

# High Resolution Low Light Cameras



## PROXICAM

### Applications

- High Sensitivity from 180 nm to 900 nm
- High Resolution
- Low Noise
- Video Signal Output
- Compact Size
- Wide Dynamic Range
- Digital Control Unit

### Features

- Fluorescence Microscopy
- Astronomy
- Low Light Level Microscopy
- Electron Microscopy
- Security
- Surveillance
- UV measurement
- Single Photon Counting

Low Light Cameras  
Special Purpose Cameras

Short Exposure Cameras  
Pulse Generators

Fiber Optical Coupling  
Phosphor Coatings

Detector and Camera Upgrades  
and Customised Prototyping

Solar Blind & Visible  
Image Intensifiers

UV & X-Ray Cameras  
Corona Detection Cameras

Customised Facilities  
& Equipment

Vacuum &  
Open MCP Detectors

ProxiVision, a leading manufacturer of "Image quality" Intensifiers, has more than ten years of experience in fiber optic coupling of image intensifiers to CCD detectors.

As a result of this expertise, ProxiVision has developed and produces a broad range of Intensified CCD Cameras for a wide variety of applications in industry, science, research, and low light surveillance.

PROXICAM® - low-light-cameras made by ProxiVision are designed for use in applications where normal CCTV cameras don't see anymore:

### High Grade Image Quality

ProxiVision developed the direct fiberoptical coupling for the optical connection between the image intensifier and the CCD which allows the most efficient light transmission together with high resolution and image quality.

### High Sensitivity

The HL cameras are an extremely sensitive camera ideal for very low light situations. It incorporates a high sensitivity, high resolution image intensifier making it many times more sensitive than a standard CCD camera.

At low-light conditions and events with weak light emission like bioluminescence, chemoluminescence, fluorescence, and when the spectral range of a CCD camera is not sufficient.

### Spectral Sensitivity

from 180 nm to 900 nm to cover the entire spectrum.

### UV Sensitivity

Especially for the difficult visualization of ultraviolet radiation ProxiVision produces cameras with UV-sensitive - and even solar-blind - photocathodes.

### X-ray visualization

The big variety of applications includes security surveillance with auto-iris lenses as well as microscope adaption with the control panel and X-ray visualisation with built-in X-ray converter screens.

### Digital Control Unit

The new high-quality camera electronics in CCIR TV standard guarantees signal processing and readout at its best. With an optionally available digital control unit the cameras are optimised for operation with most digital image processing computers.

### C-Mount Input

C-mount lens input is standard format. Other lenses such as Nikon, Olympus, etc., may be used with the appropriate adapters, thus making the HL cameras easy to adapt to any system.



Front view of the light camera with c-mount input adapter.

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### Video Signal Output

CCIR 625 lines or EIA (RS-170) 525 lines.



Rear view of HL5 low light camera with standard connectors and optional output signals PC, VD and HD.

### Many Applications

Examples of applications are found in the pharmaceutical research where fluorescent cells are taken with the microscope camera and measured by an image processing system. At the production of integrated circuits, a UV-sensitive camera is used to measure finest structures in the micron range. Maritime biologists use a camera with a high-resolution Inverter image intensifier to observe little plankton animals in their innate environment under water. Astronomers utilize the extremely high gain of a camera with an image intensifier cascade to track weakest stars...

### Easy To Use

The HL cameras may be easily mounted onto a microscope or attached to any lens and the output connected to either a video monitor, frame grabber or video recorder. An overload protection to protect the image intensifier makes using the camera very simple. The sensitivity increases over a standard CCD camera and will allow for imaging under low light conditions which were previously impossible.



Camera fits perfectly to a microscope with a c-mount output.

### Compact Size

Light weight and completely integrated into one very small, self-contained unit.

### Development for Customers

In addition to the camera types mentioned in this data sheet, ProxiVision offers custom-designed versions developed in close cooperation with the user.

