



SG-4 Autoguider Operating Manual

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Note: This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the receiver and the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Shielded I/O cables must be used when operating this equipment. You are also warned, that any changes to this certified device will void your legal right to operate it.

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I. Introduction

Description of the SG-4:

SBIG's SG-4 Stand-Alone guider is designed to be used for guiding a CCD camera or Digital Single Lens Reflex (DSLR) Camera at the focus of a telescope when taking a long exposure. The design assumption was that the SG-4 would be mounted on a separate guide telescope firmly mounted to the side of the main imaging telescope. While it is possible to use the product successfully in other configurations such as in an off-axis guider, it is much easier to use in its intended configuration with a separate guide scope. The main attribute of the SG-4 is that, once setup and focused with a PC, a computer is not needed. This is what SBIG means by Stand-Alone operation.



Figure One: Front View of SG-4 Stand-Alone Guider

The other important attribute of the SG-4 is it is meant to be a true single button guider. The button turns guiding on, and turns it off. We wanted the user to spend his or her time imaging, not struggling with a guider. You don't need a Ph.D. to use it!

Figure One shows the front view of the SG-4. The unit has a T-thread interface on the front, and SBIG provides a 1.25 inch nosepiece for users that do not have a T-thread coupling on their scope. The unit is 2.8 by 4.3 by 3.5 inches (71 by 110 by 88 mm) is size (WxHxL), and weighs about 1.0 pound (0.4 Kg). It operates from 12 volts DC and requires 190 milliamps average current draw (2.3 watts). As such, it can be easily operated by the portable battery power systems popular in astronomy.



Figure Two: Connector Plate View of SG-4

Figure Two shows the connector side of the SG-4. 12 volt power is brought in through a connector with a locking thread collar, and an illuminated power switch is included to turn the unit on and off. A 9 pin RS-232 connector provides for connection to a PC. At this time SBIG only offers software for Windows based computers. An I2C connector and External LED power are included for future expansion capabilities. Near the bottom is a button for starting and stopping the guiding, an LED to indicate status, and a toggle switch to designate which side of a German Equatorial mount you are on. Finally, there is a phone jack with ST-4 pinout connections to interface to the mount. The relays are mechanical, so no relay box is needed for any commercial mounts.

SBIG chose an RS-232 interface for a variety of reasons. First of all, this device was not intended to be used with a computer at all times like our other products – the computer was optional. So a fast interface was not that important for normal operations like viewing images and focusing. Secondly, our customers often have problems with USB when trying to extend the cable beyond the standard 15 feet. With the RS-232 link this guider can communicate over 150 feet cable runs with no special equipment. Finally, with RS-232 the user has the option of employing a Bluetooth wireless link and eliminating the cable altogether. Since the SG-4 is also used in our AllSky camera having a wireless capability is very useful. With the optional USB to RS-232 adapter SBIG offers one can communicate at 460Kbaud over 150 feet of cable with no problem. At this rate a full image with 16 bit accuracy can be downloaded in 15 seconds.

The SG-4 includes a shutter for automatic, remote collection of dark frames. The CCD used is the Kodak KAI-340 interline CCD, which has a high gain output stage allowing this device to routinely achieve readout noise levels below 15 electrons rms. The CCD is not cooled, but the dark current is quite low, allowing exposures longer than 120 seconds for other applications. The maximum stand-alone guiding exposure is 10 seconds.

II. Initial Setup:

Setup with a computer:

A computer is needed only for this initial setup. After the setup is completed, the SG-4 can be used without connecting to a computer unless you wish to download images or control the SG-4 remotely. A detailed description of the software is found in Section IV. SBIG recommends becoming familiar with SG-4 operation in a comfortable setting, someplace warm with plenty of light, before using it at the telescope. Begin by installing the software on your PC or laptop that will later be used to setup the camera.

- Make sure you have administrator privileges on the PC, and insert SBIG's software disk. A screen should pop up in a few seconds. Select "SG-4, AllSky-340" software to install and, on the next screen, select "Install SG-4 Software". The

software should install automatically. You might also choose to install CCDOPS at this time. (Note – CCDOPS will not communicate with the SG-4. It can display FITS files saved with the SG-4 Program, but that is all.)

- Next, connect the supplied 9 pin serial cable between a serial port on your computer and the RS-232 port on the SG-4. If your computer does not have a serial port, one can be easily implemented using an USB-RS-232 converter. One we have had good luck with is the FTDI US232R-10-BLK, but there are many to choose from. We stock this converter if you wish to purchase it, and the drivers are also on the software disk.
- Install the drivers from our software disk, select the “Install USB-to-RS-232 Drivers” option under the SG-4, AllSky-340 selection.
- Finally, hook up the power to the SG-4 camera, making sure the connector is well seated and does not wiggle. Power up the supply, and flip the small recessed Power On/Off switch toward the lettering. The red LED in the switch should light steadily.

If you are using a laptop with no CD drive you must first copy the needed files over to a thumb drive with another PC and then load the files from the thumb drive. The files you need can be found on the CD. Copy over the “SG-4 Software Installer” and “USB-to_RS-232 Driver Installer” folders to the Mini via the thumb drive. Run the executable files under these folders to install the software.

In either case the software will by default be installed to the “C:\Program Files\SBIG\SBIG SG-4 Interface Software” directory. You can either run the SBIG SG-4.exe software from that folder, or from the desktop shortcut that is generated automatically during the software installation. Launch the SBIG SG-4 software. You will see the screen shown in Figure Three.

