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# Lens Mount Adapters Application Notes

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## **Basler Support Worldwide:**

Americas: +1-877-934-8472  
vc.support.usa@baslerweb.com

Europe: +49-4102-463-500  
vc.support.europe@baslerweb.com

Asia: +65-6425-0472  
vc.support.asia@baslerweb.com

[www.basler-vc.com](http://www.basler-vc.com)

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# 1 Purpose

The purpose of this document is to describe the lens mount adapters available for Basler cameras and to explain how to change adapters. The document also includes information covering some of the most common questions that people ask about lens mount adapters.



The drawings in this document are not to scale. Some part sizes have been exaggerated for emphasis.



The lens mount adapter can be changed on all Basler cameras with an RS-644, Channel Link, Camera Link or IEEE 1394 interface with the exception of A600 series cameras. A600 cameras have a fixed C-mount adapter that can't be changed.

## 2 Changing Lens Mount Adapters on Channel Link, Camera Link, and IEEE 1394 Cameras

This section describes changing the lens mount adapter on Basler cameras with a Channel Link, Camera Link or IEEE 1394 interface. The procedure describes removing a C-mount adapter from a camera and replacing it with an F-mount adapter. The procedure is similar if you are working with a V-mount adapter or an M42 mount adapter



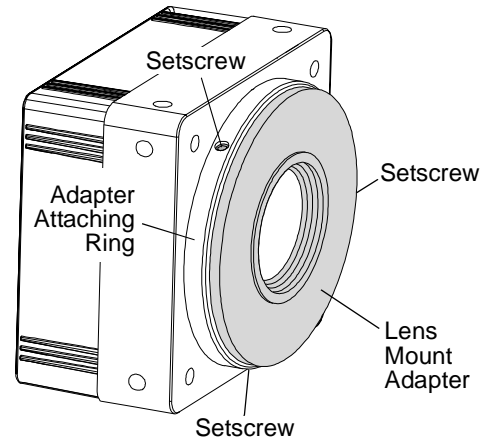
If you are removing a V-mount adapter from the camera, you must remove the adapter from the camera before you can remove the lens from the adapter. When installing a V-mount adapter, you must install the lens in the adapter before you install the adapter in the camera. (See Section [4.4](#) for more details.)



Due to mechanical tolerance variations, changing the lens mount on your camera may result in the camera's flange to image plane distance being slightly out of specification. (This is caused by an effect commonly called "tolerance stacking.")

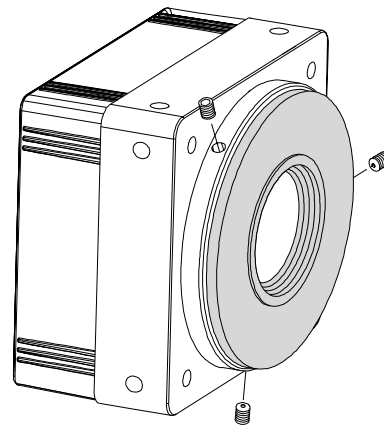
To change a lens mount adapter:

1. Locate the three set screws in the adapter attaching ring as shown in the drawing.



2. Place the camera in a small tray and then use a 1.5 mm allen wrench to remove the setscrews. (The setscrews are very small, easy to drop, and easy to lose. If you put the camera in a small tray, you won't lose the screws if you drop them.)

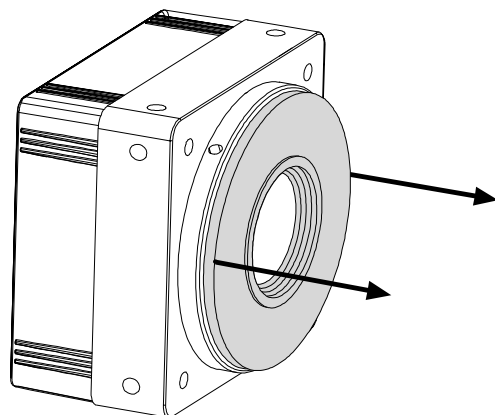
Be sure to completely remove the setscrews. If you just loosen them, you may not be able to remove the adapter or the screws may scratch the adapter. Scratching the adapter can create metal shavings which may damage the camera.



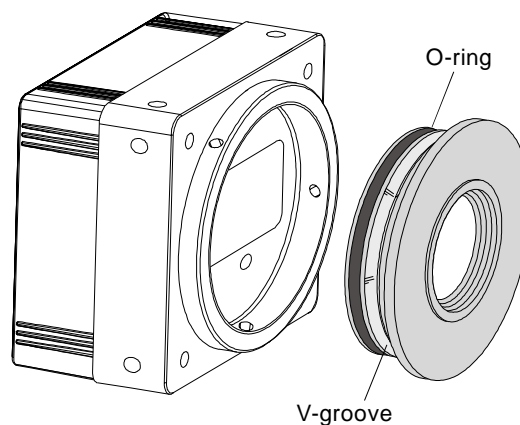
	<p><b>Caution!</b></p> <p><b>DO NOT</b> attempt to remove the adapter attaching ring. Attempting to remove this ring will severely damage the camera.</p>
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3. Pull the lens mount adapter straight out of the camera as shown in the drawing.

