CCD Line Scan Camera Digital b/w SK4096CPD-L

4096 pixels, 10x10µm, 50 MHz pixel frequency, CameraLink interface

1 CCD line scan camera SK4096CPD-L mounting:

2 Focus adapter **FA16-45**

3 Lens APO-Rodagon N4.0/80

4 Mounting bracket SK5105-L

5 Mounting clamps SK5102-L

Characteristics:
- digital camera 8/12 bit
- line frequency up to 11.90 kHz
- anti-blooming
- integration control
- high dynamic range
- 100% optical fill factor
- CameraLink interface

Accessories (optional)

Cable set

for line scan cameras with CameraLink interface of the series CTO, CSD, CPD, CPT, CJR, CJRC composed of control cable and power supply cable.

1. Control cabel: 26-pin shielded cable, both sides with mini-ribbon connector (male, 26-pin).

SK9018.5 MM **Order Code**

MM= Connector both sides (male)
3 = 3 m cable length
5 = 5 m(standard cable length)
x = length customer specified

max. length =10 m

2. Cable for power supply: Shielded cable with connector Lumberg SV60 (male, 6-pin) and connector Hirose HR10A (female, 6-pin).

SK9015.5 MF **Order Code**

MF = Connector male / female
1.5 = 1.5m cable length (standard)
3 = 3 m cable length
x = length customer specified

Power supply

PS 051515 **Order Code**

Input: 100-240 VAC, 0,8A, 50/60Hz, input socket acc. IEC 320 (3-pin).

Output: 5VDC/2,5A, 15VDC/0,5A, -15VDC/0,3A, output socket Lumberg KV60 (6-pin, female), length 1m

Software

SK91CL-WIN **Order Code**

SKCLConfig: Configuration program for CCD line scan cameras with CameraLink interface (all grabbers)

SkLinScan®: operation program with oscilloscopic signal display (grabber has to be specified).

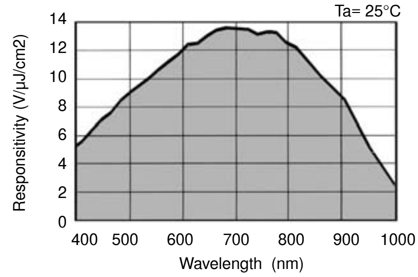
Lenses

high resolution lenses and macro lenses.
extension rings: ZR-L15, ZR-L25, ZR-L60, ZR-L87.
filter: for suppression of unrequested light.

Performance Specifications

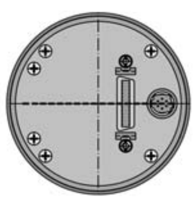
Camera type Order Code	SK4096CPD-L
Sensor:	CCD linear
Type:	IL-P1-4096 E
Pixel number:	4096
Pixel size:	10x10µm
Pixel distance:	10µm
Line width:	10µm
Active length:	41.00 mm
Pixel frequency:	50 MHz
Line frequ. max:	11.90 kHz
Line frequ. min:	0.05 kHz
Integration time min:	0.010 ms
Integration time max:	20.0 ms
Dynamic range:	1:2500
Spectral range:	400-1000 nm

Typical Spectral Responsivity



Input control signals:	MasterCock (optional) StartOfScan
Output signals:	LVAL
Video signal:	8/12 Bit digital
Interface:	CameraLink
Voltages:	+5 V, +15 V
Power Consumption:	2.7 W

Camera back



Connectors:
Data:
Mini D Ribbon, 26pin-female
Power:
Hirose Serie HR10A, 6pin-male

Work. temperature:	+ 5°C ... + 45 °
Case (Ø x T):	65 mm x 61 mm
Weight:	0.2 kg
Lens thread:	M45 x 0,75

Content: Page

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1. Technical specifications of the CPD camera series

Camera type	SK512CPD	SK1024CPD	SK2048CPD	SK4096CPD-L
Sensor:	CCD linear	CCD linear	CCD linear	CCD linear
Type:	IL-P1-512	IL-P1-1024	IL-P1-2048	IL-P1-4096
Pixel number:	512	1024	2048	4096
Pixel size:	10x10µm	10x10µm	10x10µm	10x10µm
Pixel distance:	10µm	10µm	10µm	10µm
Line width:	10µm	10µm	10µm	10µm
Active length:	5.12 mm	10.24 mm	20.50 mm	41.00 mm
Anti-Blooming	ja	ja	ja	ja
Integration Control	ja	ja	ja	ja
CDS 1)	ja	ja	ja	ja
Pixel frequency:	50 MHz	50 MHz	50 MHz	50 MHz
Line frequency max:	83.00 kHz	45.00 kHz	23.00 kHz	11.90 kHz
line frequency min:	0.05 kHz	0.05 kHz	0.05 kHz	0.05 kHz
Integration time min:	0.010 ms	0.010 ms	0.010 ms	0.010 ms
Integration time max:	20.0 ms	20.0 ms	20.0 ms	20.0 ms
Dynamic range:	1:1500	1:1500	1:1500	1:2500
Spectral range:	400-1000 nm	400-1000 nm	400-1000 nm	400-1000 nm
Video signal:	8/12 Bit	8/12 Bit	8/12 Bit	8/12 Bit
Interface:	Camera Link	Camera Link	Camera Link	Camera Link
Voltages:	+5V, +15V	+5V, +15V	+5V, +15V	+5V, +15V
Power consumption	2.3 W	2.4 W	2.6 W	2.7 W
Lens thread:	C-Mount	C-Mount	M40x0.75	M45x0.75
Case (Ø x T):	Ø65mm x 52,4 mm	Ø65mm x 52,4 mm	Ø65mm x 54 mm	Ø65mm x 61mm
Weight:	0.2 kg	0.2 kg	0.2 kg	0.2 kg
Working temperature:	+ 5°C ... + 45 °	+ 5°C ... + 45 °	+ 5°C ... + 45 °	+ 5°C ... + 45 °

