Instructions for configuring StarDot NetCam SC IR for use with a CR1000 and Raven XT cellular modem.

Written by: Earl Keel   USDA/ARS Southeast Watershed Research Laboratory(SEWRL) Tifton, GA

Protocol Overview

This document provides guidance for setting configuring a StarDot NetCam SC IR with data collection with a Campbell Scientific CR1000 and data transfer through a cell modem. The configuration described in this protocol will allow the CR1000 to capture a red green blue (RGB), an infrared (IR) image and the corresponding metadata file for each image. The configuration is designed specifically for use with a CR1000 program that will make calls to common gateway interface scripts (.cgi) that will be created in the camera. The required steps to implement the configuration are:

1. Run Phenocam Installation Tool (PIT).
2. Create custom .cgi scripts within the camera.
3. Configure the Net Cam SC IR camera.
4. Change settings within the CR1000 datalogger to communicate with the camera.
5. Setup Loggernet software to retrieve images and metadata files.

Image processing:

The CR1000 datalogger will call the Metadata.cgi script in the camera. When this script is run in the camera it will create the metadata file and store the image in temporary locations within the cameras' memory. The metadata.cgi script returns the metadata file to the CR1000. The CR1000 will then request the image file from the camera. This sequencing is taken care of by the CR1000 program. Once the RGB is retrieved from the camera, the CR1000 issues commands to the camera to activate the IR filter. The above process is repeated for the IR image. After the IR image is received from the camera, the CR1000 sets the camera back into RGB mode. The camera is now ready to take images again, starting with RGB and ending with IR.

The RGB and IR images are temporarly stored on a "USER drive"(USR) in the CR1000 memory. The images are also stored on a compact flash(CF) card as a backup if so equiped. If the images are not retrieved remotely, due to telemetry failure, they can still be accessed manually by collecting the images from the CF card. A 2Gb CF card will store approximately 3 ½ months of images.

The images can be retrieved through local networks via LoggerNet or the datalogger can FTP the images directly to the phenocam or other network. The appropriate program must be loaded into the datalogger for image retrieval. Retrieving the images from the CR1000 with LoggerNet requires approximately 7 minutes to download via cell modem and local connections in the SEWRL network. Sending the images with FTP requires 1.5 minutes for the SEWRL network. The FTP option will lower the overall power budget of the site. The FTP option requires the use of a CF card.

The following list is an example of the equipment used on the SEWRL phenocam sites:

ENC16/18 inch weather resistant fiberglass enclosure

CH200 12V charging regulator

BP24 12v sealed rechargable battery with mounts

SP20 20 watt solar panel

RavenXTV Raven celluar modem for the Verizon network*

Mounting kit for the RavenXTV

Null modem cable 1 foot to connect the RavenXTV to the CR1000

½ wave whip antenna with SMA connector to connect to the RavenXTV

CR1000**

NL115 ethernet and compact flash module

2Gb CF memory card

SPST solid state relay (ie Crydom D1D07) used to control power to the Raven XTV

StarDot NetCam SC IR

CCD camera housing and mounting bracket

Intergrated ethernet/power cable and a crossover adaptor used to connect the camera to the NL115/CR100

*The RavenXTV must be activatved on the Verizon. The modems used at SEWRL were given static IP addresses assigned by Verizon. The modems also had the appropriate template loaded into them for each of the image retrieval types discussed below. The standard template was used for the LoggerNet retrieval annd the PPP template was loaded for the FTP option. See the Campbell Scientific RavenXTV manual on how to configure the cellular modem.

**The operating system of the CR1000 must be version 29 or newer. Certain commands used in the program are not supported in earlier versions of the operating system.

Required Software:

PIT (link can be found on phenocam network website)

StarDot Tools

CR1000 program (link can be found on phenocam network website)

Loggernet

StarDot NetCam SC IR configuration

The NetCam itself must be configured by runnig the PIT tool written by Koen Hufkens prior to image collection. A link to this tool and instructions can be found on Phenocam network website (http://phenocam.sr.unh.edu/webcam/) . A link directly to the tool and instructions (http://khufkens.github.io/phenocam-installation-tool/). To run the tool, connect the NetCam to a network connection that can access the internet . The StarDot tool software provided with the camera can be used to detect the camera IP address. The IP address of the camera will be needed to run the PIT tool and to communicate with the camera using telnet.