**Note:** The back of the lens mount adapter has an O-ring that stops dirt from getting into the camera (see the drawing for step four). Sometimes, the O-ring can make it very difficult to pull the adapter out of the camera. In this case, gently rocking the adapter as you pull on it can aid in removing the mount. Avoid using tools to pry the adapter out of the camera - using tools can damage the adapter or the camera.

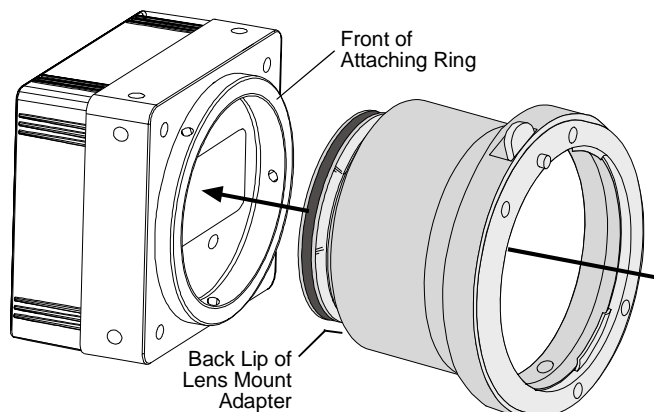


- After you remove the adapter, notice the O-ring. You will also notice that there is a V-groove in the back part of the adapter. Each version of lens mount adapter has a similar type of groove. When you install an adapter, the tips of the setscrews tighten against this V-groove and hold the adapter in the camera.



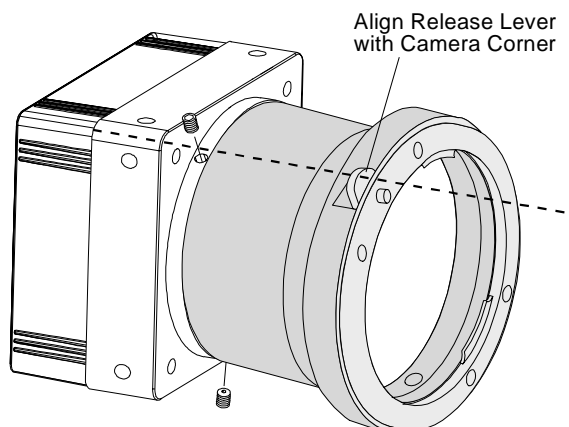
- Insert the replacement adapter into the camera as shown in the drawing. Push the adapter into the camera until the back lip of the adapter is against the front of the attaching ring.

If the adapter is difficult to insert, gently rocking the adapter as you push it in will often help.



- Reinstall and tighten the three setscrews.

**Note:** If you are installing an F-mount adapter, make sure that the locking pin release lever is aligned with a corner of the camera as shown. When the lever is not aligned with a corner, it can interfere with mounting the camera on a flat surface.



### 3 Changing Lens Mount Adapters on RS-644 Cameras

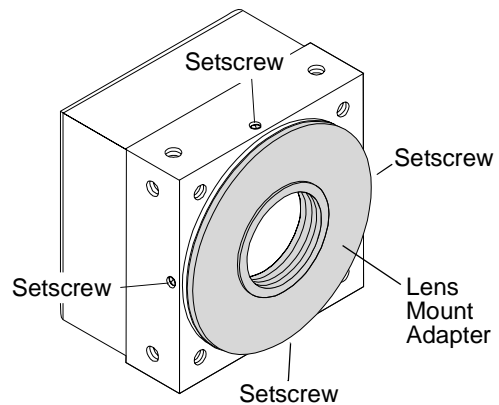
This section describes changing the lens mount adapter on Basler cameras with an RS-644 interface. The procedure describes removing a C-mount adapter from a camera and replacing it with an F-mount adapter. The procedure is similar if you working with a V-mount adapter or an M42 mount adapter.



If you are removing a V-mount adapter from the camera, you must remove the adapter from the camera before you can remove the lens from the adapter. When installing a V-mount adapter, you must install the lens in the adapter before you install the adapter in the camera. (See Section 4.4 for more details.)

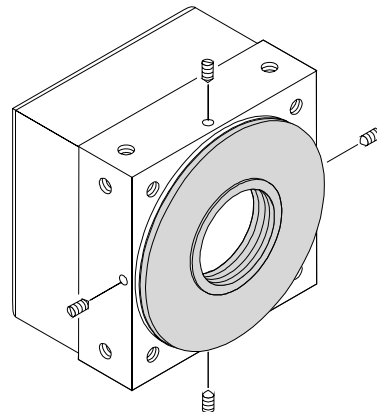
To change the lens mount adapter:

1. Locate the four set screws in the camera body as shown in the drawing.

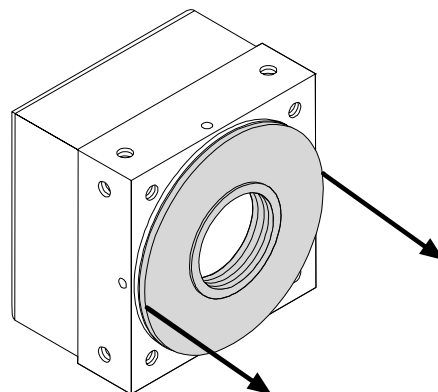


2. Place the camera in a small tray and then use a small, flat head screwdriver to remove the setscrews. (The setscrews are very small, easy to drop, and easy to lose. If you put the camera in a small tray, you won't lose the screws if you drop them.)