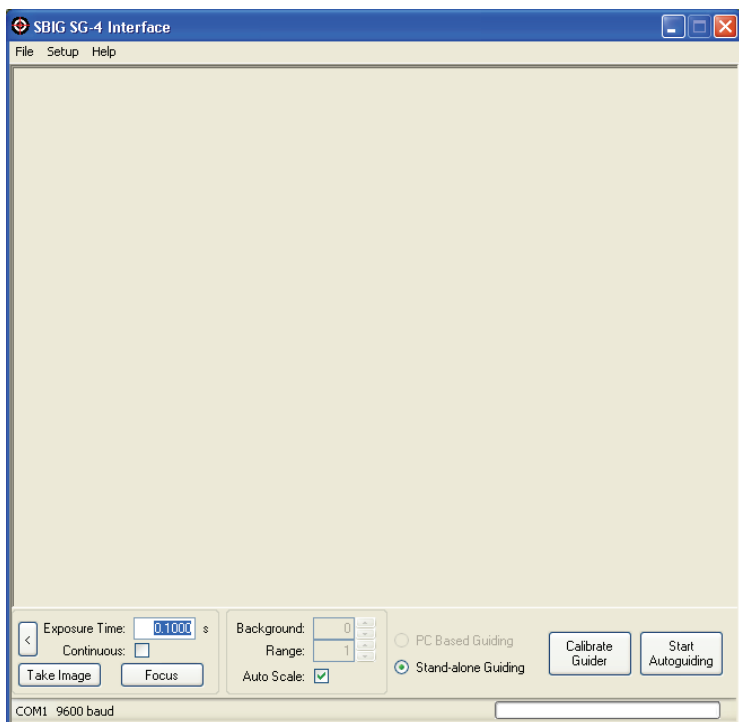


Figure Three: SBIG SG-4.exe Opening Window

Once you have installed the software, begin setting up the SG-4 by establishing communication with the SG-4. Do this using the Setup menu item - Serial Port. This will open up a window you can use to test the RS-232 link. There you can enter the COM port and the baud rate, and hit TEST. If you are successful, a box will pop up saying so. Note that when the Test Button is pushed, it automatically tries to communicate with the camera on the selected COM port, starting at 9600 baud and working it way up in speed. If it successfully finds a camera it tells the camera to switch to a higher baud rate and try that. If it cannot communicate at the higher baud rate, it reverts back to the last successful baud rate. This all happens automatically without user control. The reason you need to know this is if you try the camera indoors on a computer with a fast link, and then move outside to a laptop with a slower link, the camera may not communicate. When this happens, the camera can be reset to 9600 baud by turning off the power, and holding down the Guide On/Off button while powering up the camera, and holding it until the status LED turns red. Then when the Serial Port command is run it will start out at a baud rate that will work on any machine (9600).

Once you have successful communication click the “Take Image” box and the computer will automatically initiate an exposure of the commanded length and download it to the PC. The counts in the image under the cursor will be automatically displayed in the bar at the bottom of the program window when you drag the mouse over the window, so you can check that you are sensing light by trying exposures in the dark and such. Also, clicking the small arrow on the left side of the screen (near the “Take Image” box) will open up a camera control window that allows you to capture a dark, or a binned image for focusing or experimentation. In normal operation you don’t need the commands under this window but they are handy for initial checkout. The binning is done on-chip. Once you are comfortable that the camera is working properly you are ready for the next clear night!

Setup under the stars:

Mount the SG-4 to your intended guide scope using either the T-ring threads on the face of the SG-4, or by means of the 1.25 inch nosepiece that is provided with the camera, screwed into the T-ring threads. One should use a guide scope of at least 100 mm focal length with the SG-4. A focal length of 200 to 400 mm is optimal, with as fast an F/number as you can find. We estimate that 95% of the time the SG-4 will find a guide star bright enough for a one second guide exposure if your guide scope F/number is F/7 or faster. A small, quality 60 to 80 mm aperture refractor is ideal. Point the telescope at a bright star (but not the moon or a planet), start up the SG-4 software, select a 1 second exposure, select the “Continuous” box, and click the “Take Image” box. The software will repetitively take images and display them. This can be slow, but start this way your first night. You should see out-of-focus star images. Adjust your guide scope focus until the images are only a few pixels out of focus, which can be slow, and then click “Abort”. When the process stops, adjust your exposure time if necessary (i.e., if the counts are over 10,000 in the center of the star), and then select “Focus”. Focus will take a full image, after which you click on the brightest star and tell it to resume. It will then zoom into a small focus box that updates more rapidly, speeding the process.

If you have a slow baud rate, you can speed up initial focusing by opening up the camera control window and selecting 2x2 binning. This will download 4 times faster, which makes it easier to initially find a star but is not as good for final focusing.

The assumption we have made here at SBIG is that you will leave the SG-4 attached to the guide scope and do not change the focus, or you will mark or scribe or lock down the drawtube so you can repeat your focus position in the field without a computer, once you have determined it.

Once you have found the best focus (it is not that critical for guiding), make sure the phone guiding cable is connected between your mount and the SG-4. Position an isolated bright 3rd to 5th magnitude star located within 20 degrees of the celestial equator onto the center of the SG-4 field using the “Take Image” and “Continuous” controls, and click “Calibrate Guider”. The guider will attempt to calibrate the mount speed. A pop-up text window will appear so you can see the process. The SG-4 starts out with a series of small moves with the “X” relay, which should be in the Right Ascension direction, but by no means is necessarily in the X-direction on the screen or on the CCD. Once it detects movement, it knows the backlash has been taken out of the mount and it makes a few long moves to calibrate the speed. Once it finishes in X the SG-4 will assume the speed in the -X direction is the same, but in the opposite direction, and it will start the same calibration process in Y. When it finishes it will display the calibration vectors it found. It is a good idea to check out these vectors to see if the speeds are reasonable. Most mounts correct at a speed of around 7.5 arcseconds per second, which is about 5 pixels per second with a focal length of 1000 mm. With a 200 mm focal length it will be 1 pixel per second. When the calibration finishes save your calibration text file so you can send it to customer service at SBIG if there is a problem. The calibration you obtain should work at any declination so, as long as you don’t rotate your camera or the guide scope, or reposition the guide scope on your main scope, the vectors should be good. If you have a German Equatorial mount take note of the position of the East/West toggle switch on the back of the SG-4 and remember to keep it in the same place when on the same side of the pier. Do not worry about which is East and which is West – it doesn’t matter as long as you remember which side of the pier you were on. Note, however, that the SG-4 assumes that +X and -X correspond to RA motion for this switch to function properly with a GEM. If you flip the telescope to the other side, flip the switch to flip the calibration vectors. NOTE: if you forget to flip it the mount will immediately run away in one axis while tracking, with your corrections getting longer and longer. That is how you will recognize this problem. Also, if calibration fails, you will not be able to track.

