

ISSI

INNOVATIVE SCIENTIFIC SOLUTIONS, INC

EF Lens Controller (LC-2)

Operation Manual (Version 4.7)



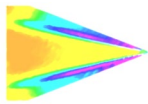


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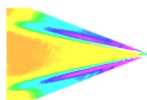
Website: innssi.com/canon



Made in
U.S.A.



Revision Date: 3/13/2023



Description

The ISSI EF Lens Controller (LC-2) is a control device for Canon®, Sigma® and select Tamron® EF/EF-S auto focus lenses. The LC-2 can operate most Canon® (USM) and Sigma® (HSM) and select Tamron® (USD) EF/EF-S lenses including L series and IS/VC models. See the list of compatible tested lenses on ISSI's website: innssi.com/canon.



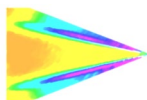
The device is operated via a graphical user interface and allows for preset positions of the lens to be saved and then recalled at any time. It can also be integrated into existing software via TCP/IP API commands in Windows and Linux operating systems. The presets will save the position of the focus and aperture. Since the LC-2 is an Ethernet device, it can be networked with other LC-2s or Ethernet devices. This makes communication and physical cable connections much simpler than traditional serial lens controllers and also allows them to be operated over a longer distance than serial devices. The IP address of the LC-2 can be configured to match the local network.

Specifications

Power	100-240 V, 50-60Hz
Input	6.5-28VDC, 10W
Interface	10/100 Mbps Ethernet
Lens Adapter (Standard)	c, M42x1, T, T18, M58x0.75
Lens inputs	1
Presets	Unlimited, programmable
Software	Windows GUI, TCP/IP API
Warranty	1 year
ECCN	EAR99

Environmental Specifications

Uses	Indoor, Outdoor
Altitude	2,000 m
Operating Temperature	2- 60 °C
Relative Humidity	80% (up to 31°C), 50% (40°C)



Connections

The EF lens control system consists of the control box (LC-2) and adapter (LC-2A-C/M42/T/T18/M58). The adapter should be selected to match the desired camera body connection.

LC-2 Control Box Back Panel

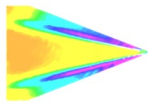
Power	Device is powered on
Ethernet	Ethernet communication connection

LC-2 Control Box Front Panel

Lens	Connection for lens adapter
Reset	Reset switch

On the back panel, the power and Ethernet communication connections are made. The lens connection and reset are located on the front panel. If the IP address is changed and forgotten, the reset switch will set the device back to its default IP address of **192.168.2.252**. Use a paper clip to reset the device, holding for 3 seconds. Restart the software and the LC-2 will connect with its default IP address.





EF-c Lens Adapter (LC-2A-C)

A popular mount for lower resolution image sensors, the c-mount is a 25 mm threaded optics mount. The front side of the adapter features an EF adapter ring to lock the lens in place and pins to make contact with the pads on the lens. The back side is a male c-mount threaded screw mount which threads directly into a camera lens mount.



EF-M42x1 Lens Adapter (LC-2A-M42)

A popular mount for medium to high resolution image sensors, the M42-mount is a 42 mm threaded optics mount. The front side of the adapter features an EF adapter ring to lock the lens in place and pins to make contact with the pads on the lens. The back side is a male M42x1.0 metric threaded screw mount which threads directly into a camera lens mount.



EF-M42x0.75 Lens Adapter (LC-2A-T)

The "T" mount is a common lens mount for astronomy cameras and other optical assemblies. The front side of the adapter features an EF adapter ring to lock the lens in place and pins to make contact with the pads on the lens. The back side is a male M42x0.75 metric threaded screw mount which threads directly into a camera lens mount. Also available in short 18mm thickness (LC-2A-T18).



EF-M58x0.75 Lens Adapter (LC-2A-M58-75)

The M58 adapter is used on cameras with large format, high-resolution imaging sensors. The front side of the adapter features an EF adapter ring to lock the lens in place and pins to make contact with the pads on the lens. The back side is a male M58x0.75 metric threaded screw mount which threads directly into a camera lens mount.

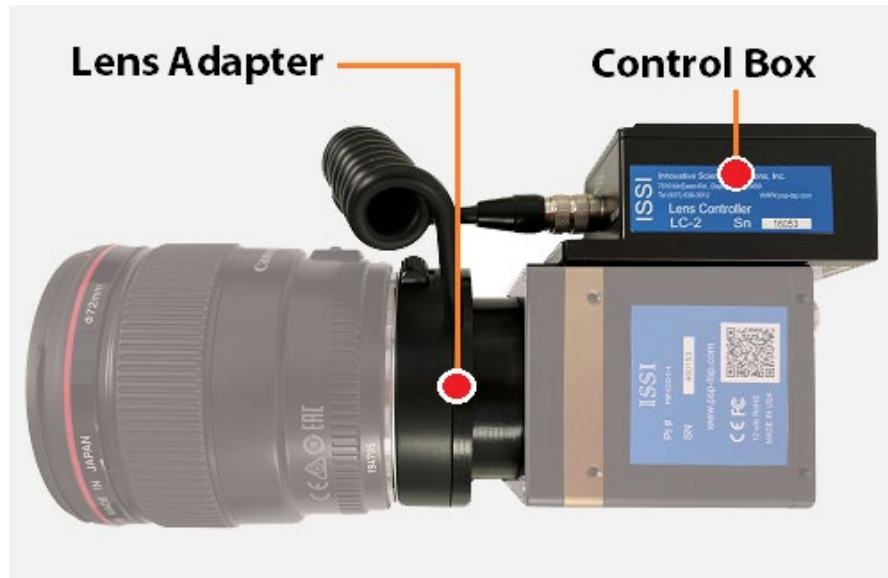
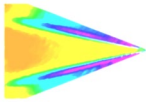


The LC-2 is shipped with:

1. DC Power adapter
2. Ethernet cable
3. LC-2A lens adapter
4. LC-2 lens control box
5. M3 Toolkit for mounting
6. USB drive with software and instruction manual



Unboxing the LC-2 Lens Controller



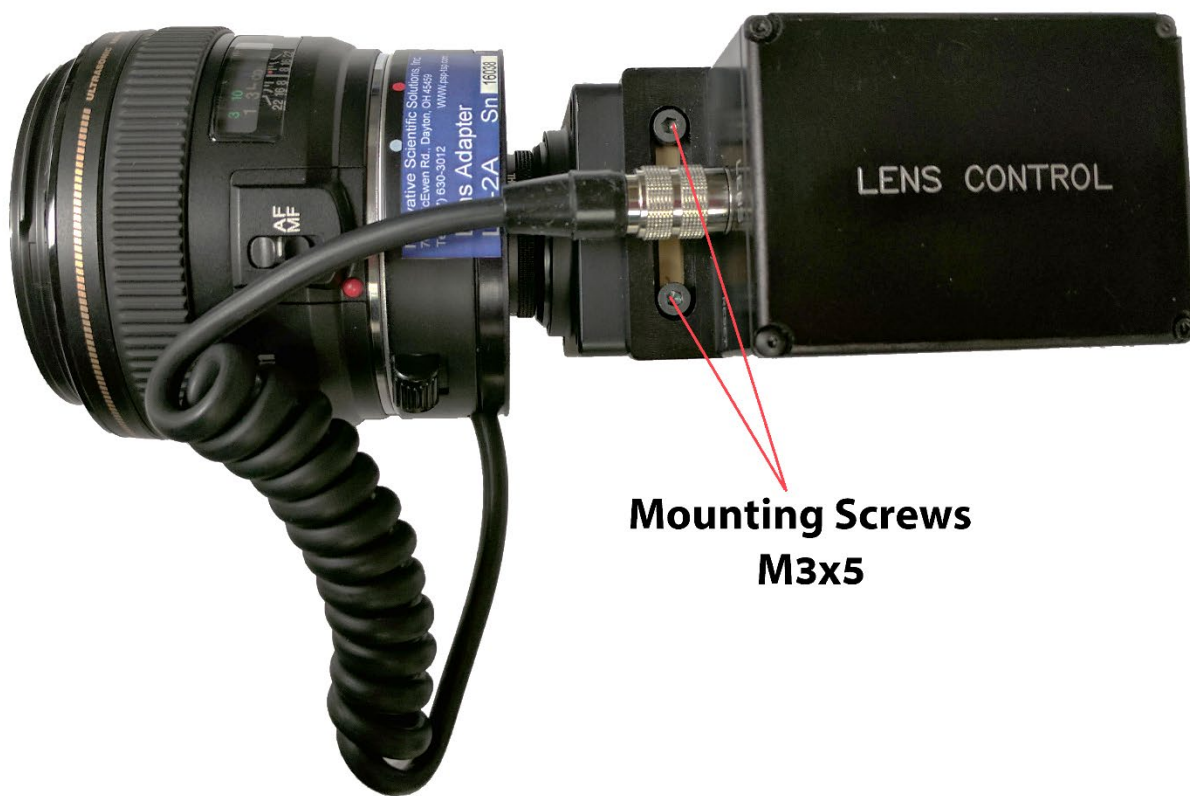
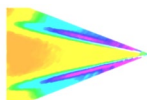
Connection of LC-2 to Canon® EF Lens using LC-2A-M42 lens adapter on M42-mount camera

Installation and Operation

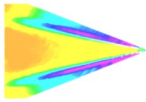
The LC-2 control box has a small slotted bracket to countersink M3 hex bolts for mounting. If the camera being used with the LC-2 has no mounting holes to mount the LC-2 control box, a bracket will need to be made to bolt the control box. It should be mounted within 6-inches (150-mm) of the lens connection on the camera.



