gbdtDSLR

A CCDSoft®-compatible camera plug-in for
Canon DSLR cameras.

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Support

Information on the gbdtDSLR plug-in can be found at out website
http://dslr.gbdt.com.au

Support is provided via our YAHOO group at
http://groups.yahoo.com/group/ccdsoft_dslr

The author can be connected by email at mailto:dslr@gbdt.com.au

Introduction

Thank you for considering gbdtDSLR for your astronomical imaging needs.

gbdtDSLR is a camera plug-in for CCDSoft Version 5 (5.00.184 or later) that allows CCDSoft to control and acquire images from Canon DSLR cameras using the Digic II and Digic III chipsets. Camera using these chipsets include the 1Ds Mark II, 5D, 20D, 350D/Rebel XT, 400D/Rebel XTi, 450D/Rebel XSi. Support for newer cameras can be added on request.

This version of the plug-in does not support the older Digic I-based cameras such as the 1Ds, 10D, and the 300D/Rebel. These are supported by an older version of the plug-in available on our website.

The features of this plug-in include:

- RAW images can be saved to computer hard disk for use with other image processing programs
- Optional mirror lockup with user-specified time between lockup and start of exposure
- Several shutter release methods are used to support long exposures (longer than 30 seconds) and to allow the use of mirror lockup.
- The Av exposure mode is supported to simplify collection of flat frames
- Support for scripting and automated operation (errors reported via a log rather than with popups) is available to simplify scripted or remote operation
- Allows a DSLR camera to operate as a single-shot color camera in CCDSoft
- Runs under Windows2000 and WindowsXP

Requests for new features are always welcome and can be sent via the Yahoo support group.

What you need

To use the plug-in you need the following:

- A computer or computers[1] with CCDSoft installed (version 5.00.184 or later) installed

[1] See the gbdtDSLR EULA for information about installing and running the plug-in on multiple computers.

- The latest camera drivers for your camera installed on the computer(s) if drivers are required for you camera. These should be available from your regional Canon website
- A supported Canon DSLR camera, with the latest firmware installed. This firmware should be available from your regional Canon website
- A USB cable to connect the camera to the computer

Several types of shutter release cable (serial port, parallel port, and Shoestring DSUSB) are supported.

Users of Digic II-based cameras will require a shutter release cable for exposures longer than 30 seconds, or to use mirror lockup.

Users of Digic III-based cameras will require a shutter release cable to enable mirror lockup operation. These cameras can perform long exposures using their USB connection.

Shutter release cables can be purchased ready-built, or can be constructed from plans freely available on the Internet.

Ready-built serial port and parallel port cables can be obtained from:

http://www.hapg.org/astrocables.htm

Shoestring DSUSB units are designed and built by Shoestring Astronomy and can be purchased directly from Shoestring Astronomy.

http://www.store.shoestringastronomy.com/products_ds.htm

Instructions on building your own serial or parallel port cable can be found at:

http://www.covingtoninnovations.com/dslr/CanonRelease.html

There are other cable suppliers[2] in various countries that may be more conveniently located – try searching for canon remote shutter cables in Google.

Each type of remote release cable has its own advantages and disadvantages. The following may help in choosing the best type of cable if your setup requires one:

- Parallel port interfaces are still commonly found on laptop and desktop computers. Note that only built-in parallel ports are likely to operate correctly with the plug-in. USB-based printer cables are very unlikely to

[2] If you are a supplier of these cables please contact the author to add a link to your product in this manual.

operate correctly.

- Serial ports are less commonly found on modern computers, but many permanent observatory setups often have multi-port serial interfaces suitable for use with serial port shutter release cables.

  Serial port cables will also operate correctly with USB serial port adapters.

- The Shoestring Astronomy DSUSB is an excellent alternative for setups where USB connectivity is available. This option is far easier to setup (in fact no setup is required!) than using the serial or parallel port cables.

Installing the Camera Plug-in

The gbdtDSLR plug-in can only be installed on a computer that has CCDSoft installed as it is located in the same directories as CCDSoft. Any previous version of the plug-in should be uninstalled using the Windows Control Panel "Add/Remove Programs" option.

Install the plug-in as follows:

1. Download the latest version of the gbdtDSLR plug-in from the gbdtDSLR plug-in website http://dslr.gbdt.com.au

2. Double-click on the downloaded plug-in installation file. The installer will start and lead you through the installation process.

   The gbdtDSLR plug-in EULA is displayed as part of the installation process. The terms of this EULA must be agreed to in order to install and use the plug-in.

3. Attach your camera to a USB port using a suitable USB cable. If an image capture window or other window appears dismiss it.