**Give us your requirement -  
we'll find a solution.**

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# PROXICAM - Type guide

## PROXICAM HR0

As a basis for all PROXICAM<sup>®</sup> low light cameras, a new CCD camera electronics with many unique features has been developed in order to utilise the geometrical resolution available by image intensifiers and also to perform in a wide range of applications without image intensifiers. Determining for the high resolution is the broadband processing of the video signal supplied by the CCD type SONY ICX 083 with 756 x 581 in the CCIR version and SONY ICX 022 with 768 x 493 pixels in the EIA version by use of high quality amplifiers and filters. This combination of high quality components results in a limiting resolution of 7 MHz (equivalent to 560 TV-lines) and a modulation depth of 55 % at 5 MHz (equivalent to 400 TV-lines).

Various signal inputs and outputs provide the use of the PROXICAM<sup>®</sup> HR 0 in all applications where CCTV cameras are required. The video output signal complies with the CCIR standard. Optionally, control via a computer interface is provided.

### Resolution and Modulation Transfer Function of HR0 (MTF):

Resolution [MHz]	0,5	1	2	3	4	5	6	7
Resolution [TVL]	40	80	160	240	320	400	480	560
MTF [%]	100	100	95	85	65	55	35	5

## PROXICAM HR1 / HL1

**Assembly HR1:** Basic camera HR 0 with direct fiberoptically coupled proximity focus intensifier diode PROXIFIER<sup>®</sup>. (HL1: Assembly like HR1, but without direct coupling).

**Features:** Image diagonal 11 mm, absolutely no geometric distortion, wide dynamic range, high resolution, insensitive to magnetic stray fields, variety of photocathodes selectable from UV to near IR, specially suitable for measuring in the UV range.

## PROXICAM HR5 / HL5

**Assembly HR5:** Basic camera HR 0 with direct fiberoptically coupled 18:11 minifying Inverter intensifier diode. (HL5: Assembly like HR5, but without direct coupling).

**Features:** Image diagonal 18 mm, wide dynamic range, high resolution, extremely low noise, specially suitable as microscopy camera.

## PROXICAM HL4 S / HL4 V

**Assembly HL4 S:** Basic camera HR 0 with proximity focus MCP intensifier MCP-PROXIFIER<sup>®</sup> coupled with 18 : 11 minifying fiber taper (HL4 V: Assembly like HL4 S, but with double-MCP-PROXIFIER<sup>®</sup>, coupled with 25 : 11 minifying fiber taper).

**Features HL4 S:** Image diagonal selectable 18 mm or 25 mm, high light sensitivity at relatively low noise, variety of photocathodes selectable from UV to near IR, specially suitable for real time recording at extremely low light.

**Features HL4 V:** Image diagonal 25 mm, high light sensitivity, variety of photocathodes selectable from UV to near IR, specially suitable for scientific applications at low light down to single photon counting.

## PROXICAM HLA

**Assembly:** Basic camera HR 0 with proximity focus MCP intensifier MCP-PROXIFIER<sup>®</sup> as input, fiberoptically coupled to minifying Inverter intensifier as booster.

**Features:** Image diagonal 18 mm, extremely high light sensitivity in a wide spectral range due to high-gain intensifier cascade, variety of photocathodes selectable from UV to near IR, specially suitable for scientific applications at low light down to single photon counting.

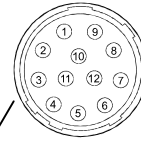
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# Controls and Connectors