Open a Windows Command Promt. Now telnet into the camera(`telnet <IP>`) (enter)(i.e. `telnet 192.168.1.100` (enter)). Use the default `Login:admin`(enter), `Password:admin`(enter). This should bring up a command promt. Verify that you are in the /etc/config/ directory. You can tpye `cd /etc/config` (enter). This will make sure that you are in the proper directory.

Type the following commands to create the .cgi files that will allow the CR1000 to call the metadata and image files. The touch command creates the file and chmod command grants access to the file and creates an executable. Be sure to hit (enter) after each command.

`touch metadata.cgi` (enter)

`touch rgb.cgi` (enter)

`chmod 755 metadata.cgi` (enter)

`chmod 755 rgb.cgi` (enter)

`config save` (enter) (very important step, writes the newly created files to the camera memory)

You can then type `ls` (enter). This will list the files in the directory, the metadata.cgi and rgb.cgi should be present. Press ctrl + d to log out of telnet.

The following steps configure the NetCam SC IR to temporarily save the metadata and image files and sets up the camera to operate in the CR1000 network.

Open the StarDot tool. Highlight the camera and click **Configure Device**. Enter the default user and password(admin admin). Click on the **Advanced tab**, then **Manual Config**. Scroll down to **metadata.cgi** and click **edit**. Copy and paste the following text:

```
#!/bin/sh
#Copies metadata to temporary file.
#Captures image and send to temporary location
#E.Keel Southeast Watershed Research Laboratory ARS 2016
TMP=`mktemp /var/tmp/metadata.XXXXXX`
cp /dev/video/config0 $TMP
cp /dev/video/jpeg0 /var/tmp/rgb.jpeg
LEN=`wc -c $TMP | awk '{ print $1 }'`

echo -ne 'Content-type: text/plain\r\n'
echo -ne "Content-length: $LEN\\r\\n"
echo -ne '\r\n'
cat $TMP

rm $TMP
```

Click the **Save** button. This should return to the Manual Config page.

Highlight **rgb.cgi**. Then click **Edit**. Copy and paste the following text:

```
#!/bin/sh
#This .cgi will get the temporary image file created by the metadata.cgi
#E.Keel Southeast Watershed Research Laboratory ARS 2016
LEN=`wc -c $/var/tmp/rgb.jpeg | awk '{ print $1 }'`

echo -ne 'Content-type: image/jpeg\r\n'
echo -ne "Content-length: $LEN\\r\\n"
echo -ne '\r\n'
cat /var/tmp/rgb.jpeg

rm /var/tmp/rgb.jpeg
```

Click the **Save** button. This should return to the Manual Config page.

Highlight **start**. Click **Edit**. Copy and paste the following text to the bottom of the file.


```
#Create softlinks from the /etc/config to the /var/httpd directory
ln -s /etc/config/metadata.cgi /var/httpd/metadata.cgi
ln -s /etc/config/rgb.cgi /var/httpd/rgb.cgi
```


Click the save button. This should return to the Manual Config page.

Highlight **crontab**. Click **Edit** to change the following two lines:

```
0 12 * * * admin /etc/rc.ntpdate
*/30 5-21 * * * admin sh /etc/config/phenocam_upload.sh
```
Change the 0 to a 1 in the first line. Comment out the second line by inserting a # in front of it to prevent the phenocam_upload.sh script from running.
The lines should look like this:

```
1 12 * * * admin /etc/rc.ntpdate
#*/30 5-21 * * * admin sh /etc/config/phenocam_upload.sh
```

Click the **Save** button. This should return to the Manual Config page.

Now click **Save** at the bottom of the Manual Config page. This will save all the config files to ram.

Go to back to the StarDot tool software and Configure Device. Log back in using default login(admin admin). Click **Date/Time**. Click **Automatic** button and enter the IP of the datalogger i.e. 192.168.1.2. Click **Apply**. (Usually will hang there without the connection to the datalogger).

Click on **Date/Time**

Automatic should be checked.
Time server: 192.168.1.2 this should be whatever the IP address of the datalogger is.

