

**Unibrain Firewire-800 cameras, Juniper series**

**Models: 580/780/785/980**

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# **User Operation Manual**

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Version 1.3

January 2011



# Legal Notice

## **For Customers in U.S.A.**

This equipment has been tested and found to comply with the limits for a Class B 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 their own expense. You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart J of Part 15 of FCC Rules.

## **For customers in Europe**

This apparatus has been certified to meet or exceed the standards for CE compliance per the Council Directives. Pertinent testing documentation is available for verification.

## **For customers in Canada**

This apparatus complies with the Class B limits for radio noise emissions set out in the Radio Interference Regulations.

## **Pour utilisateurs au Canada**

Cet appareil est conforme aux normes Classe B pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

## **Life support applications**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Allied customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify allied for any damages resulting from such improper use or sale.

## Before You Start

This manual should help you in installation and setting of the camera and we recommend you to carefully follow the instruction described.

To ensure that your warranty remains valid, read the manual carefully before using the camera.

DO NOT disassemble, modify or repair the camera since there is no user serviceable part inside and may void warranty. For prevention of fire or electric shock DO NOT remove screws or cover from the camera.

Operation in wet area is NOT recommended and camera SHOULD NOT be exposed to rain or moisture. For prolong life and use of camera's CCD, do not point the camera directly to the sun or strong spotlight which may result CCD blooming and permanent damage. DO NOT operate camera beyond operation temperature range stated and AVOID usage in conditions exceeding 90% humidity.

DO NOT use unregulated power supply source to prevent camera's circuit damage.

Use soft materials such as lens tissue or cotton tipped applicator with ethanol for CCD faceplate cleaning ONLY when necessary and AVOID contact with fingers or any hard object. Do not use solvent, abrasives or detergent in case of cleaning camera body.

Warranty shall be voided for improper usage or fault caused by user or damage caused by other equipments due to negligence

## Warranty

Unibrain warrants the original components free of defects for one year from purchase date. This warranty covers failures and damage due to defect which may occur during normal use. It does not cover damages or failure resulting from mishandling, abuse, misuse or modification. For every repair or replacement, RMA numbers must be obtained in advance.

## Disclaimer

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# 1. Introduction

## 1.1. Overview

Unibrain's new **Fire-i IIDC 1394b camera series** opens up a new horizon on digital image processing by providing more features in a small form factor while maintaining the cost effectiveness and high quality. All models are comprised of a wide range of sensor resolutions and are equipped with dual Firewire-800 interfaces and a trigger to suit the needs of every application.

The **Firewire-800 Juniper series** offers the highest frame rate in each of its resolutions, compared with other products currently available. The small form factor design has expanded implementation and broadens application areas by eliminating the limits that currently exist due to size and weight.

A Large selection of cameras is available and additional cameras are scheduled to be added in the future or per special OEM request. These will consist of various sensor sizes (1/3", 2/3") and resolution (VGA, SXGA, QSXGA) both in color and black and white. The Juniper series consists of the following models.

Type	Model Name	CCD	Resolution	FPS at Max Resolution
Black & White	Fire-i 980b	2/3"	2448 x 2048	15
	Fire-i 780b	2/3"	1388 x 1040	30
	Fire-i 785b	1/3"	1288 x 964	30
	Fire-i 580b	1/3"	656 x 484	86
Color	Fire-i 980c	2/3"	2448 x 2048	15
	Fire-i 780c	2/3"	1388 x 1036	30
	Fire-i 785c	1/3"	1288 x 960	30
	Fire-i 580c	1/3"	652 x 484	86

Unique features include a lookup table and external trigger mode 0 ~ 5 plus 15, multi camera auto-sync, ones-hot and multi-shot, a wide range of shutter speeds (Fire-i 580/780/785 : 1us ~ 3600s, Fire-i 980 : 5us ~ 3600s ), RS232C pass through via FireWire, Fast format 7 partial scan, and horizontal and vertical binning modes (1x2, 2x2 for B&W). All of these features provide maximum flexibility for a wide variety of applications.

### Software support

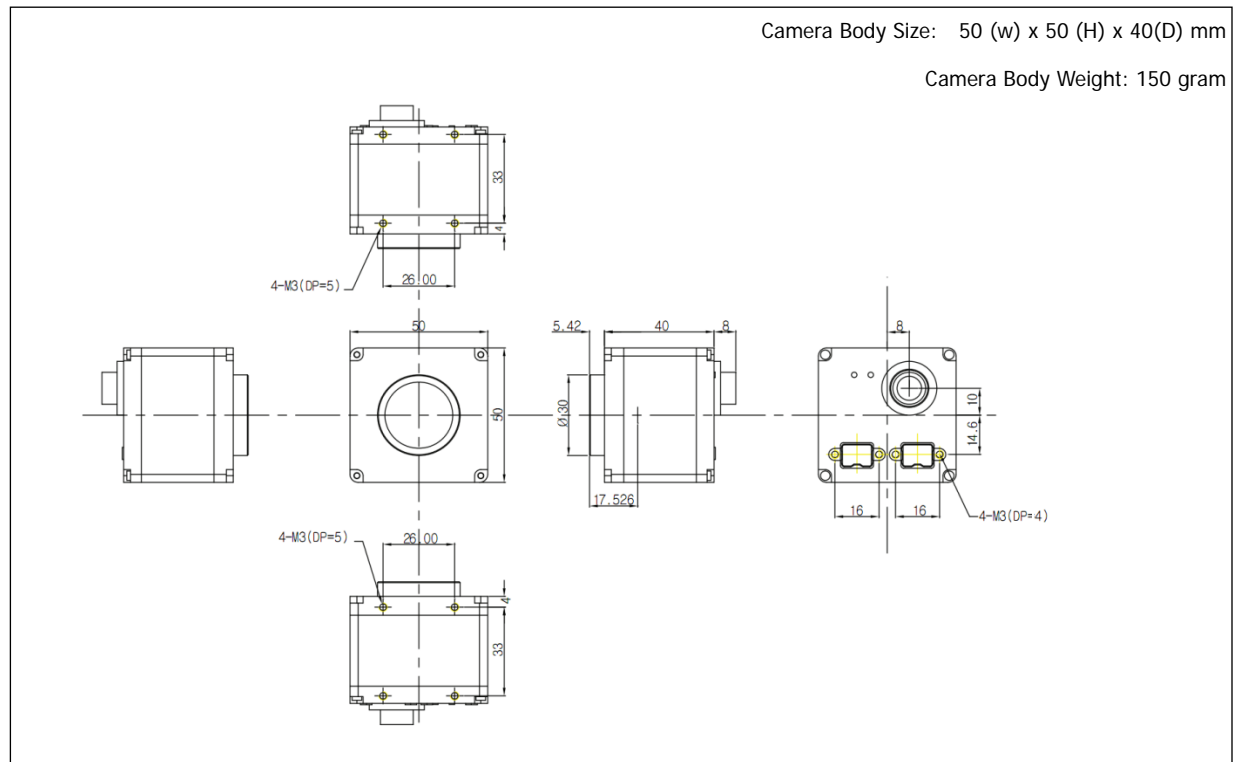
All cameras are fully supported from Unibrain's Fire-i™ drivers and software and embed a Fire-i API™ SDK license.

Latest versions of Fire-i™ software and SDK can be downloaded from our web site:

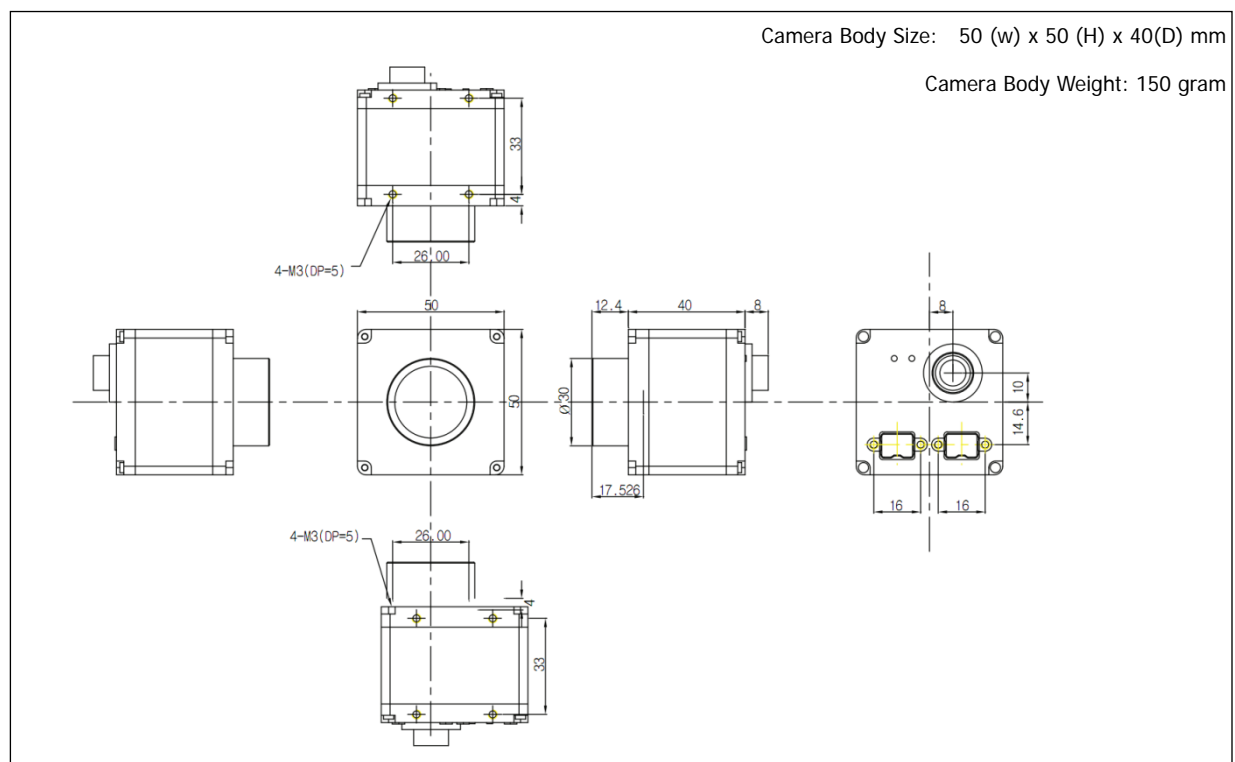
<http://www.unibrain.com/downloads/>

## 1.2. Mechanical dimensions

### 1.2.1. Fire-i 580, Fire-i 785

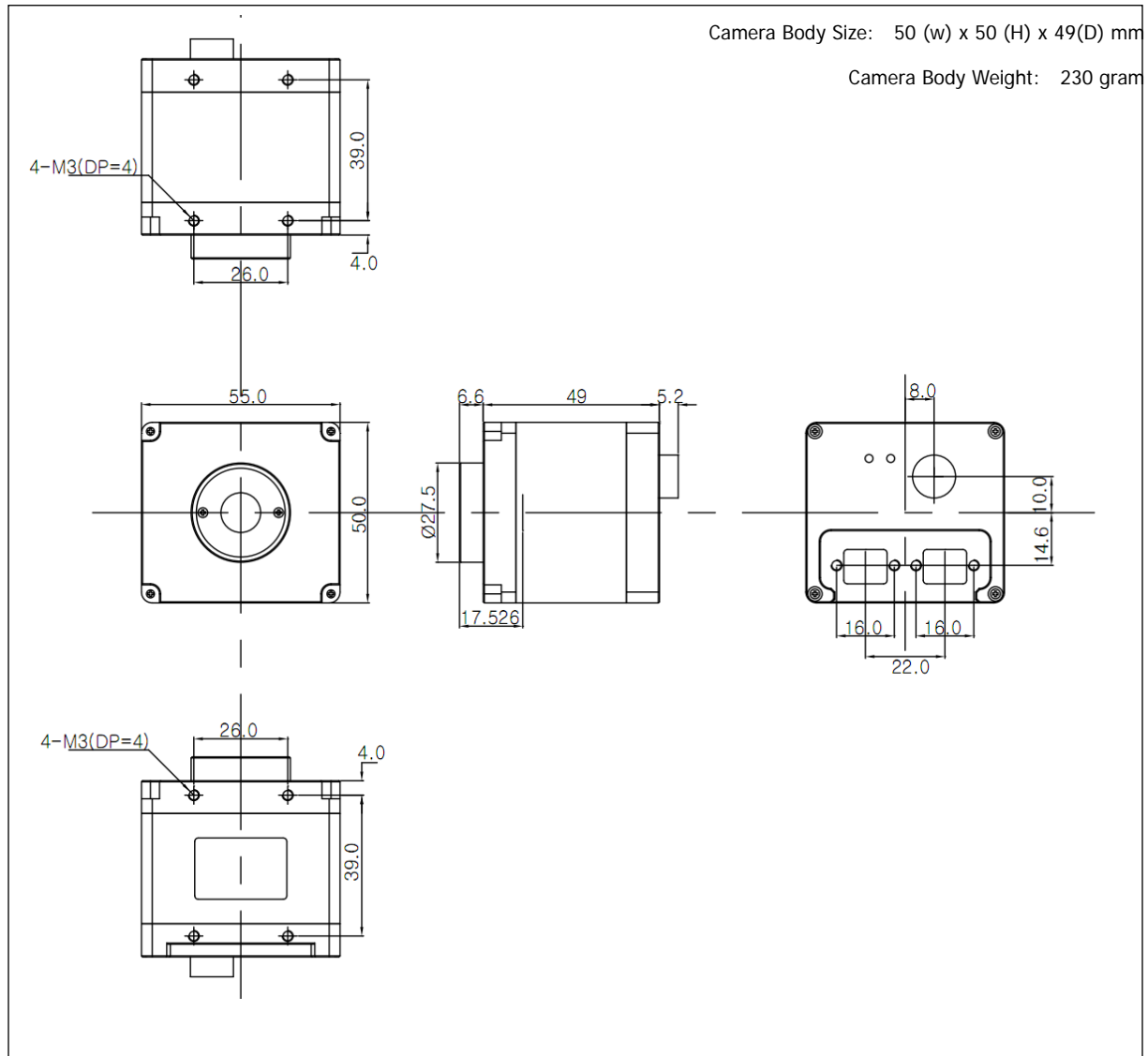


### 1.2.2. Fire-i 780





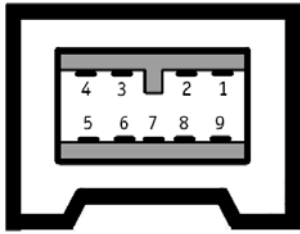
### 1.2.3. Fire-i 980



## 1.3. Camera Interface

### 1.3.1. FireWire-800 Port

The industry standard Firewire-800 (IEEE-1394b) port has the following pin assignment. Data and control of the camera are provided via 1394B and camera power can also be supplied by FireWire bus.



Pin	Signal
1	TPB-
2	TPB+
3	TPA-
4	TPA+
5	TPA R (A GND)
6	TPA-
7	Not connected
8	VP (+8 to +36 VDC)
9	TPB R (B GND)

CAUTION: DO NOT reverse the polarity as it will result in damaging the camera.

### 1.3.2. Trigger Connector Port

The External Trigger Connector provides access to multiple I/O and also provides power as a secondary source.



Pin	Signal	Pin	Signal
1	Power GND	7	GND
2	Ext. Power(+12v)	8	Rx RS232
3	GND	9	Tx RS232
4	Ext. Trigger	10	NC
5	Ext. Trigger GND	11	Strobe
6	NC	12	Strobe Power

Note: NC pins must have no connection

### 1.3.3. Status LED

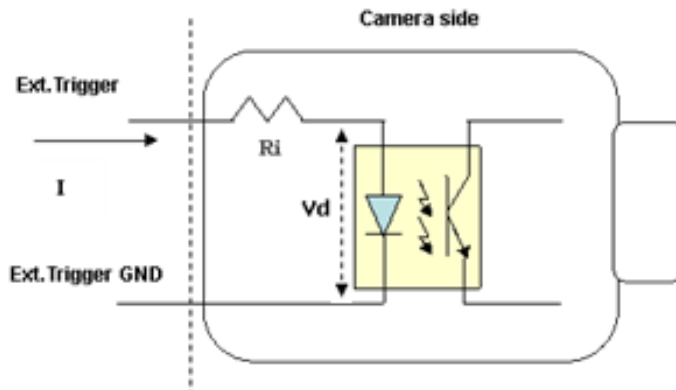
LED Status	Isochronous Channel	Packet Transfer
RED	Disable	NO
GREEN	Enable	Flicker
OFF	Enable	NO

Note: When power off, LED is OFF

## 1.4. Electrical Operating Condition

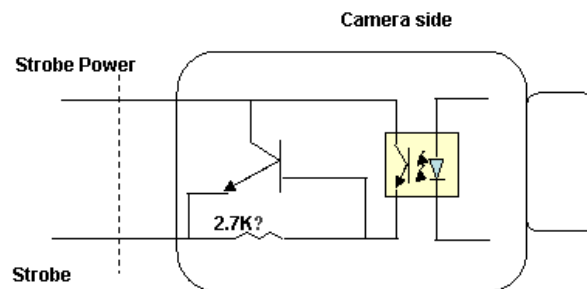
The cameras feature a photo coupler as below:

### Trigger



Parameter	Min	Typical	Max
I	7 mA	10 mA	20 mA
Ri	-	270 $\Omega$	-
Vd	-	1.08 V	-
Rising trigger delay	2.24 $\mu$ s	3.34 $\mu$ s	3.36 $\mu$ s
Falling trigger delay	2.62 $\mu$ s	3.61 $\mu$ s	3.64 $\mu$ s

### Strobe



Strobe Power	Strobe falling delay	Strobe rising delay
5 V	26.8 $\mu$ s	2.16 $\mu$ s
12 V	7.6 $\mu$ s	2.8 $\mu$ s
24 V	3.6 $\mu$ s	3.4 $\mu$ s

## 1.5. Pixel Data

Juniper series cameras comply with the IIDC 1394-Based Digital Camera Specification V1.32 where data packets are transmitted by Firewire interface as isochronous packets. Every video format, mode and frame rate has different video data format. (Pixel data source: IIDC V1.32 Specification)

### Isochronous Data Block Packet Format

0 - 7	8 - 15	16 - 23	24 - 31
Data Length	tg	channel	tCode Sy
Header CRC			
Video data payload			
Data CRC			

Where the following fields are defined in the IEEE 1394 standard:

