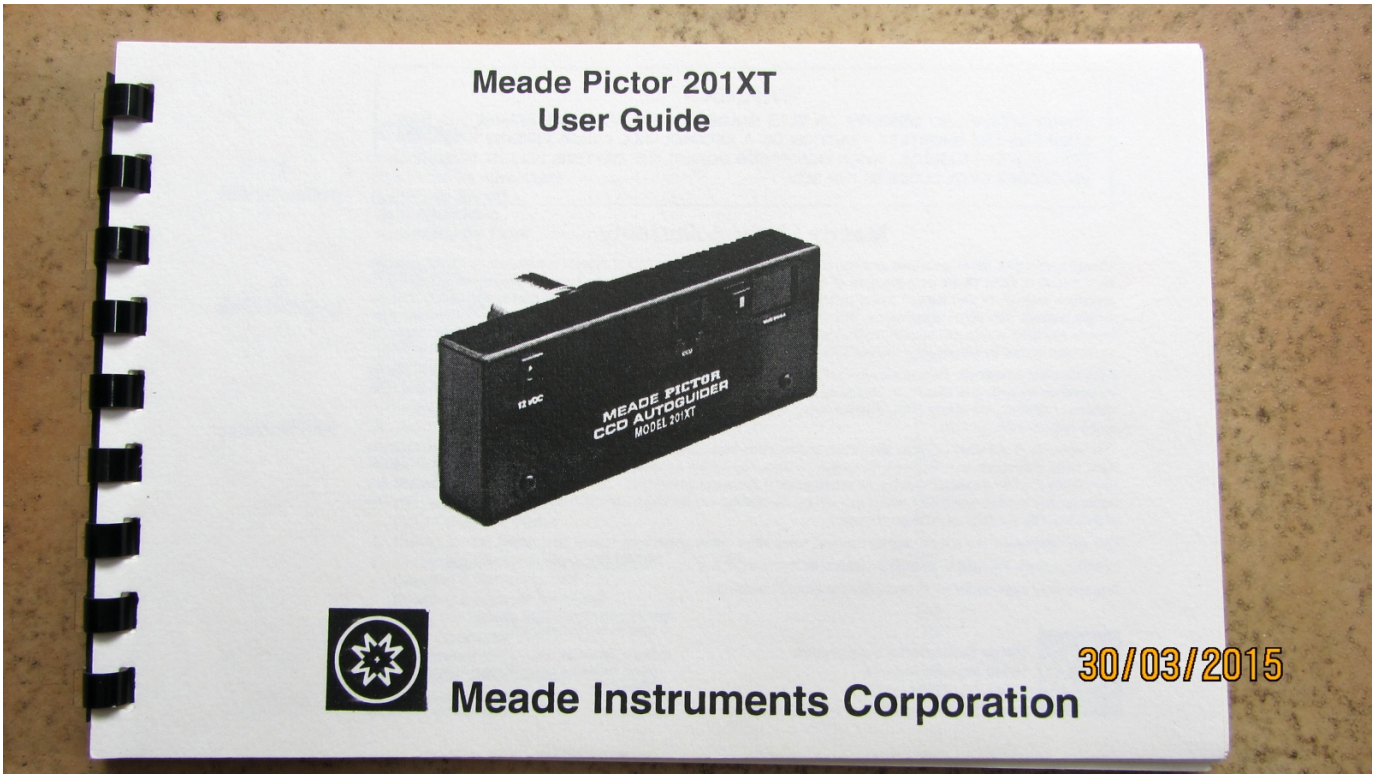
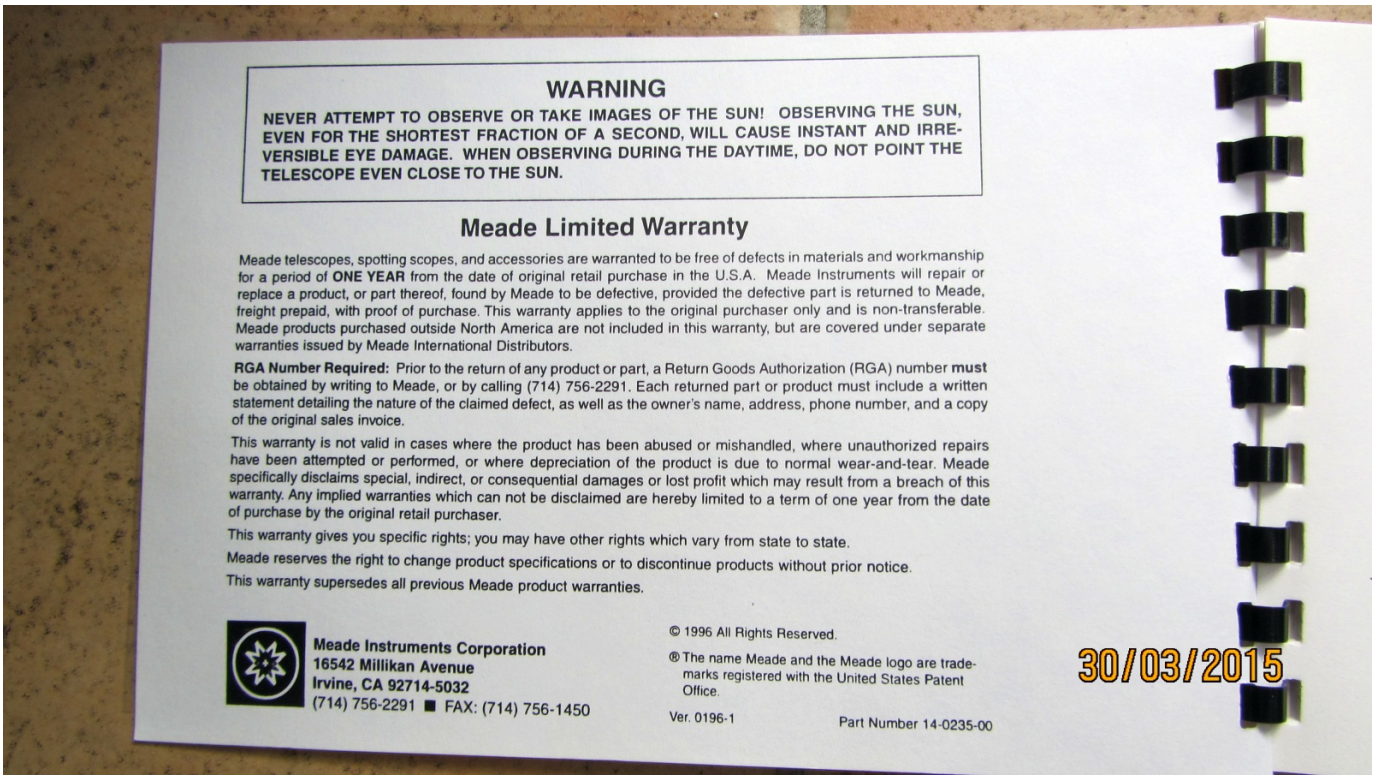
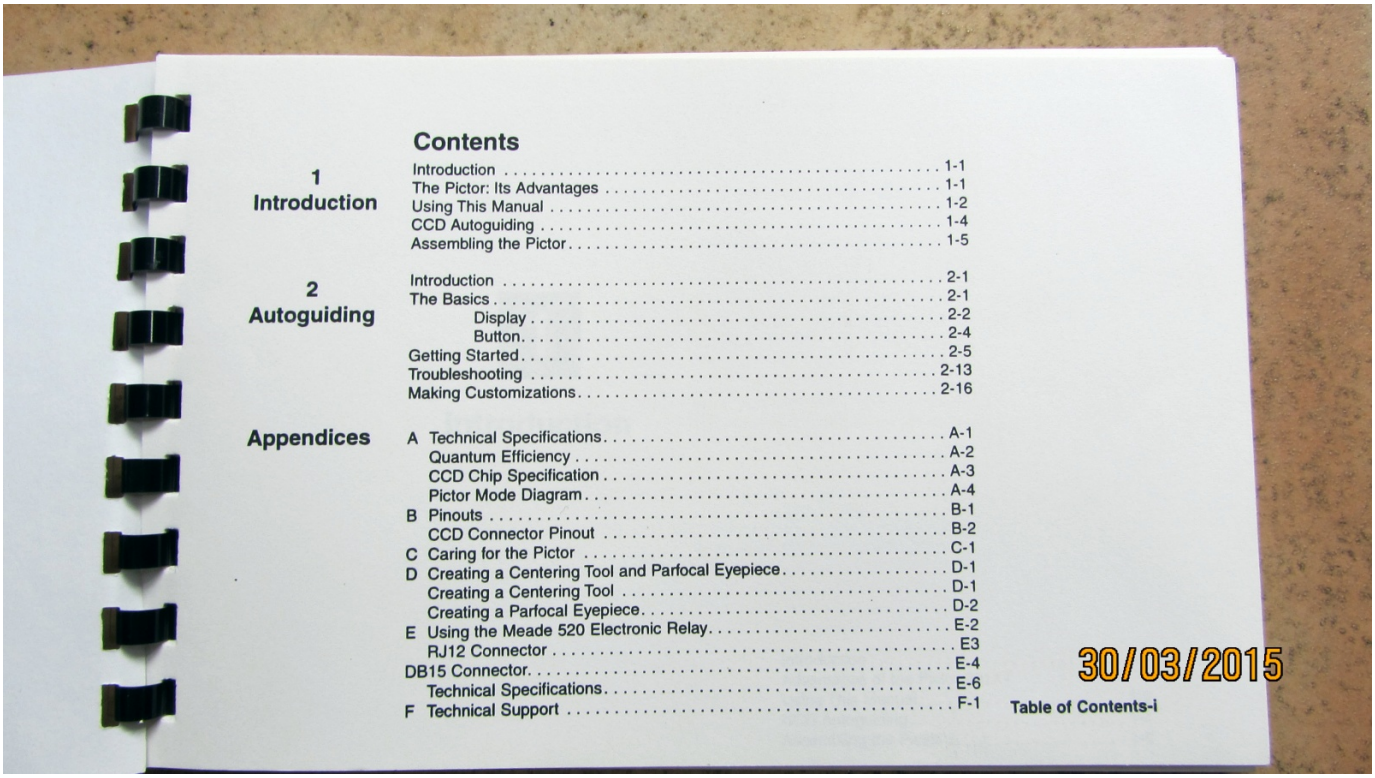


IMG_1509



IMG_1510



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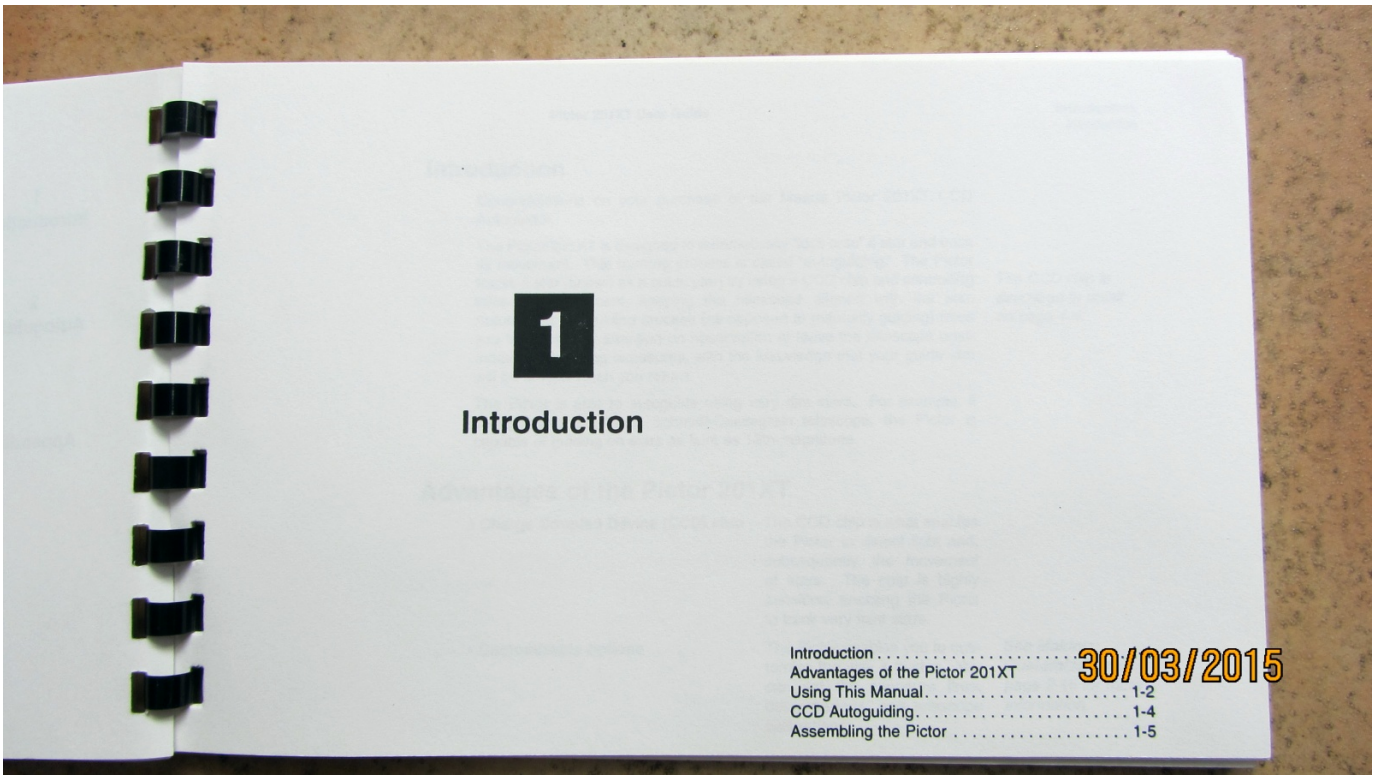

