

# VIDEOLOGY

IMAGING SOLUTIONS INC.  
Original Equipment Manufacturer

## Application Note

20C21XW/ 21C21XW  
20C21XWUSB/ 21C21XWUSB  
22C21XWUSB-UVC/ 23C21XWUSB-UVC



20/ 21C21XW



20/ 21C21XWUSB  
22/ 23C21XWUSB-UVC

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## 1. Document History

Revision	Issue Date	Reason	CN#
Rev G	04-20-2017	Added models 22C/23C21XWUSB-UVC	17-0036
Rev F	03-28-2016	Updated Specification table	16-0046
Rev E	01-19-2015	Register Update for firmware v25 (Sections 7.5.1. and 7.5.2.)	15-0005
Rev D	12-18-2014	Update on I2C and OSD options	15-0003
Rev C	11-17-2014	Update from Videology Europe (rev B.1), fixed connector drawings	14-0109
Rev B	09-23-2014	D&N Mode-, OSD control select-, alternative I <sup>2</sup> C Camera address- and Zoom Factor- registers included. OSD control corrected	14-0077
Rev A	07-23-2014	Initial release (never officially released)	-
Rev 0.2	06-02-2014	Update after review by CTO (never officially released)	-
Rev 0.1	05-26-2014	Draft for initial review (never officially released)	-

## 2. Product Features

### Provides analog (CVBS) and digital (BT.656) video output simultaneously

- Color Board Camera with 1/3" CMOS sensor (690TVL)
- Wide Dynamic range to 120dB provides brilliant color detail within both shadows and brightest light scenes
- Miniature rugged 22mm x 26mm single board
- Low 0.1 lux sensitivity
- Metal CS, M-12 and pinhole lens mounts
- Available as USB 2.0 camera via extension board
- Optional additional mini metal housings for available for e.g. ATMs and Kiosk applications

## 3. Introduction

This document is written to give technical background on this camera module, also all the connectors are being described in this application note.

The 2XC21XW is a CMOS based camera family with an analog and digital output (CCIR656 based). The dimensions are 26\*22mm with 2 mounting holes.

Communication is possible via an OSD keyboard and via software (I<sup>2</sup>C communication via the main camera connector or through the extension board).

The digital output is described in chapter 6 of this document. Connections for the digital interface are available on a 30-pin board to board connector.

Examples of application PCB's are:

- USB 2.0 Board: Videology product that has the same small dimensions (22x26mm). When two boards are stacked together to complete the USB 2.0 camera.
- Interface to the 60SVMx, Videology's Ethernet server board.
- Customized application specific PCB.

## 4. Specifications

Electrical	NTSC PAL	20C21XW	20C21XWUSB	22C21XWUSB-UVC
		21C21XW	21C21XWUSB	23C21XWUSB-UVC
Image sensor		1/3" CMOS		
Effective Pixels		756 x 504 (H x V)		
Pixel Size		6.35µm x 7.4µm		
Shutter Mode		Rolling		
Horizontal Resolution		690 TVL		
Aspect Ratio		4:3		
Sensitivity		<0.1 Lux color   <0.01 Lux B&W		
White Balance Range		2,200 - 11,000K		
Wide Dynamic Range		120dB (max), 102dB (typical)		
Synchronization		Internal		
Iris		Manual		
Gamma		.45 default		
Video Output		CVBS / BT.656	USB 2.0 / CVBS	USB 2.0
Signal to Noise Ratio		47.9dB		
Supplied Voltage		4.5VDC - 15VDC ±10%	5VDC via USB bus	
Power Consumption		<0.8W	<1.0W	
Scanning System		2:1 Interlace default / progressive (optional)		
Frame Rate		30fps (NTSC) / 25fps (PAL)		
White Balance Control		AWB (default)		
Day & Night		Auto (default)		
Communication		I <sup>2</sup> C		
Image Flip		Default off		
Mirror Mode		Default off		
AGC Control		Auto (default)		

## Environmental

Operating Temp.	-10° ~ 50° Celsius (14°F ~ 122°F)
Operating Humidity	30% ~ 90% RH
Storage Temp.	-30° ~ 80° Celsius (-22°F ~ 176°F)
Storage Humidity	< 85% RH

## Mechanical

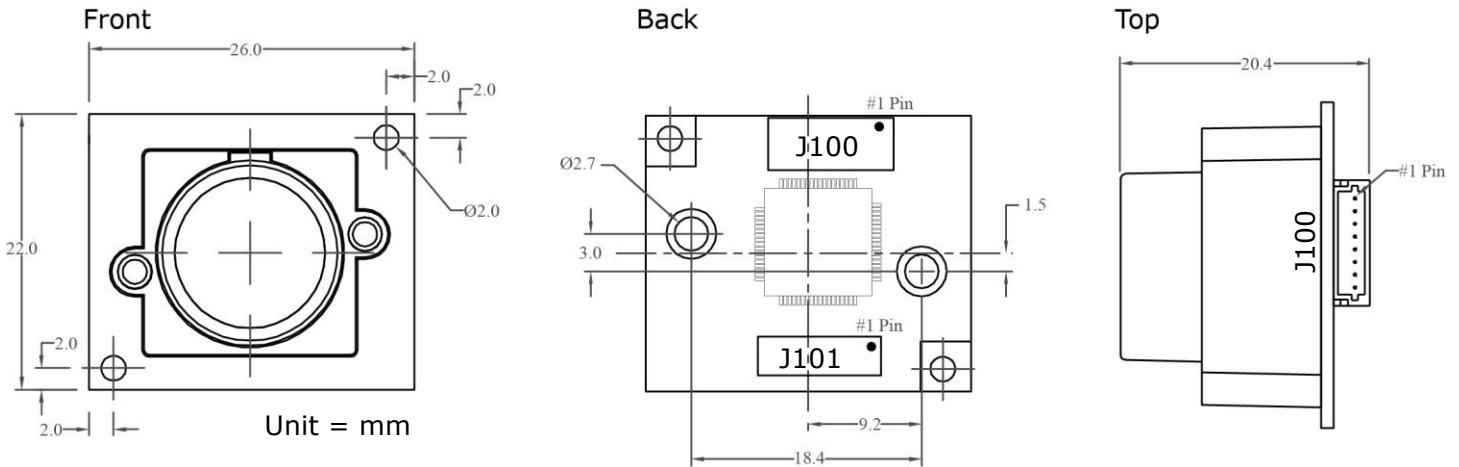
Dimensions WxHxD (w/ M-12 lens mount)	26mm x 22mm x 20.4mm	26mm x 22mm x 30.9mm
Weight	13.5g (w/ M-12 lens mount)	17g (w/ M-12 lens mount)
Lens mount	Replace "X" in model number with desired lens mount: 2: Metal pinhole lens mount 5: Metal M12 board lens mount 7: No lens mount 8: Metal CS lens mount	

## Accessories

Included Cable (2XC21XW only)	60C1041	6.89in (175mm) 8-pin JST with flying leads
Optional USB Cables (2XC21XWUSB only)	60C1147	10ft (3.048m) USB mini (B) to USB (A)
	60C1062	8ft (2.4384m) 6-pin JST to USB (A)
	Other cable length options are available. Please contact a Videology Sales Representative for details.	