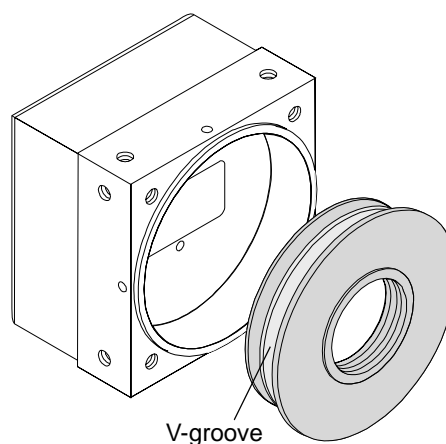
Be sure to completely remove the setscrews. If you just loosen them, you may not be able to remove the adapter or the screws may scratch the adapter. Scratching the adapter can create metal shavings which may damage the camera.



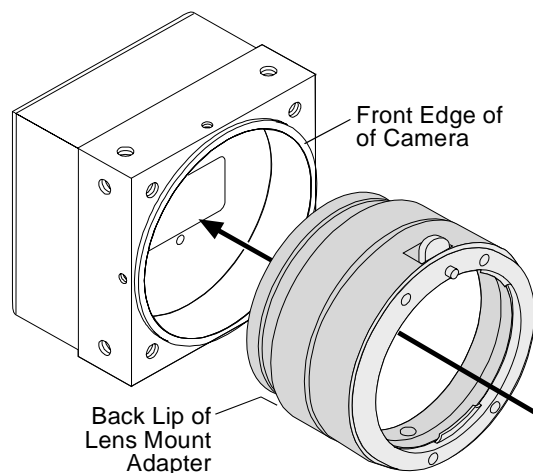
3. Pull the adapter straight out of the camera as shown in the drawing.



4. When you have removed the adapter, notice the V-groove in the back part of the adapter. Each version of lens mount adapter has a similar type of groove. When you install an adapter, the tips of the setscrews tighten against this V-groove and hold the adapter in the camera.

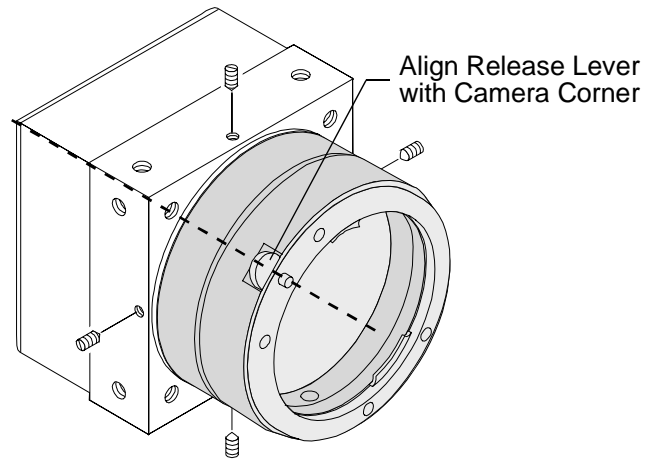


5. Insert the replacement adapter into the camera as shown in the drawing. Push the adapter into the camera until the back lip of the adapter is against the front edge of the camera.



6. Reinstall and tighten the four setscrews.

**Note:** If you are installing an F-mount adapter, make sure that the locking pin release lever is aligned with a corner of the camera as shown. When the lever is not aligned with a corner, it can interfere with mounting the camera on a flat surface.



## 4 Types of Lens Mount Adapters

Four types of lens mount adapters are available for Basler cameras: C-mount, M-42, F-mount, and V-mount. For each lens mount adapter type, there are two versions available. One version is designed for use with Basler cameras that have a Channel Link, Camera Link, or IEEE-1394 interface. The other version is designed for use with Basler cameras that have an RS-644 interface. The main difference between the adapter versions is that the Channel Link/Camera Link/IEEE-1394 mounts have an O-ring seal and the RS-644 mounts do not.

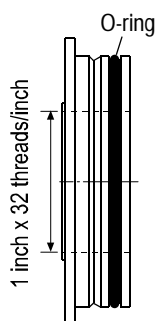
**Note:** The Basler A600 series is an exception. It has a fixed C-mount that can't be changed.

### 4.1 The C-Mount Adapter

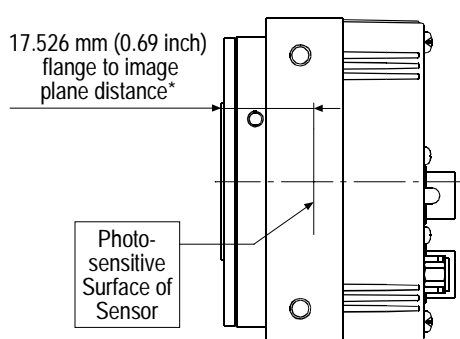
The C-mount type of lens mount was originally used primarily with closed-circuit television cameras. It was designed for use with screw in lenses that have a 1 inch diameter and 32 threads per inch. The C-mount adapter has a flange to image plane distance of 17.526 mm (0.69 inch).\*

The drawings below show these dimensions for a C-mount adapter on a Camera Link camera and on an RS-644 camera.

