DALSA

A D V A N C E D L I N E S C A N

ECLIPSE Cameras

World's Most Responsive Linescan Camera

DALSA's new single tap, bidirectional, advanced line scan camera combines amazing responsivity, a small body, and high speed with advanced features such as programmability, in-camera pixel-to-pixel correction, and finely adjustable gain.

Table 1. Camera Configurations

Specification	0512	1024	2048
Pixel Pitch	[	13µm x 13µm	]
Lens Mount	C-mount	C-mount	F-mount
Max. Line Rate:	64.1kHz	34.8kHz	17.4kHz
Data Format	[1x8 bits, EIA-644 (LVDS)]		
Data Rate	[	40MHz	]
CE Compliance	[	Yes	]
Power Supplies:	[	single 12 - 15V DC	]

Features

Responsivity
- Responsivity of 1950 DN/(nJ/cm^2)
- 100x more responsive than standard line scan cameras
- Ideal for applications with low-intensity, low-cost lighting

Size
- Small form factor (50mm x 50mm x 88mm, <350g)

Programmability
- Simple ASCII protocol controls binning, gain, offset, line rate, trigger mode, data rate, direction, test pattern output, and camera diagnostics
- RS-232 interface (ASCII, 9600 baud)

Performance
- 512, 1024 or 2048 pixels, 13µm x 13µm
- Bidirectional
- 96 TDI stages
- 40MHz single output data rate, 8-bit output from 10-bit digitization
- Line rates to 64kHz
- RS-644 (LVDS) data format

Usability
- Programmable gains, offsets, and camera controls
- End-of-line sequence and test pattern output for debugging
- Single input supply (12-15V)
- Compliant with CE and MIL-STD-810E (shock and vibration)

Applications

Eclipse is ideal for space-constrained applications demanding low-light or cost-effective lighting, including:
- postal sorting (address lift, barcode reading, cancellation mark detection)
- web inspection
- electronics and semiconductor manufacturing machine vision (pick and place machines, wafer aligners, solder paste inspection)

Description

The Eclipse camera family represents an exponential increase in responsivity, performance and ease-of-integration, while drastically reducing the size and cost of advanced linescan camera technology. With unmatched sensitivity, size, and an unprecedented array of programmable diagnostic and signal processing features, Eclipse is a truly remarkable camera and exceeds the demands for space-constrained, low-cost and low-light industrial applications.

The camera's simple ASCII communications protocol allows you to configure and program virtually all camera functions through an RS232 serial interface.

To speed setup and system debugging, the camera can output a test pattern and end-of-line sequence to help track the path of data through an acquisition system.

Sensor

The Eclipse cameras use DALSA's IT-F7 line scan sensors. The sensors' photoelements have a photosensitive area of 13µm x 13µm.

Operation

Power Supply

The Eclipse camera requires a single input (12V - 15V). The camera meets all performance specifications using standard switching power supplies, although well-regulated linear supplies provide optimum performance. See the Performance Specifications for current requirements.

Default Operation

The camera defaults (no external input required) to maximum data rate, forward direction, maximum line rate, and internal Sync to trigger readout. Line rate can be set internally using the RS232 interface.

Input Control Signals

External control signals, EXSYNC, EXRCLK, and FORWARD, are enabled through the RS232 interface.

EXSYNC

EXSYNC is an optional input signal that can be used to trigger the line readout rate. This camera uses the falling edge of EXSYNC to trigger line readout.

Note: EXSYNC must not be clocked faster than the camera's specified maximum line rate.

EXRCLK

EXRCLK is an optional input signal used to control readout timing. EXRCLK is applied to the read portion of a FIFO and directly drives STROBE and LVAL. EXRCLK is required for multisync operations.

FORWARD

FORWARD is an optional input signal supporting bidirectional camera functionality. "Logic high" for a forward direction. "Logic low" for reverse. Eclipse defaults to "logic high".

Multisync

Multisync is used to connect two or more cameras to the framegrabber and receive all of the cameras' output synchronously. Camera switches to multisync mode when both EXSYNC and EXRCLK are applied.