## 5. Connectors / Interface

### 5.1. 20C21XW / 21C21XW



Connectors			
J100	70CN0061	JST-SM08B-SRSS-TB	CONN JST 8 PIN 1MM HOR SMD
J101	70CN0303	JST-30P4.0-JMCS-G-TF	CONN JST 30 PIN 4MM 0,5MM PITCH BTB SMD

Connector J100	
Pin #	Pin name
1	OSDC
2	GND
3	I2C-SDA
4	I2C-SCL
5	DO NOT USE
6	Video
7	GND
8	Vin

Connector J101					
Pin #	Pin name	Pin #	Pin name	Pin #	Pin name
1	GND	11	YUV4	21	IRIS OUT (analog)
2	GND	12		22	GND
3	YUV0	13	YUV5	23	HSYNC
4		14		24	VSYNC
5	YUV1	15	YUV6	25	
6		16		26	
7	YUV2	17	YUV7	27	I2C-SDA
8		18		28	I2C-SCL
9	YUV3	19	CLOCK	29	CVBS OUT (analog)
10		20		30	POWER IN

Connector J100 is the main connector for operating the analog camera. Via the optional cable (60C0510) within the I<sup>2</sup>C kit (60C2-U), the camera can be powered and controlled through I<sup>2</sup>C. Single sided CVBS video-out is available on this connector as well.

The OSD can be controlled by applying various pull-down resistor values to the OSDC pin. A keyboard, supplied with the 60C2-O cable kit, provides this function.

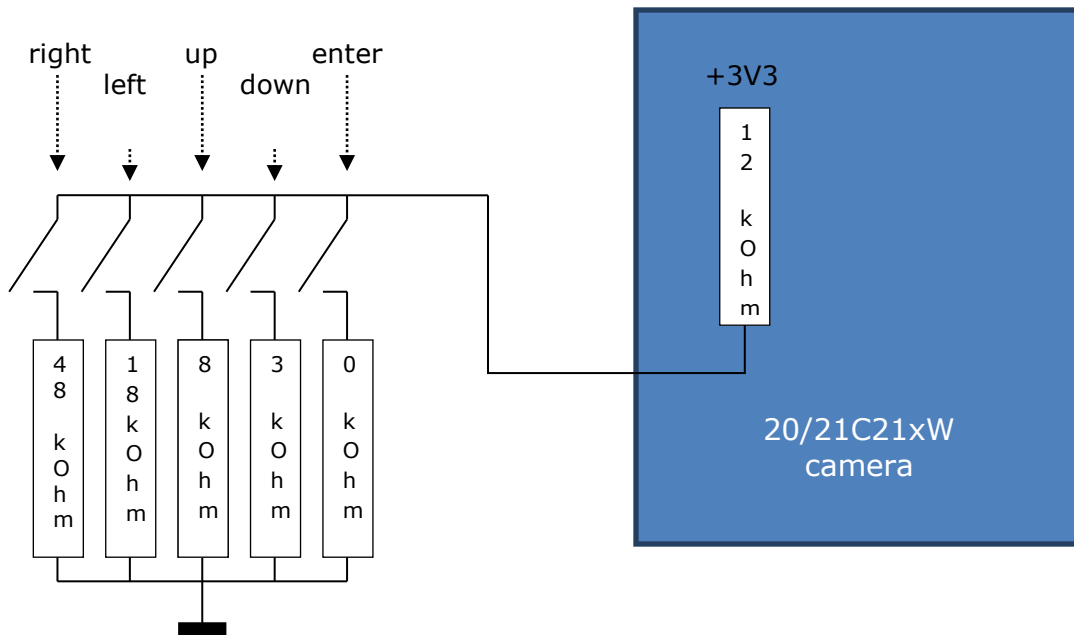
Instead of using the Videology keyboard, the function can be easily embedded in the application, since the OSDC pin is a single wire input.

Inside the camera board, this connection has a pull up resistor of 12kOhm to the +3V3. By means of externally connecting the OSDC pin via resistors of different values to ground, the following button functions are created:

- Resistor of 0 kOhm: enter/return button
- Resistor of 3 kOhm: down button
- Resistor of 8 kOhm: up button
- Resistor of 18 kOhm: left button
- Resistor of 48 kOhm: right button

To enter the OSD menu press the enter/return button till the OSD menu appears on the screen.

