



# VICTOREM™

## 2KSDI-MINI



## 3G-SDI 2K HDR CAMERA SERIES

# User's Manual

Revision 3.0

## Notice

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The Victorem 2KSDI-Mini product family is warranted for one (1) year from the date of purchase unless otherwise agreed in writing. If the product proves to be defective during this warranty period, IO Industries Inc. will, at its discretion, either repair or replace the product at no cost. In the case where a new device is to be provided but the product has been discontinued, a product with similar or better performance capabilities and features will be provided. This warranty shall not apply to any damage, defect or failure caused by improper use or inadequate maintenance of the product.

## Certifications

FCC Class A Digital Device or Peripheral – Information to User

### NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

### WARNING

Changes or modifications not expressly approved by IO Industries Inc. could void the user's authority to operate the equipment.

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This equipment has been certified to conform to the requirements of Council Directive 89/336/EC for electromagnetic compatibility and to comply with the following European Standards:

- Immunity: EN55024:1998, A1:2001
- Emissions: EN55022:1998 Class A / CISPR 22:1997

All IO Industries Inc. products bearing the CE mark have been declared to be in conformance with the applicable EEC Council Directives. Note that the use of interconnect cables that are not properly grounded and shielded may affect CE compliance.

**About IO Industries Inc.**

IO Industries Inc. designs cutting-edge digital video equipment. Since 1991 we have focused on providing our customers with high performance and high quality solutions for all types of digital video applications. Our products are proudly designed and built in Canada, at our headquarters in London, Ontario.

With our deep roots in uncompressed digital video recording and high-speed imaging systems, and more recently, compact digital video cameras, our experience leads our product designs and brings us into custom projects ranging from deep-sea to outer space.

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# 1 Introduction

The compact Victorem 2KSDI-Mini camera series is designed for a broad range of applications, from specialty video production to aircraft or vehicle recording and security or surveillance. The high-quality Sony CMOS sensors give the 2KSDI-Mini cameras outstanding image quality and high dynamic range. Table 1 shows the camera models covered in this manual.

Model	Sensor	Resolution	Optical Format	Shutter
2KSDI-Mini 2KSDI-Mini D	Sony Pregius IMX265	2048 x 1080	8.9mm (Type 1/1.8)	Global
2KMSDI-Mini 2KMSDI-Mini D	Sony Pregius IMX252	2048 x 1080	8.9mm (Type 1/1.8)	Global
2KM5SDI-Mini	Sony Pregius IMX250	2464x2056	2/3" (11.1mm)	Global
2KSDI-Mini RS 2KSDI-Mini RS D	Sony Exmor-R IMX183	4096 x 2160	2/3" (11.1mm)	Rolling

Table 1. Covered Victorem 2KSDI-Mini models

## 1.1 Output Formats

The supported output formats for the 2KSDI-Mini cameras are shown in Table 2. Outputs from the 2KSDI-Mini RS and 2KSDI-Mini RS D are scaled down from the full sensor resolution. 2K outputs are scaled from 4096x2160 (4K) and HD outputs are scaled from 3840x2160 (UHD). The 2KSDI-Mini RS and 2KSDI-Mini RS D do not support 1280x720 output.

Interface	Resolution	Output Format	Frame Rate (Hz)
Single 3G-SDI SMPTE 424M	2048 x 1080 (2K)	4:2:2 Y'Cb'Cr' / RAW	47.95, 48, 50, 59.94, 60
	2048 x 1080	4:4:4 R'G'B'	23.98, 24, 25, 29.97, 30
	1920 x 1080 (HD)	4:2:2 Y'Cb'Cr' / RAW	50, 59.94, 60
	1920 x 1080	4:4:4 R'G'B'	23.98, 24, 25, 29.97, 30
Single HD-SDI SMPTE 292M	2048 x 1080	4:2:2 Y'Cb'Cr' / RAW	23.98, 24, 25, 29.97, 30
	1920 x 1080	4:2:2 Y'Cb'Cr' / RAW	23.98, 24, 25, 29.97, 30
	1920 x 1080 Interlaced	4:2:2 Y'Cb'Cr' / RAW	50, 59.94, 60 (field rates 25, 29.97, 30)
	1280 x 720 <sup>1</sup>	4:2:2 Y'Cb'Cr' / RAW	50, 59.94, 60

<sup>1</sup> Not supported on 2KSDI-Mini RS

Table 2. Supported output formats

## ***1.2 Camera Highlights***

- Superior image quality
- Low noise and high dynamic range
- Multiple output format options
- Multiple image sampling formats, 4:2:2 / 4:4:4 / RAW
- ISO settings in ½ stop increments (3dB)
- Fine gain adjustment up to 48.0dB
- Advanced color processing
- Automatic exposure and gain control
- Optical Low Pass Filter (OLPF) and IR-Cut filter
- Tri-level sync input
- Rugged aluminum case
- RS485 control with host application or handheld remote
- On Screen Display (OSD) menu overlay
- Low power, 3.7W @ 12V

## 2 Mechanical

Mechanical drawings of camera body shown in Figure 1.

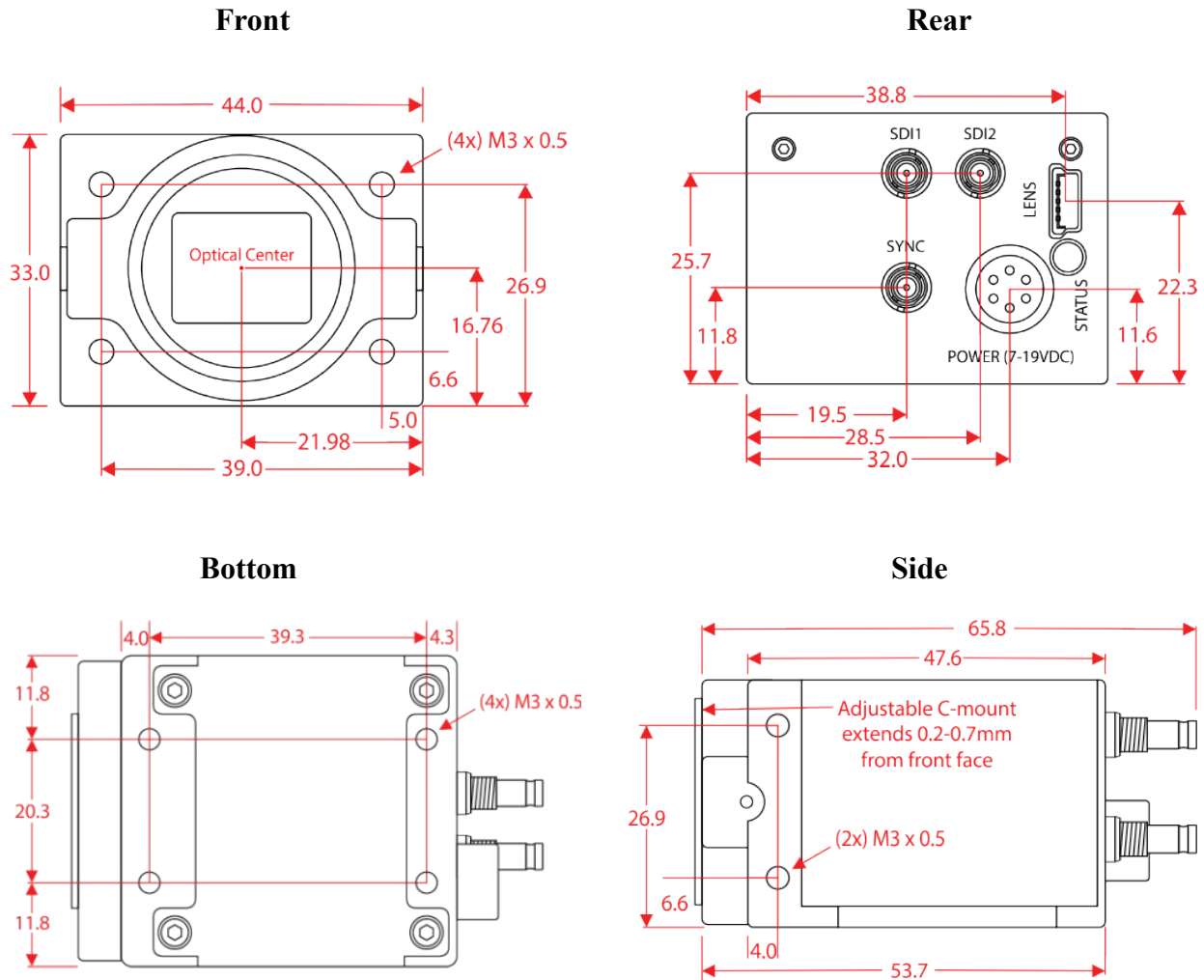


Figure 1. Mechanical drawings



## 2.1 Mechanical Specifications

Summary of mechanical specifications are shown in Table 3.

Specification	Description
Size	33.0 mm x 44.0 mm x 53.7 mm
Weight	140 g (with no lens)
Mounting Holes	Bottom – 4x M3 x 0.5 Other sides – 2x M3 x 0.5
Power Connector	Male 6-pin push pull Hirose Mating connector: HR10A-7P-6S(73)
Lens Connector	USB Mini B
Video Output	2x DIN 1.0/2.3 type
Sync Input	1x DIN 1.0/2.3 type

Table 3. Mechanical specifications

## 2.2 Power

2KSDI-Mini cameras are powered using a 7-19V DC power source. The power connector is shown in Figure 2, and the pinout is shown in Table 4. When using active EF lens mount the power supply must be 8-16V DC.

Pin	Description
1	NC
2	RS485 (A) –
3	7-19V
4	NC
5	RS485 (B) +
6	GND

Table 4. Power connector Pinout

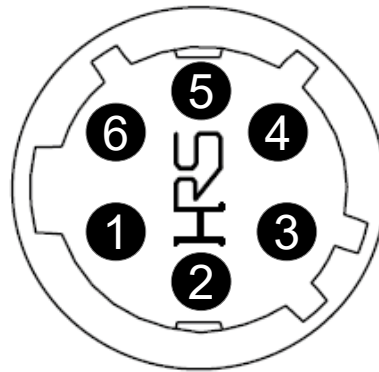


Figure 2. Power Connector

Typical power consumption for 2KSDI-Mini cameras is shown in Table 5.

Model	Configuration	Typical Power (12V supply)
2K(M)SDI-Mini	2K/1080P 60Hz, 3G-SDI ( <i>res 2, fps 9</i> )	0.29A, 3.5W
	2K/1080P 30Hz, HD-SDI ( <i>res 2, fps 4</i> )	0.26A, 3.1W
	720P 50 Hz HD-SDI ( <i>res 0, fps 7</i> )	0.25A, 3.0W
2KSDI-Mini RS	2K/1080P 60Hz, 3G-SDI ( <i>res 2, fps 9</i> )	0.31A, 3.7W
	2K/1080P 30Hz, HD-SDI ( <i>res 2, fps 4</i> )	0.28A, 3.5W

Table 5. Power consumption

## 2.3 Lens

A stainless steel C-mount lens adapter ring is used to ensure the proper back focus. The position is factory calibrated and tested on each camera. Two set screws on the sides (#4-40) firmly hold the ring in place. The position of the ring can be adjusted, if necessary, use a 0.05" hex key. The amount of torque on the set screws should not exceed 22.5 ounce inches or deflection in the stainless steel ring may occur causing issues threading lenses on and off the camera.