1) CDS = Correlated Double Sampling. Noise reduction technology, increase of photosensitivity.
2) Longer exposure times are possible, but the signal-to-noise ratio will be reduced.

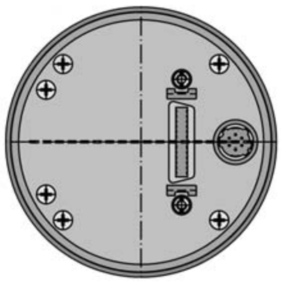
2. Handling details of the CameraLink line scan camera

A successful application of the line scan camera is based upon a careful adjustment of the whole optical system. Attention should be paid to the arrangement of the illumination, the aperture setting, the focussing range of the lens, as well as the orientation of the sensor axis to the scanning direction.
The line scan camera needs a CameraLink grabber with Base-Configuration. The grabber generates the StartOfScan (SOS) signal which controls the exposure time and the line frequency of the camera.
With the configuration program SkCLConfig by Schäfter+ Kirchhoff, line scan camera parameters, e.g. gain, offset, and pixel frequency, are adjusted via serial interface of the CameraLink interface. For this the software uses the clser***.dll, which is attached to all CameraLink grabbers. The software SkCLConfig is included in the shipment of the camera.

For selected grabbers[1] **Schäfter+Kirchhoff** supplies the operating program **SkLineScan**® with oscilloscopic display for plotting line scan signals with zoom function and for online camera parameter setting in order to set up the optical system conveniently. The adaptation of SkLineScan program to other costumer specified CameraLink grabbers is possible.
The camera is shipped aligned and with default settings in gain and offset. Extensive modifications of the gain/offset-parameters can lead to a decrease in signal quality.
The last programmed gain/offset values keep stored in the camera after disconnecting the camera from the PC and are active at the next connection of the camera.

[1] Matrox series, CORECO, NI-PCI 1428, microEnable III

3. Connecting and Control Signals



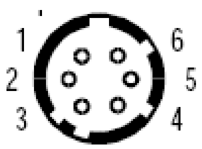
Connector:

Data:
Mini D Ribbon,
26pin-female

Power:
Hirose series HR10A,
6pin-male

Voltage Supply

+ 5 V	± 5%	ca. 300 mA	(25 MHz Clock)
		ca. 430 mA	(50 MHz Clock)
+15 V	± 5%	ca. 35 mA	



Signal	Pin	Signal	Pin
+ 15 V	1	+ 5 V	4
+ 15 V	2	GND	5
+ 5 V	3	GND	6

Pin Assignment

Mini D Ribbon 26 pin female

Signal	Pin		Pin	Signal
GND	1	o o	14	GND
X0-	2	o o	15	X0+
X1-	3	o o	16	X1+
X2-	4	o o	17	X2+
Xclk-	5	o o	18	Xclk+
X3-	6	o o	19	X3+
SerTC+	7	o o	20	SerTC-
SerTFG-	8	o o	21	SerTFG+
CC1-	9	o o	22	CC1+
CC2+	10	o o	23	CC2-
CC3-	11	o o	24	CC3+
CC4+	12	o o	25	CC4-
GND	13	o o	26	GND

Control Signals

Input control signals:

The camera uses only the control signals "Clock" (MCLK) and "Start Of Scan" (SOS) for operation. A 50-MHz-oscillator generates the Clock signal internally. Alternative it's possible to reduce this frequency by a frequency divider to 25 MHz pixel frequency. Optionally the clock signal can be fed in externally. The camera electronic reacts on the edges of the signals, which - according to this - should be 'clean'.
The frequency of the 'Start of Scan' signal determines the number of lines per second. On the positive edge of the signal, the collected charge carriers of all pixels are transferred to the analog shift register of the line sensor and are read out in time with the clock signal.
The frequency of the clock signal determines the rate with which the charge carriers of the individual pixels of a line sensor appear at the video output of the camera. With every positive edge the charge carriers of the next pixel are shifted to the video output.
The clock and 'Start of Scan' signals need no synchronization. The clock frequency should be selected in such a way that between two following 'Start of Scan' signals sufficient clock pulses are available for reading out the camera. For full read out of a line scan the camera SK4096CPD-L requires 4180 clock pulses. A larger number of pulses is no problem.

MCLK: Master-Clock in: determines the frequency of the pixel transport 50 MHz max.

SOS: Start of Scan: 30 ns minimal pulse length.
With the frequency of the SOS signal the line frequency of the camera is controlled.
The rising edge of the SOS signal determines the start of the read out process. The charge carriers inside the sensor are transferred to the analog transport register parallel to the sensor line.

