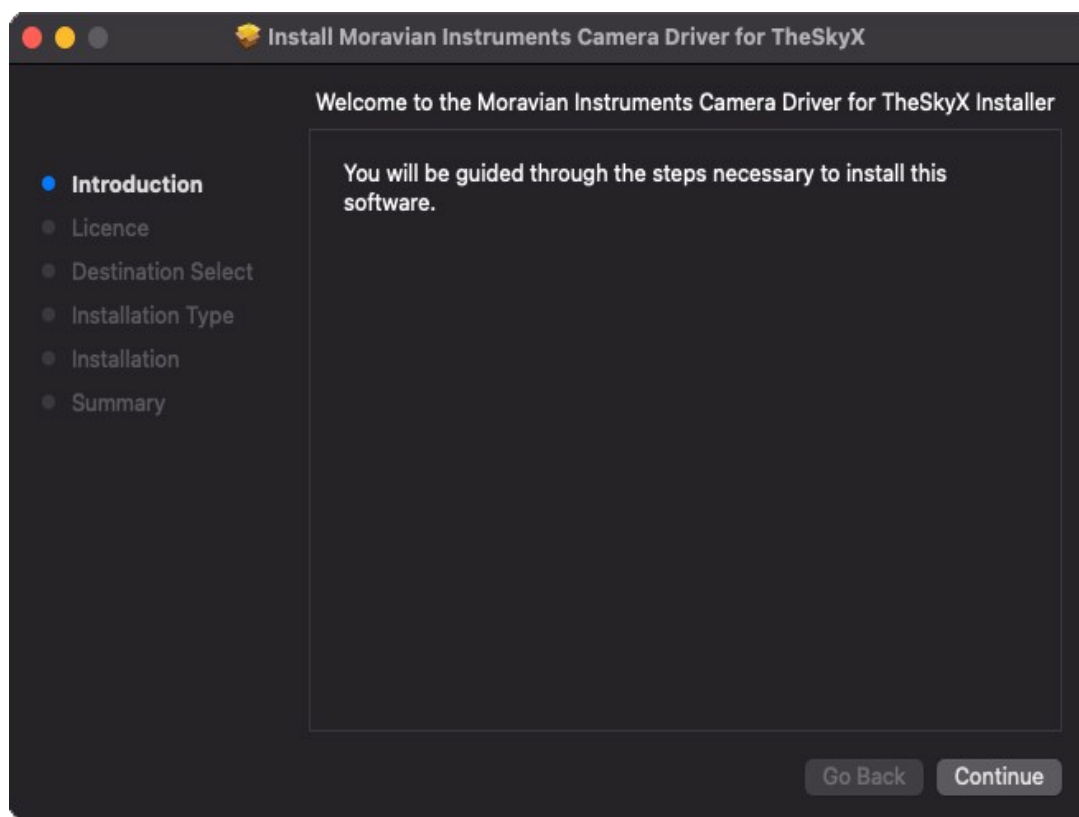


Moravian Instruments Gx/Cx Camera macOS Driver for TheSkyX



The series of Gx cameras (models G0 to G4) and series of Cx cameras (models C1 to C4) with USB connection or cameras connected through the Camera Ethernet Adapter can be operated under TheSkyX planetarium and camera control software package using the proper camera driver.

Driver Installation

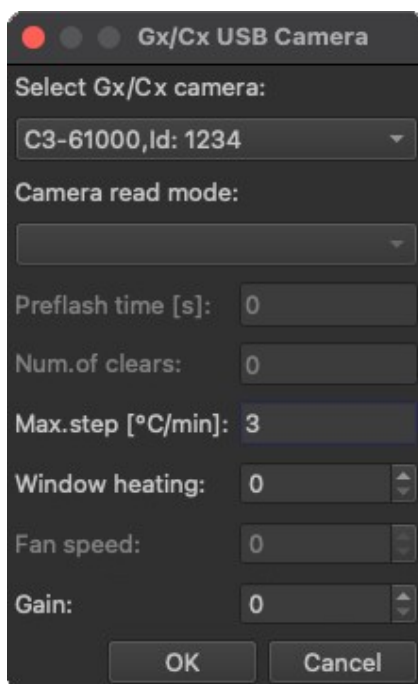
To install the Gx/Cx camera macOS driver for TheSkyX, just download and run the installer package 'GxCx Camera–TheSkyXdriver.dmg' from the web site <http://www.gxccd.com/>. This will launch standard installer interface, which will guide you through the installation process.