**data\_length** : number of bytes in the data field **tg** : (tag field) shall be set to zero

**channel** : isochronous channel number, as programmed in the iso\_channel field of the cam\_sta\_ctrl register

**tCode** : (transaction code) shall be set to the isochronous data block packet tCode

**sy** : (synchronization value) shall be set to 0001h on the first isochronous data block of a frame, and shall be set to zero on all other isochronous data blocks

**Video data payload** : shall contain the digital video information, as defined in the following sections

Video data Payload Structure

Pn : Pixel number / packet .  
 K : Pn x n (n = 0.....N-1)  
 (Pn x N = Total pixel number /frame)

#### <YUV (4: 2: 2) format >

U-(K+0)	Y-(K+0)	V-(K+0)	Y-(K+1)
U-(K+2)	Y-(K+2)	V-(K+2)	Y-(K+3)
U-(K+4)	Y-(K+4)	V-(K+4)	Y-(K+5)
U-(K+Pn-6)	Y-(K+Pn-6)	V-(K+Pn-6)	Y-(K+Pn-5)
U-(K+Pn-4)	Y-(K+Pn-4)	V-(K+Pn-4)	Y-(K+Pn-3)
U-(K+Pn-2)	Y-(K+Pn-2)	V-(K+Pn-2)	Y-(K+Pn-1)

#### <YUV (4: 1: 1) format >

U-(K+0)	Y-(K+0)	Y-(K+1)	V-(K+0)
Y-(K+2)	Y-(K+3)	U-(K+4)	Y-(K+4)
Y-(K+5)	V-(K+4)	V-(K+4)	Y-(K+5)

U-(K+Pn-8)	Y-(K+Pn-8)	Y-(K+Pn-7)	V-(K+Pn-8)
Y-(K+Pn-6)	Y-(K+Pn-5)	U-(K+Pn-4)	Y-(K+Pn-4)
Y-(K+Pn-3)	V-(K+Pn-4)	Y-(K+Pn-2)	Y-(K+Pn-1)

**<Y(Mono) Format >**

Y-(K+0)	Y-(K+1)	Y-(K+2)	Y-(K+3)
Y-(K+4)	Y-(K+5)	Y-(K+6)	Y-(K+7)
Y-(K+Pn-8)	Y-(K+Pn-7)	Y-(K+Pn-6)	Y-(K+Pn-5)
Y-(K+Pn-4)	V-(K+Pn-3)	Y-(K+Pn-2)	Y-(K+Pn-1)

**<Y(Mono) Format >**

High Byte	Low Byte
-----------	----------

Y-(K+0)	Y-(K+1)
Y-(K+2)	Y-(K+3)
Y-(K+Pn-4)	Y-(K+Pn-3)
V-(K+Pn-2)	Y-(K+Pn-1)

**Data Structure****<Y, R, G, B >**

Each component has 8 bit data. The data type is "Unsigned Char"

	Signal Level (Decimal)	Data (Hexadecimal)
Highest	255	0xFF
	254	0xFE
	.	.
	.	.
	1	0x01
Lowest	0	0x00

**<U, V>**

Each component has 8 bit data. The data type is "Straight Binary"

	Signal Level (Decimal)	Data (Hexadecimal)
Highest(+)	127	0xFF
	126	0xFE
	.	.
	.	.
Lowest	1	0x81
	0	0x80
	-1	0x7F
	.	.
Lowest	.	.
	-127	0x01
	-128	0x00

**<Y(Mono16)>**

Y component has 16 bit data. The data type is "Unsigned Short(big-endian)"

Y	Signal Level (Decimal)	Data (Hexadecimal)
Highest	65535	0xFFFF
	65534	0xFFFE
	.	.
	.	.
Lowest	1	0x0001
	0	0x0000

## 2. Camera specifications

### 2.1. Black and White Cameras

#### 2.1.1. Fire-i 980b Specification

Features		
Image Sensor Type		2/3-inch Interline CCD (ICX625AL)
Effective pixels		5,054,448 pixels 2456(H) x 2058(V)
Picture Size		2448x2048, 1600x1200, 1280x960, 1024x768, 800x600, 640x480
Cell Size(um)		3.45x3.45
Real Frame Rate		15, 7.5, 3.75, 1.875 15 (2448x2048, Format 7 mode 0, mono 8) 7.5 (2448x2048, Format 7 mode 0, mono 16) 27 (1220x1020, Format 7 mode 1 2x2 binning, mono 8) 27 (2448x1020, Format 7 mode 1 1x2 binning, mono 8)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		2x2, 1x2
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active Low or High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Shutter, Gain
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface / Transfer Rate		IEEE1394B 2 port(9pin) / 800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		Manual or Auto / Range : 5 usec ~ 3600 sec
Data Depth		12 bit B/W
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 49(D) mm/ Approx. 230g
Operation Temp.		-5° C to 45° C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

Note: Camera Specifications subject to change without notice.

### 2.1.2. Fire-i 780b Specification

Features		
Image Sensor Type		2/3-inch Interline CCD (ICX285AL)
Effective pixels		1,450,000 pixels 1388(H) x 1040(V)
Picture Size		1388x1040, 1280x960, 1024x768, 800x600, 640x480
Cell Size(um)		6.45x6.45
Real Frame Rate		30, 15, 7.5, 3.75, 1.875 30 (1388x1040, Format 7 mode 0, mono 8) 26.5 (1388x1040, Format 7 mode 0, mono 16) 55 (688x516, Format 7 mode 1 2x2 binning, mono 8) 50 (688x516, Format 7 mode 1 2x2 binning, mono 16)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		2x2, 1x2
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 30,15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface / Transfer Rate		IEEE1394B 2 port(9pin) / 800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit B/W
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm/ Approx. 150g
Operation Temp.		-5° C to 45° C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32



### 2.1.3. Fire-i 785b Specification

Features		
Image Sensor Type		1/3-inch Interline CCD (ICX445AL)
Effective pixels		1.2Mega pixels 1280(H) x 964(V)
Picture Size		1288x964, 1280x960, 1024x768, 800x600, 640x480
Cell Size(um)		3.75 x 3.75
Real Frame Rate		30, 15, 7.5, 3.75, 1.875 30 (1288x964, Format 7 mode 0, mono 8) 26.5 (1288x964, Format 7 mode 0, mono 16) 54 (640x476, Format 7 mode 1 2x2 binning, mono 8) 49 (640x476, Format 7 mode 1 2x2 binning, mono 16)
Lens Mount		C-Mount
Scanning System		Progressive System
Binning		2x2, 1x2
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 30,15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface / Transfer Rate		IEEE1394B 2 port(9pin) / 800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit B/W
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm / Approx. 150g
Operation Temp.		-5° C to 45° C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

### 2.1.4. Fire-i 580b Specification

Features		
Image Sensor		1/3-inch Interline CCD (ICX424AL)
Effective Pixels		330,000 pixels 659(H) x 494(V)
Picture Size		656x488, 640x480
Cell Size		7.40x7.40
Real Frame Rate		60, 30, 15, 7.5, 3.75, 1.875 87 (656 x 488, Format 7 mode 0, mono 8) 80 (656 x 488, Format 7 mode 0, mono 16) 161 (324 x 240, Format 7 mode 1 2x2 binning, mono 8) 150 (324 x 240, Format 7 mode 1 2x2 binning, mono 16)
Lens Mount		C-mount
Scanning System		Progressive System
Binning		2x2, 1x2
Format 7		Partial Scan (Unit: 4x4)
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 60,30,15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface / Transfer Rate		IEEE1394B 2 port(9pin) / 800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit B/W
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm / approx. 150g
Operation Temp.		-5°C to 45°C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

## 2.2. Color Cameras

### 2.2.1. Fire-i 980c Specification

Features		
Image Sensor Type		2/3-inch Interline CCD (ICX625AQA)
Effective pixels		5,054,448 pixels 2456(H) x 2058(V)
Picture Size		2448x2048, 1600x1200, 1280x960, 1024x768, 800x600, 640x480, 320x240
Cell Size(um)		3.45x3.45
Real Frame Rate		15, 7.5, 3.75, 1.875 15 (2448x2048, Format 7 mode 0, mono 8, RAW 8) 7.5 (2448x2048, Format 7 mode 0, mono 16, RAW 16) 10 (2448x2048, Format 7 mode 0, YUV411) 7.5 (2448x2048, Format 7 mode 0, YUV422)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		Not supported
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active Low or High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Shutter, Gain U/B V/R, Hue/G, AWB
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface / Transfer Rate		IEEE1394B 2 port(9pin) / 800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		Manual or Auto / Range : 5 usec ~ 3600 sec
Data Depth		12 bit
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 49(D) mm/ approx. 230g
Operation Temp.		-5° C to 45° C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

## 2.2.2. Fire-i 780c Specification

Features		
Image Sensor Type		2/3-inch Interline CCD (ICX285AQ)
Effective pixels		1,450,000 pixels 1392(H) x 1040(V)
Picture Size		1388x1036, 1280x960, 1024x768, 800x600, 640x480, 320x240
Cell Size(um)		6.45x6.45
Real Frame Rate		30, 15, 7.5, 3.75, 1.875 30 (1388x1036, Format 7 mode 0, mono 8, RAW 8) 26.5 (1388x1036, Format 7 mode 0, mono 16, RAW 16) 30 (1388x1036, Format 7 mode 0, YUV411) 26.5 (1388x1036, Format 7 mode 0, YUV422)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		Not supported
Format7		Partial Scan (Unit: 4x4)
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 30,15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt U/B V/R, Hue/G, AWB
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface		IEEE1394B 2 port(9pin)
Transfer Rate		800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm / approx. 150g
Operation Temp.		-5°C to 45°C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

### 2.2.3. Fire-i 785c Specification

Features		
Image Sensor Type		1/3-inch Interline CCD (ICX445AQ)
Effective pixels		1,250,000 pixels 1296(H) x 966(V)
Picture Size		1288x960, 1280x960, 1024x768, 800x600, 640x480, 320x240
Cell Size(um)		3.75 x 3.75
Real Frame Rate		30, 15, 7.5, 3.75, 1.875 30 (1288x960, Format 7 mode 0, mono 8, RAW 8) 27.5 (1288x960, Format 7 mode 0, mono 16, RAW 16) 30 (1288x960, Format 7 mode 0, YUV411) 27.5 (1288x960, Format 7 mode 0, YUV422)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		Not supported
Format7		Partial Scan (Unit: 4x4)
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt U/B V/R, Hue/G, AWB
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface		IEEE1394B 2 port(9pin)
Transfer Rate		800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm / approx. 150g
Operation Temp.		-5°C to 45°C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

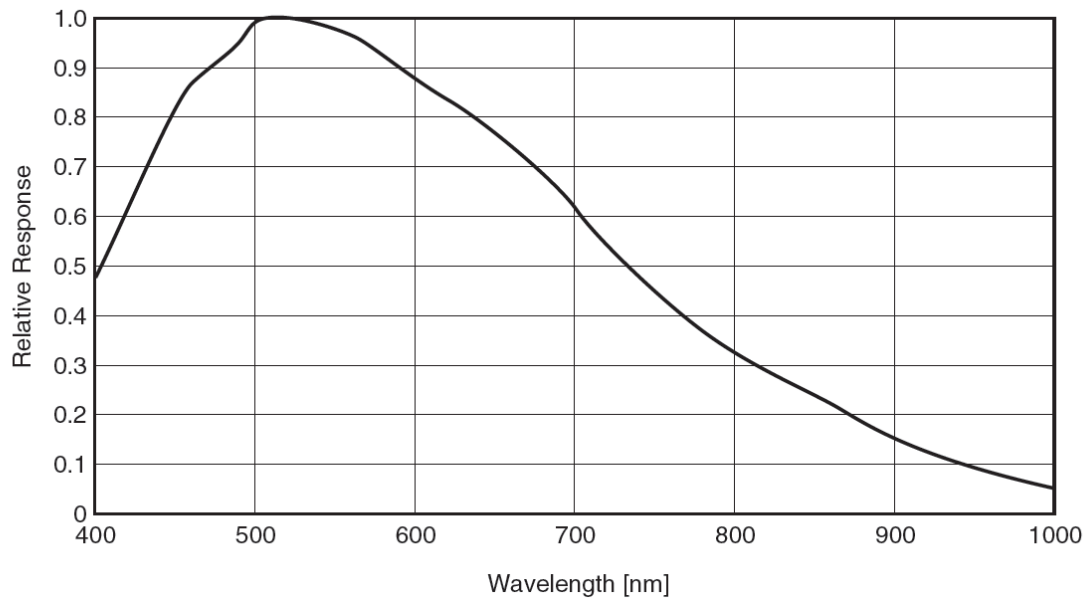
## 2.2.4. Fire-i 580c Specification

Features		
Image Sensor Type		1/3-inch Interline CCD (ICX424AQ)
Effective pixels		330,000 pixels 659(H) x 494(V)
Picture Size		652 x 484, 640 x 480, 320x240
Cell Size(um)		7.40x7.40
Real Frame Rate		60, 30, 15, 7.5, 3.75, 1.875 88 (652x484, Format 7 mode 0, mono 8, RAW 8) 80 (652x484, Format 7 mode 0, mono 16, RAW 16) 87 (652x484, Format 7 mode 0, YUV411) 80 (652x484, Format 7 mode 0, YUV422)
Lens Mount		C Mount
Scanning System		Progressive System
Binning		Not supported
Format7		Partial Scan (Unit: 4x4)
Trigger	Edge	Rising Edge or Falling Edge
	Mode	0, 1, 2, 3, 4, 5, 15
	Source	External Trigger or Software Trigger
Strobe		Active High, Support Normal Mode or Trigger Mode
Multi-camera auto sync		-144 us ~ +144 us at 60,30,15,7.5 frame rate
Memory Save/Load		16 Channels (0:factory, 1~4:feature, 5~15:mode/feature)
One-shot/Multi-shot		65535 Shots
Control Functions		Brightness, Sharpness, Gamma, Auto-Exposure, Auto-Shutter, Pan/Tilt
		U/B V/R, Hue/G, AWB
SIO(RS-232)		IIDC v1.32 version : Pass through or custom command
Digital Interface		IEEE1394B 2 port(9pin)
Transfer Rate		800Mbps
Gain		0 ~ 18 dB Manual or Auto
Shutter Speed		1 usec ~ 3600 sec
Data Depth		12 bit
S/N Ratio		56dB or better
Supply Voltage & Power		8 VDC ~ 30 VDC
External Dimension / Weight		50(W) x 50(H) x 40(D) mm / approx. 150g
Operation Temp.		-5°C to 45°C
Storage Temp		-20° C to 65° C
Camera Specification		IIDC 1394-based Digital Camera Specification v1.32

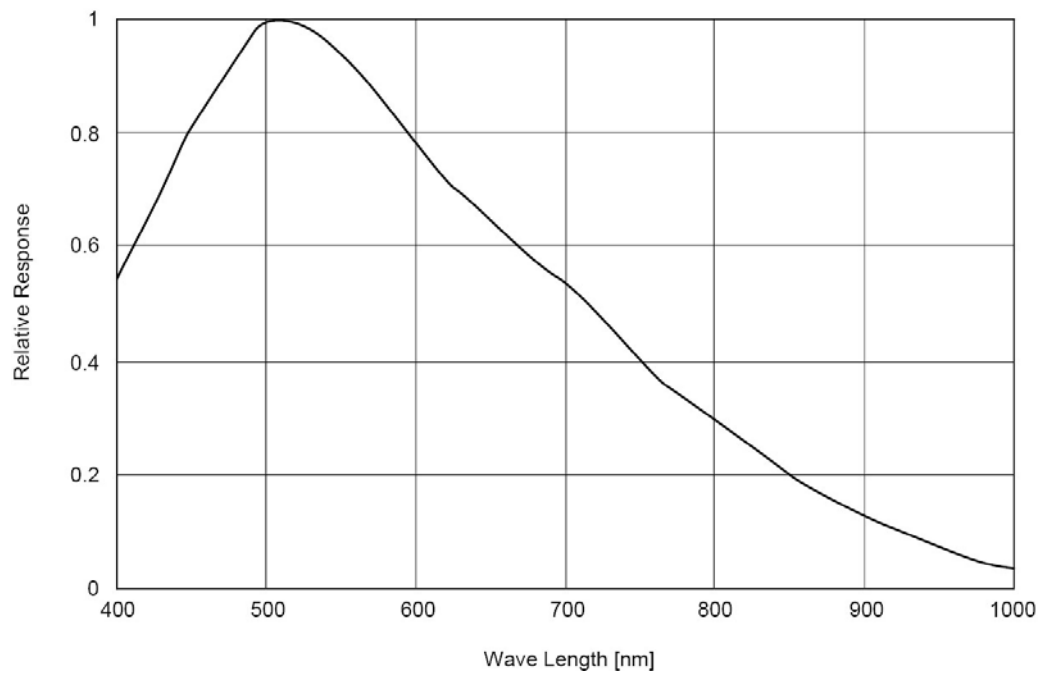
## 2.3. Spectral Sensitivity

Excludes lens and light source characteristics.