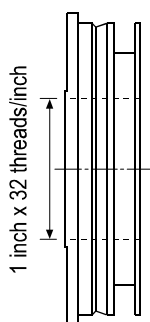
Channel Link, Camera Link, or  
IEEE-1394 C-Mount Adapter



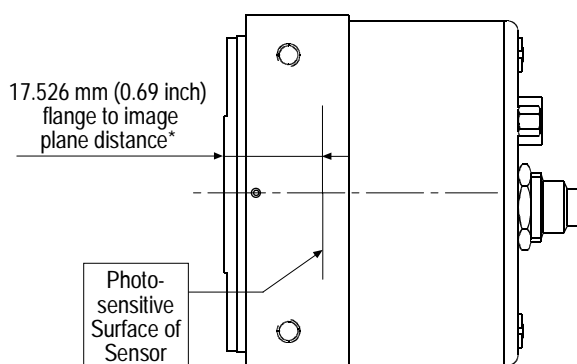
Adapter on a  
Camera Link Camera



RS-644  
C-Mount Adapter



Adapter on an  
RS-644 Camera



\* This is an optical distance. The physical distance differs slightly.

## 4.2 The F-Mount Adapter

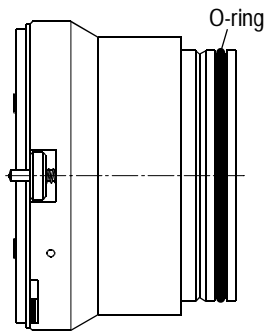
The F-mount is a bayonet type mount originally designed for use with Nikon lenses. This type of lens mount was so associated with Nikon that it is frequently called Nikon F. Today, a variety of F-mount compatible lenses are available from many leading optics companies.

The basic physical design of the F-mount has not changed since it was developed in 1959. But over the years, more complex versions of the mount have been introduced that include mechanical indexing, electronic data transfer support, and support for lenses with integral focus motors. The F-mount adapter used by Basler is the most basic version of the mount. Although all F-mount lenses are physically compatible with the Basler lens mount adapter, advanced features incorporated into the lenses may not be supported.

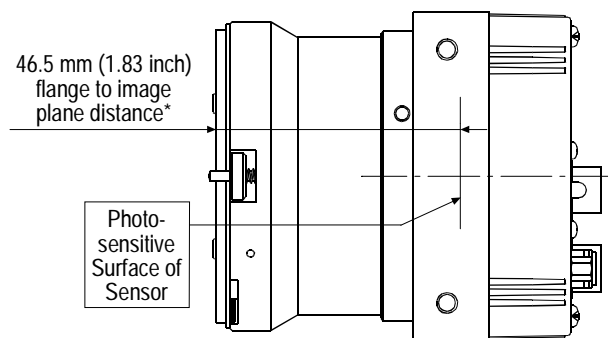
The F-mount adapter has a flange to image plane distance of 46.5 mm (1.83 inch).\*

The drawings below show these dimensions for an F-mount adapter on a Camera Link camera and on an RS-644 camera.

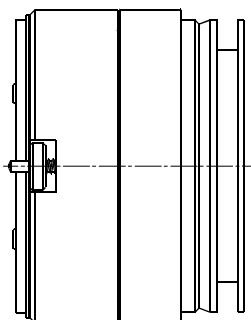
**Channel Link, Camera Link, or IEEE-1394 F-Mount Adapter**



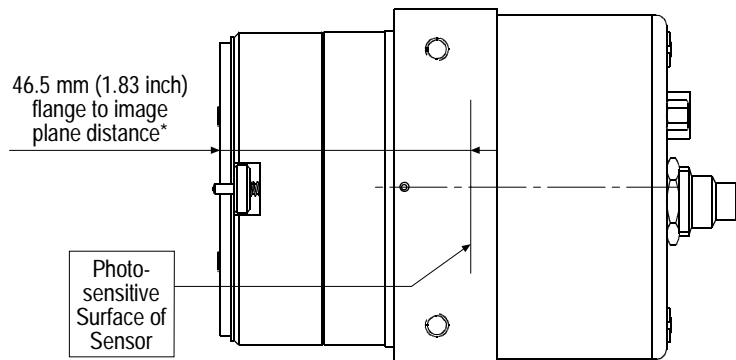
**Adapter on a Camera Link Camera**



**RS-644 F-Mount Adapter**



**Adapter on an RS-644 Camera**



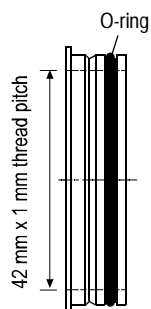
\* This is an optical distance. The physical distance differs slightly.

## 4.3 The M-42 Adapter

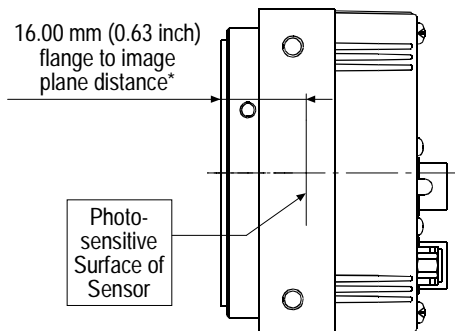
The M-42 type of lens mount was popularized by Pentax cameras. It was designed for use with screw in lenses that have a 42 mm diameter and a 1 mm thread pitch. The M-42 adapter for Channel Link, Camera Link, and IEEE-1394 cameras has a flange to image plane distance of 16.00 mm (0.63 inch).\* The M-42 adapter for RS-644 cameras has a flange to image plane distance of 20.00 mm (0.79 inch).\*

The drawings below show these dimensions for an M42 adapter on a Camera Link camera and on an RS-644 camera.

