UNIQ

UC-1800DS/UC-1800DS-CL
Color Digital CCD Camera
User's Manual

091-1806 V.1.1
07-26-04

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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 UC-1800DS/UC-1800DS-CL is a high resolution color digital CCD camera using progressive scanning interline-transfer technology with R, G, B primary color mosaic filters (Bayer arrangement). A frame grabber collects digital data and displays color images by software conversion. This color camera is useful for applications where color and high resolution are required. With the asynchronous capture control, high speed moving objects can always be captured. The square pixels are especially suitable for processing, measuring, and analyzing tasks. This compact and lightweight camera offers excellent signal to noise performance. It's compatible with most popular frame grabbers in the market. The "user-friendly" RS-232C interface control allows users to control all camera functions without physically touching the camera.

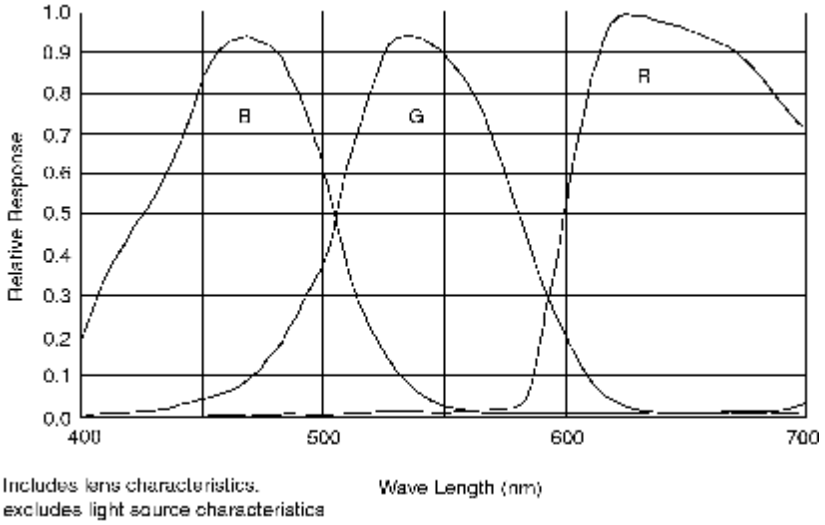
1.2 Features

- **2/3" Exview HAD Progressive Scan CCD Imager (R, G, B primary color mosaic filters)**
- **1380 x 1034 active pixels**
- **30 Hz frame rate**
- **10-bit RS-644 (LVDS)/Camera Link digital output**
- **Full frame shutter**
- **<56 dB**
- **Asynchronous reset at full frame shutter**
- **50 MHz pixel clock**
- **RS-232C interface Control**
- **C-mount lens**

1.3 Applications

UC-1800DS/UC-1800DS-CL applications include machine vision, automated inspection, motion capture and analysis, high-resolution graphics capture, medical imaging, biomedical imaging, non-contact measurement, microscopy, and other scientific applications where color image is needed.