An optional C-mount to Active EF-mount adapter is also available. Focus and aperture controls are fully integrated into the 2KSDI-Mini camera. The lens connector is shown in Figure 3, and the pinout is shown in Table 6. When using the Active EF-mount adapter the power supply must be 8-16V DC.

Pin	Description
1	NC
2	RS232 RX
3	RS232 TX
4	Power Out (8-16V)
5	GND

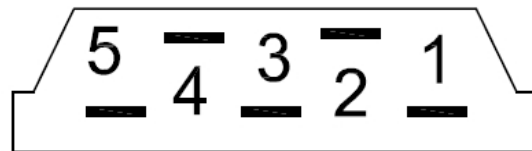


Figure 3. Lens Connector

Table 6. Lens connector Pinout

### 2.3.1 DC Iris

All 2KSDI-Mini cameras are available in a “D” variant that includes an alternate lens connector pinout (Table 7) that supports DC iris lenses.

Pin	Description
1	Drive+
2	Damp+
3	Damp-
4	NC
5	Drive-

*Table 7. DC iris lens connector Pinout*

## 3 Environmental

### 3.1 Temperature

The operating temperature range of the 2KSDI-Mini cameras is -30°C to 65°C, with 20-85% relative humidity non-condensing. The Field Programmable Gate Array (FPGA) die and image sensor temperatures can be monitored through the RS485 interface (see *tmp* and *stp* commands in Table 15).

The storage temperature range is -40°C to 85°C, 10-90% relative humidity non-condensing.

### 3.2 Shock and Vibration

Results of shock and vibration testing performed on 2KSDI-Mini camera are shown in Table 8.

Specification	Spec Paragraph Method/Condition	Test Level Details	Result
MIL-STD-810G	514.6 Vibration	3-axis Vibration Category 20	Pass
MIL-STD-810G	516.6 Shock	3-axis Shock 40G (3 pulses +/-)	Pass
MIL-STD-810G	516.6 Shock	3-axis Shock 75G (2 pulses +/-)	Pass

Table 8. Shock and vibration testing results

## 4 Sensor Specifications

The 2KSDI-Mini camera sensor specifications are shown in Table 9.

Specification	2KSDI-Mini	2KM5SDI-Mini	2KMSDI-Mini	2KSDI-Mini RS
Sensor	Sony Pregius IMX265	Sony Pregius IMX252	Sony Pregius IMX250	Sony Exmor-R IMX183
Active Pixels	2048 x 1080	2048 x 1080	2464 x 2056	4096 x 2160
Optical Format	Type 1/1.8 (8.9mm diagonal)	Type 1/1.8 (8.9mm diagonal)	2/3" (11.1mm diagonal)	2/3" (11.1mm diagonal)
Pixel Pitch	3.45 $\mu\text{m}$	3.45 $\mu\text{m}$	3.45 $\mu\text{m}$	2.4 $\mu\text{m}$
Shutter Type	Global	Global	Global	Rolling
ADC Bit Depth	12-bit	12-bit	12-bit	12-bit
Dynamic Range	73.6 dB	73.6 dB	73.6 dB	72.0 dB

Table 9. Sensor specifications

## 5 Remote Control

A handheld remote control can be used to control the 2KSDI-Mini cameras. The remote body is made from machined aluminum with a 9-button membrane keyboard making it extremely rugged and durable. On three sides of the remote there are 1/4"-20 (tripod) mounting holes and the bottom side has a 4-pin LEMO connector for power and communications.

Figure 4 shows the front view of the remote control, with a description of the button functions.

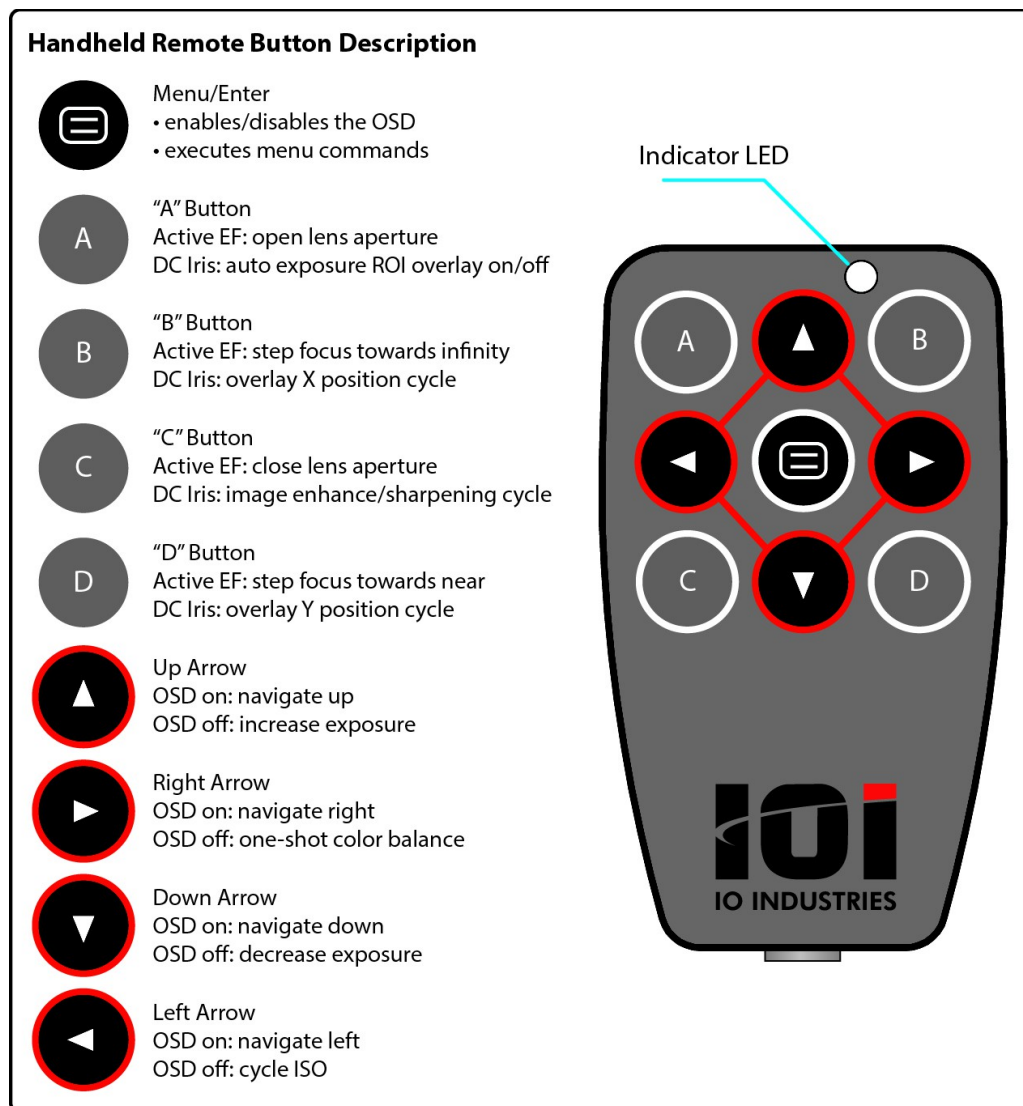


Figure 4. Remote control

The mechanical specifications are shown in Table 10.

Specification	Description
Size	62.0 mm (w) x 99.3 mm (h) x 17.5 mm (d)
Weight	150 g
Mounting Holes	3x 1/4"-20 (tripod), top and sides
Power/Comm Connector	4-pin LEMO EGJ.0B.304-CLA Mating connector used on IO Industries cables: FGJ.0B.304-CLLD52Z

Table 10. Remote mechanical specifications

The pinout of the power connector is shown in Table 11.

Pin	Description
1	RS485 (A) –
2	RS485 (B) +
3	GND
4	10-19V DC

Table 11. Remote power connector pinout

## 5.1 On Screen Display

The On Screen Display (OSD) menu overlay is in the top left corner of the output images. The OSD is overlaid on the primary output when the enter button is pressed.

Press the **Enter** button in the center of the remote to open the menu. The main menu is shown in Figure 5.

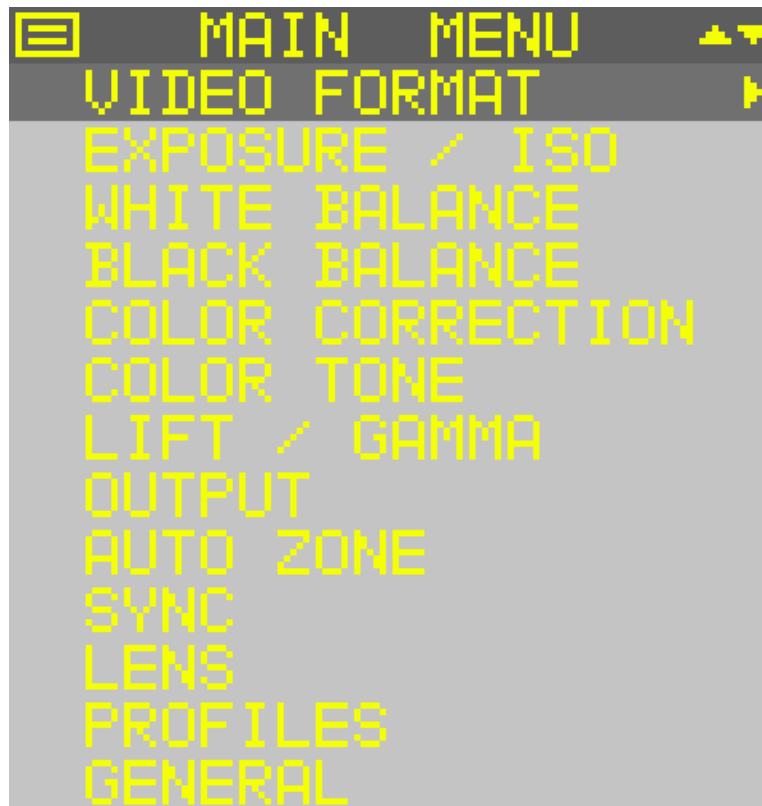


Figure 5. Main menu

The main menu is overlaid in the top left of the image, inside the safe action zone. The menu is alpha blended with the luma portion of the image for transparency. The top line or title line of the menu indicates whether the main menu or sub-menu is currently being displayed. The **Enter** button symbol is shown in the top left corner of the main menu to indicate how to exit the main menu. Press the **Enter** button to close the main menu.

Use the **Up** and **Down** scroll keys on the keypad to navigate the main menu, indicated by the up/down arrow in the top right corner of the menu.

The currently selected line is indicated by the mid grey level. The menu background is the lightest grey tone, and the title line is the darkest.

Press the **Right** scroll key to select a sub-menu.

### 5.1.1 Sub-Menus

While in the main menu press the **Right** scroll key to select a sub-menu. The **Exposure** sub-menu is shown in Figure 6.