Tracking:

To track, close the text window if it is still up from calibration, and click “Start Autoguiding”. Another text box opens up to show the results. The SG-4 begins by taking a series of exposure, each time increasing the exposure time, until it finds a guide star. When a suitable star is found it starts guiding. The mount should begin tracking the star with a series of rapid corrections between every exposure, if necessary. If the star is lost due to clouds the SG-4 will start beeping, but the star has to fade a lot, by 10X or so, before it will be lost. When you are done guiding you can click “Abort” in the text window and the process will stop, and you can save the results. To review these results later, or those from calibration, use the Windows Notepad program, or Word, to open the files.

Under SETUP you will find a Guiding Parameters choice, which allows you to customize the tracking somewhat. The MIN MOVE is the smallest move the SG-4 will bother sending to the mount. Most mounts barely respond to corrections less than 0.1 second in length, so we recommend you leave this correction at 0.05 seconds. The MAX MOVE command stops the mount from making a big move. This is useful since satellites do occasionally drift through the track box, or you might get a radiation hit on the detector within the track box that could also cause the mount to jump away from the star momentarily. This setting should be set to 0.5 to 1.0 seconds.

You can also set the guiding aggressiveness. Aggressiveness tunes the response of the SG-4 and mount to the star position error. Lets say the star is 5 pixels off the desired position and the correction speed is 10 pixels per second. With an aggressiveness of 1.0 the mount would make a full move of 0.5 seconds. If the aggressiveness is 0.2 then the move would only be a fifth as much, or 0.1 second. With a good mount with little periodic error you should set the aggressiveness low to minimize the guider trying to follow the star hopping around in moments of poor seeing, say to 0.2 to 0.5. If your mount has a lot of periodic error you should set the aggressiveness to 1.0 or the star position will lag behind its actual position when the mount pointing is drifting. The aggressiveness can be set to different values for X and Y. Since Y is usually Declination, where errors occur slowly even on a mount with

poor periodic error performance, it can be set lower than X. When tracking is successful the status LED on the back of the SG-4 panel will blink green between exposures.

Re-programming the SG-4:

Program updates will be available from time to time for the SG-4, and the device is easily reprogrammed in the field using the following procedure:

- 1) within the SBIG SG-4 INTERFACE program, select HELP from the top task bar menu, and select ABOUT
- 2) click the REPROGRAM button
- 3) browse to the new program file (.BF2)
- 4) select "OK"

At the end of reprogramming turn power off to the camera and turn it back on to force a fresh boot of the camera. You will also want to perform a fresh calibration.

III. SG-4 Stand-alone Operation

Overview

Once you have set up the SG-4 as described in the preceding sections, no computer is needed at the telescope. In fact, except for initial focus, most of the setup could be done without a computer. When the SG-4 is powered up, but doing nothing, the STATUS LED glows a steady red. To calibrate the SG-4 at the telescope, simply hold down the GUIDE ON/OFF button about 5 seconds until the STATUS LED flashes red slowly and then release it. The LED will blink red a few more times, and then go to a faster blink rate while the SG-4 looks for a star. When it finds the star, and is calibrating, it will blink green. The calibration will proceed automatically. When the STATUS LED goes to steady RED again, calibration is done. To start tracking, depress the GUIDE ON/OFF button momentarily. The STATUS LED will blink rapidly red while the SG-4 searches for a star. After the unit finds a star and begins tracking the LED blinks green. To stop tracking before moving to another field press and hold the GUIDE ON/OFF button until you see the STATUS LED revert to a steady red glow. Then release the GUIDE ON/OFF button.

Stand-Alone Guiding – Step-by-step

Power

10.5 - 14V DC is required on the Power In connector to operate the guider.

Guide Port

A 6P6C connector and cable must be connected between the SG-4 and the mount's guide port. See the appendix of this manual for wiring details.

Calibration

- Power-on the SG-4, wait for the Status LED to turn solid red.
- Push and hold the Guide On/Off button until the Status LED blinks slowly red (about 5 seconds).

- Immediately release the Guide On/Off button.
- After the slow blinking stops, the Calibration process will begin by attempting to find a star to calibrate on. During this process the Status LED will blink red at various rates.
- If a star is found, the Status LED will change to green, and will continue to blink at various rates.
- If no star is found, the Status LED will change to solid red.
- When the calibration is complete, the Status LED will change to solid red. The calibration vectors are stored in the camera's non-volatile flash memory, so if power is lost the camera can be guided again without re-calibrating.

Guiding

- Power-on the SG-4, wait for the Status LED to turn solid red.
- Push and release the Guide On/Off button. The Status LED should now blink quickly red.
- After the fast blinking stops, the Guiding process will begin by attempting to find a star to guide on. During this process the Status LED will blink red at various rates.
- If a star is found, the Status LED will change to green indicating guiding is active. The Status LED will continue to blink at various rates. Guiding will continue until aborted.
- If no star is found, the Status LED will change to solid red.