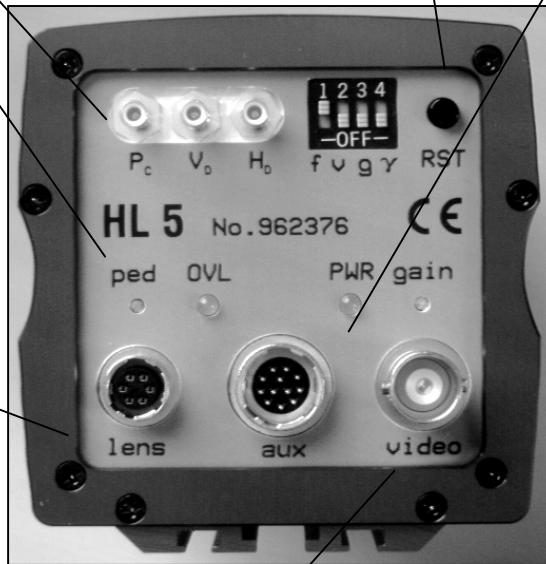
Optional signal outputs (please order P <sub>C</sub> , V <sub>D</sub> , H <sub>D</sub> )
Pixel clock out (50 Ohm driver)
H <sub>D</sub> out (50 Ohm driver)
V <sub>D</sub> out (50 Ohm driver)

Camera controls
Power-on indication LED
Overload indication LED
Blacklevel
Manual Video gain control
Manual MCP gain control (only for HL4 cameras)
Overload reset button

Multifunctional DIP switch	
1	Field / Frame select
2	Video on / off
3	Automatic Gain Control (AGC) off / on
4	Gamma control 1 / 0.45



12 pole connector H IR 10A-10P-12P	
1	GND
2	Power + 10 .. 17 V
3	GND
4	CVS video (75 Ohm)
6	V init
7	V <sub>D</sub> in
8	GND
9	H <sub>D</sub> in
11	Integration Control
12	GND



6 pole connector Hirose HR 10A-7P-6P	
1	B <sub>2</sub>
2	GND
3	Video Lens (CVS lens control out CVS lens power (= power in) or (Motor lens 1 and 2 out))
4	Power + 10 .. 17 V
5	B <sub>0</sub> (Speed) CCD shutter function
6	B <sub>1</sub>

BNC connector	
	CVS video out (75 Ohm driver)
	GND

## Standard Blemish Specification

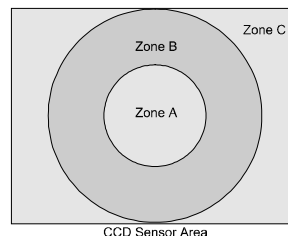
Blemish size (Largest dimension in TV-lines)	Zone A	Zone B	Zone C
up to 1	minimal*	minimal*	minimal*
up to 3	2	minimal*	minimal*
up to 6	1	2	3

### Remarks:

- \* the sum of blemish areas shall not exceed 1 % of the zone area.
- Blemishes are only considered if their contrast is more than 5 %.
- Linear faults (chickenwire) are only considered if their width is more than 1 line

## Definition of Zone A, B and C

Zone	Inner Zone Diameter	Outer Zone Diameter
A	∅ 0 mm	∅ half image height
B	∅ half image height	∅ image height
C	∅ image height	∅ image diagonal



Definition of Zone A, B and C

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## Digital Control Unit for HL Low Light Cameras



Low light camera HL5 with Digital Control Unit.

For microscopy and other applications it is useful to control the PROXICAM HL low light cameras with the optionally available external Digital Control Unit (DCU).

The DCU is available in two different versions:

- **DCU HL Basic**
- **DCU HL Extended**

The DCU HL Extended version of the Digital Control Unit for low light cameras is similar to the DCU HL Basis version with some additional functions (see next page).

The Digital Control Unit is connected to the camera with a 3 m [10 ft] long cable and allows the user to control many camera settings and functions:

- **Blacklevel:** for an individual setting of the signal dynamic to enhance weak image signals or to suppress background illumination
- **Gamma:** the Gamma setting changes the grey scale response and thus the ratio between bright and dark image parts
- **CCD integration:** selectable from 40 ms to 4 s in steps of 40 ms for increasing the sensitivity of the CCD camera
- **CCD shutter:** for blur-free images of fast moving objects
- **Camera multisystem number:** up to 100 cameras can be controlled via the serial interface
- **Memory:** store all camera settings in 16 memory blocks



HL low light camera with Digital Control Unit connected to a microscope.