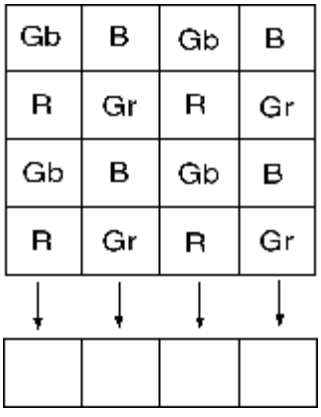
1.4 CCD Imager Spectral Response Curve



1.5 Camera Specifications

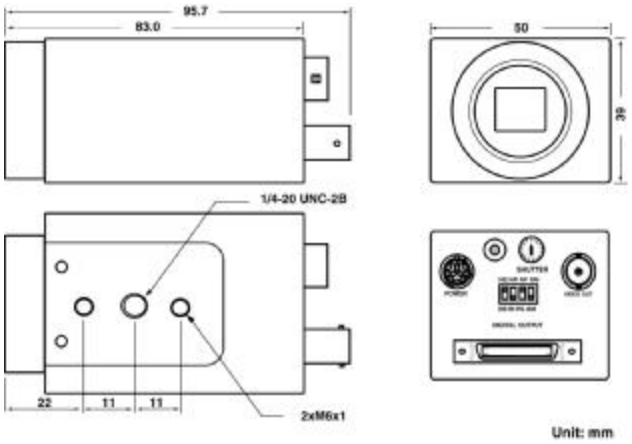
Model	UC-1800DS	UC-1800DS-CL
CCD Sensor	2/3" Progressive scan CCD (R, G, B primary color mosaic filters)	
Chip Size	10.20 mm x 8.30 mm	
Effective Pixels (H x V)	1380 x 1034	
Unit Cell Size (H x V)	6.45 μm x 6.45 μm	
Pixel Clock	50 MHz	
Frame Rate	30 FPS	
Sync.	HD: 31.367 KHz; VD: 30.0 Hz	
Digital Video Output	10-bit RS-644/LVDS	Camera Link format
Analog Video Output	1 V p-p, 75ohm (BNC or 12 pin Hirose)	
S/N Ratio	<56 dB	
Min. Illumination	0.5 lux	
Gain	MGC	
Gamma	1.0	
Electronic Shutter	1/30 ~ 1/62,000 selectable	
Lens Mount	C-Mount	
Operating Temperature	-10 °C ~ +55 °C	
Power Requirement	12 V DC, 470 mA, 5.6 W	12 V DC, 460 mA, 5.5 W
Dimension	50mm x 39mm x 83mm	
Ext. Sync.	Internal/External Auto Switch	
Asynchronous Reset	Standard	
Weight	200 g	

1.6 Color Coding Diagram



The bottom left pixel is the first signal output

1.7 Camera Dimension



2. Camera Setup

A basic camera and frame grabber system setup, as shown in Figure 1 below, requires a UC-1800DS/UC-1800DS-CL 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.

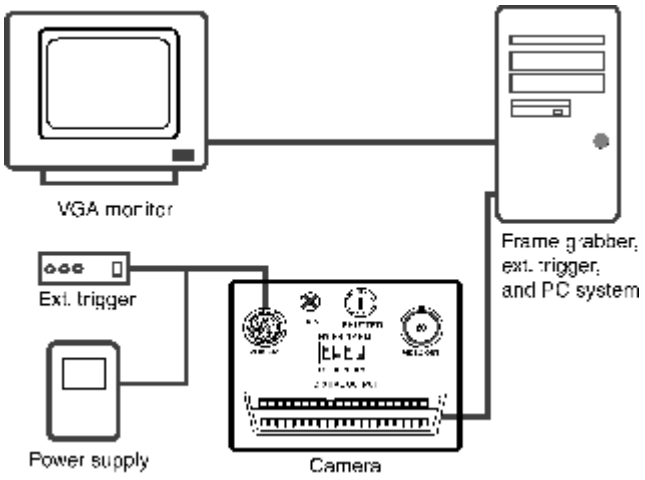


Figure 1. Camera and Frame Grabber System Setup

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. For HD (pin 6) and VD (pin 7) inputs, TTL signals are required (see section 6.6 for details). For asynchronous capture (VINT) applications, refer to section 6 for details. For RS-232C interface control via this 12-pin connector, use pin # 10 and #12. Figure 2 below shows a top view of the 12-pin Hirose connector.

Pin No.	UC-1800DS	UC-1800DS-CL
1	GND	
2	+12V DC input	
3	GND	
4	Video	
5	GND	
6	External HD	N/C
7	Ext. VD/VINT	N/C
8	GND	
9	N/C	
10	RX (RS-232C)	N/C
11	Integration control	
12	TX (RS-232C)	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)	
		Shutter Speed (sec) (NM Mode)	Asynchronous Capture (sec) (AM Mode)
0	Normal	1/30 (Off)	No shutter
1	Gain Adjustment	1/60	1/120
2	Reference Adjustment	1/120	1/240
3	Factory Page	1/240	1/500
4	User Page 1	1/500	1/1,000
5	User Page 2	1/1,000	1/2,000
6	User Page 3	1/2,000	1/4,000
7	User Page 4	1/4,000	1/6,000
8	Normal/Double Speed	1/6,000	1/8,000
9	Reserved	1/8,000	1/10,000
A	Reserved	1/10,000	1/12,000
B	Reserved	1/12,000	1/15,000
C	Reserved	1/15,000	1/20,000
D	Reserved	1/20,000	1/31,000
E	Reserved	1/31,000	1/62,000
F	Reserved	1/62,000	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 (N/A)
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 Digital Output Pinout and Connector