Line up the mounting bracket to the camera body mounting holes. If your camera has different mounting holes, secure with customized bracket to fit the camera. Place the M3-0.5 hex bolt in place and tighten each using M3 hex wrench. Three M3-05 bolts are supplied with the hardware kit.



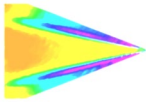
**Mounting Screws
M3x5**



Once the LC-2 control box is secured, connect the power adapter to universal power (110-240 VAC). Plug the power adapter to the LC-2 control box in the receptacle labeled **POWER**. Seat the plug so it is fully inserted in the power receptacle. Screw the locking connector clockwise until tight. When mounting the control box, do not position it so that the power plug is difficult to plug in or unplug.



Connect the Ethernet cable to the NIC of the control computer or local network switch. Connect the other end of the Ethernet cable to the **ETHERNET** receptacle on the LC-2. The green and orange lights on the Ethernet receptacle will flash once communication has been established.



Next connect the lens adapter (LC-2A-XXX) to the lens mount on the camera. This is a screw-on connection and should be screwed on clockwise until secure.



Connect the lens to the adapter. The lens will have a red dot indicating the position of the lens to correctly install to the adapter. Line up the red dot on the lens with the indicator on the adapter and insert lens into adapter.



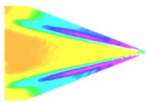
Align Red Dots



Push Lens Into Adapter

Twist the lens clockwise until it clicks and locks. To release the lens, push down (toward the camera) on the release button (pictured on next page) and twist the lens counterclockwise.

Note: It is recommended to disconnect the device from power when changing the lens. Reconnect once the new lens is attached and locked.



Lens in Lock Position

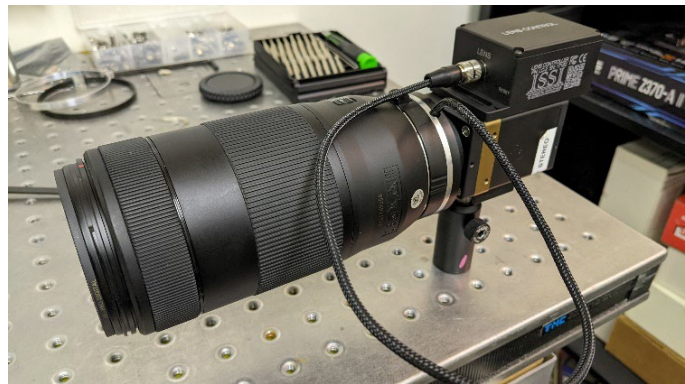


Push Button to Release

Once the lens is connected, connect the plug from the lens adapter to the receptacle labeled **LENS** on the control box. This is a keyed connector. Rotate and push in until it slides on and locks. Screw on clockwise until secure.

Some EF lenses have a zoom function but they are not motorized zoom, only manual. For these lenses, the zoom is displayed in the interface but not controlled. The LC-2 will connect with non-AF EF lenses but will only be able to control the aperture as they have no motor to control focus.

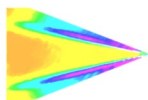
Failure to install and operate the LC-2 according to instructions may result in impairment or damage to the controller and attached lens.



Lens Controller and Lens Connected to Camera

Maintenance

Inspect all connections and ensure they are free of debris that could prevent electrical contact from being made. Make sure no debris is present that could cause an electrical short. Always disconnect the device from power when performing routine maintenance inspections.



Network Setup

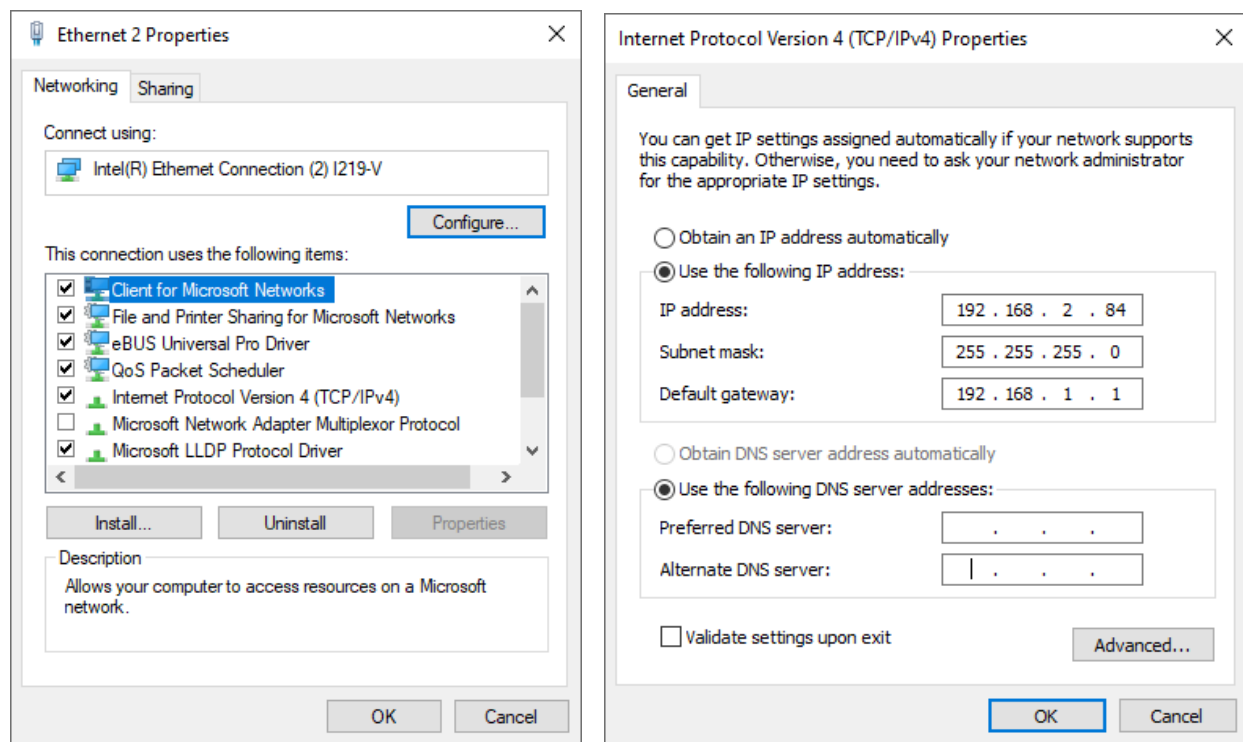
The network on the PC NIC (network interface card) needs to be properly configured for communication over the network. To do this, navigate to the *'Network Connections'* page on the control panel where the local networks of the computer is displayed. Right-click on the network where the LC-2 is connected and select *'Properties.'*

From the *'Local Area Connection X Properties'* window, click on *'Internet Protocol Version 4 (TCP/IPv4)'* and then press the *'Properties'* button, now useable. This will open the *'Internet Protocol Version 4 (TCP/IPv4) Properties'* window. This is where the IP addresses are entered so that LC-2 can be reached over the local network. The settings needed for communication are **IP Address** and **Subnet mask**.

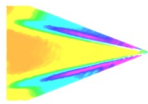
The IP address of the NIC should use the following conventions:

IP Format: **Network.Network.Subnet.Host**

- LC-2 IP: 192.168.2.252
- NIC IP: 192.168.2.XXX



The NIC IP address should have the same network and subnet addresses but a unique host, the last line of the IP address. The host can be any value 1-254 but different from the host address of the LC-2. The subnet mask should be set to match that of the LC-2 which, by default is 255.255.255.0. The **Default Gateway** and all other fields can be left blank.



