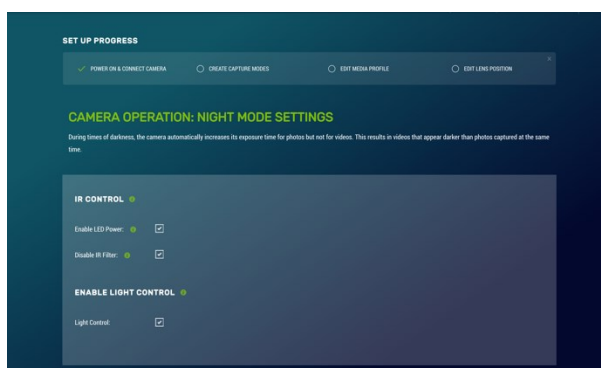


FIGURE 14-43. Night Mode

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 automatically switches 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 20° cone from the centerline. This is a fairly narrow beam angle, which concentrates the light on the center of the photo, allowing distant objects up to 36m (120 ft) away to be illuminated.

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.

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.

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.

Use the **Digital I/O** page to configure the **Modem Power Control** and **Lens Defroster Control**.

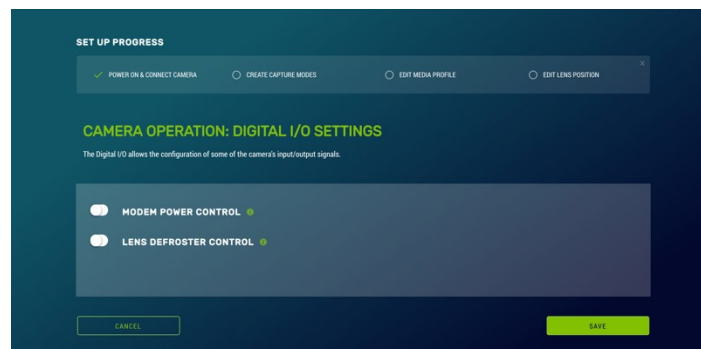


FIGURE 14-44. Digital I/O Settings

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 the power consumption of communication devices needs to be limited.

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 input power (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.

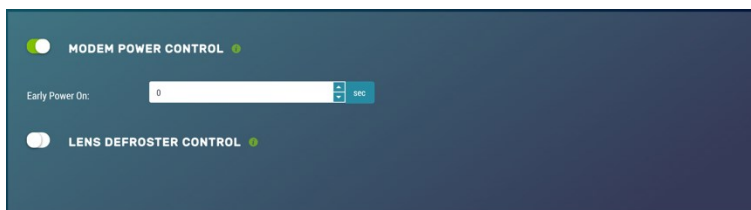


FIGURE 14-45. Modem Power Control

In order to communicate via cell modem, set the CCFC wired Ethernet settings to the appropriate values as per the cell modem 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 webpage, forward the HTTP port (default 80). To access the camera FTP server through the cell modem, forward the camera FTP server port (21) and the port range of 1024 to 1043.

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.

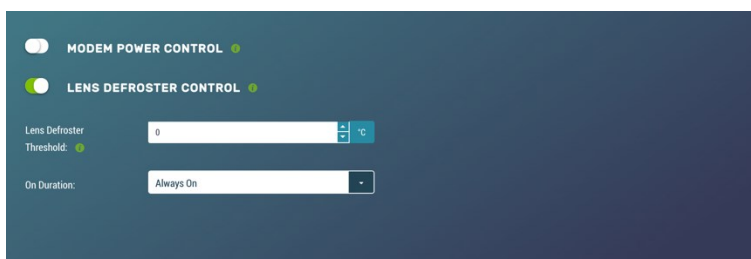


FIGURE 14-46. Lens Defroster Control: Always On

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 set up 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 14-47. 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.

NOTE:

Please refer to [Setting up data logger to work with CCFC: PakBus® variable control](#) (p. 113) for details on controlling the defroster from your connected data logger

14.9.5 Advanced

14.9.5.1 GPS Coordinates

Photos created by the CCFC can be geotagged, that is GPS coordinates can be embedded in the photo files metadata.

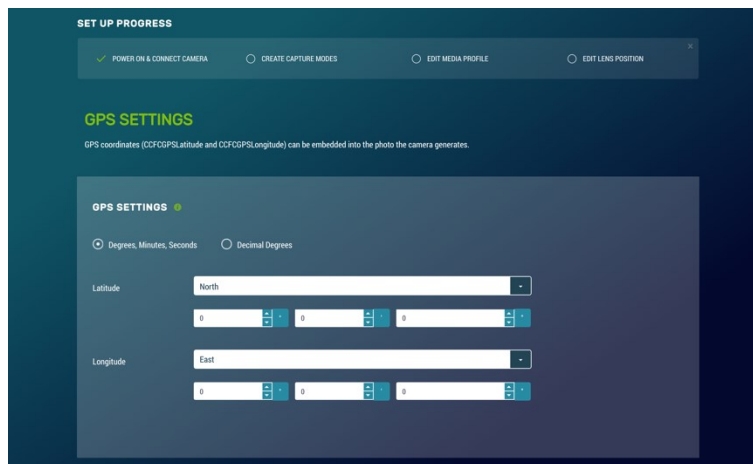


FIGURE 14-48. GPS

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 entered.