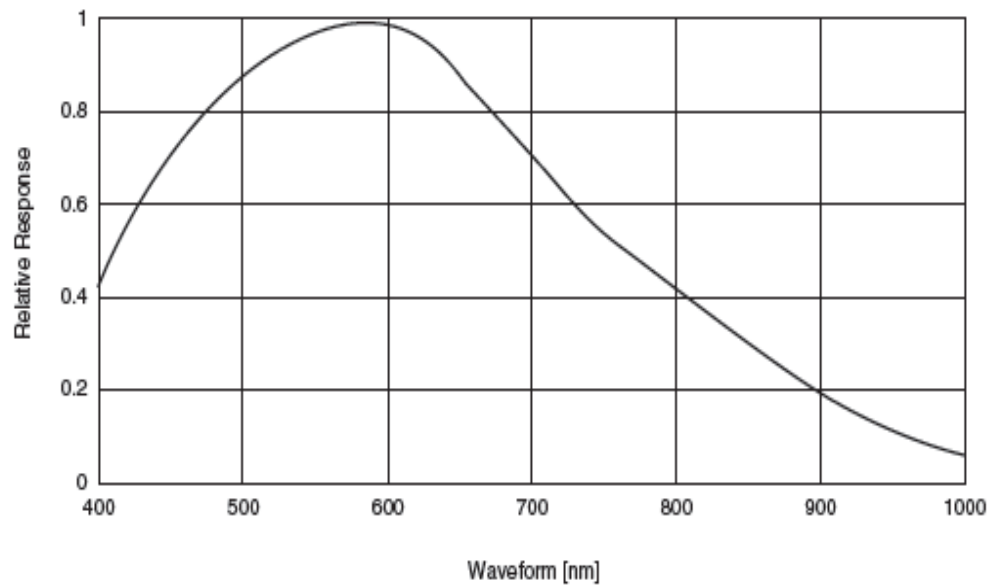
### 2.3.1. Monochrome cameras



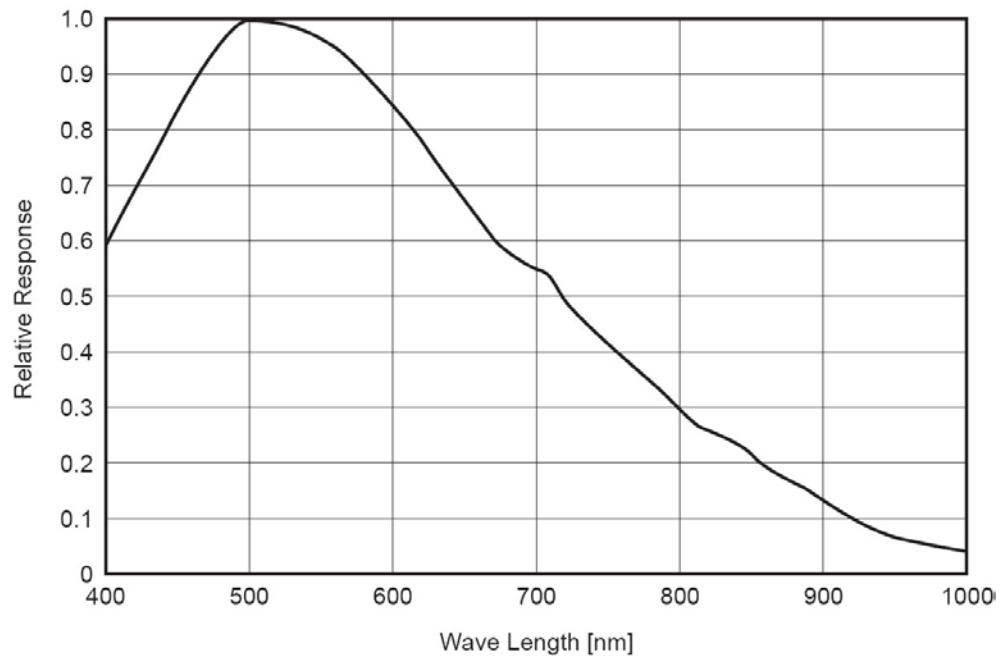
Spectral sensitivity for Fire-i 980b



Spectral Sensitivity for Fire-i 780b



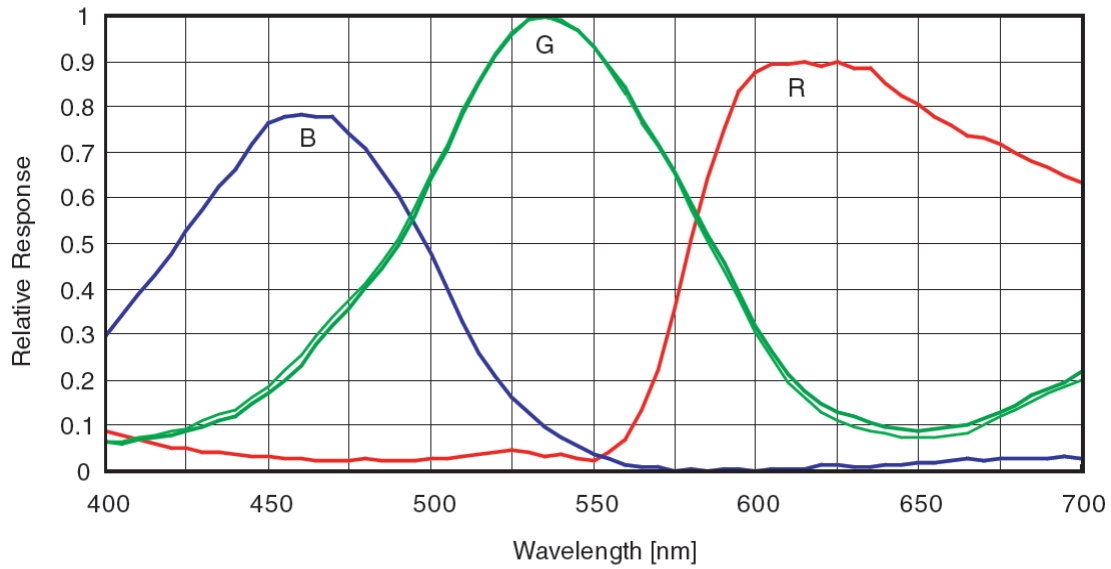
Spectral Sensitivity for Fire-i 785b



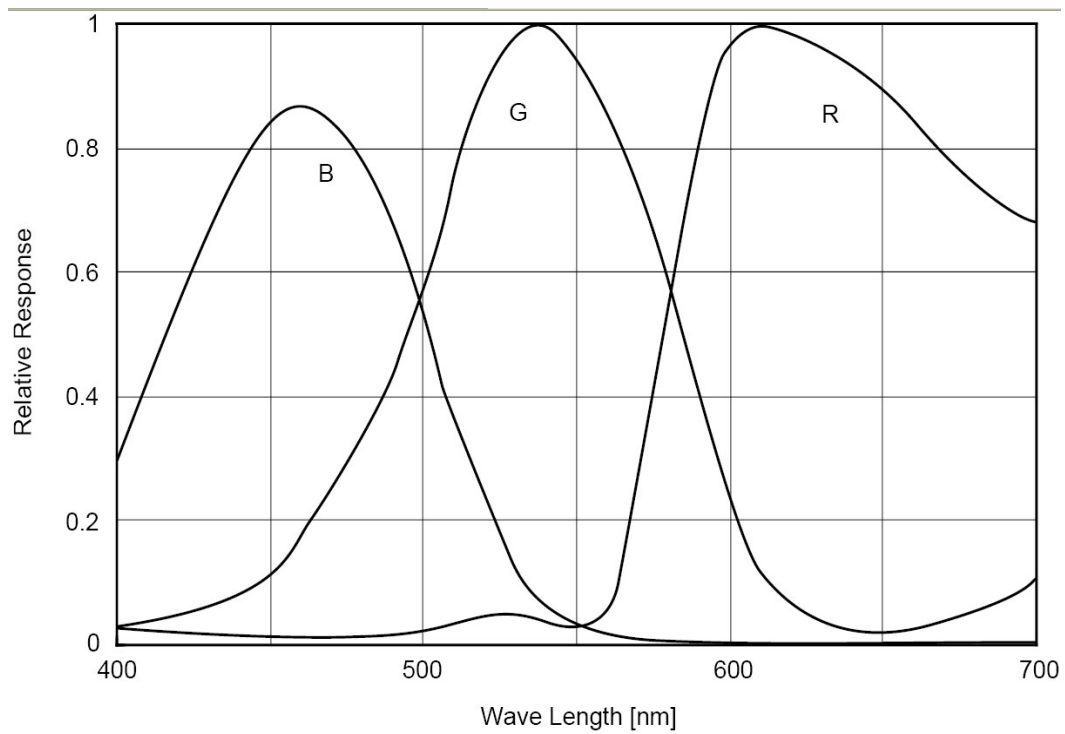
Spectral Sensitivity for Fire-i 580b



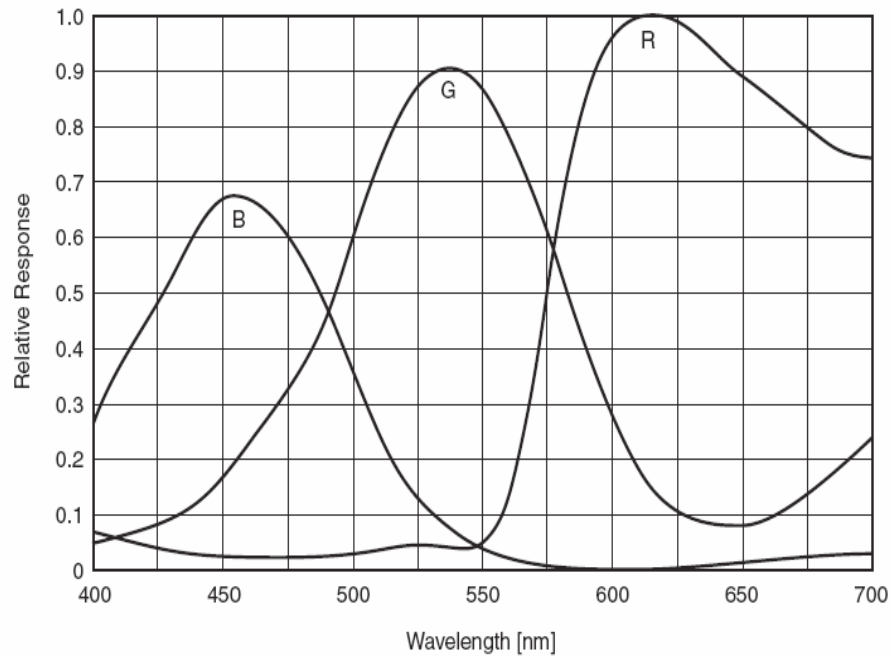
### 2.3.2. Color Cameras



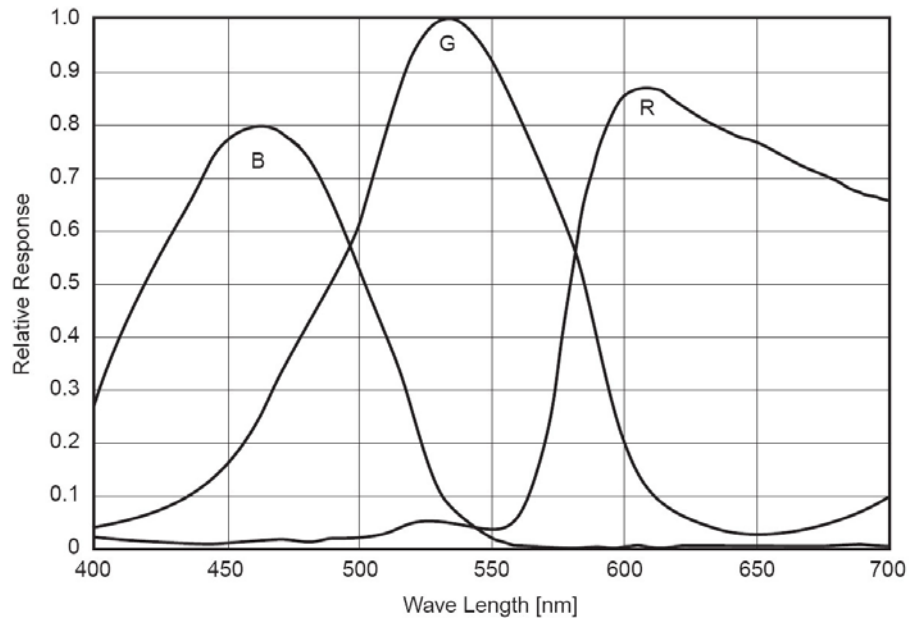
Spectral sensitivity of Fire-i 980c



Spectral Sensitivity for Fire-i 780c



Spectral Sensitivity for Fire-i 785c



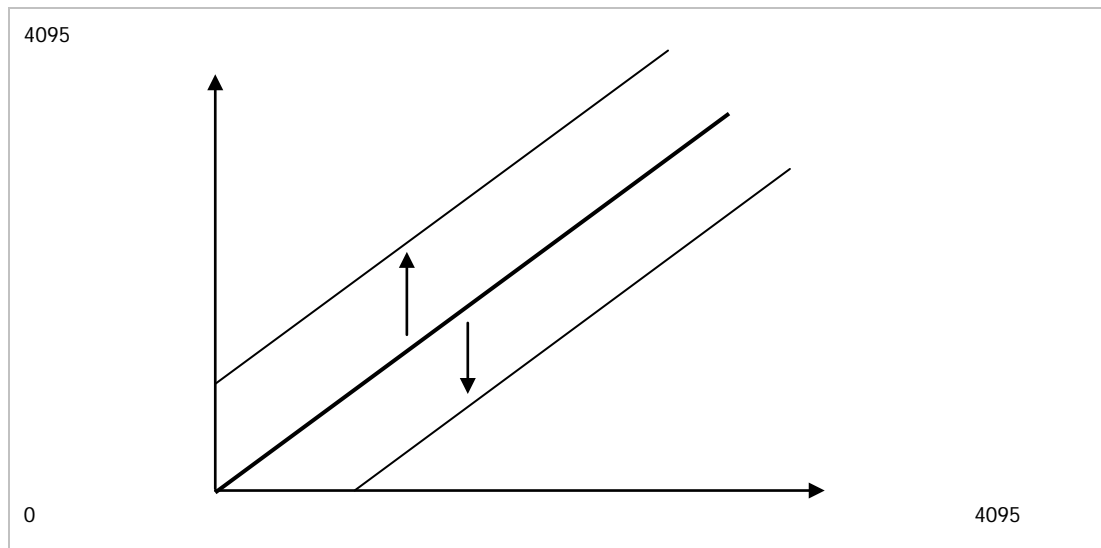
Spectral Sensitivity for Fire-i 580c

### 3. Basic Operation and Features

The Unibrain cameras employ progressive scan CCD sensor which provides features according to each model. Basic functions and features are similar while each camera of its range would have their specific function support. The cameras- fully support the IIDC V1.32 specification such as registers, video format, mode of operation and control.

#### 3.1. Brightness

Brightness of the camera can be controlled by changing the black level in the camera. The user can inquire the settings of the camera and control using the status control register. Adjust the brightness if the appropriate gradation cannot be obtained due to blurring of black portion of the image. The parameters of Brightness are changed inside the camera. For brightness, its parameters are shifted by the black level.



#### Inquiry Register

Address	Name	Field	Bit	Description
500h	BRIGHTNESS_INQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2]	Reserved
		One_Push_Inq	[3]	One push auto mode (Controlled automatically by camera only once)
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/OFF_Inq	[5]	Capability of switching this feature ON and OFF
		Auto_Inq	[6]	Auto Mode (Controlled automatically by camera)
		Manual_Inq	[7]	Manual Mode (Controlled by user)
		Min_Value	[8..19]	Minimum value for this feature control
		Max_Value	[20..31]	Maximum value for this feature control

**Status Control Register**

Address	Name	Field	Bit	Description
800h	BRIGHTNESS	Presence_Inq	[0]	Presence of this feature 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in Value field 1: Control with value in Absolute value CSR if this bit =1, value in Value filed is ignored
		-	[2..4]	Reserved
		One_Push	[5]	Write '1': begin to work(Self cleared after operation) Read : Value='1' in operation Value ='0' not in operation If A_M_Mode=1, this bit is ignored
		On/OFF	[6]	Write : ON or OFF this feature Read : read a status 0: OFF, 1:ON If this bit=0, other fields will be read only.
		A_M_Mode	[7]	Write : Set the mode Read : Read a current mode 0: Manual, 1:Auto
		-	[8..19]	Reserved
		Value	[20..31]	Minimum value for this feature control

**3.2. Auto Exposure Control**

The automatic shutter/gain mode is based on a feedback loop which calculates the average pixel luminance. Then the average is compared with the exposure reference value, adjusting shutter and gain accordingly.

**Inquiry Register**

Address	Name	Field	Bit	Description
504h	AUTO_EXP OSURE_INQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2]	Reserved
		One_Push_Inq	[3]	One push auto mode(Controlled automatically by camera only once)
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/Off_Inq	[5]	Capability of switching this feature On and OFF
		Auto_Inq	[6]	Auto mode (Controlled automatically by camera)
		Manual_Inq	[7]	Manual mode(Controlled by user)
		Min_Value	[8..19]	Minimum value for this feature control
		Max_Value	[20..31]	Maximum value for this feature control

**Status Control Register**

Address	Name	Field	Bit	Description
804h	AUTO_EXP OSURE	Presence_Inq	[0]	Presence of this feature 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in the Value field 1: Control with value in the Absolute value CSR If this bit = 1, value in the Value field is ignored.
		-	[2..4]	Reserved
		One_Push	[5]	Write '1' :begin to work (Self cleared after operation)

				Read: Value='1' in operation Value='0' not in operation If A_M_Mode =1, this bit is ignored
		ON_OFF	[6]	Write: ON or OFF this feature, Read: read a status 0:OFF, 1:ON If this bit=0, other fields will be read only.
		A_M_Mode	[7]	Write: set the mode, Read: read a current mode 0: Manual, 1:Auto
		-	[8..19]	Reserved
		Value	[20..31]	Value : Write the value in Auto mode, this field is ignored. If "ReadOut" capability is not available, read value Has no meaning

### 3.3. Sharpness

This feature controls sharpness by enhancing the edges of image. By applying this feature the edge of the images is sharpened against the ambient noise, which makes it more visible. The user can control the desirable level to obtain the best result. If you do not prefer such signal manipulation, you may switch it OFF or set its value to '10' (a value of '10' equals turning OFF Sharpness).

For sharpness control inquiry and status register, follow the same definition as "BRIGHTNESS".

### 3.4. White Balance

Color models have the white balance feature which can be controlled automatically or manually, U/R (Red/Green) and V/B (Green/Blue) alter the degree to which Red and Blue CCD component pixels are weighed to form composite pixels. In manual mode you can adjust the white balance by altering the Blue and Red Value. One push white balance option can be used for a non-interactive calibration in addition. Currently automatic white balance features are not supported.