External connectors of the Digital Control Unit.

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	DCU HL Basic	DCU HL Extended
<b>Camera settings and functions</b>		
Blacklevel	✓	✓
Gamma	✓	✓
Integration mode field / frame	✓	✓
Automatic video gain	✓	✓
Manual video gain	✓	✓
Manual MCP gain	✓	✓
CCD integration	-	✓
CCD shutter	-	✓
Camera multisystem number	-	✓
Memory	-	✓
Overload protection	✓	✓
Baud rate (2400,04800, 9600, 19200)	✓	✓
<b>DCU settings</b>		
LCD display contrast	✓	✓
In- and output configuration	✓	✓
<b>DCU in- and outputs</b>		
Power in 100 - 240 V AC 50/60 Hz or 100 - 375 V DC (please specify at order)	✓	✓
Video output in CCIR-Norm or EIA-Norm (75 Ohm) (please specify at order)	✓	✓
Synchronization outputs HD and VD	✓	✓
Synchronization inputs CVS, HD and VD	✓	✓
Odd/Even output	✓	✓
Integration in- / output	✓	✓
25 pol D-SUB system connector	✓	✓
<b>Connector cable</b>		
3 m [10 ft] long system cable	✓	✓
<b>Options for DCU</b>		
DCU BS2 Optional frame store output only in combination with the frame store. The optional frame store for the Digital Control Unit is useful while using the integration mode. After a long time integration (for example 4 sec) the integrated information on the CCD is read out and stored in the frame store. The frame store gives a continuous video signal of the stored image. (Please order DCU BS2)	option	option
DCU RS 232 RS 232 Matrix connector to control all camera and DCU settings with the PC Control software (Please order DCU RS 232)	option	option
DCU PCS Control software for the PC to control all camera functions (Please order DCU PCS)	option	option

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## Technical Data of the PROXICAM Low Light Cameras

Camera type	HR0	HL1	HR1	HL5	HR5	HL4 S	HL4 S NIR	HL4 S NIR2+	HL4 V	HLA
<b>TV standard</b>										
CCIR 625 lines/50 Hz	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EIA (RS-170) 525 lines/60 Hz	0	0	0	0	0	0	0	0	0	0
<b>Sensor type</b>										
SONY ICX 024 (CCIR version)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SONY ICX 022 (EIA version)	0	0	0	0	0	0	0	0	0	0
<b>Coupling method</b>										
25:11 Fiberoptik taper to CCD	-	-	-	-	-	0	-	-	✓	-
18:11 Fiberoptik taper to CCD	-	-	-	-	-	✓	✓	✓	0	-
1:1 Fiberoptik to CCD	-	✓	✓	✓	✓	-	-	-	-	✓
<b>Photocathode</b>										
S 25	-	✓	✓	✓	✓	✓	-	-	✓	✓
S 20	-	0	0	-	-	0	-	-	0	0
Advanced Solar Blind	-	0	0	-	-	0	-	-	0	0
Bialkali	-	0	0	-	-	0	-	-	0	0
UV Enhanced S 20	-	0	0	-	-	0	-	-	0	0
NIR	-	0	0	-	-	0	✓	-	0	0
NIR2+	-	-	-	-	-	0	-	✓	0	0
<b>Input window</b>										
Clear glass	-	✓	✓	-	-	✓	-	✓	✓	✓
Fused Silica	-	0	0	-	-	0	-	-	-	0
Fiberoptic	-	0	0	✓	✓	0	✓	0	-	0
<b>Phosphor screen</b>										
P 43	-	✓	✓	-	-	✓	-	-	✓	✓
P 20	-	0	0	✓	✓	0	✓	✓	0	0
P 11, P 46, P 47, others on request	-	0	0	-	-	0	-	-	0	0
<b>Sensitivity</b> (for 100% video with standard photocathode)	0,2 Lx	15 mLx	15 mLx	5 mLx	5 mLx	20 µLx	20 µLx	20 µLx	1 µLx	1 µLx
<b>Signal/noise ratio</b>										
unweighted [dB]	60	39	39	41	41	36	36	36	31	31
weighted [dB]	50	43	43	46	46	39	39	39	36	36
<b>Resolution [MHz]</b>	7	5,5	5,5	6	6	5	5	5	4,5	4,5
<b>Geometric distortion</b> [% of picture height]	0	0	0	1,5	1,5	1,0	1,0	1,0	1,0	1,0
<b>Image Format</b>										
6,6 mm x 8,8mm (2/3")	✓	✓	✓	-	-	-	-	-	-	-
12,8 mm x 9,6mm (1")	-	-	-	✓	✓	✓	✓	✓	✓	✓
20 mm x 15 mm	-	-	-	-	-	0	-	-	0	-
<b>Lenses</b>										
c-mount 1"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F-mount others on request	0	0	0	0	0	0	0	0	0	0
<b>Digital Control Unit</b>										
DCU HL Basic version	0	0	0	0	0	0	0	0	0	0
DCU HL Extended version	0	0	0	0	0	0	0	0	0	0
<b>Dimensions [mm]</b>	70 x 70 x 140	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 205	70 x 70 x 230
<b>Weight approx. [kg]</b>	1	1	1	1,2	1,2	1	1	1	1	1,3
<b>Power Supply</b> 12 V DC +- 10 %, approx. 500 mA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