4. Interface

Camera Control

Signal Name	I/O	Type	Description
TRIG1	I	RS644	CC1 - Synchronzation input (SOS)
TRIG2	I	RS644	CC2 - Start of integration period in the dual synchro mode (only cameras with integration control)
CLK_IN	I	RS644	CC3 - External pixel clock (optional)

I= Input, O= Output, IO= Bi-Directional, P= Power/Ground, NC= not connected,
Advice: CC4 is not used

Video Data

For transmission of high-speed video data from the camera to the frame grabber the differential LVDS signals X0-X3 and XCLK are reserved. The Video data between camera and grabber are transmitted via several serial channels. The basic principle of the serial protocol is built by the Channel Link Chip set by National Semiconductor. The CameraLink standard defines the pixel signal names, the description of the signal level as well as the connector pin assignment and the pin content of the chip.

Signal Name	I/O	Typ	Description
D[0-11]	O	RS644	Pixel Data, 00= LSB, 11= MSB
STROBE	O	RS644	Output Data Clock, With rising edge data are not valid
LVAL	O	RS644	Line Valid, aktiv High Signal

I= Input, O= Output, IO= bi-directional, P= Power/Ground, NC= not connected,
Advice: FVAL, as defined in the CameraLink standard, is not used here. FVAL is permanently set to 0(Low) level. DVAL is not used. DVAL is permanently set to 1(High) level.
With Single output, data are output on ODD (multiplex).

Bit allocation 12-bit data (F12)

Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name
D 0	Tx0	D 7	Tx5	NC	Tx19	NC	Tx14
D 1	Tx1	D 8	Tx7	NC	Tx20	NC	Tx10
D 2	Tx2	D 9	Tx8	NC	Tx21	NC	Tx11
D 3	Tx3	D 10	Tx9	NC	Tx22	STROBE	TxCLK
D 4	Tx4	D 11	Tx12	NC	Tx16	LVAL	Tx24
D 5	Tx6	NC	Tx15	NC	Tx17		
D 6	Tx27	NC	Tx18	NC	Tx13		

Bit allocation 8-bit data (F8)

Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name	Bit	DS90CR285 Pin Name
D 0	Tx0	D 7	Tx5	NC	Tx19	NC	Tx14
D 1	Tx1	NC	Tx7	NC	Tx20	NC	Tx10
D 2	Tx2	NC	Tx8	NC	Tx21	NC	Tx11
D 3	Tx3	NC	Tx9	NC	Tx22	STROBE	TxCLK
D 4	Tx4	NC	Tx12	NC	Tx16	LVAL	Tx24
D 5	Tx6	NC	Tx15	NC	Tx17		
D 6	Tx27	NC	Tx18	NC	NC		

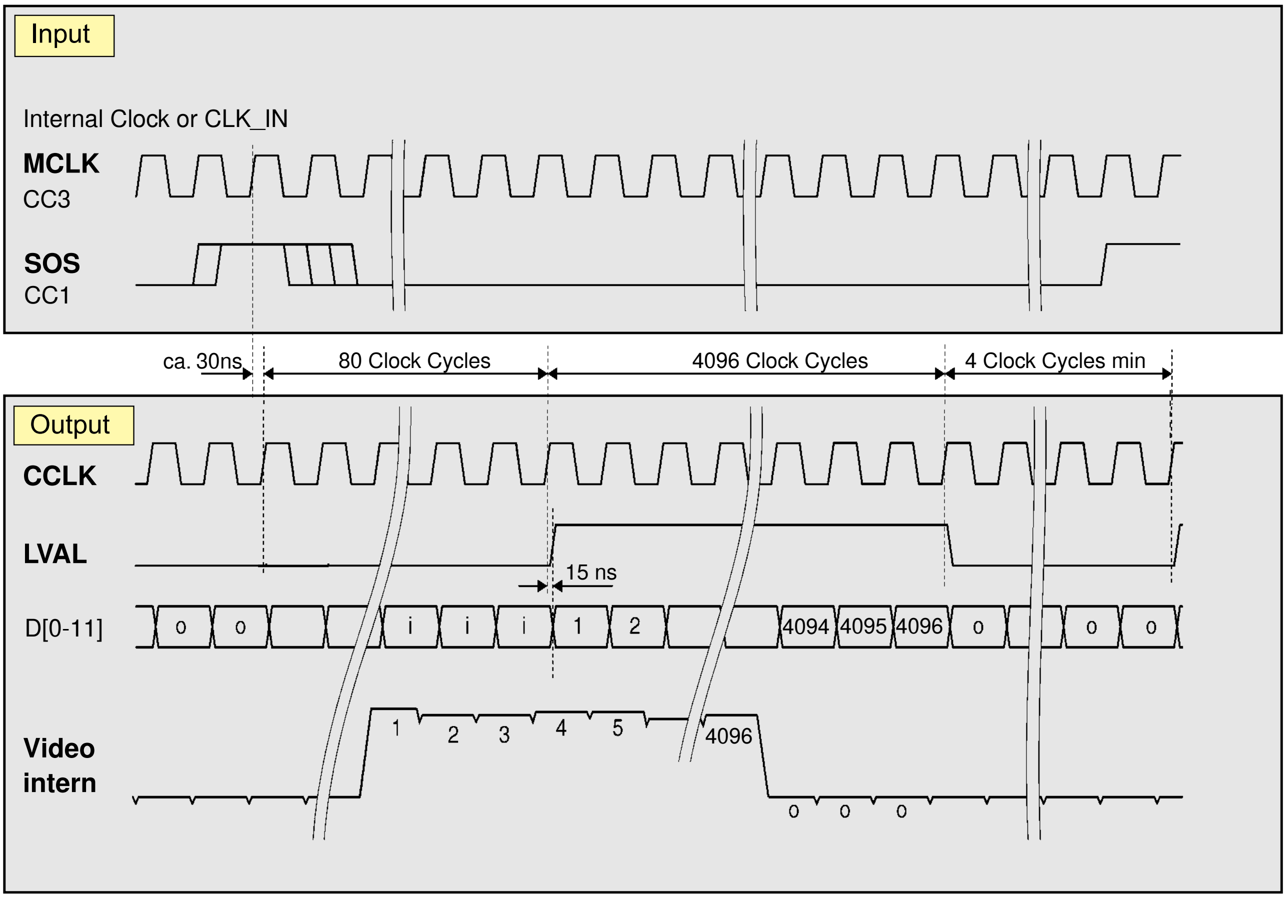
The bit allocations are conform with the CameraLink specifications in the base configuration