Using the driver

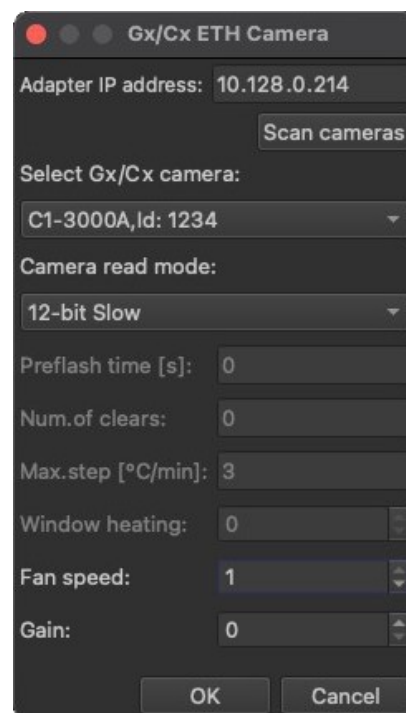
TheSkyX then allows choosing of the Moravian Instruments Gx/Cx ETH and Gx/Cx USB camera in the Imaging System Setup window:



Clicking the 'Settings...!' option in the 'Imaging System Setup' window opens driver specific configuration window.



Gx/Cx USB configuration



Gx/Cx ETH configuration

Note:

It is not possible to change the parameters while some camera is connected. It is necessary to click the Disconnect button and only then to open the configuration window and adjust settings for the camera.

The Setup dialog box slightly differs according to the driver used. If the driver for cameras connected through of Ethernet is used, the dialog box contains controls allowing IP address selection.

Adapter IP address (*ETH variant*) allows entering of the Camera Ethernet Adapter IP address (because the device works as a server, fixed address must be assigned to it – see the device documentation for further reference). It is also possible to enter FQDN if the device has assigned name in the Domain Name System.

Up to four cameras of any type can be connected to the Camera Ethernet Adapter. **Scan cameras** (*ETH variant*) button asks the device for a list of all connected cameras, which are then offered in the **Select camera** combo-box. It is necessary to scan for cameras when the IP address is changed.

USB connection is designed to be “Plug-and-Play”, so it is no necessary to explicitly scan for connected cameras. When the camera is connected directly to the computer USB port, the **Select camera** combo-box always contains all currently plugged (and powered) cameras.

The combo box always offers all cameras currently connected to your Mac or to the particular Camera Ethernet Adapter. This window adopts itself (enables/disables specific settings) according to the selected camera type.

Beside choosing of the particular connected camera, the configuration dialog box allows definition of other parameters:

Camera read mode allows choosing desired read mode. Gx imaging cameras offer one slower mode with lower read noise (marked “Low noise”) and one faster mode (marked “Preview”). Cx cameras offer 8-bit mode (faster), 12-bit or 16-bit mode (slower). G0/G1 guiding cameras offer “Slow read” and “Fast read” modes.

Preflash time defines time in seconds, for which the chip is illuminated with near-IR LEDs to eliminate Residual Bulk Image (RBI), accumulated during previous exposure (more precisely not to eliminate RBI, but to make it uniform and reproducible regardless of the illumination of the scene previously imaged). If the LED preflash is not desired, this parameter must be set to zero.

Num. clears parameter defines the number of “Chip Clear“ commands performed to purge the charge accumulated during preflash. If no preflash is performed (preflash time equals zero), default single clear is performed regardless of the value of this parameter.

Note:

Preflash is not enabled on all cameras. If the particular camera does not enable preflash, these parameters remain grayed (disabled) indicating no preflash can be performed.

Max. step defines the speed of temperature changes in degrees Celsius per minute. Ramped temperature changes (as opposed to rapid cooling/heating, often with temperature overshoot on both sides) protects the chip from shocks and ensures its longer life.

