UNIQ

UP-2000CL
Digital CCD Camera
User's Manual

091-2000 V.1.4
02-03-17

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WARNING

**TO PREVENT FIRE OR ELECTRIC SHOCK HAZARD,
DO NOT EXPOSE THIS CAMERA UNIT TO RAIN OR MOISTURE.
DO NOT ATTEMPT TO REMOVE CAMERA COVER OR MODIFY THE CAMERA UNIT,
WARRANTY WILL BE VOIDED.**

PRECAUTIONS

**Do dot attempt to disassemble, modify, or repair the camera. Contact UNIQ for help.
Do not point the camera at bright objects, such as the sun, for a long period. It may cause CCD blooming and permanent damages.
Do not operate the camera beyond the temperature range. Avoid using the camera above 90% humidity.
Do not use unregulated power supply source.
Do not touch CCD glass cover with fingers or any hard objects other than professional glass cleaning solvents.**

Limited Warranty

UNIQ warrants to the original customer to be free from defects in material and workmanship for two full years from the date of original purchase. This warranty covers failures or damages due to defects in material or workmanship, which occur during normal use. It does not cover damages or failures, which result from shipment, mishandling, abuse, misuse, or modification.

A Return Material Authorization (RMA) number is required prior to returning any UNIQ product for repair or replacement.

For immediate technical assistance, please call (408) 330-0818 or email to tech@uniqvision.com

1. Introduction

1.1 General Description

The UP-2000CL is a 10-bit, high-resolution digital CCD camera using progressive scan sensor. This compact and lightweight camera offers excellent signal to noise performance. The square pixels are especially suitable for processing, measuring, and analyzing tasks. High speed moving objects can be captured with the external asynchronous capture control.

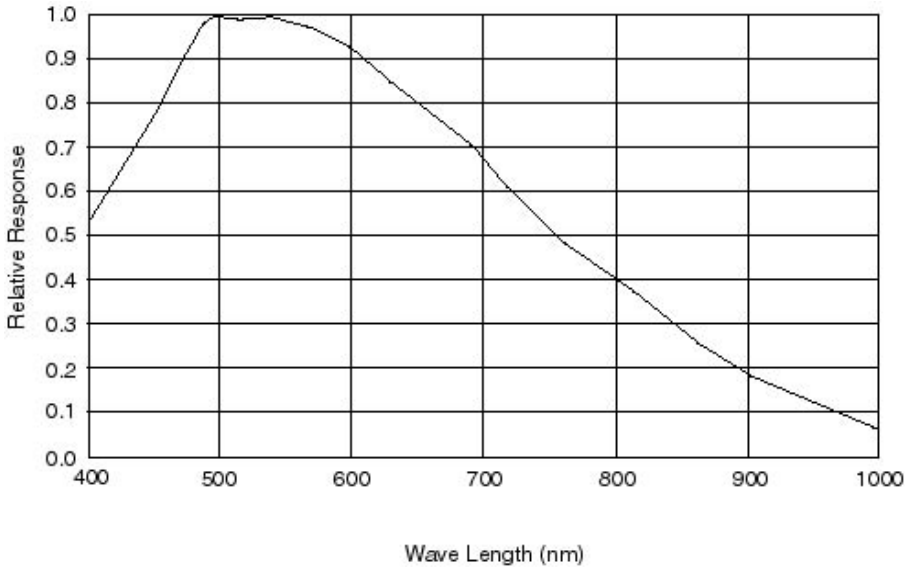
1.2 Features

- **1/2" Progressive Scan CCD Imager**
- **1620 x 1236 active pixels**
- **16 Hz frame rate**
- **2 x 2 (810 x 618) Binning at 32 FPS**
- **10-bit Camera Link output**
- **Analog output**
- **Full frame shutter (1/16 ~ 1/40,000 sec.)**
- **<58 dB**
- **Asynchronous reset at full frame shutter**
- **40 MHz data clock**
- **RS232C interface control**
- **C-mount lens**

1.3 Applications

UP-2000CL applications include machine vision, automated inspection, motion capture and analysis, high-resolution graphics capture, medical imaging, biomedical imaging, microscopy, and other scientific and industrial applications where high resolution is required.

