CAMELIA 1.6M

1.6 MEGAPIXEL DIGITAL CAMERA

User guide

CAMELIA PACKAGE CONTENTS :

Depending on the selected configuration, a CAMELIA package may include :

♦ CAMELIA camera

♦ FGT frame grabber board

♦ ''Power supply'' cable + ''RS232'' cable

♦ ''Data & Sync'' cable.

♦ ''COMMCAM'' software.

♦ FGT software.

♦ documentation

SYSTEM REQUIREMENTS :

♦ +24V(0.6A) power supply

♦ computer :

    ◊ minimal configuration :
- PENTIUM II 350MHz.
- RAM : 128 Mb, 256 Mb for 3 shot color operation.
- Cache memory : 256 Kb.
- 1 free PCI slot.

    ◊ operating system :
- windows NT 4.0.
- windows 95b, 98.

♦ NIKON lens

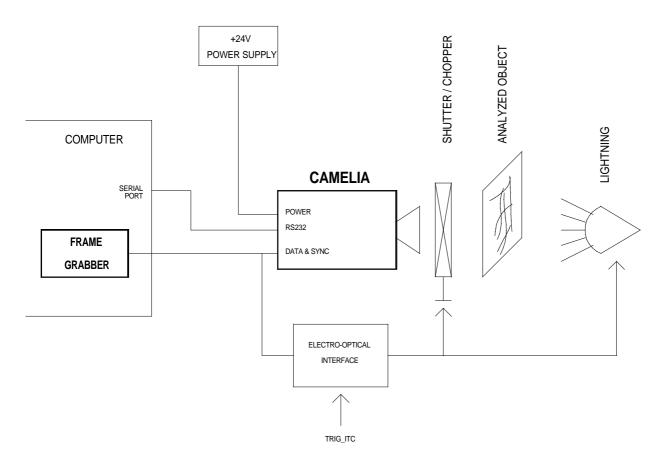♦ lightning control (shutter/chopper or pulsed lightning).

GETTING STARTED :

♦ connect the camera to one of the computer serial ports (COM1 or COM2) by using the RS232 cable

♦ power on the camera

♦ install ''COMMCAM'' software in your computer. (see "COMMCAM User Guide")

♦ install FGT frame grabber board and FGT software in your computer. (see "FGT Frame Grabber User Guide")

♦ run the system

1. IMAGING SYSTEM DESCRIPTION

- ♦ CAMELIA camera is powered by a +24V power supply.
- ♦ CAMELIA camera is configured through the serial port of the computer.
- ♦ CAMELIA camera sends digital video to the FGT frame grabber.
- ♦ As CAMELIA 's CCD is a full frame sensor, you must use either pulsed lightning or a chopper/shutter in front of the camera in order to have incident lightning on the CCD only during integration time. You must design an electro-optical interface to drive camera, shutter/chopper or lightning by using the "SHUTTER" signal delivered by the camera. If required, the system can send an external trigger or external ITC (integration time control signal) to the camera.

2. CAMELIA 1.6M CAMERA

2.1 CCD

♦ image format : 30.0mm(V) x 20.0mm(H)

♦ 1536(V) x 1024(H) active pixels

♦ readout register along the small side of the image area. (vertical image)

♦ pixel geometries :

  ◊ 19.5um(V) x 19.5um(H).
  ◊ aperture ratio : 100%.

♦ anti-blooming by clocking.

2.2 TIMING

3 timing modes are available :

♦ continuous : the camera delivers frames continuously :

  ◊ frame N+1 integration starts as soon as frame N readout is completed.
  ◊ integration time is set by RS232

♦ operation with external trigger : integration start is controlled by the user from the external signal TRIG :

  ◊ the rising edge of TRIG activates the start of the frame integration. This rising edge is synchronized by the camera with a precision of 62µs
  ◊ integration time is set by RS232
  ◊ note : TRIG signal period must be greater than integration time plus frame readout time.

♦ operation with "integration time control" : integration is fully controlled by the user from the external signal ITC :