1

Introduction

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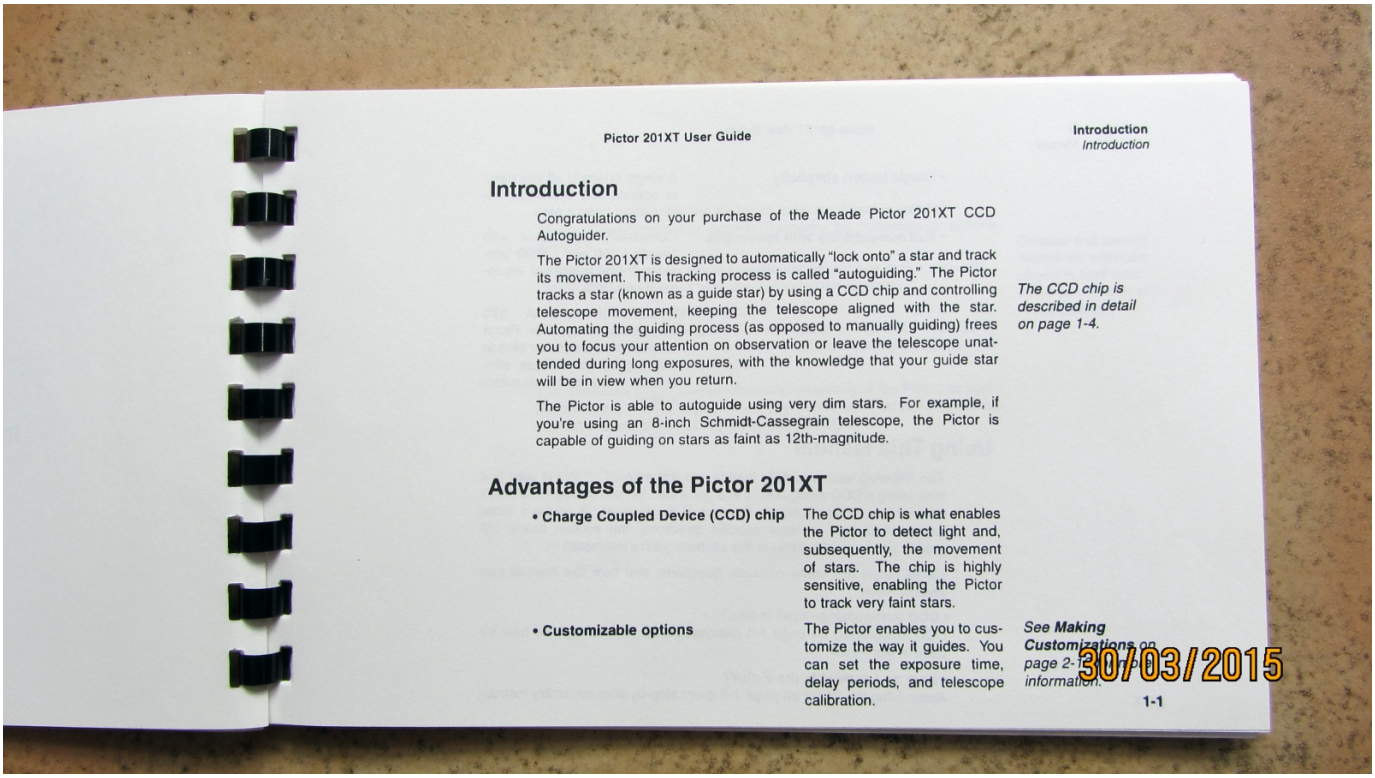
IMG_1512



Introduction

Congratulations on your purchase of the Meade Pictor 201XT CCD Autoguider.

The Pictor 201XT is designed to automatically "lock onto" a star and track its movement. This tracking process is called "autoguiding." The Pictor tracks a star (known as a guide star) by using a CCD chip and controlling telescope movement, keeping the telescope aligned with the star. Automating the guiding process (as opposed to manually guiding) frees you to focus your attention on observation or leave the telescope unattended during long exposures, with the knowledge that your guide star will be in view when you return.

The CCD chip is described in detail on page 1-4.

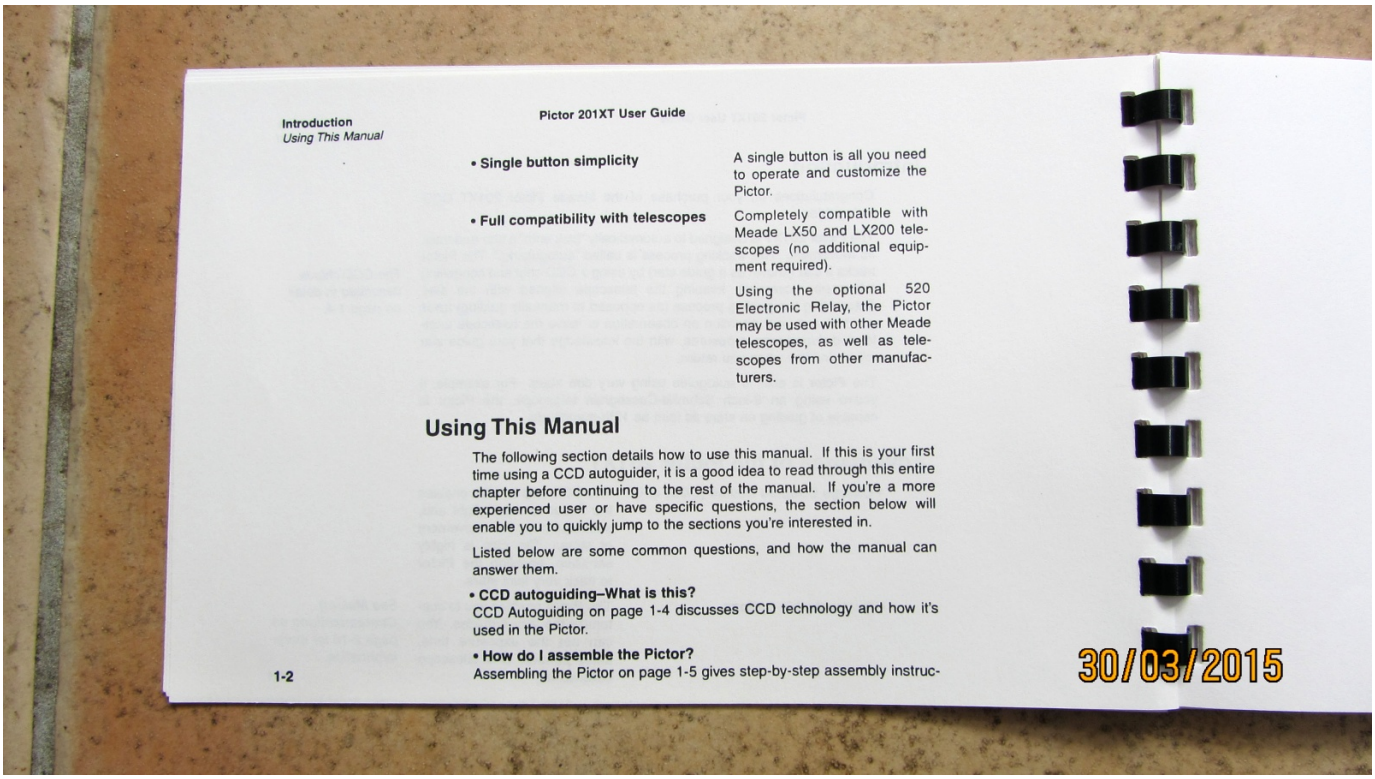
The Pictor is able to autoguide using very dim stars. For example, if you're using an 8-inch Schmidt-Cassegrain telescope, the Pictor is capable of guiding on stars as faint as 12th-magnitude.

Advantages of the Pictor 201XT

- **Charge Coupled Device (CCD) chip** — The CCD chip is what enables the Pictor to detect light and, subsequently, the movement of stars. The chip is highly sensitive, enabling the Pictor to track very faint stars.
- **Customizable options** — The Pictor enables you to customize the way it guides. You can set the exposure time, delay periods, and telescope calibration.

See Making Customizations *on page 2-1 for more information.*

IMG_1513



- **Single button simplicity** — A single button is all you need to operate and customize the Pictor.
- **Full compatibility with telescopes** — Completely compatible with Meade LX50 and LX200 telescopes (no additional equipment required).

  Using the optional 520 Electronic Relay, the Pictor may be used with other Meade telescopes, as well as telescopes from other manufacturers.

Using This Manual

The following section details how to use this manual. If this is your first time using a CCD autoguider, it is a good idea to read through this entire chapter before continuing to the rest of the manual. If you're a more experienced user or have specific questions, the section below will enable you to quickly jump to the sections you're interested in.

Listed below are some common questions, and how the manual can answer them.

- **CCD autoguiding–What is this?**
  CCD Autoguiding on page 1-4 discusses CCD technology and how it's used in the Pictor.
- **How do I assemble the Pictor?**
  Assembling the Pictor on page 1-5 gives step-by-step assembly instruc-

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tions.

- **How can I customize the Pictor to meet my specific needs?**
  Making Customizations on page 2-16 explains the customization options available.
- **What if I don't understand a particular word I see in the manual?**
  Words displayed in **bold type** are defined in the Glossary.
- **What if the Pictor doesn't work?**
  Read through *Assembling the Pictor* on page 1-5 to determine that all cables are properly connected. If you're still experiencing problems, refer to Appendix F, *Technical Support*.

The remainder of this chapter discusses assembly of the Pictor, its components, and what to expect when you turn it on. Complete operating instructions are given in Chapter 2, *Autoguiding*.

Chapter and section names are often displayed in bold type; these do not appear in the Glossary.

IMG_1515

CCD Autoguiding

A CCD (Charge Coupled Device) is a semiconductor device similar to the integrated circuits found in televisions and computers. It's usually a small (less than 1" square) silicon chip subdivided into as many as 4 million picture elements, commonly known as **pixels.**

The pixels are arranged in a matrix, or rectangle. Figure 1-1 displays a simplified arrangement of pixels on a chip.

Figure 1-1: Matrix of CCD Chip

When light (in the form of a photon) hits a particular pixel, an electron is generated. The CCD chip will store this electron at the location of the pixel; for example, if a photon of light hits a pixel at the upper right of the CCD chip, the electron will be stored at the upper right of the CCD chip. More than one electron can be stored at a particular pixel location; if a number of photons hit a specific pixel, a corresponding number of electrons will be stored at that location.

Light from a celestial object will hit more than one pixel.

By tracking the number of electrons stored at a particular location on the CCD chip, the Pictor can monitor any changes (movement of stars) in its field of view. For example, if a large number of photons have hit one pixel, this probably indicates the location of a particular celestial object. As these electrons move across the CCD chip, the Pictor 201XT is alerted to that object's movement in the sky.

IMG_1516

Assembling the Pictor

After unpacking the Pictor, examine the packing list enclosed in the carton. Compare the components to the packing list to ensure that all items have been included in the carton.

To assemble the Pictor, complete the following steps.

Note: The telescope or telescope parts shown in this manual's illustrations are of a Meade LX200 Schmidt-Cassegrain telescope. Your telescope may differ; consult your telescope's documentation for instructions.

Caution: Do not plug the Pictor into a power source until all cables are connected. Turning the power on before installation is complete could damage the Pictor.

1 Set up your telescope.

2 Locate the black coil cord (Figure 1-2).

Figure 1-2: Coil Cord

IMG_1517

3 Connect one end of the cord to the connector marked "CCD" on the Pictor (Figure 1-3).

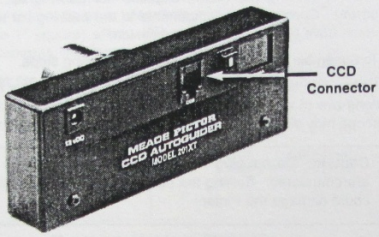


Figure 1-3: CCD Connector on Pictor

If you're using a Meade LX50, LX200, or another CDS-equipped Meade mount with the Pictor, connect the remaining end of the cord to the telescope's CCD connector (Figure 1-4, page 1-7).

IMG_1518

3 (continued)

Figure 1-4: CCD Connector on LX200

On most telescopes other than the Meade LX50, LX200, or CDS-equipped ED/APO, you'll need to use the optional Meade 520 Electronic Relay to connect the Pictor to your telescope. Appendix B describes the pinout of the Pictor's connectors in detail; please read this information before attempting to connect your telescope to the Pictor.

To order the 520 Electronic Relay, please contact your local Meade dealer.

IMG_1519

4 You are now ready to connect the Pictor to a power source.

To use an AC power source, an AC adapter is required. This adapter may be purchased from your local Meade dealer.

The Pictor enables you to get power from an automobile cigarette lighter plug (if you're going to use the Pictor in a remote location), or from an AC power source (such as a wall plug) using a Meade #541 AC adapter.

To use a cigarette lighter plug for power, locate the cigarette lighter power cord (Figure 1-5).

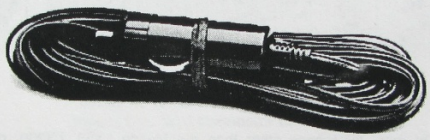
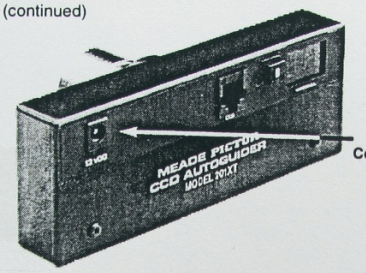


Figure 1-5: Cigarette Lighter Power Cord

Connect the smaller end of the adapter or power cord to the **12vDC** connector on the Pictor (Figure 1-6, page 1-9).

IMG_1520

4 (continued)



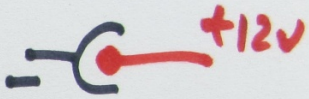


Figure 1-6: 12vDC Connector

Plug the remaining end of the power cord into your cigarette lighter. Power will come on automatically; you do not need to turn on a power switch.

Note: If an AC adapter will be used with the Pictor, be sure to plug the adapter into an indoor AC power source, such as a wall plug or power strip. Do **not** plug the adapter into an outdoor AC receptacle. If you cannot use an indoor AC source, it is recommended that a DC source be used to power the Pictor 201XT.

The Pictor will perform a variety of self-tests. During these tests, the LED will display a series of two-character patterns representing the Pictor's operation and connection to the telescope.

Assembly is now complete. Please continue to the next chapter, *Autoguiding.*

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2

Autoguiding

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Introduction

This chapter is designed to lead you through autoguiding step-by-step. Please read through this chapter completely and follow each step in sequence; the text will explain everything that's required to successfully use the Pictor.

If you've already used the Pictor to autoguide and would like to make customizations, see page 2-16.

The Basics

While you're using the Pictor, the display will show various letters and values, and the Pictor's button will light (Figure 2-1). The messages on the display and the lighting of the button convey information; for example, to prompt you to press the button, or to indicate that the Pictor is "busy" with a particular function.

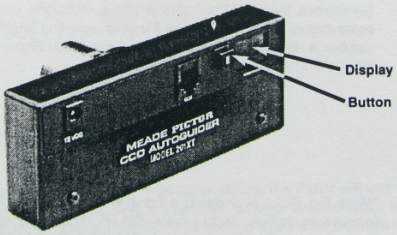

Figure 2-1: Button and LED

The display and button are discussed on the following page.

