Version 6.0

Camera Guide:
Xillix MicroImager

Imaging
Research Inc.

Xillix MicroImager

Introduction

The Xillix MicroImager is a high-resolution digital integrating camera. It can be used as an 8 bit device (yielding 256 gray levels) and/or a 10 bit device (yielding 1024 gray levels). The camera output can also be "binned" to provide greater sensitivity for use with low light levels.

This document describes the installation, use and adjustment of the Xillix MicroImager. Most of the functions and features described here are exclusive to these cameras. The **MCID™ Elite** imaging system, however, provides many other features related to camera-based image acquisition in general (e.g., frame averaging for noise reduction). These are described in the online *MCID Elite Reference Manual* (*Chapter 2: Acquiring Camera Images*).

Connecting

The Xillix MicroImager consists of a camera head, a power supply/control unit, a digital interface cable (camera head to **MCID Elite** imaging board), a controller cable (camera head to controller), and an AC power cord. The controller cable (black) has a DB15 connector on both ends. Connect one end to the controller, and other end to the rear of the camera head. Plug the female end of the AC power cord into the socket on the rear of the controller. The digital interface cable connects the camera head to the imaging board. Use the **M5 Xillix Input** cable to connect the camera head to the RS-422 digital input board (see the *MCID Elite Start-Up Guide* for information regarding the RS-422 digital input board).

Note: The digital interface cable is very fragile. Avoid stretching this cable or bending it near the connectors.

Installing in MCID Elite

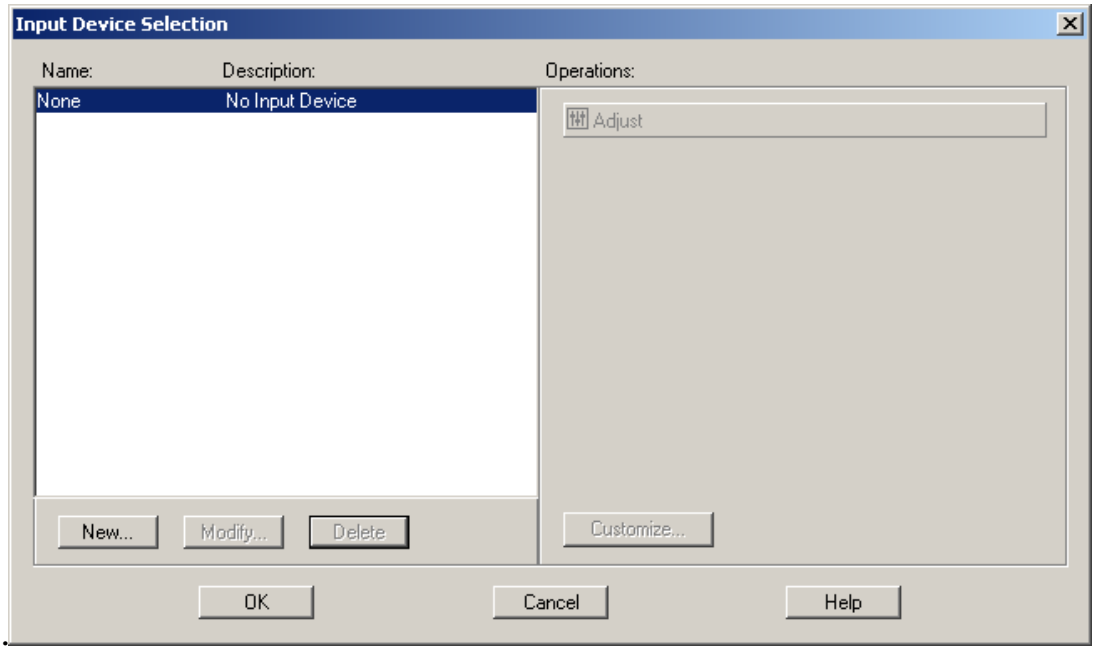
The Xillix digital camera may be installed as an 8 bit input device (yielding 256 gray levels) and/or a 10 bit device (yielding 1024 gray levels). The Xillix also offers two display resolutions; **full** and **binned**. At full resolution, the image is 1280 x 1024 pixels. In binned mode, each group of four pixels in the camera chip is summed to yield a single output pixel. This yields greater sensitivity for use with low light levels. Binning also yields a 640 x 512 pixel image.

To use these different capabilities, you must install the camera as though it were more than one device. For example, to use the camera in both 8 bits and 10 bits, it must be installed as two separate devices: an 8 bit camera and a 10 bit camera.