#### Inquiry Register

Address	Name	Field	Bit	Description
50Ch	WHITE_BAL _INQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2]	Reserved
		One_Push_Inq	[3]	One push auto mode(Controlled automatically by camera only once)
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/Off_Inq	[5]	Capability of switching this feature On and OFF
		Auto_Inq	[6]	Auto mode(Controlled automatically by camera)
		Manual_Inq	[7]	Manual mode(Controlled by user)
		Min_Value	[8..19]	Minimum value for this feature control
		Max_Value	[20..31]	Maximum value for this feature control

**Status Control Register**

Address	Name	Field	Bit	Description
80Ch	WHITE_BALANCE	Presence_Inq	[0]	Presence of this feature. 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in the Value field 1: Control with value in the Absolute value CSR If this bit = 1, value in the Value field is ignored.
		-	[2..4]	Reserved
		One_Push	[5]	Write '1':begin to work(Self cleared after operation) Read: Value='1' in operation Value='0' not in operation If A_M_Mode =1, this bit is ignored
		ON_OFF	[6]	Write: ON or OFF this feature, Read: read a status 0:OFF, 1:ON If this bit=0, other fields will be read only.
		A_M_Mode	[7]	Write: set the mode, Read: read a current mode 0: Manual, 1:Auto
		-	[8..19]	U Value / B_Value. Write the value in AUTO mode, this field is ignored. If "ReadOut" capability is not available,, read value has no mean
		Value	[20..31]	V Value / R_Value Write the value in AUTO mode, this field is ignored. If"ReadOut" capability is not available, read value has no meaning

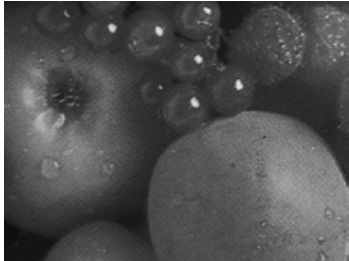
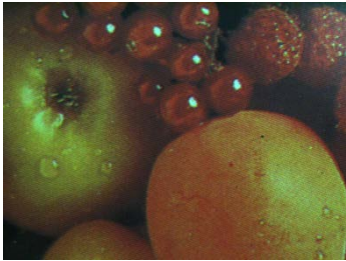
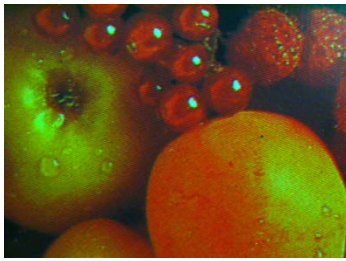
### 3.5. Hue

Color models support Hue control which changes the color phase of the picture by adjusting the Green gain. You may use this feature when white balance correction adjusting Red and Blue value does not give satisfying result.

### 3.7. Saturation

The saturation register at offset 814h allows the intensity of the colors to be changed in the range of 0 ~ 255.

For Saturation control inquiry and status register, follow the same definition as "BRIGHTNESS"

Value 0	Value 128	Value 255
		

- **Operation**

$$U' = U * \text{saturation}/128$$

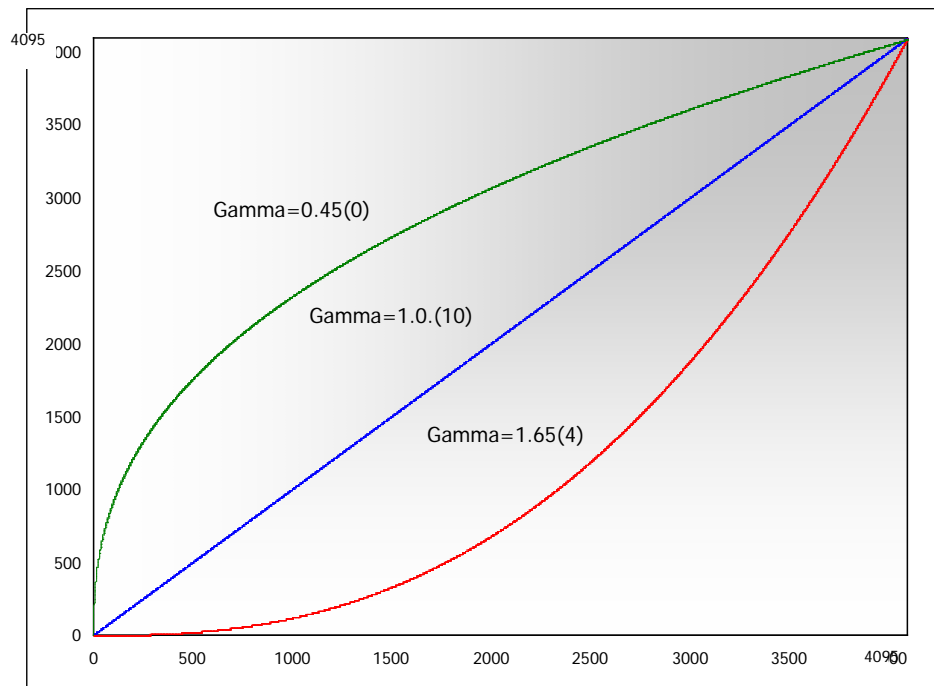
$$V' = V * \text{saturation}/128$$

(U', V' = After applying the Saturation on the original image - U, V = Original color U and V)

- **Absolute values (%)** = saturation\* 100/128(%)

### 3.9. Gamma

Gamma control defines the function between incoming light level and output picture level. Factory default setting for Gamma is set to 1.0. Gamma value is adjustable in the range of 0.45 ~ 1.65 as per the table below. For Gamma control inquiry and status register, follow the same definition as "BRIGHTNESS"



Gamma Range Table

Gamma Value	0	1	2	3	4
Gamma	0.45	0.65	1.0	1.45	1.65



### 3.10. Shutter

Shutter is defined as the integration time of the incoming light where both the Manual and Auto Shutter are supported. The shutter range varies from 1us ~ 3600sec. For Shutter control inquiry and status register, follow the same definition as "BRIGHTNESS"

#### Shutter Speed Value & Range

1394 Shutter Value (Y)	Increment Step	Shutter Speed Time : T	
		Exposure Time	Range
1~500	1us	$T = Y \text{ us}$	1us ~ 500us
501~1000	10us	$T = (Y-500)*10+500 \text{ us}$	510us ~ 5500us
1001~1705	100us	$T = (Y-1000)*100+5500 \text{ us}$	5.6ms ~ 76ms
1706 ~ 2399	1ms	$T = (Y-1705)+76 \text{ ms}$	77ms ~ 770ms
2400~2902	10ms	$T = (Y-2399)*10+770 \text{ ms}$	780ms ~ 5800ms
2903~3304	100ms	$T = (Y-2902)*100+5800 \text{ ms}$	5.9s ~ 46s
3305~3508	1s	$T = (Y-3304)*1000+46000 \text{ ms}$	47s ~ 250s
3509~3843	10s	$T = (Y-3508)*10 + 250 \text{ s}$	260s ~ 3600s

#### Shutter Speed Example

Example Shutter Speed Table					
1394 Shutter	Exposure Time	1394 Shutter	Exposure Time	1394 Shutter	Exposure Time
1	1us	1729	100ms	3378	2 min
10	10us	1829	200ms	3438	3 min
100	100us	2129	500ms	3513	5 min
500	500us	2422	1s	3525	7min
550	1ms	2522	2s	3543	10 min
650	2ms	2822	5s	3603	20 min
950	5ms	2944	10s	3663	30 min
1045	10ms	3044	20s	3723	40 min
1145	20ms	3318	60s	3783	50 min
1445	50ms	3323	65s	3843	60 min

### 3.11. Gain

Gain refers to the amount of the CCD output signal amplification where gain and shutter have similar effect on the image. Manual and Automatic gain mode are supported and manual adjustment is possible for the following range. For Gain control inquiry and status register, follow the same definition as "BRIGHTNESS"

Camera Type	Step Range	Range in dB	Increment Length
Monochrome Camera	0 ~ 511	0 ~ 18	approx. 0.0358 dB/step
Color Camera	0 ~ 511	0 ~ 18	approx. 0.0358 dB/step

### 3.12. Trigger & Strobe

The cameras support external trigger by receiving input through the external trigger port. The falling edge and rising edge can be detected as trigger according to the modes it supports as per the following table. A software trigger can also be used that issues a trigger signal via a software command. Software trigger is supported in modes 0 and 15.

Trigger	Edge	Rising Edge or Falling Edge
	Mode	Fire-i 580/785/780
		0, 1, 2, 3, 4, 5, 15
	Method	Optocoupler (Photo-coupler)
	Source	External or Software Trigger

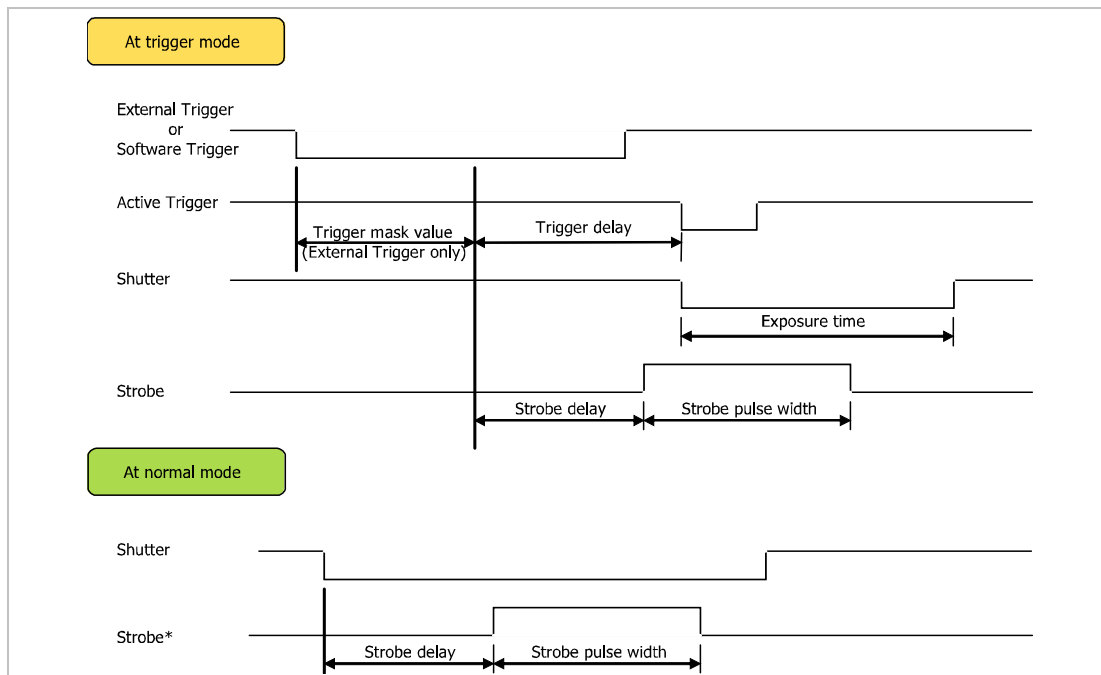
#### Inquiry Register

Address	Name	Field	Bit	Description
530h	TRIGGER_INQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2..3]	Reserved
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/Off_Inq	[5]	Capability of switching this feature On and OFF
		Polarity_Inq	[6]	Capability of changing polarity of trigger input
			[7..15]	Reserved
		Trigger_Mode0_Inq	[16]	Presence of Trigger Mode0
		Trigger_Mode1_Inq	[17]	Presence of Trigger Mode1
		Trigger_Mode2_Inq	[18]	Presence of Trigger Mode2
		Trigger_Mode3_Inq	[19]	Presence of Trigger Mode3
			[20..31]	Reserved

**Control Register**

Address	Name	Field	Bit	Description
830h	TRIGGER_MODE	Presence_Inq	0	Presence of this feature 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in the Value field 1: Control with value in the Absolute value CSR If this bit = 1, value in the Value field is ignored.
		-	[2..5]	Reserved
		ON_OFF	[6]	Write: ON or OFF this feature Read: read a status 0: OFF, 1: ON If this bit=0, other fields will be read only.
		Trigger_Polarity	[7]	If Polarity_Inq is "1", Write to change polarity of the trigger input Read to get polarity of trigger input If Polarity_Inq is "0", Read only. (0: Low active input, 1: High active input)
			[8..11]	Reserved
		Trigger_Mode	[12..15]	Trigger mode.(Trigger_Mode_0-15)
			[16..19]	Reserved
		Parameter	[20..31]	Parameter for trigger function, if required.

### 3.12.1. Trigger and Strobe Signal Relation



**Trigger overlapping function : max trigger frame rate speed up to normal mode frame rate.**

#### Previous version

$$\text{Trigger max frame rate} = \frac{1}{1/\text{fps} + \text{shutter\_time}(0x0f0081c) + \text{trigger\_delay}(0x0f00834) + \text{trigger\_noise\_filter}(0xf2f10110)}$$

#### Version 3.10

**At trigger mode 0 :**

$$\text{Trigger max frame rate} = \frac{1}{1/\text{fps} + \text{trigger\_delay}(0x0f00834) + \text{trigger\_noise\_filter}(0xf2f10110) + 200 \text{ usec}}$$

**If trigger delay = 0 and trigger noise filter is disabled, trigger max frame rate speeds up to frame rate at normal mode**

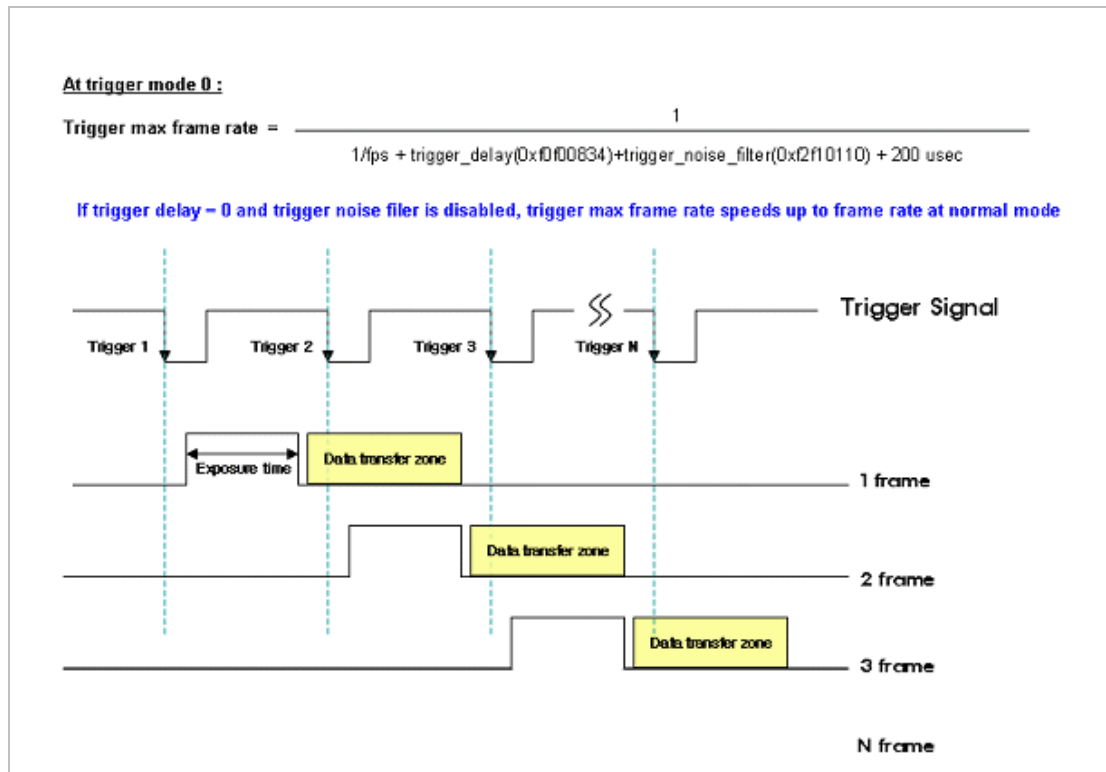
#### Caution:

If the next trigger pulse interval is less than  $(1/\text{fps} + \text{trigger\_delay}(0x0f00834) + \text{trigger\_noise\_filter}(0xf2f10110) + 200 \text{ usec})$ , this trigger pulse may be lost.

**At other trigger mode :** equal to the previous frame rate.

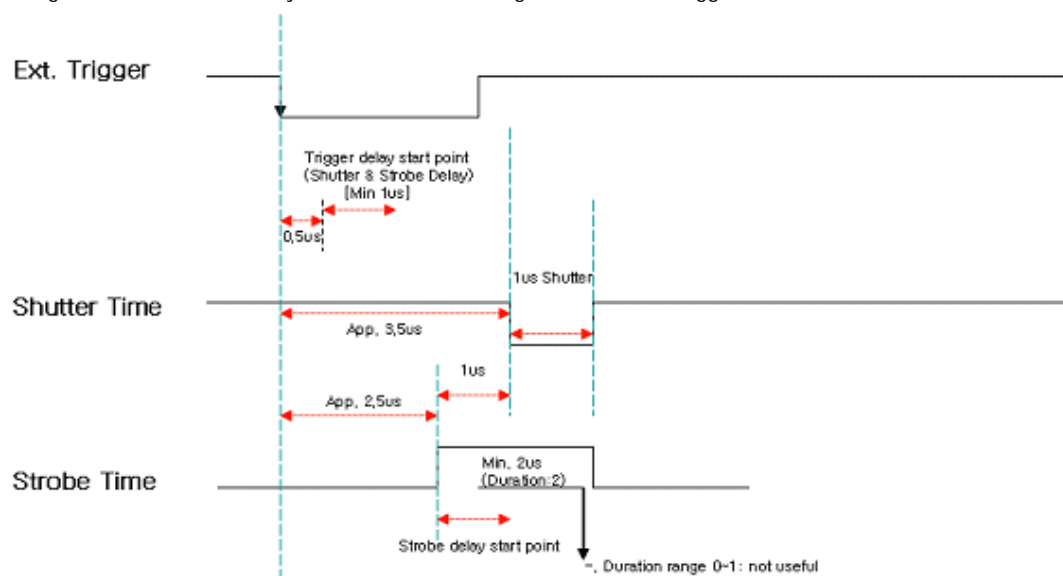
$$\text{Trigger max frame rate} = \frac{1}{1/\text{fps} + \text{shutter\_time}(0x0f0081c) + \text{trigger\_delay}(0x0f00834) + \text{trigger\_noise\_filter}(0xf2f10110)}$$

**If trigger interval is less than  $(1/\text{fps} + \text{shutter\_time})$ , bar noise may be detected.**



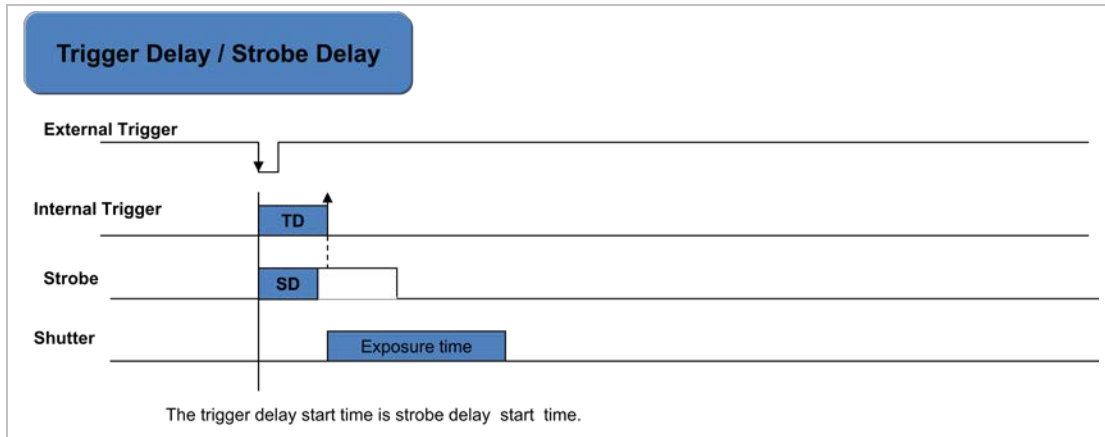
### 3.12.2. Timing Diagram for External Trigger and Shutter and Strobe

This diagram shows the necessary time related to each signal for External trigger and Shutter and Strobe.