4. You may need to configure windows to allow the plug-in to access the camera by performing the following steps:

   - From the Windows start menu select 'run'
   - Type dcomcnfg and press OK
   - A new window will pop up. Double click on "Component Services"
   - Click on the small computer symbol in the toolbar
   - On the window that pops up select the 'Default Properties' tab
   - Set the "Default Authentication Level" setting to 'None'
   - Make sure the "Default Impersonation Level" to 'Identify'
   - Press OK to confirm the changes

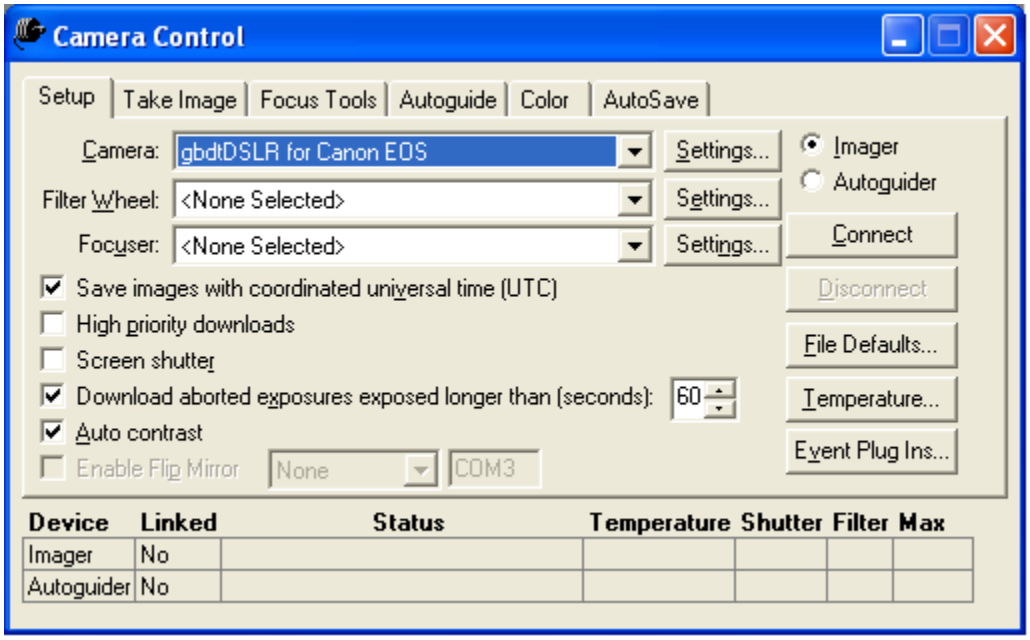
- Reboot the computer

A more detailed version of this procedure can be found in the troubleshooting section of the CCDCommander documentation at http://ccdcommander.astromatt.com/CCDCommander.chm

Note that this will only be required once for a particular computer system (unless the operating system is reinstalled).

5. Start CCDSoft and open the camera window. Select the plug-in from the various camera supported by CCDsoft as shown below.

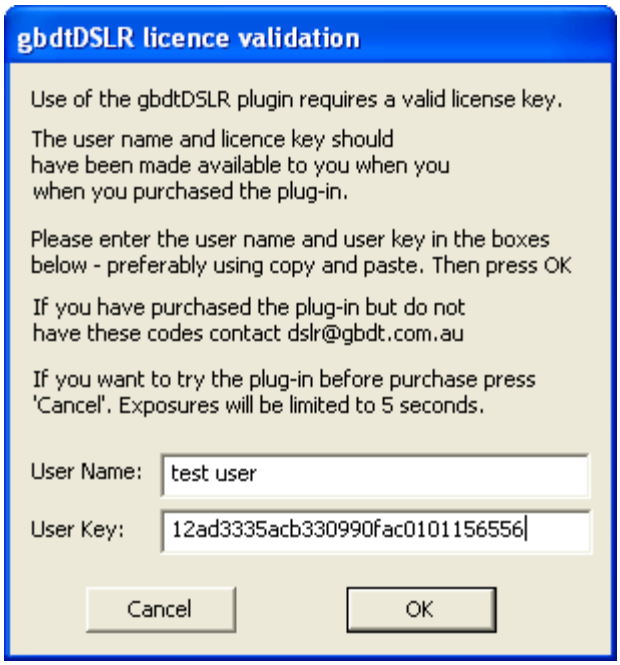
The plug-in will operate in trial mode until a license key is installed. In trial mode the plug-in is fully functional, except that exposures will be limited to a maximum of 5 seconds.



… and press the ‘Connect’ button.

6. The first time you use the plug-in a window will appear asking for the user name and user key provided to you when you purchased the license. The user name and user key must be entered exactly as provided. The best way to do this is to copy the values from the license registration email and paste them into the window.

   Note that the user key is a series of characters that are 0 to 9 and A to F.



If you are absolutely sure that you have entered the user name and user correct correctly (try a few times!) but the window reappears after you press the ‘OK’ button, press the ‘Cancel’ button and contact the author using the email address at the front of this document.

Alternately you can press the ‘Cancel’ button to use the plug-in for pre-purchase evaluation. In this mode exposures will be limited to five seconds. This window will then appear each time you connect to the camera until correct license details are entered.