Serial communication

Signal name	I/O	Type	Description
SerTFG	O	RS644	Differential pair for serial communication to the frame grabber
SerTC	O	RS644	Differential pair for serial communication from the frame grabber

The CameraLink interface supports two LVDS signal pairs for the communication between camera and frame grabber. This asynchronous serial communication is based on the RS232 protocol.
The configuration of the serial line is:
- full duplex / without handshake
- 9600 bauds, 8-bit data, no parity bit, 1 stop bit

5. Timing Diagram



The black level pixels are located 7 to 20 pixels before pixel #1.

i = isolation pixels
o = overclocking

6. Configuration program SKCLConfig

The configuration program SKCLConfig is a tool for programming the CameraLink camera and its status request. It communicates with the camera via the serial interface of the CameraLink interface. For this purpose, the program uses the clser***.dll, which is inscribed in the system register when installing the grabber. The DLL name begins with the standard 'clser' and contains specific characters of the grabber manufacturer (***). As the commands in the DLL are standardized, the program operates with any grabber that fulfils the CameraLink standard. In case more than one clser***.dll's are installed on the computer, the program operates with the DLL it detects first. The DLL name is displayed.
At the start, information about type, revision and serial number of the camera are requested. In the field "Type" the name of the camera must be displayed.

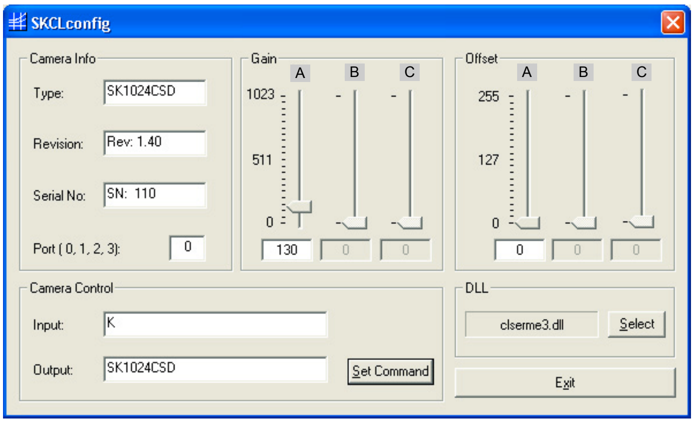
Gain / Offset Adjustment

After the start of the SKCLConfig program the sliders for gain and offset are positioned according to the values stored in the camera. With the sliders the settings for gain and offset can be modified. The maximum possible amplification for the camera signal is 36dB (gain=1023). When varying gain and offset, the camera line signal should be monitored (e.g. with the SkLineScan program). With increasing amplification, noise is also raised - the signal-to-noise ratio degrades.

The camera is provided with optimum gain/offset adjustment (base setting). After modifying gain and offset, a new calibration can be necessary. This is achieved as follows:
1. **Offset**:
With shaded sensor the video signal is set near to 0 with the offset slider A. The line signal should visible still remain visible.

2. **Gain**:
The sensor is slightly overexposed. With the gain slider A the limit of the video signal is set to about '255' (8-bit data) or higher.

With cameras with two-channel sensors, the sliders B for gain and offset are activated automatically. The intensities of even and odd pixels are brought into line at the best.