Additional subnetworks can be configured for the same NIC. In the '*Internet Protocol Version 4 (TCP/IPv4)*' window, the **Advanced** button will open the '*Advanced TCP/IP Settings*' window. IP addresses of any subnetwork can be added for that NIC here. If multiple devices are being used on the same network and they have differing subnetworks, this option provides communication for all devices without the need to change IP addresses for each device.

TCP/IP Address

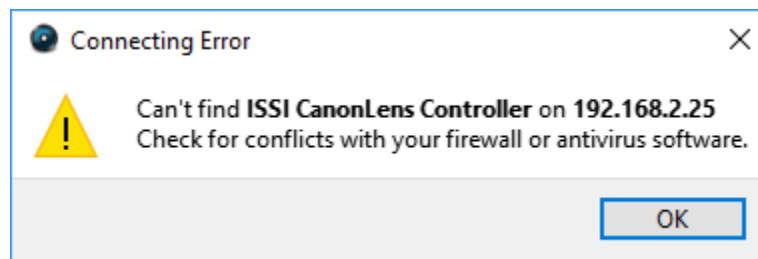
IP address: 192 . 168 . 2 . 100

Subnet mask: 255 . 255 . 255 . 0

Add Cancel

***Note:** Verify that lens controller default subnetwork (192.168.2.XXX) is configured on the NIC as well as any other subnetwork that may be used to communicate with the LC-2. Failure to do so will prevent the software interface from finding any connected LC-2.

If the lens controller is not connected properly a connection error (below) will be displayed. First, reset the device via the reset switch which will restore the default IP address.



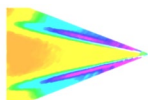
If connection problems persist, check the connection of the Ethernet cable between the computer NIC and the LC-2. To check that there is a physical connection, ping the IP address of the LC-2 from the Command Prompt. To do this, open the command prompt window and enter: **Ping XXX.XXX.XXX.XXX -t**

```
C:\Windows\system32\cmd.exe - ping 192.168.2.109 -t

Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

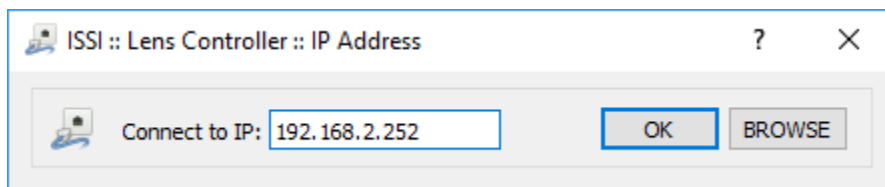
C:\Users\Steve>ping 192.168.2.109 -t

Pinging 192.168.2.109 with 32 bytes of data:
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
Reply from 192.168.2.109: bytes=32 time<1ms TTL=128
```

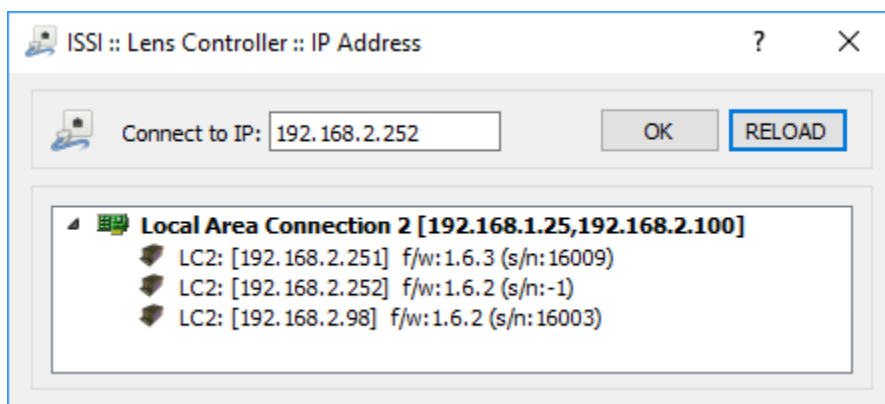


Software Operation

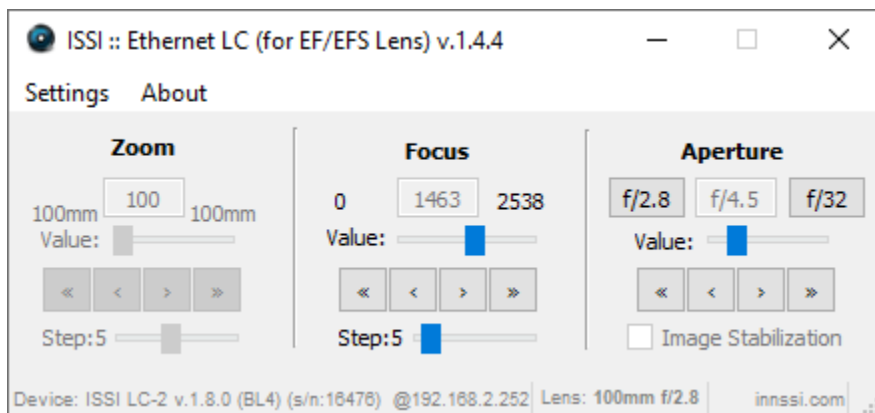
Open the software for the LC-2 from the desktop and it will ask for the IP of the connected LC-2. Enter the IP address of the LC-2 connected to the network.

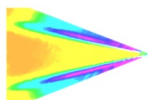


If the IP address is unknown, press '**Browse**' to search through all IP addresses on the network under the subnetwork(s) of the NIC.



Once connected, the GUI will learn the limits on the attached lens and show the current position of each motor of the lens. For the preset capability, this determines the minimum and maximum motor positions. The firmware version, serial number and IP address are displayed at the bottom of the GUI. The lens information (focal length and F number) are displayed as well. To communicate with multiple LC-2s over this network (through a network switch), open up another instance of the program on the desktop. Do not use the same IP address for multiple LC-2s to avoid creating an IP address conflict.



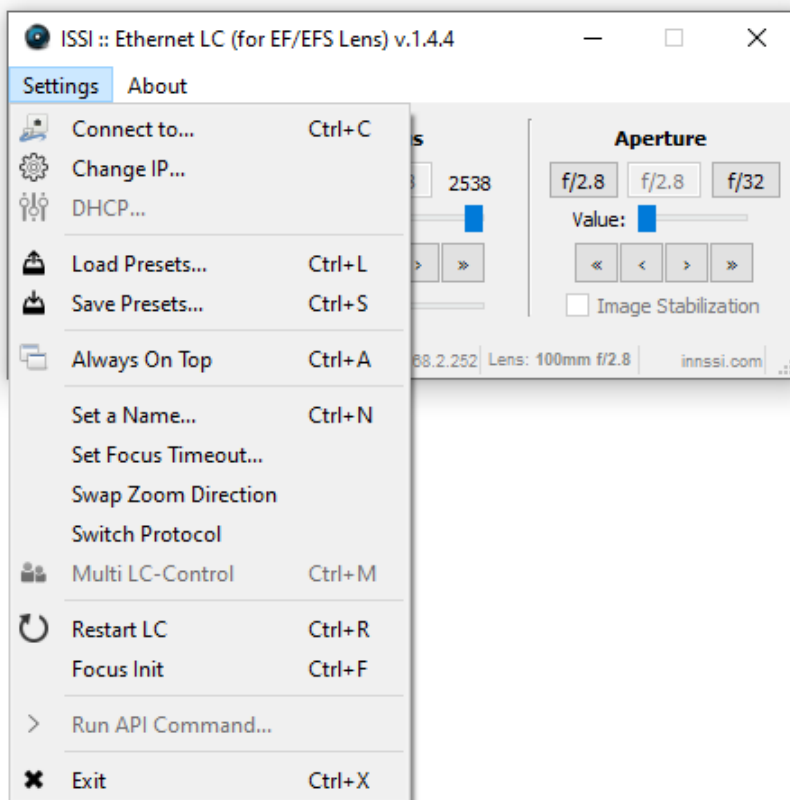
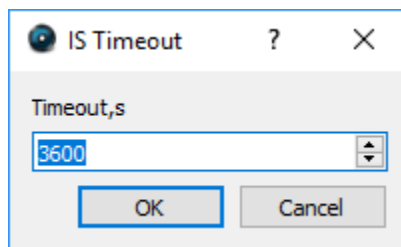


The user interface displays the current positions of the Focus and Aperture. There are two sets of arrows below this which are used to move the position of the motor. The single-arrow moves the focus one step increment and the double-arrow moves the focus 2x one step size for coarse adjustments. Step size can be set from 1 to 50. The focus and aperture can also be moved to points within its range using the sliding adjustment labeled '**Value**'.