Serial Interface

Eclipse features can be controlled through the serial interface (RS232, 9600 baud). Functions available include:

- Controlling basic camera functions such as binning (horizontal and vertical), gain, offset, line and data rate, and direction
- Pixel-by-pixel FPN and PRNU correction and balancing
- Measuring sensor temperature, supply voltages
- Capturing video and line statistics
- Generating end-of-line sequencing (line counter, line average, pixels above/below threshold) and test patterns for debugging

The serial interface uses a simple ASCII-based protocol and the camera does not require any custom software. The complete protocol is described in the camera manual.

For quick help, the camera can return all available commands and parameters through the serial interface.

Output

Digital Data

The camera digitizes to 10-bit ADCs and outputs the most significant 8 bits in LVDS format. To clock digital data into framegrabbers, the camera outputs clocking signals STROBE and LVAL.

STROBE

STROBE is a pixel clock signal for digital data. It is continuous, toggling even when data is not valid. Data is valid on the **rising** edge of STROBE.

LVAL

LVAL high indicates the camera is outputting a valid line of pixels.

Figure 1.

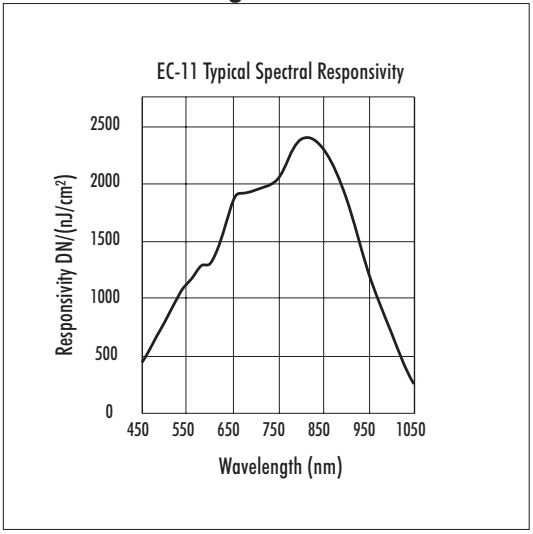


Table 2. EC-11 Performance Specifications

Physical Characteristics		Units				Notes
Power Dissipation		W	Typ			
	512		5			
	1024		5.1			
	2048		5.5			
Sensor-to-Sensor Alignment (x,y)		µm	±125			
	Rotational Tolerance	°	±0.6°			
	Parallelism/Tilt	µm	<100			
	Z-axis sensor distance	mm	17.52±0.18	C-mount		
		mm	46.50±0.18	F-mount		
Time to calibrate		sec.	Typ			
	512		10			
	1024		17			
	2048		30			
Time to power up, typ		sec.	11			5
Forward/Reverse Switching Time, typ		ms	150			
Operating Ranges		**Units**	**Min**	**Max**		**Notes**
Data Rate		MHz	10	40		3
Line Rate	512	kHz	3.5	64.1		
	1024	kHz	3.5	34.8		
	2048	kHz	3.5	17.4		
Temperature		°C	0	50		
Temperature drift before recalibration, recommendation		°C		10		
RS232 Data Rate		kbps	9.6 (only)			
Photoresponse Variation across field of view (combining light source variation and lens vignetting)		DN		128 (7 bits)		2
Electro-Optic Specifications		**Units**	**Min**	**Typ**	**Max**	**Notes**
Average Broadband Responsivity, typ		DN/(nJ/cm^2)	730	1950	5850	
Dynamic Range		Ratio				1
	Minimum Gain		272:1	500:1		
	0dB Gain		174:1	350:1		
	Maximum Gain		63:1	120:1		
Pk-Pk Noise, max		Ratio	4	8	24	1
RMS Noise, max		Ratio	0.9	1.4	3.8	1
FPN uncorrected, max		DN	6	15	46	1
FPN corrected, max		DN	2	4	10	1,4
PRNU uncorrected, max		DN	14	23	54	1
PRNU corrected, max		DN	4	6	12	1,4
DC Offset, max		DN	3	5	7	1,6
Power Supply Current - Vin @ 12V		A				1
	512			420	480	
	1024			430	500	
	2048			450	540	

Notes:

DN = Digital Numbers (0-255); also known as gray levels.