FIGURE 14-49. GPS: Degrees, Minutes, Seconds

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

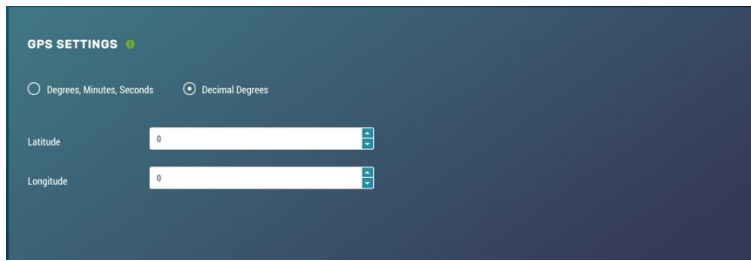


FIGURE 14-50. GPS: Decimal Degrees

14.9.5.2 Import/Export

Use the **Import/Export** tool to maintain continuity between cameras. It can 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 Device Configuration Utility.

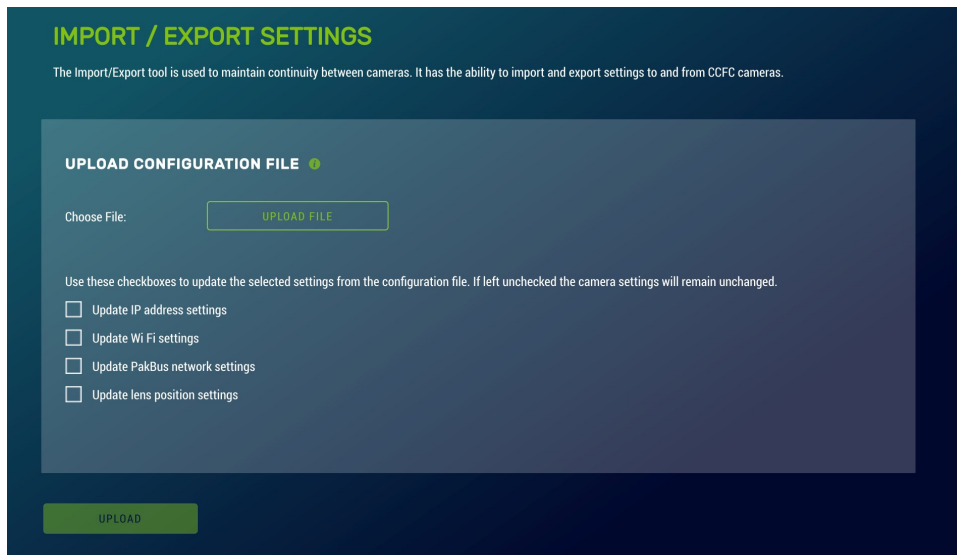



FIGURE 14-51. Import/Export Settings

Table 14-29: 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 www.campbellsci.com/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 (PakBus® (p. 89)). 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 position settings (Lens Position (p. 62)) If selected, review lens positions to ensure proper focus. Not selecting this will not update the lens position settings.
	Upload Button	Sends 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.

14.9.5.3 Update

Use **Update** to update the firmware in the camera. It is recommended that you regularly check for firmware updates on the Campbell Scientific website www.campbellsci.com/ccfc to ensure that the camera has the most recent version of firmware.

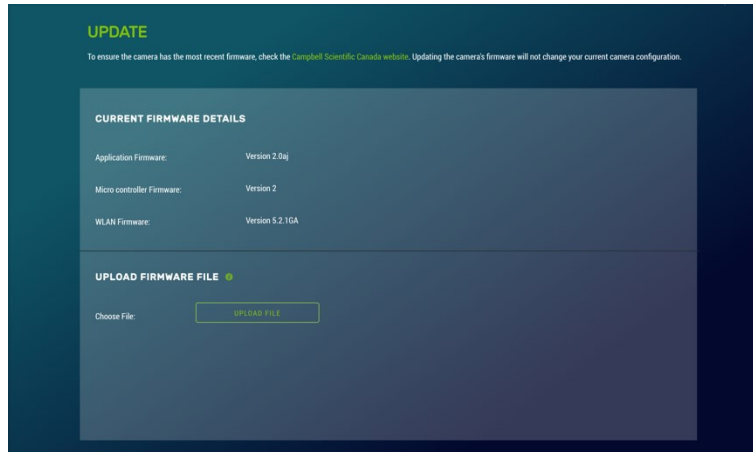


FIGURE 14-52. Update

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.

WARNING:

During the update process DO NOT disconnect power, close web browser, or navigate away from the **Update** page. Once the update is downloaded, unzip the .tar.gz file and save to the desired location. DO NOT uncompress the .tar.gz file; send as is to camera.

Once the firmware update process is completed, the **Dashboard** is displayed indicating that the process is complete. The camera reboots itself. It will take a few minutes for the camera to operate normally. If connecting to the camera via Ethernet, the web interface automatically refreshes 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.

14.9.5.4 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 is 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 Device Configuration Utility, using the RS-232 or RS-485 port, depending on the CCFC model that was ordered.