  ◊ the falling edge of ITC activates the start of the frame integration. This falling edge is synchronized by the camera with a precision of 62µs
  ◊ the rising edge of ITC activates the stop of the frame integration. This rising edge is synchronized by the camera with a precision of 62µs
  ◊ note : ITC signal period must be greater than integration time (defined by ITC low) plus frame readout time.
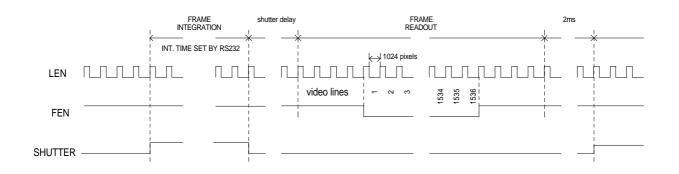
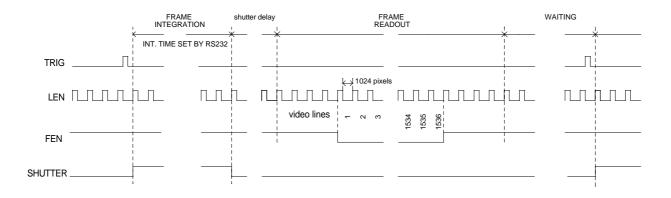2x2 and 4x4 pixel binning is possible to enable previewing modes.

Data rate is :

♦ pixel clock : 20 MHz

♦ frame readout time :

  ◊ normal mode : 100ms
  ◊ 2x2 pixel binning : 55ms.
  ◊ 4x4 pixel binning : 35ms.

Timing diagram (for continuous operation) :

FRAME INTEGRATION   shutter delay   FRAME READOUT   2ms

INT. TIME SET BY RS232

1024 pixels

LEN

video lines   1 2 3   1534 1535 1536

FEN

SHUTTER

Timing diagram (for operation with "external trigger") :

FRAME INTEGRATION   shutter delay   FRAME READOUT   WAITING

INT. TIME SET BY RS232

1024 pixels

TRIG

LEN

video lines   1 2 3   1534 1535 1536

FEN

SHUTTER

Timing diagram (for operation with "integration time control") :

FRAME INTEGRATION   shutter delay   FRAME READOUT   WAITING

1024 pixels

ITC

LEN

video lines   1 2 3   1534 1535 1536

FEN

SHUTTER

2.3 ANTI-BLOOMING BY CLOCKING

Anti-blooming can be activated or inhibited (see 2.5.3) :
- ◊ anti-blooming OFF : anti-blooming inhibited. This position is recommended if anti-blooming is not required for the application.
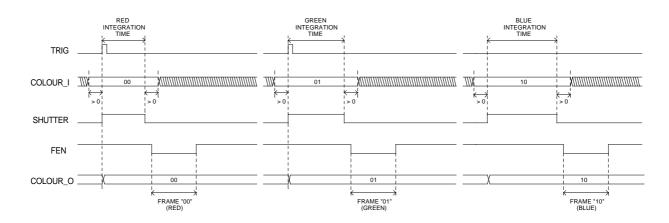- ◊ anti-blooming ON : anti-blooming activated.

2.4 COLOR OPERATION

In ''3 shot color'' mode, each image is made of 3 frames : red, green, blue :
- ◊ the camera must be operated either in ''external trigger'' mode or in ''integration time control'' mode.
- ◊ for each image, the user selects the color of the next frame by setting COLOUR_I1 and COLOUR_I2 input signals. COLOUR_I1, _I2 must be valid in the time period between TRIG signal rising edge (or ITC signal falling edge) and SHUTTER signal falling edge. (see timing there after)
- ◊ color definition is :

COLOUR_I2	COLOUR_I1	Frame Color
0	0	Red
0	1	Green
1	0	Blue

- ◊ integration time can be adjusted differently for each color. This allows to have a better signal to noise ratio for the colour with the lowest sensitivity (i.e the blue)
- ◊ each frame requires a TRIG_ITC signal.
- ◊ CAMELIA 1.6M camera synchronizes COLOUR_I1, _I2 with the rest of the timing and sends COLOUR_O1, _O2 to FGT frame grabber.

2.5 ELECTRICAL INTERFACES

2.5.1 POWER SUPPLY

Voltage	Current
+24V Min : +20V; Max : +28V	0.6A

2.5.2 DIGITAL I/O

SYMBOL	I/O	DEFINITION	LEVEL
TRIG_ITC	I	Timing control : TRIG_ITC is either an external trigger or "integration time control" depending on the timing mode configured by RS232 (see after) operation with external trigger : TRIG_ITC = TRIG operation with "integration time control" : TRIG_ITC = ITC TRIG_ITC is synchronized by the camera line clock (jitter : 62 µs)	LVDS
COLOUR_I(1..0)	I	Colour selection of the next frame (in color mode) : - "00" : red - "01" : green - "10" : blue	LVDS
S(11..0)	O	Digital video output : 12 bits	LVDS
FEN		Frame enable : - FEN = 0 : frame data valid : active lines - FEN = 1 : frame data not valid	LVDS
LEN	O	Line enable : - LEN = 0 : line data valid : active pixels - LEN = 1 : line data not valid	LVDS
PCK	O	Pixel clock	LVDS
COLOUR_O(1..0)	O	Color identification of the current frame (in color mode) : - "00" : red - "01" : green - "10" : blue.	LVDS
SHUTTER	O	shutter open/close : - during integration : shutter = 1 - during readout : shutter = 0 delay between the falling edge of shutter and the start of readout : - 4 positions : 1ms, 5ms, 10ms, 20ms.	LVDS