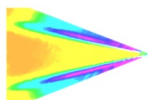
To enable focus control of the connected lens, the lens must be switched to autofocus (AF) mode. If the lens is switched to manual focus (MF) mode, the focus tab will no longer be operable via the GUI.



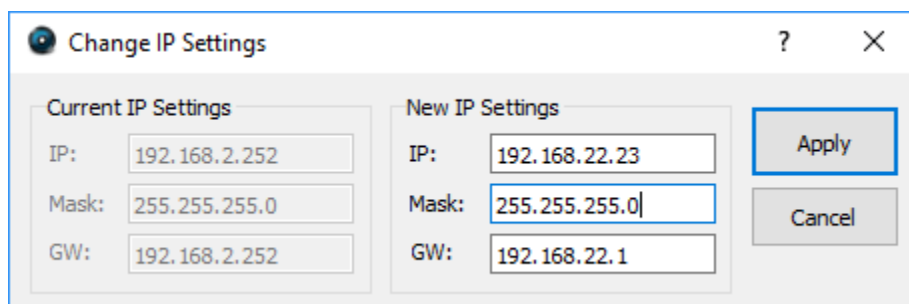
Image stabilization (IS) can be enabled and disabled for lenses that have the IS feature. The IS switch on the lens must be switched ON to use this feature. Check '**Image Stabilization**' to enable and leave unchecked to disable. Once checked, a pop-up window will appear so the timeout can be set. The maximum timeout is 3600 seconds (1 hour). This feature will be disabled for lenses without IS capability. If a longer timeout is needed, the API commands can be set so that the IS stays on continuously although continuous operation is not recommended.



To connect to a different lens controller, select '**Connect to**' from the **Settings** menu.

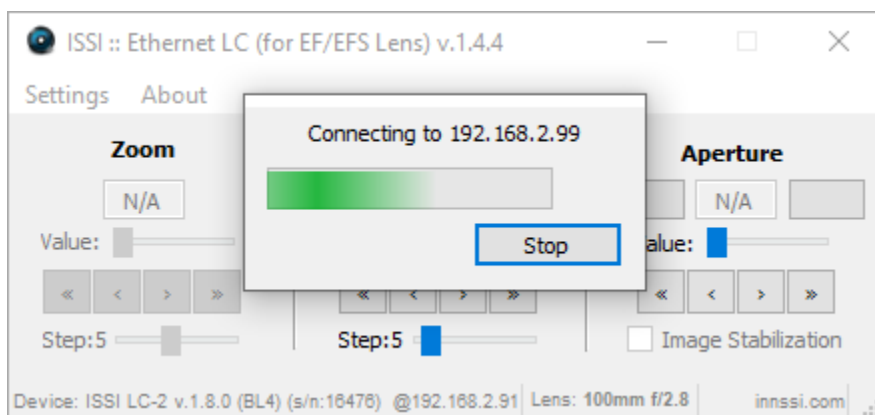


Once connected, the IP address, mask and gateway (if being used through a router) of the lens controller can be changed if desired. Under the **Change IP** window the settings can be updated. If networking multiple LC-2s the IP address of each must be unique.

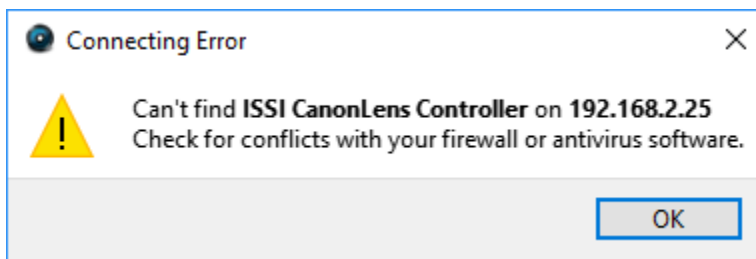


If the toolbar is red, that means it is not a valid IP address. Type in the desired IP address and click **Apply** to implement.

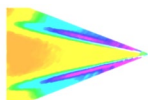
The new IP address will automatically be connected:



If the IP address does not change and the following message is displayed after the IP is changed, it may need to be run as administrator.

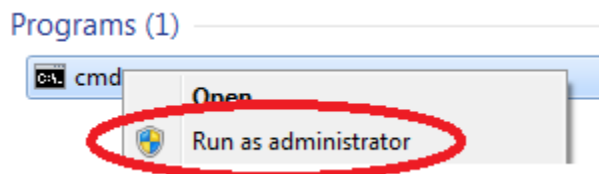


When the IP address is changed, the software will automatically attempt to switch communication to the new address. If it can't find that address, it is likely to be because the IP address previously used is stored on the computer and needs to be cleared before the new address can take hold. The timeout for this to occur by itself can sometimes be 10-20 seconds. To do this, there are two options:



1. Run the lens control software as the administrator
2. Clear the list of IP addresses in the computer through the command prompt (shown below):

Open the Command Prompt (Start > Search > cmd) as administrator:



Once the command prompt is open, type “**arp -a**” to display the IP address and Physical Address of all devices on the local network.

```
C:\Windows\system32\cmd.exe
C:\Users\Steve>arp -a

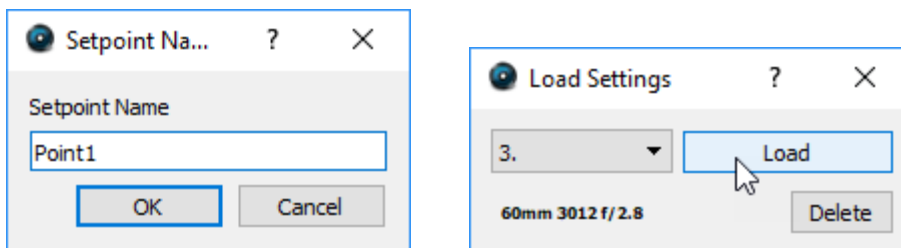
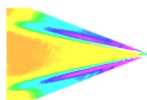
Interface: 192.168.1.25 --- 0xc
Internet Address      Physical Address      Type
192.168.1.1           6c-41-6a-48-78-2b     dynamic
192.168.1.2           6c-62-6d-a6-65-26     dynamic
192.168.1.3           14-18-77-6f-9d-76     dynamic
192.168.1.22          b4-b5-2f-d9-f3-4f     dynamic
192.168.1.30          14-dd-a9-d5-e8-9f     dynamic
192.168.1.32          00-1d-73-19-ef-86     dynamic
192.168.1.40          00-21-b7-ba-0a-84     dynamic
192.168.1.42          00-1e-c9-d5-05-91     dynamic
192.168.1.43          00-11-1c-f6-31-7b     dynamic
192.168.1.44          7c-05-07-8a-5d-d8     dynamic
192.168.1.48          c0-7c-d1-fc-98-68     dynamic
192.168.1.53          00-1f-bc-09-39-03     dynamic
```

To clear the table so the lens controller IP is reset to the new address entered, type “**arp -d**”. Running the lens control software as administrator will automatically clear the ARP table.

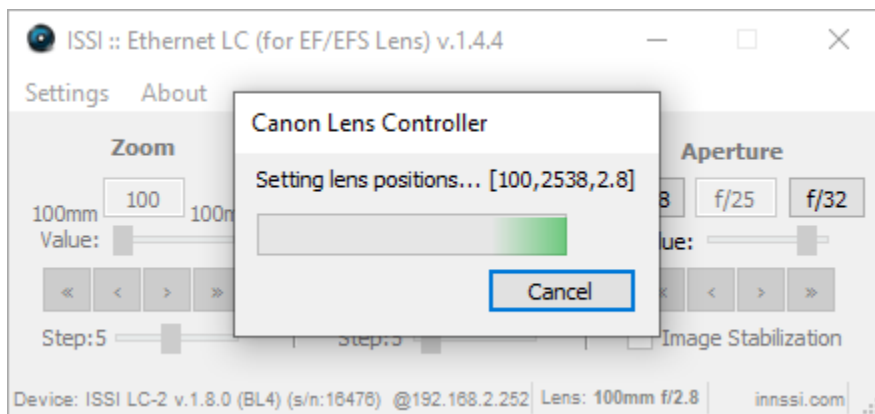
```
C:\Windows\system32>arp -d
```

Always on Top makes the LC-2 software always appear as the front window for all windows open on the desktop.