1. Min, Typ, and Max are maximum values at the minimum, 0dB, and maximum gain levels. Tungsten halogen light source, 3200K bulb temp., and 750nm cutoff filter.
2. This specification represents the amount of variance across the field of view that the camera can compensate for with its FPN and PRNU correction algorithms.
3. Internal clock: Camera is selectable between 40, 20 and 10MHz data rates. External clock (EXRCLK): Range between 10-40MHz.

Notes:

4. This is the value the specification can meet when the camera is calibrated and remains at the calibrated temperature. It is recommended that after a >10°C temperature change the camera is re-calibrated because DC Offset, FPN and PRNU vary with temperature.
5. When coefficients are loaded, startup takes approximately 21 seconds for the 512 camera, 31 seconds for the 1024 camera, and 51 seconds for the 2048 camera–startup time will decrease with future generations of cameras.
6. DC Offset needs to be set at calibrated gain setting. Digital gain correction may be required to achieve maximum values.

Figure 2. Camera Interface

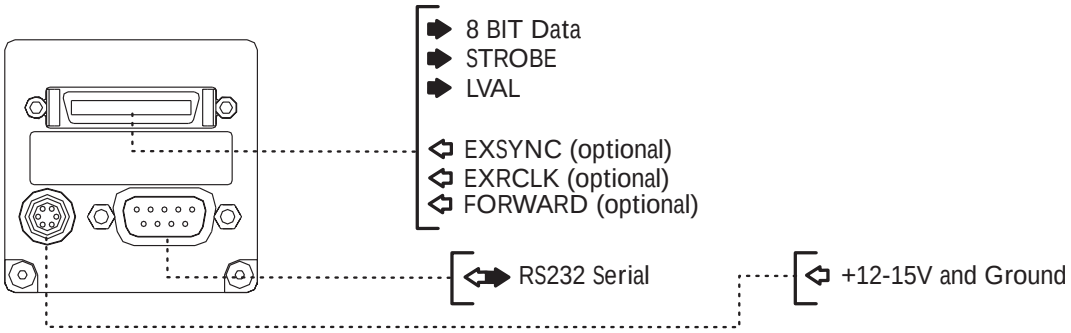
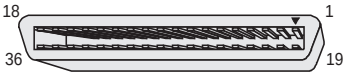


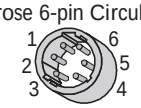
Figure 3. 68-Pin Data Connector Pinout

MDR36 Female



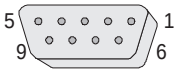
Mating Part: 3M 10136-6000EC series
Cable: 26AWG 100 Wshielded twisted pair

Hirose 6-pin Circular Male



Mating Part: HIROSE
HR10A-7P-6S

DB9 Female



"straight-through"
9-pin serial cable

Pin	Description	Pin	Description	Pin	Description	Pin	Description
1	N/U	19	N/U	1	+12-15V	1	Data Carrier Detect, N/U
2	N/U	20	N/U	2	+12-15V	2	Received Data
3	Future Use	21	Future Use	3	+12-15V	3	Transmitted Data
4	Future Use	22	Future Use	4	GND	4	Data Terminal Ready, N/U
5	EXRCLK	23	EXRCLKB	5	GND	5	GND
6	FORWARD	24	FORWARDB	6	GND	6	Data Set Ready, N/U
7	EXSYNC	25	EXSYNCB			7	Ready To Send, N/U
8	Future Use	26	Future Use			8	Clear To Send, N/U
9	D7	27	D7B			9	Ring Indicator, N/U
10	D6	28	D6B				
11	D5	29	D5B				
12	D4	30	D4B				
13	D3	31	D3B				
14	D2	32	D2B				
15	D1	33	D1B				
16	D0	34	D0B				
17	STROBE	35	STROBEB				
18	LVAL	36	LVALB				

