

Digital Camera Imaging with a Telescope

By Jordan Blessing (Copyright 2001, 2002)



Examples of what can be accomplished with a consumer digital camera.

These images were taken by William Paul using a Sony DSC-S70 on a 12.5" Meade Dob using the Digi-T System. The images were taken Nov 21st, 2001 in the suburbs of Atlanta, Georgia. Way to go William, simply outstanding!

Forward

Digital imaging is here. In the last couple of years consumer digital cameras have increased in image quality, added tons of nifty features and all the while the prices have tumbled. Digital imaging is quick (no waiting for developing), inexpensive (don't like the picture? Delete it!), and easy (well, at least you can instantly see if there is a problem and correct it on the spot!). Digital imaging has taken the world by storm and each new generation of digital cameras is getting better and cheaper still. However there remains a place for film cameras and dedicated CCD imagers in astrophotography as well. In this article we will look at the pros and cons of each. We will explore a variety of popular digital camera adapters, and we will get in depth on what to look for in a digital camera and accessories for this purpose (which also includes nature photography). So read on and get interested in the exciting new world of digital imaging with a telescope. It is becoming so popular it has spawned its own name - Digiscoping!

Introduction

My name is Jordan Blessing. I am the founder and CEO of ScopeTronix Astronomy Products. We are innovators in the design of popular telescope accessories. We have been hard at work developing the worlds largest selection of digital camera adapters and are adding many more all the time. They have quickly become the most popular and well regarded adapters available. In this process we have tested literally hundreds of combinations of adapters, telescopes, eyepieces, and digital cameras. We have built up a wealth of information on all of the various combinations and it is time to put it on paper (or at least in pixels). Rather than go into every possible ever changing combination that will be outdated in a month I will lay out a few simple rules to guide you in the selection of your camera and accessories to achieve good results. Much as I can't easily describe to you what gravity is, but I can accurately predict that an object will fall to the ground if not supported, a few simple rules can be applied to the coupling of digital cameras to telescopes (and other optics in general). So it is this simplified approach I will use here, I will not get too technical or in depth, but I will cover all important aspects. I hope you enjoy reading it and are able to glean some useful information from our efforts.

Types of Astrophotography

Traditionally 35mm film cameras have been the tool of choice for amateur astrophotographers. Film cameras have served this role admirably and continue to do so. We will take a look here at how a 35mm camera is typically used and compare that to how a digital camera is used so you can see the similarities as well as the critical differences. Digital cameras are better at some things and film cameras better at others.

Film cameras can be coupled to telescopes in numerous ways such as:



A 35mm Camera "Piggybacked" on a Telescope

Piggyback - A piggyback mount is a simple device which attaches a camera to the telescope tube. This is typically through either a bracket bolted to the rear cell of the scope or a ring which clamps around the telescope tube, both types attach to the tripod mounting hole on the bottom of the camera. The camera is not optically coupled to the telescope, it shoots through its own lens. The magnification obtained would depend solely on the camera lens used. In this method the telescope is used for 2 purposes. It serves as a tracking mount, and additional guiding accuracy can be obtained by using the telescope optics as a guide scope (using a reticle eyepiece to make small corrections of the telescopes drive motors as needed).

Typically images would be at low power and provide a wide field of view. This type is great for very wide shots such as of the Milky Way or constellations. This is also the most forgiving method since you can guide at high power through the scope while imaging at low power through the camera. The relatively short exposure times also make it more forgiving of guiding errors. Guiding errors will cause stars to be oblong streaks rather than pinpoints. Exposures of more than a minute or so should be performed on a telescope which is polar mounted (on a wedge or equatorial mount) otherwise field rotation will show up in the images. Field rotation is caused by the photographic field rotating and will cause stars to stretch into circular streaks. In a telescope which is not polar mounted the view very slowly rotates even though the telescope may track accurately and keep the object centered. While this effect is unnoticeable to the visual observer it is a concern for astrophotographers.