Aborting either Calibration or Guiding

- Push and hold the Guide On/Off button until the Status LED is solid red.
- Release the Guide On/Off button.
- The Status LED may turn off momentarily.
- When idle, the Status LED will be solid red.

Troubleshooting:

If you find you are getting elongated stars in your guided images there are a few tests you can do to narrow down the culprits. If short guided exposures of 1 to 2 minutes exhibit good guiding, then the problem is most likely field rotation due to poor polar alignment, or differential deflection. If you have an Alt-Az mount, you will only be able to take exposures of 30 to 60 seconds before the stars at the edges of the field smear badly. This is easily recognized since the stars are smearing about a point in the field. If you are on an equatorial mount, then even with poor polar alignment you should not see this effect on exposures less than 15 minutes in length. With good alignment you can go hours.

Differential deflection is very common. This occurs when the guide scope pointing direction shifts relative to the main scope as the combination rotates and the gravity load changes direction. It may not even be in the mounting of the scopes – the primary mirror on a Schmidt-Cassegrain scope might shift slightly. The problem is such that one can usually go 5 minutes, but seldom more than 15 minutes, even on a good setup. It can be reduced by making sure your guide scope (or main scope) does not have a sloppy focusing mechanism (it doesn't take much!), your SCT secondary adjustment screws are not loose, your guide scope is not loosely clamped in O-rings or soft felt rings, and you have at least two well spaced rings to hold the guide scope. Fortunately with CCD cameras and even DSLR cameras, exposures of 5 to 15 minutes are commonly used when aggregating multiple exposures. With film, however, where individual exposures can be an hour long and it can take a day or two to see your results, this problem is non-trivial to solve.

IV. The SG-4 Interface Software

Introduction

The SG-4 Interface Software is a tool for setting up the SBIG SG-4 Stand-Alone Guider. The steps for setting up the SG-4 are described in the previous sections of the manual. This section describes the software commands in more detail. The software provides the following functionality:

- Guider parameter adjustment
 - Min/Max Move
 - X and Y Aggressiveness
- Focus Assistance
- Image Capture
- Image Saving (JPG or FITS)
- Initiation and monitoring of:
 - Stand-Alone Calibration
 - Stand-Alone Guiding

Further details about the functionality of the SG-4 Interface Software can be found by browsing the software help files.

Menus

File Menu

The File Menu offers commands to save the most recent image downloaded from the SG-4.

Commands

Save As FITS...

Opens the Save As dialog box. After a file name is entered, the software will save the current image in FITS format.

Save As JPG...

Opens the Save As dialog box. After a file name is entered, the software will save the current image in JPG format using the current screen stretch.

Exit

Closes the application.

Setup Menu

The File Menu offers commands to save the most recent image downloaded from the SG-4.

*Commands***Serial Port...**

Opens the Serial Port Setup dialog where the RS-232 port settings can be configured.

Guiding Parameters...

Opens the Guiding Parameters Setup dialog where the parameters for the internal guiding routines can be set.

Windows and Dialogs**Main Window**

The SG-4 Interface Software main window contains the most commonly used functions when operating the SG-4 guider.

The main central region is available to show the most recent image taken by the SG-4.

*Entries***Exposure Time**

Sets the exposure time for the next image. The minimum exposure time supported by the SG-4 Interface Software is 0.01 seconds. The maximum exposure time is 655 seconds.

Continuous

Causes the SG-4 Interface Software to continually take images when the "Take Image" button is pushed. When not checked, the software will take only one image.

Background

The pixel value that will be assigned to absolute black in the displayed image. This value is disabled when "Auto Scale" is checked.

Range

The span of pixel values between absolute black and pure white in the displayed image. This value is disabled when "Auto Scale" is checked.

*Commands***Take Image Button**

Takes an image of the specified exposure time. While the exposure and download are in progress, this button text will change to "Abort Image". If "Continuous" is checked, the software will continually take images until the "Abort Image" button is pushed.

Abort Image Button

Stops the current exposure and download. When the abort process is complete, the button text will change to "Take Image".

Focus Button

Starts the Focus process. This process begins by taking a low-resolution image and displaying it in the image area. While the exposure and download are in process, this button text will change to "Abort Focus". When the low-resolution image is ready, the status text will state "Click on a feature to focus on..." and the button text will change to "Continue".

Continue Button

After a clicking a feature in the image to focus on, pushing this button will continue the focus process. After clicking the button text will change to "Abort Focus" and a full-resolution sub-frame image will be displayed in the image area. The sub-frame will continuously be updated until the "Abort Focus" button is pushed.

Abort Focus Button

Stops the Focus process and returns the software to an idle state.

Auto Scale

Automatically adjusts the Background and Range for the current image. Un-check this to allow manual setting of the Background and Range.

PC Based Guiding

Causes the "Calibrate Guider" and "Start Autoguiding" buttons to execute the guiding on the PC. This requires user intervention in the guider setup (star identification), but also allows image monitoring during calibration and guiding. ***This function is currently disabled.***

Stand-alone Guiding

Causes the "Calibration Guider" and "Start Autoguiding" buttons to execute the stand-alone guide functions within the SG-4. This is faster and completely automated, but only outputs a textual log during calibration and guiding.

Calibrate Guider

Executes the guider calibration routine.

Start Autoguiding

Executes the guiding routine.

Status Bar

The SG-4 Interface Software Status Bar shows current information about the state of the software.



Indicator Description

- The first item shows the current RS-232 COM port.
- Second is the current RS-232 baud rate.
- Next is the current pixel location where the mouse is pointing in the image and the pixel value of this location.
- Fourth is the status text for the current process. Depending on the current process, this text will change.

- Last is a progress bar indicating progress of whatever is listed in the status text. In the screen capture above, the image download is about 70% complete.

Serial Port Setup Dialog

The Serial Port Setup Dialog allows setup and testing of the RS-232 port.