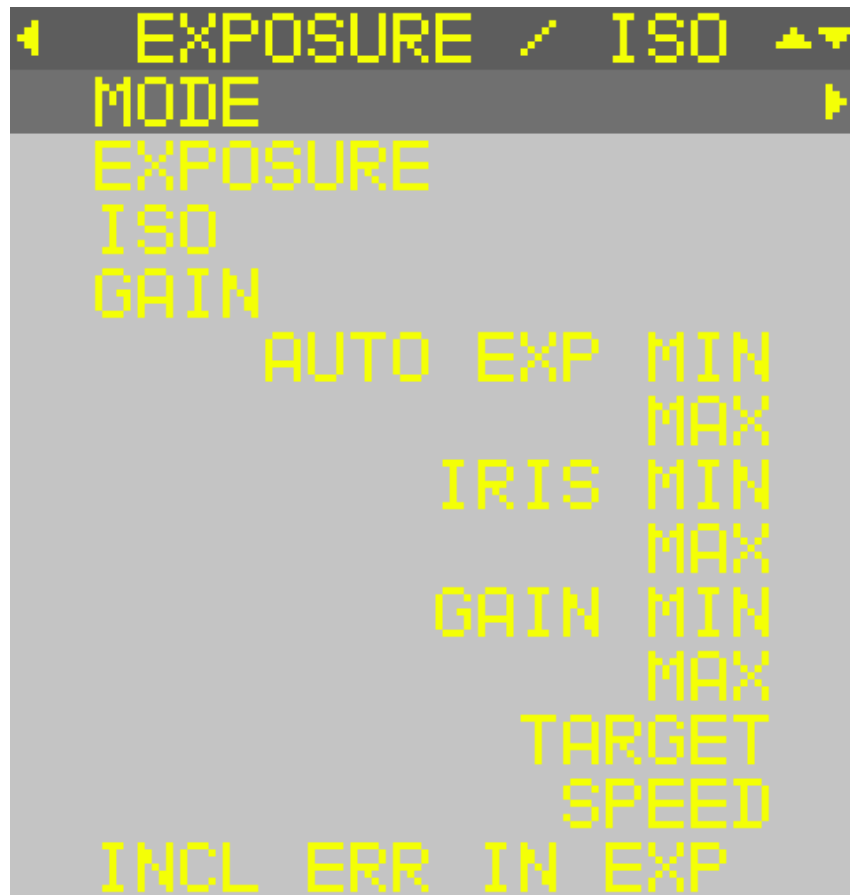


Figure 6. Exposure sub-menu

The **Left** scroll button symbol is shown in the top left corner of any sub-menu to indicate how to return to the main menu. Press the **Left** scroll button to return to the main menu.

Use the **Up** and **Down** scroll keys on the keypad to navigate the selected sub-menu commands, indicated by the up/down arrow in the top right corner of the menu.

To select a command press the **Right** scroll key while that command is the active line (mid grey tone line). If a command is not selectable the right arrow will not appear when the line is selected. For example changing the exposure is not possible when auto-exposure is enabled.

Figure 7 shows the Exposure sub-menu with the exposure command selected.

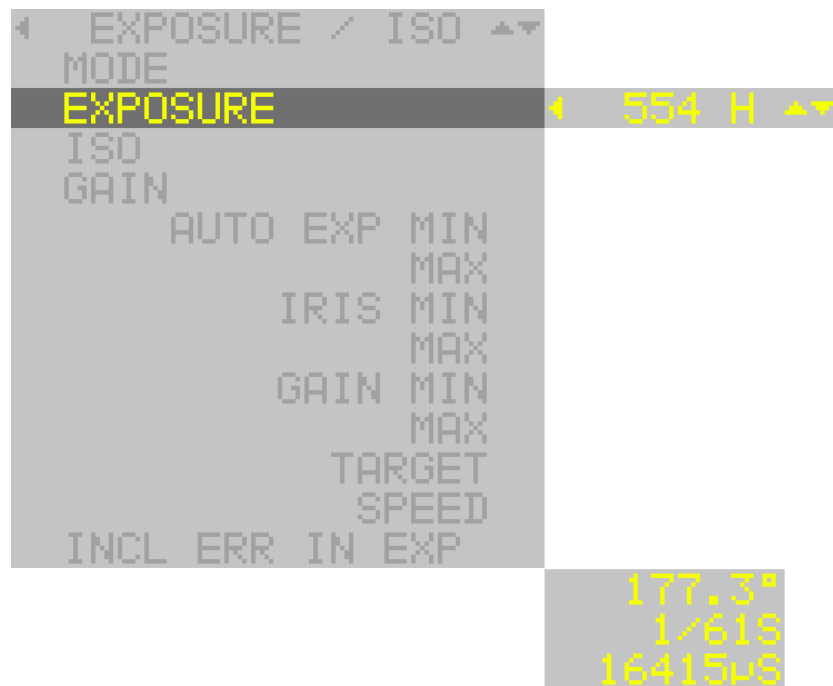


Figure 7. Exposure sub-menu with exposure command selected

When a command is selected the current setting is shown to the right of the sub-menu. Only the selected command line is displayed with yellow text and the rest of the sub-menu text is changed to a mid grey value. Use the **Up** and **Down** scroll keys to change the command parameter, indicated by the up/down arrows shown at the end of the parameter line.

When the lowest parameter value for the command is reached only the up arrow will be displayed, and when the highest parameter value is reached only the down arrow will be displayed. If there is only one option for the command neither the up nor down arrow will be shown.

To return to the sub-menu press the **Left** scroll key.

When an exposure related command is selected a secondary overlay is shown to the bottom right of the menu. The exposure command in 2KSDI-Mini cameras is set in number of lines. The total number of lines transferred over an SDI interface varies with the resolution and the line time varies with frame rate. The secondary overlay displays the exposure time in commonly used terminology: degrees, fraction of a second and in microseconds.

Some commands will change the parameter immediately, like the exposure time shown in Figure 7. For commands that take longer to execute (output format) and those which present a list of available options to select (save to user set), the **Enter** key will be shown at the end of the parameter line.

The Video Format sub-menu with the format command selected is shown in Figure 8.



Figure 8. Video format sub-menu with format command selected

For commands where the **Enter** key is shown at the end of the parameter line, scroll through the list of parameters using the **Up** and **Down** scroll keys and to set the desired parameter press the **Enter** button. After the command completes the on-screen menu will return to the sub-menu. To exit the parameter list for a command press the **Left** scroll key.

## 5.2 Command Protocol

The remote control uses a simple ASCII command protocol similar to the host RS485 adapter. Below are some key points about the serial control:

- 8-bit, 115200 baud, 1 stop bit and no parity.
- All remote control commands start with a single apostrophe sign (0x27) followed by a character in the range 0x30-0x3f and finish with a carriage return (0x0d).
- When the remote control is first powered a discovery command of '0<CR> (0x27, 0x30, 0x0d) is repeated until any button is pressed or an ACK character (0x06) is received from the camera. The status LED will blink during this process.

Table 12 shows the character values for each button on the membrane keyboard. Some advanced users can integrate these commands into other RS485 equipment to control 2KSDI-Mini cameras.

Button	ASCII Character (hex value)	Button	ASCII Character (hex value)
Enter	5 (0x35)	A	1 (0x31)
Left Scroll	4 (0x34)	A held	< (0x3c)
Right	6 (0x36)	B	3 (0x33)
Up	2 (0x32)	B held	= (0x3d)
Up held	: (0x3a)	C	7 (0x37)
Down	8 (0x38)	C held	> (0x3e)
Down held	; (0x3b)	D	9 (0x39)
		D held	? (0x3f)

Table 12. Keyboard ASCII command values

## 6 Host Control Utility

A utility is provided to control the Victorem 2KSDI-Mini cameras using a USB to RS-485 adapter connected to a PC running a 32-bit or 64-bit Windows (XP and higher) operating system. Other RS-485 adapters can be used, however contact IO Industries for a list of supported devices.

### 6.1 Installation

Follow the steps below to install the application:

1. Extract the installers
2. Run `victorem.exe` (or `victorem_x64.exe`).
3. Press `Next` on the first screen, *Welcome to Victorem Software Setup*.
4. Choose a destination folder for the install. Use the `Browse` button to navigate the system for a location.
5. Chose which components to install on the *Choose Components* screen.
6. Press `Install` button.
7. Part way through a driver installer package for the USB to RS-485 cable adapter will also run. Follow the instructions.
8. Depending on the system a reboot may be necessary when the installation completes.

### 6.2 Component Setup

Once the control utility has been installed, follow the steps before to setup the Victorem 2KSDI-Mini camera system:

- Put lens on camera.
- Connect power supply or battery to camera.
- Connect coax cable to SDI output SDI1 and/or SDI2 and connect the other end of the cable to a monitor or recorder.
- Plug USB to RS-485 connector cable to PC (USB side), and connect other end of cable (Lemo) to power cable extension connector.
- With the camera powered start host application, `victorem_sdi.exe`.

There are 7 main views to the control application which are described in the following sections:

- General, Exposure, Gain/Level, Color, Output, Lens, and Sync/Misc.

When the application starts all detected cameras' serial numbers will be in the drop list at the top of the application interface. A refresh button in the top left corner will force the application to re-scan all available COM ports in the system for Victorem 2KSDI-Mini cameras.

Select the serial number of the camera to control in the drop list.

## 6.3 Slider Bar Control

Many parameters in the control utility are changed using a slider bar control. Use the mouse to move the slider bar to change values, while holding down the left mouse button. Once focus is on the slider bar the following keyboard options can also be used to change the setting:

- Left/right or up/down arrow keys for fine adjustment.
- Page up/down keys for coarse adjustment.
- Home and End keys to set value to minimum or maximum, respectively.

## 6.4 General View

The general control view is shown in Figure 9.

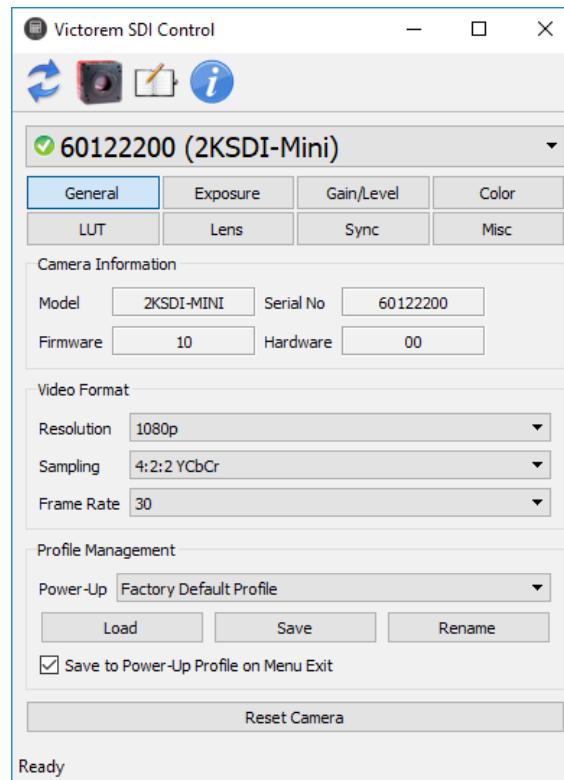


Figure 9. General view

### 6.4.1 Camera Information

The model, serial number, firmware version, and hardware version are shown in the section for the selected camera.