A 35mm Camera Mounted at "Prime Focus"

Prime Focus - In this method the camera is attached at the telescopes "prime focus", no eyepiece is used. The device used for the coupling is called a "T" adapter. A "T" adapter is a simple tube like device that attaches either to the telescopes rear cell threads or into its eyepiece port (depending on the type of telescope). A male "T" thread is on the other end of the coupler. The "T" thread is a standard in the photographic industry. It is an oddball thread size of approximately 42mm, but it is a standard nonetheless and you will see it mentioned quite frequently in this article. The "T" thread is attached to the camera with a

"T" Ring. There are many kinds of "T" Rings available, all have a female "T" thread on the inside and a proprietary bayonet or thread mount to attach to the camera body on the outside. They are typically identified by camera brand or model and attach to the camera just like (and in place of) the camera lens. In this method the telescope essentially becomes a telephoto lens of the focal length of the telescope. For this example lets consider a typical 8" SCT with a focal length of 2000mm. If you consider a typical 50mm camera lens as 1:1 (what you see is what you get) you can divide the focal length of the telescope by 50 to get a rough idea of the "power" or magnification the images will be at. So our example would yield an image at approximately 40 times magnification. We would consider this method to be at medium power. It is very useful for dim but large deep sky objects such as the Orion Nebula, giving a reasonably short exposure time while magnifying enough for a good view. Since exposure times are typically measured in minutes with this method fairly accurate tracking is required. Exposures over a minute or so would require polar mounting (a wedge or equatorial mount) to prevent field rotation. Longer exposures would require auxiliary guiding by either manual means (a separate guide scope or an off-axis guider with a reticle eyepiece) or a CCD autoguider.



A 35mm Camera Mounted on an "Eyepiece Projection" Adapter

Eyepiece Projection - In this method the image from an eyepiece is "projected" onto the film plane of the camera. A number of different projection adapters are available. In its simplest form it is a tube which attaches to the telescope in the same manner as an eyepiece. The tube has a male "T" thread at the back end. An eyepiece is inserted within the tube and the camera is attached via "T" Ring to the back of the tube. This type of adapter is called a "Basic Projection Adapter" or "Variable Projection Adapter" and pictured above is a typical example. The variable units have the ability to slide the upper body up and down lengthening the unit. By moving the camera (and film plane) further from the eyepiece the cone of light expands and enlarges the image. This allows you to fill more of the film frame and increases the magnification slightly. Since an eyepiece has to fit within a standard projection adapter there are limits to the size of eyepiece which are suitable. For larger eyepieces there are specialized solutions such as our patented AdaptaView™ line of adapters. These adapters attach to the lens end of the eyepiece and provide a male "T" mount, the eyepiece itself becomes a projection adapter. This allows the use of many large 2" eyepieces for projection. We would consider this to be medium-high power imaging. The power would vary with the focal length of the eyepiece used and the distance between the eyepiece and film plane. It is typically used for fairly large objects such as the Moon. Since magnification may be high, accurate guiding and polar alignment are critical if the exposure is going to be longer than a minute or so. For bright objects such as the Sun (with proper filter) or the Moon the exposure time will still be very short so guiding is not mandatory.



A Digital Camera with Eyepiece Mounted "Afocally"

Afocal Coupling - This method is very rarely used with film cameras but *it is the primary method used for digital cameras*. In this method *both* the camera lens and an eyepiece are used. An adapter similar to the eyepiece projection adapter is used but the eyepiece image is optically coupled through the camera lens rather than being projected directly onto the film plane. Since most consumer digital cameras (at least units still reasonably priced at this writing) do not have removable lenses, it can be seen why this method is used for digital cameras. Though you could physically couple a digital camera at prime focus you would simply get a picture of the inside of your telescope and so far that has not become an exciting hobby ;) Magnification with the afocal method can be very high, in fact higher than we would sometimes like as we will see. However, the speed with which most digital cameras can image reduces the guiding error problem. Most better digital cameras have filter threads on the lens and can be afocally coupled using adapters such as our popular Digi-T™ system. Digital cameras without threaded lenses can be mounted using our EZ-Pix™ digital camera holder. There are a number of other adapters for attaching a digital camera afocally and we will look at them as well.