Click **Apply**. The Stardot will try to acquire the time from the server but will not succeed since the datalogger is not connected yet.

Click **Network** tab. Configure network to:

Manual
IP address: 192.168.1.100
Subnet mask: 255.255.255.0
MAC address: this should remain the same.
Hostname: remains the same.
Gateway: 192.168.1.2(this is the address of the CR1000)
DNS 1: leave blank
DNS 2: leave blank

All other remain the same.

Click **Apply**. You will no longer be able to connect to the camera with the computer unless you change the network settings of your computer to match that of the camera. You would need to change the IP address of your computer to something other than that of the camera.

For example:
IP address: 192.168.1.50
Subnet mask: 255.255.255.0
Gateway: 192.168.1.100 (this can be the camera's IP if you connect directly to it using an Ethernet crossover cable)

At this point you will have to power down the camera wait a few seconds then reapply the power. This allows the camera to setup the .cgi files.

The StarDot SC IR should now be ready to connect to the CR1000.

CR1000 configuration for downloading images with Loggernet via local network (option 1)

Open Device Configuration Utility. Connect to CR1000. Select **Ethernet** tab. Set the following:

IP address: 192.168.1.2
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.100 (set to camera's IP)
DNS Server 1: 0.0.0.0
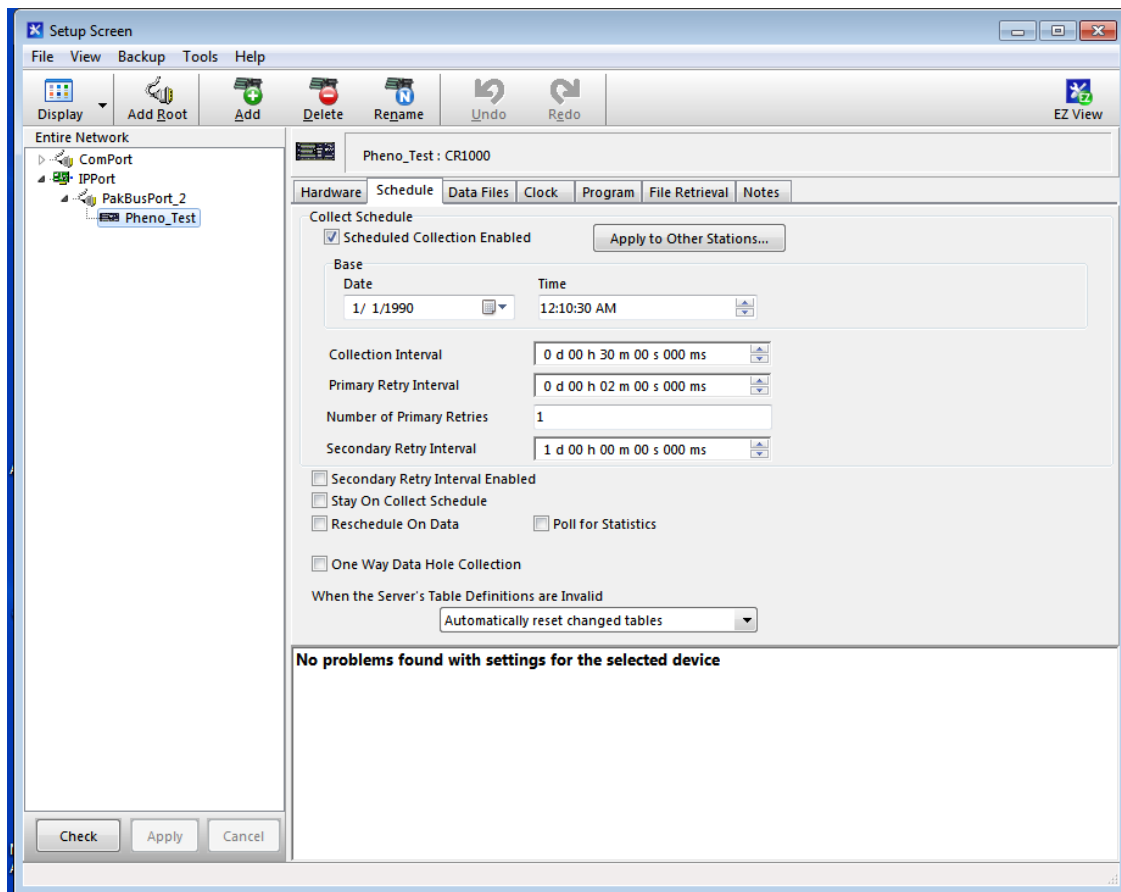DNS Server 2: 0.0.0.0