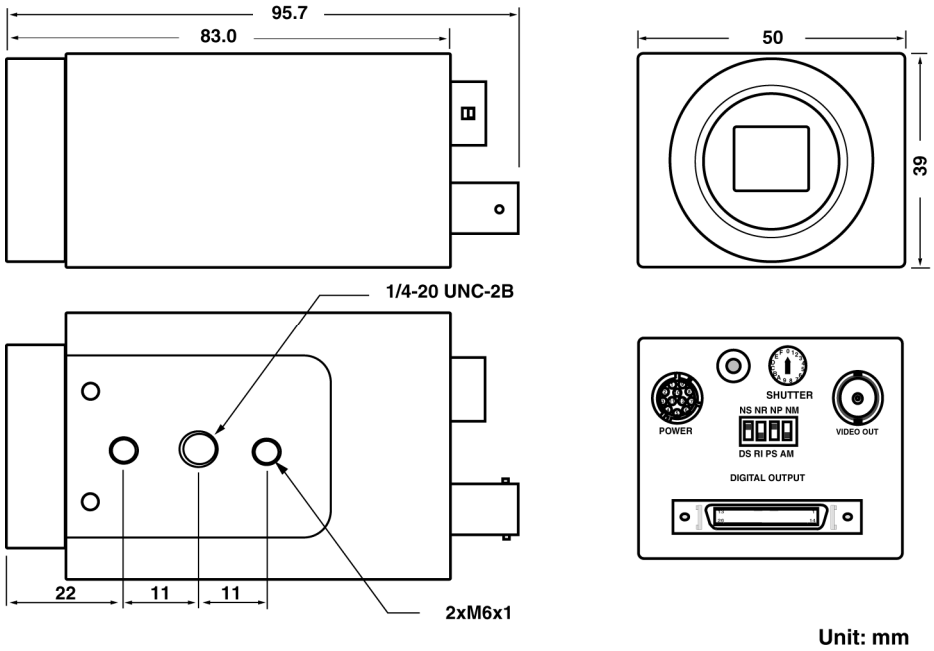
1.4 CCD Imager Spectral Response Curve



1.5 Camera Specifications

Model	UP-2000CL
CCD Sensor	1/2" Progressive scan interline-transfer CCD
Chip Size	8.50 mm x 6.80 mm
Effective Pixels (H x V)	1620 x 1236
Unit Cell Size (H x V)	4.40 ㎜ x 4.40 ㎜
Pixel Clock	40 MHz (80 MHz for master clock)
Frame Rate	16 FPS (32 FPS for 2x2 binning)
Sync.	HD: 19.979 KHz; VD: 16.009 Hz
Digital Video Output	Camera Link format
Analog Video Output	1 V p-p, 75ohm (BNC or 12 pin Hirose)
S/N Ratio	<58 dB
Min. Illumination	0.1 lux
Gain	MGC
Gamma	1.0
Electronic Shutter	1/16 ~ 1/40,000 selectable
Lens Mount	C-Mount
Operating Temperature	-10 °C ~ +55 °C
Power Requirement	12V DC, 300mA, 3.6 W
Dimension	50mm x 39mm x 83mm
Ext. Sync.	Internal/External Auto Switch
Asynchronous Reset	Standard
Weight	200 g

1.6 Camera Dimension



Unit: mm

2. Camera Setup

A basic camera and frame grabber system setup, as shown in Figure 1 below, requires a UP-2000CL camera, a standard C-mount lens, a PS-12C power supply or equivalent, a PC system and a VGA monitor, a frame grabber, and an external trigger device if necessary.