3.6.1 40-Pin D-Sub Connector

PIN	SIGNAL	I/O	NOTE	PIN	SIGNAL	I/O	NOTE
1	+12VIN/OUT	I/O		21	RESERVED		
2	GND			22	RESERVED		
3	CLK+	O	RS644/LVDS	23	HD	I	TTL
4	CLK-	O	RS644/LVDS	24	GND		
5	FEN+	O	RS644/LVDS	25	VD / VINT	I	TTL
6	FEN-	O	RS644/LVDS	26	RESERVED		
7	LEN+	O	RS644/LVDS	27	INT	I	TTL
8	LEN-	O	RS644/LVDS	28	RESERVED		
9	DATA0+	O	RS644/LVDS	29	DATA1+	O	RS644/LVDS
10	DATA0-	O	RS644/LVDS	30	DATA1-	O	RS644/LVDS
11	DATA2+	O	RS644/LVDS	31	DATA3+	O	RS644/LVDS
12	DATA2-	O	RS644/LVDS	32	DATA3-	O	RS644/LVDS
13	DATA4+	O	RS644/LVDS	33	DATA5+	O	RS644/LVDS
14	DATA4-	O	RS644/LVDS	34	DATA5-	O	RS644/LVDS
15	DATA6+	O	RS644/LVDS	35	DATA7+	O	RS644/LVDS
16	DATA6-	O	RS644/LVDS	36	DATA7-	O	RS644/LVDS
17	DATA8+	O	RS644/LVDS	37	DATA9+	O	RS644/LVDS
18	DATA8-	O	RS644/LVDS	38	DATA9-	O	RS644/LVDS
19	RESERVED			39	RESERVED		
20	RESERVED			40	RESERVED		

Note:

1. **DATA9+/- is most significant bits.**
2. **DATA0+/- is least significant bits.**
3. **Pin #1 (+12VIN/OUT) of 40-pin digital connector and pin #2 (+12V) of 12-pin Hirose connector are connected. If 12V power is provided from 12-pin connector, pin #1 of the 40-pin connector will act as a +12V output.**

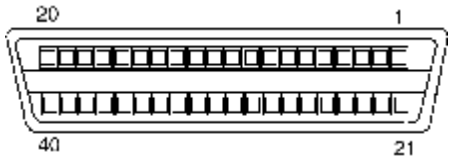


Figure 7. 40 pin digital connector

3.6.2 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-	VINT/VD+, VINT/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

4.1 Hyper Terminal Program

UNIQ does not provide its own software program for RS-232C communication. In order to use RS-232C interface, a Hyper Terminal software program must be installed and applied. The following shows how to run and use of Hyper Terminal.

Windows 95/98/Me/2000/XP

How do I run Hyper Terminal?

1. Click Start / Programs / Accessories

2. Within accessories double click Hyper Terminal (If you do not see Hyper terminal click the communications folder and then click Hyper Terminal). If you are unable to locate Hyper Terminal it may not be installed see next question.

How do I uninstall / reinstall / install Hyper Terminal?

1. **Click Start / Settings / Control Panel and double click Add Remove Programs.**
2. **Within Add Remove Programs click the Windows Setup tab.**
3. **Double click the communications icon.**
4. **And check or uncheck the Hyper Terminal section depending if you want Hyper Terminal to be installed or uninstalled, if you want to reinstall Hyper Terminal uncheck and then click ok and then repeat the above process and re-check Hyper Terminal.**

For first time user of Hyper Terminal, go to Properties,
Select 9600 bits per second in Configure…
Enable "Echo typed characters locally" box in ASCII setup…

4.2 RS232C communication setting requirement

Baud Rate	**9600 bps**
Parity	**None**
Data	**8 bit**
Start Bit	**1 bit**
Stop Bit	**1 bit**
Xon/Xoff	**None**

Go to Hyper Terminal program

- **Click File and click Properties**
- **Click Settings tab**
- **Click ASCII Setup…**
- **In ASCII Sending section,**
  check Echo typed characters locally but uncheck Send line ends with line feeds

4.3 RS-232C Command Pinout (LVDS only)

Command	12-pin Hirose Connector	40-pin Digital Connector
TX	Pin #12	Custom request only
RX	Pin #10	Custom request only

Note: If RS-232C is via 9-pin D-sub connector at PC end, make sure to short or connect pin # 4 and # 6, and then short or connect pin # 7 and #8, but do not connect all 4 pins together.