Select Advanced Tab. Set the following:

USR: Drive size: 1500000
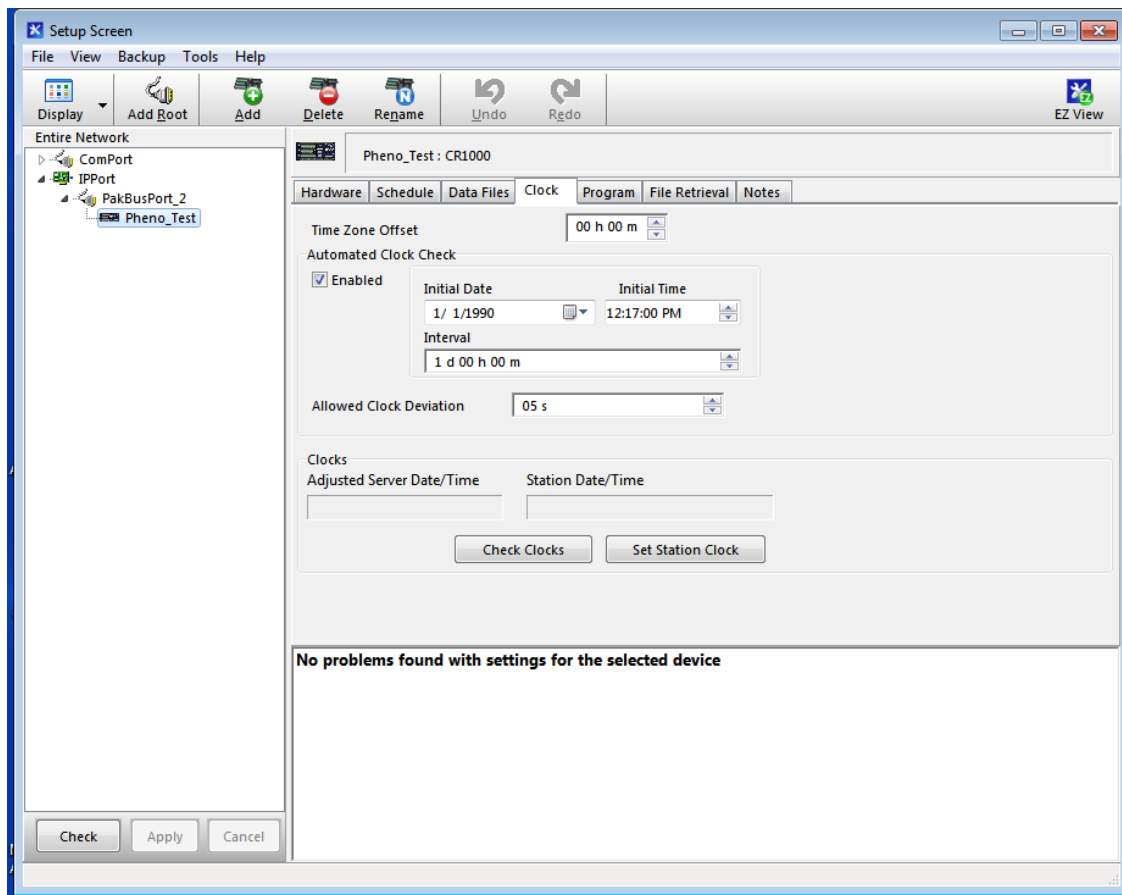
Apply the settings. (Button at the bottom of the screen)

Loggernet Settings

Configure the IP port to match the static IP of the cell modem.

Use the following screen captures for the settings. The settings match the datalogger program for times when the modem is on.

Data collection must occur during a time when the modem is on.