**Channel Link, Camera Link, or  
IEEE-1394 M-42 Adapter**



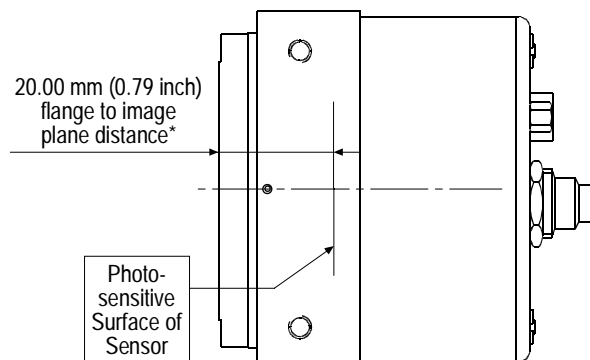
**Adapter on a  
Camera Link Camera**



**RS-644  
M-42 Adapter**



**Adapter on an  
RS-644 Camera**



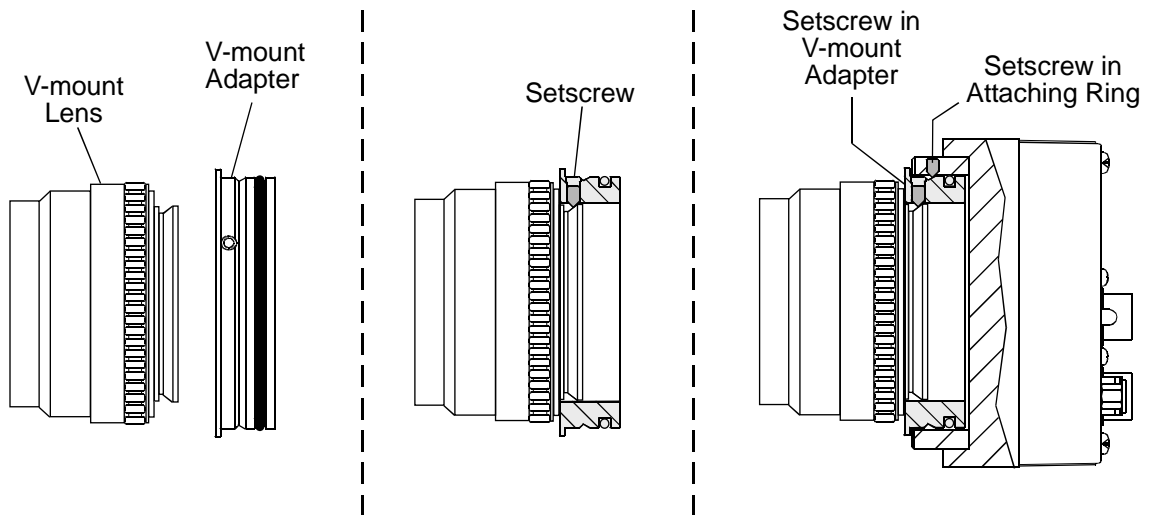
\* This is an optical distance. The physical distance differs slightly.

## 4.4 The V-mount Adapter

The V-mount type of lens mount was designed for use with lenses made by Schneider Kreuznach ([www.schneiderkreuznach.com](http://www.schneiderkreuznach.com)). Several lines of Schneider lenses have V-mount capability. A unique feature of the V-mount system is that the lens is held in the adapter by three setscrews. The intent of this design is to hold the lens firmly in place even in industrial situations where the camera may be subject to vibrations.

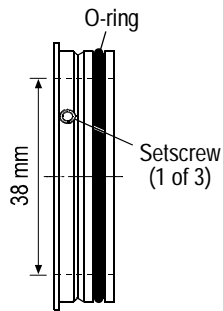
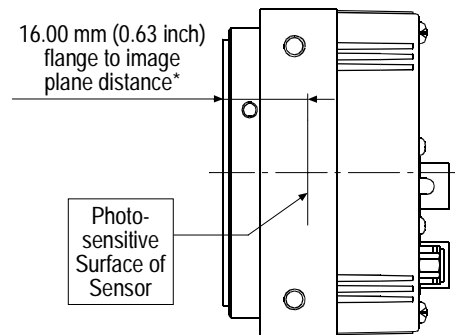
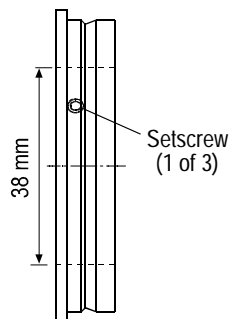
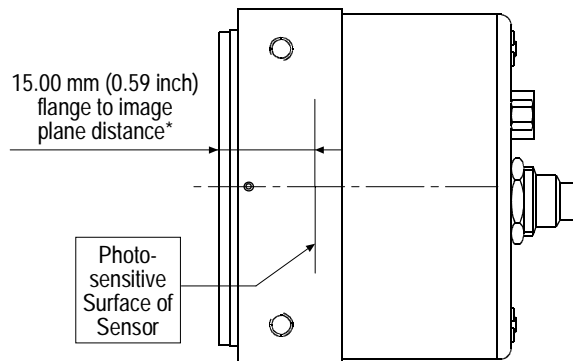
The use of setscrews to hold the lens in the adapter adds a unique aspect to the installation of a V-mount adapter in a camera. The setscrews used to hold the lens in the adapter are hidden when the adapter is in a camera. Therefore, **you must install the lens in the adapter before you install the adapter in the camera**. If you want to remove a V-mount lens, you must remove the adapter from the camera before removing the lens from the adapter.