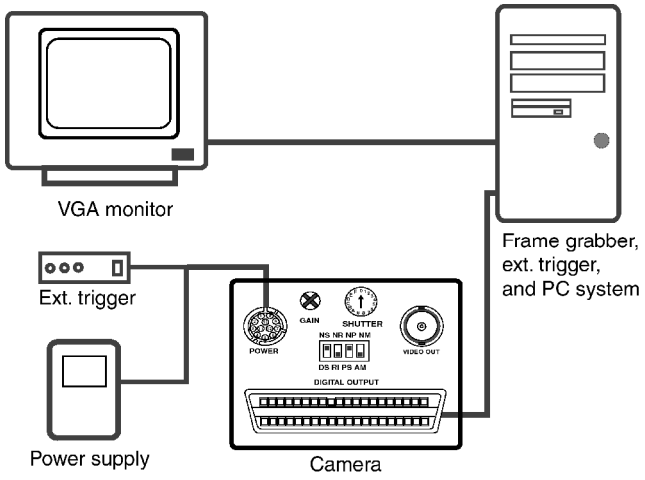


Figure 1. Camera and Frame Grabber System Setup

3. Camera Functions

3.1 12-Pin Connector

The 12-pin Hirose connector is located on the rear panel of the camera. All ground signals on pin 1, 3, 5, and 8 are common grounds. +12 V DC input is recommended on pin 2, but this camera should withstand +12 V ± 1V input voltage. Make sure to set the NM/AM switch to NM position for external HD and VD locking. Figure 2 below shows a top view of the 12-pin Hirose connector.

Pin No.	UP-2000CL
1	GND
2	+12V DC input
3	GND
4	Video
5	GND
6	N/C
7	N/C
8	GND
9	N/C
10	N/C
11	Integration control
12	N/C

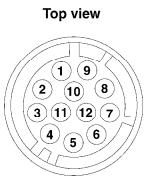


Figure 2. 12-Pin Hirose Connector

3.2 Mode Switches Selection

Designation:
NS-Functional select
DS-Shutter speed select
NR- RS-232C communication Enable
RI- Rear switch control Enable
NP- Reserved for custom options
PS- Reserved for custom options
NM-Normal mode
AM-Asynchronous mode

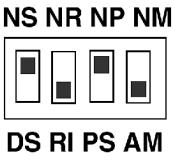


Figure 3. Mode switches

Timing details of the mode switches are shown in section 6.

3.3 Shutter Speed Dial Switch

Shutter speed dial switch is located on the rear panel and there are 16 different positions. To select camera gain, reference, or to save a user page, set NS/DS switch to NS position. To adjust shutter speed, set NS/DS to DS position. For normal shutter speed, make sure to set NM/AM mode to NM location. For asynchronous capture, set NM/AM mode to AM location.

Position No.	Functional Select (NS)	Shutter Speed Select (DS)			
		Normal Speed		Double Speed (2x2 binning)	
		Shutter Speed (sec) (NM Mode)	Asynchronous Capture (sec) (AM Mode)	Shutter Speed (sec) (NM Mode)	Asynchronous Capture (sec) (AM Mode)
0	Normal	1/16 (Off)	No shutter	1/32	No shutter
1	Gain Adjustment	1/50	1/500	1/50	1/500
2	Reference Adjustment	1/100	1/1,000	1/100	1/1,000
3	Factory Page	1/200	1/1,500	1/200	1/1,500
4	User Page 1	1/400	1/2,000	1/400	1/2,000
5	User Page 2	1/500	1/3,000	1/500	1/3,000
6	User Page 3	1/1,000	1/4,000	1/1,000	1/4,000
7	User Page 4	1/2,000	1/5,000	1/2,000	1/5,000
8	Normal/Double Speed	1/3,000	1/6,000	1/3,000	1/6,000
9	Reserved	1/5,000	1/6,500	1/5,000	1/6,500
A	Reserved	1/6,500	1/8,000	1/6,500	1/8,000
B	Reserved	1/8,000	1/10,000	1/8,000	1/10,000
C	Reserved	1/10,000	1/15,000	1/10,000	1/15,000
D	Reserved	1/13,000	1/20,000	1/13,000	1/20,000
E	Reserved	1/20,000	1/40,000	1/20,000	1/40,000
F	Reserved	1/40,000	Pulse Width Control	1/40,000	Pulse Width Control

Figure 4. Shutter Speed Dial Switch

3.4 Momentary Switch (UP/Down Switch)

Position No.	Functional Select (NS)	Up/Down Switch
0	Normal	N/A
1	Gain Adjustment	Move up or down to adjust gain
2	Reference Adjustment	Move up or down to adjust reference
3	Factory Page	Move up or down to recall factory page
4	User Page 1	Up: Recall; Down: Save
5	User Page 2	Up: Recall; Down: Save
6	User Page 3	Up: Recall; Down: Save
7	User Page 4	Up: Recall; Down: Save
8	Normal speed/Double speed	Up: Normal speed; Down: Double speed
9	Reserved	
A	Reserved	
B	Reserved	
C	Reserved	
D	Reserved	
E	Reserved	
F	Reserved	

Camera settings can be saved into four different user pages. Once the user page is saved and set between shutter speeds 4 and 7, it will be activated as long as the camera is powered ON. User Page works in both rear plate control and RS232C communication selections.