4.4 10-Bit Camera RS-232 Command

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 curve below for 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:

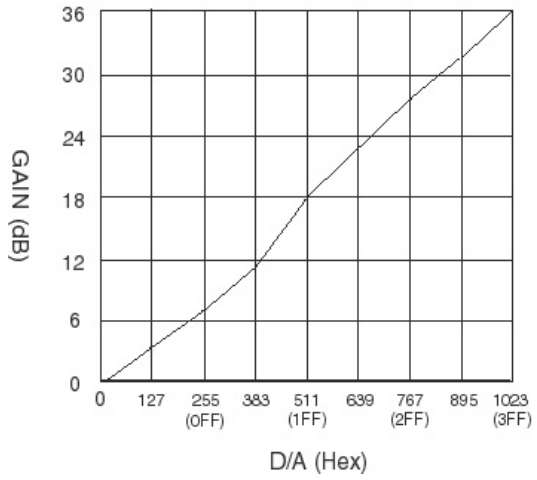
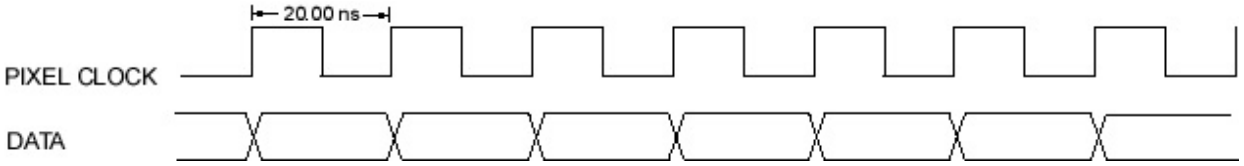


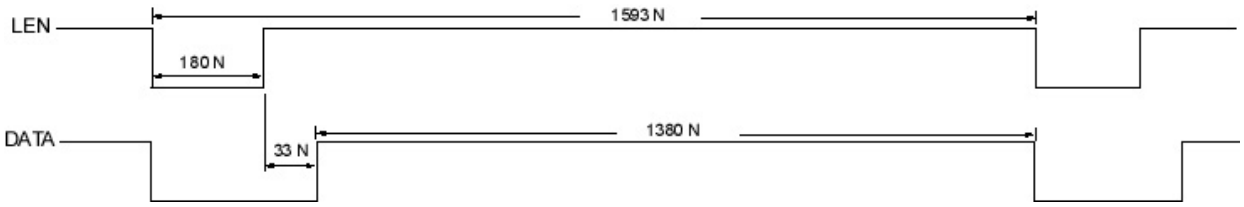
Figure 9. Camera Gain Curve

5. Digital Interface Timing

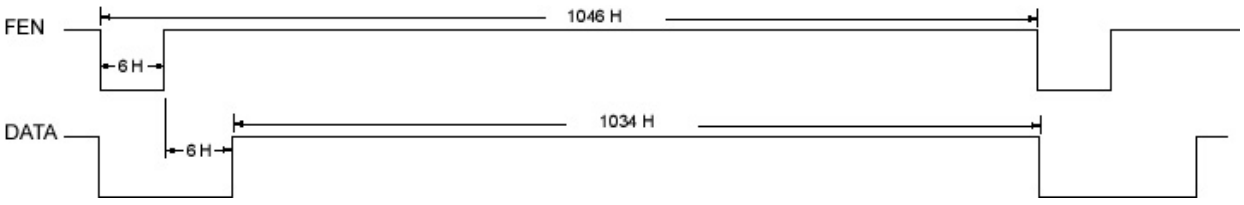
5.1 Pixel Clock



5.2 Line Enable



5.3 Frame Enable

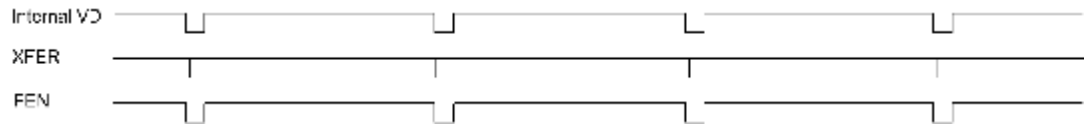


Note:

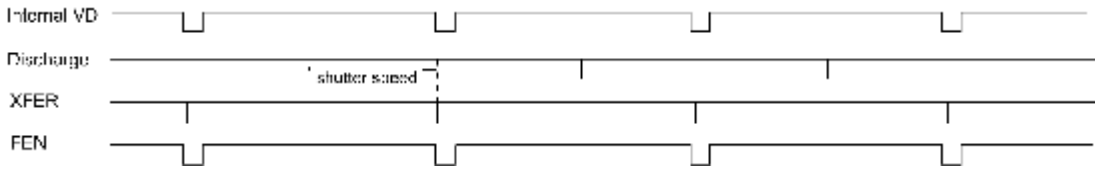
1. **Pixel clock = 50MHz**
2. **1 N = 20 nsec**
3. **H = 1593 N**

6. Camera Functional Timing

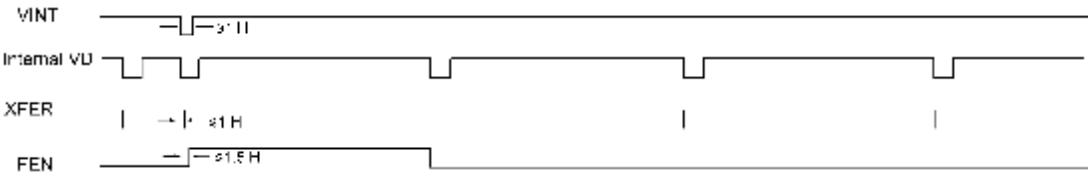
6.1 Free Run (shutter speed position 0, 30 fps)



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

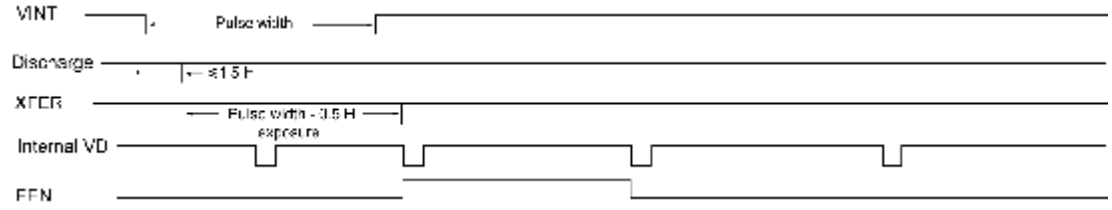


6.3 Asynchronous Capture (shutter speed position 0)



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 UC-1800DS/UC-1800DS-CL camera automatically locks to the external sync source. The external sync source must match the camera HD and VD specification, which are are 31.367 KHz and 30.0 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

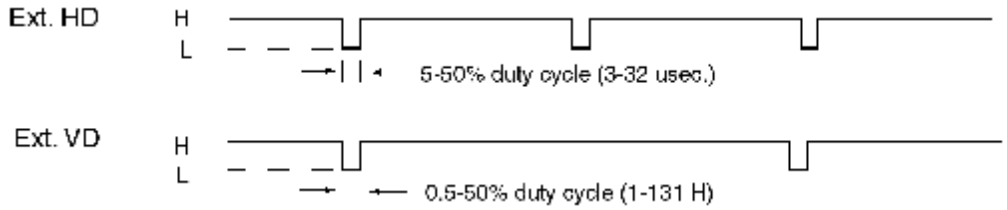


Figure 10. External Synchronization and Gen-lock Timing

6.7 Long Term Integration (via 12-pin Hirose connector ONLY)

The UC-1800DS/UC-1800DS-CL 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.