Window heating of the chip cold chamber front window limits condensation on the window front surface. Different cameras may offer different levels of the front window heating, so maximum allowed value of this parameter may vary, but the count-box allows setting of the heating level in the range valid for the selected camera ID. Zero value means no (or minimal) heating, maximum value means maximum heating allowed by camera hardware.

Fan speed allows controlling of the camera fan. It depends on the particular camera hardware whether the fan can be controlled and in how many steps. In the case of G1 or C1 cameras, fan can

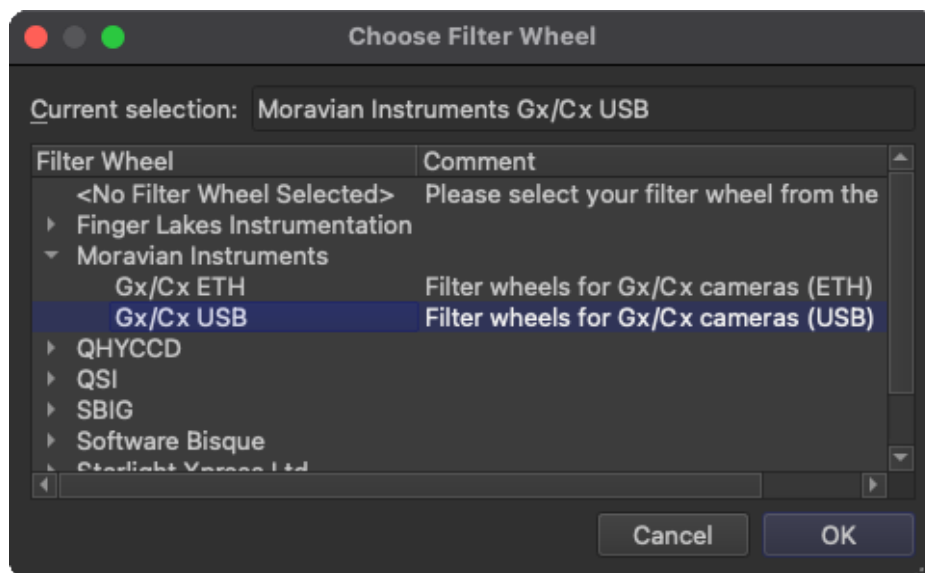
be turned off (value 0) or on (value 1). The fan control is available on G1/C1 cameras only, G0 cameras are not equipped with a fan, while larger actively cooled cameras G2 to G4 and C2 to C4 have fans always running.

It is desired to keep the fan on in most cases because it very significantly reduces the detector temperature by keeping it close to ambient. This also reduces the chip dark current (thermal noise pattern). Dark current doubles with every approx. 6 °C, so lowering the temperature by 12 °C causes four times lower dark current.

Gx/Cx Camera Filter Wheel in TheSkyX

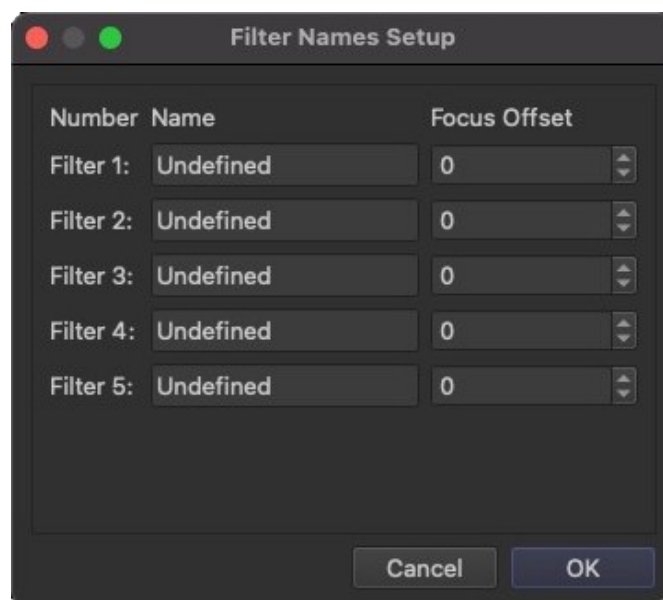
Each G2, G3, C2 and C3 camera can be equipped with internal filter wheel. All G2, G3, G4, C2, C3 and C4 cameras also support external filter wheels with larger number of filter positions, which operate the same way like internal wheels (they are indistinguishable from internal filter wheels from the software point of view).