Figure 5. Up/Down Switch

3.5 Gain Control (AGC/MGC)

Note: This gain potentiometer only applies to cameras without Up/Down switch on rear plate.

Manual gain control (MGC)

MGC is standard factory setting on this camera. The manual gain control can be adjusted from 4 dB to 36 dB. Adjusting the gain potentiometer located on rear panel will change the gain value.

Automatic gain control (AGC):

AGC is not available and it is not recommended to use. Contact UNIQ for further details.

Figure 6. Gain potentiometer

3.6 26-Pin Camera Link Connector

PIN NO.	CAMERA LINK SYMBOL	UNIQ CAMERA SYMBOL	FUNCTION
1, 14	INNER SHIELD	SHIELD	Inner shielding
2, 15	X0-, X0+	DATA0-, DATA0+	Video, LEN and FEN data output
3, 16	X1-, X1+	DATA1-, DATA1+	Video, LEN and FEN data output
4, 17	X2-, X2+	DATA2-, DATA2+	Video, LEN and FEN data output
5, 18	Xclk-, Xclk+	CLK-, CLK+	Pixel clock output
6, 19	X3-, X3+	DATA3-, DATA3+	Video, LEN and FEN data output
7, 20	SerTC+, SerTC-	Rx+, Rx-	Differential pair, serial communications from frame grabber
8, 21	SerTFG-, SerTFG+	Tx-, Tx+	Differential pair, serial communications to frame grabber
9, 22	CC1-, CC1+	HD-, HD+	Camera Control 1 (CC1) - Horizontal signal input
10, 23	CC2+, CC2-	VINIT/VD+, VINIT/VD-	Camera Control 2 (CC2) - Vertical signal or asynchronous reset input
11, 24	CC3-, CC3+	Reserved	Reserved for custom options
12, 25	CC4+, CC4-	Reserved	Reserved for custom options
13, 26	INNNER SHIELD	SHIELD	Inner shielding

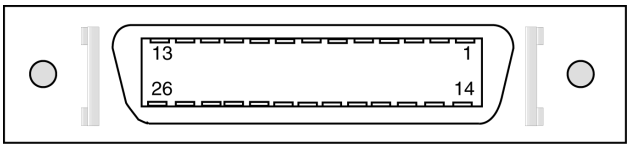


Figure 8. 3M 26-pin Camera Link Connector (MDR-26 pin)

4. RS-232C Communication Control

UNIQ does not provide its own software program for RS232C communication, contact frame grabber vendor or UNIQ for further details.

Command	Command Name	Notes
?	Error	"?" Error will appear on screen if incorrect command is entered
ru#	Recall user page	Must have a number after "ru" such as 1, 2, 3 or 4
rp	Report current camera setting	G = Gain; R = Reference S = Shutter Mode; NS, NM (refer to rear plate setting)
rf	Recall factory setting page	Factory default setting
sm#	Shutter mode	Must have a number after sm (1 ~ f), refer to section 3.3 for details.
sp#	Save user page	There are 4 user page available
ns	Normal speed	Refer to camera specifications
ds	Double speed	Refer to camera specifications
nm	Normal mode	Normal free running
am	Asynchronous mode	Asynchronous reset
gi###	Gain increase	### = Hexadecimals (000 ~ 3ff). If no number entered, gain will be increased by factor of 1. If a number is entered, then number will be added to stored gain.
gd###	Gain decrease	### = Hexadecimals (000 ~ 3ff). Same as gi above, except it will be decreased.
gn###	Gain number	### = Hexadecimals (000 ~ 3ff). Refer to the gain curves below for details. Only one curve applies to each camera depending on camera model, contact UNIQ for further details.
bi###	Reference increase	### = Hexadecimals (000 ~ 3ff). If no number entered, reference will be increased by factor of 1. If a number is entered, then number will be added to stored reference. Note: It's very uncommon to change reference level, contact UNIQ for further details.
bd###	Reference decrease	
bn###	Reference number	