### ***6.4.2 Video Format***

Use the Resolution drop down list to chose the camera's output resolution. The resolution selection overrides the color sampling and frame rate options. For example if the current color sampling is set to 4:4:4 RGB and the resolution is changed to 1080i, the color sampling will be automatically switched to 4:2:2 YCbCr.

For frame rates 30Hz or lower at 1080p and 2K resolutions, both 4:4:4 RGB and 4:2:2 YCbCr sampling are available. Only 4:2:2 YCbCr is available for frame rates higher than 30Hz as well as 720p and 1080i resolutions. RAW sampling is available for all resolutions and frame rates. The 2KMSDI-Mini monochrome camera is limited to RAW sampling only. Use the Sampling drop down list to choose the sampling format.

Use the Frame Rate drop down list to choose the camera's output frame rate.

### ***6.4.3 Profile Management***

To change the power-up profile of the camera select one of the 8 user profiles or the factory profile in the drop down list.

To save the current camera settings to one of the 8 user profiles press the Save button. Select the profile from the drop list and press the OK button.

To rename one of the 8 user profiles press the Rename button. Select the profile to rename in the drop down list. Enter the new name for the profile, max 31 characters and press OK.

Note only the first 16 characters of the user profile name will be shown in the OSD menu overlay.

An option is included to save the camera's current settings the selected power-up profile when exiting the camera's on-screen display menu.

## ***6.5 Exposure View***

The Exposure control view with Manual exposure mode selected is shown in Figure 10.

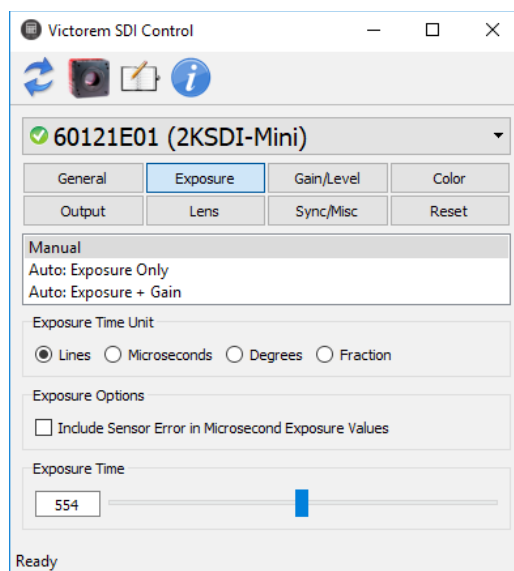


Figure 10. Exposure view

### 6.5.1 Exposure Time

Use the slider bar to or enter a value to set the exposure time. Exposure time in the camera is in units of lines, but the Exposure Time Unit selection changes the control's display to be either lines, microseconds, degrees or fractions of a second as desired. Table 13 lists the line times of all output modes.

Output Mode	Line Time ( $\mu$ s)
1080p60 / 2k60 / 1080i60	14.815
1080p59 / 2k59 / 1080i60	14.830
1080p50 / 2k50 / 1080i60	17.778
2k48	18.519
2k47	18.537
1080p30 / 2k30	29.630
1080p29 / 2k29	29.659
1080p25 / 2k25	35.556
1080p24 / 2k24	37.037
1080p23 / 2k23	37.074

Table 13. Line times

The sensor in the camera has a fixed “exposure error” that is added to the exposure time. To include this error in the displayed exposure time, click the checkbox under Exposure Options. Table 14 lists the exposure error.



Model / Mode	Exposure Error ( $\mu$ s)
RS models / 1080p or 2K, 60 or 59Hz	2.18
RS models / all other modes	2.11
All other models and modes	13.73

Table 14. Exposure error

### 6.5.2 Auto Exposure Modes

The Exposure view with automatic exposure enabled is shown in Figure 11. All 2KSDI-Mini cameras support two modes of automatic exposure control: Exposure Only and Exposure + Gain. Cameras equipped with an EF lens mount add the following modes: Exposure + Aperture and Exposure + Aperture + Gain.

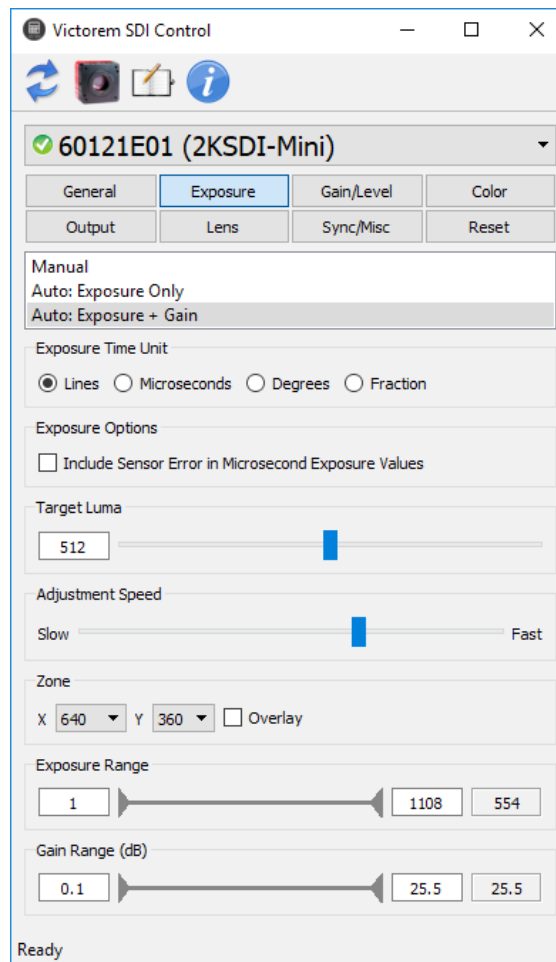


Figure 11. Automatic exposure mode

When automatic exposure is enabled, the camera calculates the average luma of a 1/5 height by 1/5 width zone and compares it to the Target Luma value. Adjustments are made to the exposure, gain and aperture to reach the target value. Use the edit box or slider bar to adjust Target Luma. Move the auto exposure zone by selecting its X and Y position with the drop down lists. Check the check box to display the zone on the overlay.

Use the Exposure, Gain, and Aperture Range controls to ensure that the exposure, gain and aperture stay within the desired range. The rate at which the camera modifies the parameters is controlled by the Adjustment Speed slider.

“D” model cameras add a DC Iris auto exposure mode. In this mode the camera uses the calculated average luma of the auto exposure zone to drive a voltage to the DC Iris lens. The lens will adjust its aperture to keep a consistent luma level.

## 6.6 Gain/Level View

The Gain/Level view is shown in Figure 12.

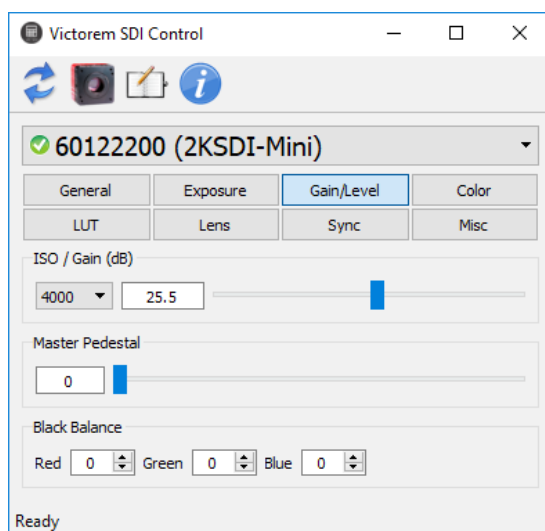


Figure 12. Gain/level view

### 6.6.1 Gain

Gain can be adjusted by selecting either the ISO level or directly setting the gain in dB.

The gain setting varies between non-RS and RS camera models. All models have a total analog and digital gain that can be set from 0dB to 48dB. Non-RS cameras have gain up to 24dB applied with an analog gain block, while any additional gain up to 48dB total is applied with a digital gain block, both of which are on the sensor. RS models cameras have gain up to 26.6dB applied with an analog gain on the sensor, while any additional gain up to 48dB total is applied with a digital gain block in the camera.

## 6.6.2 Master Pedestal

Use the slider bar or edit box in the Master Pedestal section to set the output master pedestal.

## 6.6.3 Black Balance

The black balance can be used to apply an offset to each color plane independently. The range of the offsets is -511 to 511. The pixel value range is compressed or stretched depending on the offset to maintain the full dynamic range.

## 6.7 Color View

The Color control view is shown in Figure 13.

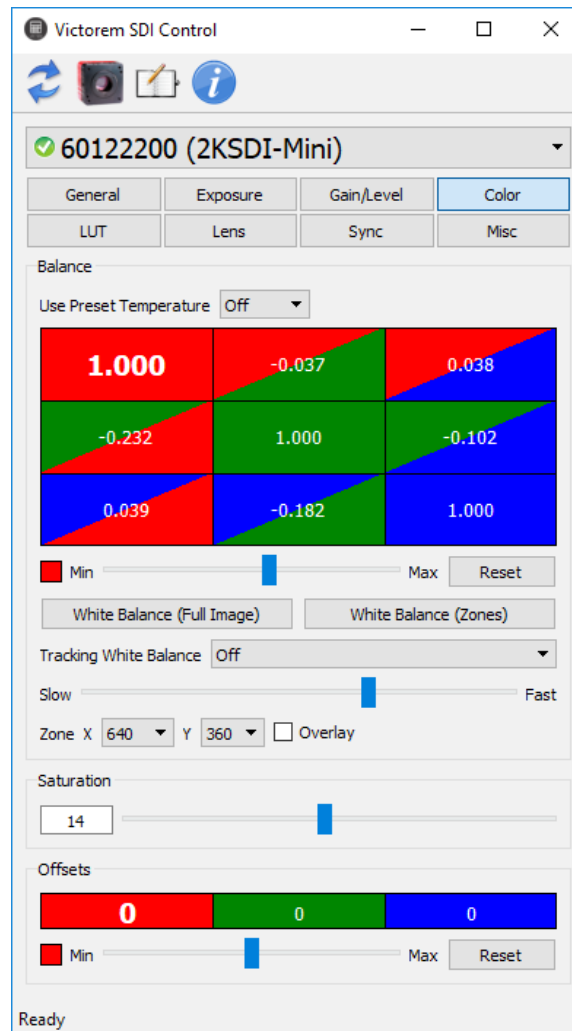


Figure 13. Color view

### 6.7.1 Balance

The Victorem 2KSDI-Mini has a number of color temperature presets from 2000K to 8000K, in 100K increments. Select the desired color temperature from the Use Preset Temperature list to load the color matrix with the preset. With a color preset selected the red, green, and blue multipliers in the Color Correction Matrix (CCM) cannot be changed and will be greyed out. The White Balance and Tracking White Balance features are also not available when a color preset is selected. To manually change the color multipliers or use the automatic white balance features select Off from the Use Preset Temperature list.