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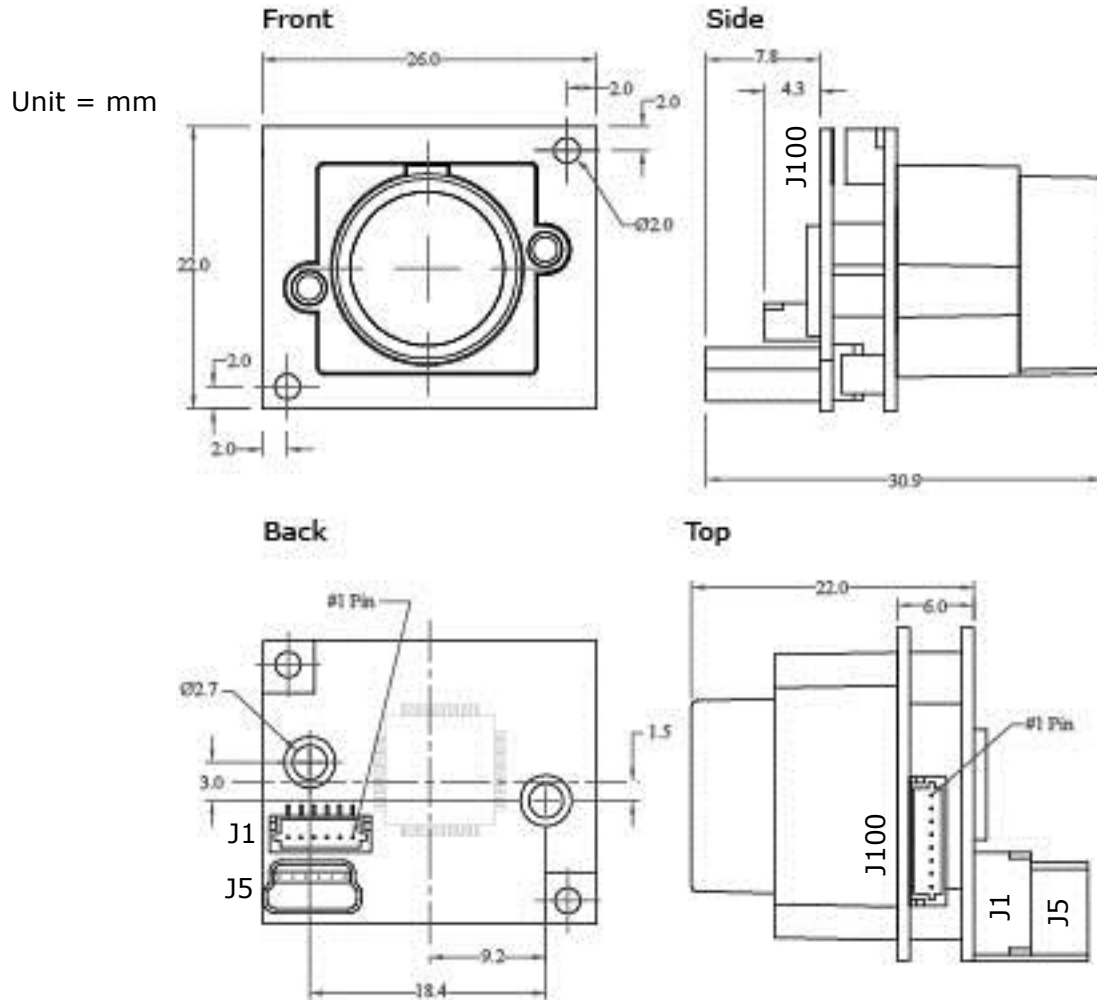
The selectable menu items are described in chapter 9.

Connector J101 is the digital output connector. In the 20C21xWUSB and 21C21xWUSB camera, this connector is used to connect the optional Videology USB board, see chapter 5.2. 20C21XWUSB / 21C21XWUSB.

## 5.2. 20C21XWUSB / 21C21XWUSB

When the camera is extended with the USB interface, the analog connector J100 is still available.

The camera is operational via the USB connector J100 or J103. The pinning of those connectors is shown below (M12 mount 20C21**5**WUSB / 21C21**5**WUSB versions):



Connector J100 I2C	
Pin #	Pin name
1	OSDC
2	GND
3	I2C-SDA
4	I2C-SCL
5	DO NOT USE
6	Video
7	GND
8	Vin

Connector J1 USB	
Pin #	Pin name
1	+5VDC
2	DATA -
3	DATA +
4	GND
5	GND
6	GND

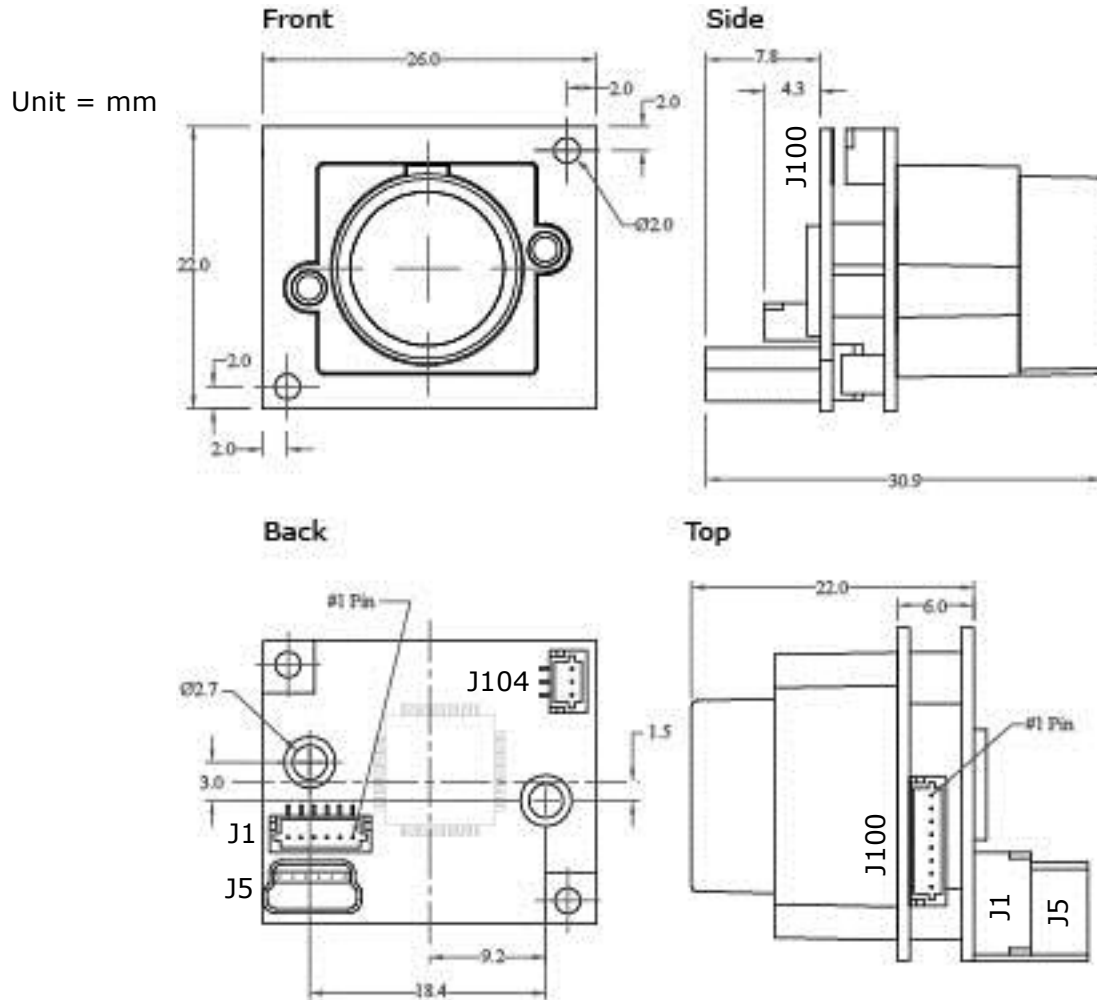
Connector J5 mini B USB	
Pin name	Pin #
1	+5VDC
2	DATA -
3	DATA +
4	GND
5	GND



### 5.3. 22C21XWUSB-UVC / 23C21XWUSB-UVC

When the camera is extended with the USB interface, the analog connector J100 is still available.