Camera Commands

Command	Feedback	Description
Gxxxx<CR>	0=ok, 1= not ok	set gain 6 - 36 dB / single or even Gain (xxxx= 0-1023)
Bxxxx<CR>	0=ok, 1= not ok	set gain 6 - 36 dB / odd Gain (xxxx= 0-1023)
Oxxx<CR>	0=ok, 1= not ok	set offset / single or even offset (xxx= 0 - 255)
Pxxx<CR>	0=ok, 1= not ok	set offset / odd offset (xxx= 0 - 255)
F8<CR>	0=ok, 1= not ok	output format: 8 Bit data
F10<CR>	0=ok, 1= not ok	output format: 10 Bit data
F12<CR>	0=ok, 1= not ok	output format: 12 Bit data
C25<CR>	0=ok, 1= not ok	pixel clock: 25 MHz*)
C50<CR>	0=ok, 1= not ok	pixel clock: 50 MHz*)
T0<CR>	0=ok, 1= not ok	test pattern off
T1<CR>	0=ok, 1= not ok	test pattern on
M1<CR>	0=ok, 1= not ok	extern trigger CC1 input
M2<CR>	0=ok, 1= not ok	free run with max line rate
M3<CR>	0=ok, 1= not ok	ext. trigger & integr. CC1 input
M4<CR>	0=ok, 1= not ok	ext. trigger CC1, int. CC2 input
K<CR>	SK4096CPD<CR>	SK type number
R<CR>	Rev1.20<CR>	revision number
S<CR>	SNr00140<CR>	serial number
I<CR>	SK4096CPD<CR> Rev1.20<CR> SNr00140<CR>	camera identification
I1<CR>	VCC:00501<CR>	returns operation voltage VCC
I2<CR>	VDD:01523<CR>	returns operation voltage VDD
I4<CR>	CLo:00025<CR>	camera clock low frequency
I5<CR>	CHi:00050<CR>	camera clock high frequency
I6<CR>	Ga1:00043<CR>	get single or even gain
I7<CR>	Ga2:00044<CR>	get odd gain
I8<CR>	Of1:00011<CR>	get single or even offset
I9<CR>	Of2:00009<CR>	get odd offset

*) Commands for programming the pixel frequency are composed of the character 'C' and a number nn. Valid values for nn are obtained by 'I4<CR>' (low),- or 'I5<CR>' (high), respectively !

7. Illumination and Integration Control

The camera SK4096CPD-L has a maximum line frequency of 11.90 kHz. The programmable range for the illumination period amounts to 0.08 ms to 20.0 ms.
For programming the minimum illumination period or the maximum line frequency, respectively, the timing between two SOS signals minimum has to least N= 4096 pixel clocks plus sensor-dependent passive pixel clocks N_P. The camera SK4096CPD-L has 84 of these.
Read out velocity is determined by the pixel frequency (MCLK).
The illumination period (exposure time) T_E of a camera is calculated as follows:

$$T_E = \frac{(N + N_P)}{fp}$$

The line frequency results as:

$$f_L = 1 / t_E$$

Example: SK4096CPD-L
50 MHz pixel frequency

t_E = (4096+ 84) / 50 MHz
t_E = 0.084 ms

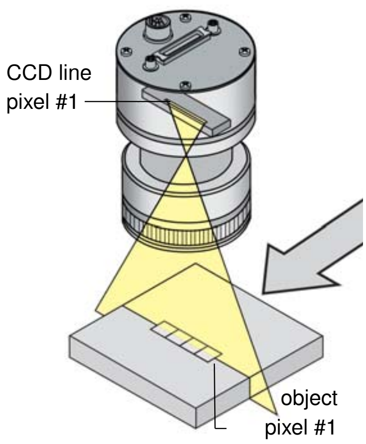
f_L = 50 MHz / (4096 + 84)
f_L = 11.90 kHz

8. Image generation

A two-dimensional image is generated by moving either the object or the camera. The direction of transport is upright to the sensor axis of the CCD line scan camera.
A proportional image with correct aspect ratio requires a line-synchronous feed motion.

$$V_O = \frac{W_P \cdot \beta}{t_E} \quad [1]$$

V_O = Objekt speed
W_P = Pixel width
β = Reproduction scale
t_E = Exposure time



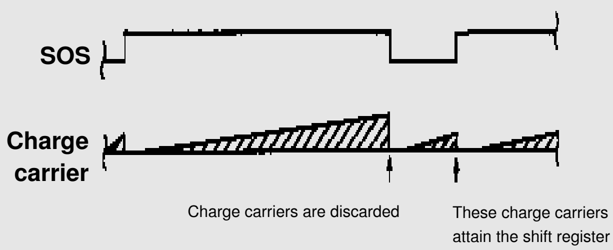
Technical details on illumination:
Charge carriers originating from light shining in within a specific time interval are stored by the light-sensitive elements of the sensor. The accumulated charges are converted to voltage values. The voltage values indicate the intensity of light falling on the individual pixels.
Integration time is the time within the charge carriers are accumulated.
The **illumination period** (or **exposure time) T_E** is the time within the charge carriers of the line sensor. It is determined by the time between two following edges of the SOS signal.
The maximum line frequency results as **$f_{L\,max} = 1/T_E$**.
Cameras with **integration control** function are able to shorten the integration time within an illumination period (shutter). As the illumination period stays constant, the line frequency is not affected by this operation.

Integration Control (SK4096CPD-L)

With the camera in normal mode, the SOS signal between two illumination periods is set to 'high' only for a few pixel clocks. Integration time and exposure time are almost equal.
The integration control function allows for extending the 'high' pulses in the SOS signal to a programmable number of pixel clocks. Through this the start of charge accumulation within the illumination cycle is delayed.
The integration time t_A is shortened to the difference of the minimum required pixel clocks within a illumination cycle (N + N_P) and the programmable number of clocks to prolongate the 'high' pulses in the SOS signal (SOSL).
The line frequency is not affected by the integration control function.