Note:

1. **Command must be in "lower case."**
2. **All numbers have to be in "hex" format, use a PC calculator to convert between hex and decimal numbers if necessary.**
3. **Command example:**

   User Enters: "sm5" (shutter speed at 5)

   Camera returns: "?" or "3f" in Hex
   (incorrect answer, no RS232C communication or something's wrong)

   or

   Camera return: "□" or "1" in Hex (correct answer, it might show other symbols depending on PC system)

4. **Gain Curves:**

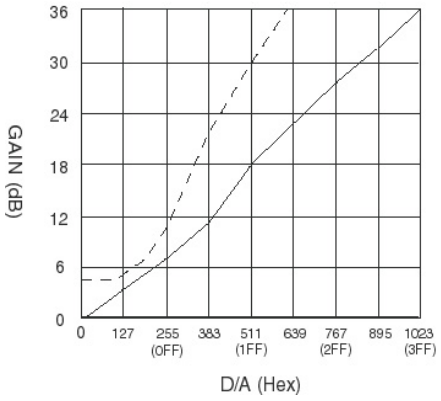
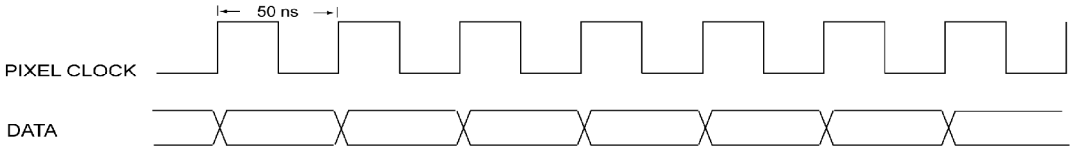