The camera is operational via the USB connector J100 or J103. The pinning of those connectors is shown below (M12 mount 22C215WUSB-UVC / 23C215WUSB-UVC versions):



Connector J1 USB	
Pin#	Pin name
1	+5VDC
2	DATA -
3	DATA +
4	GND
5	GND
6	GND

Connector J100 I2C	
Pin#	Pin name
1	N/A
2	GND
3	I2C-SDA
4	I2C-SCL
5	DO NOT USE
6	DO NOT USE
7	GND
8	VIN

Connector J5 mini B USB	
Pin#	Pin name
1	+5VDC
2	DATA -
3	DATA +
4	GND
5	GND

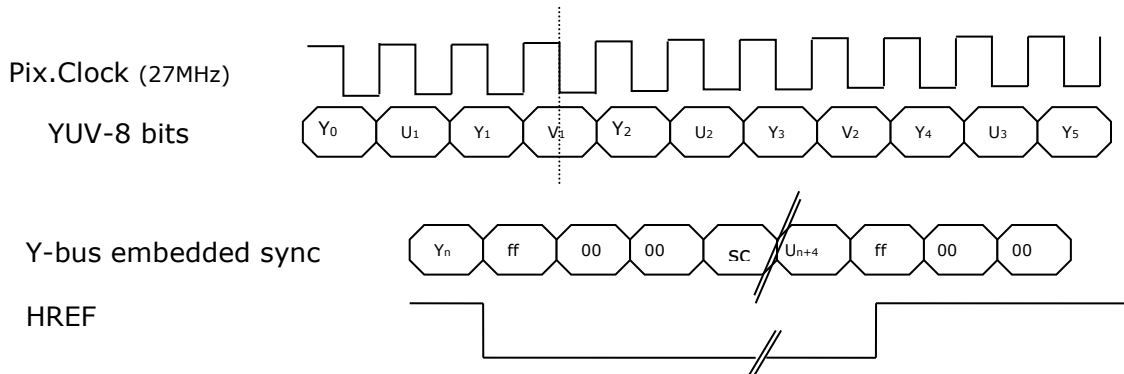
Connector J104 JST	
Pin#	Pin name
1	SNAP
2	GND
3	FREX (optional)

## 6. Digital Interface

The camera is meant to be used as a digital output camera. Besides the digital output, the camera also provides a CVBS output (NTSC in 60Hz and PAL in 50 Hz mode). This analog output is only to be used as quick review since it will have aspect ratio distortion (the 16:9 format is cropped into 4:3).

### 6.1. BT.656

The BT.656 standard has one bus of 8 bits.



The digital Y-bus uses the values of  $0xff$  and  $0x00$  to indicate the start of the embedded sync code. At the moment the value  $0xff$  is detected followed by two times  $0x00$  the system knows that the next data is the sync code.

The sync code data is build up as:

1	Field	Vblank	Hblank	P3	P2	P1	P0
---	-------	--------	--------	----	----	----	----

VBlank is 1 during the vertical blanking and HBlank is 1 during the horizontal blanking. So more or less reversed with HREF and VREF.

Data should be clocked in on the positive edge of the pixel clock.

Timing data clock				
item	min	nominal	max	Unit
Freq pixel clock	26.997	27.000	27.003	MHz
Clock period	37.033	37.037	37.041	nS
Clock Duty cycle	40	50	60	%
Min Data hold after rising clock edge	3			nS
Data change time			3	nS

## 7. I<sup>2</sup>C Camera Control

### 7.1. I<sup>2</sup>C Protocol for the Camera

The camera has a 2-wire serial communication interface (I<sup>2</sup>C). This serial bus has a line for the clock signal and a line for the data signal. The camera will act as a slave device on the bus.

The protocol supports clock speeds from 1kHz – 100kHz, the default camera address is 0x70/0x71.

The communication protocol exists out of two serial blocks. The first block is the command block, followed by the data block.

The command block is always 4 bytes long. It contains the camera address (write only = 0x70), a mode byte, device address byte and register address byte.

The data block is either read or write. This is indicated by the camera address (write = 0x70 and read = 0x71). Further for reading, the least significant bit of the mode byte in the command block indicates a read or write action (for read this bit = 1).

Note that there is a minimal delay time required between the command and data block. This delay depends on the direction of communication (write or read), as follows:

Between Command Block and Data block apply a Delay1 with a minimal value of:

- 150 µs in case the mode byte (in command block) indicates a write
- 1.5 ms in case of a read action (again indicates by the mode byte inside the command block)

Between Data block and next Command Block apply a Delay2 with a minimal value of:

- 10ms for a write action to the EEPROM.
- 35ms for a write action to the command register. Needed in order to make the change effective after the next frame which lasts about 20 ms plus an EEPROM write action.
- 1.0ms for a DSP write action.
- 1.0ms for all read actions (either command register, EEPROM or DSP read).

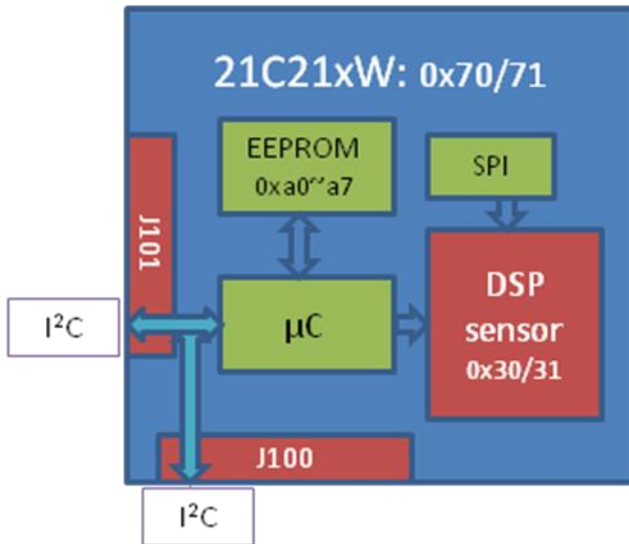
<b>Comm block</b>	Delay1	<b>Data block</b>	Delay2	<b>Comm block</b>	Delay1	<b>Data block</b>
-------------------	--------	-------------------	--------	-------------------	--------	-------------------

#### Examples:

Minimal delay time in mSec.		
Type of communication	Delay1	Delay2
Write to command register followed by another write	0.15	35
Write to DSP followed by a write to another device	0.15	1.0
Write to EEPROM followed by another write to the EEPROM	0.15	10
Write to EEPROM followed by read to EEPROM	0.15	10
Two read action behind each other	1.5	1.0
A Read action followed by any write action	1.5	1.0

In chapter 7.2 “The Command Block” and chapter 7.3 “The Data block”, both blocks are described.