The clock sync will allow the datalogger clock to stay current and provide the StarDot NetCam SC IR with the current time. This must be scheduled during a time when the cell modem is powered up.
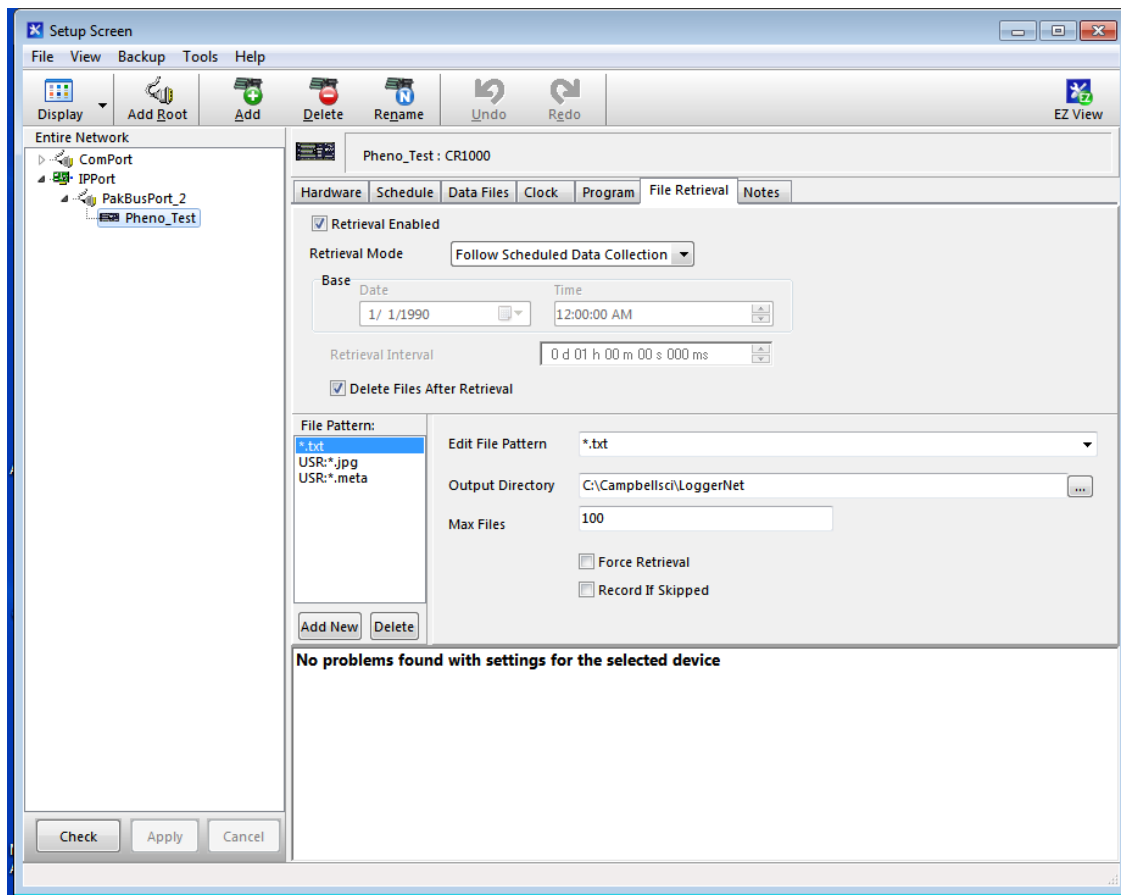