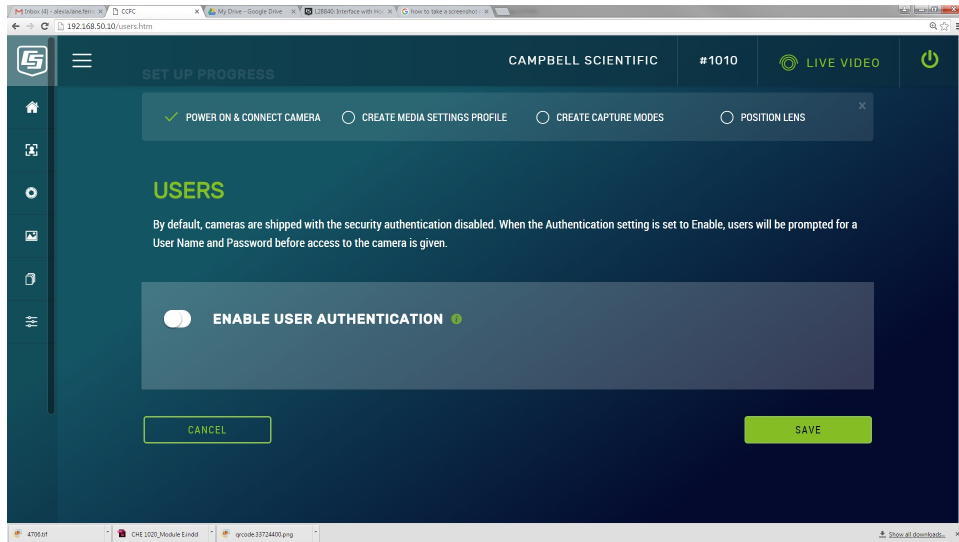


FIGURE 14-53. Users and Security Settings

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 to 32 characters in length. Used to log into the web interface.

Variable	Toggle, Drop Down, or Text	Description
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 to 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 **Save** is clicked.

NOTE:

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

14.9.5.5 History

The **History** page provides a log of system events. A common recorded event indicates that the camera is correctly powered. Other common messages confirms that the camera memory is functioning and provides the camera memory size.

Other types of event messages and log files include:

- Notification that the camera memory or allocated memory is full when using fill and stop memory management.
- Communication and file transfer errors that include:
 - FTP
 - Email
 - PakBus®

HISTORY
The Event Log maintains a history of recent camera activity. It records user and camera activities.

Item	Date and Time	Events
1.	2016-03-22 13:33:02	Camera Memory (15448 Mbytes)
2.	2016-03-21 16:26:42	Camera Memory Fill And Stop - Self-Timed 1 Video
3.	2016-03-21 15:33:23	PakBus File TX Fail (Err: File Send) - Self-Timed 1 Still
4.	2016-03-21 15:13:02	Camera Memory (15448 Mbytes)
5.	2016-03-21 10:41:48	Camera Memory (15448 Mbytes)
6.	2016-03-21 10:39:25	Camera Memory (15448 Mbytes)
7.	2016-03-21 10:32:36	Camera Memory (15448 Mbytes)
8.	2016-03-18 14:46:18	FTP File TX Fail - Self-Timed 1 Still
9.	2016-03-18 14:42:40	Camera Memory (15448 Mbytes)
10.	2016-03-18 13:50:49	Camera Memory (15448 Mbytes)
11.	2016-03-18 13:46:35	Camera Memory (15448 Mbytes)
12.	2016-03-18 13:43:02	Camera Memory (15448 Mbytes)

FIGURE 14-54. History

15. RS-232 communications

The camera uses RS-232 serial communications for two purposes:

1. Configure and setup the camera using Campbell Scientific *Device Configuration Utility* software
2. 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®**.

FILE TRANSFER: PAKBUS SETTINGS
Used to enable media files to be sent to PakBus compatible device (data logger). Ensure your device is set up to receive. The max file size that can be sent is 2 MB.

PakBus Port:

PakBus Address:

PakBus Destination:

PakBus Neighbour:

Communication Delay:

Security Code:

FIGURE 15-1. PakBus® settings

The CCFC Power I/O port configuration defaults to a 3-wire RS-232 connection (Tx, Rx, G), as well as power. The wires connect directly to the control terminals of a compatible data logger. For connection to a computer 9-pin serial port, use a DB9 female-to-terminal block adapter, which

facilitates the connection of the cable pigtail end to a computer 9-pin serial port. The adapter is included with the CCFC.



FIGURE 15-2. DB9 FEMALE to Terminal Block Adapter

Wire color	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 data logger are shown in [Table 15-2](#) (p. 110).

Wire color	Function	Connection required
Red	Power	12 V
Black	Shield	Data logger 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

16. RS-485 communications

Use the optional RS-485 communication interface in conjunction with the MD485 to interface a data logger with one or more cameras or when a long cable length is required. Refer to the MD485 Manual for additional information. If multiple cameras are connected to an MD485, offset the capture times of the photos so that only one camera is transmitting a file at any given time.

To use RS-485 on the web interface, go to **Settings > File Transfer > PakBus®**.