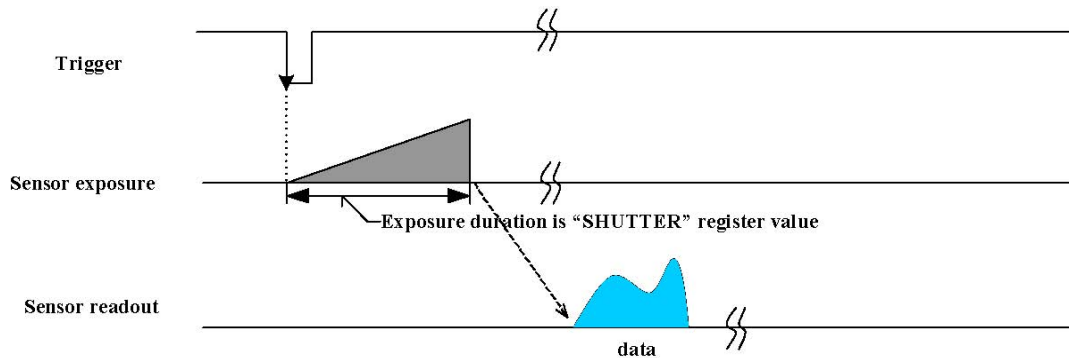
### 3.12.3. Trigger & Strobe delay

For Fire-i 580/785/780/980, the strobe signal starting point is almost the same as the exposure starting point.



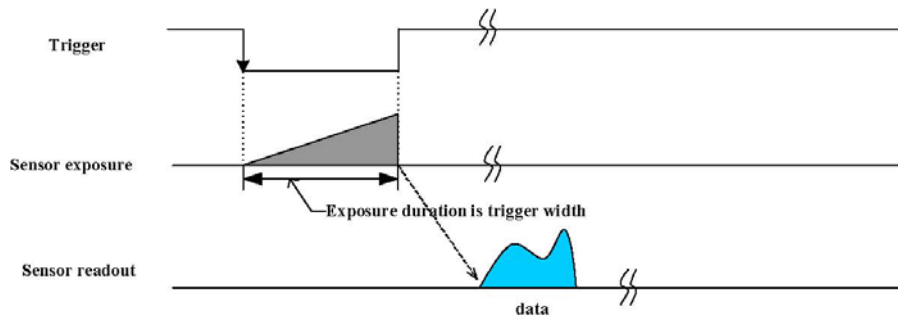
### 3.12.4. Trigger Mode 0

Camera starts integration of the incoming light from external trigger input falling edge. Integration time is described in the "Shutter" register. No parameter is needed. A Trigger delay is applied to mode 0 for H/W trigger. The Trigger in mode 0 is supported by both H/W trigger and S/W trigger.



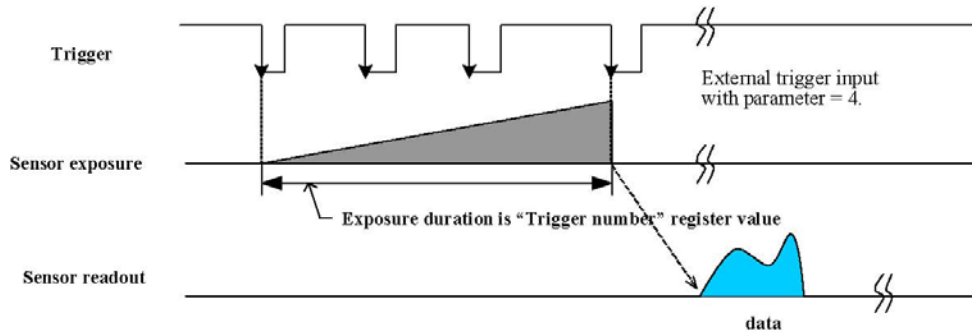
### 3.12.5. Trigger Mode 1

Camera starts integration of the incoming light from external trigger input falling edge. Integration time is equal to the low state time of the external trigger input. No parameter is needed.



### 3.12.6. Trigger Mode 2

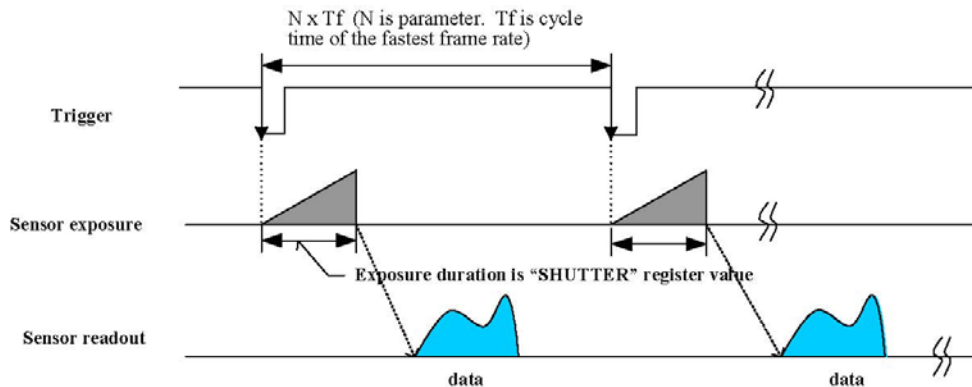
Camera starts integration of incoming light from first external trigger input falling edge. At the N-th (parameter) external trigger input falling edge, integration will be stopped. A Parameter is required and shall be two or more. ( $N \geq 2$ )



### 3.12.7. Trigger Mode 3

#### Not supported in Format 7

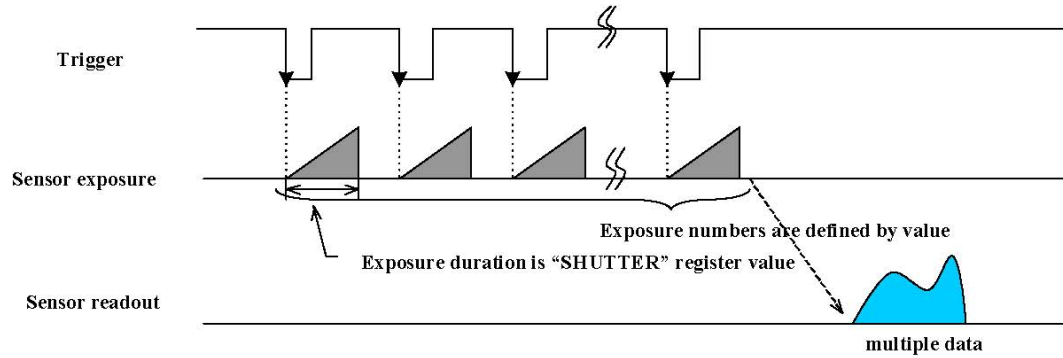
This is an internal trigger mode. Camera will issue a trigger internally and cycle time is N times (parameter) of the cycle time of the fastest frame rate. The Integration time of incoming light is described in the "Shutter" register. A Parameter is required and shall be one or more ( $N \geq 1$ )



### 3.12.8. Trigger Mode 4

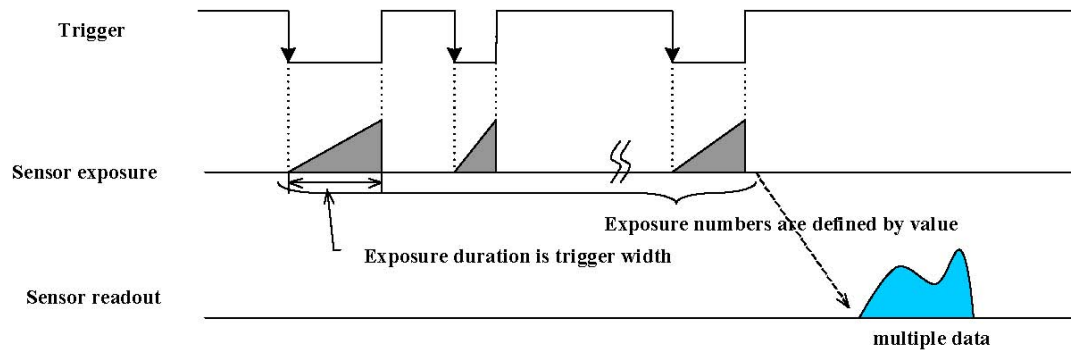
This mode is "multiple shutter preset mode". The Camera starts integration of incoming light from the first external trigger input falling edge and exposes incoming light at shutter time. It repeats this sequence the N-th (parameter) external trigger input falling edge and then finishes integration.

A Parameter is required and shall be one or more. ( $N \geq 1$ )



### 3.12.9. Trigger Mode 5

This mode is "multiple shutter pulse width mode". The Camera starts integration of the incoming light from the first external trigger input falling edge and exposes incoming light until the trigger is inactive. It repeats this sequence for the N-th (parameter) external trigger input falling edge and then finish integration. A Parameter is required and shall be one or more. ( $N \geq 1$ )



### 3.12.10. Trigger Mode 15

Users can capture as many images as they want with one external trigger signal. This mode is called 'One-trigger Multi-frames'. For this mode 15, the value of the shutter time should be fixed. The mode 15 is supported by both H/W trigger and S/W trigger.



N : 1 ~ 255

Control Address : 0xF0F00830

Number of frame : N

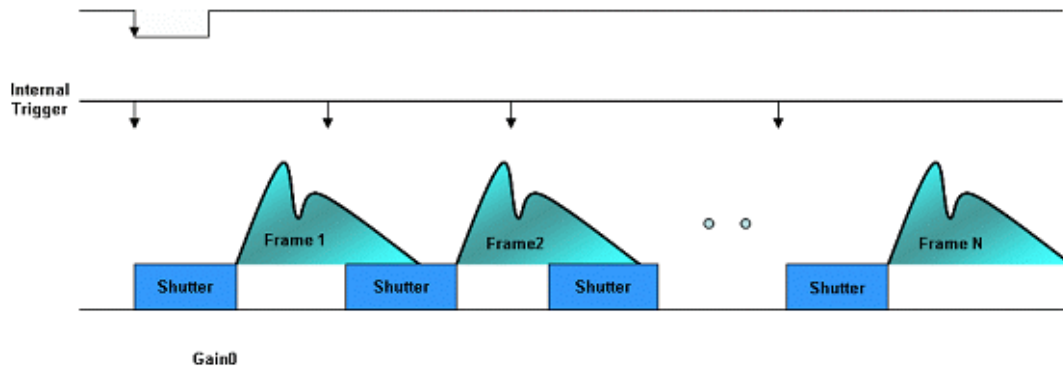
830h	TRIGGER_MODE	Presence_Inq	[0]	Presence of this feature. 0: N/A, 1: Available
		Abs_Control	[1]	Absolute value control 0: Control with value in the Value field 1: Control with value in the Absolute value CNR If this bit = 1, value in the Value field is ignored
		-	[2..5]	Reserved
		ON_OFF	[6]	Write: ON or OFF this feature. Read: read a status 0: OFF, 1: ON If this bit = 0, other fields will be read only.
		Trigger_Polarity	[7]	Select trigger polarity (except for software trigger) If Polarity_Inq is "1", Write to change polarity of the trigger input Read to get polarity of the trigger input. If Polarity_Inq is "0", Read only 0: Low active input, 1: High active input
		Trigger_Source	[8..10]	Select trigger source Get trigger source ID from trigger source ID_Inq
		Trigger_Value	[11]	Trigger input raw signal value Read only 0: Low, 1: High
		Trigger_Mode	[12..15]	Trigger mode (Trigger_Mode: 0..15)
		-	[16..19]	Reserved
		Parameter	[20..31]	Parameter for trigger function, if required. (Optional)

**Caution:**

At trigger mode 15, Shutter value must be not changed. This operation may loss the frames and the next trigger. Therefore, the shutter value must be changed before trigger generation or trigger enable command.

**Trigger mode 15**

No Trigger Delay  
N : 1 ~ 255  
Same Shutter Value and Same Trigger Frame Interval



### 3.13. Strobe Control Register

Base Address: 0xF2F23000h

Address	Name	Field	Bit	Description
000h	Strobe_CTRL_Inq	Strobe_0_Inq	[0]	Presence of strobe 0 signal
		Strobe_1_Inq	[1]	Presence of strobe 1 signal
		Strobe_2_Inq	[2]	Presence of strobe 2 signal
		Strobe_3_Inq	[3]	Presence of strobe 3 signal
		-	[4..31]	Reserved
004h . 0FCh	Reserved			
100h	Strobe_0_Inq	Presence_Inq	[0]	Presence of this function
		-	[1..3]	Reserved
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/Off_Inq	[5]	Capability of switching this function ON and OFF
		Polarity_Inq	[6]	Capability of changing polarity of the signal
		-	[7]	Reserved
		Min_Value	[8..19]	Minimum value of this function control
		Max_Value	[20..31]	Maximum value of this function control
104h	Strobe_1_Inq	Same definition to Strobe_0_Inq		
	Strobe_2_Inq	Same definition to Strobe_1_Inq		
	Strobe_3_Inq	Same definition to Strobe_2_Inq		
110h . 1FCh	Reserved			
200h	Strobe_0_Cnt	Presence_Inq	[0]	Presence of this function 0:N/A 1: Available
		-	[1..5]	Reserved
		ON_OFF	[6]	Write : ON or OFF this function Read: read a status 0: OFF, 1: ON if this bit=0, other fields will be read only
		Signal Polarity	[7]	Select signal polarity If Polarity_Inq is “1” Write to change polarity of the strobe output Read to get polarity of the strobe output If Polarity_Inq is “0” Read only ( 0: low active output, 1: High active output)
		Delay_Value	[8..19]	Delay after start of exposure until the strobe signal asserts
		Duration_Value	[20..31]	Duration of the strobe signal A value 0 means dessert at the end of exposure function if required.
204h	Strobe_1_Cnt	Same definition to Strobe_0_Inq		
208h	Strobe_2_Cnt	Same definition to Strobe_1_Inq		
20Ch	Strobe_3_Cnt	Same definition to Strobe_2_Inq		
210h . 2FFh	Reserved			

### 3.14. Trigger Delay Control

Based on external triggers users can delay image acquisition by the trigger delay control feature. Fire-i camera series support the IIDC V1.32 specification for trigger delay control as per the following tables.

**Trigger Delay Table**

Mode	Value range	Trigger delay Time : T	
		DelayTime	Range
All Cameras	0 ~ 4000	T = Yus	0 usec ~ 4000 usec

**Inquiry Register**

Address	Name	Field	Bit	Description
534h	TRIGGER_DLY_INQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2]	Reserved
		One_Push_Inq	[3]	One push auto mode (Controlled automatically by camera only once)
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/OFF_Inq	[5]	Capability of switching this feature ON and OFF
		Auto_Inq	[6]	Auto Mode (Controlled automatically by camera)
		Manual_Inq	[7]	Manual Mode (Controlled by user)
		Min_Value	[8..19]	Minimum value for this feature control
		Max_Value	[20..31]	Maximum value for this feature control

**Status Control Register**

Address	Name	Field	Bit	Description
834h	TRIGGER_DELAY	Presence_Inq	[0]	Presence of this feature 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in Value field 1: Control with value in Absolute value CSR if this bit =1, value in Value filed is ignored
		-	[2..5]	Reserved
		On/OFF	[6]	Write : ON or OFF this feature Read : read a status 0: OFF, 1:ON If this bit=0, other fields will be read only.
		-	[7..19]	Reserved
		Value	[20..31]	Minimum value for this feature control

### 3.14.1. Strobe Delay / Duration Table

The table shows the strobe index by increment step through the strobe delay time and the strobe duration time. The Increment Step is different according to strobe index.

Strobe Delay Table				
Strobe Index(Y)	Increment Step	Strobe Delay Time : T		
		Delay Time	Range	
0	1us	0us	0us	
1		1us	1us	
2		2us	2us	
3~250		T=Y us	3us~250us	
251~3900		T=Y us	251us~3900us	
Strobe Duration Table				
Strobe Index(Y)	Increment Step	Strobe Duration Time : T		
		Duration Time	Range	
0	N.A	N.A	N.A	
1	N.A	N.A	N.A	
2	1us	2us	2us	
3~250	1us	T=Y us	3us~250us	
251~489	250us	T = (Y-250)*250us+250us	500us~60ms	
Delay Index(Y)	Strobe Delay Time		Duration Index (Y)	Strobe Duration Time
0	0us		0	N.A
1	1us		1	N.A
2	2us		2	2us
10	10us		10	10us
100	100us		100	100us
200	200us		250	250us
300	300us		253	1ms
500	500us		257	2ms
800	800us		269	5ms
1000	1000us		289	10ms
2000	2000us		329	20ms
3000	3000us		449	50ms
3900	3900us		489	60ms

### 3.15. Optical Filter Control

Optical Filter control allow user to change the optical filter of the camera lens function. You can change the Bayer patterns by moving the starting position which to output pixel data by one position up, down, right or left. (Only for color models)

#### Inquiry Register

Address	Name	Field	Bit	Description
58Ch	OPTICAL_FILTER_I NQ	Presence_Inq	[0]	Presence of this feature
		Abs_Control_Inq	[1]	Capability of control with absolute value
		-	[2]	Reserved
		One_Push_Inq	[3]	One push auto mode (Controlled automatically by camera only once)
		ReadOut_Inq	[4]	Capability of reading the value of this feature
		On/OFF_Inq	[5]	Capability of switching this feature ON and OFF
		Auto_Inq	[6]	Auto Mode (Controlled automatically by camera)
		Manual_Inq	[7]	Manual Mode (Controlled by user)
		Min_Value	[8..19]	Minimum value for this feature control
		Max_Value	[20..31]	Maximum value for this feature control

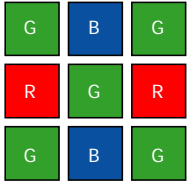
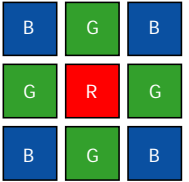
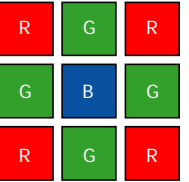
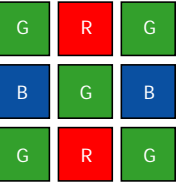
#### Status Control Register

Address	Name	Field	Bit	Description
88Ch	OPTICAL_FILTER	Presence_Inq	[0]	Presence of this feature 0:N/A 1:Available
		Abs_Control	[1]	Absolute value control 0: Control with value in Value field 1: Control with value in Absolute value CSR if this bit =1, value in Value field is ignored
		-	[2..5]	Reserved
		On/OFF	[6]	Write : ON or OFF this feature Read : read a status 0: OFF, 1:ON If this bit=0, other fields will be read only.
		-	[7..19]	Reserved
		Value	[20..31]	Minimum value for this feature control

### 3.16. Color (Bayer) Patterns Conversion

Color sensors capture images through an optical low pass filter which is coated over the individual pixels in Bayer mosaic layout. Imaged data are transferred by passing color processing which can save bandwidth gaining higher frame rate and flexibility of applying different Bayer Pattern on the PC side.