Figure 4. IT-F7 Image Sensor

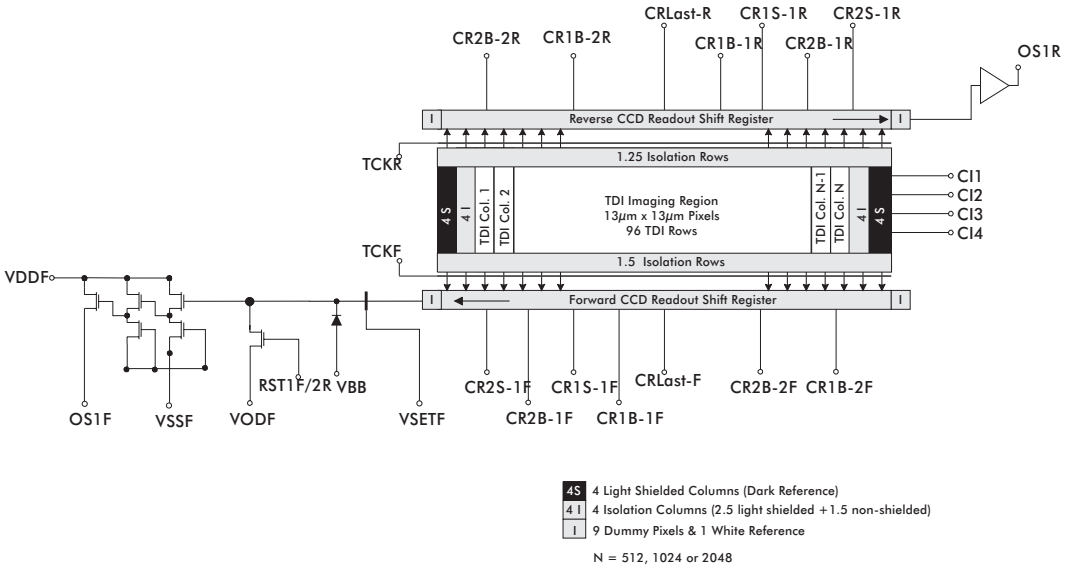
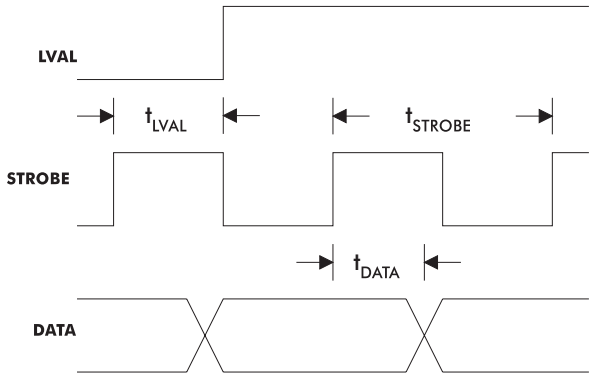


Figure 5. Timing



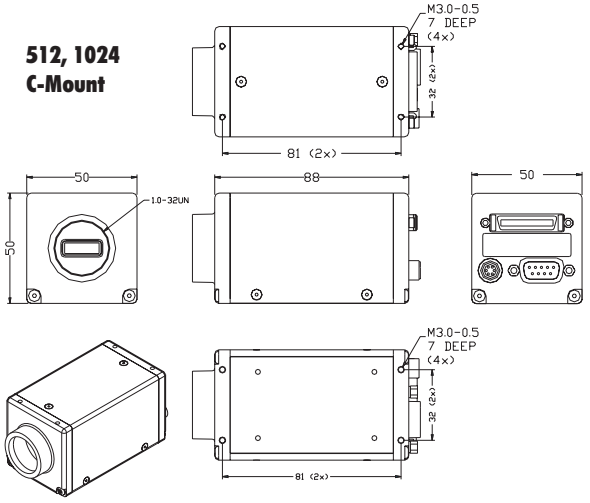
Symbol	Parameter	Units	Min.	Nom.	Max
t_{LVAL}	Strobe to LVAL	ns	12	15	18
t_{DATA}	Strobe to Data	ns	5	10	20
t_{STROBE}	Strobe period	ns	25	25	100

Notes

t_{LVAL} and t_{DATA} measured at 40MHz.

Figure 6. Mechanical Dimensions

512, 1024
C-Mount



2048
F-Mount