The following block diagram indicates the I<sup>2</sup>C architecture of the camera:



## 7.2. The Command Block

This block is 4 bytes.

Command block								
start	Cam addr W	A	Mode byte r/w	A	Dev add	A	Reg addr	A stop

A= acknowledge

- 1st byte is camera address, only valid value is the camera write address, default 0x70
- 2nd byte is the mode byte. The mode byte tells the camera if the host wants to read or write to the camera. If the host wants to read the LS-bit is 1. Valid values can be found in the following table.

Mode byte in command block: valid values	
0x00	Command register write and EEPROM write
0x01	Command register read and EEPROM read

- 3rd byte is the device address inside the camera. Valid values can be found in the table below:

Device address		
Mode value (2nd byte)	Address value	description
0x00/0x01	0x30/0x31	Command Register access
	0xa0/0xa1	EEPROM 1st page
	0xa2/0xa3	EEPROM 2nd page
	0xa4/0xa5	EEPROM 3rd page
	0xa6/0xa7	EEPROM 4th page

- 4TH byte is the register address. This byte can have any value between 0x00 and 0xff.

### 7.3. The Data block

This block is always 2 bytes. The difference here is that the camera can either send or receive data via this block.

In case the host sends data to the camera:

Data block: data from host to camera					
start	Cam addr W	A	data	A	stop

A= acknowledge

In case the camera has to send data to the host:

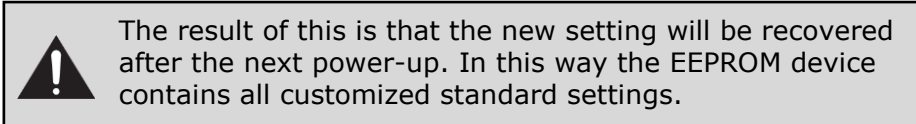
Data block: data from host to camera					
start	Cam addr R	NA	data	A	stop

NA= Not acknowledge

- The first byte is either the camera write or read address. The default camera write address is 0x70, and the default read address is 0x71.

### 7.4. I<sup>2</sup>C Registers

The camera has several command registers that allow the user to customize the behavior of the camera. For every command register that is set with a new value, this value will be stored in the corresponding EEPROM location.



In case the default (factory) settings should be used again, a special command register (0xf0) is provided. Beside the EEPROM the camera has command registers (mode 0x00/0x01 in combination with device address 0x30/31).

In this document also the command registers will be addressed as well as the EEPROM mapping.

## 7.5. Command Registers

The camera has several accessible command registers to optimize the performance of the camera. Often are these commands a combination of DSP registers.

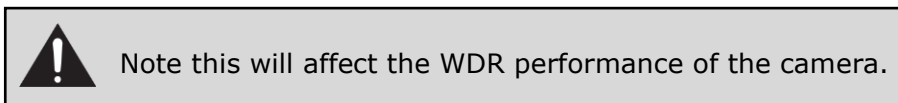
### 7.5.1. Register Overview

Device address (w/r)	Register address	function
0x30/0x31	0x02	Manual gain on/off
0x30/0x31	0x04	Control register: Mirror, shutter, white balance
0x30/0x31	0x06	AEX reference point
0x30/0x31	0x07	WDR mode
0x30/0x31	0x13	BLC mode weight factor
0x30/0x31	0x14	BLC window position
0x30/0x31	0x15	BLC window size
0x30/0x31	0x1d	Maximum Gain Manual fixed gain
0x30/0x31	0x31	Alternative I2C Camera address
0x30/0x31	0x42	Manual white balance Red gain
0x30/0x31	0x43	Manual white balance Blue gain
0x30/0x31	0x53	Analog and Digital C gain (color saturation)
0x30/0x31	0x54	Analog and Digital Offset (brightness)
0x30/0x31	0x55	Flip Mode
0x30/0x31	0x56	One Push Automatic White Balance
0x30/0x31	0x57	Analog and Digital Y gain (Contrast)
0x30/0x31	0x60	Day and Night mode
0x30/0x31	0x6a	Zoom Factor
0x30/0x31	0x63	Day & Night Auto Level
0x30/0x31	0x70	Suppression mode
0x30/0x31	0x71	Low luminance color suppression gain
0x30/0x31	0x72	Low luminance AGC suppression starting point
0x30/0x31	0x73	Low light edge suppression gain
0x30/0x31	0x7b	Sharpness on/off
0x30/0x31	0x7c	Sharpness level
0x30/0x31	0x80	OSD control select
0x30/0x31	0x8b	Analog output gain
0x30/0x31	0xa0	PAL/ NTSC mode
0x30/0x31	0xf0	Write default register values in EEPROM and apply these settings
0x30/0x31	0xfe	DSP Revision Number (read only)
0x30/0x31	0xff	Microcontroller Software revision number (read only)

## 7.5.2. Detailed Register Information

### Manual gain

The camera is equipped with auto exposure control. However in some circumstances it is desired that not all the auto loops are running. Therefore the camera has the capability to switch off the auto gain control and set the gain manually.



Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x02	[1]	0x29
If b[1] = 0, the camera runs in auto gain mode, If b[1] = 1 manual gain mode is selected. Required gain value can be set via register address 0x1d. All other bits are don't care.			

### Maximum AGC Gain factor (means that the gain is limited to this value)

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x1d	[7:0]	0x80 (=32X)
Gain value 0x01 (=0,25X)– 0x80 (=32X). Gain Factor (X) = value / 4 1 = 0,25X, 2 = 0,5X, 3 = 0,75X, 4 = 1X, 5 = 1,25X, 6 = 1,5X ... 0x80 = 32X			

### Control register:

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x04	[7:3],[1,0]	0x78
Bit[7]: <b>mirror mode</b> (horizontal) if bit[7] = 1 mirror, else if bit[7] = 0 normal output Note register 0x55 bit[1] has the same function. If either one of these two is changed the other one will be overwritten as well.			
Bit[6:3] <b>shutter selection</b> (PAL/NTSC) <ul style="list-style-type: none"> <li>• 1111 = auto mode (WDR)</li> </ul> Remark: Other shutter values are not supported.			
Bit[1:0] <b>white balance</b> mode <ul style="list-style-type: none"> <li>• 00 = auto mode</li> <li>• 01 = manual mode</li> </ul>			

### Manual white balance red gain

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x42	[7:0]	0x67
Gain value 0x00 – 0xff			

### Manual white balance blue gain

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x43	[7:0]	0xa0
Gain value 0x00 – 0xff			

### AEX reference point

The camera has an auto shutter and gain control. These controls make sure that the output of the camera reaches an average level. This is calculated by the accumulation of all Y values of the image and take the average from this. This is compared with the AEX reference point.