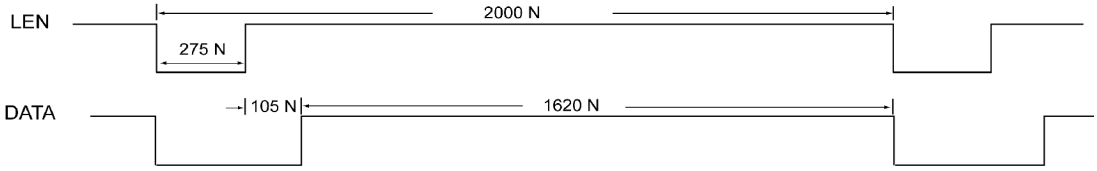
Figure 9. Camera Gain Curves

5. Digital Interface Timing

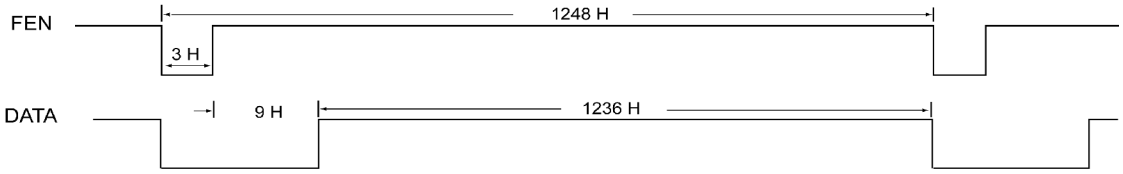
5.1 Pixel Clock



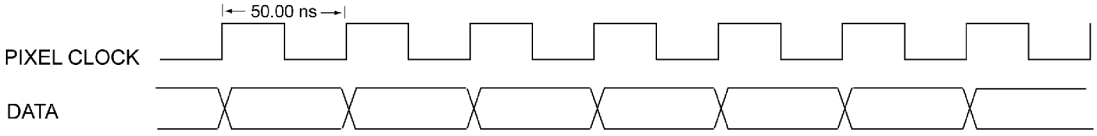
5.2 Line Enable



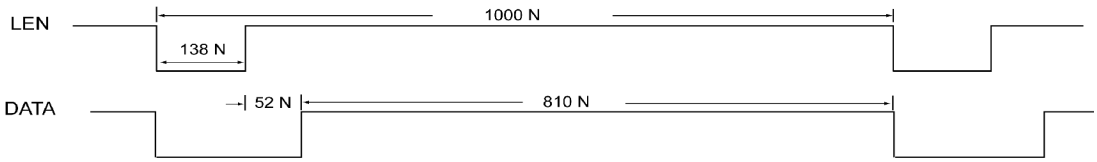
5.3 Frame Enable



5.4 Pixel Clock for 2 x 2 Binning



5.5 Line Enable for 2 x 2 Binning

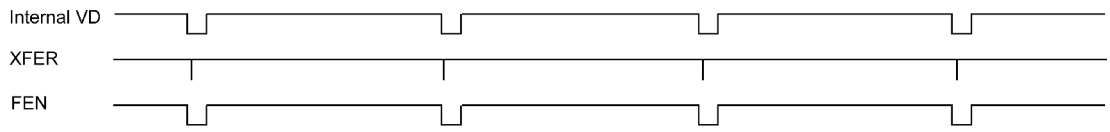


5.6 Frame Enable for 2 x 2 Binning

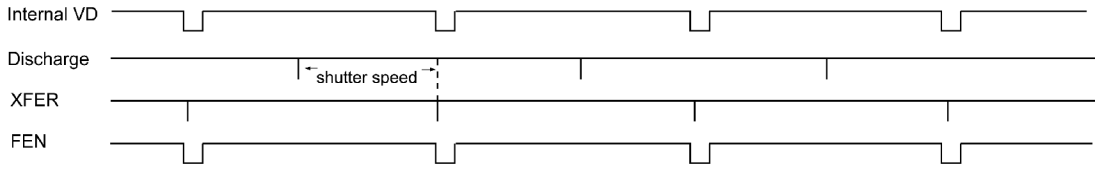
Note:
1. 1 N = 25 nsec (50 nsec for 2 x 2 binning)
2. 1 H = 2000 N (1000 N for 2 x 2 binning)

6 Camera Functional Timing

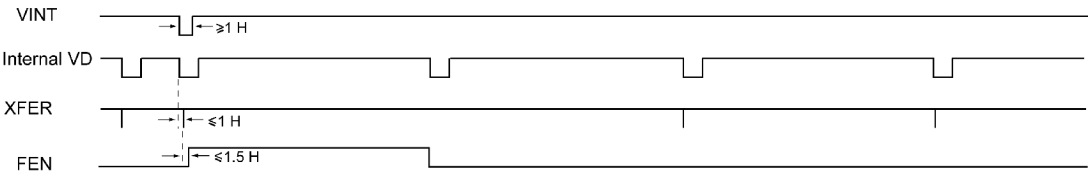
6.1 Free Run (shutter speed position 0, 16 fps)



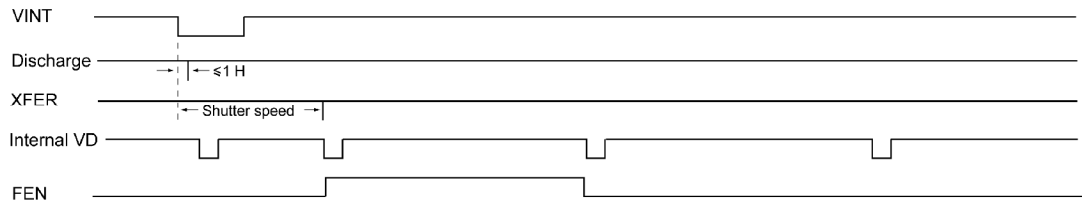
6.2 Free Run (shutter speed position from 1 to F)



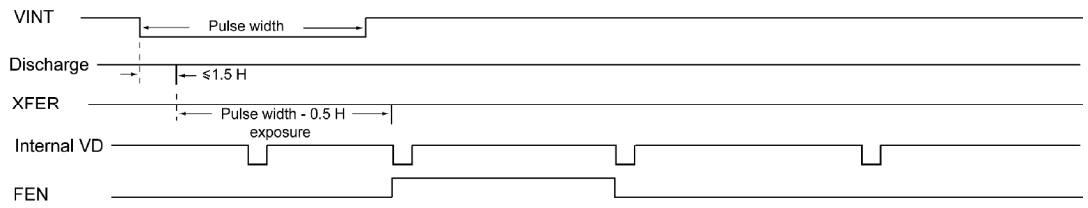
6.3 Asynchronous Capture (shutter speed position 0)