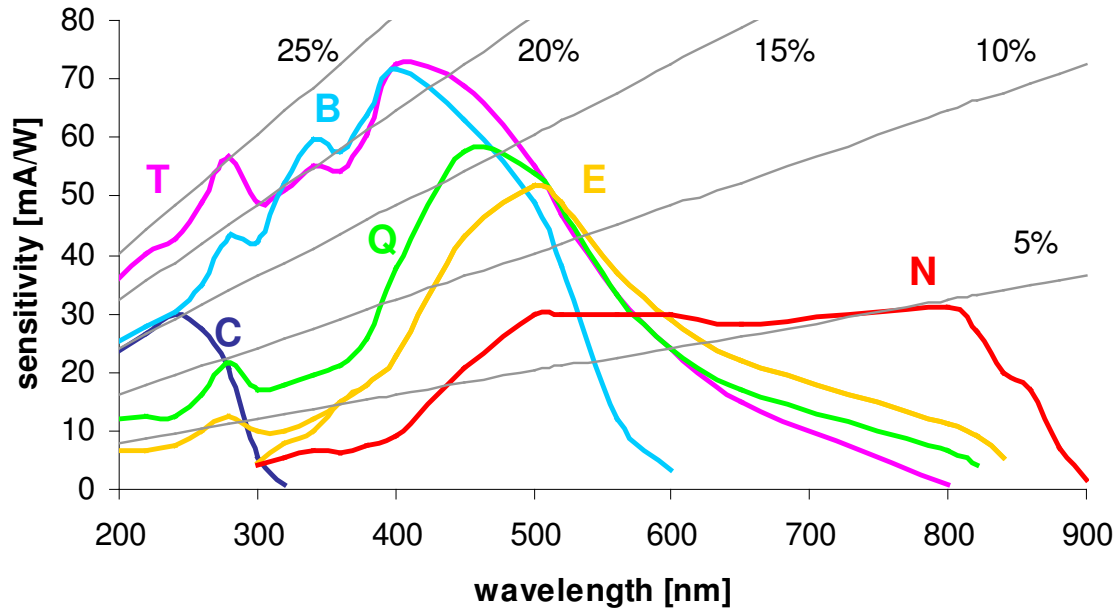
0 = option

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## Spectral Response of Photocathodes

The spectral response characteristic depends on the photocathode type used in the camera.