Depending if the camera is still in the shutter range (scene is relative bright) exposure control is achieved by controlling the shutter. When the shutter reaches maximum integration time, the gain control will take over until it reaches its max value.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x06	[7:0]	0x30
Reference point valid values 0x00-0x78			

### WDR Mode

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x07	[2:0]	0x03
000 = OFF 001 = LOW 010 = Middle 011 = High			

### BLC mode and weight factor

The image is divided in 8 horizontal and 8 vertical blocks. With these blocks a BLC window can be created. This window will get a weight factor in the AEX reverence point calculation when the BLC mode is active. Via the registers 0x14 and 0x15 the position and the size can be set.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x13	[6:0]	0x30
Bit[7] BLC view on/off, 0 = off. Remark the view function does not work for the WDR mode is OFF(=000).			

### BLC window position

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x14	[5:3],[2:0]	0x00
Bits[5:3] X position Bits[2:0] Y position			

### BLC window size

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x15	[5: 0]	0x3F
0x00 = 1H/1V, 0x01 = 1H/2V, 0x03 = 1H/4V, 0x07 = 1H/8V 0x08 = 2H/1V, 0x09 = 2H/2V, 0x0B = 2H/4V, 0x0F = 2H/8V 0x18 = 4H/1V, 0x19 = 4H/2V, 0x1B = 4H/4V, 0x1F = 4H/8V 0x38 = 8H/1V, 0x39 = 8H/2V, 0x3B = 8H/4V, 0x3F = 8H/8V			

### I<sup>2</sup>C Camera address

Set the I<sup>2</sup>C Slave Address.

Setting a new value will take effect at the next I<sup>2</sup>C communication and is kept after new power-up.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x31	[7:1]	0x70
Address range 0x00-0xFC			

### Analog and Digital C gain (color saturation)

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x53	[6: 0]	0x18
Gain value: 0x00-0x7f (0x20 = 1x)			



**Analog and Digital Offset (brightness)**

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x54	[7: 0]	0x00
Note this is a 2 complement value. 0x00-0x7f → 0 - (+127) and 0x80-0xff( -127) - 0			

**Analog and Digital Y gain (Contrast)**

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x57	[7: 0]	0x3C
Gain value: 0x00-0xff			

**Flip / Mirror Mode**

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x55	[1: 0]	0x00
B[0]: mirror(horizontal) 1=mirror on B[1]: flip (vertical) 1= flip on			

**One Push Automatic White Balance**

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x56	[1: 0]	0x00
0: apply the AWB mode as set in bit0~bit1 of Reg. 0x04. 1: to start the ONE PUSH White Balance Function and apply this new AWC-set afterward 2: recover and apply last AWC-set value			

**Day & Night Mode**

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x60	[1: 0]	0x02
0: BW (black and white) only 1: Color only 2: Smart: automatically switch to BW in low light situations (when AGC exceeds a threshold); switch back to color when light level increases. The level can be set with register "Day & Night Auto Level", address 0x63.			

**Day & Night Auto Level**

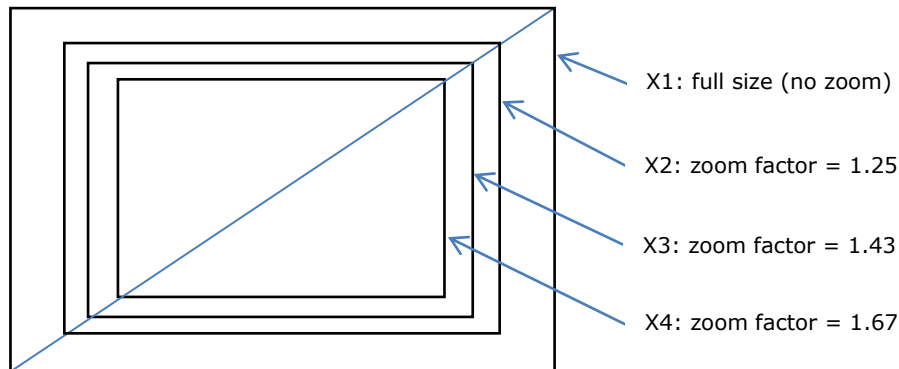
Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x63	[7:0]	0x40
Auto Level value 0x08 - 0x80			

When AGC exceeds the Day & Night Auto Level and remains there for at least 2.5 seconds, it switches from Color to Black & White. It switches back to Color when the AGC drops below ½ the Day & Night Auto Level.

## Zoom factor

The image can be zoomed with 3 different zoom factors. These factors will zoom the image with a factor of 1.25, 1.43 or 1.67. (the aspect ratio is kept the same).

See figure:



Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x6A	[1: 0]	0x00
0: X1 (no zoom)			
1: X2 (zoom factor 1.25)			
2: X3 (zoom factor 1.43)			
3: X4 (zoom factor 1.67)			

## Suppression mode

At low light conditions, the gain will go up to keep a visible picture. A negative side effect of this increasing gain is that noise levels will increase as well and also color noise will be more visible. The noise will be even more visible due to the edge enhancement function in the camera.

Since it is harder to see colors and sharp details at low light, both the edge enhancement and color gain can be reduced at low light and thus improve the image quality at low light.

At bright light conditions, also an artifact will appear. The high light clipper will reduce the gain to keep a visible picture. Due to the fact that the color filter on the CCD has not the same transparency between the RG and B filter, a particular pixel will reach its saturation level, while another still can increase. This will result in discoloration around high lights.

To avoid this, a High Luminance Color Clipper can be activated.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x70	[2: 0]	0x07
B[0] : low light color suppression, 1 = suppression on			
B[1]: low light edge suppression, 1 = suppression is active			

Low luminance color suppression gain:

When the AGC reaches the level set by register 0x72, this factor determines how fast the color gain is reduced as function of the increasing gain.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x71	[7: 0]	0x80
Low luminance color suppression gain 0x00-0xff			

Low luminance AGC suppression starting point:

When the AGC level reaches this value (increasing) from this point onwards when active, the color and edge enhancement signals are reduced to improve the image quality.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x72	[7: 0]	0x20
Low luminance AGC suppression starting point: 0x00-0xDF			

Low luminance edge suppression gain:

When the AGC reaches the level set by register 0x72, this factor determines how fast the edge enhancement signal is reduced as function of the increasing gain.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x73	[7: 0]	0x56
Low luminance edge suppression gain: 0x00-0xff			

### Edge enhancement

Due to the limited number of pixels in the sensor the maximum resolution is limited by the pixel count. However due to smart processing the impression of the resolution can be increased by edge enhancement.