In the drawings below, the left drawing shows a side view of a V-mount lens and the V-mount lens adapter for a Basler Camera Link camera. The center drawing shows the lens inserted into a cutaway drawing of the V-mount adapter and illustrates how the setscrews hold the lens in the adapter. The right drawing shows the lens and the adapter inserted into a cutaway drawing of the camera. Notice how the setscrews in the V-mount adapter are hidden when the adapter is mounted in the camera.



The V-mount adapter has a 38 mm, smooth bore hole for the lens. The V-mount adapter for Channel Link, Camera Link, and IEEE-1394 cameras has a flange to image plane distance of 16.00 mm (0.63 inch).\* The V-mount adapter for RS-644 cameras has a flange to image plane distance of 15.00 mm (0.59 inch).\*

The drawings on the next page show these dimensions for an V-mount adapter on a Camera Link camera and on an RS-644 camera.

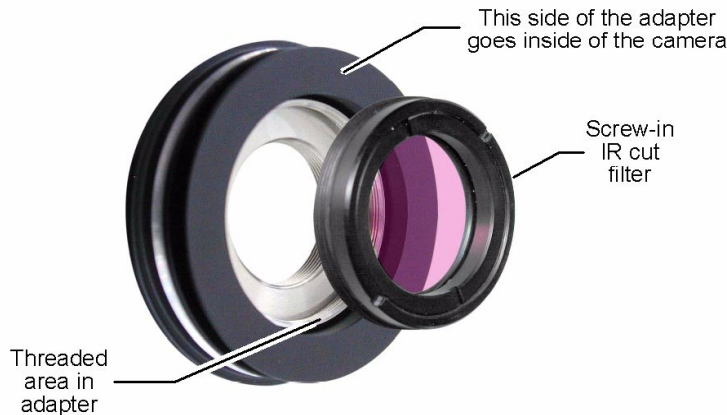
**Channel Link, Camera Link, or IEEE-1394 V-Mount Adapter****Adapter on a Camera Link Camera****RS-644 V-Mount Adapter****Adapter on an RS-644 Camera**

\* This is an optical distance. The physical distance differs slightly.

## 5 Adapters with an Integrated IR Cut Filter

The sensors used in Basler color cameras are sensitive to visible light and to a portion of the infrared spectrum. When a light source with a high infrared component is used with a Basler color camera, it can cause the colors in the captured images to appear “brownish” or “muddy.” Because it is especially sensitive to infrared, the image quality on the Basler A102k monochrome camera is also negatively affected when it is used with a light source that outputs infrared.

These negative effects can be corrected by using an “IR cut” filter with Basler color cameras and with the A102k. The standard C-mount adapters supplied for Basler color cameras and for the A102k include an integrated IR cut filter. As shown in the drawing below, the IR cut filter is a small screw-in filter. The filter mounts in versions of the adapter that have been specially threaded to accept it.

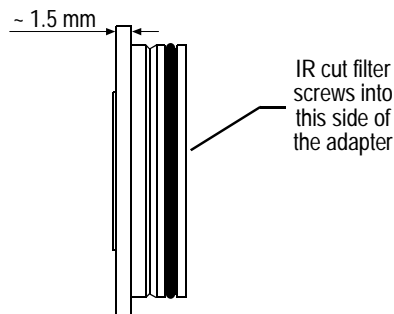


When you look at a C-mount adapter that has an integrated IR-cut filter, you may notice that the front face of the adapter is slightly thicker on adapters equipped with the filter. This is done to compensate for the additional refraction caused by the glass in the filter.

C-Mount Without Filter

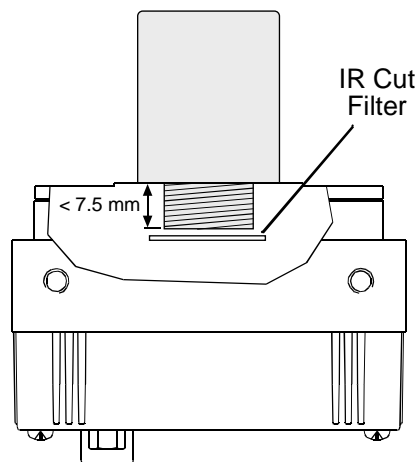


C-Mount With Filter



Do not remove the filter from the adapter and then attempt to use the adapter with your camera. With the filter removed, the flange to image plane distance will not be correct and you may no longer be able to focus on your object.

When you are using a C-mount lens adapter equipped with an integrated IR cut filter, you must be aware of the thread length of your lens. The thread length on the lens must be less than 7.5 mm as shown below. If a lens with a longer thread length is used, the IR cut filter will be damaged or destroyed and the camera will no longer operate.