Obtained Images can be processed in either of the following 4 different conversion algorithm can on the PC side.1

Modes	Mode 0 GB/RG	Mode 1 BG/GR	Mode 2 RG/GB	Mode 3 GR/BG
Color(Bayer) Pattern				

## 4. Advanced Features

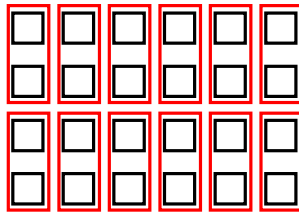
### 4.1. Binning Mode

Binning is defined as reading neighboring pixel from the CCD and combining them to create one pixel value. Binning has an advantage in the following situations as well as in various applications. Relative binning mode per camera model is described in each camera specification.

- Low Light Operation: Combining neighboring pixels increases the area of the unit pixel receiving light and may obtain a brighter picture in low light conditions with a possible noise reduction.
- High Frame Rate Operation: Vertical Binning accelerates the speed of the CCD data transfer rate by combining multiple vertical line per single horizontal line of the CCD; resulting in a significant gain in frame rate

#### 4.1.1. Vertical Binning

Vertical binning combines neighboring CCD pixels vertically into a single pixel; increasing the light sensitivity of the camera. Since a CCD acquires data horizontally, multiple lines are acquired in the case of vertical binning which results in a significant speed gain. Thus the vertical resolution is reduced. Due to the increased CCD area per pixel, over exposure may occur which may require adjustment.

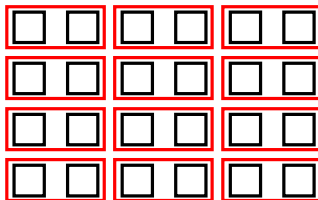


1x2 Vertical Binning

Example

#### 4.1.2. Horizontal Binning

Horizontal binning combines neighboring CCD pixel horizontally into a single pixel; increasing the light sensitivity of the camera. However due to the nature of CCD transferring each horizontal line at a time, there is no speed gain in horizontal binning. Light sensitivity increase may occur, due to the increased CCD area per pixel, similar to vertical binning. The horizontal resolution is reduced.

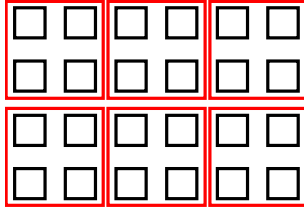


2x1 Horizontal Binning

Example

### 4.1.3. Full Binning

Full binning mode can be obtained by combining both vertical and horizontal binning. First horizontal pixels are combined; followed by a vertical conjunction of these pixels. This would increase light sensitivity by a factor of 4 in case of 2 x 2 ( Horizontal x Vertical ) binning. However as described above, only vertical binning would result in a speed gain while horizontal binning gives no speed gain. Thus the speed gain result is similar to vertical binning. Resolution in this mode would be reduced both horizontally and vertically..



2x2 Full Binning

Example



## 4.2. Partial Scan

Cameras provide a certain resolution which is dictated by the image sensor. Often, a certain region may be of interest to the user. Partial scan mode provides the function to capture a certain region of interest (ROI) which can provide an advantage in data transfer speed, resulting in a faster operation. As described in binning mode, the speed gain would occur only if vertical resolution decreases. Partial Scan is only supported in Format 7 by setting the following registers described in the IIDC1.32 specification. Unit size of the partial scan is described in the camera specification, which the user must consider in setting the increment configuration.

IMAGE\_POSITION & IMAGE\_SIZE register

Left = Hposunit \* n1

Top = Vposunit \* m1

Width = Hunit \* n2

Height = Vunit \* m2

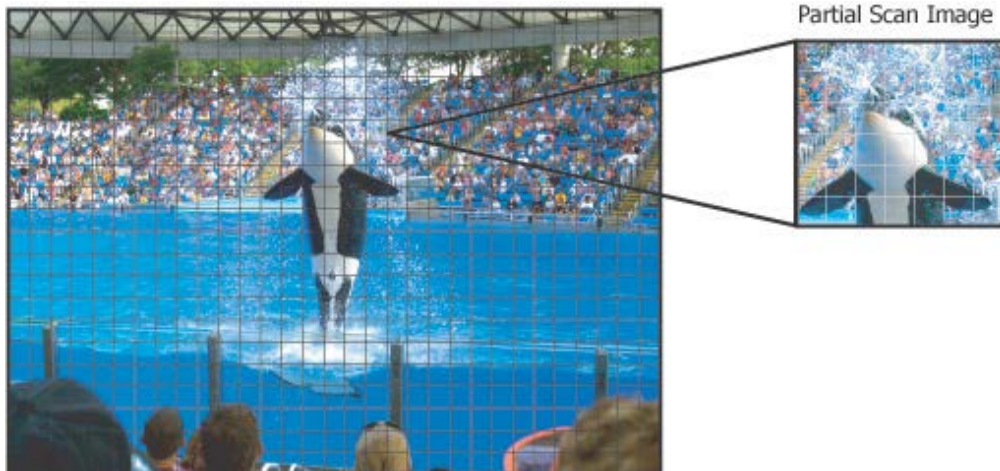
Left + Width <= Hmax

Top + Height <= Vmax

(n1, n2, m1, m2 are integer)

0 - 7	8 - 15	16 - 23	24 - 31
Left		Top	
0 - 7	8 - 15	16 - 23	24 - 31
Width		Height	

Initial Values	System Dependant
Read Values	Last Update Value
Write Effect	Stored



### 4.3. Pan/Tilt

Pan/Tilt is a function used to move a camera up and down or left and right. However unlike the mechanical Pan /Tilt which is carried out by physically moving the camera up and down, this functions by using a smaller video mode than the CCD's effective pixels and moving the image up and down. This results in a reduced resolution, which the user can specify by the Pan/Tilt command. Pan/Tilt range and values depend on the characteristic of each CCD used in the camera respectively as per the following tables. Note that at Format 7 mode, the pan/tilt value must be set at non-format 7 mode before operation.

### 4.4. One-Shot and Multi-Shot

This camera supports One-Shot and Multi-Shot features. The camera should be in ISO disabled mode before the execution of these commands, and if the camera is in ISO enabled mode, these commands are ignored.

One-Shot is used to grab only one frame. Multi-Shot is used to grab 1~65,535 frames.

Caution : One-Shot and Multi-Shots are not supported in trigger mode

One-Shot		Multi-Shot	
Address	F0F0061CH	Address	F0F0061CH
Data	80000000h	Data	400nnnnh

nnnn is the number of output frames which can be any number between 0001h ~ FFFFh.(1~ 65,535)

Priority of the command execution is as follows. Continuous > One-Shot > Multi-Shot

When a command with higher priority is being executed; the command with lower priority will be ignored

### 4.5. Multi-Camera Auto-sync

#### Not supported in 3.75 fps

In applications incorporating multi camera, there is often a need to synchronize the cameras. Multi-Camera Auto Synchronization is supported utilizing the FireWire bus time cycle register which is connected on the same FireWire bus. A maximum of 3 cameras can be auto synchronized.

The video mode of the camera must be set within the limit of a single FireWire bus bandwidth of 400Mbps. Also the maximum shutter value must be set as per the table below not exceeding the FireWire bus cycle time. Jitter may occur due to CPU operation timing. In the auto-sync mode, the shutter time and the fps should be set as follows

FPS	Fire-i 580		Fire-i 785/780		Fire-i 980	
	Max Shutter		Max Shutter		Max Shutter	
	Value	Time	Value	Time	Value	Time
60	1110	16.5ms	-	-		
30	1270	32.5ms	-	-		
15	1605	66 ms	1605	66ms	1605	66ms
7.5	1760	131ms	1761	132ms		
3.75	1893	264ms	1895	266ms		

To utilize Auto-sync, please set Bit 31 to Auto-sync Enable, and then check the Bit 27 to verify whether it is ready. Please refer to the details in the following table.

0xF2F10018	<b>Auto-Sync Mode control register</b> Bit 31 : <b>auto sync enable</b> Bit 30 : SIO enable mode ( <b>0 : custom mode</b> , 1 : IIDC v1.32) Bit 27 : auto sync complete (read only. 1: ready, 0: not yet auto-sync)	Read/Write
------------	--	------------

## 4.6. Memory Channel Save / Load

The settings of the camera features (Shutter, gain, etc.) and video modes can be stored in a non-volatile memory. The camera supports 16 memory channels as per the table below to conveniently save and load different features as well as video modes. Channel 0 is the factory default (preset) and Channels 1 ~ 4 can be used for saving camera configuration. Channels 5 ~ 15 are used for resolution, mode and frame rate plus saving other features.

Address	Name	Bit	Description
618h	Memory_Save	[0]	Saves the current setting
		[1..31]	Reserved
Address	Name	Bit	Description
620h	Mem_Save_Ch	[0]	Factory Default Setting Cannot overwrite
		[1..4]	Write Channel for Memory Save for Channel 1 ~ 4 ( Only for Features )
		[5..15]	Write Channel for Memory Save for Channel 5 ~ 15 (For Features, Format and Mode Save)
Address	Name	Bit	Description
624h	Cur_Save_Ch	[0]	Read and Load Factory Default Setting
		[1..4]	Read and Load Memory Channel 1 ~ 4
		[5..15]	Read and Load Load Memory Channel 5 ~ 15

### User Defined FireWire Register Control

The values saved in the channel are users define; and can be made the default values at power-on. The channels from 1 to 15 are to be set in the power-on default mode.

Address	Description( bit : msb*)	Read/Write
0xF2F1011C	<b>Power on default memory channel</b> Bit 0 ~ Bit 3 : power on initial memory channel	Read/Write
	Example: Channel 5 is to be set the default mode at power-on. →add F2F1011C read -> 50000000 write	

## 4.7. Time Stamp Register

The Time stamp register may be inquired from the fireWire bus. CYCLE\_TIME register can be configured as shown in the table below. You may also get the same value from the user defined, but we recommend using this.

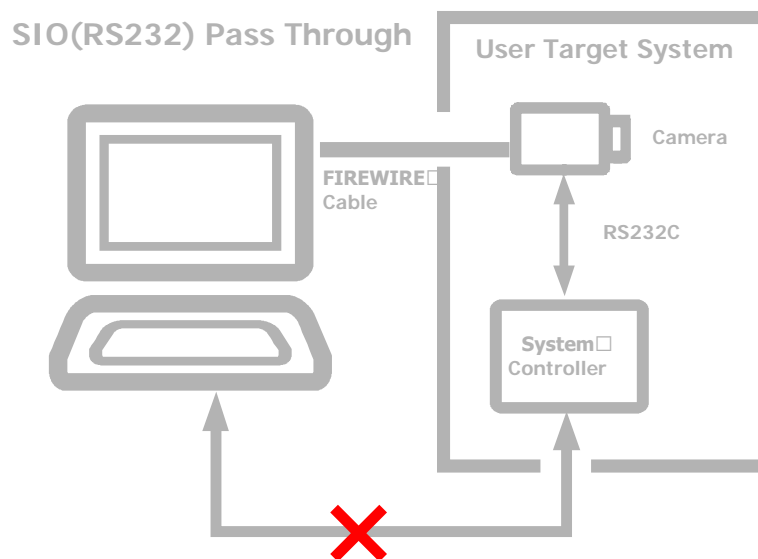
Address	Description( bit : msb*)	Read/Write																																																															
0xF0000200	CYCLE_TIME	Read																																																															
	<table><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr><tr><td colspan="7">SECONDS COUNT</td><td colspan="11">CYCLE COUNT</td><td colspan="13">CYCLE OFFSET</td></tr></table>		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SECONDS COUNT							CYCLE COUNT											CYCLE OFFSET												
	0		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																																
	SECONDS COUNT							CYCLE COUNT											CYCLE OFFSET																																														
	<table><tr><td>Bit Number r</td><td>Bit Name</td><td>Function</td><td>DIR</td><td>Description</td></tr><tr><td>0 - 6</td><td>SECONDS COUNT</td><td>Seconds Coun t</td><td>R/W</td><td>1 Hz c ycle timer counte r</td></tr><tr><td>7 - 19</td><td>CYCLE COUNT</td><td>Cycle Coun t</td><td>R/W</td><td>8,000 Hz c ycle timer counte r</td></tr><tr><td>20 - 31</td><td>CYCLE OFFSET</td><td>Cycle Offset</td><td>R/W</td><td>24.576 MHz c ycle timer counte r</td></tr></table>		Bit Number r	Bit Name	Function	DIR	Description	0 - 6	SECONDS COUNT	Seconds Coun t	R/W	1 Hz c ycle timer counte r	7 - 19	CYCLE COUNT	Cycle Coun t	R/W	8,000 Hz c ycle timer counte r	20 - 31	CYCLE OFFSET	Cycle Offset	R/W	24.576 MHz c ycle timer counte r																																											
Bit Number r	Bit Name	Function	DIR	Description																																																													
0 - 6	SECONDS COUNT	Seconds Coun t	R/W	1 Hz c ycle timer counte r																																																													
7 - 19	CYCLE COUNT	Cycle Coun t	R/W	8,000 Hz c ycle timer counte r																																																													
20 - 31	CYCLE OFFSET	Cycle Offset	R/W	24.576 MHz c ycle timer counte r																																																													

## 4.8. Serial Interface

Fire-i industrial cameras are equipped with SIO (Serial input/output) feature described in the IIDC 1.32 specification.

By using the serial interface, users can execute commands by writing data in a specific address in the FireWire address range. SIO can be further used as a RS232 interface which supports pass through and custom commands.

### 4.8.1. SIO Pass Through Scheme



## 4.8.2. SIO Registers

Base address: F2F22000h, default baud rate is 57600

Address	Name	Field	Bit	Description
000h	Serial_Mode_Reg	Baud Rate	[0..7]	Baud Rate Setting Write : Set baud rate Read : Get current baud rate 0: 300 bps    1: 600 bps 2: 1200 bps   3: 2400 bps 4: 4800 bps   5: 9600 bps 6: 19200 bps   7: 38400 bps 8: 57600 bps   9: 115200bps 10: 230400bps   Other value reserved.
		Char_Length	[8..15]	Character length setting Write: Set data length(must not be 0) Read : Get data length 7: 7 bits 8: 8 bits Other values reserved.
		Parity-	[16..17]	Parity setting Write : Set Parity Read : Get current parity 0: None   1 : Odd   2 : Even
		Stop_bit	[18..19]	Stop bits Write : Set stop bit Read : Get current stop bit 0: 1    1: 1.5   2: 2.
		-	[20..23]	Reserved
		Buffer_Size_Inq	[24..31]	Buffer Size (Read Only) This field indicates the maximum size of receive/transmit data buffer. If this value=1, Buffer_Status_Control, SIO_Data_Register Char1-3 should be ignored
004h	Serial_Control_Reg	RE	[0]	Receive enable Read : Current status Write : 0 : Disable   1: Enable
		TE	[1]	Transmit enable Read : Current status Write : 0 : Disable   1: Enable
		-	[2..7]	Reserved
	Serial_Status_Reg	TDRD	[8]	Transmit data buffer ready Read only 0 : Not ready   1: Ready
		-	[9]	Reserved
		RDRD	[10]	Receive data buffer ready Read only 0 : Not ready   1: Ready
		-	[11]	Reserved
		ORER	[12]	Receive buffer over run error Read : Current status Write : 0: Clear flag   1: Ignored
		FER	[13]	Receive data framing error

				Read : Current status Write : 0: Clear flag 1: Ignored
		PER	[14]	Receive data parity error Read : Current status Write : 0: Clear flag 1: Ignored
		-	[15]	Reserved
008h	Receive_Buffer_Status_Control	RBUF_ST	[0..8]	SIO receive buffer status Read : Valid data size of current receive buffer Write : Ignored
		RBUF_CNT	[8..15]	SIO receive buffer control Read : Remain data size for read Write : Set input data size
		-	[16..31]	Reserved
00Ch	Transmit_Buffer_Status_Control	TBUF_ST	[0..7]	SIO output buffer status Read : Available data space of transmit buffer Write : Ignored
		TBUF_CNT	[8..15]	SIO output buffer control Read : Written data size to buffer Write : Set output data size for transmit
		-	[16..31]	Reserved
010h .. 0FFh				Reserved
100h	SIO_Data_Register	Char_0	[0..7]	Character_0 Read : Read character from receive buffer Padding data, if data is not available Write : Character to transmit buffer padding data if data is invalid
		Char_1	[8..15]	Character_1 Read : Read character from receive buffer +1 Padding data, if data is not available Write : Character to transmit buffer +1 padding data if data is invalid
		Char_2	[8..15]	Character_2 Read : Read character from receive buffer +2 Padding data, if data is not available Write : Character to transmit buffer +2 padding data if data is invalid
		Char_3	[16..31]	Character_3 Read : Read character from receive buffer +3 Padding data, if data is not available Write : Character to transmit buffer +3 padding data if data is invalid
104h .. 1FFh	SIO_Data_Register_Alias		[0..31]	Alias SIO_Data_Register area for block transfer

### 4.8.3. SIO (RS232) special Commands

SIO (RS232) special commands are non IIDC compliant and are specific mode for the Fire- cameras.