The save and load settings are used to save positions and recall them on each motor of the lens. When the lens parameters are at their desired location, those positions on each motor can be saved and later recalled. To save new settings, select **Save Settings** and enter a name for those lens settings. Settings are saved to the computer in which the interface is open, not the lens controller itself.



To recall those lens settings, select **Load Settings** and the lens will return each motor to those positions. The lens focal length, position of the focus motor and F number will be displayed for each saved set point.



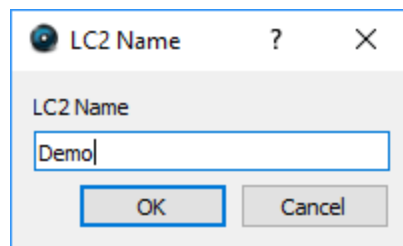
When the position of the lens is being set, the above status window will show the progress.

Keyboard Commands

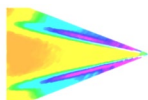
For faster access to preset positions, keyboard commands can be used to recall saved positions. If a preset is saved with any single digit integer (0-9) it can be recalled by the command *Ctrl*+0, 2.....9. Individually recall these commands by holding *Ctrl* + the number of the preset. To recall these presets, they must have the name of the single digit integer being recalled. For example, if a preset is saved as 1, then pressing *Ctrl*+1 will recall that preset.

Set Name will allow a device name to be entered for the connected lens controller. If multiple lens controllers are being used over the same network, this will aid in distinguishing them.

This name will then be displayed in the bottom right corner of the user interface.



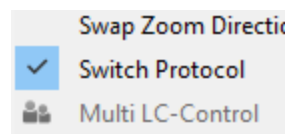
The **Set Focus Timeout** feature enables users to set a timeout value for older and slower lenses (such as STM or equivalent), which may not provide reliable feedback from the encoder. This is especially useful for lenses with a large focus range, where increasing the timeout value may be necessary. The timeout value is



saved in non-volatile memory for future use. By default, the timeout value is set to 900ms. However, in some cases, the focus movement may lag behind the encoder response, which means that the full focus range is not discovered by the lens controller. To address this issue, increasing the timeout value allows for sufficient time for the full focus range to be discovered, this enables the lens to be adjusted throughout the entire range, and for presets to be saved and recalled effectively.

Swap Zoom Direction will switch the direction of the zoom orientation in the user interface to match the zoom direction of the lens. Some lenses zoom clockwise while other zoom counter-clockwise. Only used for LC-PZA2 models with EF zoom control which the LC-2 does not have.

Switch Protocol will switch between lens communication protocols so that the connected lens may work properly. A select number of Canon EF-S lenses use a different protocol to communicate with the camera requiring a selectable mode for proper operation with the lens controller so that it may mimic camera communication.



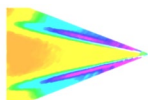
Restart LC will perform a software reset. This should be used to fix connection problems or if the software becomes unresponsive.

Focus Init will find the limits again. This can be used if the lens limits need to be re-learned for lenses with multiple focal range settings.

Exit will disconnect from the lens controller and exit the program.

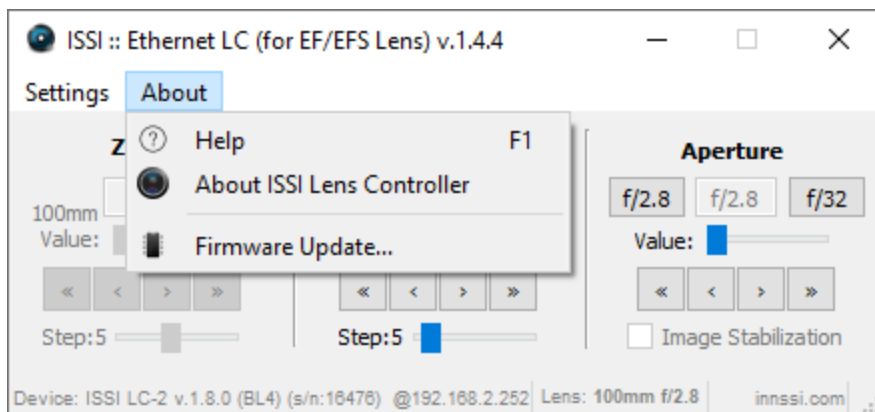
Multi Control

The *Lens Controller Interface* allows for master control of multiple LC-2s connected over a local network. This is only done through the ProAcquire Multi-camera add-on and is detailed in the ProAcquire user manual.

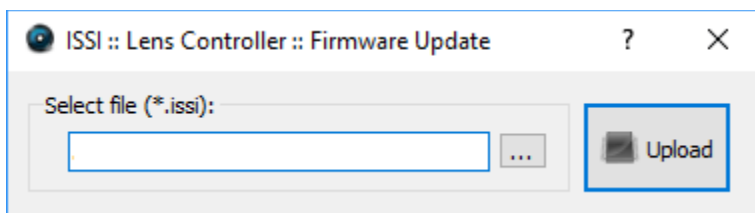


Firmware Upgrade

Firmware can be upgraded over the Ethernet connection. When a firmware update is available, download from the ISSI website (innssi.com/canon) and save. The firmware update tool can be found in the '**About**' menu. Firmware updates will be issued if needed and will always be posted to the ISSI website under the ISSI products page in the download section for the LC-2. Always use the software version recommended for the firmware.

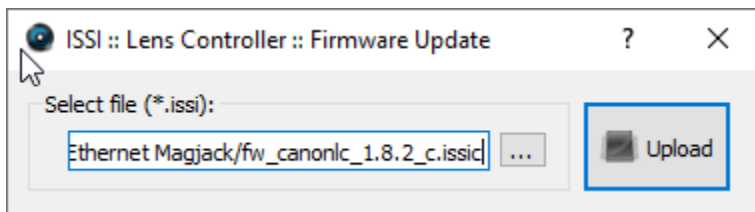


Click on **Firmware Update** to open the window to select the firmware file to upload.

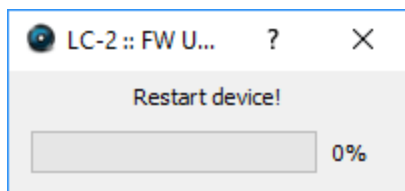
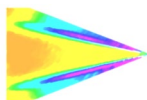


Select the file to upload.

Once the file is loaded into the Firmware Upload tool, click **Upload**.

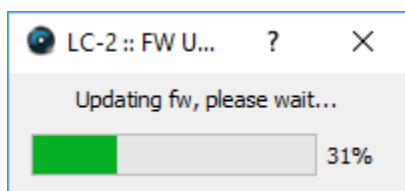


The following warning will appear to notify the user to cycle the power by the power connection before uploading the firmware update.

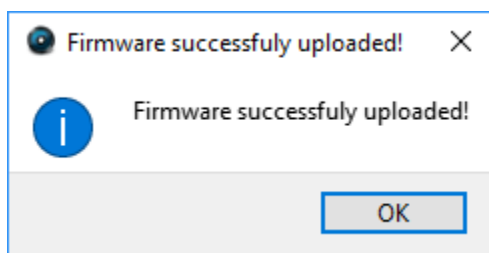


Restarting the power to the LC-2 will place it into firmware upgrade mode. Cycle the power and the firmware will be uploaded.

When the firmware is uploading the status will be displayed.



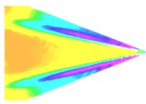
Once the firmware is successfully uploaded, the following message will appear.



*****Lens controllers purchased after July 2017 will update firmware without requiring a power reset.*****

Follow the serial number format to assure the correct firmware version is loaded. Loading the wrong firmware version could lock out the lens controller which is explained in the troubleshooting section.

- For lens controllers with serial number 16XXX: fw_canonlc_1.8.2_c.issic
- For lens controllers with serial number 17XXX: fw_canonlc_1.8.2_new_c.issic



Troubleshooting

Communication

The lights on the Ethernet port should be flashing if communication is established. If the device is locked and the lights are not flashing, it is locked in firmware upgrade mode.

Check the lens to assure the lens is locked in place. If the lens is not locked in place, the pins may not be correctly aligned, which can cause the device to lose power.



Firmware Upgrade

If the lens controller firmware update fails to initialize, it may appear that the lens controller is locked and communication can't be established. Start by pinging the IP address in the command prompt to assure there is communication.

```
Pinging 192.168.2.251 with 32 bytes of data:
Reply from 192.168.2.251: bytes=32 time<1ms TTL=128
Reply from 192.168.2.251: bytes=32 time<1ms TTL=128
Reply from 192.168.2.251: bytes=32 time<1ms TTL=128
Reply from 192.168.2.251: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.2.251:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

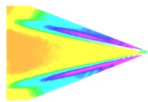
If there is no communication and a general failure message is displayed, there may be another issue like the Windows Firewall or antivirus blocking the program.