Filter can be also chosen from the Imaging System Setup window:



Filter description

Unfortunately the current X2 Camera API used by TheSkyX to communicate with camera and filter wheel drivers does not support passing of the filter offsets from the driver to TheSkyX. It is necessary to enter filter offsets manually in TheSkyX Filter Names Setup window.



Further reference

For the documentation of Gx/Cx cameras, refer to the particular camera 'Operating Manual'. These manuals are supplied with each camera in the printed form and can be also downloaded as PDF file from the web site <http://www.gxccd.com/>.

Driver revision history

Version 1.0, released on October 11th, 2016

- Driver supports the following camera models, including possible internal filter wheels:
 - G2-0402, G2-1600 and G2-3200 (revisions 3 and higher)
 - G2-2000(C), G2-4000(C)
 - G2-8300(C)
 - G3-11000(C), G3-16000(C)
 - G3-01000
 - G4-09000, G4-16000
 - G0-0300(C), G0-0301(C), G0-0800(C), G0-2000(C)
 - G1-0300(C), G1-0301(C), G1-0800(C), G1-1200(C), G1-1400(C), G1-2000(C)
- Driver supports the following external filter wheel models:
 - EFW-2XS-7, EFW-2XS-8
 - EFW-2S-12, EFW-2S-10, EFW-2S-7
 - EFW-3S-7
 - EFW-4M-5, EFW-4M-7
 - EWF-4L-7, EWF-4L-9

Version 1.1, released on October 17th, 2016

- Updated camera firmware

Version 1.2, released on January 3rd, 2017

- Fixed issue when driver was not accepting selected binning.
- Fixed issue when cooling could not be turned off with corresponding TSX setting.
- Synchronized sub-frame y-axis with TSX (0 is at the top)

Version 1.3, released on April 10th, 2017

- Updated camera firmware
- Fixed display of cooler status in TSX
- Driver now rounds several values to first decimal place to avoid unnecessarily long numbers.

Version 1.4, released on November 3rd, 2017

- Updated camera firmware
- Driver now reports chip pixel size to TSX. This adds XPIXSZ and YPIXSZ to the FITS file header

Version 1.5, released on October 24th, 2019

- Driver built as 64-bit to support new TheSkyX 64-bit version and macOS Catalina

Version 3.2 released on July 24th, 2021

- Driver built as Intel 64-bit and ARM64 to support new Apple Silicon processors. 32-bit versions of macOS are no longer supported.
- Driver is now distributed with proper installer package to ease the installation.
- Added support for new CMOS cameras:
 - C1-1500, C1-3000(A), C1-5000(A), C1-12000(A)
 - C1+3000(A), C1+5000(A), C1+7000A, C1+12000(A)
 - C1×26000 (PRO), C1×61000 (PRO)
 - C2-3000(A), C2-5000(A), C2-7000A, C2-12000(A)
 - C3-26000 (PRO), C3-61000 (PRO)
 - C4-16000

Version 3.3 released on November 23rd, 2021

- Fixed an issue with macOS Monterey when Gx camera didn't connect the first time after power on.

Version 3.4 released on August 3rd, 2022

- Added support for new CMOS cameras:
 - C5A-100M, C5A-150M
- Configuration window can now set camera gain for Cx CMOS cameras.

Version 3.5 released on August 11th, 2022

- Added support for C1×, C3 and C5 binning parameters. You can set it in driver .ini file located next to the main driver file (*TheSkyX Professional Edition*\Content\Resources\Common\PlugIns64\CameraPlugIns folder).

Version 3.6, released on September 5th, 2022

- Fixed GPS exposure time reporting

Version 3.7, released on March 28th, 2023

- Added support for C2-9000 camera

Version 3.8, released on September 13th, 2023

- Added support for C4 BSI camera
- Improved GPS handling

Version 3.9, released on December 14th, 2023

- Added support for new camera PIDs

Version 4.0, released on May 31st, 2024

- Added support for new C0 cameras:
 - C0-1500, C0-3000(A), C0-5000(A), C0-12000(A)
- Added support for new camera PIDs

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