Shad-o-Snap™ 1024

Large-Area X-Ray Camera with USB Interface

Key Features:

- Large active area of 5 x 5 cm
- 10 lp/mm (48 µm) resolution
- Convenient USB interface
- "Smart" camera electronics

- 12-bit digitization of images
- Image transfer to PC in 8-bit TIFF or 16-bit raw integer format
- Ready-to-run software and drivers

The Shad-o-Snap 1024 x-ray camera is part of the new product line of easy-to-use, "smart" USB cameras developed by Rad-icon Imaging Corp. This microprocessor-based camera offers simple timing control combined with new readout modes and easy image transfers as TIFF or raw integer image files. The Shad-o-Snap 1024 features the large-area RadEye™ 2 CMOS image sensor with a 1024 by 1000 pixel photodiode matrix and 48 µm pixel spacing. The sensor has an integrated direct-contact scintillator and is available for both the standard (10-50 kV) and extended (50-160 kV) energy ranges, covering the spectrum from biomedical to industrial inspection applications.

Rev. 01/06-03

Description:

The Shad-o-Snap 1024 is a complete, stand-alone x-ray imaging camera featuring "smart" microprocessor-controlled camera electronics and a convenient USB interface. The plug-and-play interface allows easy control of camera features such as integration time settings, offset correction and image retrieval. Each Shad-o-Snap camera ships with our CameraConsole application, which provides a user-friendly interface for communicating with the camera. All camera timing signals are internally generated, although a separate frame sync input and output are provided in order to synchronize the camera to external events.

The Shad-o-Snap camera contains a large-area high-resolution CMOS detector with a photodiode pixel array featuring 1000 rows and 1024 columns. With a pixel pitch of 48 µm, the active area of this detector is about 5 cm by 5 cm and has a 70 mm diagonal. The detector array consists of two RadEye1 sensors that are tiled side-by-side and read out through separate electronic channels. The signal from each sensor is digitized to 12 bits and then transferred into an internal memory storage where it can be further processed. Images can be retrieved as 128 by 124 pixel TIFF thumbnails, or as full-resolution 8-bit TIFF or 16-bit raw integer files.

The CMOS sensor inside the Shad-o-Snap camera contains a direct-contact Gd_2O_2S scintillator such as Kodak Lanex® Fine or Min-R® Medium. The scintillator converts x-ray photons into visible light that is sensed by the CMOS photodiodes. A thin graphite cover protects the sensor from accidental damage as well as ambient light. The Shad-o-Snap camera also contains lead and steel shielding to protect the camera electronics from the x-ray radiation. The Shad-o-Snap 1024 camera is optimized for the standard energy range (10-50 kV), whereas the Shad-o-Snap 1024 EV model is designed for the extended energy range (50-160 kV). Please refer to our application notes for additional information.

Specifications:

Detector Specifications		Units
Number of rows	1000	pixels
Number of columns	1024	pixels
Active area height	48.0	mm
Active area width	49.3	mm
Pixel spacing (pitch)	0.048	mm
Typical fill factor	85	%
Avg. dark current (23°C) [1]	8	ADU/s [2]
Read noise (rms)	< 1	ADU
Dynamic range	4000:1	
Digitization	12	bits
Conversion gain	500	electr/ADU
Readout period [3]	540	ms

[1] dark current doubles approx. every 8°C
[2] ADU = Analog-Digital Unit ≡ 1 LSB (Least Significant Bit)
[3] time required to transfer image from sensor to camera memory

Camera Specifications		Units
Typical supply voltage	6.5	Volts
Supply voltage range	6.0 to 8.0	Volts
Maximum supply current	270	mA
Typical power dissipation	1.6	Watts
Data interface	USB 1.1	
Image transfer time to PC		
Thumbnail (TIFF)	<0.3	sec
Full image (RAW)	3-4	sec
SMA connector interface	TTL	

General Specifications		Units
Operating Temperature	0 to 50	°C
Storage Temperature	-25 to +85	°C
Humidity (non-condensing)	10 to 80	% R.H.
Weight	1.5	kg

Software
The Shad-o-Snap camera and the CameraConsole application currently work with the Windows® 2000 and Windows XP operating systems. Custom drivers for other OS versions will be available soon.