Select each File Pattern: and place in the appropriate Output Directory. This allows for storing a local copy of the images and image metadata.
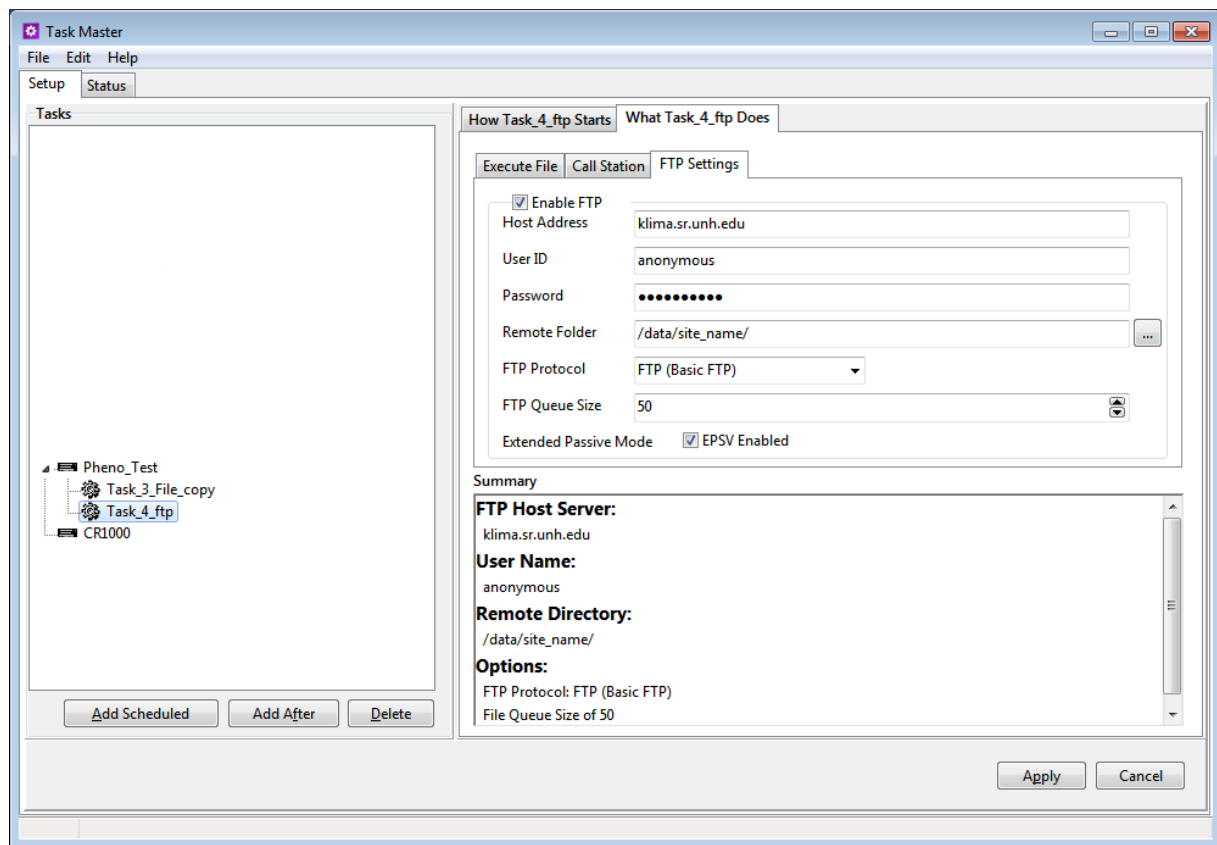
Configure your Data Files tab for your normal data collection needs.