Dialog Entries

COM Port

This specifies the COM port number that the SG-4 is connected to. If you have multiple COM ports, you may have to experiment to determine the correct number or try the "Find Camera" button.

Baud Rate

The drop-down list shows all the baud rates supported by the SG-4 and this software. The default baud rate for the camera is 9600 baud.

Find Camera Button

After pushing this button, the software will scan all the currently active RS-232 ports on the PC and attempt to talk to the SG-4. If the SG-4 is found, the software will then try to determine the maximum baud rate the SG-4 can successfully communicate at. If you have other RS-232 devices connected, this routine may send data to these devices. Expect undetermined operation from these devices when using this function.

Test Button

Pushing this button will cause the software to attempt to connect to the SG-4 camera. If the software finds the camera at the specified COM port, but at a different baud rate it will attempt to change the baud rate to the requested value. If it cannot communicate with the camera at the requested COM port or baud rate the test will fail. If the test succeeds, the Ok button will be enabled.

Ok Button

This accepts the COM Port and Baud Rate and closes the dialog.

Cancel Button

This discards any changes to the COM Port and Baud Rate and closes the dialog.

Notes

While the camera does ship from the factory set to 9600 baud, it is possible that communication with the camera may fail when using third-party adapters (e.g. Bluetooth) that do not operate at this baud rate. Thus you must first connect to the SG-4 using a hard-wired RS-232 (or USB-to-RS-232) link. When the "Test" button is used and a successful connection is established at a baud rate, the SG-4 will store the baud rate into its non-volatile memory and always use the new baud rate.

Since it is possible to use high speed baud rates not always supported (230400 baud, and 460800 baud) there may be a situation where the camera is set to a baud rate the PC cannot achieve. If the "Test" button fails at any Baud Rate and the COM Port is correct, the SG-4 can be reset back to 9600 baud using the following procedure:

- Power-off the camera.
- Push and hold the Guide On/Off button.
- Power-on the camera.
- Release the Guide On/Off button when the Status LED is red.
- Cycle power to the camera. Now the camera will be reset to the default 9600 baud.

Guiding Parameters Setup Dialog

The Guiding Parameters Setup Dialog allows setup and testing of the parameters used by the SG-4 internal guiding routine.

Dialog Entries

Min Move

This defines the minimum time (in seconds) that any guide relay will be closed. Any centroid error resulting in a relay closure less than this time will simply be ignored and the next image will be taken.

Max Move

This defines the maximum time (in seconds) that any guide relay will be closed. Any centroid error resulting in a relay closure greater than this time, will instead close the relay for the Max Move time.

X Aggressiveness, Y Aggressiveness

When the guide algorithm determines the relay close time necessary to center the guide star, before it closes the relay it will scale the relay close time by the aggressiveness value. A value of 1.0 will use the fully calculated relay close time. A value of 0.5 will use half of the calculated relay close time. These parameters can be set to 0 to disable the X or Y relays completely.

The "X Aggressiveness" value is applied to the X relays, and the "Y Aggressiveness" value is applied to the Y relays.

SG-4 Log Dialog

The SG-4 Log dialog window displays the current text output from the internal calibration or guiding routines in the SG-4. These can be used to monitor and validate operation.

The logs during guiding include the guiding results that can then be evaluated for guiding performance at a later time.

Dialog Entries

Abort Button

Pushing this button aborts the calibration or guiding process. This is equivalent to pushing the button on the back of the camera.

Save Log Button

This button opens the Save As dialog box allowing the log text in the window to be saved for later use.

Close Button

This closes the SG-4 Log dialog window and returns operation to the main window.

V. Further Help

Contacting SBIG

At SBIG we pride ourselves in our products and our commitment to you, our customer. We want to hear from you when things go right and we want to hear from you when things go wrong, as they sometimes do. Please help us make our products better by giving us your feedback. Feel free to contact us:

Phone

(805) 571-7244

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Home Page

<www.sbig.com>

Frequently Asked Questions Database

<www.sbig.com/FAQ/SBIGFAQ.htm>

User List Server

subscribe from our home page

US Mail/Shipping Address

Santa Barbara Instrument Group
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Santa Barbara, CA 93117

Appendix A: Bluetooth RS-232 Operation

SBIG has experimented with operation of the AllSky-340 camera using a wireless Bluetooth RS-232 solution. The AllSky camera incorporates the SG-4 as the imager. We have had good luck running the camera over Bluetooth for a number of months. While we do not recommend using Bluetooth for initial setup of the SG-4 for Autoguiding, you may wish to use Bluetooth for image downloads from time to time or for remote control of the SG-4. The instructions for using Bluetooth with the SG-4 are identical to the AllSky camera:

About the AIRCable Serial3X

The product we have been using is the AIRCable Serial3X Bluetooth device. We use two of these products – one on the AllSky-340 camera and one on the PC. The external antenna gives good range, and the camera-side device is able to get 12V DC directly from the camera's RS-232 port.

Information about the AIRCable Serial3X is available here: <http://www.aircable.net/serial3x.html>

The device can also be purchased from the above site. Be sure to order two devices.

AIRCable Serial3X Setup

As they are delivered, the two AIRCable Serial3X devices are not setup to talk to each other. The process of “pairing” the devices is fairly simple, but does require using a PC based terminal, like HyperTerminal. The instructions here show how to configure the devices using HyperTerminal.

Disclaimer: The process shown here is what worked at SBIG. SBIG does not support the AIRCable Serial3X devices. The procedure outlined below may or may not work on all Serial3X devices.