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The Display

All messages that appear on the Pictor's display are explained throughout this chapter.

The display can show two characters (letters or numbers). The characters on the display are used to indicate what the Pictor is about to do or is currently doing; for example, the letters "FF" indicate that the Pictor is about to find and focus the image (Figure 2-2).

Figure 2-2: Pictor Ready to Focus Image

Numeric Displays.

Sometimes the Pictor will give a status indication using numbers. In some cases, such as when the Pictor is reporting brightness, a two digit number is displayed ranging from 00 through 99. Figure 2-3 (below) indicates a brightness value of "35":

Figure 2-3

When the Pictor is showing a location in the image, the two digits will indicate a position. In this case, the left digit is the horizontal location (sometimes called the "x direction") and the right digit is the vertical position (sometimes called the "y direction.") Throughout this manual the position display will be shown as in figure 2-4 below. Figure 2-4 shows the position 2, 7:

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IMG_1524

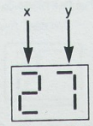

Figure 2-4

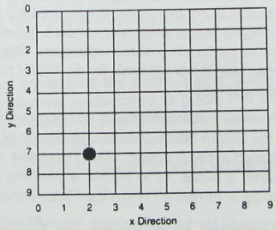

Figure 2-5

When the display is used to enter time values, the Pictor will use a two digit display. If the left digit is displayed as 0, a decimal point will be assumed to be between the first and second digit. The example below shows how Pictor will display the number 0.5:

IMG_1525

If the Pictor is displaying the number 5, the left digit will be unlit, as shown below:

The Button

The button on the Pictor controls the opertaion of the autoguider. The button contains an LED in its center. When the LED is flashing, the Pictor is idle and waiting for you to enter a command. When the button is solidly lit, the camera is performing some operation. You can still press the button, but it may take a few seconds for the Pictor to respond. The Pictor will interrupt the operation.

You can enter one of three commands with the button depending on how long you hold the button down. A brief depression of the button (less than 1 second), is called a ***short press.*** **Short presses** are used for selecting parameters within a mode, or to initiate a pending operation. The right digit of the display is turned off when the Pictor recognizes a short press.

If you hold the button for 1 to 2 seconds, you will notice that the right digit of the display is replaced with an underscore as shown below:

Releasing the button while the underscore is displayed in the right digit is called a ***medium press.*** The **medium press** is used to move between the different operating modes of the Pictor.

IMG_1526

If you hold the button down for more than 2 seconds, the right digit will display the dash, as shown below:

Releasing the button while the dash is displayed in the right digit is called a ***long press.*** The **long press** is used to command the Pictor back to its initial "Find and Focus" mode. No matter what the camera is doing, the **long press** will bring you back to the Pictor's initial mode.

Pictor assembly is covered in Chapter 1.

Getting Started

Once you've assembled the Pictor, you're ready to get started autoguiding. This chapter is designed to guide you step-by-step through the autoguiding process. If this is the first time you're using the Pictor, be sure to follow each step in sequence.

1 Attach an off-axis guider or guide scope to your telescope (Figure 2-6).

Figure 2-6: Off-axis Guider

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2 Attach your camera to the off-axis guider or guide scope. An example of a 35mm camera attached to an off-axis guider is displayed below.

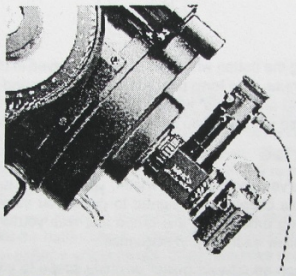

Figure 2-7: 35mm Camera Attached to Off-Axis Guider

3 Look through the camera window and frame the desired image.

4 Focus the image.

5 Insert an eyepiece into the eyepiece holder (Figure 2-6) and locate a bright star (known as **guide star**) for the Pictor to guide from. Try rotating the off-axis guider rather than moving the telescope so that the framed picture in the camera is not disturbed.

***Guide star** is explained in the Glossary.*

IMG_1528

6 Look through the camera window to make sure the picture in the camera is still framed correctly.

7 Use the telescope to position the star in the center of the eyepiece. Check back to make sure the picture in the camera is still framed correctly. Continue cycling through steps 5-7 until both the framed image and the guide star are centered.

Centering the star in the off-axis eyepiece is an important step; the entire area seen through the off-axis eyepiece will not be seen by the Pictor. The Pictor will see a very small section in the center of the off-axis eyepiece's field of view.

The area seen by the Pictor will be seen in a small upper section of what is seen by the primary eyepiece. For example, if an eyepiece 10mm in diameter is used as the primary eyepiece, the Pictor will see the following area (Figure 2-8).

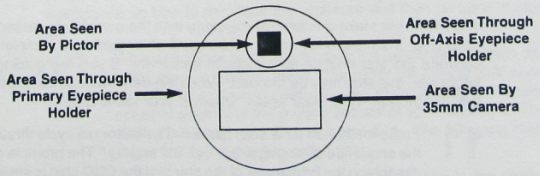

Figure 2-8: Pictor's Field of View

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IMG_1529

8 If this is the first time you have used the Pictor you will want to find the rough focus point where the star will be focused on the Pictor's CCD chip. A detailed description is given in Appendix D for finding Pictor focus and creating a parfocal eyepiece for use in locating guide stars.

9 Insert the Pictor into the off-axis guider or guide scope. Attach the power cable to the Pictor. Initially it will cycle the LED display and then display "PI," short for power up initialization. It will then display "FF" with the button flashing. The "FF" display is the initial prompt for the Pictor. It stands for "Find and Focus." You can get to this prompt from any mode the Pictor is in by entering a ***long press***.

10 Cover your telescope with its dust cap and enter a ***medium press***. The Pictor will display "dr" (dark ready) indicating it is ready to make a dark reference exposure. A ***medium press*** will cause the Pictor to take a dark frame. The Pictor will display "df" while exposing the dark frame. A ***short*** or ***long press*** will abort this operation.

The Pictor will make a reference exposure with the completely darkened CCD chip. This reference frame will be used while guiding to completely calibrate the star images for maximum sensitivity. If you are guiding a bright star, this step may be skipped. When the dark frame is completed, the "FF" prompt will appear again. Uncover your telescope.

11 Press the button for a ***short press***. The Pictor will cycle through the sequence of displays "br," "vv," "at," and "xy." The prompts are describing the brightness of the star that the CCD chip is seeing. "br" is short for brightness, and "vv" is the brightness of the star on a scale from 00 to 99. The "at" display precedes the location

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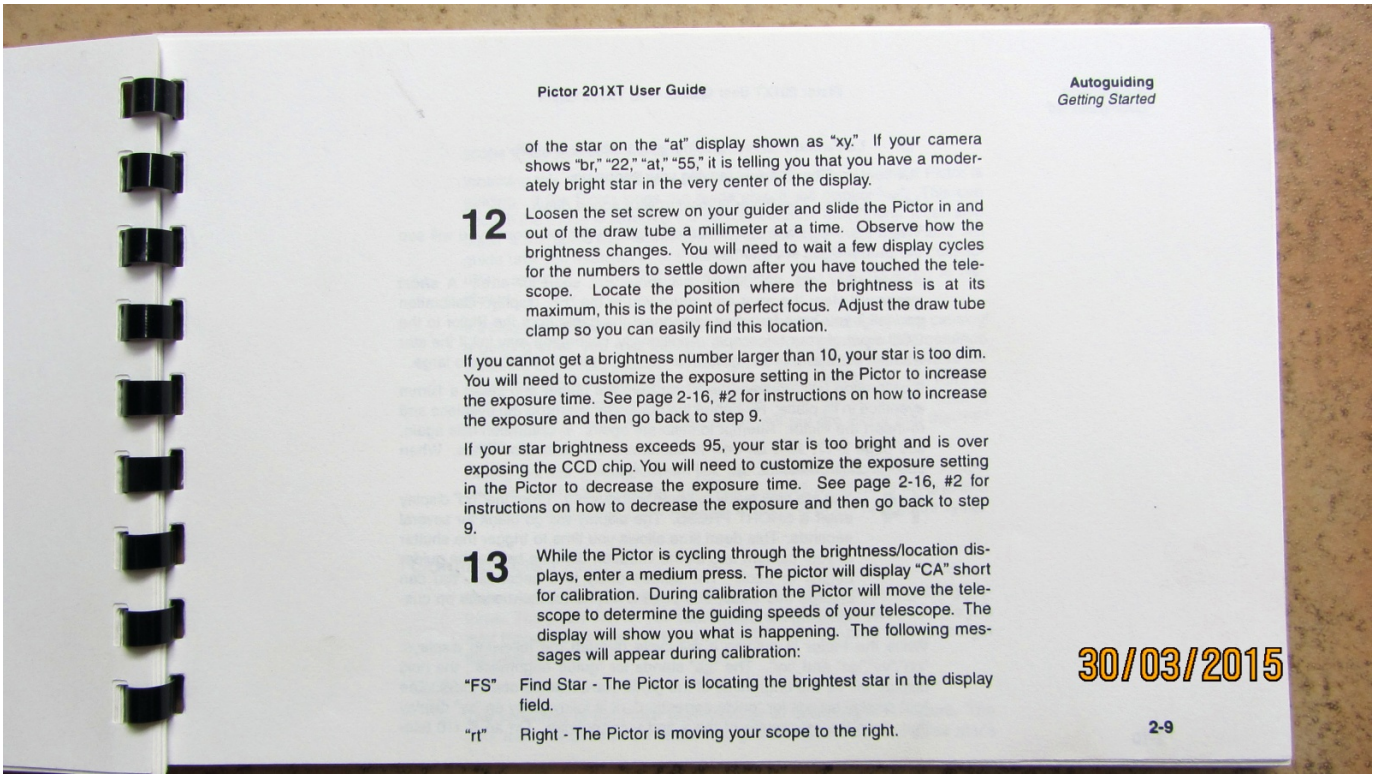


of the star on the "at" display shown as "xy." If your camera shows "br," "22," "at," "55," it is telling you that you have a moderately bright star in the very center of the display.

12 Loosen the set screw on your guider and slide the Pictor in and out of the draw tube a millimeter at a time. Observe how the brightness changes. You will need to wait a few display cycles for the numbers to settle down after you have touched the telescope. Locate the position where the brightness is at its maximum, this is the point of perfect focus. Adjust the draw tube clamp so you can easily find this location.

If you cannot get a brightness number larger than 10, your star is too dim. You will need to customize the exposure setting in the Pictor to increase the exposure time. See page 2-16, #2 for instructions on how to increase the exposure and then go back to step 9.

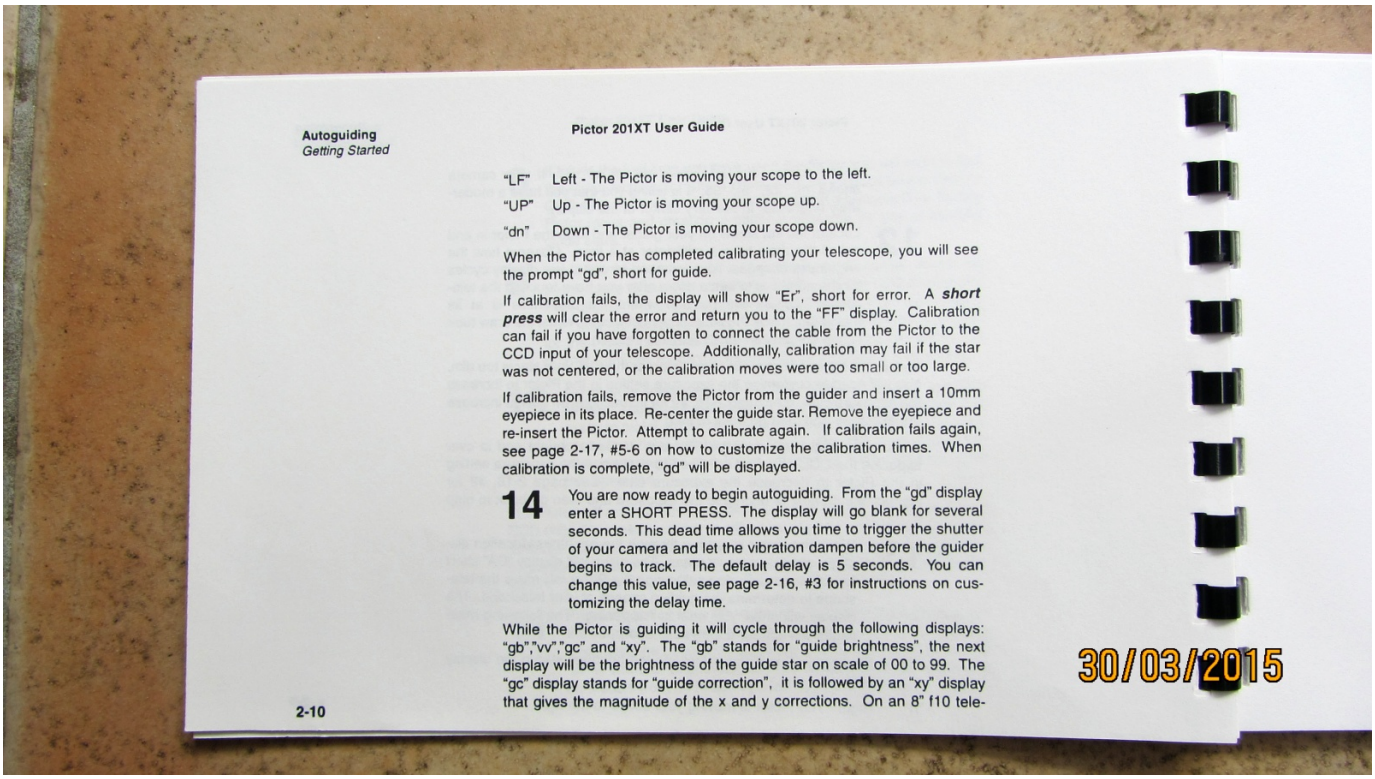
If your star brightness exceeds 95, your star is too bright and is over exposing the CCD chip. You will need to customize the exposure setting in the Pictor to decrease the exposure time. See page 2-16, #2 for instructions on how to decrease the exposure and then go back to step 9.

13 While the Pictor is cycling through the brightness/location displays, enter a medium press. The pictor will display "CA" short for calibration. During calibration the Pictor will move the telescope to determine the guiding speeds of your telescope. The display will show you what is happening. The following messages will appear during calibration:

"FS" Find Star - The Pictor is locating the brightest star in the display field.