The camera can download photos or video using an RS-485 port and the PakBus® protocol. An MD485 is required to interface the camera to a data logger. 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 RS-485.
- Set the **RS-485 baud** rate to match the baud rate of the device being connected to the camera.
- Set **Communication Settings > PakBus® Address** to a unique value in the PakBus® network.
- Set the **PakBus® Destination Address** of the device in which the camera is sending photos.
- Include **PakBus® Security Code**, as required.

17. 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 data logger or other PakBus® compatible device. The *LoggerNet Tool PakBus® Graph* can be used to change the configuration of a camera. *PakBus® Graph* is discussed in [Send via PakBus®: PakBus® graph operations](#) (p. 112). Refer to the *LoggerNet* manual or Help for more details.

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

The CCFC may produce video files that exceed 30 MB. Sending such a large file to a data logger using PakBus® can be problematic. For this reason, the CCFC does not send files using PakBus® that are larger than 2 MB.

The camera is a PakBus® leaf node and is not capable of performing routing. However, the CCFC can communicate with devices several hops away on the PakBus® network.

17.1 Send using PakBus®: concurrent PakBus® communications

PakBus® allows the camera to download photos to a data logger simultaneously with other data logger communications. Communications take longer if the data logger is simultaneously communicating with multiple devices.

Set the system timing 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 data logger 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.

17.2 Send via PakBus®: PakBus® graph operations

The CCFC supports configuration using **PakBus® Graph** over the serial port. A data logger or other PakBus® relay device is required to interface PakBus® Graph to the camera.

17.2.1 Data logger settings

The data logger must be configured as a router (**Is Router** set to true) and the camera PakBus® address must be in the list of allowed neighbors for the data logger port used. The camera and the data logger must have the same baud rate to communicate properly. See [Data logger COM port \(control port\) communications](#) (p. 121) for more details on setting up a data logger.

17.2.2 Discovery

After starting the PakBus® graph, the camera may not be visible immediately. To discover the camera, right click the green box labeled **[4094]** in the graph and click **Search for Neighbours** to open the **Search for Neighbours** dialog box. Press **Start** and the graph should display all devices in the PakBus® network.

17.3 Setting up data logger to work with CCFC: PakBus® variable control

The camera can receive variables, commands, or text from a data logger. The specific operational parameters that can be altered or controlled include:

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

The **SendVariables** instruction allows the data logger to transfer values or text to the camera then use the values/text in photo or video banners. The **SendVariables** instruction can also toggle the camera window defroster on and off and safely shut the camera down.

To update the **File Caption** information, declare the variable as a **String** and limit it 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 data logger 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, enter as decimal coordinates.

17.3.1 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 using the web interface or *Device Configuration Utility*.
2. One-shot mode using the PakBus® **SendVariables** command.

Turn on the defroster by sending a non-zero numeric value such as 1 to the camera. When the camera receives the non-zero value, the heater turns on and a 65 second countdown timer starts. After 65 seconds, the defroster automatically turn off (unless the defroster is turned on using the **Automatic Mode**). If another non-zero is sent before the defroster is turned off, the timer resets and begins 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.


17.3.2 PakBus® control of CCFC power

A PakBus® command can safely shut the CCFC down. Write 1 (or any nonzero value) to the public Boolean variable **CCFCShutdown** and the camera will safely power down. The shutdown process can take up to 30 seconds. The camera will turn back on after 10 minutes or can be externally triggered.


The following example shuts down a camera with PakBus® address 55:

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

17.3.3 Example data logger program – SendVariables instruction

A downloadable example program using the **SendVariables** instruction to alter Still Photo Banner #2, as well as toggle the camera window defroster is available at www.campbellsci.com/downloads/ccfc-program-examples .

17.3.4 Example data logger program – adding GPS coordinates to the photo banner

A downloadable example program using `CCFCGPSLatitude` and `CCFCGPSLongitude` instructions to add GPS coordinates to the photo banner is available at www.campbellsci.com/downloads/ccfc-program-examples .

17.4 PakBus® neighboring address

The PakBus® protocol allows devices to relay data in a network. The CCFC can communicate with devices that are several hops away on the PakBus® network. A setting on the web page PakBus® configuration screen configures this feature.

Type the address of the PakBus® device connected to the CCFC PakBus® communication lines and the neighbor device will relay communications between the CCFC and the final destination for data. Set the PakBus® address to zero (0) if the CCFC is directly connected to the final destination.

18. 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.

18.1 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 18-1](#) (p. 116) 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 18-1: Power consumption (standalone operation)

Power mode	Ethernet power save mode	Quiescent current draw max. @ 12 VDC	Active current draw max. @ 12 VDC 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 [Existing network](#) (p. 83)), 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.

18.2 Operation with communications

Communications increases power consumption because the camera needs to be in the **Fully On** active state while the camera is transferring a photo or video. The transfer times are influenced by the photo or video size and the transfer speed used to send the file. Large files and slow communications rates increase the amount of time the camera needs to be on.

The power calculation needs to account for the increased current draw for the time the camera is in the **Fully On** current draw state. The following table provides a guideline for determining the amount of time it takes to transfer files using RS-232 or RS-485 PakBus® communications.