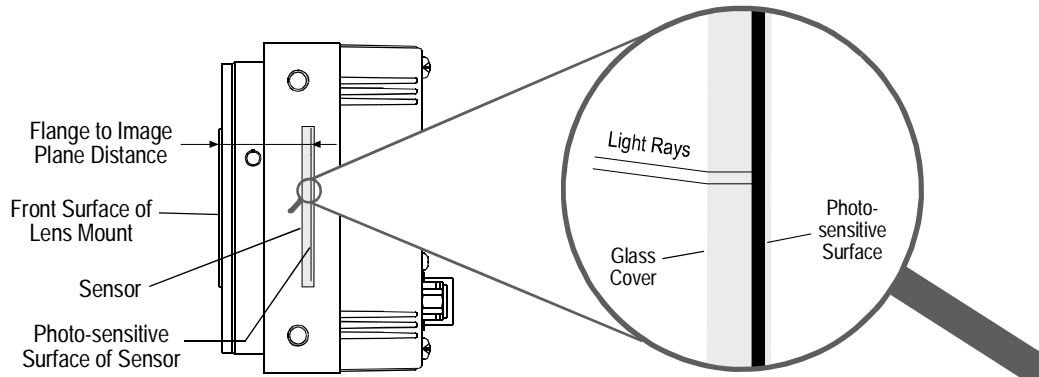
The standard C-mount adapter for Basler color cameras and for the A102k include an integrated IR cut filter. C-mount adapters without a filter are available for all cameras.

## 5.1 Add-on IR Cut Filters

If you are using an adapter without an IR cut filter and you think that an IR cut filter would be beneficial, you can add a filter to your lens. Most optics suppliers carry a wide variety of IR cut filters that can be screwed or clamped directly onto your lens. Filters are available to fit C-mount, F-mount, V-mount and M42 lenses.

## 6 Flange to Image Plane Distance

The “flange to image plane distance” is frequently employed by camera users when making optical calculations. This parameter is also commonly known as the “flange focal length” or the “back focal length.” For the purposes of Basler cameras, the flange to image plane distance indicates the *optical* distance between the front surface of the lens mount adapter and the photo-sensitive surface of the sensor in a camera. The drawing below shows this dimension for a Camera Link camera with a C-mount adapter. The optical distance differs slightly from the physical distance because it takes into account the refraction of the incoming light rays caused by the glass cover on the sensor.



The position of the photo-sensitive surface within the sensor can vary slightly from sensor-to-sensor. This fact means that the distance from the front surface of a camera to the photo-sensitive surface of the sensor inside of the camera can vary slightly from one camera to the next. For cameras with an RS-644 interface, there is no provision to deal with this variability, and the flange to image plane distance does vary slightly from camera to camera. For almost all applications, this variability in RS-644 cameras has a negligible effect on performance and is very rarely noticed.

To ensure that Basler cameras can be used in even the most demanding situations, a provision for eliminating the variability was designed into cameras with a Channel Link, Camera Link, or IEEE-1394 interface. On these cameras, the distance between the front of the lens mount adapter and the photo-sensitive surface of the sensor in the camera is measured in the factory with a very precise optical measuring unit. With the measuring unit in place, the lens mount attaching ring is adjusted so that the optical distance between the front of the adapter and the photo-sensitive surface of the sensor is exact with a typical tolerance of  $+0.000 / -0.025$  mm. When the measurement is correct, the attaching ring is securely locked in place. This exact measurement and adjustment ensures that when a lens adapter is installed in the camera, the flange to image plane distance will be correct.

The drawings on the next page illustrate the measurement and adjustment process.

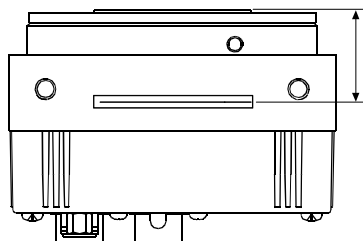


### Caution!

**DO NOT** attempt to remove or adjust the adapter attaching ring. Attempting to remove or adjust this ring will severely damage the camera.



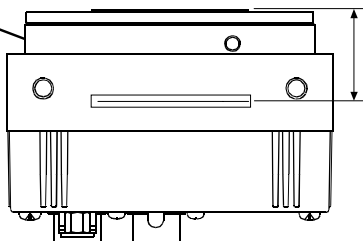
Due to mechanical tolerance variations, changing the lens mount on your camera may result in the camera's flange to image plane distance being slightly out of specification. (This is caused by an effect commonly called “tolerance stacking.”)

**1**

This distance is precisely measured in the factory.

**2**

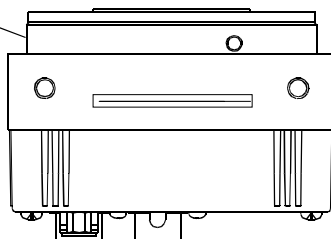
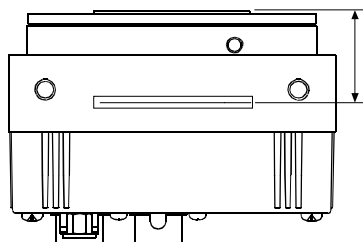
Attaching Ring



The attaching ring is adjusted so that the optical distance is exact within a typical tolerance of + 0.000 / - 0.025 mm.

**3**

The attaching ring is securely locked in place.

**4**

The measurement and adjustment ensures that the flange to image plane distance is correct.

## 7 Some Tips on Using F-Mount Lenses

F-mount lenses are easy to work with, but there are a few tips that can be helpful to novice users. New users sometimes have trouble mating the lens with the F-mount adapter on the camera. The alignment dot that appears on most lenses can help with this problem. The photo below shows some lenses with alignment dots.