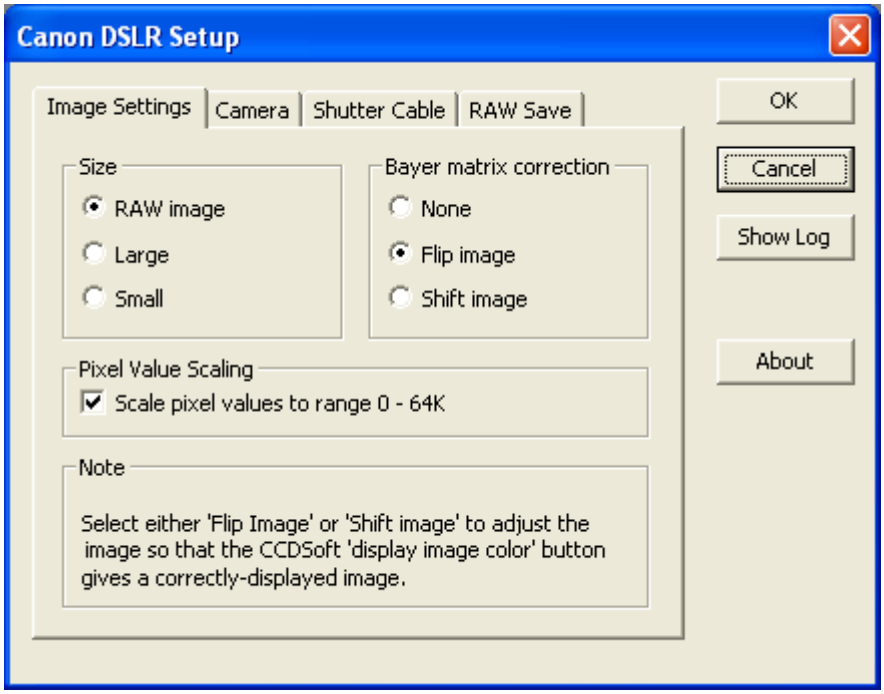
7. Configure the gbdtDSLR plug-in as described in the next section.

During the installation process the plug-in EULA and this documentation will be placed in the CCDSoft Help directory.

Camera Settings

Pressing the ‘Settings…’ button next to the camera on the CCDSoft Camera Control window setup tab brings up the settings window for the gbdtDSLR plug-in. This window can only be accessed when the camera is connected to the PC and the camera is shown as ‘Connected’ by CCDSoft.

The plug-in setup window looks like:



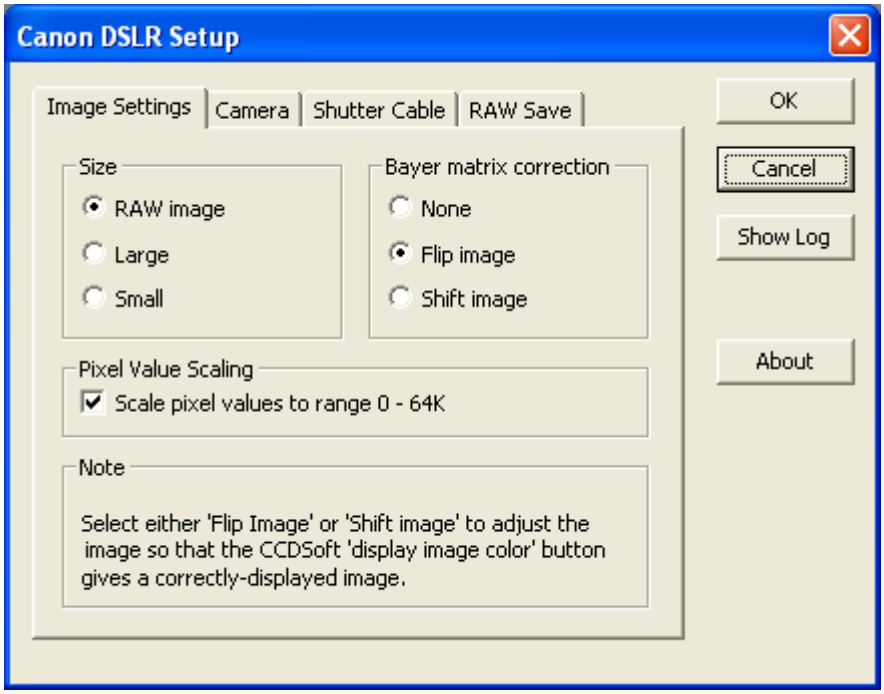
Note that at the top of the setup window there are a set of tabs – “Image”, “Camera” and so forth. Each tab gives access to a different group of settings. Each group is defined in the sections below.

In addition to the settings in each tab there are four buttons always displayed in the setup window:

OK	Save and apply all changed settings. Closes the settings window.
CANCEL	Discard all changed settings and close the settings window.
SHOW LOG	Open the log window. The operation of the log window is described later.
ABOUT	Show the plug-in version and support information. Please include the plug-in version in any communication about the plug-in.