Film and Pixels

In this section we will look at the pros and cons of film cameras vs digital cameras as well as their similarities and differences. We are all familiar with film. It has been around as long as we have and modern films are still capable of the highest resolution images possible. The film is coated with photosensitive chemicals which undergo a change when exposed to light. When the film is "developed" a negative image is produced which can then be positively printed onto paper making a "picture". A modern consumer digital camera uses a CCD chip to capture images. The CCD chip is a tiny (compared to a 35mm film frame) silicon wonder that senses incoming photons and converts them to an electrical signal. The signal is stored in a memory chip and can then be transmitted to a view screen, a computer for editing

or enhancement, or to a printer to produce (you guessed it) a "picture". While physically film has little in common with CCD imaging arrays they share many of the same traits with some critical differences. Film is typically identified by its ASA/ISO speed rating. The speed ratings of today's more popular films are in the range of 100-1600. With film the speed rating actually indicates several factors such as the speed with which it can expose (capture) the image and (due to its construction) the "fineness" or quality of the image it is capable of capturing. The tiny grains which make up the photosensitive part of the film are larger in fast films and smaller in slow films. Thus a slower film will give higher quality images while very fast films can appear "grainy". The lower the film speed the longer it takes to expose an image, consequently the higher the speed the faster it can expose an image. For astrophotography the exposure times can be quite long due to the small amount of light available to expose the film. Shooting a dim fuzzy at prime focus may require an hour long exposure on relatively fast film to expose adequately. So you would choose a film speed that is fast enough to capture an image in a reasonable time and slow enough that the image quality will be good. Though we are starting to get beyond the scope of this article I will mention that there is also a factor known as "reciprocity failure". As the film exposes for an extended period of time it actually becomes less sensitive to light which makes the exposure take even longer.

Let's compare that with a digital camera. On better digital cameras that offer manual adjustments you will also deal with these factors but they are not necessarily all tied together as they are in film cameras. For example exposure time does not necessarily affect the quality of the image. Most of today's digital cameras have anywhere from 1-5 million "pixels" on the CCD chip. Each pixel is a single light sensitive point. These pixels are the equivalent to the grains in film. The image quality a particular digital camera is capable of is limited by the number of pixels on the chip. The more pixels the finer the detail that can be captured and unlike film the exposure time has little to do with it. So the image quality (while limited to the number of pixels at the upper end) is actually adjusted by selecting the image quality you would like from the camera's menu, independent of the exposure speed. There are other factors to consider when this is applied to astrophotography so don't stop reading now and just rush out and buy the camera with the most pixels. One of these factors is known as noise. When a CCD chip is capturing an image for more than a few seconds "noise" can be a problem. We can easily see noise if we want to, just cover up the digital camera lens with its cap and take a long exposure. You would think you should get a perfectly black image but if the exposure is long enough you will see that quite a few pixels are lit up. These are called "hot" pixels. Noise is unavoidable on a consumer digital camera taking long exposures but there are ways to lessen it and ways to deal with it. To lessen noise we want to keep the camera as cool as possible since the amount of noise is directly related to the temperature of the CCD chip. This is why professional dedicated CCD imagers for telescopes are cooled by peltier coolers, ice water, or liquid nitrogen. I have read reports where people have actually put their digital cameras in the freezer before imaging but I would highly recommend against this, the dew likely to form as soon as the cold camera is taken outside could easily damage the electronics and optics of the camera. Some steps you can take to lessen noise are to keep the camera cool by not powering it up until you are ready to shoot, by keeping the LCD screen off unless absolutely needed (some people use a cord to an external monitor for long exposures), and shooting on cooler nights. The only other way to reduce noise at the source is to reduce exposure time. This can be done by taking many short exposures and combining them using software such as Astrostack which is available on the internet. This method is known as "track and stack" and also has the added benefit that it can be more forgiving of tracking errors.

So how do we deal with noise after the fact? There is a technique known as "dark frame subtraction". It is used even on dedicated cooled CCD imagers and it works well with digital cameras too. Say you take a 20 second exposure of the Orion nebula which shows a number of hot pixels. Immediately after taking the first image cover the front of the camera and take a "dark frame" exposure under the same conditions, settings and exposure time as the original. Now using software such as Photoshop you can "subtract" the dark frame from the original image. While not 100% perfect it does do a pretty good job of erasing hot pixels. Some newer cameras have this feature built-in and can do it automatically (typically called noise reduction). Also it should be noted that as more and more pixels are squeezed onto a chip the noise problem tends to get worse, so older lower megapixel cameras can actually have less noise than the latest and greatest 8 megapixel camera.