Table I: *Input sync selections for the Xillix MicroImager.*

Display Format	Full Resolution (1280 x 1024)	Binned (640 x 512)
8 bit	Xillix-10-To-8	Xillix-10C-To-8C
10 bit	Xillix-10	Xillix-10C

Figure 1: *The Input Device Selection dialog box lists all cameras installed in MCID Elite. It is also used to add new cameras to the list.*



Procedure

The **MCID Elite** imaging system's interface to cameras is controlled through the *Settings* > *Input select* menu command. The *Input Device Selection* dialog box (Figure 1) contains a list of every camera that you have already installed. You can select, add, or delete any camera input from the list. You can also edit the definition of a specific input, and assign specific operations and settings to it. For details, see *Chapter 2: Acquiring Camera Images* in the online *Reference Manual* for details.

To add the Xillix camera to the **MCID Elite** input selection list:

1. Open the *Settings* menu and select *Display format*. Set the **Image Type** to the desired bit density (**8 bit mono** or **10 bit mono**).
2. Open the *Settings* menu again and select *Input select*. The *Input Device Selection* dialog box appears (Figure 1), which lists every color camera that is currently installed in **MCID Elite**.
3. Click the **[New]** button. If another color camera has been installed already, a *Create Input Device* dialog box will appear. Select the **New input device** option and click **[OK]**. If no other cameras have been installed, the *Input Device Definition* dialog box appears (Figure 2).
4. Select the appropriate **Input sync**, using Table I above as a guide. The "C" stands for "compressed", which means the same as "binned".
5. Enter a unique **Name** and **Description** in the entry fields (e.g., "Mono1", "Xillix"). Press **[OK]** to exit.

Figure 2: *The Input Device Definition dialog box is used to describe a camera and its video signal.*

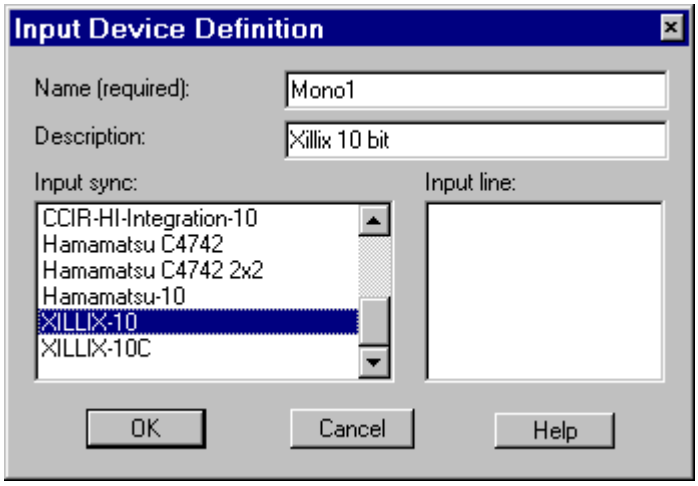
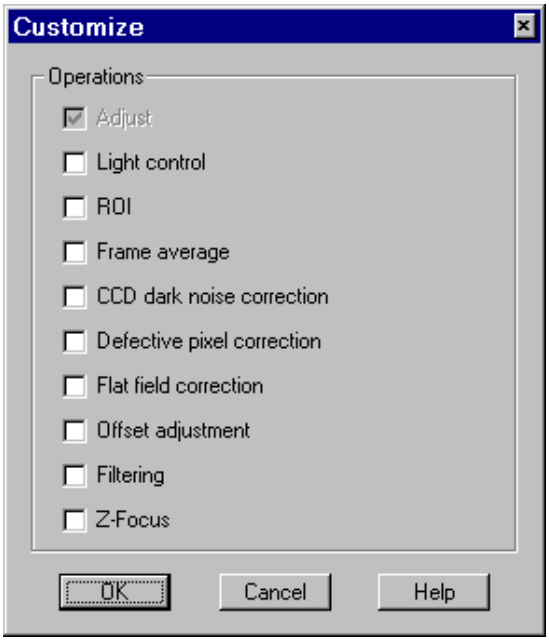


Figure 3: *The Customize dialog box is used to link controls for various camera operations to the camera.*



6. A *Customize* dialog box appears next (Figure 3), which allows you to assign various input device operations to this camera (e.g., frame averaging controls). You can select them now or assign them later (see *Chapter 2: Acquiring Camera Images* for details). Click **[OK]** to exit.

The camera is now installed in the list of input devices. When you exit the *Input Device Selection* dialog box, the camera (and all of the settings and operations associated with it) becomes the default input device.

Acquiring Images

The basic procedure for acquiring images with the Xillix camera is as follows:

1. Select the desired *Display format* (8 or 10 bits).
2. Select the camera from the list of input devices, if necessary.
3. Press the **Digitize** icon to display a "live" image.
4. Make any necessary adjustments to the live image (e.g., focus or exposure time).
5. Press the **<Return>** key to complete digitization.