Communication baud rate	Time (seconds) per 100 KB
9600	240 seconds 0.0123 Ah
19200	120 seconds 0.0076 Ah
38400	60 seconds 0.0054 Ah
57600	40 seconds 0.0044 Ah
115200	30 seconds 0.0038 Ah

To estimate the system power consumption, use [Table 18-2](#) (p. 117) along with the communication times to calculate the power consumption as follows:

1. Determine the Active Time in minutes:

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

For example, a camera in the Deep Sleep state sends 24 photos per day. When the baud rate is 115200 bps and the photo size is 100 KB, the active minutes are:

Active Minutes = $24 \times (25 \text{ seconds} + 30 \text{ seconds})/60 = 22 \text{ minutes/day of Active Time}$

2. Determine the total time in Quiescent Low Powered State

Quiescent minutes = 1440 minutes per day – Active minutes

For the example, the time in the quiescent low-powered state is:

Quiescent minutes = $1440 - 22 = 1418 \text{ minutes}$

3. Determine the power consumption during the quiescent state in Amp hours.

Quiescent power = (quiescent minutes x quiescent current draw)/60

In the example, the power consumption for the quiescent state in Amp hours is:

Quiescent power = $(1418 \text{ minutes} \times 6 \text{ mA})/60 = 141.8 \text{ mAh}$ or 0.1418 Ah/day

4. Determine the power consumed by the active state in Amp hours.

Active power = (Active minutes x active current draw)/60

The active power for the example is:

Active power = $(22 \text{ minutes} \times 250 \text{ mA})/60 = 91.67 \text{ mAh}$ or 0.0917 Ah/day

5. Total power consumption is the sum of the active and quiescent power consumption:

Total power = quiescent power + active power

The total power consumption for the example is:

Total power = $0.1418 \text{ Ah/day} + 0.0917 \text{ Ah/day}$

Total power = 0.2335 Ah/day

19. CCFC compatibility

The following table lists compatible contemporary and retired Campbell Scientific data loggers.

Table 19-1: CCFC compatibility with contemporary and retired data loggers

Contemporary data loggers	Retired data loggers
CR1000X	CR1000
CR6	CR200/200X
CR300 series ¹	CR510 ²
CR3000	CR10X ²
CR800/CR850	CR23X ²

¹100 ohm resistor to the TX (green) line recommended when sending images to the data logger.
²Must be the -2M versions and must use the PakBus® operating system.

20. Campbell Scientific data logger interface guide

The CCFC interfaces with compatible Campbell Scientific data loggers (see website) using RS-232 (default) or RS-485. The RS-232 configuration is the simplest option, because it does not require an additional hardware interface (see [RS-232 communications](#) (p. 109)). The pigtail end of the CCFC Power and I/O cable terminates directly to the data logger wiring panel control terminals. Refer to [Cables/wiring](#) (p. 20) for wiring details.

The CCFC RS-485 interface can also be used. Only the CR1000X and CR6-series data loggers have a built-in RS-485 interface. Other data loggers require the use of an MD485 interface to provide conversion of the RS-485 signal (see [RS-485 communications](#) (p. 111)). The MD485 connects to the data logger using the CS I/O port or the RS-232 port. Refer to the MD485 manual for additional information.

20.1 Data logger memory setup

To facilitate the storage of photos, a CFM100 allows the use of a compact flash card on the data logger. Memory can also be allocated from the data logger 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 KB, which is 25% of the 4 MB available on a standard data logger.

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

- *Device Configuration Utility*
- *PakBus® Graph*
- Editing the parameter from the **Status Table**
- Optional data logger keypad and display

NOTE:

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

20.2 Data logger files manager

The **Files Manager** setting on the data logger 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 ring memory.

Once *Device Configuration Utility* is opened, select the **Advanced** tab. This displays the **Files Manager**.