"rt" Right - The Pictor is moving your scope to the right.

IMG_1531



"LF" Left - The Pictor is moving your scope to the left.

"UP" Up - The Pictor is moving your scope up.

"dn" Down - The Pictor is moving your scope down.

When the Pictor has completed calibrating your telescope, you will see the prompt "gd", short for guide.

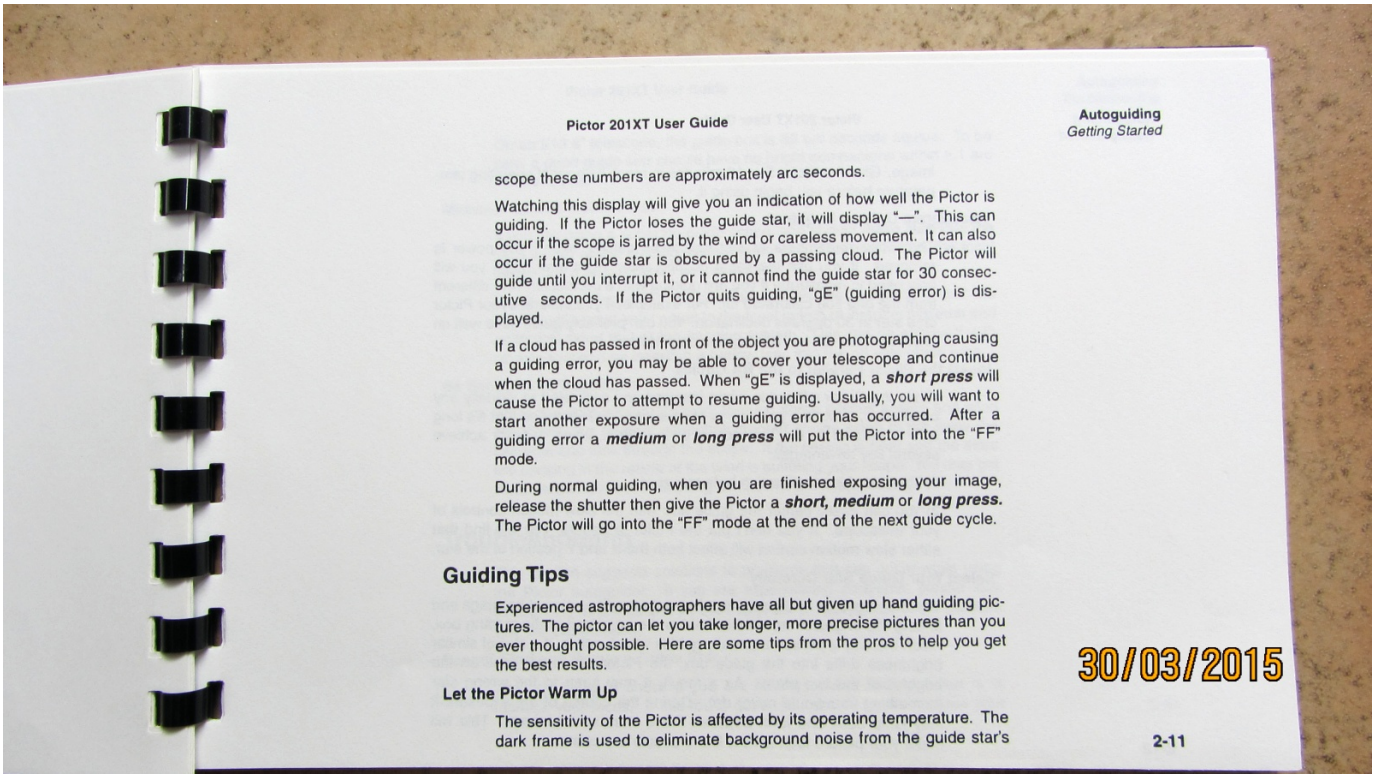
If calibration fails, the display will show "Er", short for error. A ***short press*** will clear the error and return you to the "FF" display. Calibration can fail if you have forgotten to connect the cable from the Pictor to the CCD input of your telescope. Additionally, calibration may fail if the star was not centered, or the calibration moves were too small or too large.

If calibration fails, remove the Pictor from the guider and insert a 10mm eyepiece in its place. Re-center the guide star. Remove the eyepiece and re-insert the Pictor. Attempt to calibrate again. If calibration fails again, see page 2-17, #5-6 on how to customize the calibration times. When calibration is complete, "gd" will be displayed.

14 You are now ready to begin autoguiding. From the "gd" display enter a SHORT PRESS. The display will go blank for several seconds. This dead time allows you time to trigger the shutter of your camera and let the vibration dampen before the guider begins to track. The default delay is 5 seconds. You can change this value, see page 2-16, #3 for instructions on customizing the delay time.

While the Pictor is guiding it will cycle through the following displays: "gb","vv","gc" and "xy". The "gb" stands for "guide brightness", the next display will be the brightness of the guide star on scale of 00 to 99. The "gc" display stands for "guide correction", it is followed by an "xy" display that gives the magnitude of the x and y corrections. On an 8" f10 tele-

IMG_1532



scope these numbers are approximately arc seconds.

Watching this display will give you an indication of how well the Pictor is guiding. If the Pictor loses the guide star, it will display "—". This can occur if the scope is jarred by the wind or careless movement. It can also occur if the guide star is obscured by a passing cloud. The Pictor will guide until you interrupt it, or it cannot find the guide star for 30 consecutive seconds. If the Pictor quits guiding, "gE" (guiding error) is displayed.

If a cloud has passed in front of the object you are photographing causing a guiding error, you may be able to cover your telescope and continue when the cloud has passed. When "gE" is displayed, a ***short press*** will cause the Pictor to attempt to resume guiding. Usually, you will want to start another exposure when a guiding error has occurred. After a guiding error a ***medium*** or ***long press*** will put the Pictor into the "FF" mode.

During normal guiding, when you are finished exposing your image, release the shutter then give the Pictor a ***short, medium*** or ***long press.*** The Pictor will go into the "FF" mode at the end of the next guide cycle.

Guiding Tips

Experienced astrophotographers have all but given up hand guiding pictures. The pictor can let you take longer, more precise pictures than you ever thought possible. Here are some tips from the pros to help you get the best results.

Let the Pictor Warm Up

The sensitivity of the Pictor is affected by its operating temperature. The dark frame is used to eliminate background noise from the guide star's

IMG_1533

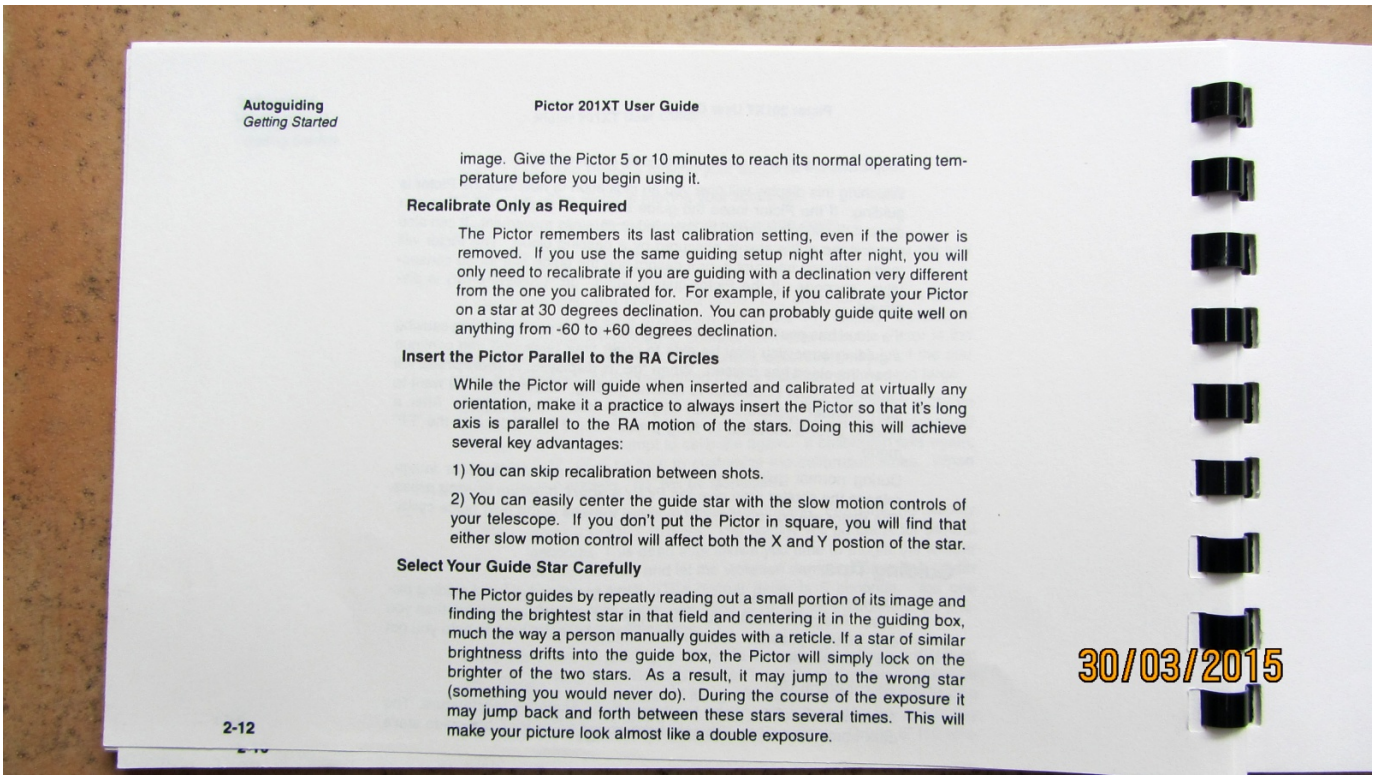


image. Give the Pictor 5 or 10 minutes to reach its normal operating temperature before you begin using it.

Recalibrate Only as Required

The Pictor remembers its last calibration setting, even if the power is removed. If you use the same guiding setup night after night, you will only need to recalibrate if you are guiding with a declination very different from the one you calibrated for. For example, if you calibrate your Pictor on a star at 30 degrees declination. You can probably guide quite well on anything from -60 to +60 degrees declination.

Insert the Pictor Parallel to the RA Circles

While the Pictor will guide when inserted and calibrated at virtually any orientation, make it a practice to always insert the Pictor so that it's long axis is parallel to the RA motion of the stars. Doing this will achieve several key advantages:

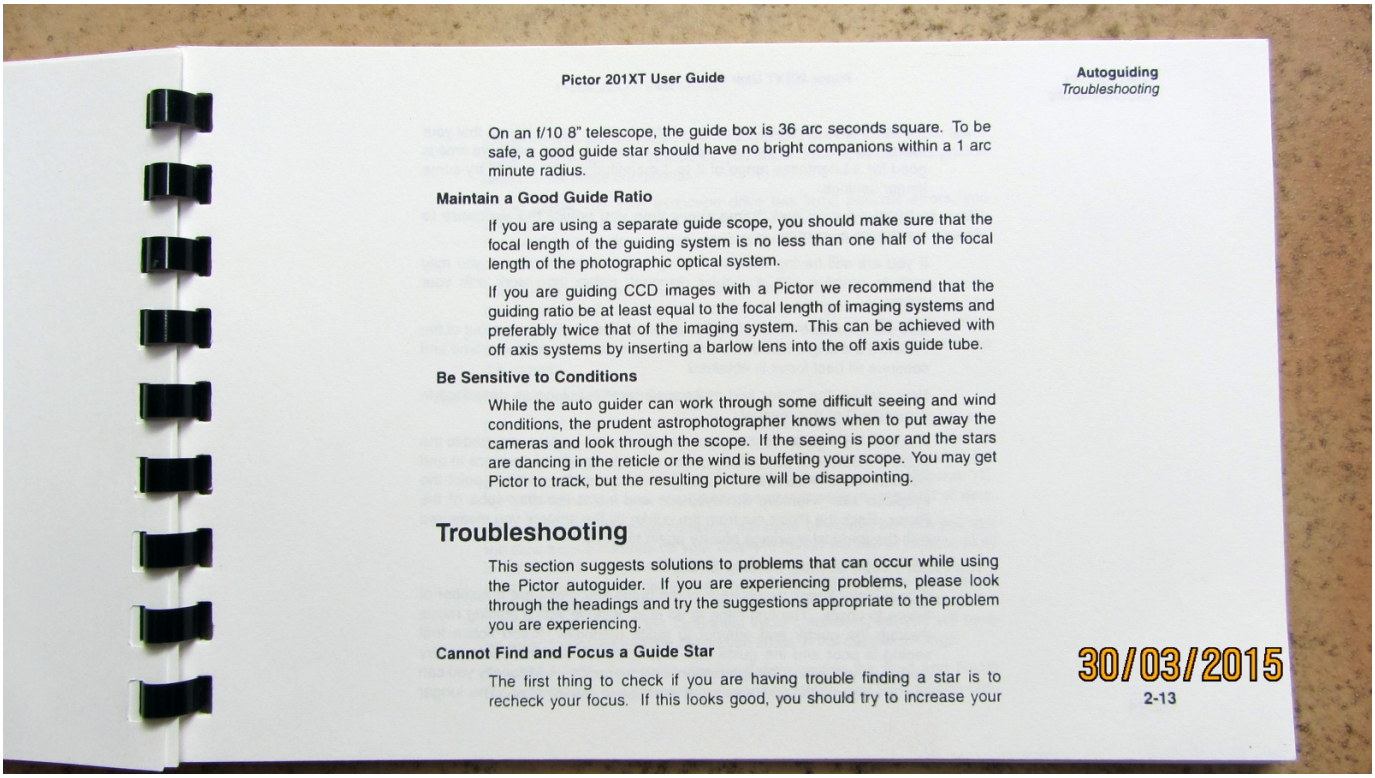
1) You can skip recalibration between shots.

2) You can easily center the guide star with the slow motion controls of your telescope. If you don't put the Pictor in square, you will find that either slow motion control will affect both the X and Y postion of the star.

Select Your Guide Star Carefully

The Pictor guides by repeatly reading out a small portion of its image and finding the brightest star in that field and centering it in the guiding box, much the way a person manually guides with a reticle. If a star of similar brightness drifts into the guide box, the Pictor will simply lock on the brighter of the two stars. As a result, it may jump to the wrong star (something you would never do). During the course of the exposure it may jump back and forth between these stars several times. This will make your picture look almost like a double exposure.