“Image” Settings Tab

Selecting the “Image” tab brings up the following settings:



Size — Select the desired image download size.

RAW image capture provides the largest, highest quality images and this mode is almost always used for astronomical image capture.

Large and small allow the downloading of large or small images from your camera. These may be useful for testing your setup or framing of objects as these images display more quickly.

However these should not generally be used for imaging.

Bayer Matrix Correction — CCDSoft only supports CCD sensors conforming the format used by Kodak sensors. In order to support the CMOS sensor used the Canon DSLR camera it is necessary to modify how the image is passed to CCDSoft.

None specifies that the image is presented to CCDSoft unchanged. In this mode CCDSoft may display the image colors incorrectly. CCDSoft will not be able to correctly process the image, but other programs that do understand the format used by the Canon sensor will be able to process the image correctly.

Flip image specifies that the image be presented to CCDSoft after reversing the image both horizontally and vertically. This preserves all the image pixels and allows CCDSoft to display and process the image correctly but it will be upside down and reversed.

Shift image specifies that a row and column of image data be trimmed from the each edge of the image. This also allows CCDSoft to display and process the image correctly and it will be correctly orientated.

Note that this setting does NOT affect the images saved directly by the plug-in, just the image data passed to CCDSoft.

Pixel Value Scaling — Generally the plug-in passes the raw pixel values to CCDSoft. However some programs (ie. Focusmax) assumes that the pixel values have a certain range.

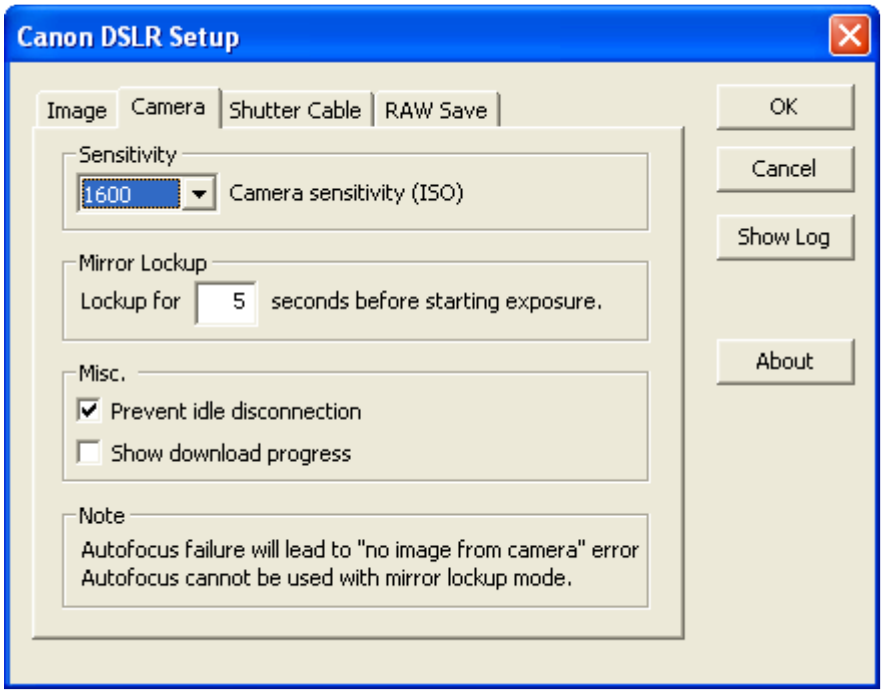
Checking this option tells the plug-in to scale all pixel values to a range between 0 and 65535 (64K).

Note that this setting does NOT affect the images saved by the plug-in directly, just the image data passed to CCDSoft.

Note that changing the Bayer Matrix Correction or Pixel Value Scaling settings may render any existing dark frame library for the camera invalid.

"Camera" Settings Tab

Selecting the "Camera" Settings tab brings up the following settings:



Sensitivity — Selects the camera sensitivity (ISO rating)

Mirror Lockup — Selects the mirror lockup time. This is the amount of time the mirror will be raised before the exposure begins. This allows any vibration caused by the mirror movement to dampen before the shutter is opened.