The CCM is used to compensate for cross-talk induced by the sensor micro-lenses and color filter process, lighting and temperature effects. The range of the multipliers in the 3x3 matrix is (-7.999, 7.999) in steps of  $1/1024 \approx 0.001$ . The matrix is shown in Figure 14.

$$\begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} = \begin{bmatrix} C_{rr} & C_{rg} & C_{rb} \\ C_{gr} & C_{gg} & C_{gb} \\ C_{br} & C_{bg} & C_{bb} \end{bmatrix} \times \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Figure 14. Color matrix

Each of the nine elements are colored to easily identify the colors effected by the multiplier. To change one of the multipliers first select the element in the matrix with the left mouse button. The selected element's value will be shown large than the others. Use the slider bar below the matrix to adjust the selected multiplier. Press the Reset button to reset the selected element.

The identity elements ( $C_{rr}$ ,  $C_{gg}$ , and  $C_{bb}$ ) are used for white balance. These elements can be changed manually or press either of the White Balance buttons to perform automatic color balance.

For continuous automatic white balance select one of the options from the Tracking White Balance drop down. Tracking white balance uses either the full image or a 1/5 height by 1/5 width movable region. Use the slider bar to adjust the speed and smoothness of CCM adjustments made by tracking white balance.

### 6.7.2 Saturation

The color saturation can be set from 0 to 30. A saturation of 10 produces no change, a value of 0 produces black and white images, and values greater than 10 increase saturation with a value of 30 producing super color. To change the color saturation enter a value into the edit control box, or use the slider bar.

### 6.7.3 Offsets

An offset can be applied to each color plane at the output of the CCM and saturation block within the color processing pipeline of the 2KSDI-Mini camera. The range of the integer offset is (-511, 511). To change the offset value first select the color plane to adjust. Next use the slider bar to adjust the offset value. Press the Reset button to set the selected offset back to zero.

## 6.8 LUT View

The LUT control view is shown in Figure 15.

### 6.8.1 LUT

The Victorem 2KSDI-Mini cameras have two user lookup table (LUT) stages in the data path. The first stage allows separate lookup tables to be applied to each of the color planes independently before color space conversion. The second stage is the Gamma stage that applies a lookup table to luma after color space conversion.

Up to eight tables can be saved to the camera alongside a fixed factory default gamma table called IO Gamma 1. Select the lookup table to load by using the LUT drop down list.

Any of the eight saved LUTs can be renamed. Press the Rename LUT button and then select the table to rename. A dialog will pop up with an edit box to enter a new name. The name can be up to 31 characters long. Note that the SDI on-screen menu will only display 16 characters. Press OK to save the name or Cancel to abort.

To load a custom LUT into the camera press the Replace LUT button then select the LUT to be overwritten from the drop down list. Press the Load button. A file select dialog will appear for choosing the file to load. The LUTs loaded into the Victorem 2KSDI-Mini cameras at the factory are stored in the LUT sub-folder in the installation path (..\IO Industries\Victorem\Lut) shows an example of a .lut file, which can be edited using any text editor. An example .lut file is shown in Figure 16.

### 6.8.2 Luma Curve

The Victorem 2KSDI-Mini cameras include an adjustable luma curve for fine-tuning luminance output after the lookup tables have been applied. The luma curve is constructed in a piecewise manner with 4 movable knee points that are connected by 5 linear segments.

Input to the luma curve is represented by the X axis. Output from the luma curve is represented by the Y axis. The curve can be adjusted either dragging the kneepoints on the curve or directly editing their coordinates.

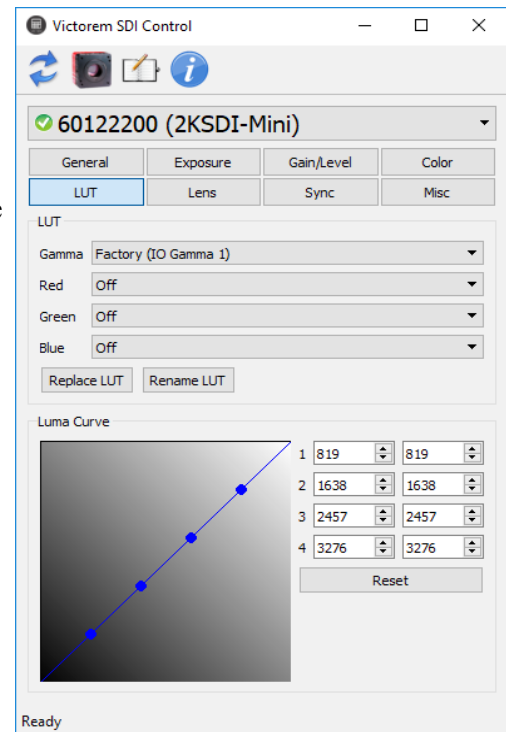


Figure 15: LUT view

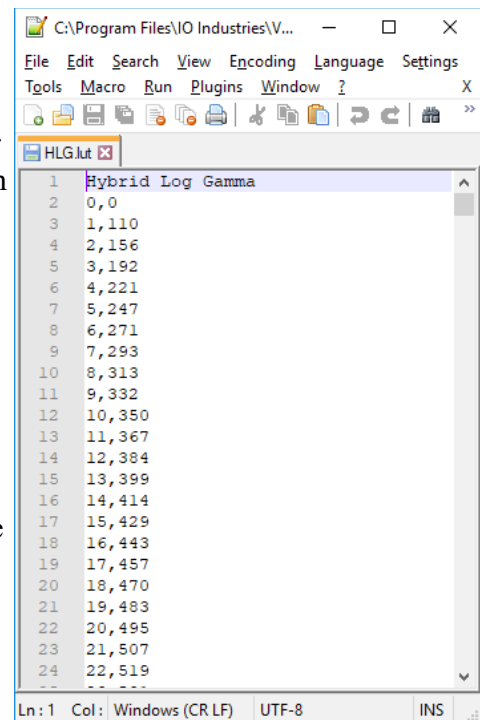


Figure 16: .lut file

## 6.9 Lens View

The Lens control view is shown in Figure 17. This view is used to control lenses connected to a camera with an EF lens mount. The Lens control view is not available for “D” model cameras that support DC Iris lenses.

### 6.9.1 Aperture

The aperture setting controls the iris in the lens to vary the amount of light it allows into the camera. An aperture value of zero corresponds to a fully open aperture. The maximum number of aperture steps varies from lens to lens.

### 6.9.2 Focus

The large arrow buttons are used to change the focus position of the lens. From left to right the button functions are: move focus to minimum, step focus towards minimum, step focus towards infinity, and move focus to infinity. The Step Size adjustment controls how far the lens moves with each press of the step arrows. The effect of the step size varies from lens to lens.

### 6.9.3 Status

Information about the current state of the lens is displayed in the status area.

### 6.9.4 Direct Control

The Direct Control section is for sending commands directly to the EF lens mount.

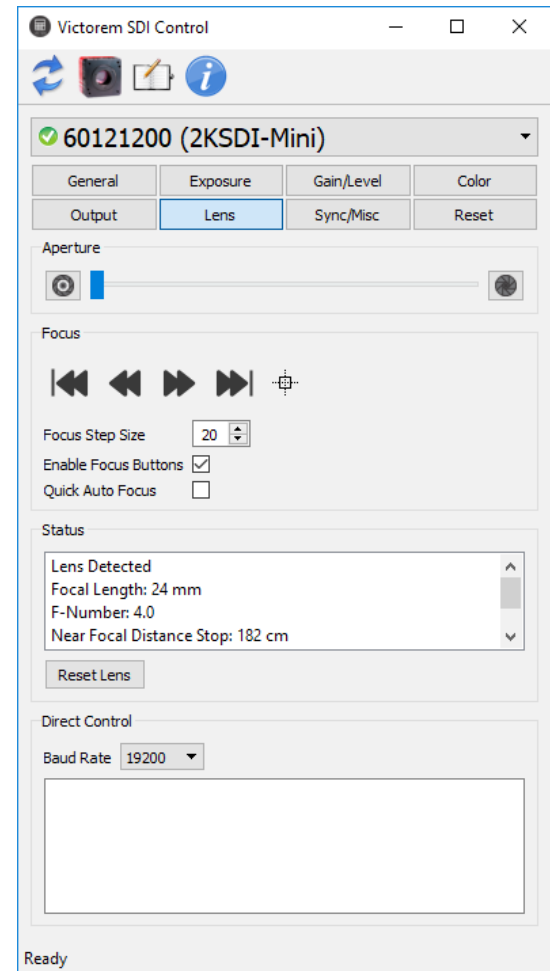


Figure 17. Lens view

## 6.10 Sync View

The Sync/Misc control view is shown in Figure 18.

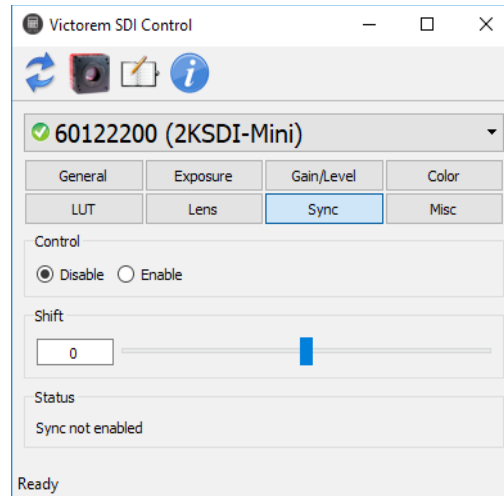


Figure 18. Sync view

The Victorem 2KSDI-Mini has a sync input on the back of the camera supporting tri-level sync signals. Use the radio button to enable tri-level sync.

Possible status indications are listed in .

Status	Description
Line Lock	The camera's internal clock is being generated based on the sync input (if connected) or past sync input (if disconnected or changed).
Frame Lock	The camera output is synchronized to the sync input.
Match	The signal on the sync input matches the camera format.
Detect	A signal is detected on the sync input.

When sync is enabled but there is not a valid signal on the sync input, the camera status LED will flash red. When the camera is locking to the sync input, the LED will flash green. When the camera is locked on to the sync signal the LED will stop flashing and remain green.

## 6.11 Misc View

The Misc View is shown in Figure 19.

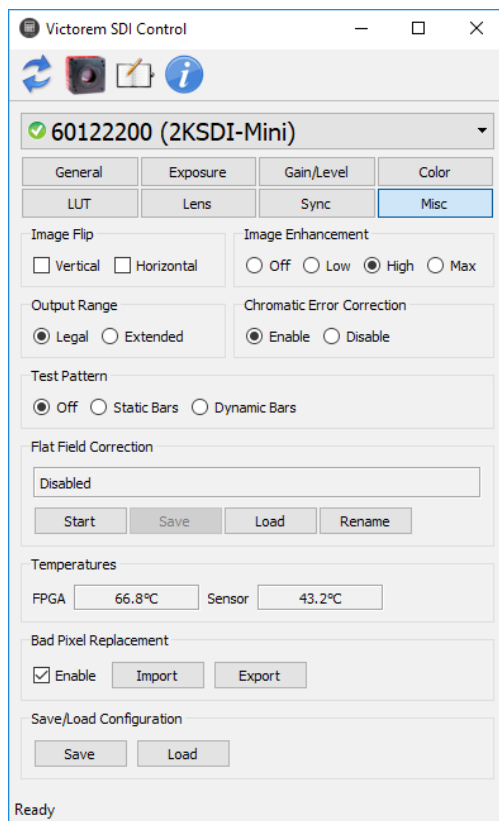


Figure 19. Sync view

### 6.11.1 Image Flip

The output of the camera can be flipped in the vertical and/or horizontal (non-RS only) directions.