Portable Applications:

The Shad-o-Snap camera operates from a single 6-8 Volt DC power supply. The maximum power dissipation is approximately 2 Watts. Each camera ships with a universal 6.5 Volt desktop power supply, but the Shad-o-Snap can also be operated from an appropriate battery supply. Together with a USB connection to a laptop computer this opens up new applications for completely portable x-ray imaging. The longest commercially available USB cables are typically about 5 meters (15 feet) long, although longer connections can be achieved by stringing cables together with repeater hubs.

USB Interface:

The Shad-o-Snap camera features a full-speed USB 1.1 interface to receive commands from a PC and transfer status information and images. The CameraConsole application for Windows 2000 or Windows XP provides an easy-to-use interface for controlling the camera and retrieving images. A Software Development Kit (SDK) for directly programming a C/C++ API to the Shad-o-Snap camera is also available.

With CameraConsole the user can select the integration time of the Shad-o-Snap detector (see Camera Timing section), control the on-board offset correction functions, read individual or continuous thumbnail images from the camera, and transfer full-resolution images in 8-bit TIFF or 16-bit raw integer formats directly to your image analysis application. The thumbnail image display can be updated at up to 1.25 frames per second, while the full-resolution image transfers typically take 3-4 seconds.

Resolution:

The Shad-o-Snap 1024 detector features a pixel spacing of 48 µm, which corresponds to a resolution of just over 10 line pairs per mm. The actual Modulation Transfer Function (MTF) of the detector depends on the type of scintillator that is installed. A thicker phosphor screen will produce more signal, but at the expense of high-frequency contrast. Please refer to the Ordering Information section to see which scintillators are available for the Shad-o-Snap 1024 camera.

Camera Timing:

The CMOS photodiode array inside the Shad-o-Snap camera is always integrating signal and therefore needs to be reset periodically. The reset operation is performed automatically during the readout cycle. As each row is scanned during the readout cycle, the photodiodes in that row are reset. In order to prevent the detector from saturating, the camera generates a periodic readout signal that initiates readout cycles at regular intervals. Any signal (images) stored in the detector is lost unless the camera receives a USB command to transfer the image data into its internal memory. In this case the next available image will be transferred and can then be accessed through the USB interface.
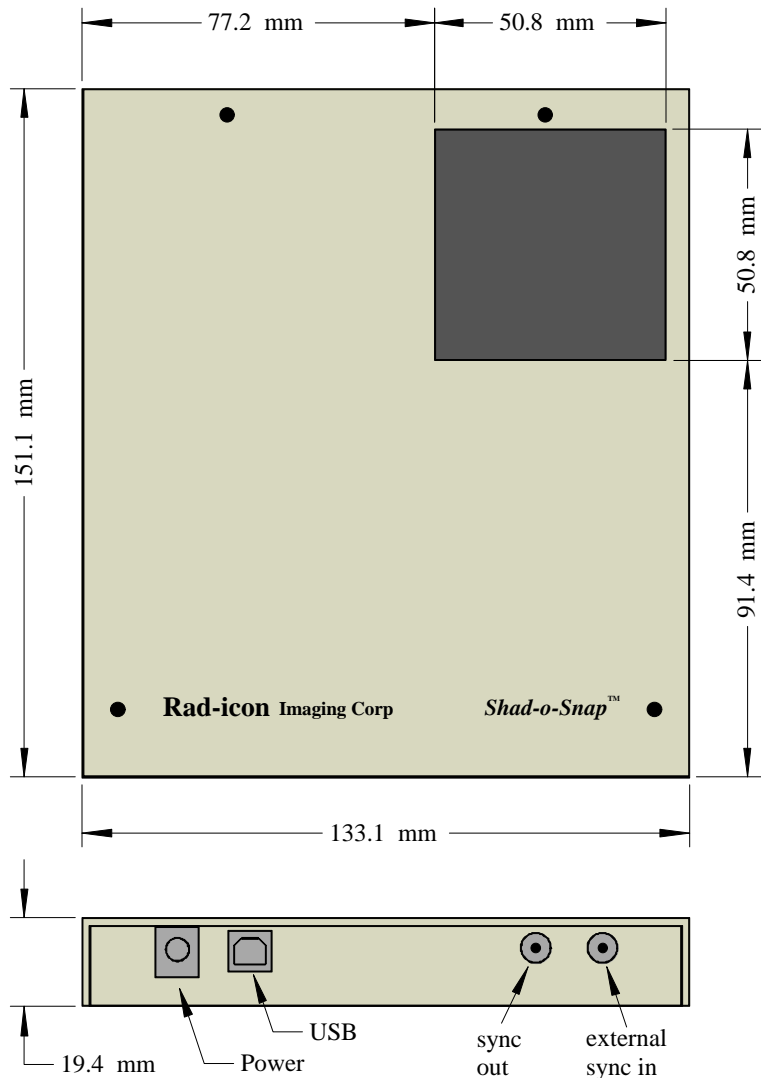
All camera timing signals are generated internally. The detector integration time (period from one frame readout cycle to the next) can be set via the USB interface. The minimum integration time is 540 ms, the length of one readout cycle. However, it is possible to set a shorter integration time in which case only a partial frame is read. The readout cycle starts at the top of the image and proceeds to scan the image row by row towards the bottom.