Apply your settings.

This setup uses LoggerNet 4.3. The *.txt file is not found on the CR1000 but used to trick Loggernet into collecting the file. This may not be needed in future updates of LoggerNet.

Task Master settings
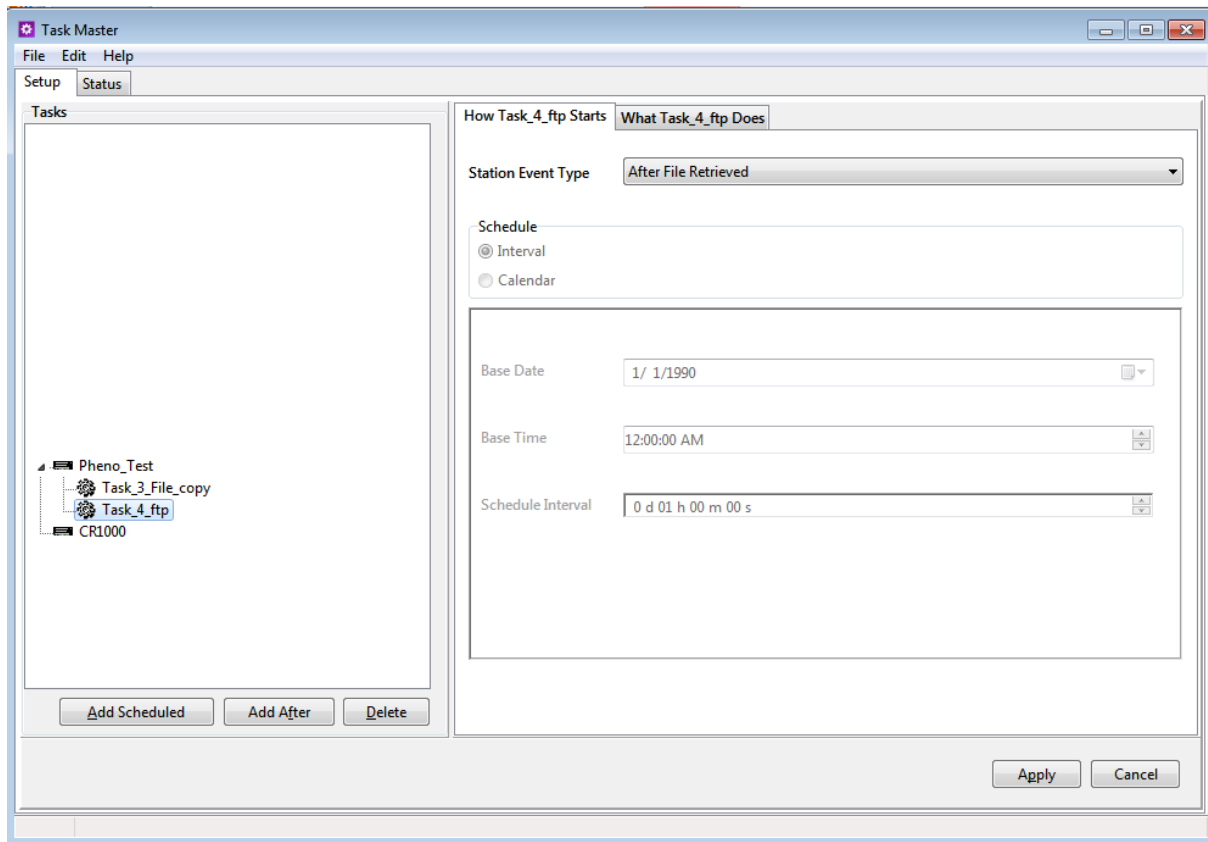
Password: anonymous

Site_name this should be the site name that was provided to the phenocam network. This name was created when the survey was filled out.

CR1000 configuration to FTP images to the PhenoCam Network (option 2)
This option requires the use of a CF card.

Open Device Configuration Utility. Connect to CR1000.

Select **Com Ports Settings** tab.

Select the ComPort: RS232
Baud Rate: 115200 Fixed

Select **Ethernet** tab. Set the following:

IP address: 192.168.1.2
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.100 (set to camera's IP)
DNS Server 1:   8.8.8.8
DNS Server 2:   0.0.0.0

Select **PPP** tab. Set the following:

Config/Port Used: RS232
Modem Dial String: PPP   (should be all capital letters)
Modem Dial Response: CONNECT   (should be all capital letters)

Select **Advanced** Tab. Set the following:

USR: Drive size: 1500000

Apply the settings. (button at the bottom of the screen)

Cell modem must be configured to use PPP. Use Campbell Scientific Raven XT template for PPP.

CR1000 Wiring:

		Cr1000	Raven XT
Camera Power:	+ 12 VDC	SW12	
	Ground	G	
Crydom relay:	Input +(3)	C5	
(D1D07)	Input – (4)	G	
	Output +(1)	12V	
	Output –(2)		+12VDC
Raven XT:	+12VDC (connects to output of relay)		
	Ground	G	

Bracket for mounting housing of StarDot NetCam SC to a pipe:

The bracket is constructed from:
6 inch piece of uni strut
1 ¼ "conduit hangers (Qty.2)
¼-20 X 1" cap screw (Qty.4)
¼" fender washer (Qty. 4) (keeps the cap screw from falling through the slots in the uni strut)
¼- 20 strut nut (Qty. 2) (maybe called a spring nut, the type in the picture has a plastic cone instead of a spring)
¼" lock washer (Qty.4)
¼-20 nut (Qty.2)

These items can be found in the electrical department in the large home improvement stores. Cap screws, washers and nuts are found in the hardware department.