6.4 Asynchronous Capture (shutter speed position from 1 to E)



6.5 Asynchronous Capture with Pulse Width Control (shutter speed: F)



6.6 External Synchronization and Gen-lock (via Camera Link interface ONLY)

The UP-2000CL camera automatically locks to the external sync source. The external sync source must match the camera HD and VD specification, which are 19.979 KHz and 16.009 Hz respectively. Both external HD and VD are TTL level signals.

a) HD

H:	**2.5V to 5V**
L:	**0V or GND**
Pulse width:	**5-50% duty cycle, see figure 8 shown below.**

b) VD

H:	**2.5V to 5V**
L:	**0V or GND**
Pulse width:	**0.5-50% duty cycles**

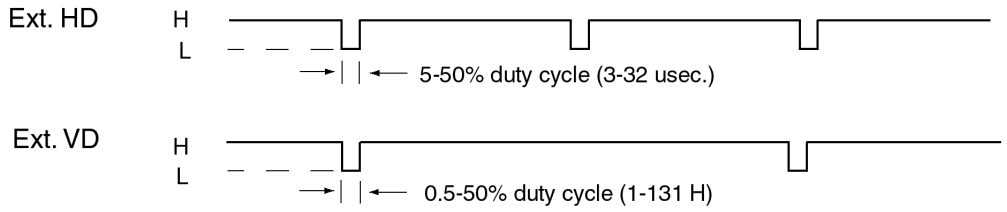


Figure 10. External Synchronization and Gen-lock Timing

6.7 Integration (via 12-pin Hirose connector ONLY)

The UP-2000CL camera can be integrated up to 2 seconds without severe noise or dark current effect. To start integration, pin #11 (same as pin #27 of 40-pin digital connector) of the 12-pin connector must be connected to GND or 0V. The integrated video will be shifted out following the next vertical drive after pin #11 goes back to high or 5V level, as shown in figure 9 below. If a frame grabber does not capture the immediate frame or integrated video, the normal video (before the integration) will display again on the monitor.

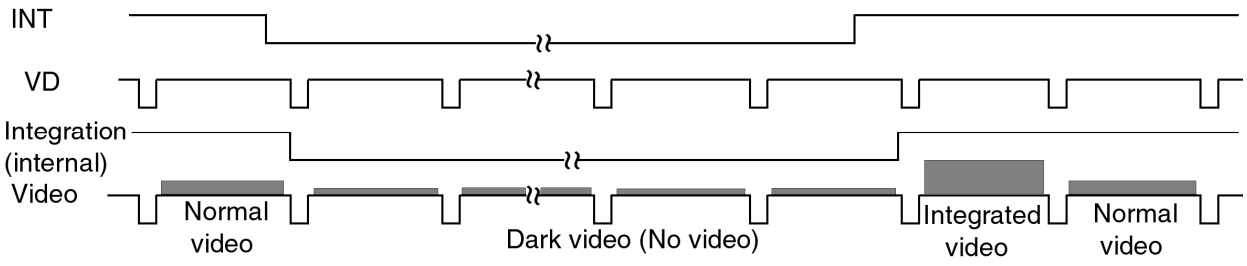


Figure 11. Integration Control Timing

7. Camera accessories

7.1 Power Supply and Power Cable

12 V DC regulated power supply with 1A current output or better is recommended. This camera uses Hirose 12-pin connector for power source. The matting cable plug connector can be purchased through distributors or UNIQ and the Hirose part number is HR10A10P12S. UNIQ provides power supplies and power cables as "one stop shopping" for customers. Alternatively, the power supplies and power cables can be purchased through power supply and cable vendors. Contact UNIQ for vendor list.

7.2 Lens

C-mount lens is the standard lens for UP-2000CL camera. There are a variety of C-mount lenses in the market that works with UP-2000CL camera. Make sure the quality and specification of the lens match the camera's application. Some of the most popular lenses in the market, such as Cosmicar, Fujinon, Rodenstock, and Schneider, are recommended.

7.3 Camera Link Cable

Camera Link cable can be purchased from 3M, Mouser, Digi-Key and frame grabber vendors.

8. Technical Support Information

For technical assistance, contact UNIQ Technical Support or Applications Engineer at

Phone: **(408) 330-0818**
Fax: **(408) 330-0886**
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