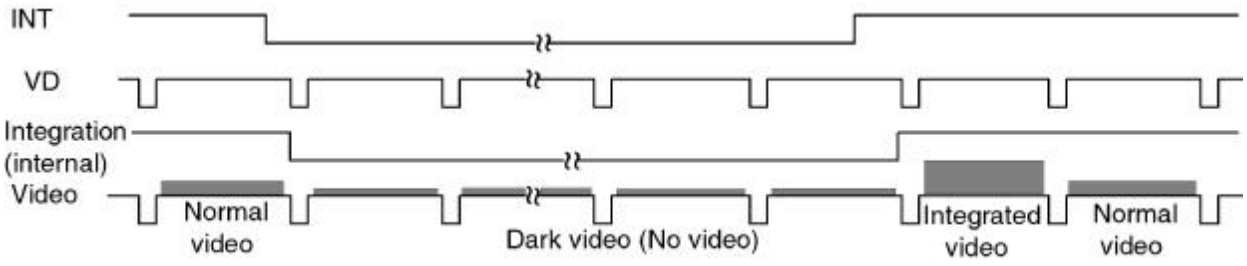


Figure 11. Integration Control Timing

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 UC-1800DS/UC-1800DS-CL camera. There are a variety of C-mount lenses in the market that works with UC-1800DS/UC-1800DS-CL 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 Digital Connector and Cable

7.3.1 40-pin Digital Connector and Cable

UNIQ stocks standard and custom cables for customer's convenience. These are high quality and flexible twisted paired, overall shielded cables. Contact UNIQ for more details.

The mating cable plug connector and back shell kits are made by AMP.
AMP: 749111-3 cable plug connector with covers.
AMP: 749192-1 back shell kits with latches

7.3.2 Camera Link Cable

Camera Link cable can be purchased from 3M, Mouser, frame grabber vendors or UNIQ.

8. Camera Malfunction

WARNING: DO NOT ATTEMPT TO OPEN THE CAMERA HOUSING IN ANY CASE WITHOUT CONSENTING THE FACTORY.

Camera malfunction rarely happens. In case camera malfunctions, the following troubleshooting procedures would help to minimize the problem; it definitely helps the user to find out the actual problem and may save a trip for sending the camera back to the factory.

a) First of all, unplug the power supply and disconnect the 12-pin Hirose power connector and any attached cable(s) from the camera unit. Make sure there is nothing connected to the camera at this time.

b) Close all necessary frame grabber software files on the computer.

c) Check the 12V DC power supply at the 12-pin connector cable and make sure it does provide the correct voltage to the 12-pin connector. If it does not, replace a good power supply and proceed the following steps.

d) Make sure to set the camera shutter dial switch and mode switches at the correct position (refer to section 4, timing signals, for details.)

e) Now, power up the camera with frame grabber cable(s) connected to the camera and the frame grabber. Click on UC-1800DS/UC-1800DS-CL configuration file from the frame grabber's configuration file list. If all the above camera and frame grabber setup procedures are done correctly, a good image should be appeared on a display monitor.

f) If it fails to show any good images, check the interface cable pinouts, both camera and frame grabber end, consult UNIQ or frame grabber manufacturer if necessary. Also, make sure the UC-1800DS/UC-1800DS-CL camera configuration file is correct.

g) If problem still exits, contact UNIQ or frame grabber manufacturer for further assistance.

h) If live video does exit but it's not good or clean, check frame grabber configuration file settings or contact UNIQ or frame grabber manufacturer for assistance.

i) " I do get the video but it's too dark." Make sure the lens is wide open and shutter speed dial switch is at "no" shutter or "low speed" shutter.

J) Point the camera at a bright scene without a lens on, a blank or bright display should be seen on a display monitor. Covering the CCD camera with hand or lens cap should see a dark video. If no video occurs, most likely the CCD camera is damaged, assuming that all setup procedures were done correctly above. Consult camera technical support at the factory.

k) If there is a good video but it is not clean or bad, it is possible that the CCD imager glass is dirty, or the CCD camera could be partially damaged. Use high-pressure air to blow the dirt away on the CCD protective glass surface if the CCD glass is not clean. If the problem still exists, contact the UNIQ technical support for help.

l) If there is a good video but the RS232C communication fails, or if the camera does not respond after sending a command, make sure to check the following.

i) Go to Hyper Terminal program
- **Click File and click Properties**
- **Click Settings tab**
- **Click ASCII Setup…**
- **In ASCII Sending section, check Echo typed characters locally but uncheck Send line ends with line feeds**

ii) If RS-232C is via 9-pin D-sub connector at PC end, make sure to short or connect pin # 4 and #6, and then short or connect pin # 7 and #8, but do not connect all 4 pins together.

9. Technical Support Information

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

Phone: **(408) 330-0818**
Fax: **(408) 330-0886**
Email: **tech@uniqvision.com**

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