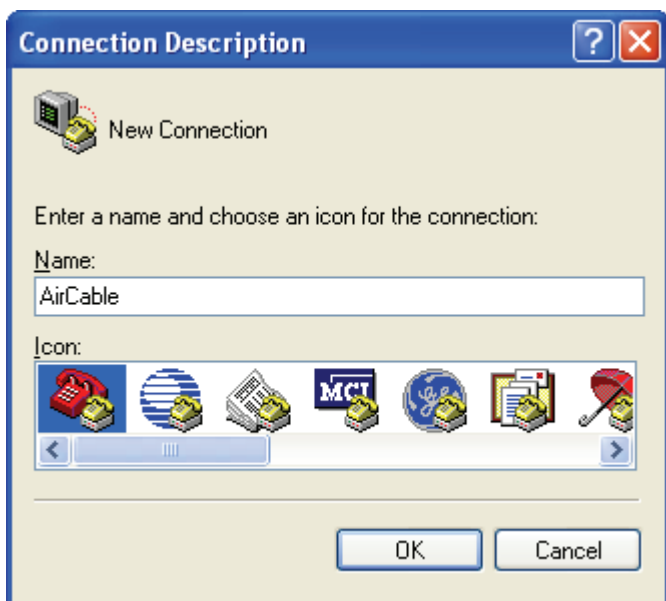
On both Serial3X devices, set the dip switches as follows. For the units we have tested: ON is away from the dip switch

numbers, OFF is close to the dip switch numbers.

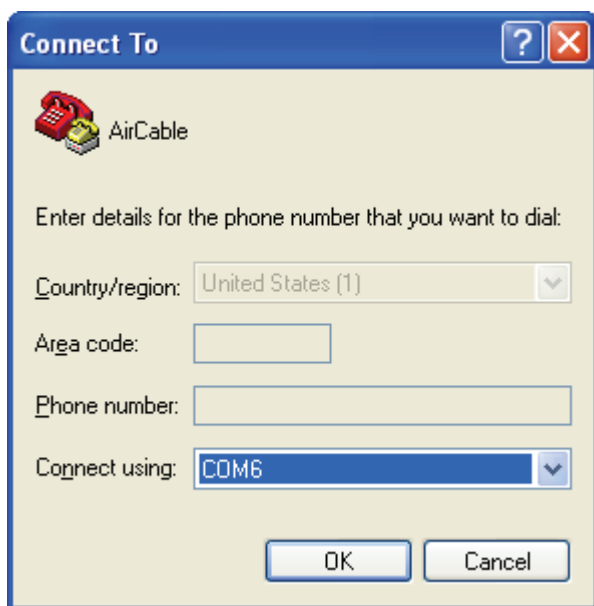
- 1 → ON
- 2 → ON
- 3 → ON
- 4 → OFF

Start with one of the two Serial3X devices.

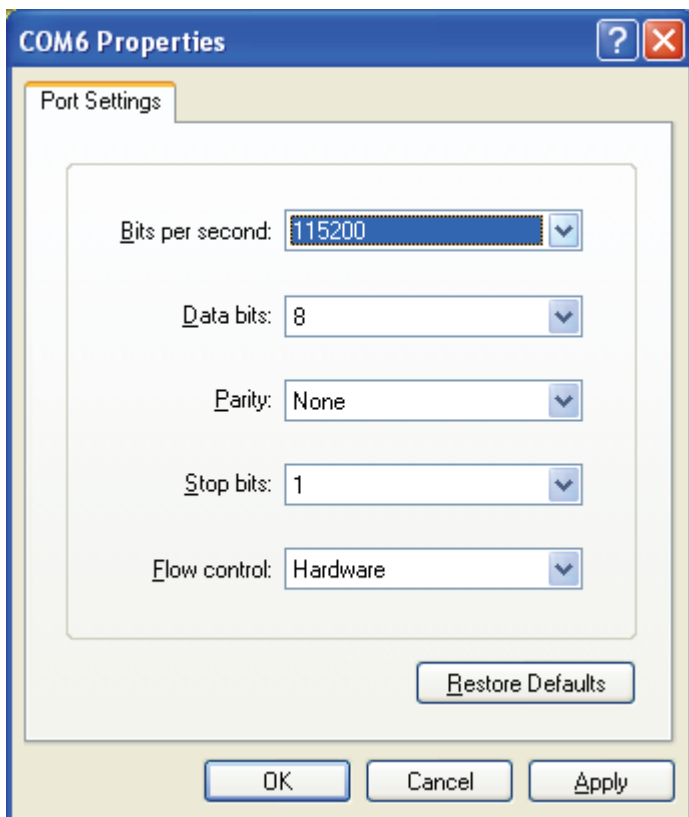
- Connect the power cable to the device and confirm that the red LED turns on.
- Connect an RS-232 cable to the PC (can be connected through a USB-to-RS-232 adapter).
- Connect the RS-232 cable to the null-modem connector included with the Serial3X device.
- Connect the null-modem connector to the Serial3X.
- Open HyperTerminal
In Windows XP this is normally at:
Start→All Programs→Accessories→Communications→HyperTerminal
- In the Connection Description, type anything you desire and click Ok.