Edge enhancement on/off

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x7b	[1: 0]	0x0
B[0]: Aperture on/off 1=off.			

Edge enhancement gain

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x7c	[7: 0]	0x14
Aperture gain 0x00-0xFF			

### OSD control select

Besides the I<sup>2</sup>C interface to control the camera, it is also possible to control the camera by means of a keyboard; in this case, the OSD menu will be activated.

Default the camera control via the keyboard is activated.

Controlling the camera in both ways simultaneously should be prevented.

When camera control via the keyboard and OSD is used (OSD control select = 1), it is prevented that at power-up, a saved setting is overwritten by a stored EEPROM value by the microcontroller.

In case that I<sup>2</sup>C communication is used to control the camera (OSD control select = 0), the EEPROM restoring process is enabled; an I<sup>2</sup>C write to a valid register automatically will set the OSD control select to 0, which is remembered after power-up.

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x80	[ 0]	0x01
0: select I2C as controlling device 1: select OSD as controlling device			

### Analog Output Gain

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0x8b	[7: 0]	0x7C
Analog output gain value 0x00-0xF0			

## TV-mode

Device address	Register address	bits	Default value
0x30/0x31 (w/r)	0xa0	[ 0]	0x01
0 = NTSC mode, 1 = PAL mode			

## Set default EEPROM values

Device address	Register address	bits	Write Only
0x30/0x31 (w)	0xf0	[7: 0]	0x01
Write default register values in EEPROM and apply these settings. Remark: value must be 0x01			

## DSP ID

Device address	Register address	bits	Read Only
0x30/0x31 (r)	0xfe	[7: 0]	0x00
DSP Software Revision number			

## Software ID

Device address	Register address	bits	Read only
0x30/0x31 (r)	0xff	[7: 0]	0x11
Software Version of the Microcontroller Data0 High nibble: Major number; Data0 nibble: Minor number. example: Data=0x13 means V1.3 (1=major, 3=minor)			

## 7.6. EEPROM mapping

Page 0xa0/a1 contain the settings for the commands ( device address 0x30). The data is stored in the corresponding register addresses.

This is not the case for the commands with register address 0xfc-0xff.



Page 0xa2/a3 and 0xa4/a5 are used to store special DSP registers and should not be modified or changed.

Page 0xa6/a7: can store customized commands. Please contact Videology for instructions how to use this feature.

## 8. Videology USB 2.0 Viewer

The 20C21XWUSB / 21C21XWUSB camera can be viewed via the Videology USB viewer. This viewer can be downloaded from <http://www.videologyinc.com/download.htm> (under Products -> Viewer Drivers & Updates). The viewer function for this camera is embedded in the SFT-07019 viewer software.

For instructions on how to use the software, refer to the software manual ([INS-07019.pdf](#)) which is downloadable from the same webpage.

## 9. On Screen Display (O.S.D.)

### 9.1. OSD menu

By means of the push buttons on the OSD board, the following menu appears on the screen:

#### SETUP

- **EXPO.**
- **WDR**                    **OFF - L - M - H**
- **LENS**                    **FIX - IRIS**
- **AGC**                    **[ZOOM 1, 2, 3, 4][OFF, X4, X8, X16, X32, X64, X96, X128]**
- **RETURN**
- **WB**
- **MODE**                    **[AUTO, 2000K, 3000K, 4000K, 5000K, 6000K, 7000K, 8000K, 9000K, 10000K]**
- **RETURN**
- **D&N**
- **MODE**                    **[SMART, COLOR, B&W, AUTO]**
- **D → N LEVEL**            **[1, 2, 3, 4, 5]**
- **N → D LEVEL**            **[1, 2, 3, 4, 5]**
- **RETURN**
- **FUNC.**
- **BRIGHTNESS**            **.....**
- **CONTRAST**                **.....**
- **SHARPNESS**             **.....**
- **COLOR GAIN**             **.....**
- **NR**                      **LEVEL [1, 2, 3]**
- **MIRROR**                **[NONE, H, V, HV]**
- **LANGUAGE**              **[ENGLISH]**
- **ENGINEER SETUP**        **[SET]**
  - **SYNC**                    **[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]**
  - **BURST**                  **[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]**
  - **PEDESTAL**              **[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]**
  - **WHITE**                  **[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]**
  - **OSD COLOR**             **[WHITE, YELLOW, RED]**
  - **OSD BG**                 **[ON, OFF]**
  - **RETURN**
  - **EXIT**
- **RETURN**
- **RESET**
- **FACTORY MODE**        **[YES, NO]**
- **EXIT**
- **SAVE & EXIT**



It is advised not to control the camera via the OSD Control pin/panel and via I<sup>2</sup>C at the same time

## 10. Videology Cable Kits



It is advised not to control the camera via the OSD Control pin/panel and via I<sup>2</sup>C at the same time