### 6.11.2 Image Enhancement

Image Enhancement can be enabled to improve the sharpness of edges and lines in the output image. Three levels of intensity are selectable with the radio buttons.

### 6.11.3 Output Range

The output pixel value range can be set to either Legal (SMPTE 274M 8.7) or Extended (SMPTE 274M 8.12). Legal range for luma is 64-940. Legal range for chroma is 64-960. Extended range for both luma and chroma is 4-1019. Raw sampling mode always used extended range output.



#### **6.11.4 Chromatic Error Correction**

Enabling this correction reduces chromatic errors along sharp edges.

#### **6.11.5 Test Pattern**

The test pattern is a set of six vertical bars. From left to right the colors are: white, yellow, cyan, green, magenta, red, and blue. The dynamic pattern adds a moving vertical line and a moving horizontal line.

#### **6.11.6 Flat Field Correction**

For lenses that do not evenly illuminate the camera's sensor, the Victorem 2KSDI-Mini cameras include a flat field correction algorithm. Once calibrated, the flat field correction can eliminate lens vignetting. Up to 4 different corrections can be stored in the camera's non-volatile memory. Use the following procedure to calibrate and load a flat field correction.

1. Set up the lens as it is to be used for shooting, including desired aperture, for best results.
2. Point the camera at an evenly illuminated and colored scene such as a white sheet of paper or a plain, out of focus wall.
3. Set the exposure time so the scene is a medium gray, with no pixels saturated or black.
4. Click the Start button in the Flat Field Correction section.
5. Save the correction by clicking the Save button and selecting a location. The stored correction can be renamed by clicking the Rename button.
6. Load a correction by clicking the load button and selecting the desired correction location.

#### **6.11.7 Temperatures**

Displays the current temperature of the camera's FPGA and sensor. Note that RS model cameras are unable to report the sensor temperature.

#### **6.11.8 Bad Pixel Replacement**

The bad pixel replacement algorithm should always be enabled. To export a text file containing a list of bad pixels, click Export. Click Import to import a list of bad pixels from a text file.

#### **6.11.9 Save/Load Configuration**

The Victorem SDI Control can save a camera configuration to a file. Use the Save and Load buttons to save or load configurations.

## 7 Camera Commands

For advanced users, control of a 2KSDI-Mini camera can be done using a terminal program or control can be incorporated into a custom user interface or application using the simple ASCII command protocol. Below are some key points about the serial control:

- 8-bit, 115200 baud (default), 1 stop bit and no parity.
- All sent commands end with a carriage return (0x0d), which can also be sent at any time to reset the uart receiver state machine within the camera and return it to an idle/ready state.
- Commands are 3 ASCII characters followed by the setting or simply a carriage return when no settings are associated with the command.
- A space is sent between the command and the setting.
- All settings are in hexadecimal.
- All commands letters are in lower case (including settings hex values a-f).
- To query a command a carriage return is sent after the last command character.
- Successful commands return ACK (0x06, generally seen as a dash (-) in terminal programs), invalid or rejected commands return NAK (0x15, generally seen as plus sign (+) in terminal programs). Note: some terminal programs do not display non-printable characters such as ACK and NAK.
- A query returns the command, the current value, the minimum and maximum allowable values within brackets, a carriage return and finally an ACK.
- Get camera parameters command (**gcp**) returns all command settings.

### *Examples:*

1. Set exposure time to 563 lines:
  - Command: **exp 233<CR>**
  - Response: **<ACK>**
2. Query exposure time:
  - Command: **exp<CR>**
  - Response: **exp 233 (001,454)<CR>**  
**<ACK>**

## 7.1 Command Summary

Table 15 summarizes all available commands. The presence and size of a command's parameters are shown with the letter 'Y' (see *Format* column). Each letter 'Y' represents a hexadecimal digit from 0 to f.

Command	Format	Description
<b>VARIANT</b>		
Variant Version	<b>var</b>	Returns variant version of firmware.
<b>VIDEO FORMAT</b>		
Resolution	<b>res Y</b>	Output resolution: 0 – 720p (not available in 2KSDI-Mini RS) 1 – 1080i 2 – 1080p (default) 3 – 2K
Image Sampling	<b>sam Y</b>	Image sampling: 0 – 4:2:2 YCbCr (default) 1 – RAW (default for 2KMSDI-Mini) 2 – 4:4:4 RGB
Frame Rate	<b>fps Y</b>	Output frame rate: 0 – 23.98Hz 1 – 24Hz 2 – 25Hz 3 – 29.97Hz 4 – 30Hz (default) 5 – 47.95Hz 6 – 48Hz 7 – 50Hz 8 – 59.94Hz 9 – 60Hz
<b>TRI-LEVEL SYNC</b>		
Sync Enable	<b>syn Y</b>	0 – off 1 – on
Sync Shift	<b>sys YYY</b>	Shift output relative to sync input. Range 0x0001 – 0x1fff (-7.76ms to 7.76ms) Camera subtracts 1000h from parameter for signed 12-bit value and each count represents 1.896µS Sync shift only applies when sync first enabled, will return NAK if sync enabled

Command	Format	Description
Sync Detect	<b>syd</b>	Returns 4-bit value (single hex digit) Bit 0 – line locked <ul style="list-style-type: none"> <li>• Current output clock trained to TLS line time ('1').</li> </ul> Bit 1 – frame locked <ul style="list-style-type: none"> <li>• Output frame locked to TLS input, with +/- 8 line times (0<sub>H</sub> analog point) ('1').</li> </ul> Bit 2 – match detected <ul style="list-style-type: none"> <li>• TLS input matches current camera output rate ('1').</li> </ul> Bit 3 – input detected <ul style="list-style-type: none"> <li>• TLS input signal detected ('1').</li> </ul> Note, if the current sync state is drifting (“x001”, sync unplugged or frequency changed) and a command is sent that restarts the sensor framing ( <i>rst, lnk, res, sam, fps, lod</i> and <i>flp</i> in RS model) the sync control block will reset back to a not locked state (“xx00”).
<b>EXPOSURE</b>		
Exposure Time	<b>exp YYY</b>	Exposure time in lines (H) Range 0x001 – 0x454
<b>GAIN AND OFFSET</b>		
Sensor Sensitivity	<b>iso Y</b>	Sensitivity in ½ F stop (3dB) increments Range 0 – 16 Changing ISO will be reflected in agn setting, and vice versa
Gain	<b>agn YYY</b>	Range 0x000 – 0x1E0 Gain in 0.1dB steps 2KSDI-Mini <ul style="list-style-type: none"> <li>• Analog gain 0x000 – 0x0F0, up to 24dB</li> <li>• Digital gain 0x0F1 – 0x1E0, 24.1 to 48dB</li> </ul> 2KSDI-Mini RS <ul style="list-style-type: none"> <li>• Analog gain 0x000 – 0x10A, up to 26.6dB</li> <li>• Digital gain 0x10B – 0x1E0, 26.7dB to 48dB</li> </ul>
Sensor Black Level	<b>blk YYY</b>	Range 0x000 – 0xFFFF Default 0x000 <i>Not recommended to change</i>
<b>MISCELLANEOUS</b>		
Bad Pixel Replacement	<b>bpx Y</b>	0 – off 1 – on
Test Pattern	<b>pat Y</b>	0 – off 1 – color bars (static) 2 – color bars (dynamic)

Command	Format	Description
RS485 Baud Rate	<b>sb</b> Y	0 – 9600 1 – 19200 2 – 38400 3 – 57600 4 – 115200 (default, remote) 5 – 230400 6 – 460800
Image Flip	<b>fl</b> Y	0 – off 1 – vertical flip 2 – horizontal flip 3 – both direction flip <i>Note RS model only support vertical flip</i>
<b>Flat Field Correction</b>		
Flat Field Calculate	<b>ffc</b>	Run the flat field correction calibration.
Flat Field Save	<b>ffs</b> Y	Range 1-4 Save the current flat field correction to one of four flat field correction tables in non-volatile memory.
Flat Field Load	<b>ffl</b> Y	Range 0-4 Load desired flat field correction from non-volatile memory. 0 – clear current flat field correction
<b>EF LENS CONTROL</b>		
RS232 Baud Rate	<b>lbd</b> Y	0 – 9600 1 – 19200 (default) 2 – 38400 3 – 57600 4 – 115200
Learn Focus Enable	<b>fen</b> Y	0 – Do not automatically learn focus (savable command) 1 – Automatically learn focus
Aperture	<b>ape</b> YY	Range depends on lens Smaller the number the more open aperture
Focus Step Size	<b>fst</b> YY	Range 0x04 – 0xC8 Default 0x14
<b>AUTO ZONE (EXPOSURE AND WHITE BALANCE)</b>		
Zone X Position	<b>apx</b> Y	Range 0-4 Default 2 Zone size changes with output resolution: 720P – 426 x 240 1080I/P – 640 x 360 2K – 682 x 360 Start column = <b>apx</b> x (zone width/2)
Y Position	<b>apy</b> Y	Range 0-4 Default 2 Start row = (4 - <b>apy</b> ) x (zone height/2)

Command	Format	Description
Overlay	<b>apo Y</b>	0 – off 1 – on
<b>AUTO EXPOSURE</b>		
AEC Min Exposure	<b>amn YYY</b>	Minimum auto exposure time in lines (H) Range 0x001 – max ( <b>amx</b> )
AEC Max Exposure	<b>amx YYY</b>	Maximum auto exposure time in lines (H) Range min ( <b>amn</b> ) - 0x454
AEC Min Gain	<b>adn YYY</b>	Minimum auto gain Range <b>0x001</b> – max ( <b>adx</b> )
AEC Max Gain	<b>adx YYY</b>	Maximum auto gain Range min ( <b>adn</b> ) - 0x0FF
AEC Min Aperture	<b>aan YY</b>	Minimum auto aperture Range 0x00 – max ( <b>aax</b> )
AEC Max Aperture	<b>aax YY</b>	Maximum auto gain Range min ( <b>aan</b> ) – max (depends on lens)
AEC Target Luma	<b>aet YYY</b>	12-bit target luma value Range 0x040 – 0x3AC (legal luma range) Factory default 0x1D0
AEC Speed	<b>aes Y</b>	0 – slowest 1 – slow 2 – fast (default) 3 – fastest
AEC Enable	<b>aex Y</b>	0 – off 1 – Auto exposure 2 – Auto exposure + gain 3 – EF Mount: Auto exposure + aperture DC Iris: Auto iris 4 – EF Mount: Auto exposure + gain + aperture
<b>COLOR</b>		
<i>Color Temperature</i>	<b>ctp YY</b>	Color temperature settings in 100K steps Value of 0x00 is off or custom Range 0x01 – 0x3D (2000K to 8000K) Any change to <b>crr/cgg/cbb</b> will change <b>ctp</b> back to custom (off), or running white balance or enabling tracking white balance Cannot be changed if tracking white balance enabled. Released in firmware version 02
Color Matrix RR	<b>crr YYYY</b>	Color Matrix Red-Red multiplier Range 0x0001 – 0x3FFF (-7.996 – 7.996) Subtract 0x2000 for signed 3.10 fixed point multiplier Value of 0.0 = 0x2000 Value of 1.0 = 0x2400 Default 0x2400