IMG_1534



On an f/10 8" telescope, the guide box is 36 arc seconds square. To be safe, a good guide star should have no bright companions within a 1 arc minute radius.

Maintain a Good Guide Ratio

If you are using a separate guide scope, you should make sure that the focal length of the guiding system is no less than one half of the focal length of the photographic optical system.

If you are guiding CCD images with a Pictor we recommend that the guiding ratio be at least equal to the focal length of imaging systems and preferably twice that of the imaging system. This can be achieved with off axis systems by inserting a barlow lens into the off axis guide tube.

Be Sensitive to Conditions

While the auto guider can work through some difficult seeing and wind conditions, the prudent astrophotographer knows when to put away the cameras and look through the scope. If the seeing is poor and the stars are dancing in the reticle or the wind is buffeting your scope. You may get Pictor to track, but the resulting picture will be disappointing.

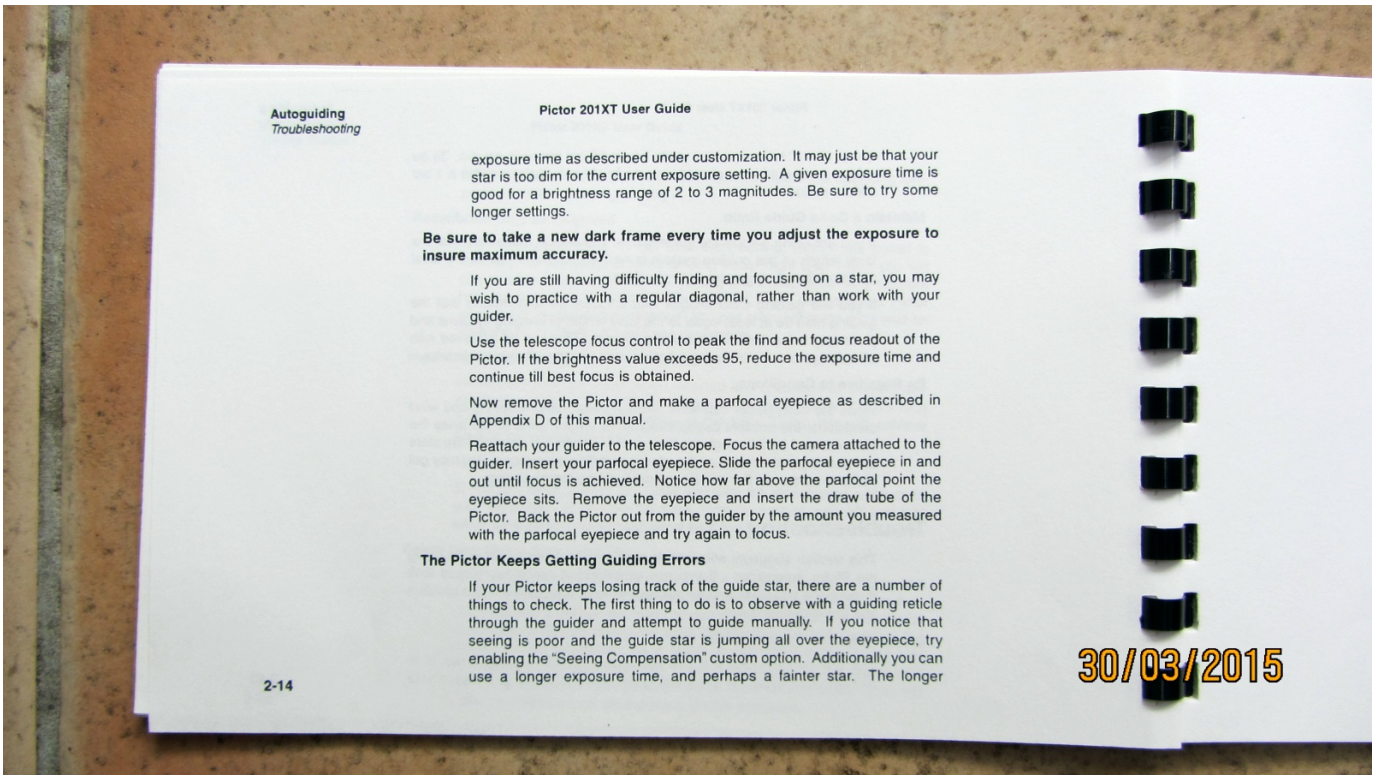
Troubleshooting

This section suggests solutions to problems that can occur while using the Pictor autoguider. If you are experiencing problems, please look through the headings and try the suggestions appropriate to the problem you are experiencing.

Cannot Find and Focus a Guide Star

The first thing to check if you are having trouble finding a star is to recheck your focus. If this looks good, you should try to increase your

IMG_1535



exposure time as described under customization. It may just be that your star is too dim for the current exposure setting. A given exposure time is good for a brightness range of 2 to 3 magnitudes. Be sure to try some longer settings.

Be sure to take a new dark frame every time you adjust the exposure to insure maximum accuracy.

If you are still having difficulty finding and focusing on a star, you may wish to practice with a regular diagonal, rather than work with your guider.

Use the telescope focus control to peak the find and focus readout of the Pictor. If the brightness value exceeds 95, reduce the exposure time and continue till best focus is obtained.

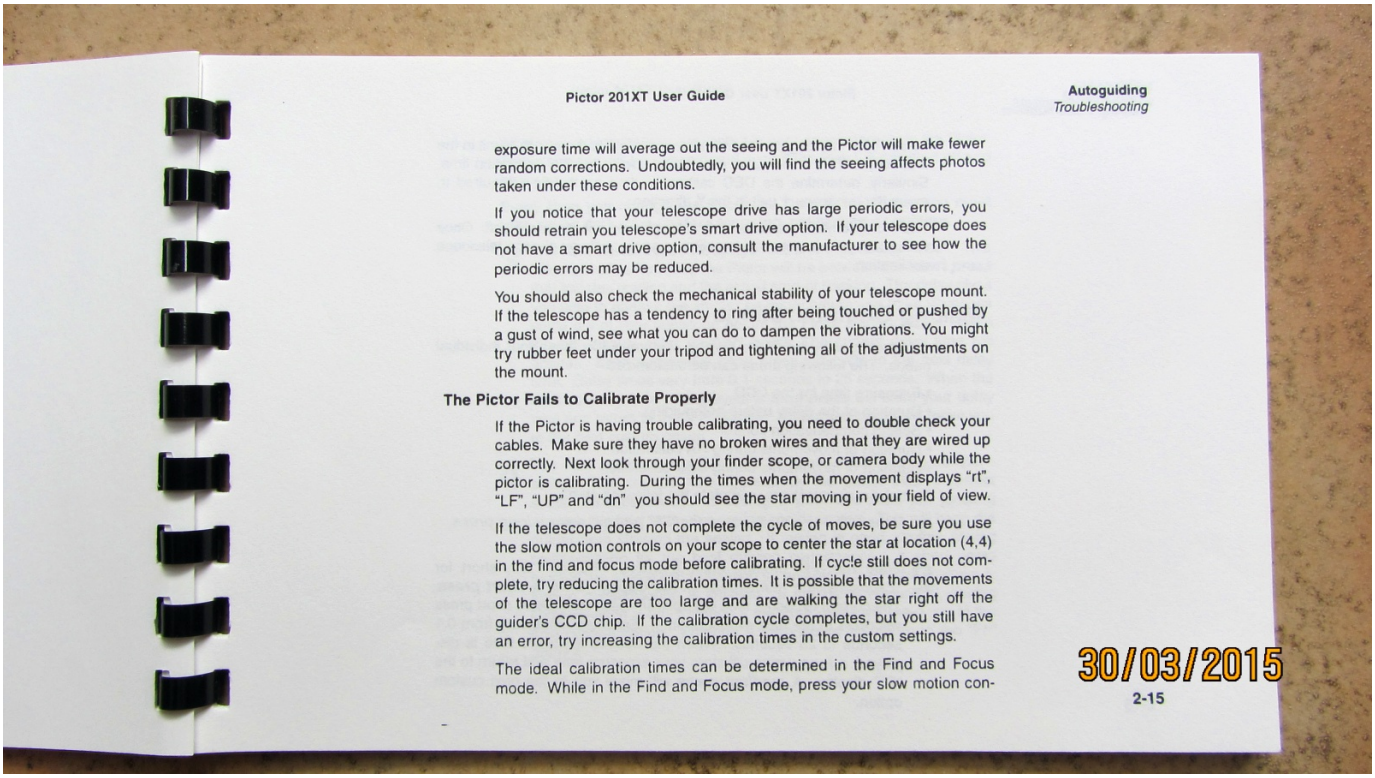
Now remove the Pictor and make a parfocal eyepiece as described in Appendix D of this manual.

Reattach your guider to the telescope. Focus the camera attached to the guider. Insert your parfocal eyepiece. Slide the parfocal eyepiece in and out until focus is achieved. Notice how far above the parfocal point the eyepiece sits. Remove the eyepiece and insert the draw tube of the Pictor. Back the Pictor out from the guider by the amount you measured with the parfocal eyepiece and try again to focus.

The Pictor Keeps Getting Guiding Errors

If your Pictor keeps losing track of the guide star, there are a number of things to check. The first thing to do is to observe with a guiding reticle through the guider and attempt to guide manually. If you notice that seeing is poor and the guide star is jumping all over the eyepiece, try enabling the "Seeing Compensation" custom option. Additionally you can use a longer exposure time, and perhaps a fainter star. The longer

IMG_1536



exposure time will average out the seeing and the Pictor will make fewer random corrections. Undoubtedly, you will find the seeing affects photos taken under these conditions.

If you notice that your telescope drive has large periodic errors, you should retrain you telescope's smart drive option. If your telescope does not have a smart drive option, consult the manufacturer to see how the periodic errors may be reduced.

You should also check the mechanical stability of your telescope mount. If the telescope has a tendency to ring after being touched or pushed by a gust of wind, see what you can do to dampen the vibrations. You might try rubber feet under your tripod and tightening all of the adjustments on the mount.

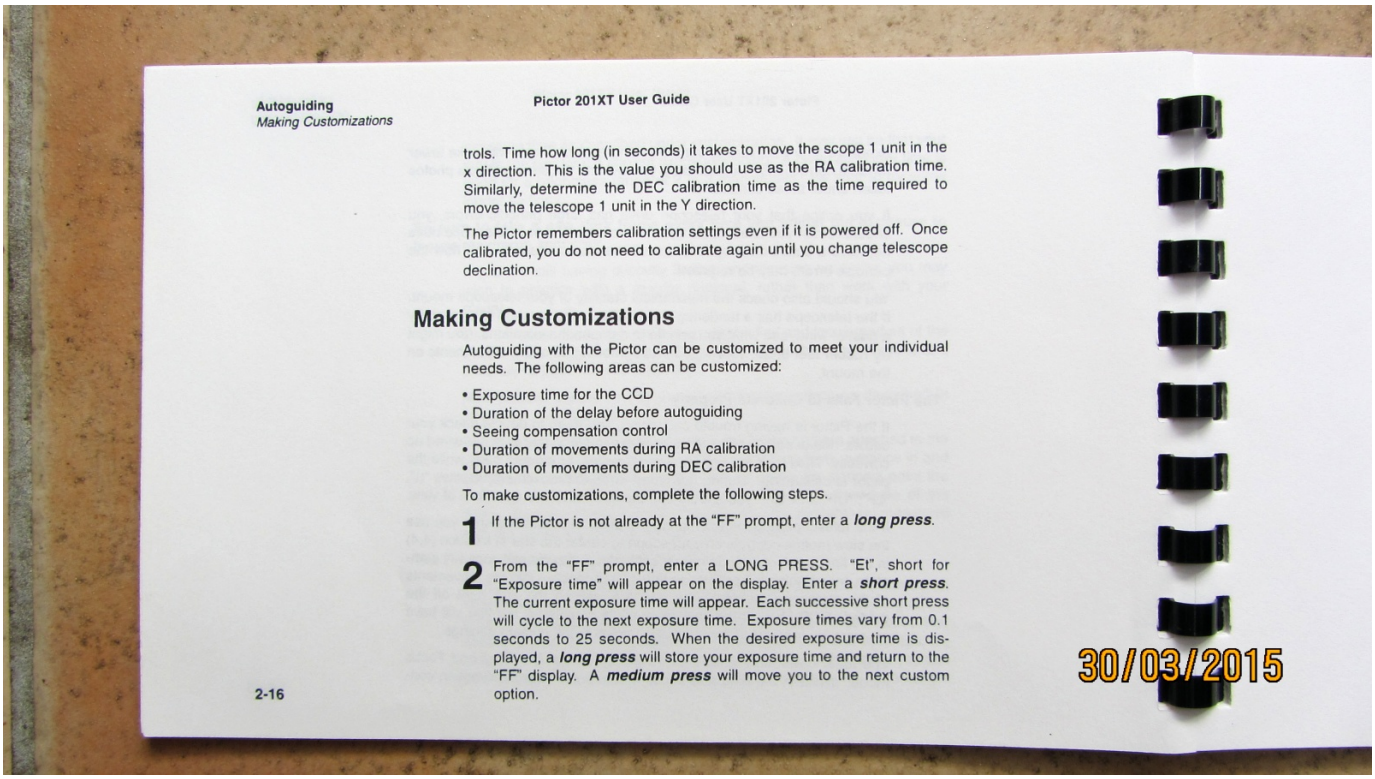
The Pictor Fails to Calibrate Properly

If the Pictor is having trouble calibrating, you need to double check your cables. Make sure they have no broken wires and that they are wired up correctly. Next look through your finder scope, or camera body while the pictor is calibrating. During the times when the movement displays "rt", "LF", "UP" and "dn" you should see the star moving in your field of view.

If the telescope does not complete the cycle of moves, be sure you use the slow motion controls on your scope to center the star at location (4,4) in the find and focus mode before calibrating. If cycle still does not complete, try reducing the calibration times. It is possible that the movements of the telescope are too large and are walking the star right off the guider's CCD chip. If the calibration cycle completes, but you still have an error, try increasing the calibration times in the custom settings.

The ideal calibration times can be determined in the Find and Focus mode. While in the Find and Focus mode, press your slow motion con-

IMG_1537



trols. Time how long (in seconds) it takes to move the scope 1 unit in the x direction. This is the value you should use as the RA calibration time. Similarly, determine the DEC calibration time as the time required to move the telescope 1 unit in the Y direction.

The Pictor remembers calibration settings even if it is powered off. Once calibrated, you do not need to calibrate again until you change telescope declination.