```
Pinging 172.0.0.21 with 32 bytes of data:
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.
```

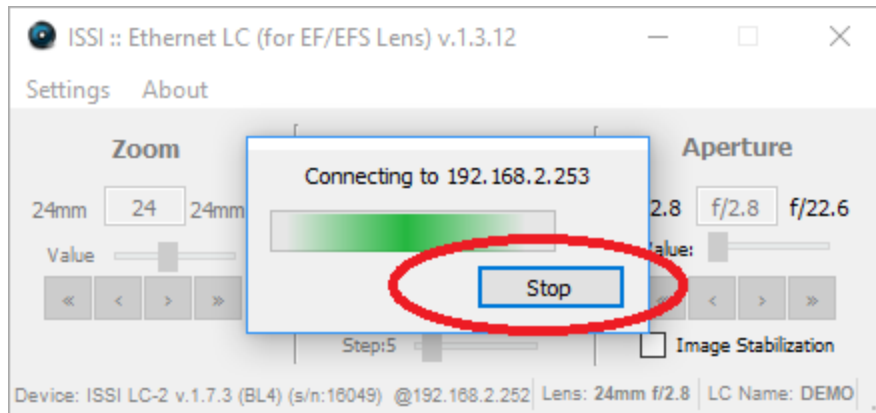
The firewall or antivirus will either need to be turned off or an exception for the software will have to be made to allow it through.

In this case, try connecting to the lens controller in the software interface. It won't connect so press the **STOP** button.

Another solution to communication issues is to clear the associated IP addresses to the LC-2. This problem can occur when the IP address is changed. There are two methods to clear the IP addresses.



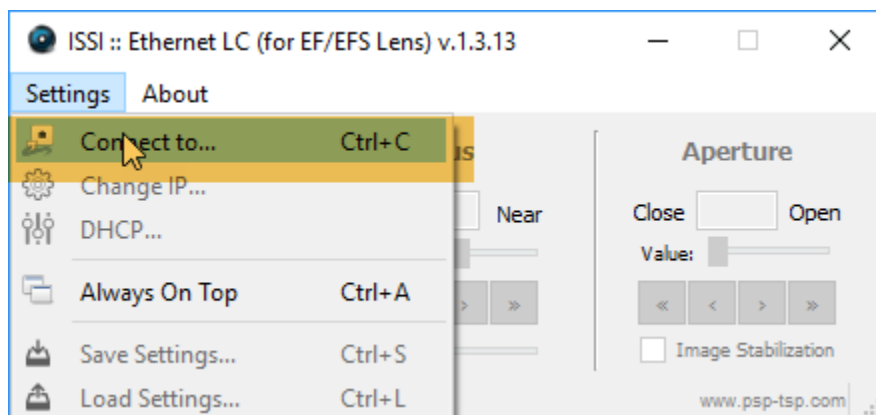
- 1.) Run the lens control interface as administrator
- 2.) Open the command prompt (as administrator) and type “arp -d”.

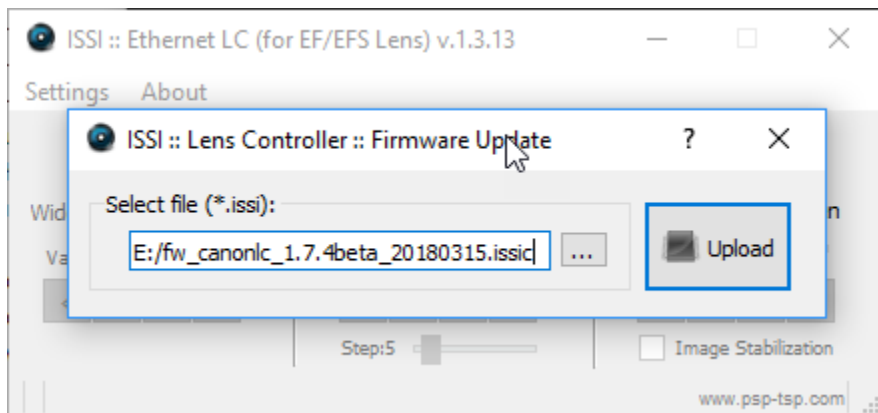
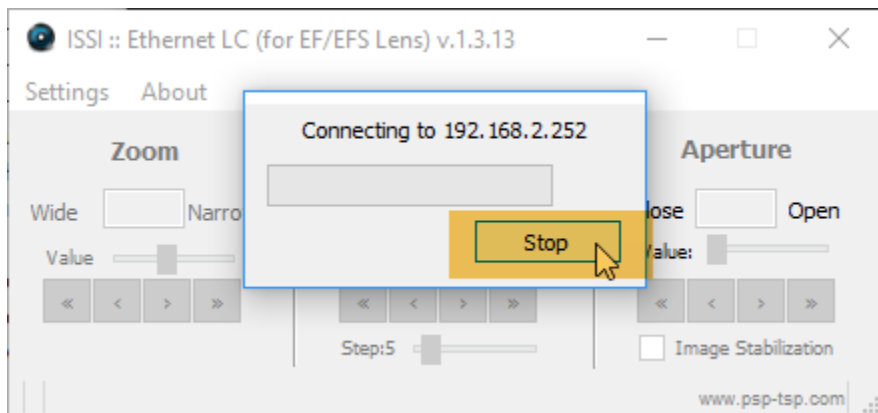
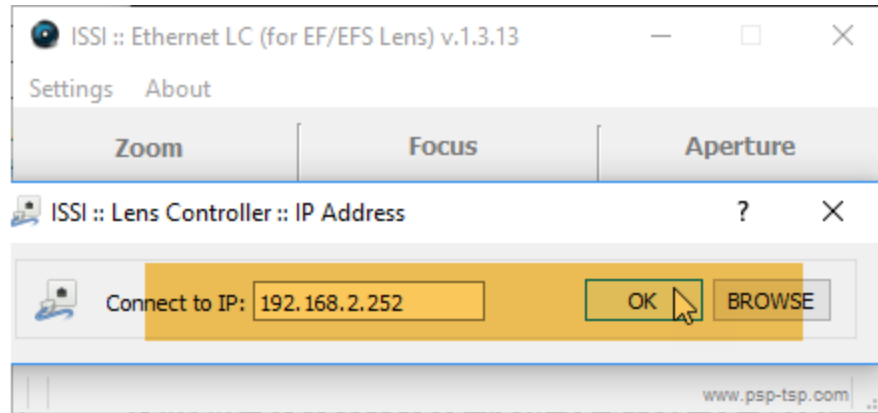
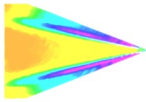


Next, go to the firmware update and load the firmware again. Even though the communication is not established with the software interface, it is still connected to the NIC, which means the firmware can still be updated. Once the firmware is uploaded, the controller should connect via the interface.

Locked In Programming Mode

If the controller can be pinged but not connected via software, it could be in programming mode, awaiting firmware. In that case, follow the steps below to gain control back:



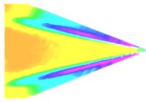


If it does not start automatically (after 1-2 sec), restart by power.

Recovery and Reset

Once all network settings have been verified to be correct and if resetting the controller doesn't solve communication problems, the following steps can be performed to reset the controller by power and recover communications.

1.) Connect a lens to the adapter to allow the controller to find the lens. It may be in a loop looking for a lens.



If that does not work:

2.) Open the software and go to the firmware update. Select the firmware and load (even if the lens won't connect). Disconnect the power. Hold the reset button down. While continuing to hold down the reset button, re-connect power. Continue to hold the reset button down until the lights on the Ethernet port begin to flash. Connect lens and try connecting to the controller again.

Focus Drift

Many lenses experience drift in the focus motor position. This causes the encoder position associated with a particular focus point to change. This is not an effect of the controller, but the lens encoder itself.

Lenses will drift a few encoder counts once they hit a stop. The higher-quality lenses (L-series and with USM) will have far less drift than the cheaper lenses. To account for drift, the focus range needs to be re-learned by the controller. This can be done using the ***Focus Init*** function in the software (or “*refRange*” command for API). After the focus range is re-learned, load the saved preset and it will move to the correct position.

Lenses Tested with LC-2

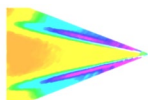
List of tested lenses maintained here: <https://innssi.com/canon/>

Tested Lenses

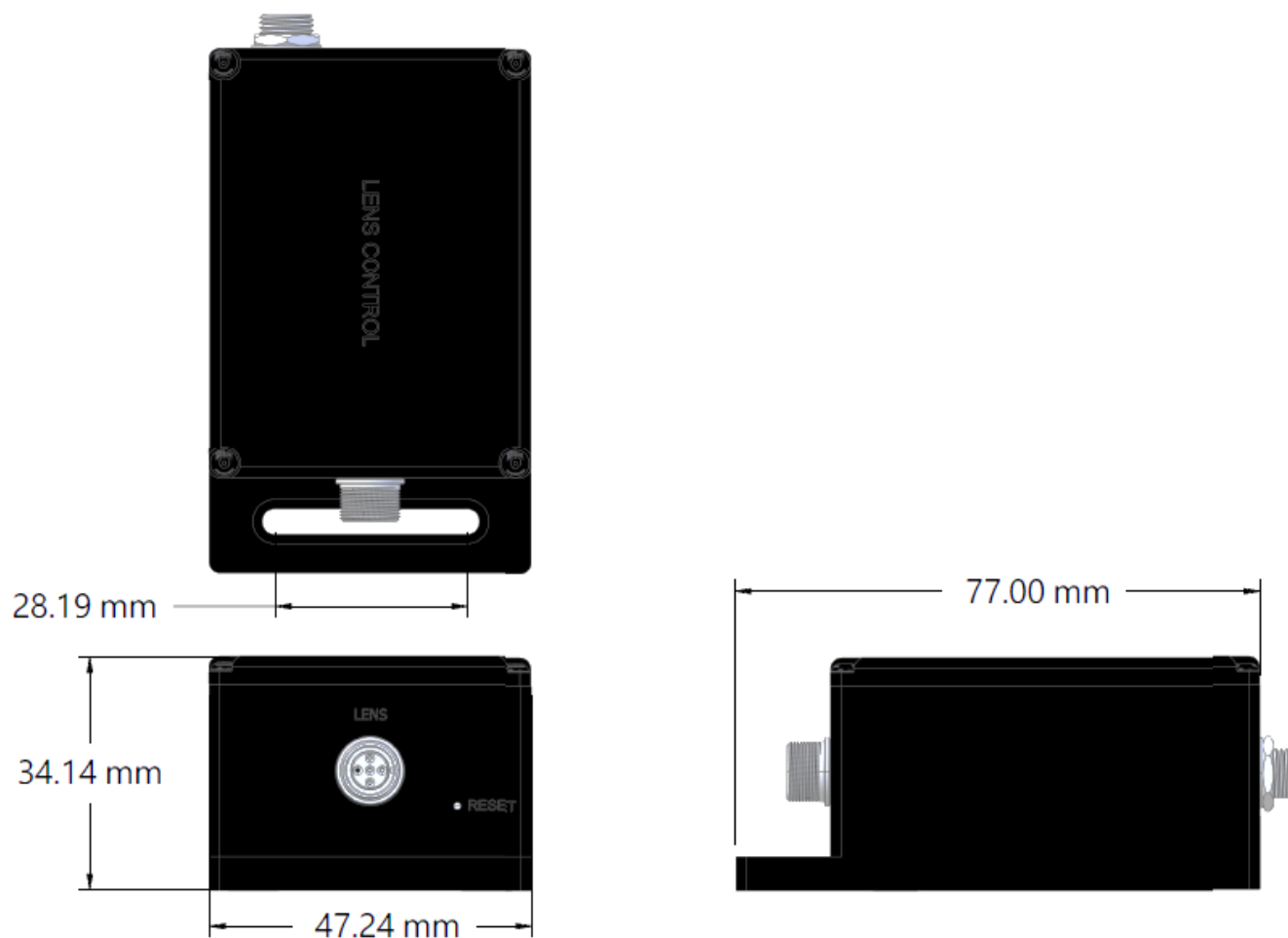
Canon®

Sigma®

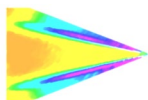
Tamron®



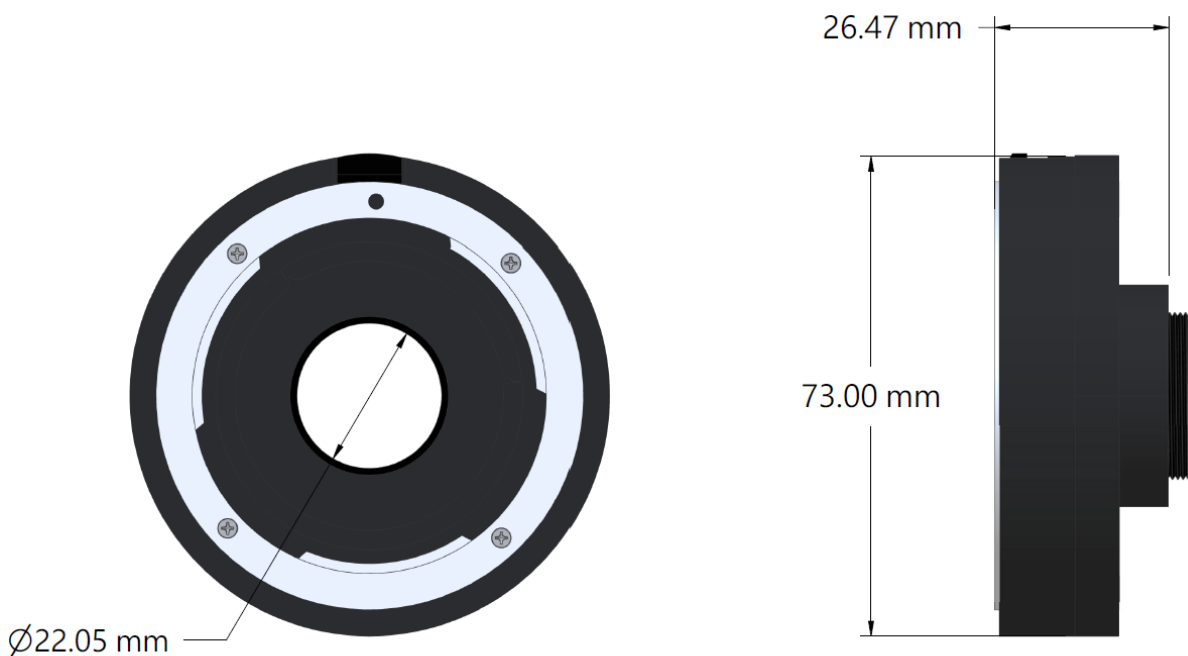
Dimensions



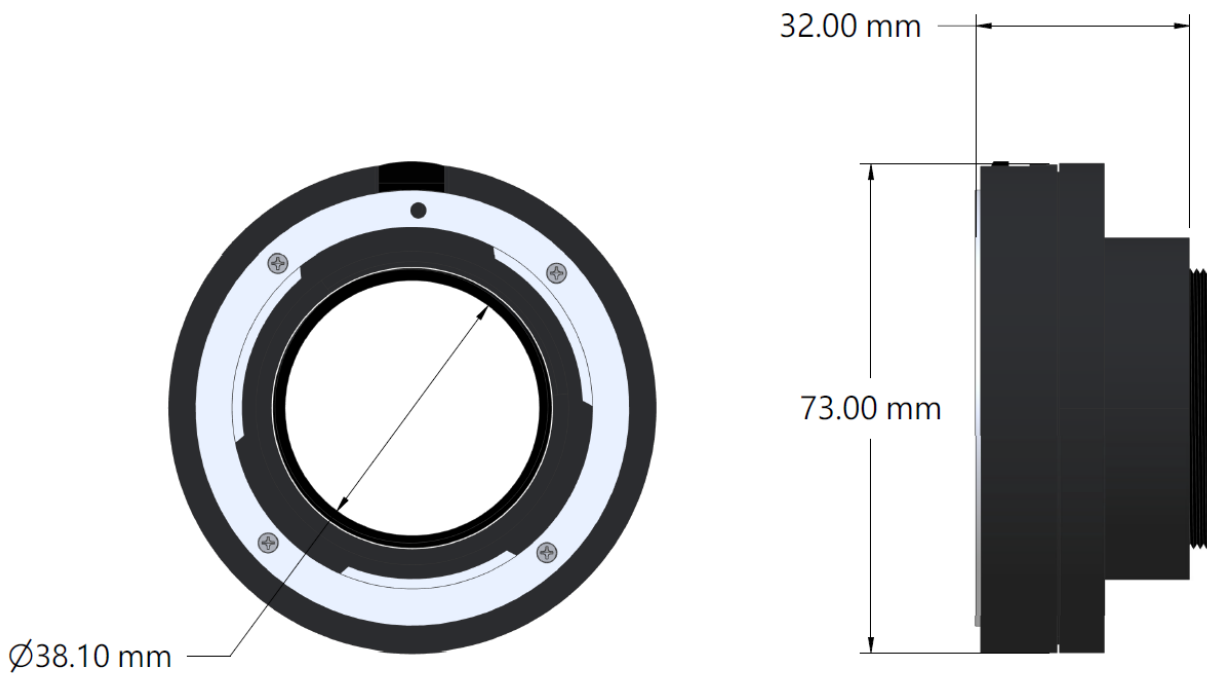
LC-2 Control Box



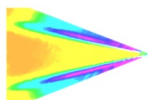
Standard Lens Mount Lens Adapters



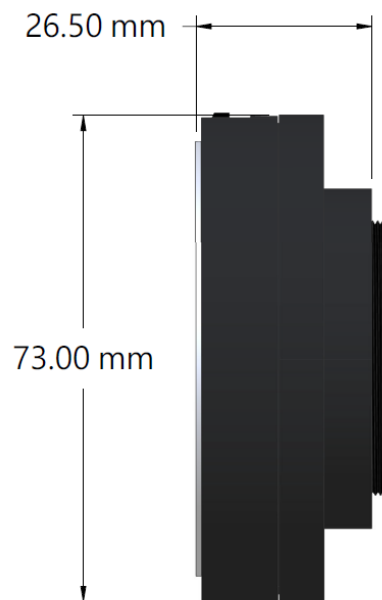
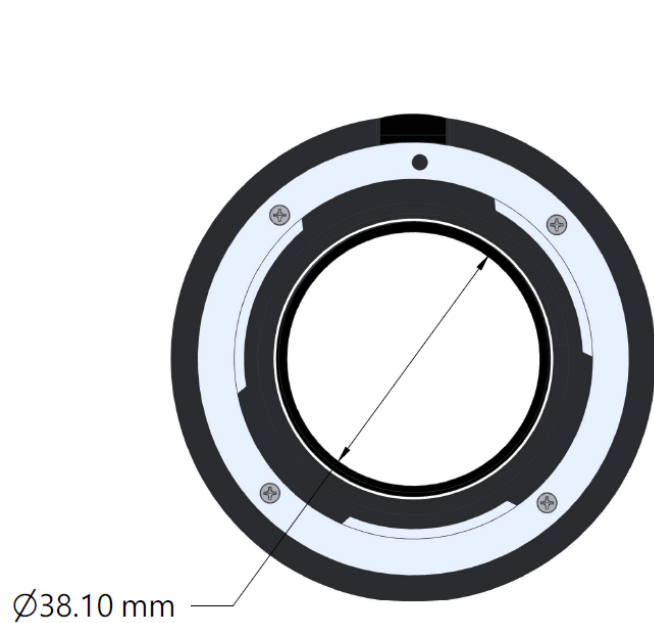
LC-2A-C Lens Adapter (EF-C lens adapter)



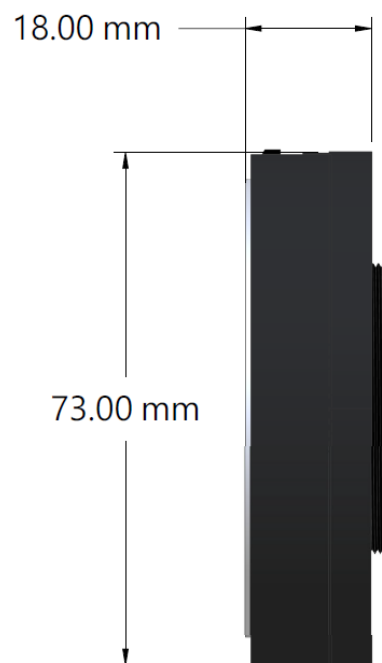
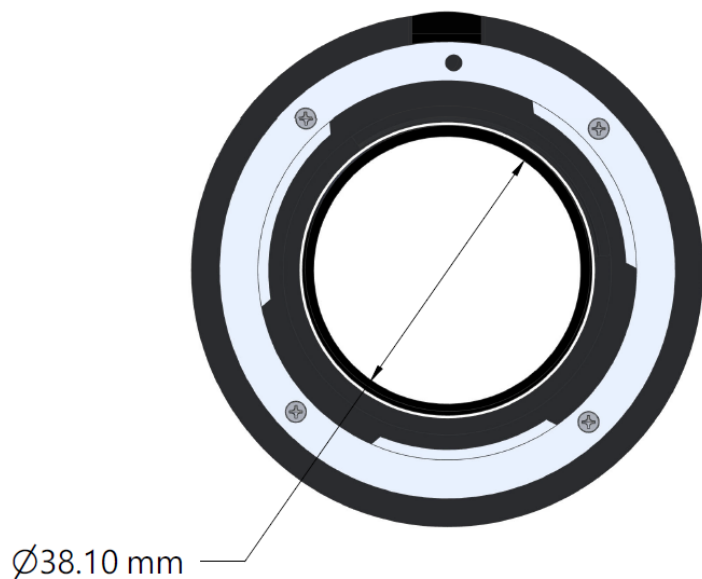
LC-2A-M42 Lens Adapter (EF-M42x1 lens adapter)



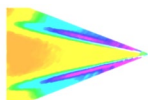
T-Mount Lens Adapters



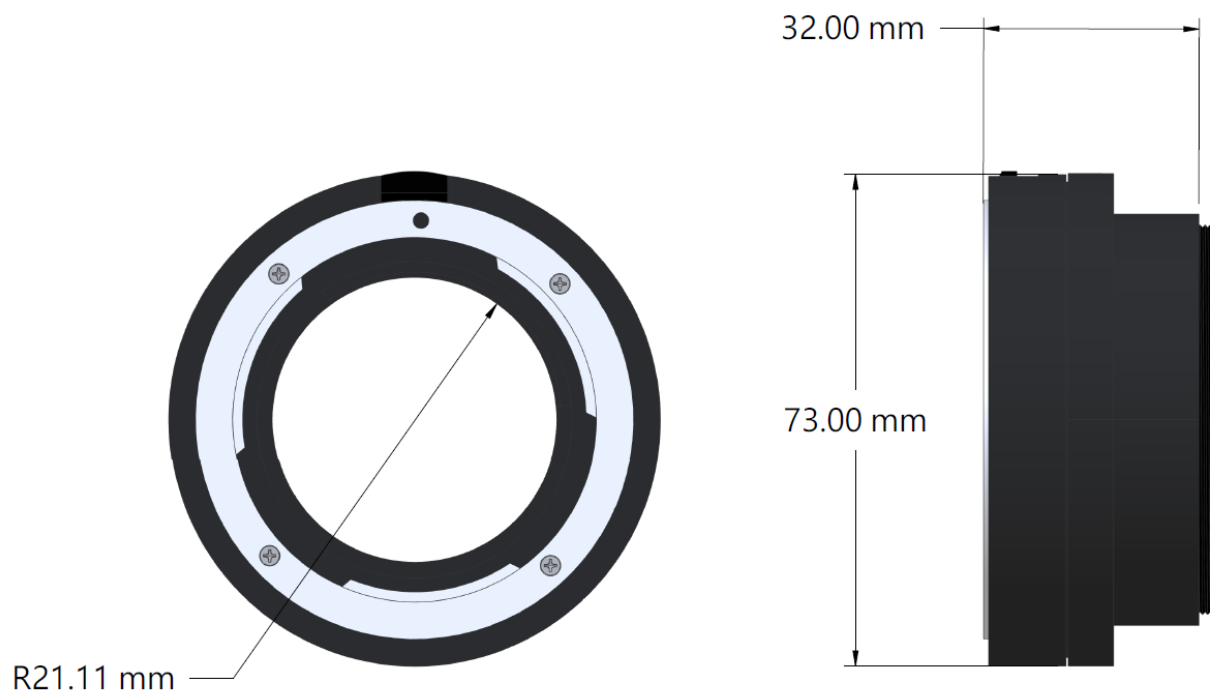
LC-2A-T (EF-T lens adapter)



LC-2A-T18 (EF-T lens adapter)



Large Format Lens Adapters



LC-2A-M58-75 Lens Adapter (EF-M58x0.75 lens adapter)

Custom adapters are available. Call or email us to get a quote.

Weights

LC-2: 581g

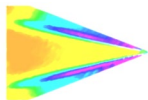
LC-2A-C: 112g

LC-2A-M42: 117g

LC-2A-T: 117g

LC-2A-T18: 116g

LC-2A-M58-75: 122g



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