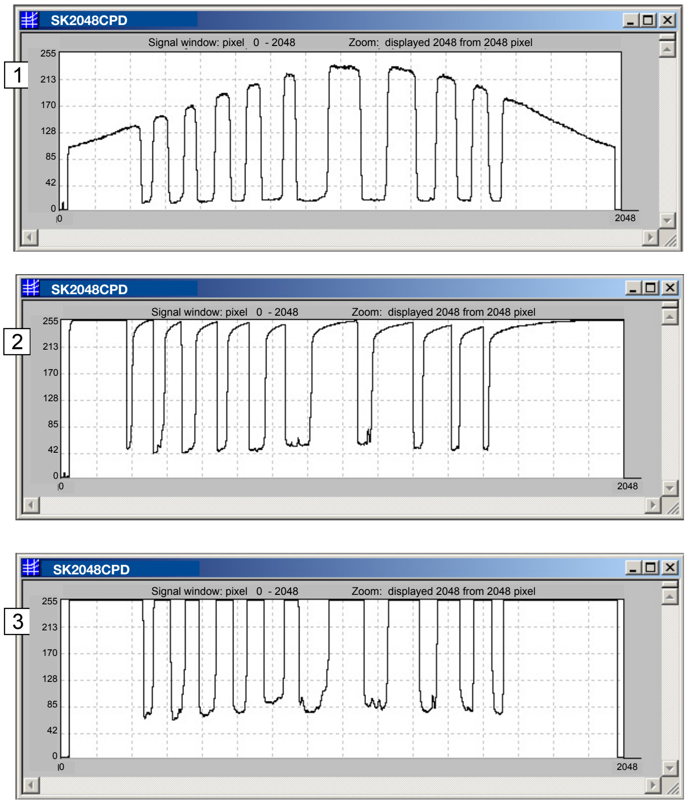
$$t_A = \frac{(N + N_P) - SOSL}{fp}$$

Functionality of the integration control function



9. Blooming

Blooming
Pixels which are saturated caused by over-exposure, i.e. cannot accumulate more charges, partly transfer their charges to neighboring pixels. This effect is called blooming. Blooming leads to corruption of the geometrical mapping between signal and image on the line sensor.
CCD line scan cameras with anti-blooming sensor drain the charge surplus in case of over-exposure via a 'drain gate'. Neighboring, less exposed pixels are not filled any more. In spite of over-exposure, the signal structure is maintained accurately.



Oscilloscopic displays of CCD line signals (bar code with incident light), SK2048CPD

[1] CCD line signal with center-accentuated illumination and steep signal edges. Integration time t_A= 0,158 ms

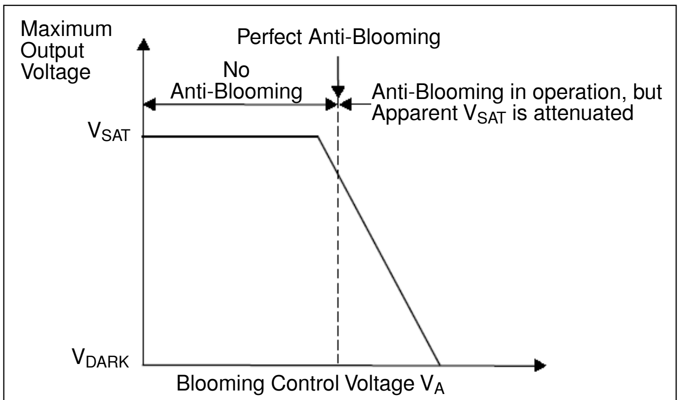
[2] Over-exposure by means of longer integration time (t_A= 0,533 ms). The blooming effect in the sensor is initiated by modifying the blooming control voltage (low V_A). Signal structures are distorted.

[3] Blooming control voltage limits the output signal of the sensor to approx. 90% of the saturation voltage V_{SAT}. The anti-blooming function is active. With even longer integration time (t_A= 0,806 ms), the edge positions of Figure [1] are maintained.

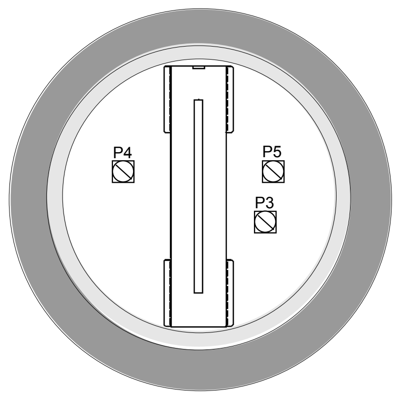
CCD line scan cameras of the CPD series feature an anti-blooming sensor and thus have a protection against over-exposure. However, the blooming drain gate has limited capacity. In general:

The less pixels are overexposed, the better the anti-blooming effect of the drain gate. For individual pixels the charge surplus of up to the 50-fold saturation charge is drained. With an increasing number of overexposed pixels, the drainable charge surplus is reduced.