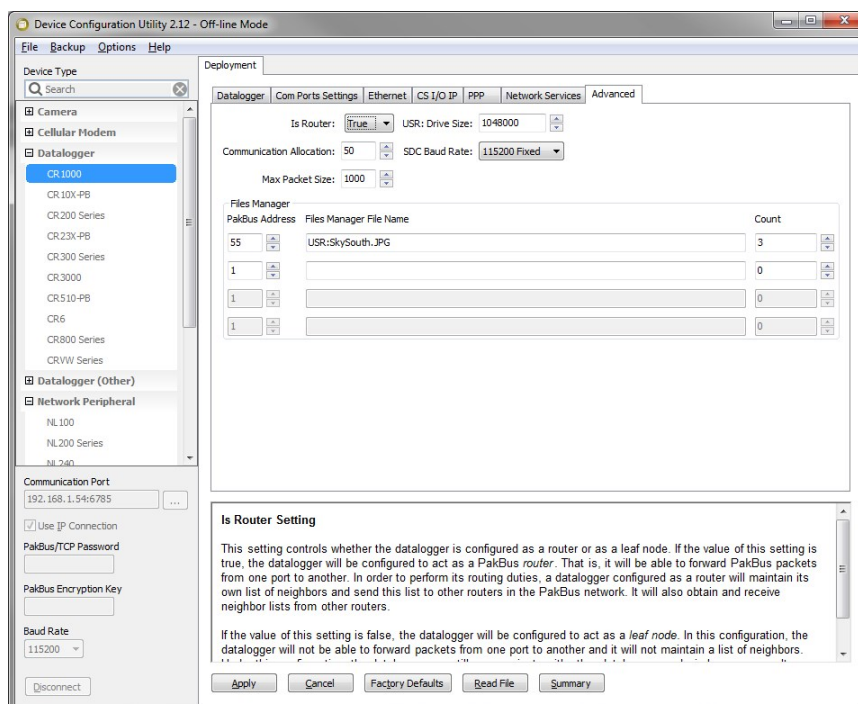


FIGURE 20-1. Data logger files manager

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

Under **Files Manager File Name**, use the following format.

(DDD:NAME.EXT)

- DDD – destination drive on the data logger. Use USR for the user drive (see [FIGURE 20-1](#) (p. 120)). Use CRD for the memory card.
- NAME – a name string used to name the files. In [FIGURE 20-1](#) (p. 120), this value is *SkySouth*. The file name automatically produces an incrementing number. In this example, the first file will be named *SkySouth1.jpg*. Type zero for this parameter to disable the automatic numbering and produce a fixed file name of 0. In this example, the **Files Manager File Name** would be USR:0.JPG.
- EXT – the file extension the incoming file must match. In the case of the camera, this must always be either jpg or avi. In [FIGURE 20-1](#) (p. 120), this value is *JPG*.

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

20.3 Data logger COM port (control port) communications

A pair of data logger control terminals can be configured as an RS-232 communication (COM) port. Any of these COM ports can be configured as PakBus® ports and used to communicate with the camera.

The COM ports can be activated as ports using the *Device Configuration Utility* or by using the [SerialOpen](#) instruction in the data logger 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

Adjust the RS-485 settings if files transfer over RS-485 extremely slowly or if a file is larger than ~20 K

1. Access the *Device Configuration Utility* software
2. Select your data logger, the control port, and click **Connect**

3. Go to **Settings Editor > ComPort Settings**
4. Turn off the RS-485 **Beacon interval** by setting it to 0
5. Set the **Verify interval** to a large number (for example, 65000)

21. Remote photo retrieval

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

The CCFC web interface also has permanent links for downloading the most recently captured photos or video files saved to the camera memory (see [Image capture URL](#) (p. 32)).

21.1 LoggerNet file retrieval

LoggerNet (version 4.0 or newer) includes the **File Retrieval** setup that facilitates the photo and video file retrieval from PakBus® data loggers (CR6, CR3000, CR1000X, CR800 series, CR300 series, and CR1000). The **File Retrieval** tab is located in the **Setup Screen** as part of the data logger configuration. Once configured, **File Retrieval** is used to retrieve photos and video from a data logger.

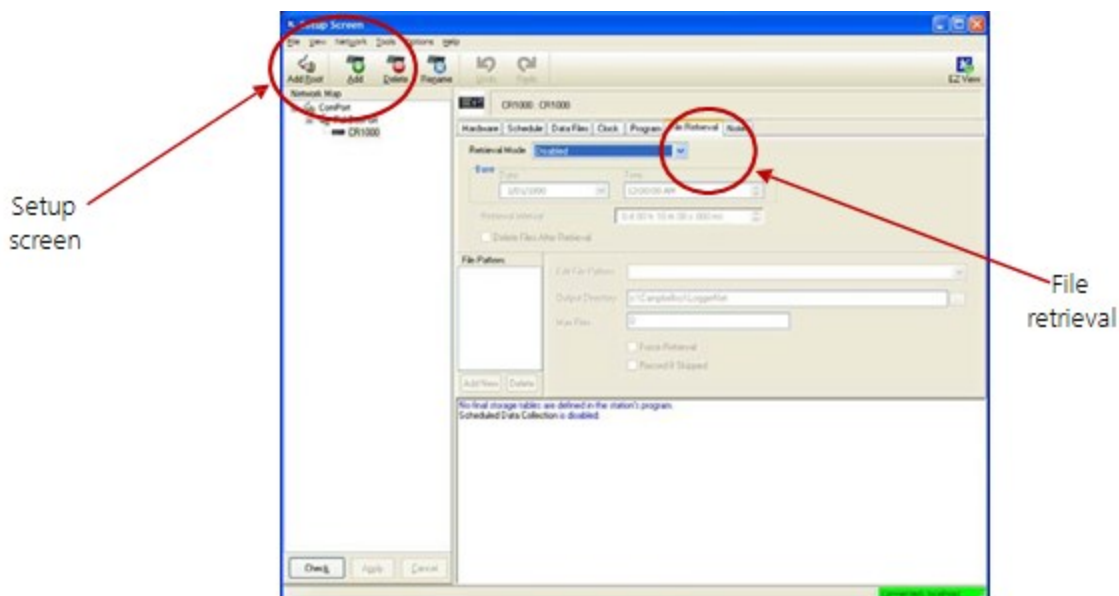


FIGURE 21-1. File Retrieval Setup Screen

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

If data logger memory capacity is a concern, configure **File Retrieval** to delete files after they are retrieved from the data logger.