Command	Format	Description
RG	<b>crg YYYY</b>	Default 0x1FDA ( <i>default matrix values changed in firmware version 10</i> ) RS model default 0x2026
RB	<b>crb YYYY</b>	Default 0x2027 RS model default 0x200D
GR	<b>cgr YYYY</b>	Default 0x1F12 RS model default 0x1F1E
GG	<b>cgg YYYY</b>	Default 0x2400
GB	<b>cgb YYYY</b>	Default 0x1F97 RS model default 0x2018
BR	<b>cbr YYYY</b>	Default 0x2028 RS model default 0x1FEC
BG	<b>cbg YYYY</b>	Default 0x1F45 RS model default 0x1FC2
BB	<b>cbb YYYY</b>	Default 0x2400
Color Offset R	<b>ofr YYY</b>	Red color plane offset Range 0x001 – 0x3FF (-511 – 511) Subtract 0x200 for signed 9.0 offset Default 0x200
G	<b>ofg YYY</b>	Default 0x200
B	<b>ofb YYY</b>	Default 0x200
Tracking White Balance (TWB)	<b>twb Y</b>	0 – off 1 – on using full image 2 – on using zone
TWB Speed	<b>tws Y</b>	0 – slowest 1 – slow 2 – fast (default) 3 – fastest
Color Saturation	<b>sat YY</b>	Saturation in 0.1x steps 0x00 – no color (mono) 0x0A – no saturation applied 0x1E – default (1.4x)
<b>GAMMA AND LUT</b>		
Gamma / RAW LUT	<b>lut Y</b>	12-bit LUT Applies to RAW data path and luma after color space conversion 0 – off 1-8 – select user 1D LUT 9 – select factory LUT
Red Tone LUT	<b>rlt Y</b>	12-bit LUT Applies to red color only before color space conversion

Command	Format	Description
Green Tone LUT	<b>glt Y</b>	12-bit LUT
Blue Tone LUT	<b>blt Y</b>	12-bit LUT
Piecewise Gamma Curve Kneepoint 1	<b>yc1 YYYYYY</b>	Input (X) and output (Y) position of first kneepoint X – bits 11:0, Y – bits 23:12 X range = 0x001 to (yc2 X – 1) Y range = 0x001 to 0xFFFF
Kneepoint 2	<b>yc2 YYYYYY</b>	X range = (yc1 X + 1) to (yc3 X – 1) Y range = 0x001 to 0xFFFF
Kneepoint 3	<b>yc3 YYYYYY</b>	X range = (yc2 X + 1) to (yc4 X – 1) Y range = 0x001 to 0xFFFF
Kneepoint 4	<b>yc4 YYYYYY</b>	X range = (yc3 X + 1) to 0xFFE Y range = 0x001 to 0xFFFF
Reset Piecewise Gamma Curve	<b>ycr</b>	Resets kneepoints 1, 2, 3 and 4 back to default values, producing 1.0x gain No parameter
<b>SENSOR POSITION (2KM5SDI-Mini only)</b>		
Sensor Position X	<b>spx YYY</b>	2k/1080p/1080i Range 0x000-0x1A0, default 0x0D0 720p Range 0x000-0x4A0, default 0x250 Must be mod 4.
Sensor Position Y	<b>spy YYY</b>	2k/1080p/1080i Range 0x000-0x3D0, default 0x1E8 720p Range 0x000-0x53C, default 0x29C Must be mod 4.
<b>OUTPUT</b>		
Master Pedestal	<b>mpd YY</b>	Range 0x00 – 0x7F
Red Black Balance	<b>rbb YYY</b>	Range 0x001 – 0x3FF (-511 – 511) Subtract 0x200 for signed 9.0 offset 10-bit data path also scaled by (1024-offset)/1024, pixel data squeezed or stretched into available space
Green Black Balance	<b>gbb YYY</b>	
Blue Black Balance	<b>bbb YYY</b>	
Image Enhance	<b>enh Y</b>	Range 0 – 3 0 – off 1-3 – increasing degree of image sharpening
Overshoot	<b>ovr Y</b>	0 – off (legal) 1 – on (extended)
Chromatic Error Correction	<b>chr Y</b>	Reduce chromatic errors along sharp edges 0 – off 1 – on (default)



Command	Format	Description
Frame Number (2KM5SDI-Mini Only)	<b>Fnm Y</b>	Replace the first pixel luma value with a frame counter. The value counts from 64 to 940 before restarting to keep it within SDI data value limits. 0 – off (default) 1 – on
<b>PROFILE</b>		
Power-Up Profile	<b>pup Y</b>	0 – factory profile 1-8 – user profile
Save to Profile	<b>sav Y</b>	Save current settings to a user profile in flash memory Range 1 – 8
Load Profile	<b>lod Y</b>	Load factory or user profile 0 – factory 1-8 – user profile
Auto save to Power-Up Profile	<b>asv Y</b>	0 – off 1 – on Auto save current settings when exiting on-screen menu Only applies if power-up profile is set to a user profile
<b>EXECUTE</b>		
Camera Reset	<b>rst</b>	Reset camera to power-up profile
<b>LENS UNSAVED</b>		
Lens adapter reset	<b>lnr</b>	Reset EF lens adapter
Focus Step to Min	<b>fsz</b>	Step focus towards minimum
Focus Step to Infinity	<b>fsi</b>	Step focus towards infinity
Move Focus to Min	<b>fcz</b>	Move focus to minimum setting
Move Focus to Infinity	<b>fci</b>	Move focus to infinity
Lens Status	<b>lns Y</b>	Query lens parameters/status 0 – Lens Ready 1 – Focal Length 2 – F Number 3 – Focus Near 4 – Focus Far 5 – Manual Focus 6 – Auto Focus Busy
Auto Focus	<b>afc Y</b>	One-shot auto focus 0 – sweep entire focus range for highest contrast position 1 – fast focus, stop at first high contrast position
<b>COLOR UNSAVED</b>		
Auto White Balance	<b>awb Y</b>	One-shot white balance 0 – using full image 1 – using zone

Command	Format	Description
<b>ADMIN</b>		
Camera Model	<b>cam</b>	Returns camera model string <i>Victorem 2KSDI-Mini</i>
Serial Number	<b>ser</b>	Returns 8 character serial number
Firmware Version	<b>ver</b>	Returns firmware version (2 char)
Hardware Version	<b>hvr</b>	Returns hardware version (2 char)
Get Camera Parameters	<b>gcp</b>	Returns all savable command up to and including <i>pup</i>
Open User Name	<b>onm YY</b>	Range 0x01 – 0x10 User savable names: 0x01-0x08 – User profiles 0x09-0x10 – LUT names 0x11-0x14 – Flat Field Correction names
Write Character to Name	<b>wnm Y</b>	Write character to open name
Save User Name	<b>snm</b>	Save current name to memory
Read User Name	<b>rnm YY</b>	Read current saved user name Range 0x00 – 0x15 0x15 – Factory LUT name
Error Register	<b>err</b>	Returns 8-bit error status Bit 0 – sensor alignment error
FPGA Die Temperature	<b>tmp</b>	Returns Sign + 8.8 (17-bit 2's complement) fixed point temperature in Celsius
Sensor Temperature	<b>stp</b>	Returns Sign + 8.8 (17-bit 2's complement) fixed point temperature in Celsius Not available in 2KSDI-Mini RS models
Firmware Reboot	<b>rbt</b>	Reload firmware bit file from flash

Table 15. Command summary

## 7.2 Video Format Commands

Notes on video format commands (*res*, *sam* and *fps*), and their interaction:

- Resolution command (*res*) takes top priority.
- Can always be changed to any value in full range (0-3).
- *res* command will change the current sampling and frame rate, and adjust their allowable ranges, if needed. For example in 720p mode only 4:2:2/RAW sampling is allowed, and frame rate range is 59.94Hz to 60Hz.
- If current frame rate is outside of allowable range for new resolution, the frame rate will be changed.
- 1080p resolution is not defined for 47.95Hz and 48Hz frame rates.
- 720p/1080i resolution is not supported for frame rates below 50Hz.
- Sampling command (*sam*) may be limited depending on frame rate and resolution.
- 2KMSDI-Mini only supports RAW output
- 4:4:4 RGB sampling format is only permitted 1080p and 2K resolutions.
- In 4:4:4 RGB format the max frame rate is 30Hz.

## 8 Firmware Update Utility

The FPGA firmware in a 2KSDI-Mini camera can be updated using a USB to RS-485 adapter connected to a PC running 32-bit or 64-bit Windows operating system. The firmware update utility, `victorem_isp.exe`, is in the **Bin** sub-folder of the install directory for the Victorem software, typically ***C:\Program Files\IO Industries\Victorem\Bin***. Please contact IO Industries if a firmware update is required. Figure 20 shows the update utility interface.

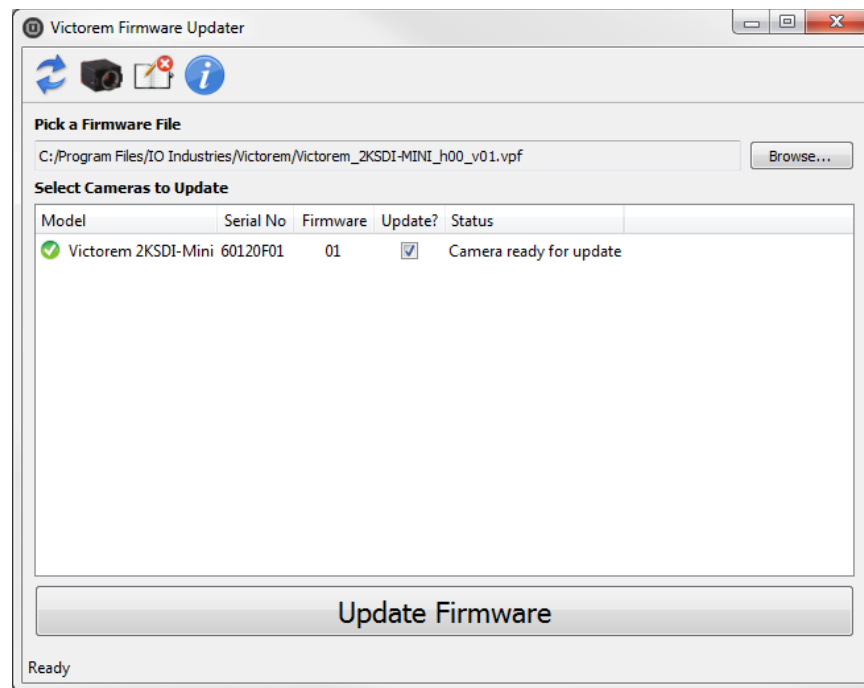


Figure 20. Firmware update utility

The utility will list all cameras found in a system. Select the file to program using the **Browse** button. Check the **Update?** checkbox beside the camera to update. Finally press **Update Firmware**. This operation takes approximately four minutes to complete. If the application is closed or power is lost part way through the update process, simply open the firmware utility and start the update again. The progress of the operation is shown on the status line for each camera.