The electronic of the CPD camera series supports the blooming-control features of the sensor. The saturation charge is controlled by the blooming control voltage V_A. The higher V_A , the earlier the anti-blooming effect begins. Thus, setting V_A to a high value improves the protection against over-exposure, however it limits the output voltage of the video signal and thereby reduces the dynamic of the camera. On the other hand, setting the voltage V_A too low, the anti-blooming effect is turned off. The maximum Output voltage of the sensor reaches the saturation voltage V_{SAT}.



By default the blooming control voltage V_A is set in a way that the output voltage of the camera reaches 90% of the saturation voltage V_{SAT}.
Thus optimum anti-blooming effect is assured. The Voltage V_A should only be altered in exceptional cases.
Blooming control voltage V_A is adjustable with the trimming resistor P3. When the trimming resistor is turned to left, voltage V_A is increased. By right turn, voltage V_A is reduced. At the right mechanical stop, anti-blooming is turned off.



camera board, sensor side

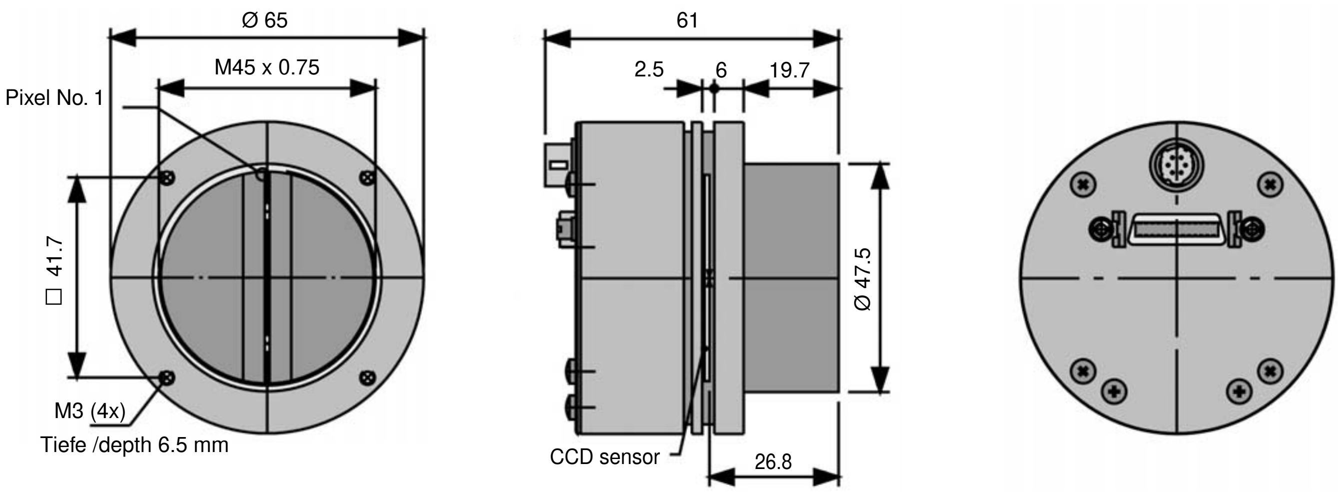
With unscrewed lens the trimming resistor P3 can be adjusted from the front side of the camera.
To avoid misadjustment of the line scan camera, the effect of the P3-modification should be observed with sufficient illumination in the oscilloscopic display on the PC monitor.

10. Dimensional Drawings

1. CCD line scan camera SK4096CPD-L mounted with:
2. Focus adapter **FA16-45**
3. Lens APO-Rodagon N4.0/80
4. Mounting bracket SK5105-L
5. Mounting clamp SK5102-L