Sensitivity

Consumer digital cameras have a limit to how long of an image they can take before being overwhelmed by noise. The Moon and larger planets are all within easy reach. But dimmer deepsky objects that require longer exposures will require special processing or techniques as outlined above to deal with noise. If you intend to shoot extremely dim objects I suggest you stay with film or a dedicated CCD imager for now.

Vignetting

Vignetting (pronounced vin-yet-ing) is a term photographers use to describe an image that is missing its edges. It can vary from just the corners of the square frame missing to a more severe tiny round image that looks as if it were taken through a soda straw. Vignetting is caused by the "light cone" not fully illuminating the CCD chip. At least some vignetting is to be expected with most digital cameras coupled afocally. Vignetting can be a real problem and all aspects of the camera, eyepiece, and attachment system

should be considered to minimize it. Luckily planets and such are round so you can center them in the image and crop it if necessary. However nature photographers will want to be even more careful to select appropriate parts to reduce vignetting. By choosing a camera, attachment system, and eyepiece that will reduce vignetting you will make your life easier in several ways. The less the vignetting your system has the more freedom you have in choosing eyepieces (for example the tiny lens of the Nikon 990 can shoot through an eyepiece with a much smaller exit pupil than the huge lensed Sony 707). Also the less vignetting your setup has the more freedom you have to zoom out to a lower power (wider field) and capture larger objects such as the Moon. You will also have an easier time locating and centering the object to be photographed if you have more usable area. There are ways to keep vignetting to a minimum and if you don't take this part seriously you will probably be disappointed with your usable image size.

Examples of Vignetting...



This is an image taken through a Minolta D'image 7. This camera has a very large lens so steps to reduce vignetting are imperative. This image was taken through a Meade 26mm Super Plossl eyepiece closely coupled with the Digi-T system. The recessed lens design of this eyepiece is causing severe vignetting. This setup would essentially be near useless for astrophotography.



The same setup shot through a 32mm ScopeTronix Plossl. You can see that while there is still a significant amount of vignetting there is a much larger usable field. I could easily shoot Saturn at high power with this setup and crop out the vignetting. On smaller lensed cameras this setup would provide a near full image.



This is using the same camera and scope but it was shot through a prototype of our new MaxView 40 eyepiece adapter. This special eyepiece allows you to fine tune your setup and squeeze out every last bit of image possible. It is recommended for cameras with really large lenses such as the D'image5/7 and Sony 505/707.



This is the exact same setup as the first picture (Meade 26mm Super Plossl and Digi-T system), except it was taken with a Nikon 990. This is a dramatic example of how a smaller camera lens translates to less vignetting.

Ways to Minimize Vignetting

1. Choose a camera with a physically small lens. That large lens may be great for outdoor photography but for this purpose the smaller the better. A lens which is larger than the eyepiece will always have some significant vignetting. I'm not saying you can't use a large lensed camera successfully (look at our gallery page at some of the fine work done with a Sony F707 and MaxView 40), but if you have one you should be even more careful about attachment system and eyepiece selection.
2. Choose an eyepiece that has the following attributes (listed by order of importance);
 A flush mounted lens design, the glass lens should be at the very top of the eyepiece. Closer is better. Recessed lens designs such as the 26mm Super Plossl are to be avoided.
 A decent sized eye lens, I highly recommend a Plossl in the 25mm-40mm focal length range (with flush mount lens). Remember you can reach high powers using the zoom and a barlow lens if necessary.
 It is compatible with a digital camera adapter such as our Digi-T™ system which can couple extremely closely with your camera lens.
 Decent eye relief, again a Plossl in the 25mm-40mm range works well so long as it is not a recessed lens type. I would highly recommend the ScopeTronix 25mm Plossl as ideal.
 If you have a camera with a large lens consider our MaxView 40™, it is specially designed to squeeze every last bit of image out of cameras with large lenses by having a flush mount design and allowing for adjustment of eye relief. It can work near miracles on most large lensed cameras.
3. Keep everything as closely spaced as possible. In most cases the ideal hookup is near glass to glass between the camera lens and eyepiece. This means selecting an adapter that lets you get as close as

possible. I recommend either the Digi-T™ system or Digi-Adapt™ (along with a ScopeTronix 25mm Plossl) for most cameras and the MaxView 40™ for larger lensed cameras.