## 9 Order Numbers

Part Number	Description
2KSDIMINI	Camera, 2K, 1080p/i, 720p, 1/2in. IMX265 sensor, color, global shutter, OLPF/IR filter, 3G/HD-SDI
2KSDIMINIRS	Camera, 2K, 1080p/i, 2/3in. IMX183 sensor, color, rolling shutter, OLPF/IR filter, 3G/HD-SDI
2KSDIMINID	Camera, 2K, 1080p/i, 720p, 1/2in. IMX265 sensor, color, global shutter, OLPF/IR filter, 3G/HD-SDI, DC auto iris
2KSDIMINIRSD	Camera, 2K, 1080p/i, 2/3in. IMX183 sensor, color, rolling shutter, OLPF/IR filter, 3G/HD-SDI, DC auto iris
2KMSDIMINI	Camera, 2K, 1080p/i, 720p, 1/2in. IMX265 sensor, monochrome, global shutter, OLPF/IR filter, 3G/HD-SDI
2KM5SDIMINI	Camera, 2K, 1080p/i, 720p, 1/2in. IMX250 sensor, monochrome, global shutter, OLPF/IR filter, 3G/HD-SDI
2KMSDIMINID	Camera, 2K, 1080p/i, 720p, 1/2in. IMX265 sensor, monochrome, global shutter, OLPF/IR filter, 3G/HD-SDI, DC auto iris
2KSDIMINIKIT	Camera Kit, 2KSDIMINI with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP
2KSDIMINIRSKIT	Camera Kit, 2KSDIMINIRS with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP
2KSDIMINIDKIT	Camera Kit, 2KSDIMINID with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP, CAB2KMINIDCI
2KSDIMINIRSDKIT	Camera Kit, 2KSDIMINIRSD with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP, CAB2KMINIDCI
2KMSDIMINIKIT	Camera Kit, 2KMSDIMINI with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP
2KMSDIMINIDKIT	Camera Kit, 2KMSDIMINID with accessories; includes VICMOUNT, 485HRMT, CABVICBATT, ACPWRTAP, CAB2KMINIDCI

## 10 Accessories

Part Number	Description
VICPWRLIO	AC to 12V DC power adapter (universal) with LEMO for RS485
CABVICBATT	Battery power cable with PowerTap connector and LEMO for RS485
ACPWRTAP	AC power adapter (universal) with PowerTap connector
CAB2KMINIAEF	Adapter cable, connects 2KSDI-Mini to VICLENMOUNT-A
CAB2KMINIDCI	Adapter cable, connects 2KSDI-Mini to DC Auto Iris lens
VICLENMOUNT-A	Lens mount, Active EF (requires CAB2KMINIAEF)
CABUSB4852M	USB to RS485 adapter cable, 2m, for camera control from PC software
485HRMT	Handheld remote control with RS485 interface for camera control
CABLEMO3M	RS485 extension cable (LEMO to LEMO), 3m

## 11 Document Revision History

Revision	Date	Description
0.1	2018-04-12	Preliminary release.
1.0	2018-08-24	Add control program.
1.1	2018-09-17	Add 2KM5SDI-Mini model
2.0	2018-12-20	Document improved data path and associated commands
2.1	2019-02-22	Updated firmware revision history
2.2	2019-03-01	Updated firmware revision history
2.3	2019-03-27	Updated firmware revision history
3.0	2019-04-09	Change gain description to match new behavior in RS models in firmware revision 14.

## 12 Firmware Revision History

2KSDI-Mini, 2KMSDI-Mini

Revision	Date	Description
01	2018-05-16	Preliminary release.
02	2018-06-05	Move overlay to primary output. Improve sharpening filter. Add 2KMSDI-Mini model. Add D models.
03	2018-06-28	Fix user set loading lockup.
04	2018-08-15	Fix loading color temperature preset from user set. Adjust CCM, offset, and black balance minimum to match 4KSDI-Mini
05	2018-08-24	Fix bug in EF lens control Fix lens menu in on screen display Fix auto focus
10	2018-12-19	Corrected color shift when using Color Correction Matrix (CCM). Fixed lens present status using user set with learn focus command disabled ( <i>fen 0</i> ). Added auto save to power-up profile on on-screen menu exit (command <i>asv</i> ). ISO command extended to 2 digits. Changed ISO setting in on-screen menu to be in ISO speed ratings. Re-organized on screen menus for easier use. Moved color bar test pattern to end of color data path. Does not show when using RAW sampling mode. Added sign bit to sensor and FPGA temperature outputs ( <i>stp</i> and <i>tmp</i> ). Changed factory LUT to IO Gamma 1 ( <i>lut 9</i> ).
11	2019-02-22	Fix bug in master pedestal
12	2019-03-01	Fix loading user sets when auto exposure/gain or tracking white balance are enabled. Fix last line shift in some modes.
13	2019-03-27	Fix user set load error flag being set incorrectly
14	2019-04-09	Fix exposure menu in overlay incorrectly blocking mode command when auto-exposure is enabled.



## 2KM5SDI-Mini

Revision	Date	Description
01	2018-05-16	Preliminary release.
02	2018-06-05	Move overlay to primary output. Improve sharpening filter. Add 2KMSDI-Mini model. Add D models.
03	2018-06-28	Fix user set loading lockup.
04	2018-08-15	Fix loading color temperature preset from user set. Adjust CCM, offset, and black balance minimum to match 4KSDI-Mini
05	2018-08-24	Fix bug in EF lens control Fix lens menu in on screen display Fix auto focus
06	2018-09-17	Add fnm, spx and spy commands
10	2018-12-19	Fixed lens present status using user set with learn focus command disabled ( <i>fen 0</i> ). Added auto save to power-up profile on on-screen menu exit (command <i>asv</i> ). ISO command extended to 2 digits. Changed ISO setting in on-screen menu to be in ISO speed ratings. Re-organized on screen menus for easier use. Moved color bar test pattern to end of color data path. Does not show when using RAW sampling mode. Added sign bit to sensor and FPGA temperature outputs ( <i>stp</i> and <i>tmp</i> ). Changed factory LUT to IO Gamma 1 ( <i>lut 9</i> ).
11	2019-02-22	Fix bug in master pedestal
12	2019-03-01	Fix loading user sets when auto exposure/gain or tracking white balance are enabled.
13	2019-03-27	Fix user set load error flag being set incorrectly
14	2019-04-09	Fix exposure menu in overlay incorrectly blocking mode command when auto-exposure is enabled.

## 2KSDI-Mini D, 2KMSDI-Mini D

Revision	Date	Description
01	2018-05-16	Preliminary release.
02	2018-06-05	Move overlay to primary output. Improve sharpening filter. Add 2KMSDI-Mini model. Add D models.
03	2018-06-28	Fix user set loading lockup.
04	2018-08-15	Fix loading color temperature preset from user set. Adjust CCM, offset, and black balance minimum to match 4KSDI-Mini
10	2018-12-19	Corrected color shift when using Color Correction Matrix (CCM). Added auto save to power-up profile on on-screen menu exit (command <i>asv</i> ). ISO command extended to 2 digits. Changed ISO setting in on-screen menu to be in ISO speed ratings. Re-organized on screen menus for easier use. Moved color bar test pattern to end of color data path. Does not show when using RAW sampling mode. Added sign bit to sensor and FPGA temperature outputs ( <i>stp</i> and <i>tmp</i> ). Changed factory LUT to IO Gamma 1 ( <i>lut 9</i> ).
11	2019-02-22	Fix bug in master pedestal
12	2019-03-01	Fix loading user sets when auto exposure/gain or tracking white balance are enabled. Fix last line shift in some modes.
13	2019-03-27	Fix user set load error flag being set incorrectly

## 2KSDI-Mini RS

Revision	Date	Description
01	2018-05-16	Preliminary release.
02	2018-06-05	Move overlay to primary output. Improve sharpening filter. Add 2KMSDI-Mini model. Add D models.
03	2018-06-21	Improve scaler.
04	2018-06-28	Fix user set loading lockup.
05	2018-08-15	Fix loading color temperature preset from user set. Adjust CCM, offset, and black balance minimum to match 4KSDI-Mini
06	2018-08-24	Fix bug in EF lens control Fix lens menu in on screen display Fix auto focus
10	2018-12-19	Corrected color shift when using Color Correction Matrix (CCM). Fixed lens present status using user set with learn focus command disabled ( <i>fen 0</i> ). Added auto save to power-up profile on on-screen menu exit (command <i>asv</i> ). Expanded gain command to include digital portion on sensor, increased ISO range up to 48dB. All gain commands ( <i>agn</i> , <i>adn</i> and <i>adx</i> ) extended to 3 digits. ISO command extended to 2 digits. Changed ISO setting in on-screen menu to be in ISO speed ratings. Re-organized on screen menus for easier use. Moved color bar test pattern to end of color data path. Does not show when using RAW sampling mode. Added sign bit to sensor and FPGA temperature outputs ( <i>stp</i> and <i>tmp</i> ). Changed factory LUT to IO Gamma 1 ( <i>lut 9</i> ).
11	2019-02-28	Fix bug in master pedestal Fix <i>agn</i> serial command not accepting the correct parameter range.
12	2019-03-01	Fix loading user sets when auto exposure/gain or tracking white balance are enabled. Fix last line shift in some modes.
13	2019-03-27	Fix user set load error flag being set incorrectly
14	2019-04-09	Change <i>agn</i> command to step by 0.1dB, matching behavior of non-RS models.

## 2KSDI-Mini RS D

Revision	Date	Description
01	2018-05-16	Preliminary release.
02	2018-06-05	Move overlay to primary output. Improve sharpening filter. Add 2KMSDI-Mini model. Add D models.
03	2018-06-21	Improve scaler.
04	2018-06-28	Fix user set loading lockup.
05	2018-08-15	Fix loading color temperature preset from user set. Adjust CCM, offset, and black balance minimum to match 4KSDI-Mini
10	2018-12-19	Corrected color shift when using Color Correction Matrix (CCM). Added auto save to power-up profile on on-screen menu exit (command <i>asv</i> ). Expanded gain command to include digital portion on sensor, increased ISO range up to 48dB. All gain commands ( <i>agn</i> , <i>adn</i> and <i>adx</i> ) extended to 3 digits. ISO command extended to 2 digits. Changed ISO setting in on-screen menu to be in ISO speed ratings. Re-organized on screen menus for easier use. Moved color bar test pattern to end of color data path. Does not show when using RAW sampling mode. Added sign bit to sensor and FPGA temperature outputs ( <i>stp</i> and <i>tmp</i> ). Changed factory LUT to IO Gamma 1 ( <i>lut 9</i> ).
11	2019-02-28	Fix bug in master pedestal Fix <i>agn</i> serial command not accepting the correct parameter range.
12	2019-03-01	Fix loading user sets when auto exposure/gain or tracking white balance are enabled. Fix last line shift in some modes.
13	2019-03-27	Fix user set load error flag being set incorrectly
14	2019-04-09	Change <i>agn</i> command to step by 0.1dB, matching behavior of non-RS models.