Note :

♦ LVDS drivers / receivers :
  ◊ LVDS : Low Voltage differential Signal. (EIA 644 standard). All digital I/Os are differential : (signal+, signal-). Specifications are given for signal +.
  ◊ manufacturer NS
  ◊ driver : DS90C031TM (SO16 package)
  ◊ receiver : DS90C032TM (SO16 package)

2.5.3 RS232 INTERFACE

Camera configuration is set by RS232 interface. The following features are available :

Function	RS232 configuration	Comment
Timing mode	3 modes : - continuous (free running) - external trigger - external ITC	
Binning	3 modes : - no binning - 2x2 pixel binning - 4x4 pixel binning	image size : 1024(H) x 1536(V) image size : 512(H) x 768(V) image size : 256(H) x 384(V)
CDS gain	2 positions : - G = 1 - G = 4	G = 4 is recommended for applications requiring high sensitivity.
Camera gain	camera gain value from 1.00x to 2.00x in 16 steps	
Shutter	2 modes : - active - inactive (always open)	
Shutter delay	4 positions : - 1ms - 5ms - 10ms - 20ms	
Anti-blooming control	2 modes : - active - inactive	
Black and white or color Mode	2 modes : - black and white - 3 shot color	
Black and white integration time	integration time value in ms from 1ms to 2000ms. active only in "black and white" mode.	Must be an integer. Ex : 120 for 120ms 120.4 not allowed.
Red integration time	integration time for the red frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms
Green integration time	integration time for the green frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms
Blue integration time	integration time for the blue frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms

Note : video signal processing gain of the camera can be adjusted by setting :

♦ either ''CDS gain'' : a commutation 1x or 4x is available at the input of the video signal processing. Use of the 4x position is recommended for low level applications (noise is lower)

♦ or ''camera gain'' : a range of 1x to 2x is available in 16 steps.
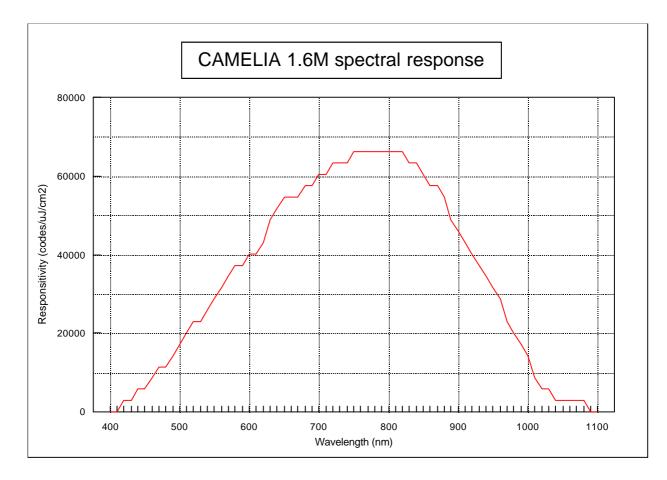
2.6 ELECTRO-OPTICAL PERFORMANCE

♦ Conditions :

◊ frame integration time : 40ms
◊ camera operating free air temperature : 25°C

♦ Performance :

Parameter	Symbol	Typical Value	Unit
Full scale value see note 2	VPE	4095	adu
Temporal noise σ see note 3	VN	2	adu
Dark signal non uniformity σ see note 4	DSNU	5	adu
Dynamic range see note 5	DY	2048	
Responsivity see note 6	R	65	adu/(lux.s)
Resolution - horizontal contrast transfer function at Nyquist - vertical contrast transfer function at Nyquist see note 7	CTFh CTFv	50% 50%	

♦ note 1 : adu : arbitrary digital unit : 12 bit = 4095 adu or gray levels.

♦ note 2 : full scale value VPE : maximum digital video signal

♦ note 3 : temporal noise VN : r.m.s value in darkness. Measured by substracting 2 images pixel to pixel

♦ note 4 : dark signal non uniformity : r.m.s value. Excludes blemishes.

♦ note 5 : dynamic range DY :

◊ $DY = VPE / VN$

♦ note 6 : responsivity :

◊ conditions : 3200K, BG38 2mm, F/4, lux measured on the scene, camera gain = 1x.