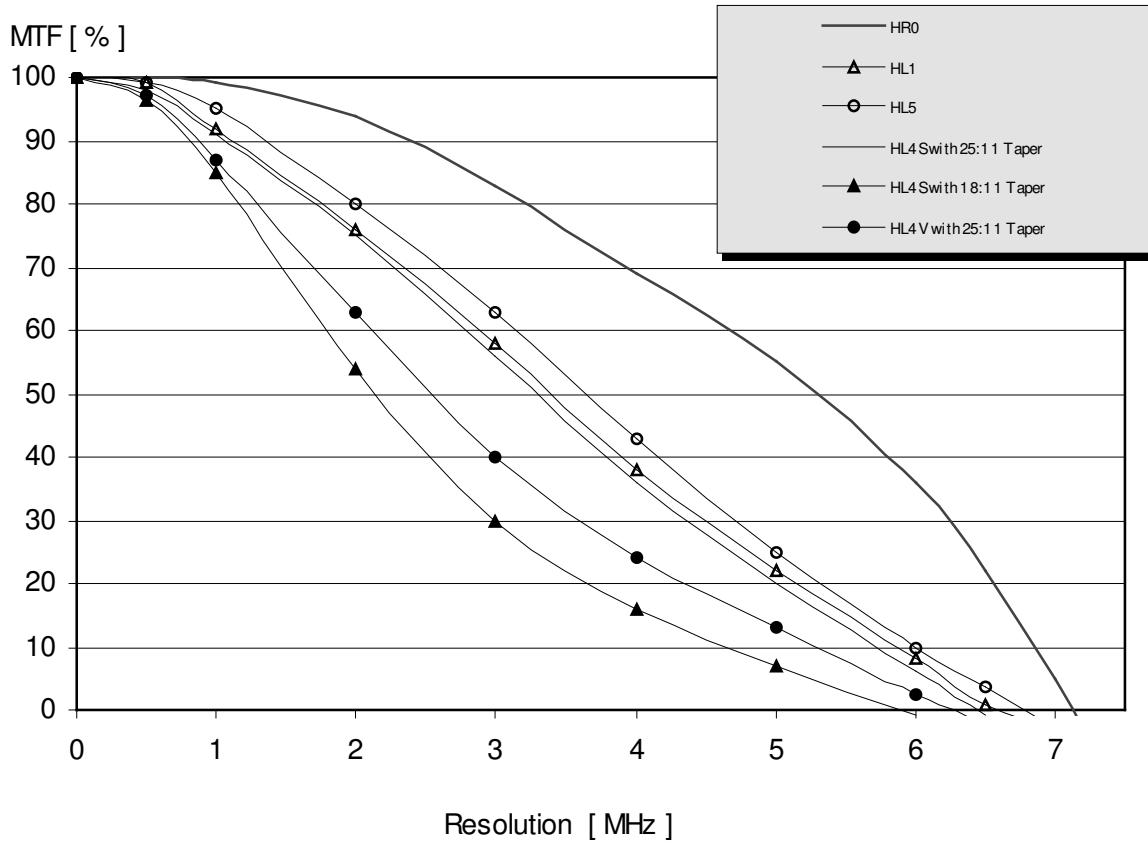
Photocathode Types	
C	Advanced Solar Blind photocathode / quartz
B	Bialkali photocathode / quartz
E	S 25 photocathode / clear glass
T	UV Enhanced S 20 photocathode / quartz
Q	S 20 photocathode / quartz
F	S 25 photocathode / quartz
N	Red Enhanced S 25 (NIR) / Fiber optic

## Dark Emission Rate

Photocathode	Type Name	Dark Emission Rate [electrons/cm <sup>2</sup> /sec]
Advanced Solar Blind	C	3
Bialkali	B	15
UV Enhanced S 20	T	500
S 20	Q	1.500
S 25	E / F	10.000
Red Enhanced S 25	N	30.000

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**Resolution and Modulation Transfer Function**



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