Making Customizations

Autoguiding with the Pictor can be customized to meet your individual needs. The following areas can be customized:

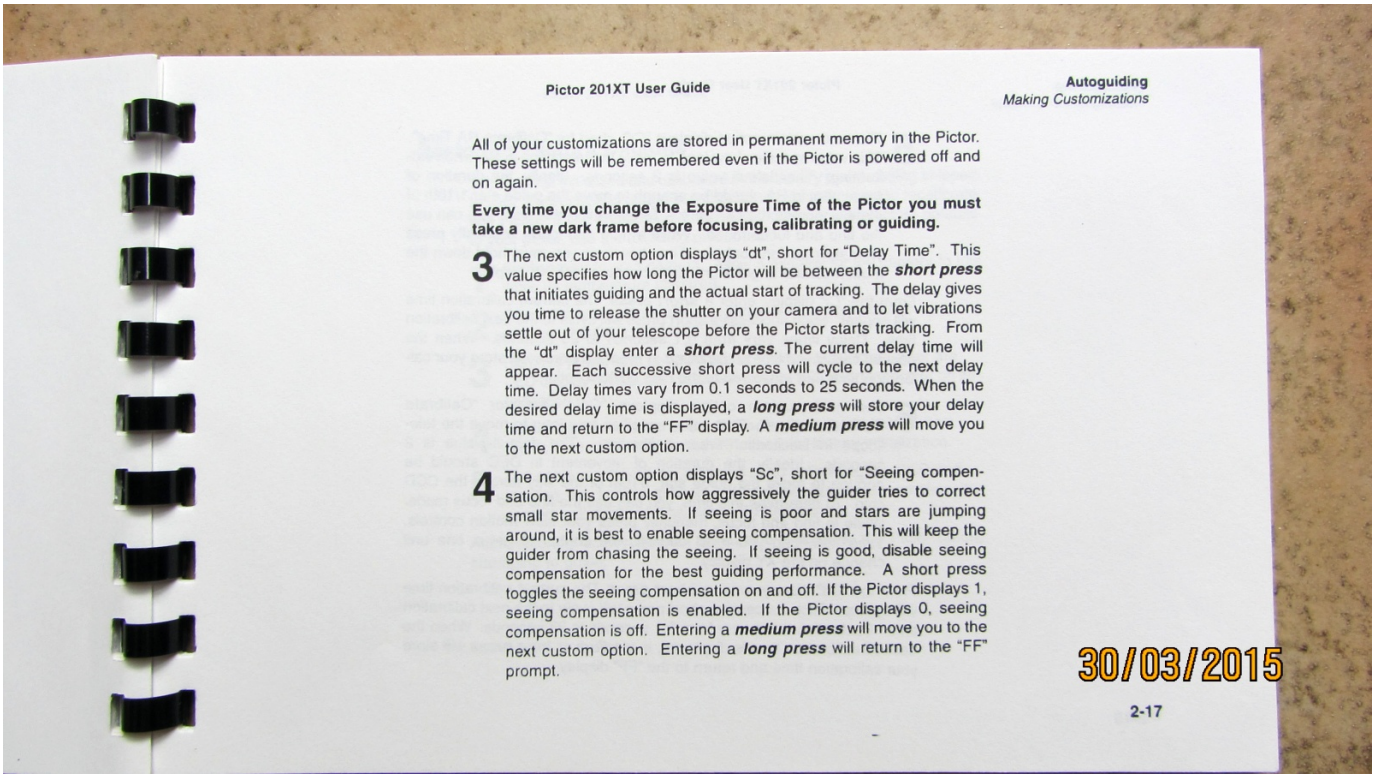
- Exposure time for the CCD
- Duration of the delay before autoguiding
- Seeing compensation control
- Duration of movements during RA calibration
- Duration of movements during DEC calibration

To make customizations, complete the following steps.

1. If the Pictor is not already at the "FF" prompt, enter a ***long press***.

2. From the "FF" prompt, enter a LONG PRESS. "Et", short for "Exposure time" will appear on the display. Enter a ***short press***. The current exposure time will appear. Each successive short press will cycle to the next exposure time. Exposure times vary from 0.1 seconds to 25 seconds. When the desired exposure time is displayed, a ***long press*** will store your exposure time and return to the "FF" display. A ***medium press*** will move you to the next custom option.

IMG_1538



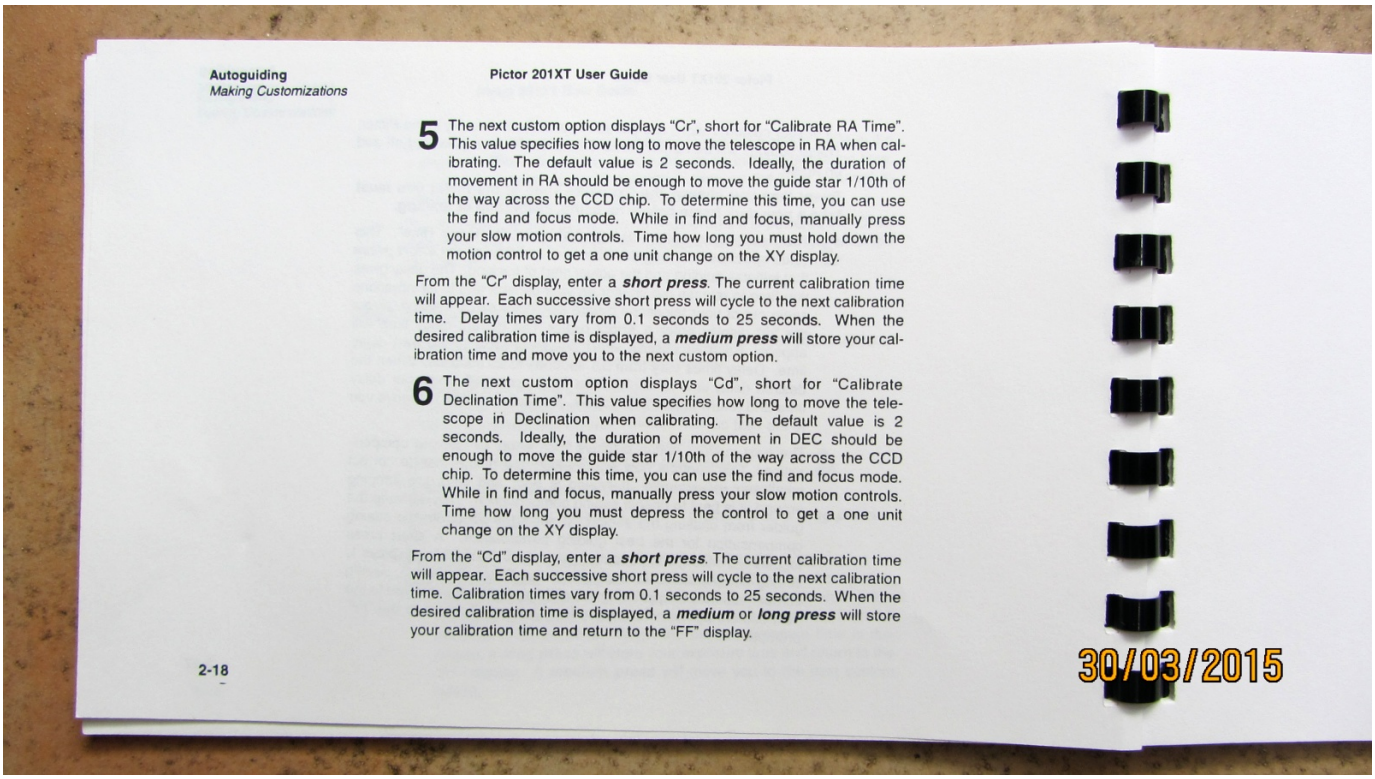
All of your customizations are stored in permanent memory in the Pictor. These settings will be remembered even if the Pictor is powered off and on again.

Every time you change the Exposure Time of the Pictor you must take a new dark frame before focusing, calibrating or guiding.

3 The next custom option displays "dt", short for "Delay Time". This value specifies how long the Pictor will be between the ***short press*** that initiates guiding and the actual start of tracking. The delay gives you time to release the shutter on your camera and to let vibrations settle out of your telescope before the Pictor starts tracking. From the "dt" display enter a ***short press***. The current delay time will appear. Each successive short press will cycle to the next delay time. Delay times vary from 0.1 seconds to 25 seconds. When the desired delay time is displayed, a ***long press*** will store your delay time and return to the "FF" display. A ***medium press*** will move you to the next custom option.

4 The next custom option displays "Sc", short for "Seeing compensation. This controls how aggressively the guider tries to correct small star movements. If seeing is poor and stars are jumping around, it is best to enable seeing compensation. This will keep the guider from chasing the seeing. If seeing is good, disable seeing compensation for the best guiding performance. A short press toggles the seeing compensation on and off. If the Pictor displays 1, seeing compensation is enabled. If the Pictor displays 0, seeing compensation is off. Entering a ***medium press*** will move you to the next custom option. Entering a ***long press*** will return to the "FF" prompt.

IMG_1539



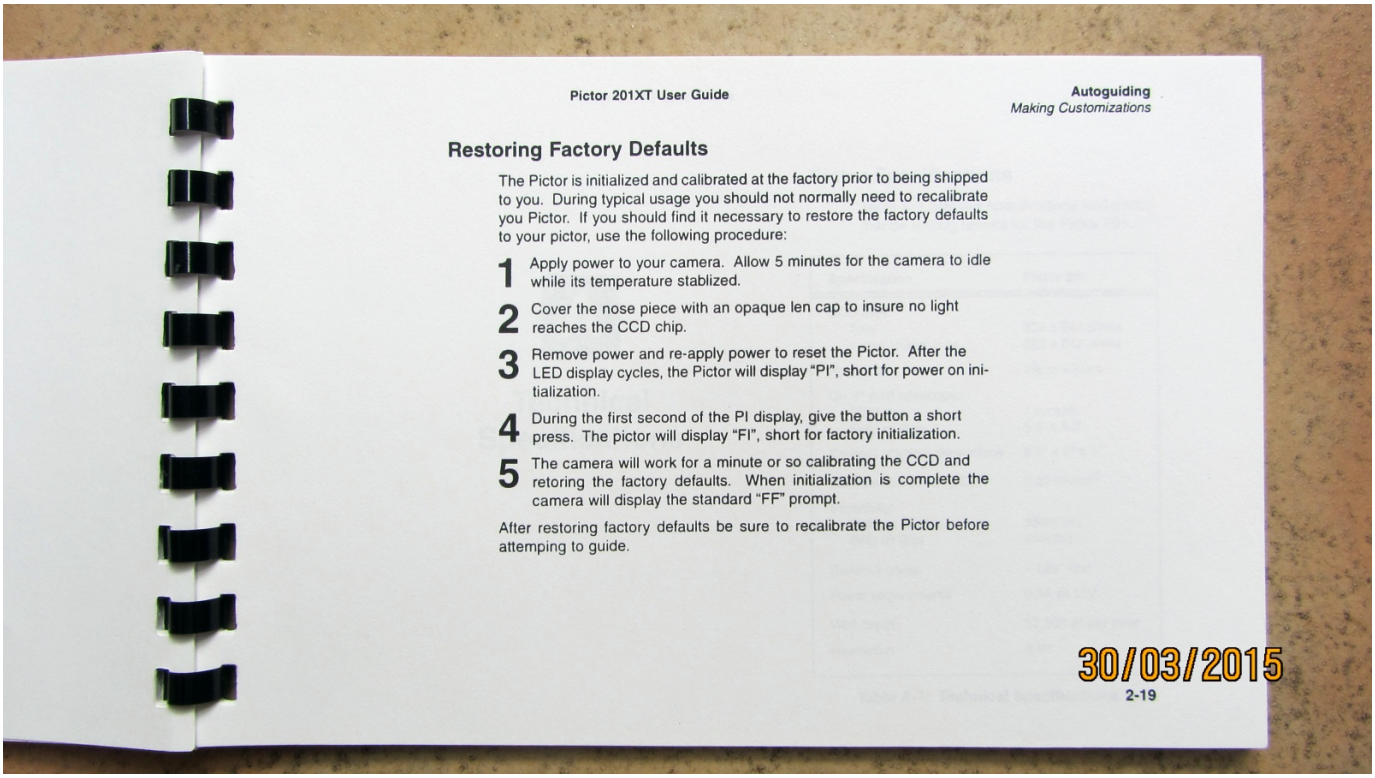
5 The next custom option displays "Cr", short for "Calibrate RA Time". This value specifies how long to move the telescope in RA when calibrating. The default value is 2 seconds. Ideally, the duration of movement in RA should be enough to move the guide star 1/10th of the way across the CCD chip. To determine this time, you can use the find and focus mode. While in find and focus, manually press your slow motion controls. Time how long you must hold down the motion control to get a one unit change on the XY display.

From the "Cr" display, enter a ***short press***. The current calibration time will appear. Each successive short press will cycle to the next calibration time. Delay times vary from 0.1 seconds to 25 seconds. When the desired calibration time is displayed, a ***medium press*** will store your calibration time and move you to the next custom option.

6 The next custom option displays "Cd", short for "Calibrate Declination Time". This value specifies how long to move the telescope in Declination when calibrating. The default value is 2 seconds. Ideally, the duration of movement in DEC should be enough to move the guide star 1/10th of the way across the CCD chip. To determine this time, you can use the find and focus mode. While in find and focus, manually press your slow motion controls. Time how long you must depress the control to get a one unit change on the XY display.

From the "Cd" display, enter a ***short press***. The current calibration time will appear. Each successive short press will cycle to the next calibration time. Calibration times vary from 0.1 seconds to 25 seconds. When the desired calibration time is displayed, a ***medium*** or ***long press*** will store your calibration time and return to the "FF" display.