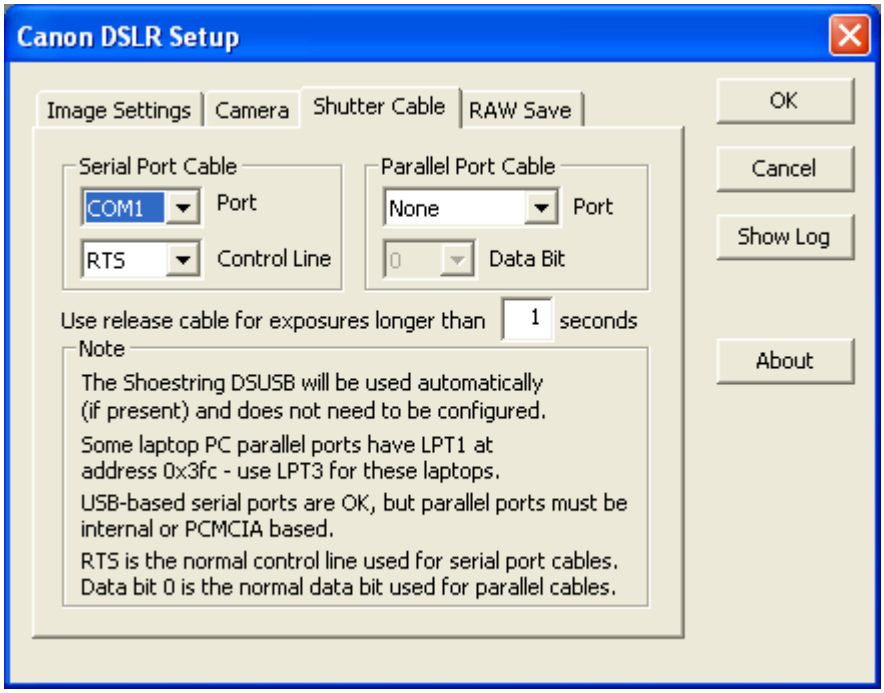
Mirror lockup will only occur if mirror lockup is enabled in the camera custom functions menu, and a remote shutter release cable is required – these exposures cannot be triggered via USB.

Misc — This contains two miscellaneous settings

- ‘Prevent idle disconnection’ forces the camera to stay powered on and connected via its USB interface. This should always be enabled.
- ‘Show download progress’ shows a download progress window when downloading images from the camera. This can be comforting during the long download time experienced when using older Canon cameras.

“Shutter Cable” Settings Tab

Selecting the “Shutter Cable” Settings tab brings up the following settings:



Serial Port Cable	Selects the serial port and control line used for the serial port remote shutter release cables. • ‘Port’ is the name of the serial port used for the cable. It should be set to NONE if a serial port remote shutter release cable is not present. Only currently unused serial ports are displayed. • ‘Control line’ specifies the serial port signal used to trigger the shutter. This is typically the ‘RTS’ line
Parallel Port Cable	Selects the parallel port and data bit used for the parallel port remote shutter release cables. • ‘Port’ is the name of the parallel port used for the cable. It should be set to NONE if a parallel port remote shutter release cable is not present • ‘Data bit’ specifies the serial port signal used to trigger the shutter. This is typically bit 0 Note that some computers (especially laptops) can use a non-standard port address for the parallel ports and the plug-in must be told the correct number. If the parallel port cable is plugged into the onboard parallel port and does not trigger the camera exposure when LPT1 is selected then try LPT3 instead. USB parallel port adapters should not be used. If your computer does not have a parallel port then use a serial port or a Shoestring Astronomy DSUSB instead.
Use shutter release cable for…	Selects the shortest exposure for which the shutter release cable should be used. Shorter non-mirror lockup exposures will be performed using the USB connection to the camera itself. If no shutter cable is present then this value is ignored (see below).

Notes:

If the camera is based on the Digic II chipset a shutter release cable will be required for exposures longer than 30 seconds.

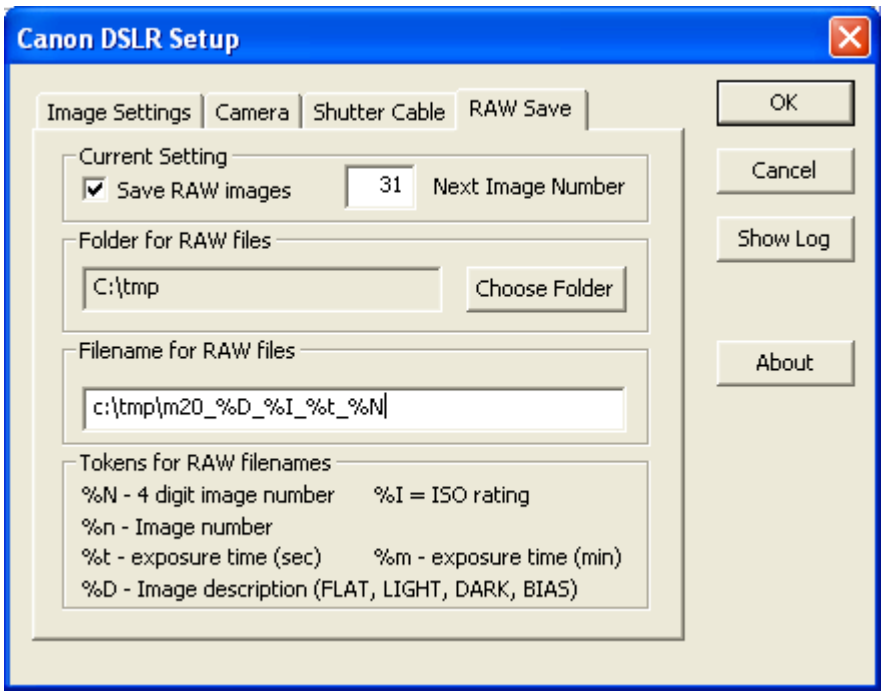
If the camera is based on the Digic III chipset then long exposure will be performed using the USB cable if:

1. Neither a serial or parallel cable is present, and
2. A Shoestring Astronomy DSUSB is not present, and
3. Mirror lockup is not enabled

A remote release cable is required for mirror lockup exposures irrespective of the type of camera you have.