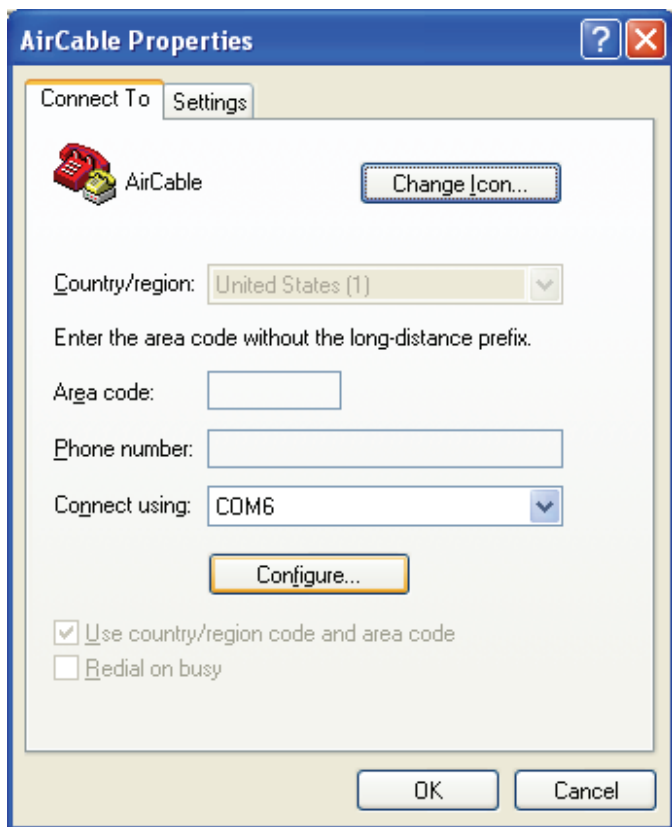
- Select the COM port that the RS-232 cable is connected to and click Ok.



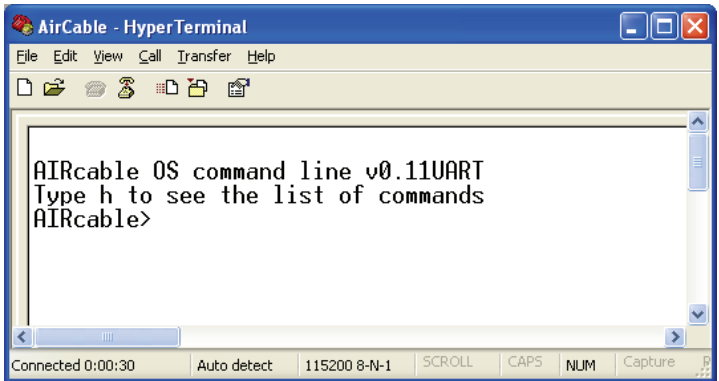
- Set the Bits per second to 115200, Data bits to 8, Parity to None, Stop bits to 1, Flow control to Hardware and click Ok.



- Go to the Call menu and select Disconnect.
- Go to the File menu and select Properties.
- Click the Configure button.



- Confirm the settings entered previously, click Ok then Ok again.
- In the HyperTerminal window, now push the + key three times and then push the Enter key.
- Wait at least 30 seconds. This should appear:



- Type the following commands. Text listed between <> indicates instructional text, not the actual text to type into HyperTerminal. When <Enter> is listed, push the Enter key on the keyboard. Do not push the Enter key unless it is specifically stated.
 - a
 - 3
 - n
 - <Type in a unique name of your choice. This IDs your device pair. Use only letters and/or numbers.>
 - Write the ID name here: _____
 - <Enter>
 - p
 - <Type in a unique 4 digit PIN. This sets the password for your device pair.>
 - Write the 4 digit PIN here: _____
 - <Enter>
 - u
 - 1152
 - <Enter>
 - 0
 - 0
 - e
- This device is now setup as the “Slave” device. This is the device that will connect to the AllSky-340. It may be helpful to write an “S” or other identifying mark on

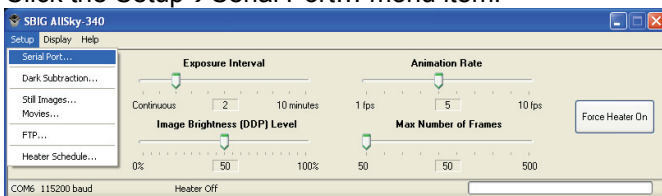
the device.

- Disconnect the “Slave” device from the null-modem connector and set aside. (Keep the power connected to the Serial3X.)
- Connect the other Serial3X device to the null-modem connector and connect the power supply.
- In HyperTerminal, again push the + key three times and then push the Enter key.
- Wait at least 30 seconds. This command prompt should again appear.
- Type the following commands. Text listed between <> indicates instructional text, not the actual text to type into HyperTerminal. When <Enter> is listed, push the Enter key on the keyboard. Do not push the Enter key unless it is specifically stated.
 - a
 - 4
 - b
 - <Type the same unique ID name you entered for the “Slave” device.>
 - <Enter>
 - p
 - <Type the same unique 4 digit PIN you entered for the “Slave” device.>
 - <Enter>
 - u
 - 1152
 - <Enter>
 - 0
 - 0
 - e
- This device is now setup as the “Master” device. This is the device that will connect to the PC.
- At this point the Serial3X devices will attempt to communicate with each other. The green LEDs should both be on solid and the blue LEDs will occasionally blink. Before about 2 minutes, both devices should show both the blue and green LEDs on solid.
- Remove the “Master” Serial3X device AND the null-modem adapter from the RS-232 cable.
- Close HyperTerminal.
-

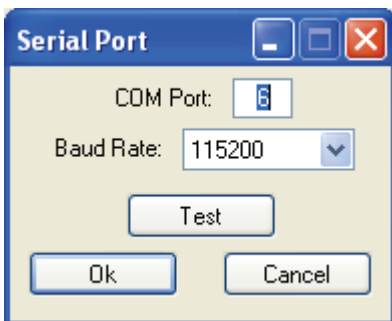
AlISky-340 Setup

The Serial3X devices have been setup to run at 115200 baud over the wireless link. The devices are not capable of communicating at any other baud rate. Thus the AlISky-340 must also be setup to communicate at 115200 baud.

- Connect the RS-232 cable from the PC to the AlISky-340.
- Power on the AlISky-340.
- Run the SBIG AlISky-340 software.
- Click the Setup→Serial Port... menu item.



- Set the proper COM port number and select 115200 baud.



- Click the “Test” button.
- If the AlISky-340 software is able to communicate with the camera (“Test successful!” window will show up), it will set the baud rate in the camera to 115200 baud. This will now be remembered even after power-off.