### 10.1. USB-I<sup>2</sup>C Interface Tool Kit (60C2-U)

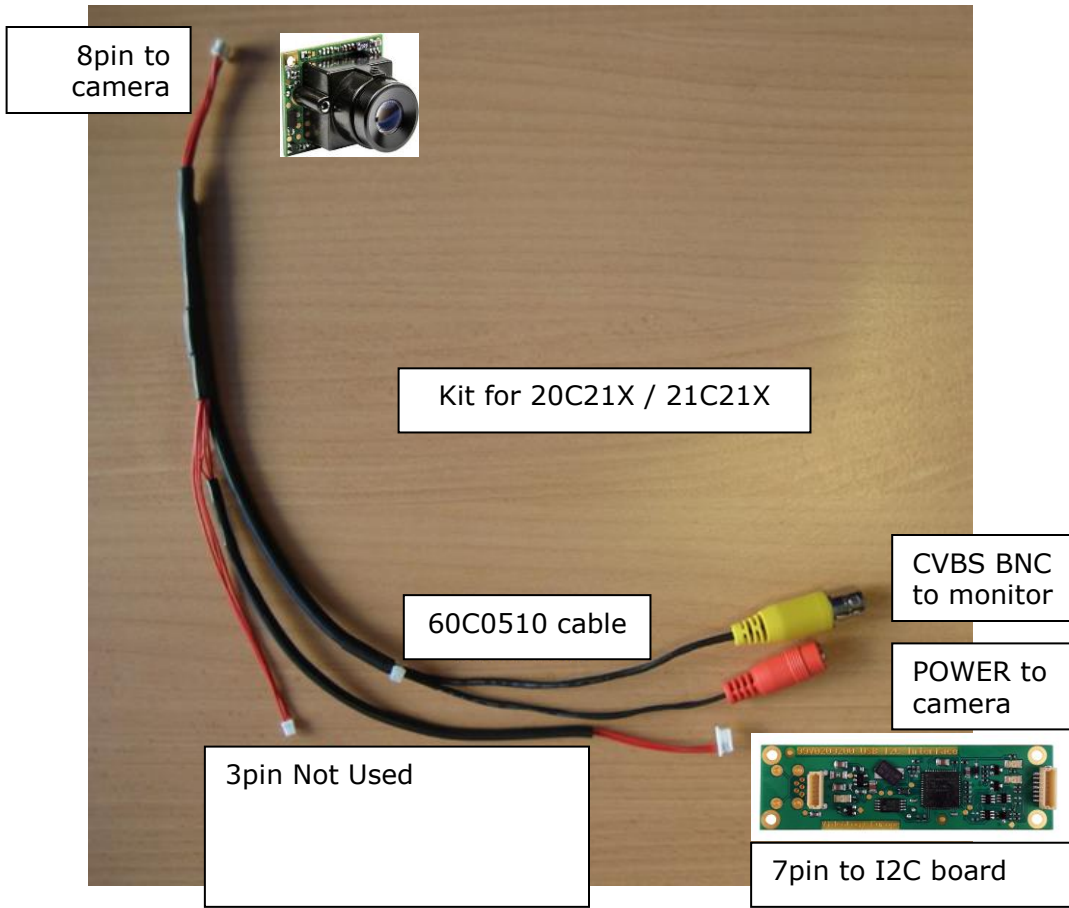
Videology also offers hardware to control the camera via I<sup>2</sup>C as well as a software control application.

To control the camera via the PC an I<sup>2</sup>C-USB interface board is available. The type number of the board is 72V0070. This board is part of the cable kit to connect that board (type number 60C2-U) to the camera.

#### 60C2-U Kit

	<p>60C0510 OSD Cable</p> <p>3pin not used 7pin to I2C board 8pin to camera CVBS video (yellow) BNC to monitor 5V-12VDC (red) power to camera</p>
	<p>72V0070 USB-I2C Board</p>
	<p>60C1062 8ft (2.4384m) 6pin JST to USB (A) Cable</p>



# 60C2-U Hardware Setup



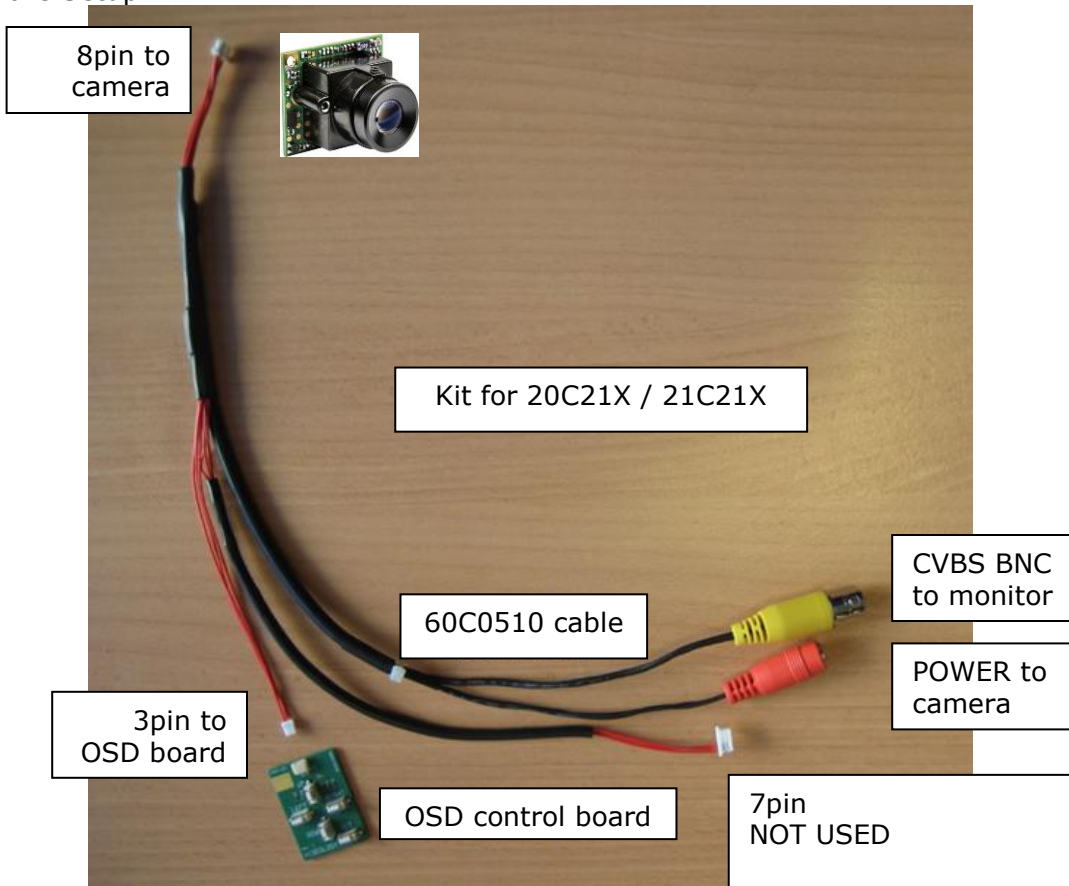
## 10.2. OSD Hardware Kit (60C2-O)

To control the OSD, a dedicated board is available with 5 push buttons, which can be connected to the cable as shown below. This board and the cable are part of the OSD Kit 60C2-O.

### 60C2-O Kit

	72V0281 OSD control board
	<p>60C0510 OSD Cable</p> <p>3pin to OSD Board 7pin not used 8pin to camera CVBS video (yellow) BNC to monitor 5V-12VDC (red) power to camera</p>

### 60C2-O Hardware Setup





## 11. Application Software

Videology can also provide software tools to control the camera. Please contact us for more information.

## 12. Contact Information

**For technical assistance with this product, please contact the supplier from whom the product was purchased.**

For OEM inquiries, contact Videology® Imaging Solutions:

### **Americas, Middle East, Far East & Australia:**

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