IMG_1540



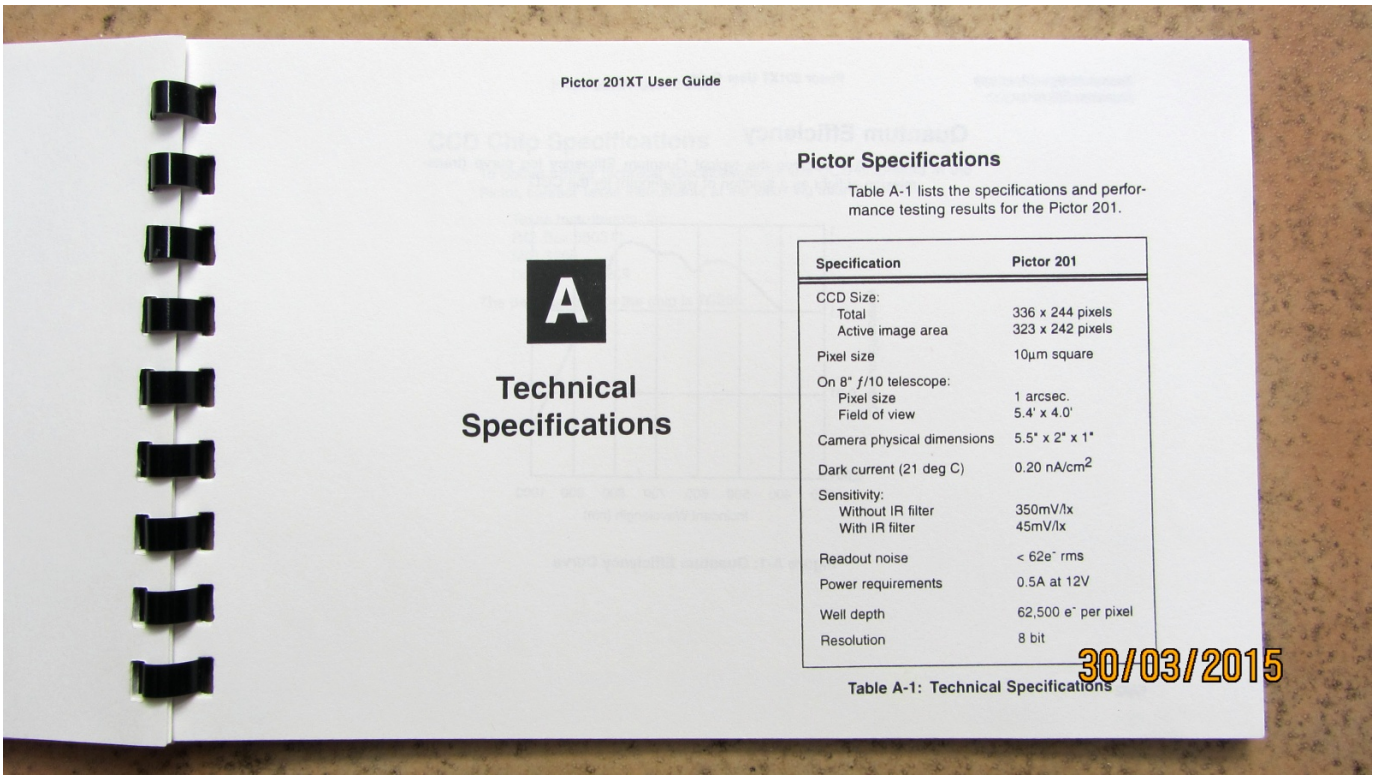
Restoring Factory Defaults

The Pictor is initialized and calibrated at the factory prior to being shipped to you. During typical usage you should not normally need to recalibrate you Pictor. If you should find it necessary to restore the factory defaults to your pictor, use the following procedure:

1. Apply power to your camera. Allow 5 minutes for the camera to idle while its temperature stablized.
2. Cover the nose piece with an opaque len cap to insure no light reaches the CCD chip.
3. Remove power and re-apply power to reset the Pictor. After the LED display cycles, the Pictor will display "PI", short for power on initialization.
4. During the first second of the PI display, give the button a short press. The pictor will display "FI", short for factory initialization.
5. The camera will work for a minute or so calibrating the CCD and retoring the factory defaults. When initialization is complete the camera will display the standard "FF" prompt.

After restoring factory defaults be sure to recalibrate the Pictor before attemping to guide.

IMG_1541



A

Technical Specifications

Pictor Specifications

Table A-1 lists the specifications and performance testing results for the Pictor 201.

Specification	Pictor 201
CCD Size:	
Total	336 x 244 pixels
Active image area	323 x 242 pixels
Pixel size	10µm square
On 8" ƒ/10 telescope:	
Pixel size	1 arcsec.
Field of view	5.4' x 4.0'
Camera physical dimensions	5.5" x 2" x 1"
Dark current (21 deg C)	0.20 nA/cm^2
Sensitivity:	
Without IR filter	350mV/lx
With IR filter	45mV/lx
Readout noise	< 62e$^-$ rms
Power requirements	0.5A at 12V
Well depth	62,500 e$^-$ per pixel
Resolution	8 bit

Table A-1: Technical Specifications

IMG_1542

Quantum Efficiency

Figure A-1 displays the typical Quantum Efficiency log curve (transmission of light as a function of wavelength) for the CCD.

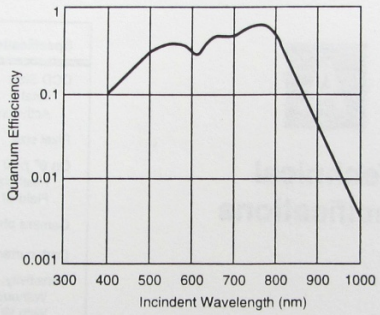


Figure A-1: Quantum Efficiency Curve

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IMG_1543

CCD Chip Specifications

To obtain further technical specifications for the CCD chip used in the Pictor, contact Texas Instruments at the following address:

Texas Instruments, Inc.
P.O. Box 650311
M/S 3966
Dallas, TX 75265

The part number for the chip is TC255.

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IMG_1544

The Pictor Mode Diagram

The Drawing below graphs the various displays and modes in which the Pictor operates. The arrows between the display show how the Pictor moves from display to display. If no notation appears on the arrow, the Pictor moves from display mode to the next display mode automatically. If the arrow is marked, the action indicated is required to move the Pictor from the first display mode to the next display mode.

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IMG_1546

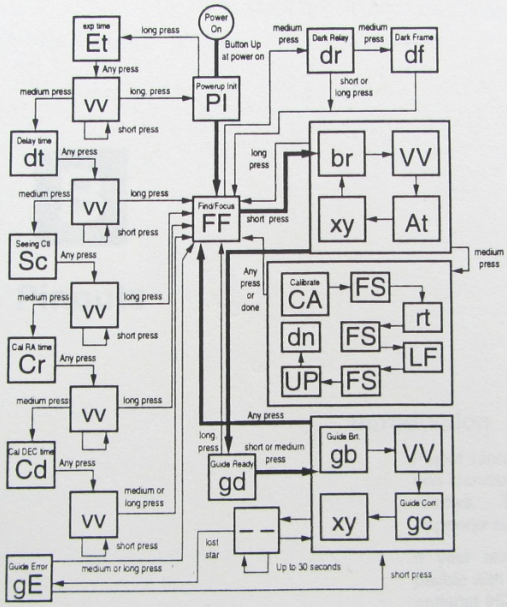

Figure A-1: Pictor 201 Mode Diagram

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B

Pinouts

Introduction

Pinout information is provided for users with non-standard connectors on their host telescopes. The pinout described in this Appendix is the Pictor CCD connector.

If your telescope's connector isn't compatible with the Pictor connector, you may need the optional #520 Electronic Relay Cable. See the Meade General catalog for further information.

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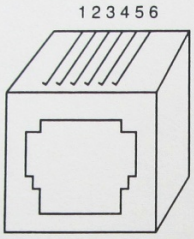
CCD Connector Pinout

The pinout of the Pictor CCD connector is displayed below (Figure B-1).



1 -Right
2 -Up
3 -Down
4 -Left
5 -Ground
6 +5V

Figure B-1: CCD Connector

This connector is compatible with Meade LX50 and LX200 CCD ports. It has the following specifications:

- All signals prefaced by a dash (–) are active-low.
- Outputs can sink up to 10mA when active, and can withstand 40V DC when off.
- +5V is regulated to 20% up to 6mA, and is diode-protected.

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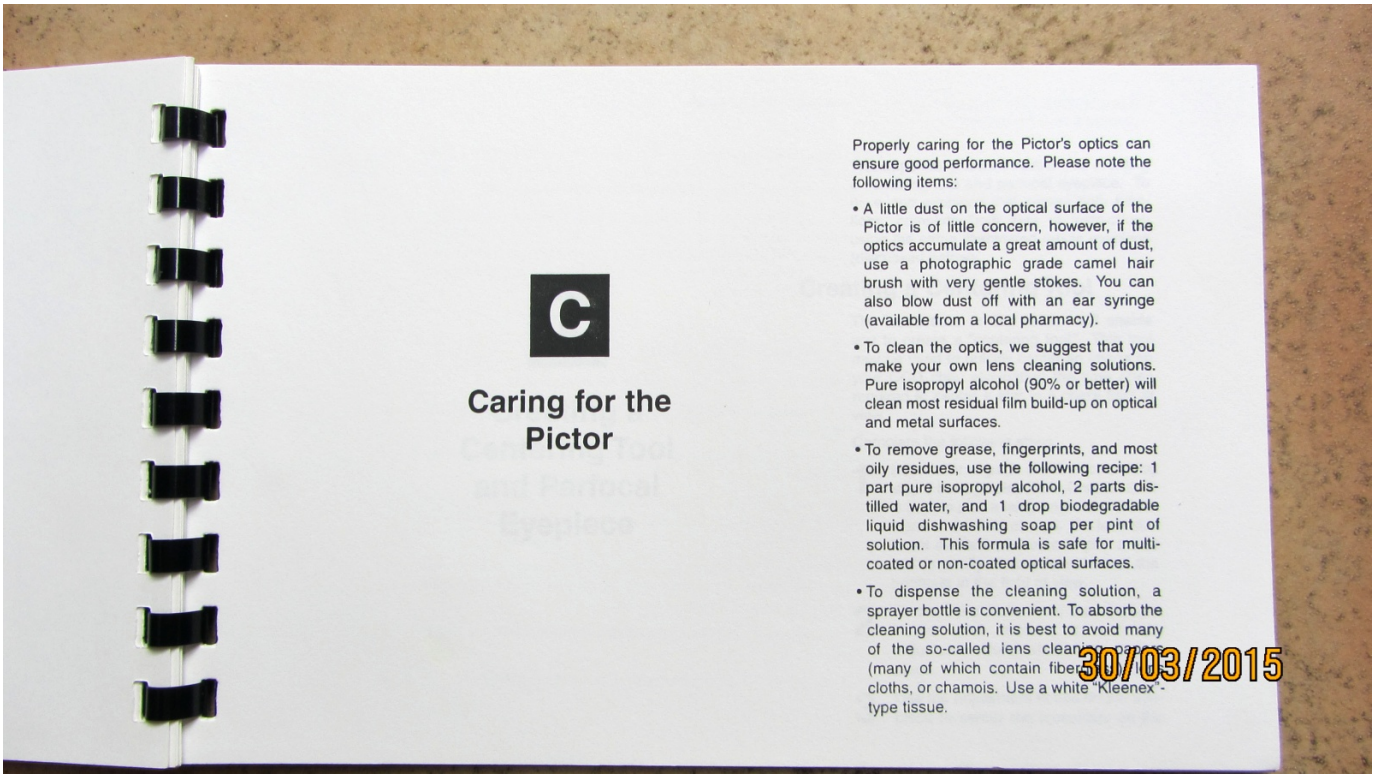
IMG_1549



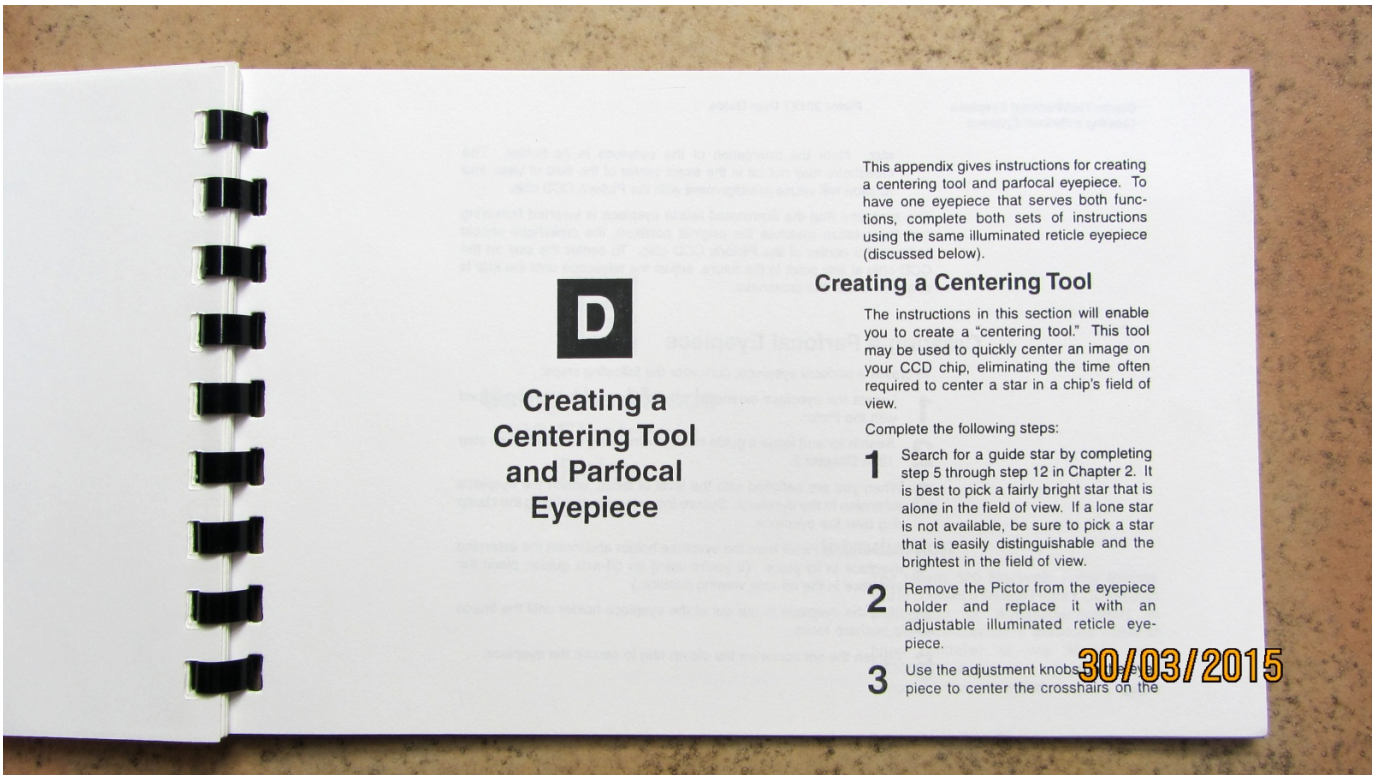
C

Caring for the Pictor

Properly caring for the Pictor's optics can ensure good performance. Please note the following items:

- A little dust on the optical surface of the Pictor is of little concern, however, if the optics accumulate a great amount of dust, use a photographic grade camel hair brush with very gentle stokes. You can also blow dust off with an ear syringe (available from a local pharmacy).
- To clean the optics, we suggest that you make your own lens cleaning solutions. Pure isopropyl alcohol (90% or better) will clean most residual film build-up on optical and metal surfaces.
- To remove grease, fingerprints, and most oily residues, use the following recipe: 1 part pure isopropyl alcohol, 2 parts distilled water, and 1 drop biodegradable liquid dishwashing soap per pint of solution. This formula is safe for multi-coated or non-coated optical surfaces.
- To dispense the cleaning solution, a sprayer bottle is convenient. To absorb the cleaning solution, it is best to avoid many of the so-called lens cleaning papers (many of which contain fibers), cotton cloths, or chamois. Use a white "Kleenex"-type tissue.