The image is now "frozen", and any of **MCID Elite's** functions can be applied to it (e.g., the image can be processed, calibrated, sampled, or saved to disk as an image file).

Selecting the Display Format

The Xillix offers either 8 bit (256 gray level) or 10 bit (1024 gray level) digitization. From the *Settings* > *Display format* selection, choose either **10 bit mono** or **8 bit mono**. The higher bit density will yield better densitometric sensitivity, but can slow down some of the imaging functions. For example, image subtraction will take longer with a 10 bit image than with an 8 bit image.

Selecting the Camera

The "full" and "binned" modes may be represented as two different Xillix cameras. Select the full resolution camera for work with higher light levels, or the binned camera for low light conditions. To select one camera or the other, open the **Settings** menu and select the **Input select** option. Select the camera you wish to use from the list of input devices (Figure 1).

Digitizing

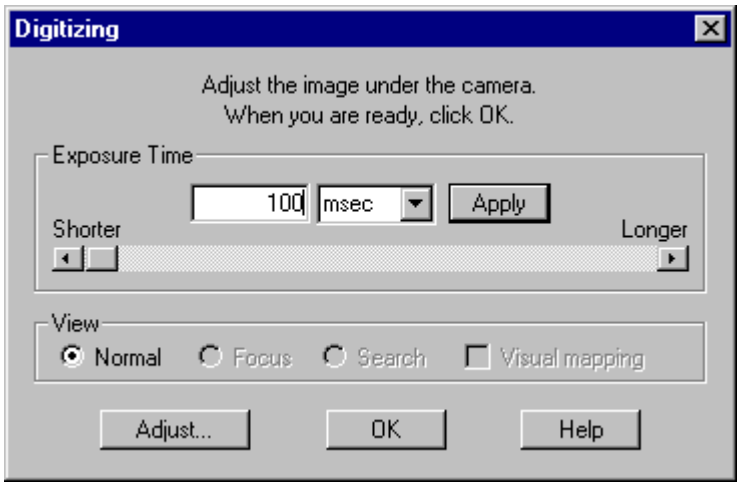
Click the **Digitize** icon to initiate digitization or press **<Ctrl - D>**. A dialog box appears to indicate that **MCID Elite** is digitizing continuously and a live image appears on the image monitor.

At full resolution (1280 x 1024) the Xillix camera acquires images at frame rates up to about 5 Hz. We can generate an image about every 200 msec, including time for the shutter to open

and close. The shutter opening is adjustable from 20 msec (useful for freezing motion), to minutes (used to clean the chip).

Light is accumulated as long as the shutter is open. Longer exposure yields higher sensitivity. Exposure is controlled by moving the **Exposure time** slider (Figure 4). For most purposes, an exposure of about 100 msec is fine. Faster shutter speeds tend to yield less stable density values. Adjust lighting to give proper illumination. In low light situations, the exposure time can be increased to periods of up to about 3 sec with a gradual increase in background. Exposures longer than this result in sufficient background noise to impair image quality. We have used the Xillix to acquire moderately bright fluorescence images with low backgrounds. Dim fluorescence is submerged within background noise.

Figure 4: *Clicking the "Digitize" icon initiates the digitization procedure and displays a dialog box. Move the slider along the Exposure Time bar to integrate over a number of frames.*



Focusing

With long exposure times, it can be difficult to focus the camera. The **Focus** option produces a faster camera read-out speed to aid in focusing.

Adjusting

The Xillix produces 10 bits of data, regardless of whether the display format is set to 8 bits or 10 bits. If you are operating the camera in 8 bit mode, the **[Adjust]** button allows you to use the lower 8 bits of data (1-8 bits) or the upper 8 bits (3-10 bits). The upper will yield less noise, and allow you to use longer exposure times.

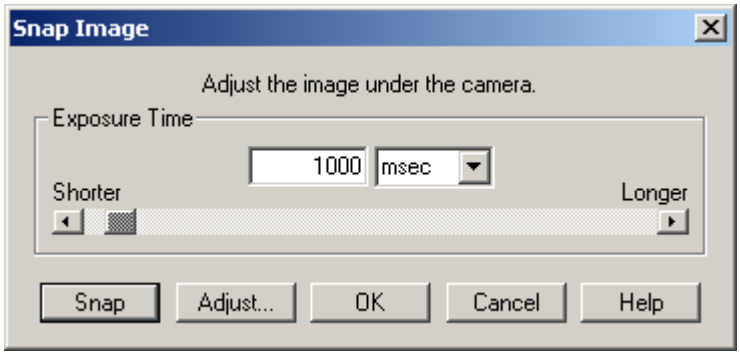
Snap Shots

Press the **Snap Shot** button to capture an image using a single exposure (i.e., without displaying a continuously 'live' image). The image is automatically captured at the end of the specified exposure period. This function can be very useful if you are working with dim

specimens and you have already chosen the correct exposure time. Clicking the **Snap Shot** icon will automatically capture a fresh image.