Final Steps

- Turn off the AlISky-340.
- Disconnect the RS-232 cable from the AlISky-340.
- Connect the “Slave” Serial3X device to the RS-232

- port on the AllSky-340.
- Connect the “Master” Serial3X device with the null-modem adapter to the RS-232 cable connected to the PC.
- Turn on the AllSky-340.
- Confirm the green and blue LEDs on both Serial3X devices turn on solid.
- In the AllSky-340 software, click the “Test” button again.
- Congratulations! Setup is now complete!

AllSky-340 Bluetooth RS-232 Known Problems

While the Serial3X devices generally work well, operating them 24-hours a day, 7 days a week does expose some minor problems.

Long Image Downloads

The wireless Bluetooth operation occasionally experiences transmission errors – especially when operating over longer distances. The AllSky-340 software can catch most transmission errors and will retry the most recent packet of image data. Occasionally the most recent packet cannot be recovered and the entire image download will be restarted. This can extend the image download time considerably. Larger gain antennas for the Serial3X may help with this problem.

Corrupted Images

Not all transmission errors are detected by the AllSky-340 software. Because of this, an occasional corrupted image may be shown. This is simply an result of the imperfect wireless connection. The worst case is when a dark frame is corrupted. This can impact a number of light frames downloaded from the camera. If a large number of images are corrupted, try reducing the distance between the Serial3X devices, or change to a larger gain antenna.

Communication Failure

At SBIG we have seen, on a regular basis, that the Serial3X devices fail to properly communicate to each other – or at least between the PC and the AllSky-340 camera. The failure could mean that no communication is possible, or that some communication is successful but that the image doesn't download.

We have seen this communication failure happen as frequently as every few weeks.

To fix the problem, the Bluetooth link between the Serial3X devices has to be reset. This can be done one of two (known to us) ways. Both involve manipulating the "Master" Serial3X device (the one connected to the PC).

Method 1. Push and hold the button on the Serial3X device for approximately 10 seconds. The blue and green light should go off. Release the button. The Serial3X device will now reboot and should re-establish a link to the "Slave" device connected to the AllSky-340. After a few seconds, the blue LED should turn on solid. Communication should now function normally.

Unscrew the external antenna from the Serial3X device. Set the antenna aside. Place the antenna connector on the Serial3X in the palm of your hand. Close your hand about the connector while watching the blue LED. When the blue LED turns off, the Bluetooth link has been broken. Reconnect the external antenna. After a few seconds, the blue LED should turn on solid. Communication should now function normally.

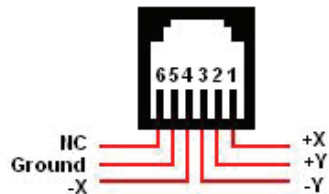
Appendix B: Connectors

Power In Jack: The POWER IN jack is used to supply 12VDC at ~0.2 amps to the camera (10.5 – 14 VDC, 2.3 watts). The jack is locking and *center-positive*. The mating plug is the locking model *Switchcraft S760K* with 0.218 inch outer diameter and 0.080 inch inner diameter (5.5/2.0 mm).

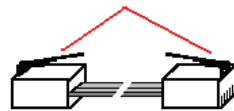
POWER JACK



Guide Port: The Guide Port is where you connect the SG-4 to the autoguider port on your telescope using the supplied relay cable (6 conductor phone type cable). Viewed from outside the back plate of SG-4, looking in, it has the pin-out configuration shown in the diagram at right. Pin 6 is not connected. The +X, +Y, -X and -Y signals are driven from mechanically isolated relays so there is no need for additional opto-isolated relays or relay box for use with any telescope. **Note: In order for the East/West toggle switch to function properly with GEM mounts, the SG-4 assumes that +X and -X moves correspond to RA on your mount.**

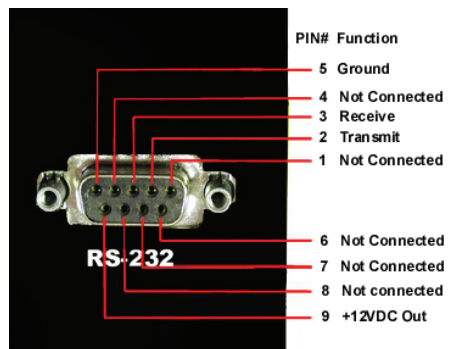


Clip is on same side of flat cable at both ends



RS-232 Port: The RS-232 port is used to connect the SG-4 to a serial port on your computer.

Note: Pin 9 supplies +12VDC out when the SG-4 is receiving power through the POWER IN jack. This allows a Blue Tooth wireless transmitter to be connected directly to this port and it will receive power from the SG-4. A serial to USB adapter may also be connected here if your computer does not have an RS-232 (serial) port. Adding accessories powered by this port will increase the power requirements for the camera by the amount used for the accessory. Our standard power supply is more than adequate for most applications.



Appendix C: Typical Specifications

CCD: Kodak KAI-340, 640x480 @ 7.4 microns square

Read Noise: Under 15 electrons rms at 1:1 binning

Operating Temperature Range: -10 degrees C to +45 degrees C

Storage Temperature Range: -20 degrees C to +50 degrees C

Internal Read Time to memory buffer: <1 second

Minimum Exposure Time: 0.1 second

Maximum Exposure Time: 10 seconds (10 min. when used with a PC)

Shutter included for remote or automated dark frame acquisition

Size: 2.8 x 4.3 x 3.5 inches in size (71x110x88 mm)

Weight: 1.0 pound (0.4 Kg)

Power Requirements: 12VDC, 200mA.

(Note: If using the SG-4's RS-232 port to provide power a USB adapter or Bluetooth transmitter, the camera's power requirements will increase by the requirement of the adapter. The Bluetooth transmitter tested at SBIG added 50mA).