To add a file retrieval process, select **File Pattern > Add New**. Once added, configure the **Edit File Pattern**, **Output Directory**, and **Max Files** settings. Individually configure each **File Pattern**.

Under **Edit File Pattern**, select the directory location to specify the photo or video to be retrieved. The jpg and avi names default to the wild card (*), which retrieves all jpg or avi files in the specified directory. However, any file name used in the camera configuration can be specified in **Edit File Pattern**. 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. **Max Files** specifies the maximum number of files retrieved during each scheduled event. The newest files will be retrieved.

Select the **Force Retrieval** box to retrieve a file that matches the file pattern regardless of the file timestamp or whether the file has already been retrieved. Select the **Record If Skipped** box to record the names and dates of files not retrieved because of the **Max Files** parameter. If this box is not selected, the skipped files can be retrieved in a later attempt.

21.2 Using *LoggerNet* file control

Connect Screen > File Control allows photos or video stored in the data logger memory to be viewed or collected on demand. It can also be used for debugging the CCFC. **File Control** requires a communications connection to the data logger.

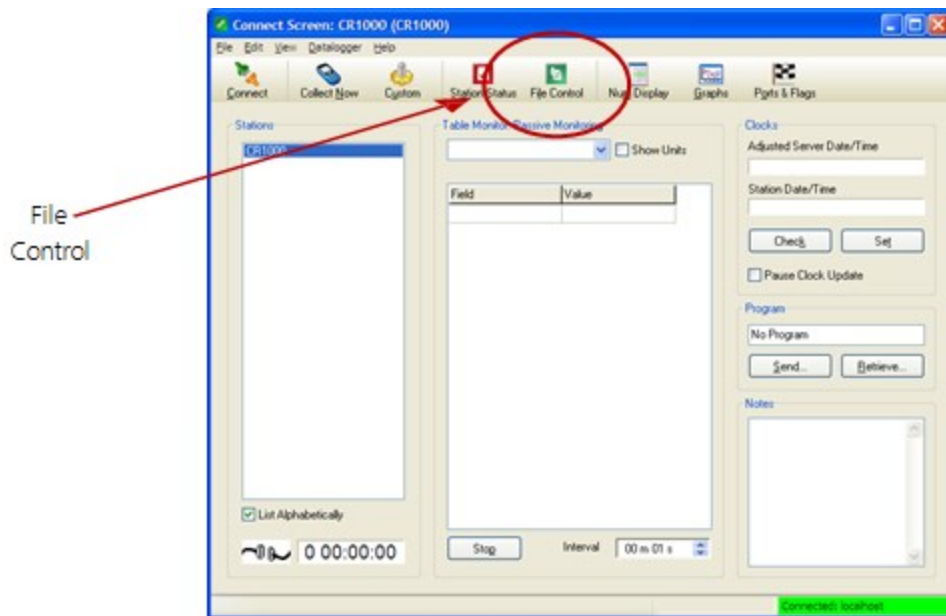


FIGURE 21-2. LoggerNet *Connect Screen*

In data loggers such as the CR1000, the **Device Map** can include the CPU, USR, and the CRD (compact flash module). The devices are listed in the left side of the **File Control** panel. To view a device files, click the device listed in the panel (FIGURE 21-3 (p. 124)). Click **Retrieve** to download the photo or video from the data logger.

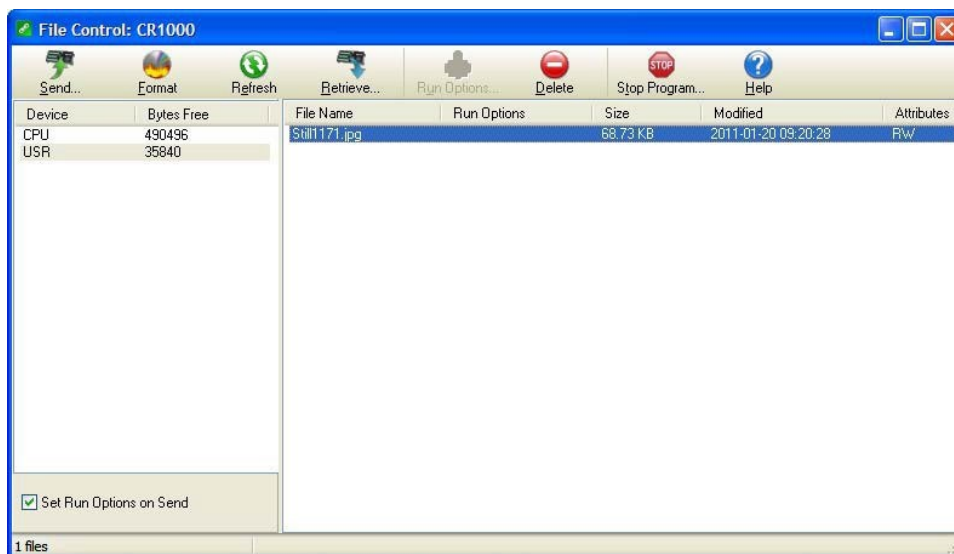


FIGURE 21-3. USR drive view in *File Control*

22. Mounting

The camera enclosure is environmentally sealed for outdoor installations. The enclosure provides protection from moisture or high humidity. All that is required is an appropriate mounting fixture.