To adjust the exposure time, Ctrl-click on the **Snap Shot** icon to display the *Snap Image* dialog box. Move the slider control to increase or decrease the exposure time. Press the **[Snap]** button to test the exposure.

Figure 5: *The Snap Image dialog box is used to control the Snap Shot exposure time.*



Maintenance and Troubleshooting

Cleaning the Camera

The Xillix camera contains a solid state sensing element (a chip) covered by a thin glass window. The glass window attracts dirt like a magnet. Dirt will appear as dark blots on the image. To determine if dirt is on the chip window, move the camera a bit, while looking at an actively digitizing image. Dirt that does not move is on the chip. To avoid gathering dirt, we recommend that you remove the lens or microscope video adapter as little as possible.

To clean the chip window, we must first expose it. With shuttered cameras like the Xillix, considerable care is necessary. You could damage the shutter if it were to close while a cleaning instrument was inside the camera. To open the shutter, set the digitization control to maximum integration time. Watch the camera for a few minutes. Does the shutter stay open? The Xillix camera is rather unreliable in this respect. Time the length of shutter opening. Now, digitize again to open the shutter and proceed to clean the chip window. With the Xillix, make sure that you take the cleaner out of the camera well before the shutter is due to close.

The first step in cleaning is to try blowing off dust with clean compressed air, of the type sold for cleaning camera lenses. Use canned air, not air from a lab tap, which often contains oil. Reassemble the camera and digitize an image to see if the dust is gone. If it is not, moisten a cotton swab or piece of lens paper with a glass or lens cleaner. Do not use alcohol or other solvents on optical surfaces (the optical coating and cements can be damaged by such solvents). With the shutter open, remove the lens and gently wipe the glass with the swab or paper. Make sure that the swab or paper has not become dry. Then blow the chip dry with compressed air. Replace the lens and digitize an image to inspect for dust. You may have to repeat the cleaning process a few times to remove all dust.

You may also clean the chip window with "Prophot" cleaners, available from many camera stores. Do not use tissue paper, which often contains impurities. Do not use dry lens paper or swabs to clean the chip, either. Dry rubbing may produce static charges.

Cleaning the camera is one of those unpleasant and thankless tasks that everyone detests. The best way to avoid cleaning is to keep the camera sealed, so that dust does not enter.

The Shutter

The Xillix's electro-mechanical shutter is prone to a certain degree of wear and tear over time. We recommend testing the shutter periodically, to ensure that the exposure time is stable over successive digitizations. If it isn't, density data may be compromised.

TO TEST THE SHUTTER:

1. Set the *Display format* to a 4-channel display.
2. Turn off **Flat field correction** and **Frame averaging** controls, if enabled.
3. Set the Xillix exposure time to ~100 msec or more.
4. Digitize a blank field of medium intensity (appears green with pseudocolor LUT).
5. Digitize the same field into the three other channels. Do not adjust the illumination level or exposure time.
6. Set the density unit to **Levels**.
7. Use the *Sample > Advanced > Channel linking* controls to link channels 1-4 (refer to *Chapter 5: Working with Multiple Channels* in the online *Reference Manual* if you are unfamiliar with channel linking functions).
8. Use the **Box** sample tool (about 20 x 20 pixels) and sample any part of an image. The channel linking function will automatically sample the same coordinates in the remaining three images.
9. Examine the data. A one or two gray level difference from one image to the next is normal. A greater difference could indicate a shutter problem.

If you suspect that the exposure time is not stable, please contact us. The camera should be returned to Xillix for repair or adjustment.

Advanced Details

12-Bit Xillix

The Xillix MicroImager model MI1400-12S can be installed as a 12 bit device (yielding 4096 gray levels) as well as an 8 bit and 10 bit device. Set the *Display format* to the appropriate bit density and install the camera as described in the "Installing in MCID" section of this chapter. Use **Table II** as a guide for selecting the correct input sync.

Table II: *Input sync selections for the 12-bit MI1400-12S model.*

Display Format	Full Resolution (1280 x 1024)	Binned (640 x 512)
8 bit	Xillix-12-To-8	Xillix-12C-To-8C
10 bit	Xillix-12-To-10	Xillix-12C-To-10C
12 bit	Xillix-12	Xillix-12C

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