4. Zoom in! On virtually all cameras you will have to zoom in to minimize vignetting. On small lensed cameras you may only have to zoom in just a bit to totally eliminate vignetting. On larger lensed cameras you will probably want to go to full zoom and even then expect some vignetting.
5. Try the different modes on your camera. Some cameras prefer to be in macro mode to minimize vignetting, some prefer to be fixed at infinity. There are so many different cameras out there that there is no one hard and fast rule, except to experiment!

Important Note: I know many of you have that huge Nagler that you paid \$500+ for so you feel you absolutely must use it or you won't be able to sleep at night. Listen to me, I have experience with this and I'm trying to help. Go with a smaller Plossl that you can couple more closely. The camera doesn't care about that 80+ degree field of view and it can't use it. By using an eyepiece larger than a T-Thread you automatically have to space the camera back some and use an adapter like the AdaptaView™. You will lose your close coupling by going to an eyepiece larger than a T-Thread so only consider eyepieces with very good eye relief. The AdaptaView™ can be used with these larger eyepieces but I would only recommend you do it with cameras that have smaller lenses and more freedom from vignetting to start with.

Choosing a Suitable Digital Camera

There are many factors to consider when purchasing a digital camera. All of the better cameras work well for vacation pictures so I will concentrate on the desirable attributes of a digital camera specifically for astrophotography. I'm going to try to avoid mentioning particular cameras as they come and go almost monthly anymore and I don't want to get into a Chevy/Ford war with the diehards of any particular brand. Suffice it to say that I have seen very impressive pictures from many brands and models of cameras. While a particular camera may not have an attribute listed it doesn't mean that it won't work, it just means that you may need to take more care or put in a little more effort to get good results.

Here is my wish list for a digital camera for astrophotography (in order of importance):

1. An LCD viewscreen, this is really a necessity otherwise you can't see what you are shooting. Luckily this is standard on virtually all non-toy digital cameras.
2. A filter thread on the lens (or on the body, or a filter adapter is commercially available). Otherwise you may be limited to using an adapter such as our EZ-Pix. While the EZ-Pix works it does require finicky adjustments every time you set up. A threaded adapter such as the Digi-T™ system allows for a quick thread-on-and-go solution. The filter thread should be of a size that an adapter is available for. We carry a wide array of Digi-T kits to fit many cameras with and without threaded lenses.
3. A physically small lens. Smaller lenses vignette less and allow the use of a wider variety of eyepieces. Less vignetting means you can also zoom out farther since the primary means of reducing vignetting is by zooming in. This can push you up to higher power than you wish to be at (for example if you are trying to shoot the full Moon).
4. A lens which zooms internally rather than moving outside of the camera body. This allows for closer coupling at all zoom positions and usually uses a less expensive telescope adapter since a lens tube is not required.
5. Noise reduction, certainly a nice feature but not a necessity. You can perform your own dark frame subtraction on a computer if necessary.
6. A swivel body, again a nice feature but not a necessity. You will appreciate it when the telescope is pointed up and you can angle the viewscreen towards you.
7. A remote shutter release. This is standard with some cameras and optional for many others. This can be a big help in reducing the shakes when shooting at high power, but you can use a built-in timer as a good work around.
8. A camera that stores all the information about an exposure so you can see what worked well, and what didn't.

Those of you that know your cameras may notice that the Nikon 990/995/4500 cameras provide virtually all of the desirable attributes, but I said I wouldn't mention names ;)

Choosing a Suitable Eyepiece

See the paragraph above on minimizing vignetting. The two subjects are one and the same. Assuming you already have a suitable camera and adapter the eyepiece can make the difference between a reasonably full image or a dot the size of a pea. Avoid eyepieces with poor eye relief, that have small or recessed lenses. *Don't worry about high power!* Since you will need to zoom in to reduce vignetting you will be at much higher power than you would be with your eye. For example if you used a Nikon 990 with a typical 2000mm focal length SCT and a 30mm Plossl you would be at roughly 200 power when zoomed in (3x zoom). Add a barlow and you are easily at 400 power. If you try to use a high power eyepiece with a small eye lens you will just get a ton of vignetting in most cases. In this same vein you will realize that you really don't need a bunch of eyepieces. Just select one that couples well optically with your camera and use the zoom and a barlow to vary the power. If you don't have a suitable eyepiece I would recommend you get a ScopeTronix 25mm Plossl, it's fit the Digi-T system and has the all important flush mount lens (which is difficult to find in an eyepiece of that focal length). Leave the Digi-T™ ring on them and you can be taking pictures at a moments notice. If you have a camera with a large lens consider our new MaxView 40™, its huge eye relief and adjustable eyeguard with integral T-Thread allows you to fine tune your setup and get the most out of it.