0xF2F10018	<b>Auto-Sync Mode control register</b> Bit 31 : auto sync enable Bit 30 : SIO enable mode ( <b>0 : custom mode</b> , 1 : IIDC v1.32) Bit 27 : auto sync complete (read only. 1: ready, 0: not yet auto-sync)	Read/Write
------------	---	------------

Before using these commands serial communication parameters must be set at **Serial\_Mode\_Reg (F2F22000h)**

Baud Rate	Stop Bit	Parity	Flow Control
57600 bps(default)	1 bit	None	Non

- **Command format : [STX] [Command] [Data] [ETX]**

[STX] : Command start character : 'S'

[Command] : Command length is 2byte. See next page command table.

[Data] : Data length is varied with each command. Data format is hexadecimal: '0'~'9', 'A'~'F'.

[ETX] : Command end character : 'Z'

- **Return value**

'G' : Command complete acknowledge.

"Gdd..d" : "dd..d" is return data and hexadecimal character.

'U' : Undefined command.

- Valid Character : '0'~'9', 'A'~'F', 'S', 'Z' Invalid character is received is discarded.

- **example) Gain setting command with 0x200 value.**

All of "SA0200Z" , "S A0 200 Z" , "SA0 200Z" , "S A0200 Z" , and "SKA0V200Z" are parsed to "SA0200Z" .

● **SIO(RS232) Commands**

STX	Command	Data Length	ETX	Return Value	Function
S	A0	3Bytes	Z	G	<b>Gain control</b> (0x000 ~ 0x30F(BW Model) or 2D3(Color Model)) (see gain mapping graph) Ex) SA0200Z : Gain index value 512 (18dB)
S	A1	3Bytes	Z	G	<b>Shutter speed control</b> (0x001 ~ 0xCFB) (see shutter speed table)
S	A2	1Bytes	Z	G	<b>Set/Clear auto shutter speed and auto gain</b> Bit 0 : Auto gain      Bit 1 : Auto shutter speed Ex) SA21Z : set auto gain and clear auto shutter speed SA23Z : set auto gain and auto shutter speed SA20Z : clear auto gain and auto shutter speed
S	A3	2Bytes	Z	G	<b>Auto exposure control</b> (0x00~0x64)
S	A4	1Bytes	Z	G	<b>Gamma control</b> (0x0~0x19) (see gamma table)
S	A5	3Bytes	Z	G	<b>Brightness control</b> (0x000~0x800)
S	A6	3Bytes	Z	G	<b>Sharpness control</b> (0x000~0x3F8)
S	A7	1Bytes	Z	G	<b>ISO control</b> 1: ISO enable, 0 : disable
S	A8	1Bytes	Z	G	<b>Trigger control</b> 1: trigger enable, 0 : trigger disable
S	AF	0Bytes	Z	'G'+18 Byte	<b>Read feature control value</b> Return value order 'G'[Gain] [Shutter] [Set/Clear auto gain and shutter] [Auto Exposure] [Gamma] [Brightness] [Sharpness] [ISO] [Trigger]  Ex) At Command SAFZ, if return value is G001200132F20020101, Gain : 0x001 Shutter speed : 0x200 Set auto gain/Clear auto shutter speed : 0x1 Auto exposure : 0x32 Gamma : 0xF Brightness : 0x200 Sharpness : 0x201 ISO : 0x0 Trigger : 0x1
S	B0	16Bytes	Z	G	<b>RS232 synchronization</b> : RS232 buffer cleared in camera.
S	B1	8Bytes	Z	G	<b>Write access of 1394 address</b> Format : SB1 [address(8 byte)] [data(8byte)] Z Ex) SB1F2F1010012345678Z : write 0x12345678 data at 0xF2F10100 address
S	B2	0Bytes	Z	'G'+8 Byte	<b>Read access of 1394 address</b> Format : SB2 [address(8byte)] Z Ex) If command is SB2F2F10100Z and return value is G12345678, Read value of address 0xF2F10100 is 0x12345678.
S	B3	3Bytes	Z	G	<b>Return to default feature value</b> Return control feature : gain, shutter speed, auto exposure, brightness, sharpness, gamma, auto shutter speed, auto gain
S	Undefined Command	Any Byte	Z	U	<b>Undefined command</b> Return Value is 'U' character.



## 4.9. Frame Save Function

The Fire-i camera series cameras can save frames in the memory. The user can instruct the camera to stop integrating when the maximum number of frames, that can be stored in the memory, has been reached.

The number of frames that can be saved in memory depends on resolution, mode and it is different for each model.

See the table below for more details.

### Fire-i 580/785/780/980

of maximum save frames : address 0xF2F10128, bit 16 ~ bit 23 read value		
Resolution	Mode 800	Mode 1600/Y422
320 x 240	127 frames	127 frames
640 x 480	63 frames	31 frames
800 x 600	63 frames	31 frames
1024 x 768	31 frames	15 frames
1280 x 960	15 frames	7 frames
1600 x 1200	15 frames	7 frames
2448 x 2048	3 frames	1 frames

## 4.10. LUT (Lookup table)

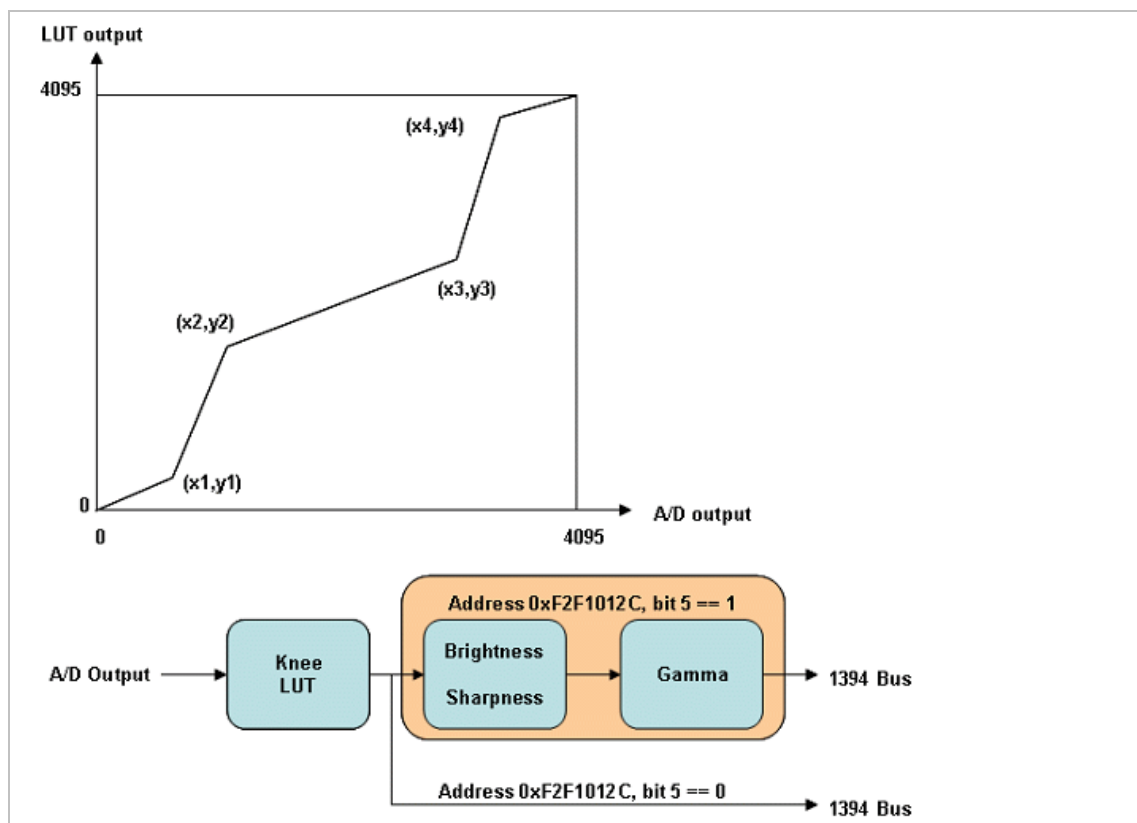
The Fire-i industrial cameras support a LUT (2008 production models or newer), which is providing users with an image with the user's defined dynamic range. Through the LUT, users can process the images from saturation to dark.

The LUT can be used optionally with Brightness, Sharpness and Gamma. However, the applied sequence is that the LUT is applied prior to features like Brightness, Sharpness and Gamma.

(Priority: LUT > Brightness and Sharpness and Gamma)

### 4.10.1. 4-step knee lookup table

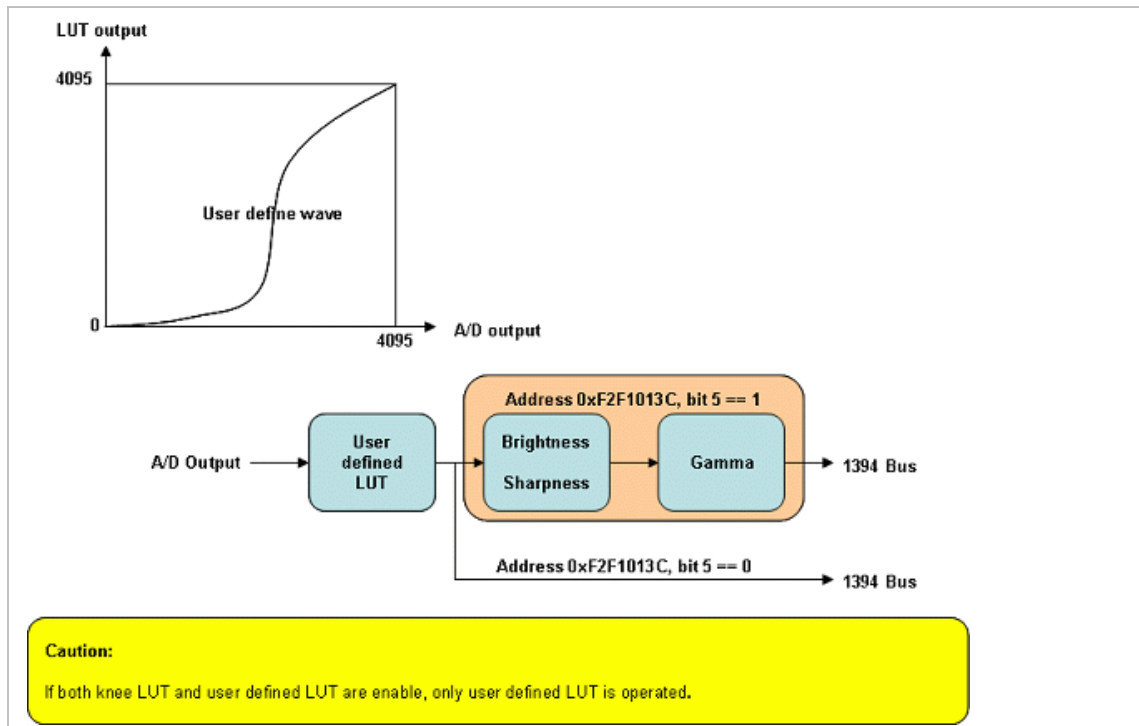
The users can set the 4 points for the images, called the knee, and apply them to LUT.



### 4.10.2. User defined lookup table

The users can set defined points (data file) for the images and apply them to the LUT. User's defined LUT running procedure is as follows. LUT index is N (0~15). The total index number of user's defined LUT is 16, but only one user defined LUT is used at a time.

Priority: User's defined LUT > 4 point LUT > Features (Brightness, Sharpness, Gamma)



The user defined LUT save procedure is as follows:

1. Check the save ready bit (bit1) status of the LUT save control register (0xF2F10140). If bit 1 is 0, wait.
2. Write 1 at the LUT buffer address init bit (bit7) of the LUT save control register (0xF2F10140): 0xF2F10140 (<= 0x01000000).
3. Then write 4096 LUT data at the LUT data register (0xF2F10144).
4. Finally, write save command (bit0), LUT index (N: bit8~bit11) at the LUT save control register (0xF2F10140): 0xF2F10140 (<= 0x80N00000).

## 4.11. One Pixel Snow Noise Remove

With this function, it is possible to average the value of snow noise pixel by using the neighboring pixels values. The formula used is: If  $((Pi - Pi - 1) > \text{Threshold} * 16)$  and  $((Pi - Pi + 1) > (\text{Threshold} * 16))$ , Pi is bad pixel. The purpose of the function is to increase the average pixels values for the whole image and be automatically displayed and the images can be compensated by over up to 50%. The register address and values for this function are:

Address	Description (bit 0: msb)	Read/Write
0xF2F20150	<b>One Pixel Snow Noise Remove</b> Bit 0 : presence inquiry (read only) Bit 1 ~ Bit 5 : reserved Bit 6 : on/off Bit 7~Bit23 : reserved Bit 24~Bit31 : Threshold Value (T) : If Pixel difference value > Threshold Value, then replace near pixel average Value	Write only



Before Snow noise image



After Snow noise removal

## 4.12. PIO Control Register

Short for Programmed Input/Output, PIO provides a set of IO ports which can be configured by the defined address.

The PIO control register by 1394 address, for strobe and trigger signal, is as follows.

Address	Description (bit 0: msb)	Read/Write
0xF2F21000	PIO output register Bit 30 : Strobe GPIO output	Write only
0xF2F21004	PIO input register Bit 31 : trigger GPIO input	Read only
0xF2F21008	PIO GPIO enable register. Bit 30 : Strobe pin GPIO selector (1: GPIO, 0: strobe)	Read/Write

## 5. User Defined FireWire Registers

User defined registers are features undefined in the IIDC specification which Fire-i cameras are capable of.

User can utilize extended features of these specific firewire registers for application.

### 5.1. User Defined FireWire Address

Address	Description( bit : msb*)	Read/Write
0xF2F10000	<p><b>A/D bit resolution</b>            Bit 28~Bit31 : A/D bit resolution            Please refer to IIDC v1.32 data depth register (address: 0xF0F00630)</p> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Mono 8 /Raw RGB 8bit</div> <div style="margin-left: 20px;">           Discard  </div> <div style="margin-left: 100px;"><b>12 Bit A/D Resolution</b></div> </div> <div style="text-align: center; margin-top: 10px;"> </div> <div style="text-align: center; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Mono 16 /Raw RGB 16bit</div> <div style="margin-left: 20px;"> </div> </div>	Read only
0xF2F10004	<p><b>Auto shutter-speed maximum/minimum value register.(32bit)</b>            At auto shutter mode, shutter speed value is checked between auto shutter-speed maximum value and minimum value</p> <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>0</span> <span>15</span> <span>16</span> <span>31</span> </div> <div style="border: 1px solid black; padding: 5px; margin: 5px auto; width: 80%;"> <div style="display: flex; justify-content: space-between;"> <span>Auto Shutter-Speed Maximum Value</span> <span>Auto Shutter-Speed Minimum Value</span> </div> </div> </div>	Read/Write
0xF2F10008	<p><b>Auto gain maximum/minimum value register.*(32bit)</b>            At auto gain mode, gain value is checked between auto gain maximum value and minimum value.</p> <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>0</span> <span>15</span> <span>16</span> <span>31</span> </div> <div style="border: 1px solid black; padding: 5px; margin: 5px auto; width: 80%;"> <div style="display: flex; justify-content: space-between;"> <span>Auto Gain Maximum Value</span> <span>Auto Gain Minimum Value</span> </div> </div> </div>	Read/Write

0xF2F10018	<b>Mode control register</b>	Read/Write
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	Bit 31 : auto sync enable Bit 30 : SIO enable mode (0 : custom mode, 1 : IIDC v1.32) Bit 27 : auto sync complete (read only. 1: ready, 0: not yet auto-sync)																																																																																				
0xF2F1001C	<b>1394 time stamp register(msb:bit0)</b> <table border="1"><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr><tr><td colspan="7">SECONDS COUNT</td><td colspan="14">CYCLE COUNT</td><td colspan="10">CYCLE OFFSET</td></tr></table> <table border="1"><thead><tr><th>Bit Number</th><th>Bit Name</th><th>Function</th><th>DIR</th><th>Description</th></tr></thead><tbody><tr><td>0 - 6</td><td>SECONDS COUNT</td><td>Seconds Count</td><td>R/W</td><td>1 Hz cycle timer counter</td></tr><tr><td>7 - 19</td><td>CYCLE COUNT</td><td>Cycle Count</td><td>R/W</td><td>8,000 Hz cycle timer counter</td></tr><tr><td>20 - 31</td><td>CYCLE OFFSET</td><td>Cycle Offset</td><td>R/W</td><td>24.576 MHz cycle timer counter</td></tr></tbody></table> <p>We recommend using native CYCLE_TIME register in Chap. 5.7.</p>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SECONDS COUNT							CYCLE COUNT														CYCLE OFFSET										Bit Number	Bit Name	Function	DIR	Description	0 - 6	SECONDS COUNT	Seconds Count	R/W	1 Hz cycle timer counter	7 - 19	CYCLE COUNT	Cycle Count	R/W	8,000 Hz cycle timer counter	20 - 31	CYCLE OFFSET	Cycle Offset	R/W	24.576 MHz cycle timer counter	Read only
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																																																						
SECONDS COUNT							CYCLE COUNT														CYCLE OFFSET																																																																
Bit Number	Bit Name	Function	DIR	Description																																																																																	
0 - 6	SECONDS COUNT	Seconds Count	R/W	1 Hz cycle timer counter																																																																																	
7 - 19	CYCLE COUNT	Cycle Count	R/W	8,000 Hz cycle timer counter																																																																																	
20 - 31	CYCLE OFFSET	Cycle Offset	R/W	24.576 MHz cycle timer counter																																																																																	
0xF2F10110	<b>Trigger noise filter register (External trigger only)</b> Bit 22~Bit 31 : trigger masking range (M, unit : usec, range:0~999)	Read/Write																																																																																			
0xF2F10114	<b>Multi-cut exposure &amp; interval time control (for Mode 14)</b> Bit 16 ~ 31 : exposure time (E) Bit 0 ~ 15 : exposure time interval (P)	Read/Write																																																																																			
0xF2F10118	<b>Local ISO_EN control register for one-shot/multi-shot</b> Bit 31 : iso_enable ( 1: enable. 0: disable)																																																																																				
0xF2F1011C	<b>Power on default memory channel</b> Bit 0 ~ Bit 3 : power on initial memory channel	Read/Write																																																																																			
0xF2F10200	<b>Camera version register</b> Bit 16~Bit 31 : camera version (ex: If reading value: 0x00003000, camera version is 3.000)	Read only																																																																																			
0xF2F10120	<b>Bright Level for Iris Control Application</b> Bit 24 ~ Bit 31 : Bright Level for Image Capture	Read only																																																																																			
0xF2F10124	<b>Test Pattern</b> Bit 0 : Vertical Grey Bar Bit 1: Bias Grey Bar	Read/Write																																																																																			

N : 1 ~ 255

Control Address : 0xF0F00830

Number of frame : N

Address	Field Name	Bit Range	Description
0x0F	TRIGGER_MODE	[0]	Presence of this feature. 0: N/A, 1: Available
	Abs_Control	[1]	Absolute value control. 0: Control with value in the Value field. 1: Control with value in the Absolute value field. If this bit = 1, value in the Value field is ignored.
	ON_OFF	[2..9]	Reserved
	ON_OFF	[9]	Write: ON or OFF this feature. Read: read a status. 0: OFF, 1: ON. If this bit = 0, other fields will be read only.
	Trigger_Polarity	[7]	Select trigger polarity (except for software trigger). If Polarity_Inq is "1". Write to change polarity of the trigger input. Read to get polarity of the trigger input. If Polarity_Inq is "0", Read only.
	Trigger_Source	[8..10]	(0: Low active input, 1: High active input). Select trigger source. Set trigger source ID from trigger source ID_Inq.
	Trigger_Value	[11]	Trigger input raw signal value. Read only. 0: Low, 1: High.
	Trigger_Mode	[12..15]	Trigger mode. (Trigger_Mode_0..15)
	Parameter	[16..19]	Reserved
	Parameter	[20..31]	Parameter for trigger function, if required. (Optional)

**Caution:**

At trigger mode 15, Shutter value must be not changed. This operation may loss the frames and the next trigger. Therefore, the shutter value must be changed before trigger generation or trigger enable command.