"RAW Save" Settings Tab

Selecting the "RAW Save" Settings tab brings up the following settings:



The plug-in is able to save a copy of RAW images from the camera as well as passing the RAW image to CCDSoft for processing. This allows the use of third-party programs that perform image processing on RAW files.

Current Settings — The current settings for the handling of raw images

- 'Save RAW images' enables the saving of the RAW camera images to the computer hard disk in addition to passing the image to CCDSoft
- 'Next Image Number' specifies the sequence number for the next image. This is incremented each time a RAW image is saved

Filename for RAW — Specifies the name for the RAW files. A number of different

files tokens can be placed in the name. These tokens will be replaced with the relevant values when the image is taken.

- %N will be replaced by the sequence number with leading zeros to give a four digit number
- %n will be replaced by the sequence number without any leading zeros
- %I will be replaced by the camera ISO setting
- %t will be replaced by the exposure time in seconds

If the mode dial on the camera is set to ‘M’ the exposure time (rounded to the nearest whole second) is used.

If the mode dial on the camera is set to ‘Av’ then “Av” will be used.

- %T will be replaced by the exposure time in minutes

If the mode dial on the camera is set to ‘M’ the exposure time (rounded to the nearest whole minute) is used.

If the mode dial on the camera is set to ‘Av’ then “Av” will be used.

- %D will be replaced by the type of image (LIGHT, DARK, FLAT, or BIAS)

Note that the appropriate raw file extension will be automatically appended and need not be specified.

In the example above the next raw image will be saved as ‘c:\tmp\m20_LIGHT_1600_10_0031.cr2’ (assuming a light frame exposure from 9.5 to 10.49 seconds and the mode dial on the camera is set to M).

Image Binning

CCDSoft allows binning modes supported by the camera driver. While the Canon DSLR does not support binning in the camera hardware the plug-in uses the binning mode to determine how to return the image to the CCDSoft.

1x1 The bayerized (raw) image is passed to CCDSoft. This

	contains color information which can be processed and displayed (if desired) by CCDSoft
2x2	The image is shrunk to 50% of its original size and converted to a monochrome image. This mode should be used for plate solving for improved results. Note that most plate solving programs cannot handle fields larger than approximately one square degree. If your camera/scope combination covers a larger field it may be worthwhile to limit the solved field, either by using a setting in the plate solve program (recommended), or by select a subframe before taking the image.

DSLR vs. Astronomical CCD Cameras

There are several differences between a DSLR camera and a conventional CCD camera. This section describes some key differences between these two types of cameras that may impact your imaging.

1. A DSLR is, generally, not cooled. Cooling is used in CCD cameras to reduce the temperature of the sensor in order to minimize the dark current noise seen by the CCD. Generally DSLR cameras exhibit low dark noise, but there may be significant dark noise in longer exposures

2. A DSLR cannot keep its shutter closed while exposing DARK and BIAS frames. The plug-in will ask the user to cover and uncover the scope as required (assuming the plug-in is not set for unattended operation, see below).

3. A DSLR shutter is far less gentle than a CCD shutter and may induce vibration. This may have a significant effect on short exposures depending on the damping time of your scope and mount. If this becomes an issue it can be avoided by using the mirror-lockup support built into the plug-in

4. Some DSLR camera exhibit a problem called ‘AMP GLOW’. This is where one part of the DSLR CMOS sensor support circuit generates infrared light that is seen as a glow as one edge of the sensor. This can generally be removed by proper use of dark frames

5. DSLR cameras are generally battery powered. Holding the shutter open for extended periods drains the battery quickly, so an AC-powered battery replacement is recommended. Canon makes these units for each of their cameras as an accessory

6. DSLR camera can have their sensitivity (ISO number) changed by the user. However changing the ISO does not actually change the sensitivity of the sensor, but the way the signal for the CMOS sensor pixel signals are digitized into pixel values. Some experimentation will be required to understand the best sensitivity to use. Note that some imaging targets may be best imaged at several different ISO settings to best capture bright regions (with low ISO settings) and smooth low level detail (at higher ISO settings)

This manual does not cover these issues in any real detail and therefore the user is urged to do their own research into to unique characteristics of DSLR cameras.

Taking an Image (Without Mirror Lockup)

The following section describes the process of taking an image with CCDSoft and your DSLR camera. Like with all new procedures you should practice it during daylight. Ideally you would set up your equipment exactly as you would for imaging.