Putting it all Together

We at ScopeTronix carry a number of different digital camera adapters suitable for digital imaging. Here is a quick rundown of the more popular units...



The Digi-T™ System

By far the most popular coupler is the Digi-T™ system. We have over 50 kits that cover well over a hundred cameras with and without threaded lenses. The kits are specially designed to fit the indicated cameras and include all parts necessary, just make sure you have a compatible eyepiece as outlined on our Digi-T™ page. Note that it will not fit just any 1.25" eyepiece with a rubber eyeguard, but it does fit over 90% of the worlds most popular eyepieces. See the "Which Eyepieces does the Digi-T system Fit?" on the Digi-T page for specifics. Also remember that just because it fits it doesn't mean it will work well, selecting the proper eyepiece to reduce vignetting is the key to a successful start in digital imaging. This adapter is also suitable for use in Newtonians and Refractors since it does not require extra back focus.



The Digadapt™

The Digadapt™ adapter looks much like a conventional variable projection adapter. The critical differences are that it is larger so that it can hold larger eyepieces and it is designed to collapse much smaller so you can still get close coupling of the lens to the camera. It allows the use of suitable lenses which are not Digi-T™ compatible such as eyepieces that don't have rubber eyeguards. This adapter is "T" threaded so you will need the correct components to couple it to your camera. It is compatible with the Digi-T™ system parts. If the eyepiece can fit through the T-Thread it can couple as closely as the Digi-T™. Not recommended for Newtonians or Refractors where back focus could be an issue (the eyepiece is raised up in the holder and some scopes with limited focus range may not be able to reach focus with the adapter in place).



The AdaptaView™

The AdaptaView™ is a very universal adapt that will fit many eyepieces with removable rubber eyeguards that have a top diameter of 1.75" or less. Fits many TeleVue and 2" eyepieces. Since it is designed to fit eyepieces that are larger than a T-Thread it does allow some spacing between the camera lens and eyepiece lens. Recommended only for eyepieces with long eye relief and cameras that have smaller lenses to reduce vignetting. This adapter is "T" threaded so you will need the correct components to couple it to your camera. It is compatible with the Digi-T™ system parts. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus.



The EZ-Pix™ Digital Camera Holder

The EZ-Pix™ adapter is designed for cameras which do not have a threaded lens or Digi-T™ kit available to fit them. It attaches to the cameras tripod mounting bolt and clamps around the telescope eyepiece. It is a very adjustable bracket that holds the camera over the eyepiece for you. This adapter requires adjustment each time it is setup so it should be considered mainly when other adapters will not work. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus.