Address	Description ( bit 0 : MSB)	Read/Write
---------	----------------------------	------------

0xF2F10128	<b>Defer Image control (Frame save)</b> Bit 0 : presence inquiry (read only) Bit 6 : defer image On/Off control ( 1: image hold mode, 0 : normal real time mode) Bit 7 : send image command : If bit 6 is on status, this bit is send image command from camera to PC. Bit 16 ~ Bit 23 : Queue size inquiry : Must check whenever format or mode is changed (read only) Bit 24 ~ Bit 31 : At read operation, this value is the number of remained image at queue. At write operation, this value is the number of sending images by bit 7 send image command	Read/Write
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0xF2F1012C	<b>4 step knee LUT run control register</b> LUT knee 1st point register Bit 0 : presence inquiry (read only) Bit 1 : LUT regeneration command (self cleared) Bit 2~Bit4 : reserved Bit 5 : enable brightness, sharpness, gamma feature with knee function Bit 6 : On/Off Bit 7 : reserved Bit 8~Bit 19 : X coordination of 1st knee point Bit 20~Bit31 : Y coordination of 1st knee point	Read only
0xF2F10130	LUT knee 2nd point register Bit 0 : presence inquiry (read only) Bit 1 : LUT regeneration command (self cleared) Bit 2~Bit5 : reserved Bit 6 : reserved Bit 7 : reserved Bit 8~Bit 19 : X coordination of 2nd knee point Bit 20~Bit31 : Y coordination of 2nd knee point	Read/Write
0xF2F10134	LUT knee 3rd point register Bit 0 : presence inquiry (read only) Bit 1 : LUT regeneration command (self cleared) Bit 2~Bit5 : reserved Bit 6 : reserved Bit 7 : reserved Bit 8~Bit 19 : X coordination of 3rd knee point Bit 20~Bit31 : Y coordination of 3rd knee point	Read/Write
0xF2F10138	LUT knee 4th point register Bit 0 : presence inquiry (read only) Bit 1 : LUT regeneration command (self cleared) Bit 2~Bit5 : reserved Bit 6 : reserved Bit 7 : reserved Bit 8~Bit 19 : X coordination of 4th knee point Bit 20~Bit31 : Y coordination of 4th knee point	Read/Write
0xF2F1013C	<b>User defined LUT run control register</b> Bit 0 : presence inquiry (read only) Bit 1 ~ Bit 4 : reserved Bit 5 : enable brightness, sharpness, gamma feature with user defined LUT function Bit 6 : On/Off	Read/Write



	Bit 7 ~ Bit 11 : reserved Bit 12 ~ Bit 15 : run LUT index Bit 16 ~ Bit 31 : reserved	
0xF2F10140	LUT save control register Bit 0 : save command Bit 1 : save ready status( read only) Bit 2 ~ Bit 6 : reserved Bit 7 : set LUT write buffer address to 0 Bit 8 ~ Bit 11 : save LUT index Bit 12 ~ Bit 31 : reserved	Read/Write
0xF2F10144	LUT data register (block write command) Save the first data at low word, then second data at high word Bit 0 ~ Bit 3 : reserved Bit 4 ~ Bit 15 : the second data Bit 16 ~ Bit 19 : reserved Bit 20 ~ Bit 31 : the first data	Write Only
0xF2F10160	<b>User defined AE X-axis value</b> Bit 0 : presence inquiry (read only) Bit 1 ~ Bit 4 : reserved Bit 5 : Make Command Bit 6 : On/Off (1: current setting value, 0: current image size) Bit 7 : reserved Bit 8 ~ Bit 19 : DAC or AE X-axis start position at current display image (AE_SX) Bit 20 ~ Bit 31 : DAC or AE X-axis width at current display image (AE_WX >= 4)	Read/Write
0xF2F10164	<b>User defined AE Y-axis value</b> Bit 0 : presence inquiry (read only) Bit 1 ~ Bit 4 : reserved Bit 5 : Make Command Bit 6 : On/Off (1: current setting value, 0: current image size) Bit 7 : reserved Bit 8 ~ Bit 19 : DAC or AE Y-axis start position at current display image (AE_SY) Bit 20 ~ Bit 31 : DAC or AE Y-axis width at current display image (AE_WY >= 4)	Read/Write
0xF2F10150	<b>Snow noise remove threshold register</b> Bit 0 : presence inquiry (read only) Bit 1 ~ Bit 5 : reserved Bit 6 : on/off Bit 7 : grid noise filter enable mode f or mono800 at color camera (0:disable, 1:enable) Bit 8~Bit23 : reserved Bit 24~Bit31 : Threshold Value (T) : If Pixel difference value > Threshold Value, the pixel is replaced with near pixel average value  <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>0</span> <span>7 8</span> <span>11</span> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>(MSB)</span> <span>(LSB)</span> </div> <div style="border: 1px solid black; width: 100%; height: 20px; position: relative;"> <div style="background-color: orange; width: 75%; position: absolute; left: 0; top: 0; bottom: 0;"></div> <div style="background-color: gray; width: 25%; position: absolute; right: 0; top: 0; bottom: 0;"></div> <div style="position: absolute; left: 50%; top: 50%; transform: translate(-50%, -50%);"> <div style="background-color: orange; padding: 2px 10px; border: 1px solid black;">Threshold Value (T)</div> <div style="background-color: gray; padding: 2px 10px; border: 1px solid black;">0</div> </div> </div> <p>Pixel compared threshold value bit map</p> </div>	Read/Write

## 6. Video Formats and Modes

IIDC specification defines several video formats. An overview of those formats is:

- Format 0: Video formats up to VGA (640 x 480) resolution.
- Format 1: Video formats for SVGA (800 x 600) and XGA (1024x768) resolution.
- Format 2: Video Formats for SXGA or higher resolutions ( 1280 x 960 and 1600 x 1200 )
- Format 6: Still Images
- Format 7: Scalable images sized ( User defined size and position )

### Format 0 / Format 1 / Format 2

In these formats, the frame rates are pre-defined for each video mode as per the IIDC specification.

There are several defined modes for each format where a mode specifies the size and color information of the pixels.

By reading the inquiry register of the camera, the user may determine which frame rates are supported by the camera.

Please refer to the IIDC specification for the details.

### Format 7

Format 0, 1, & 2 were defined at the early stage of the design and development of digital industrial cameras; where cameras supported these common VESA compliant resolutions. Because the user required a flexible and definable format; camera manufacturers utilized the user definable Format 7 to meet this demand. Format 7 is extremely flexible and allows the user to define the width, height, position and pixel format of the video data where separate sets of control registers exists for each Format 7 mode.

The NILE Series supports Format 7 Mode 0, 1, 2 with the following base address:

**Format 7 Mode 0 : F1F00000h      Format 7 Mode 1 : F1F00100h      Format 7 Mode 0 : F1F00200h**

Offset	Name	Description
000h	MAX_IMAGE_SIZE_INQ	Maximum Horizontal / Vertical pixel number
004h	UNIT_SIZE_INQ	Horizontal and Vertical unit pixel number
008h	IMAGE_POSITION	Left / Top position of requested image region (pixel)
00Ch	IMAGE_SIZE	Width / Height of the requested image region (pixel)
010h	COLOR_CODING_ID	Color coding ID from COLOR_CODING_INQ register
014h	COLOR_CODEING_INQ	Inquiry register for color information setting
034h	PIXEL_NUMBER_INQ	Pixel number per frame
038h	TOTAL_BYTE_HI_INQ	Higher quadlet of total bytes of image data per frame
03Ch	TOTAL_BYTE_LO_INQ	Lower quadlet of total bytes of image data per frame
040h	PACKET_PARA_INQ	Unit (Minimum) bytes per packet Multiple by 4 Maximum bytes per packet Multiple by UnitBytePerPacket
044h	BYTE_PER_PACKET	Packet size, Recommended bytes per packet. If this value is zero, shall ignore this field.

Please refer to the IIDC specification for the details.

NOTE: In Format 7 Mode, frame rates may vary which may depend on Size, Color, bytes per packet, shutter and system performance.

Notes: Color Models outputs Raw Bayer Pattern which is converted by software.

: Unsupported Mode as per IIDC 1.32 Specification

## 6.1. Fire-i 980

Format	Mode	Resolution		60fps	30fps	15fps	7.5fps	3.75fps	1.875fps
0	0	160 x 120	YUV 444						
	1	320 x 240	YUV 422			O	O	O	O
	2	640 x 480	YUV 411			O	O	O	O
	3	640 x 480	YUV 422			O	O	O	O
	4	640 x 480	RGB						
	5	640 x 480	Mono 8			O	O	O	O
	6	640 x 480	Mono 16			O	O	O	O
1	0	800 x 600	YUV 422			O	O	O	
	1	800 x 600	RGB 8						-
	2	800 x 600	Mono 8			O	O		
	3	1024 x 768	YUV 422			O	O	O	O
	4	1024 x 768	RGB 8						
	5	1024 x 768	Mono 8			O	O	O	O
	6	800 x 600	Mono 16			O	O	O	
	7	1024 x 768	Mono 16			O	O	O	O
2	0	1280 x 960	YUV 422			O	O	O	O
	1	1280 x 960	RGB 8						
	2	1280 x 960	Mono 8			O	O	O	O
	3	1600 x 1200	YUV 422			O	O	O	O
	4	1600 x 1200	RGB 8						
	5	1600 x 1200	Mono 8			O	O	O	O
	6	1280 x 960	Mono 16			O	O	O	O
	7	1600 x 1200	Mono 16			O	O	O	O
7	0	2448 x 2048	15 fps(mono 8) / 7.5 fps (mono 16) for B&W Model						
		2448 x 2048	15 fps(mono 8, RAW 8) / 7.5 fps (YUV422, RAW 16) for Color Model						
	1	1220 x 1020	27 fps 2x2 binning, mono 8 for B&W Model						
		1220 x 1020	27 fps 2x2 binning, mono 16 for B&W Model						
	2	2448 x 1020	27 fps 1x2 binning, mono 8 for B&W Model						

2448 x 1020 15 fps 1x2 binning, mono 16 for B&W Model

## 6.2. Fire-i 780

Format	Mode	Resolution		60fps	30fps	15fps	7.5fps	3.75fps	1.875fps
0	0	160 x 120	YUV 444						
	1	320 x 240	YUV 422						
	2	640 x 480	YUV 411			0	0	0	
	3	640 x 480	YUV 422			0	0	0	
	4	640 x 480	RGB						
	5	640 x 480	Mono 8		0	0	0	0	
	6	640 x 480	Mono 16			0	0	0	
1	0	800 x 600	YUV 422			0	0	0	
	1	800 x 600	RGB 8						-
	2	800 x 600	Mono 8		0	0	0		
	3	1024 x 768	YUV 422			0	0	0	0
	4	1024 x 768	RGB 8						
	5	1024 x 768	Mono 8		0	0	0	0	0
	6	800 x 600	Mono 16			0	0	0	
	7	1024 x 768	Mono 16			0	0	0	0
2	0	1280 x 960	YUV 422				0	0	0
	1	1280 x 960	RGB 8						
	2	1280 x 960	Mono 8		0	0	0	0	0
	3	1600 x 1200	YUV 422						
	4	1600 x 1200	RGB 8						
	5	1600 x 1200	Mono 8						
	6	1280 x 960	Mono 16				0	0	0
	7	1600 x 1200	Mono 16						
7	0	1388 x 1040	30.2 fps(mono 8) / 21.9fps (mono 16) for B&W Model						
		1388 x 1036	30.3 fps(mono 8, RAW 8) / 22fps (mono 16, RAW 16) for Color Model						
	1	688 x 516	54.9 fps 2x2 binning, mono 8 for B&W Model						
		688 x 516	49.9 fps 1x2 binning, mono 16 for B&W Model						

### 6.3. Fire-i 785

Format	Mode	Resolution		60fps	30fps	15fps	7.5fps	3.75fps	1.875fps
0	0	160 x 120	YUV 444						
	1	320 x 240	YUV 422						
	2	640 x 480	YUV 411						
	3	640 x 480	YUV 422			O	O	O	
	4	640 x 480	RGB						
	5	640 x 480	Mono 8		O	O	O	O	
	6	640 x 480	Mono 16			O	O	O	
1	0	800 x 600	YUV 422						
	1	800 x 600	RGB 8						-
	2	800 x 600	Mono 8			O	O		
	3	1024 x 768	YUV 422			O	O	O	O
	4	1024 x 768	RGB 8						
	5	1024 x 768	Mono 8		O	O	O	O	O
	6	800 x 600	Mono 16			O	O	O	
	7	1024 x 768	Mono 16			O	O	O	O
2	0	1280 x 960	YUV 422				O	O	O
	1	1280 x 960	RGB 8						
	2	1280 x 960	Mono 8		O	O	O	O	O
	3	1600 x 1200	YUV 422						
	4	1600 x 1200	RGB 8						
	5	1600 x 1200	Mono 8						
	6	1280 x 960	Mono 16				O	O	O
	7	1600 x 1200	Mono 16						
7	0	1288 x 964	30.3 fps(mono 8) / 25.4 fps(mono 16) for B&W Model						
		1288 x 960	30.3 fps(mono 8, RAW 8) / 25.5 fps (mono 16, RAW 16) for Color Model						
	1	640 x 476	54.4 fps   2x2 binning, mono 8   for B&W Model						
		640 x 476	49 fps   1x2 binning, mono 16   for B&W Model						

## 6.4. Fire-i 580

Format	Mode	Resolution		60fps	30fps	15fps	7.5fps	3.75fps	1.875fps
<b>0</b>	0	160 x 120	YUV 444						
	1	320 x 240	YUV 422						
	2	640 x 480	YUV 411		O	O	O	O	
	3	640 x 480	YUV 422		O	O	O	O	
	4	640 x 480	RGB						
	5	640 x 480	Mono 8	O	O	O	O	O	
	6	640 x 480	Mono 16		O	O	O	O	
<b>7</b>	0	656 x 484	87.1 fps(mono 8) / 79.9 fps (mono 16) for B&W Model						
		652 x 484	88.3 fps(mono 8, RAW 8) / 80.6 fps(mono16, RAW 16) for Color Model						
	1	324 x 240	161.2 fps	2x2 binning, mono 8 for B&W Model					
		324 x 240	150.5 fps	1x2 binning, mono 16 for B&W Model					

## 7. Trouble Shooting

FireWire based camera are operated in connection with system where user may encounter problems as they operate. These problems may orient either from the camera side or the system side that the camera is being used. We recommend reading the manual carefully beginning from the installation to features in concern. Also some system may not have enough power to operate these cameras especially for high resolution and frame rate we recommend the system should be Pentium 4 or higher with 512 MB of System memory and Graphic Accelerator with 32 MB or more of video memory. When using Windows, due to high graphic requirements and DirectX support, we recommend using at least Nvidia or ATI graphics controllers.

### 7.1. Hardware Related Issues

#### Camera is not recognized in the device manager

- Please check whether the LED in the back of the camera is ON. If LED is turned OFF, please check camera connection. Please check the cable connection on both the camera and the PC. The LED status, when plugging in the camera is supposed to be normal when the LED light changes from an Orange light to a Red light.
- If you haven't installed the camera driver yet, please refer to the software installation and install the drivers and software provided.
- Please reconnect the camera by plugging out the FireWire cable and plugging in the cable connected on the camera.

#### LED is OFF while power is provided either by FireWire or external power.

- Please check the supplied voltage and ensure the supplied power is compliant to the operation manual.
- Please check the firewire card and cable(s).

#### Camera Power

As described in this manual the power of the camera is provided either by the FireWire cable or the external power through 12 Pin Trigger Port. Please be careful when using external power input through the trigger port and refrain from using power over +30V DC. In normal condition we recommend using +12V DC. Also please check the operation manual for the power connection pin assign for external power input to avoid damaging the camera.

#### No Image or Black Image Displayed

Check the "Status LED" if it appears Green. If Not, camera is not Isochronous enabled which means not transmitting any image and is in an idle stage.

Check whether the lens is properly mounted and open the iris it to the maximum level.

Check feature values such as shutter speed, gain and exposure. Also check whether the camera is in trigger mode.

## 8. Technical Support

We ensure the conformity of our product to be reliable and free from defects during manufacturing by testing all the cameras before release. However unexpected problems and technical issues may come up due to the complexity of the product. In case you require technical support contact the agent near you or you may contact us directly with the following information.

Web information, specifications, FAQs: <http://www.unibrain.com/>

Technical support email: [support@unibrain.com](mailto:support@unibrain.com)

Sales inquiries: [sales@unibrain.com](mailto:sales@unibrain.com)

Telephone Numbers:

Europe/Asia: +30210-6640600

USA/Canada/South America: +1-925-866-3000

In case of RMA, you must first contact us or your local reseller in order to obtain the RMA Number before sending the product to us. The returns contact email address is: [rma@unibrain.com](mailto:rma@unibrain.com)