CAUTION:

The enclosure is not intended for operation under water.



FIGURE 22-1. CCFC mounting kit

The camera has three ¼-20 threaded mounting holes (see [FIGURE 22-2](#) (p. 126)). These mounting holes are centered along the bottom of the camera and are spaced 25.4 mm (1 in) apart. At least two of the ¼-20 threaded holes are required for mounting the camera.



FIGURE 22-2. CCFC mounting holes

Do the following to use the optional mounting kit to secure the camera to a crossarm or 1.5 in outer diameter pipe:

1. Align the outer holes of the CCFC with the mounting bracket center hole and 180 ° slot.
2. Place a washer and ¼-20 x 0.5-inch Hex bolt in the center hole and 180 ° slot and loosely tighten.
3. Fasten the bracket to the crossarm or pole by placing the U-bolt in the center hole and 180 ° slot and loosely tightening the U-bolt nuts.
4. Aim the camera at the intended target, then tighten the bolts and nuts to secure it in place.



FIGURE 22-3. CCFC mounted to crossarm

23. 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.

23.1 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.

23.2 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.

24. System limitations

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

24.1 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.

24.2 Simultaneous processes

The CCFC cannot capture two 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.

24.3 NDVI

NDVI functions only during daylight hours.

Appendix A. CCFC camera accessories

A.1 CCFCCBL1-L power and I/O cable

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

Ordering part number:

CCFCCBL1-L (-L is length in feet)

Details:

- 20-AWG 1 pair twisted, 24-AWG, two pair, individually shielded cable with Santoprene jacket
- 6-pin bayonet style environmental connector
- Maximum length 19.2 m (65 ft)
- Three single pole, 16 to 20 AWG, gray, push-operated-connector terminals for unused wires
- RoHS compliant



FIGURE A-1. CCFCCBL1-L power and I/O cable

A.2 CCFCCBL3-L environmental Ethernet cable

Ordering part numbers:

CCFCCBL3-L (-L is length in feet)

Details:

- 26-AWG, four 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 of 70 m (230 ft)
- RoHS compliant



FIGURE A-2. CCFCCBL3-L environmental Ethernet cable

As of early 2018, all CCFC cameras are manufactured with a new environmental Ethernet connector. This new connector is easier to use and provides improved ruggedness and sealing.

CCFCs with a serial number of 1277 or greater will be manufactured with the new Ethernet connector, which requires the mating cable, model number CCFCCBL3-L. Whereas CCFCs with a serial number less than 1277 require the original mating cable, model number CCFCCBL2-L.

[FIGURE A-3](#) (p. 131) and [FIGURE A-4](#) (p. 131) show the two versions of the CCFC backplates. [FIGURE A-5](#) (p. 132) and [FIGURE A-6](#) (p. 132) show the two version of the mating cables.



FIGURE A-3. Backplate – new



FIGURE A-4. Backplate – old



FIGURE A-5. CCFCCBL3-L Ethernet connector – new



FIGURE A-6. CCFCCBL2-L Ethernet connector – old

A.3 18549 mounting kit

Details:

- Mounting kit with U-bolt and fasteners



FIGURE A-7. 18549 Mounting Kit

The 18549 mounts to a pipe with a maximum outer diameter of 1.5-inch.

A.4 28840 DB9 female to terminal block adapter

Details:

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



FIGURE A-8. 28840 DB9 FEMALE To Terminal Block Adapter

Limited warranty

Products manufactured by Campbell Scientific are warranted by Campbell Scientific to be free from defects in materials and workmanship under normal use and service for two years from the date of shipment unless otherwise specified on the corresponding product webpage. See Product Details on the Ordering Information pages at www.campbellsci.com[↗]. Other manufacturer's products, that are resold by Campbell Scientific, are warranted only to the limits extended by the original manufacturer.


Refer to www.campbellsci.com/terms#warranty[↗] for more information.

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Assistance

Products may not be returned without prior authorization.

Products shipped to Campbell Scientific require a Returned Materials Authorization (RMA) or Repair Reference number and must be clean and uncontaminated by harmful substances, such as hazardous materials, chemicals, insects, and pests. Please complete the required forms prior to shipping equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page for the Global Sales and Support Network or visit www.campbellsci.com/contact  to determine which Campbell Scientific office serves your country.

To obtain a Returned Materials Authorization or Repair Reference number, contact your CAMPBELL SCIENTIFIC regional office. Please write the issued number clearly on the outside of the shipping container and ship as directed.

For all returns, the customer must provide a "Statement of Product Cleanliness and Decontamination" or "Declaration of Hazardous Material and Decontamination" form and comply with the requirements specified in it. The form is available from your CAMPBELL SCIENTIFIC regional office. Campbell Scientific is unable to process any returns until we receive this statement. If the statement is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

Safety

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.com. 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

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations.
- 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, 6 meters (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.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

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.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.
- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

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.



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