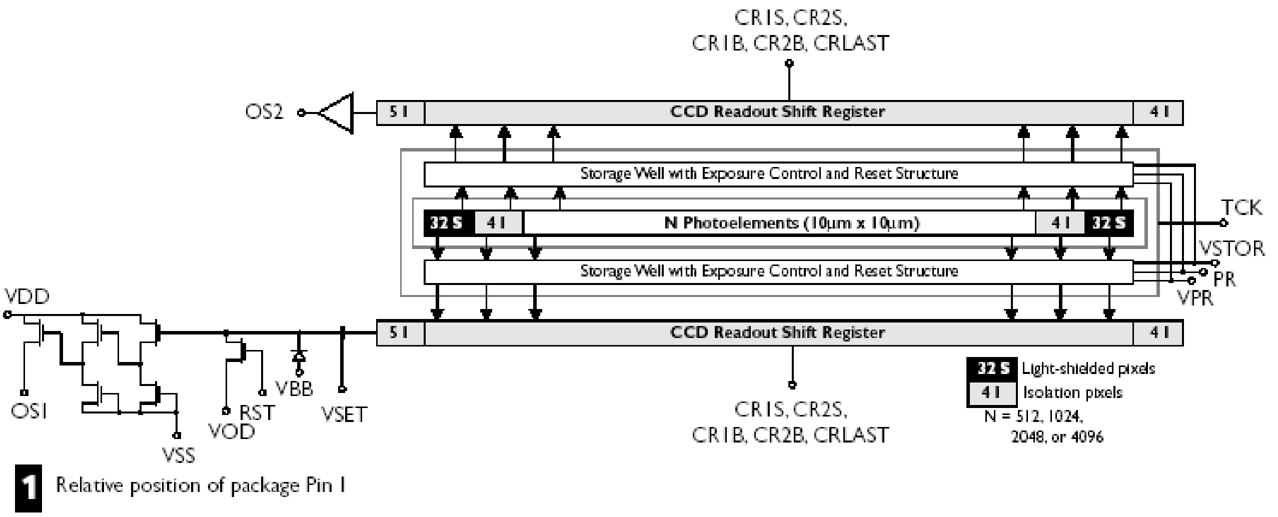
CameraLink case group **AC3**

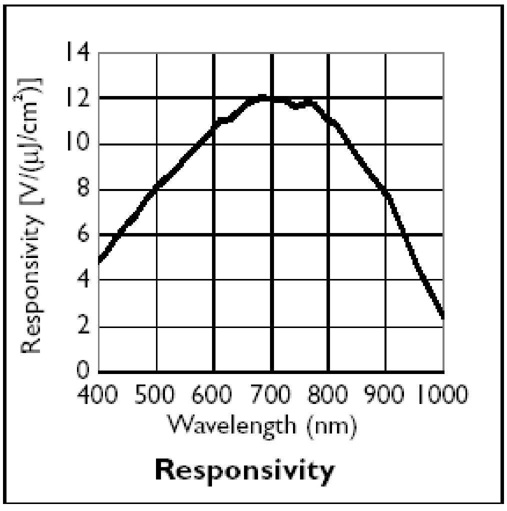
Lens thread **M45 x 0.75**

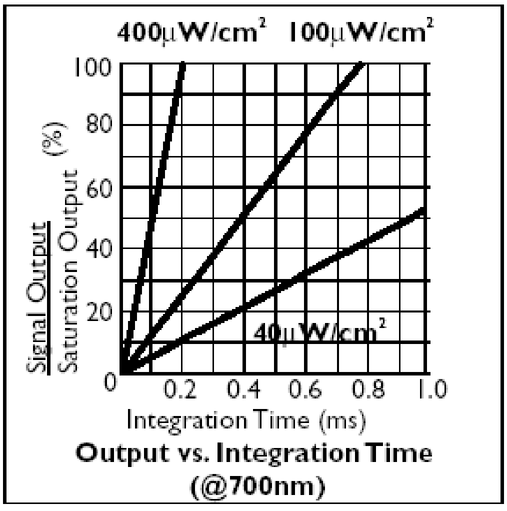


11. Sensor Data

Manufacturer: DALSA®
Type: IL-P1-4096 E
Data source: DALSA® Line Scan Sensors ,DALSA IL-P1 - Data Sheet







Specification		Unit	Min.	Typ.	Max.
Saturation Output Voltage (VSAT)		mV	700	900	1100
rms Noise		mV		0.28	0.31
Wavelength of Peak Responsivity		nm		700	
Peak Responsivity		$V/(\mu J/cm^2)$	12.6	13.8	15.5
Dynamic Range			2250:1	3200:1	3900:1
Charge Conversion Efficiency (CCE)		µV/e	5.4	5.7	6.1
Noise Equivalent Exposure (NEE)		pJ/cm^2	18	20	25
Saturation Equivalent Exposure (SEE)		nJ/cm^2	45	65	
Full Well Capacity		ke	115	158	
Fixed Pattern Noise (FPN) [1,2]	PR exposure control disabled	mV		0.5	1.0
	PR exposure control enabled	mV		2.0	5.0
Photoresponse Non-Uniformity (PRNU) [3,4]		% OS			
PR exposure control disabled	8 pixel local neighborhood			2.2	6.0
	Global			3.5	8.5
PR exposure control enabled	8 pixel local neighborhood			2.5	6.5
	Global			3.8	8.8
Charge Transfer Efficiency (CTE) (readout register)			0.99999	0.999999	
First Field Lag [5]		mV		11.5	
Dark Signal, Integration time = 84µs		mV		0.15	0.5

Notes:

1. Maximum peak-to-peak variation of all outputs.
2. Due to its general purpose design, DALSA's camera and sensor evaluation hardware provides an output that cannot be used to directly measure low FPN.
3. The peak-to-peak variation is measured at ~50% SEE.
4. With output gain mismatch correction.
5. Lag is measured at VSAT with f_{LINE} = 10kHz.

Test Conditions:

- Operating temperature = 35°C.
- f_{RST} = data rate per output = 25MHz.
- I_{LOAD} = 8mA.
- C_{LOAD} = 10pF
- Tungsten halogen light source, black body color temperature 3200K, filtered with 750nm IR cutoff filter.
- See Sensor Measurement Definitions (doc# 03-36-00149) for specification definitions.

12. References and warranty

This technical manual was provided with largest care. However no guarantee is given that it is free of errors and mistakes. For the indicated circuits, descriptions and tables no guarantee is assumed concerning third party rights.
With the data in the technical descriptions assembly groups are specified, no characteristics are assured.
The warranty for the CCD line scan camera amounts to 24 months. The warranty expires with inappropriate interferences.

13. European Union Conformity Explanation

CE

This product is in accordance with the EC Directive 89/336/EWG. The requirements of DIN EN 61326 are accomplished.