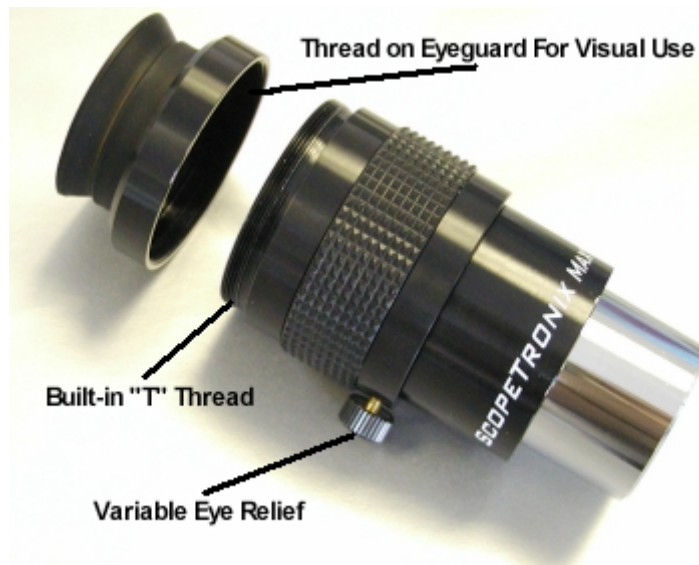
The Uni-Adapt™

The Uni-Adapt™ is a high quality adapter designed to fit virtually any eyepiece with a top outside diameter between 1" and 2". It is more expensive than the other adapters but it can quickly and firmly attach to a wide variety of optics such as field scopes, microscopes, night visions scopes, etc. that have fixed lenses that no other adapter can work with. If the eyepiece can fit through the T-Thread it can couple as closely as the Digi-T™. This adapter is "T" threaded so you will need the correct components to couple it to your camera. It is compatible with the Digi-T™ system parts. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus. This is a popular adapter for nature photographers since it works well with most Nikon, Leica, and Swarovski spotting scopes (max diameter of eyepiece 2 1/8").



The Uni-T™ Adapter

The Uni-T adapter has 6 nylon thumbscrews which can be tightened down (without marring) onto a wide variety of optics between .25" and 1.5" in outside diameter. Useful for Microscopes, .965" eyepieces and other odd optics. This adapter is "T" threaded so you will need the correct components to couple it to your camera. It is compatible with the Digi-T™ system parts. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus.



The MaxView40™ Eyepiece/Adapter

The MaxView 40 is a wide field eyepiece and adjustable projection adapter all in one. It can be used as a 40mm Plossl with an adjustable eyeguard for comfortable viewing. Thread off the eyeguard to reveal an integral "T" thread. The adapter allows you to adjust the distance between the camera lens and the eyepiece lens. This lets you to tweak the most usable image area out of large lensed cameras. In tests it provided between 10%-40% more usable field than other well suited eyepieces. The lens is a flush mount design. This adapter is "T" threaded so you will need the correct components to couple it to your camera. It is compatible with the Digi-T™ system parts. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus.



The ScopeTronix 14mm/18mm Wide Angle Eyepiece Adapters

These new eyepieces are a special optical design made to work best with the 28mm threaded Nikon Cameras. They offer a wide 66 degree AFOV when used visually. When the eyeguard is unthreaded it reveals a 28mm thread which allows them to screw directly in 28mm Nikon cameras. The special design allows use of the full zoom range with little or no vignetting. By allowing you to use the full zoom range you

can vary the power over a very wide range quite easily. There is no better solution for these cameras. This adapter is suitable for use with Newtonians and Refractors since it does not require extra back focus.

Work in Progress...

This article is a work in progress and I will continue to add to it as time permits. If you have any questions PLEASE CALL, I simply don't have time to personally answer all the email I receive anymore. I will be more than happy to take the time to explain it over the phone since I can do that in much less time than writing a letter. You can reach me during normal business hours at (239)945-6763.

Glossary

"T"-Thread - This is a standard thread size in the photographic industry. It is ~41.5mm in diameter and has a .75mm thread pitch.

Polar Mounting - The telescope is mounted in a way that it will accurately track an object through the sky without field rotation. This would mean mounted on a wedge or on an equatorial mount. Alternatively, a field derotator can be used on some computerized scopes to achieve the same results.

Wedge - A device which fits between the telescope and its tripod. It can be adjusted to tilt the scope to your latitude so the scope is "polar mounted".

Autoguider - An electronic device which uses a ccd to detect guiding errors and makes corrections automatically via the telescopes drive system.

Reticule Eyepiece - An eyepiece that has a crosshair in it. Usually of high power and illuminated for easy viewing.

Off-Axis Guider - A form of T-Adapter that is used at prime focus. It has a small mirror or prism which picks off a tiny amount of light from the edge of the view and sends it to an eyepiece (usually a reticule type) so you can see to make guiding corrections while the camera is taking an image.

Equatorial Mount - A mount which allows for polar alignment, typically of the German type which uses a pivot and counterweight setup along with a tilting head to adjust for the latitude.

Afocal - Optically coupling with both the camera lens and eyepiece in the light path.

Film Plane - This is the point in a camera where the image comes to focus (at the film on a film camera or on the CCD chip of a digital camera).

Eye Relief - The distance your eye would need to be to the eye lens of an eyepiece to see the full view.