IMG_1550



D

Creating a Centering Tool and Parfocal Eyepiece

This appendix gives instructions for creating a centering tool and parfocal eyepiece. To have one eyepiece that serves both functions, complete both sets of instructions using the same illuminated reticle eyepiece (discussed below).

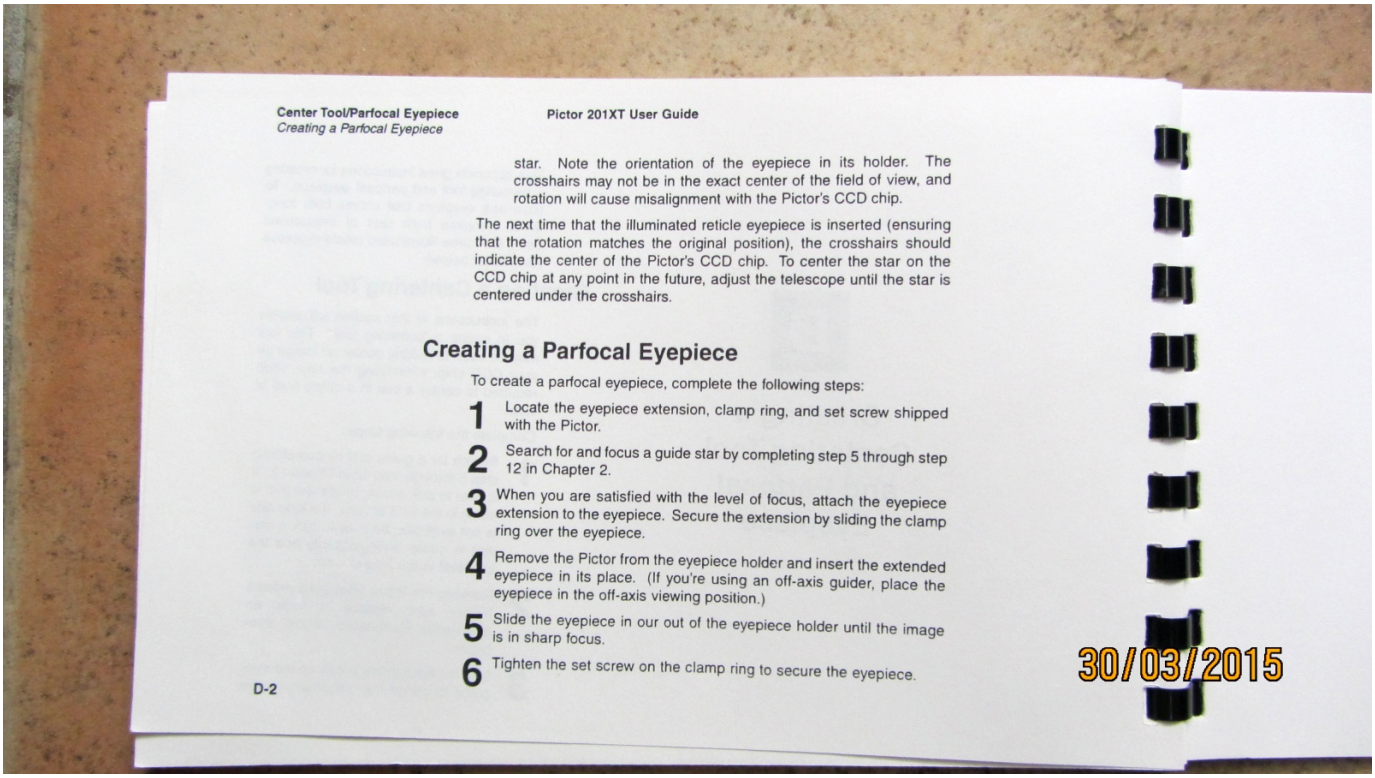
Creating a Centering Tool

The instructions in this section will enable you to create a "centering tool." This tool may be used to quickly center an image on your CCD chip, eliminating the time often required to center a star in a chip's field of view.

Complete the following steps:

1. Search for a guide star by completing step 5 through step 12 in Chapter 2. It is best to pick a fairly bright star that is alone in the field of view. If a lone star is not available, be sure to pick a star that is easily distinguishable and the brightest in the field of view.
2. Remove the Pictor from the eyepiece holder and replace it with an adjustable illuminated reticle eyepiece.
3. Use the adjustment knobs on the eyepiece to center the crosshairs on the

IMG_1551



star. Note the orientation of the eyepiece in its holder. The crosshairs may not be in the exact center of the field of view, and rotation will cause misalignment with the Pictor's CCD chip.

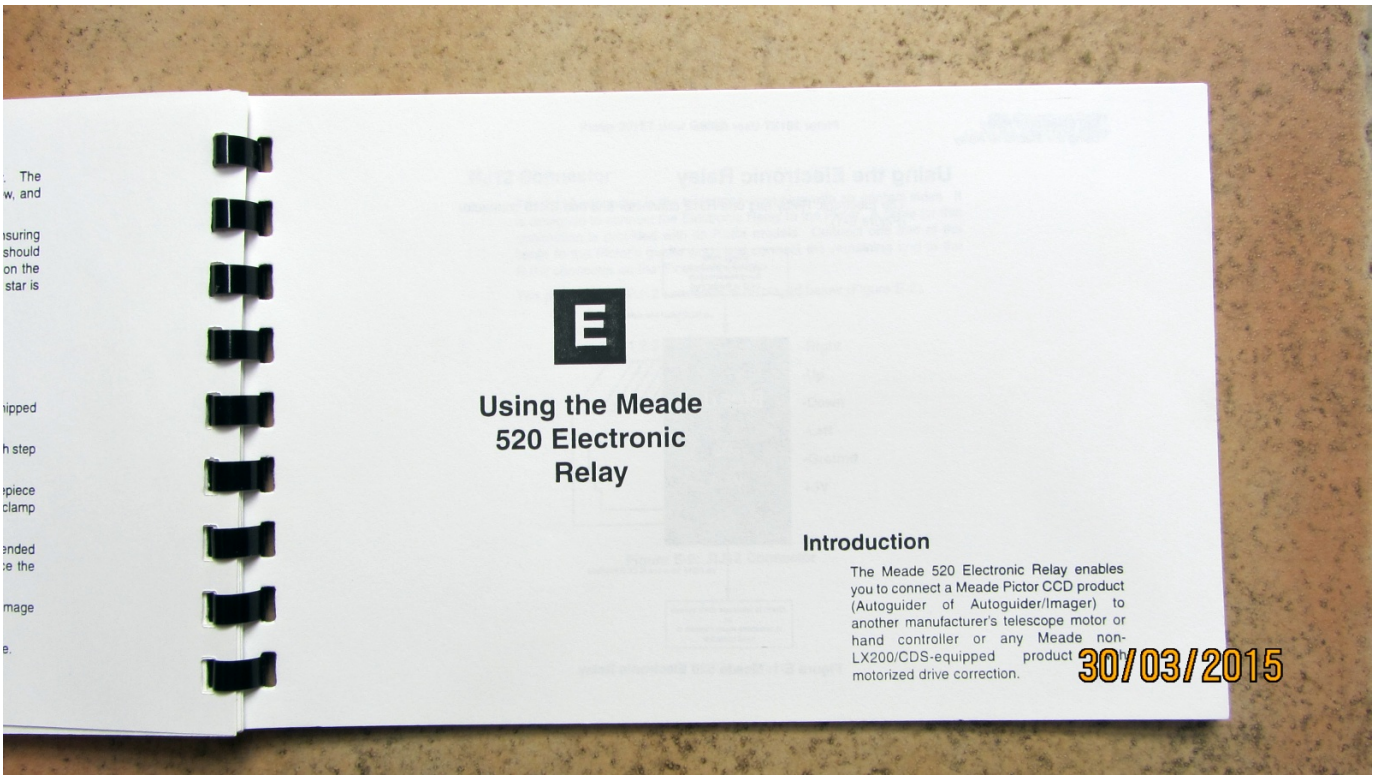
The next time that the illuminated reticle eyepiece is inserted (ensuring that the rotation matches the original position), the crosshairs should indicate the center of the Pictor's CCD chip. To center the star on the CCD chip at any point in the future, adjust the telescope until the star is centered under the crosshairs.

Creating a Parfocal Eyepiece

To create a parfocal eyepiece, complete the following steps:

1. Locate the eyepiece extension, clamp ring, and set screw shipped with the Pictor.
2. Search for and focus a guide star by completing step 5 through step 12 in Chapter 2.
3. When you are satisfied with the level of focus, attach the eyepiece extension to the eyepiece. Secure the extension by sliding the clamp ring over the eyepiece.
4. Remove the Pictor from the eyepiece holder and insert the extended eyepiece in its place. (If you're using an off-axis guider, place the eyepiece in the off-axis viewing position.)
5. Slide the eyepiece in our out of the eyepiece holder until the image is in sharp focus.
6. Tighten the set screw on the clamp ring to secure the eyepiece.

IMG_1552



E

Using the Meade 520 Electronic Relay

Introduction

The Meade 520 Electronic Relay enables you to connect a Meade Pictor CCD product (Autoguider of Autoguider/Imager) to another manufacturer's telescope motor or hand controller or any Meade non-LX200/CDS-equipped product motorized drive correction.

IMG_1553

Using the Electronic Relay

The Electronic Relay has one RJ12 connector and one DB15 connector (Figure E-1).

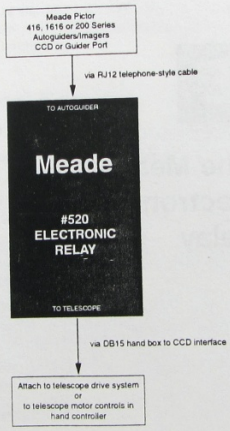


Figure E-1: Meade 520 Electronic Relay

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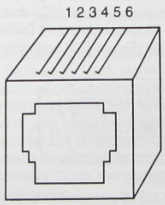
IMG_1554

RJ12 Connector

The RJ12 connector is the telephone-style plug with six contact sides. It is designed to connect the Electronic Relay to the Pictor. A cable for this connection is provided with all Pictor models. Connect one end of the cable to the Pictor's guider port, and connect the remaining end to the RJ12 connector on the Electronic Relay.

The pinout of the RJ12 connector is displayed below (Figure E-2).



1 -Right
2 -Up
3 -Down
4 -Left
5 -Ground
6 +5V

Figure E-2: RJ12 Connector

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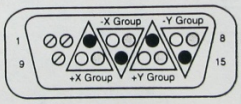
IMG_1555

DB15 Connector

The DB15 connector is designed to connect your telescope's hand controller or drive mechanism. Before attempting to connect your telescope to this connector, determine whether your telescope's hand controller is of a Normally Open (NO) or Normally Closed (NC) design. This information should be given in your telescope's documentation.

The DB15 connector has four signal groups: +X, -X, -Y, and -Y. These signal groups are controlled by the Pictor's -Right, -Left, -Up, and -Down outputs, respectively. Each of the DB15 signal groups consists of three lines: Normally Open (NO), Normally Closed (NC), and Common (CMN). The relationship between the Pictor's output and DB15 signal groups is shown in the following illustration (Figure E-3) and table (Table E-1, Page E-5).



NOTE:
The Electronic Relay DB15 connector is male.
Pinouts for female DB15 connectors will be the opposite of this pinout.

- ⊘ Not used
- ○ Common (CMN)
- ● Normally Closed (NC)
- ○ Normally Open (NO)

Figure E-3: DB15 Connector

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IMG_1556

Pictor Output	DB15 Signal Group	Normally Closed Pin	Normally Open Pin	Common Pin
-Right	+X	3	10	11
-Left	-X	12	4	5
-Up	+Y	6	13	14
-Down	-Y	15	7	8

Table E-1: DB15 Signal Groups/Pins

When connecting your telescope to the DB15 connector, you'll need to connect two pins for each signal group (see Table E-1). The Common Pin for each signal group is always connected; whether the Normally Open or Normally Closed pin is used with the Common pin depends on the setup of your telescope's hand controller/drive mechanism. If your hand controller has a Normally Closed setup, connect the Common pin and Normally Closed pin for each signal group. If your hand controller has a Normally Open mechanism, connect the Common pin and the Normally Open pin.

CAUTION: Never connect **both** the Normally Open and Normally Closed pins. This will damage the Electronic Relay.

The relay box's equivalent circuit for each signal group appears in the following figure (Figure E-4, page E-6).

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IMG_1557

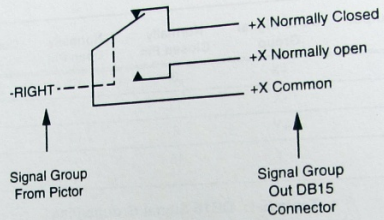

Figure E-4: Equivalent Circuit For Each Signal Group

Technical Specifications

The technical specifications of the Electronic Relay are listed below (Table E-2).

Specification	520 Electronic Relay
Voltage output can withstand when unconnected	0-40vDC
Maximum current output can pass when connected	200mA
Maximum resistance when output is connected	20 Ohms

Table E-2: Electronic Relay Specifications

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IMG_1558

F

Technical Support

If you have questions concerning the Pictor 201XT, please contact:

Customer Service Department
Meade Instruments Corporation
16542 Millikan Ave.,
Irvine, CA 92714
(714) 756-2291 • FAX (714) 756-1450

When you report a problem, please give the following information:

- Your name, address, and phone number
- Meade model number
- Serial number of the unit
- Description of the problem
- Status of the unit when the problem occurred

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IMG_1559