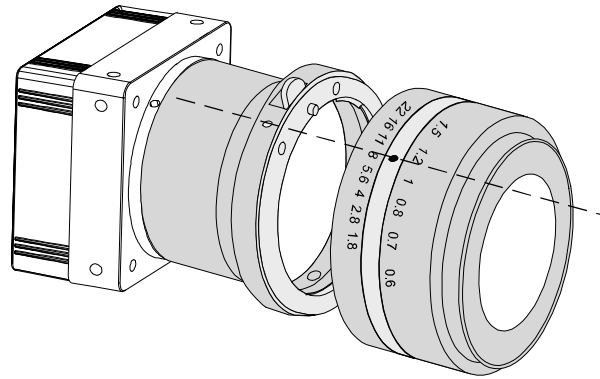


If you look closely at an F-mount adapter, you will see that it also has an alignment dot. When you are looking at the adapter, also notice the locking pin and the locking pin release lever.

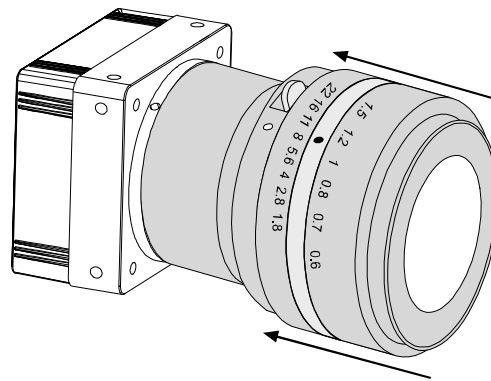


To install a lens on an F-mount adapter do the following:

1. Hold the lens so that the alignment dot on the lens and the alignment dot on the adapter are in line.

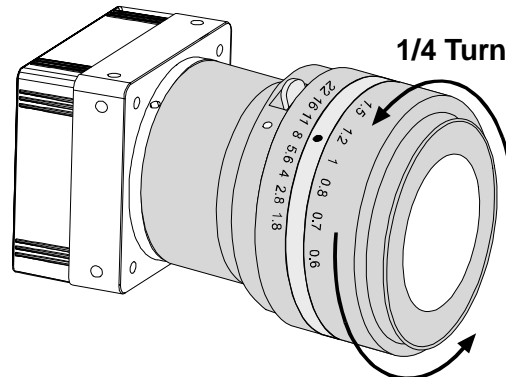


2. Gently press the lens against the front of the adapter. (The locking pin on the adapter is spring loaded. You will need to gently press the lens against the adapter to compress the spring on the locking pin.)



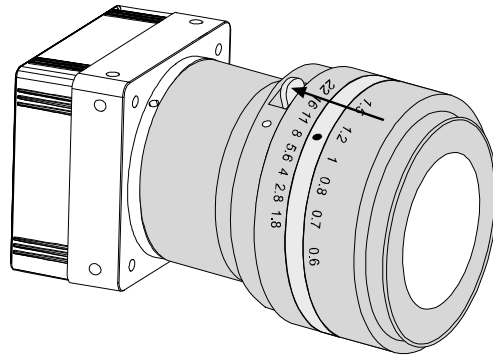
3. Turn the lens **counter-clockwise** about 1/4 turn until you hear the locking pin click into the detent on the back of the lens.

**Note:** If this is a new adapter, you may find that it is quite difficult to turn the lens. After you have installed and removed lenses a few times, the adapter will loosen up and be much easier to work with.

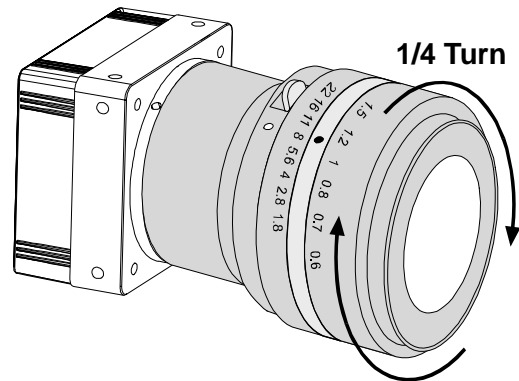


To remove a lens from an F-mount adapter do the following:

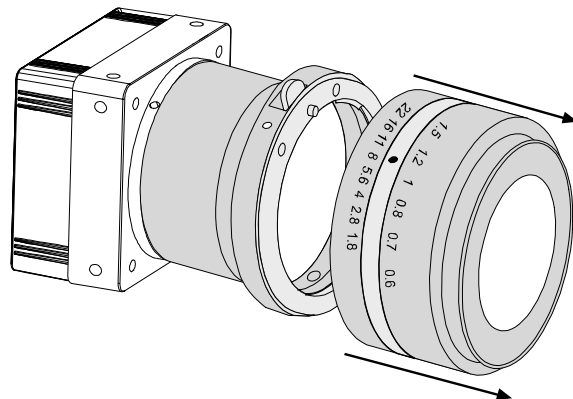
1. Push the locking pin release lever on the adapter towards the camera and hold it there. This will release the locking pin on the adapter from the detent in the lens.



2. Turn the lens **clockwise** about 1/4 turn.



3. Remove the lens from the adapter.



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# Revision History

Document Number	Date	Changes
DD00002701	15-Sept-2003	Initial release of this document.