However it may be more convenient initially just to use the camera with a standard lens. If you do this you should be aware that you camera will generally refuse to take a picture if the auto-focus is enabled but cannot successfully focus – leading you to incorrectly believe that there is a problem with either your camera or the plug-in.

If you want to test with a lens, it is suggested you take an autofocus exposure or two to focus the lens and then switch the lens to manual-focus for the rest of the testing.

Note that this section does not cover all the image acquisition options available in CCDSoft – see the CCDSoft manual for full information on image processing options.

To take an image without mirror lockup perform the following steps:

1. Disable mirror lockup in the Canon camera custom function menu. If necessary consult the manual that came with your camera for details

2. Connect the camera to the computer using a USB cable. If using a remote shutter release cable for the first time, connect it to the computer but not the camera – otherwise connect it to both the computer and camera

   Close the Canon image capture window (if it appears).

3. Start CCDSoft

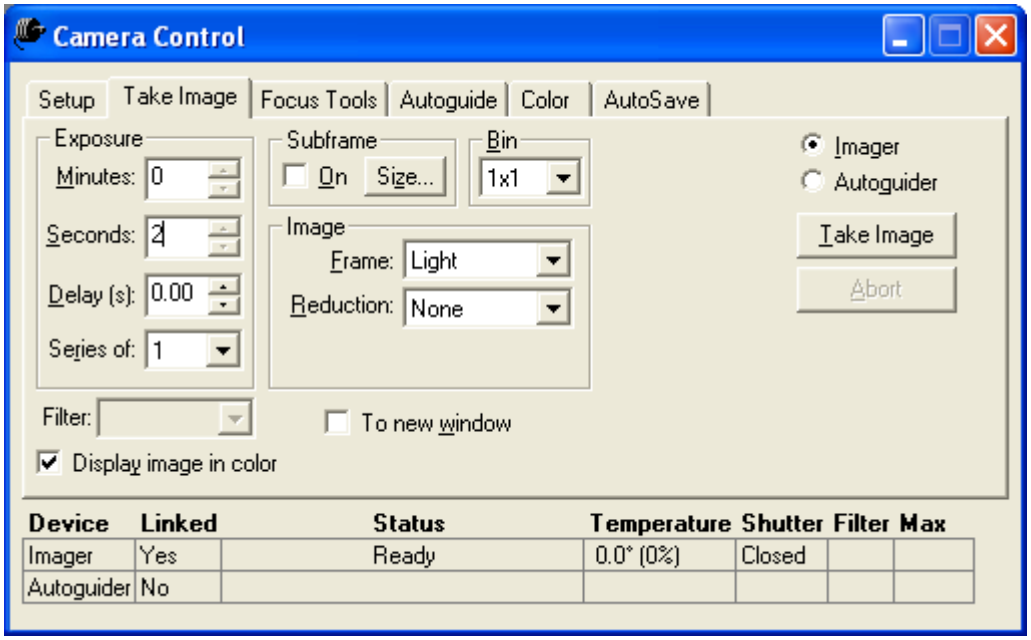
4. Press the ‘Connect’ button in the CCDSoft camera window

5. If necessary press the ‘Settings…’ button and configure the plug-in as described earlier in this manual. If you are using a remote release cable and it is not plugged in to the camera plug it in now

6. Set the camera mode appropriately for the desired exposure mode. Unfortunately this differs between models of the Canon EOS.

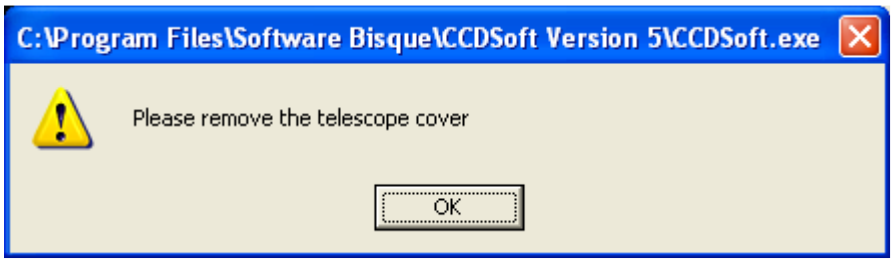
    - Set the camera mode dial to Av mode to take auto-exposed flat frames (all models)
    - Set the camera mode dial to M for use without a shutter release cable (all models) or for use with a shutter release cable (all models except EOS 5D)
    - Set the camera mode dial to B to use a shutter release cable (EOS 5D)

7. Select the ‘Image’ tab in the CCDSoft camera window. The following window pops up:



Note the checkbox labeled ‘Display image in color’. If checked the image will be displayed in color, but this adds 10 – 30 seconds to the time required to display the image after it has downloaded, depending on the image size. Generally it is best to turn this off to make your imaging time more efficient.

8. Press the ‘Take Image’ button. If this is the first time after startup (or after a DARK/BIAS frame was taken) the plug-in will prompt you to ensure that the telescope is uncovered.