The maximum integration time that can be set via the USB interface is 33.5 seconds. It is possible to use longer integration times by controlling the camera integration time through the "Ext. Sync In" SMA connector on the front panel. In this case, the rising edge of a TTL or 0-5 V input signal will trigger a frame readout cycle. The time delay between successive edges determines the integration time.

Another timing mode available on the Shad-o-Snap camera implements an electronic shutter by first performing a global reset of all photo-diodes on the array, then integrating for a preset period, and then reading out the image. This sequence can be triggered by a rising edge on the "Ext. Sync In" input or by software command.

Mechanical Drawing:

77.2 mm

50.8 mm

50.8 mm

151.1 mm

91.4 mm

Rad-icon Imaging Corp   *Shad-o-Snap*™

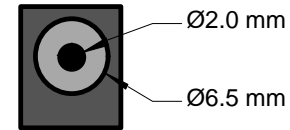133.1 mm

19.4 mm

Power

USB

sync out

external sync in

Power Connector:

DC power jack, 2.0 mm center pin diameter. Fits standard female power plug with 2.1 mm inside diameter and 5.5 mm outside diameter.

center pin:

6.5 VDC

outside:

ground

Ø2.0 mm

Ø6.5 mm

Data Connector:

USB Series "B" receptacle. Requires shielded device cable (Series "A" plug to Series "B" plug) for USB 1.1 or USB 2.0 (5m length included).

Ordering Information:

Shad-o-Snap cameras have two image quality grades (Standard and Premium), and can be ordered either with a Kodak Min-R Medium or Lanex Fine scintillator. Additional scintillators may be available by request.

All Shad-o-Snap cameras ship with a universal desktop power supply for 90-264V and 47-63Hz operation. Please specify power connector.

P/N	Description
1111	Shad-o-Snap 1024 Camera (10-50 kVp)
1115	Shad-o-Snap 1024 EV Camera (up to 160 kVp)
-01	Premium Grade[1], Min-R Medium
-02	Standard Grade[2], Min-R Medium
-03	Premium Grade, Lanex Fine
-04	Standard Grade, Lanex Fine
1116	Shad-o-Snap Battery Pack (optional)

[1] no line defects   [2] up to 3 line defects