♦ note 7 : resolution :

◊ conditions : light source 3200K, BG38 2mm.
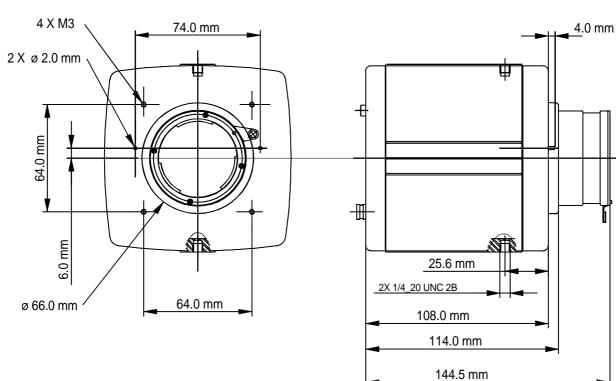◊ measured at VIDEO = 2000 adu, camera gain = 1x.
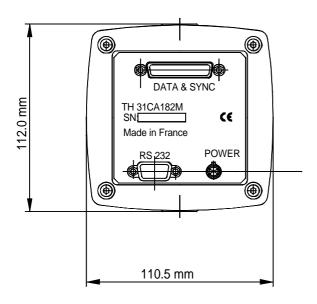
Note : µJ/cm^2 measured on the CCD chip.

2.7 GEOMETRICAL SPECIFICATIONS

FRONT PANEL

4 X M3

2 X ø 2.0 mm

74.0 mm

4.0 mm

64.0 mm

6.0 mm

ø 66.0 mm

64.0 mm

25.6 mm

2X 1/4_20 UNC 2B

108.0 mm

114.0 mm

144.5 mm

REAR PANEL

112.0 mm

DATA & SYNC

TH 31CA182M

SN

CE

Made in France

RS 232   POWER

110.5 mm

2.8 ENVIRONMENTAL REQUIREMENTS

♦ operating temperature : 0°C / +50°C

♦ storage temperature : -20°C / 70°C

♦ operating humidity : < 80% at +35°C

♦ vibration : 2g sinusoidal, from 10Hz to 100Hz.

3. CONNECTORS AND CABLES

3.1 ''DATA AND SYNC'' CONNECTOR

50 points 3M connector.

♦ connector reference :HIROSE DX10A-50S.

♦ mating connector on cable side : HIROSE DX40-50P ; shell : HIROSE DX50-CV1.

Pin-out :

Pin n°	Signal		Pin n°	Signal
1	PCK+		26	LEN+
2	PCK-		27	LEN-
3	FEN+		28	COLOUR_O1+ (1)
4	FEN-		29	COLOUR_O1-(1)
5	COLOUR_O2+ (1)		30	GROUND
6	COLOUR_O2-(1)		31	GROUND
7	PDATA0+		32	PDATA1+
8	PDATA0-		33	PDATA1-
9	PDATA2+		34	PDATA3+
10	PDATA2-		35	PDATA3-
11	PDATA4+		36	PDATA5+
12	PDATA4-		37	PDATA5-
13	PDATA6+		38	PDATA7+
14	PDATA6-		39	PDATA7-
15	PDATA8+		40	PDATA9+
16	PDATA8-		41	PDATA9-
17	PDATA10+		42	PDATA11+
18	PDATA10-		43	PDATA11-
19	GROUND		44	NC
20	GROUND		45	NC
21	SHUTTER+		46	TRIG_ITC+
22	SHUTTER-		47	TRIG_ITC-
23	COLOUR_I1+(1)		48	COLOUR_I2+(1)
24	COLOUR_I1-(1)		49	COLOUR_I2-(1)
25	NC		50	NC

Notes :

◊ NC : not connected.

◊ **(1) : grey cells : not used for CAMELIA COLOR : must be left unconnected**

◊ a "Data + Sync" cable is provided with FGT Frame grabber, including a part to be connected to the electro-optical interface, and the second one to the "FGT" frame grabber : see "FGT Frame Grabber user manual".

3.2 'POWER SUPPLY'' CABLE

♦ On power supply side :

◊ SUBD9 male.   Pin out :

Pin Number	Signal
1	+24V
2	+24V
3	NC
4	NC
5	NC
6	GROUND
7	GROUND
8	NC
9	NC

◊ note : NC : not connected.

3.3 ''RS232'' CABLE

♦ on computer side :

◊ SUBD9 female

◊ pin out compatible with computer serial port

♦ note : pin out is the same on camera side and on computer side.

This product is manufactured by Atmel-Grenoble- 38521 SAINT-EGREVE - FRANCE.

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