9. The shutter will open and the image will be taken

10. The image will download and displayed. If the ‘Display image in color’ on the ‘Take Image’ tab of the CCDSoft Camera Control window it may take up to 30 seconds to display the image.

Note that if the camera can’t take the image (typically due to auto-focus failure) the plug-in will time out waiting for the image five seconds after the specified exposure time, and show the following error:

Taking an Image (With Mirror Lockup)

Mirror lockup is a camera function where the camera flips the mirror up a short time before the exposure actually starts. This allows any vibrations caused by the movement of the mirror to dampen down before the shutter opens and the exposure starts.

The process is essentially the same as taking an image without mirror lockup, with the following differences:

1. Mirror lockup cannot be used if camera auto-focus is enabled.
2. The camera mode dial must be set to ‘M’ (all models except EOS 5D) or to ‘B’ (EOS 5D only)
3. You must enable mirror lockup in the Camera custom functions menu
4. You must use a remote shutter release cable – no matter how short the exposure time

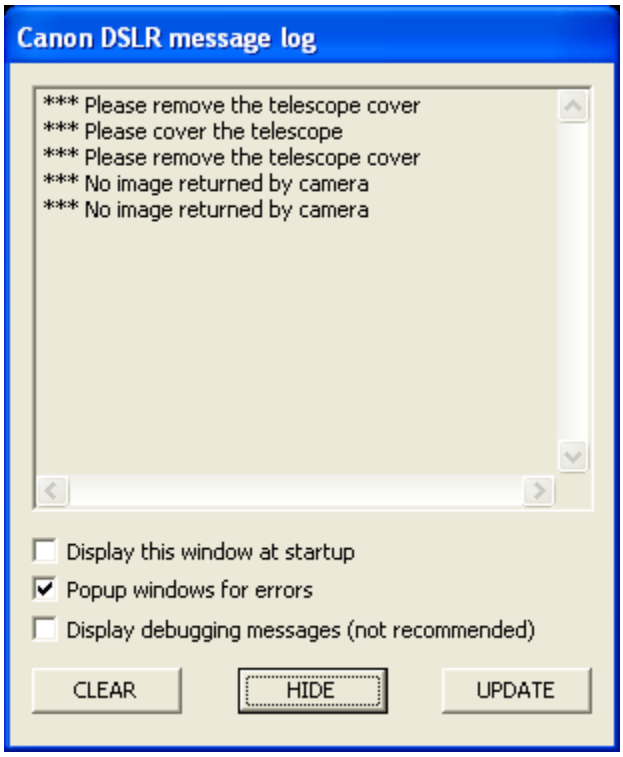
5. The CCDSoft exposure timer (in the ‘Take Image’ window) will be incorrect. The plug-in keeps the camera shutter open for the exposure time that you give to CCDSoft. CCDSoft starts the exposure timer when the mirror is locked up CCDSoft – so the exposure countdown shown by CCDSoft will finish earlier than the actual exposure. Be patient – the exposure will be performed correctly!

Remote and Scripted Operation

This plug-in has partial support for scripted operation. The plug-in settings cannot be changed via scripting, but the generation of pop-up message can be suppressed, with the messages being sent to a message log window.

To activate the message log window:

1. Press the ‘Settings’ button on the CCDSoft Camera setup window.
2. Press the ‘Show Log’ button on the plug-in setup window. The log window will be displayed:



3. Check the ‘Display this window at startup’ box and uncheck ‘Popup windows for errors’ box.

In any case where an error is detected the message will be displayed in the log window but there will not be a popup box to stop the operation of the remote or scripted operation.

If you notice unexpected operation of the plug-in remember to call up the log window to see if there are any messages indicating the source of the problem.

Note that popup box messages are always put in the log even if popup messages are enabled.

When remote/scripted operation in enabled an attempt to take a dark or bias frame will result in generated frame containing pixels with a value of zero. This allows programs (such as CCDAutopilot) which use autodarks to operate correctly. In general the low noise of CMOS sensors means that dark frame reduction is not required for the short exposures typically used for plate solving and focusing.

Gathering Diagnostic Information

The plug-in contains extensive logging capabilities that can be used if it becomes necessary to track an issue associated with the driver. If there is a problem you may be required to gather this information to aid in resolving the issue.

The gathering in diagnostic information is enabled as follows:

1. Display the log window as described in the previous section
2. Check the ‘Display this window at startup’ and ‘Display debugging messages’ boxes
3. Press the ‘Hide’ button
4. Shutdown CCDSoft
5. Restart CCDSoft and do whatever is required to reproduce the issue
6. Bring up the log window (if necessary) via the plug-in setup window
7. Press the update button. This forces all the information to be displayed and copies the text from the log window into the clipboard
8. Open a email to the author and paste the text from the clipboard into the mail

In most cases this will contain sufficient information to isolate the issue, but it would also be helpful if you can describe the sequence of events that led to the issue.