

# CCD-4000UV

## 4 MPixel high Resolution CCD-Camera with increased UV-sensitivity

Art.-No.: 3170010

### Manual

#### Version: V 1.0

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**C O N T E N T S**

<b>1</b>	<b>INTRODUCTION</b> .....	<b>2</b>
<b>2</b>	<b>TECHNICAL DATA</b> .....	<b>3</b>
<b>3</b>	<b>CAMERA CONSTRUCTION</b> .....	<b>4</b>
3.1	MECHANIC DIMENSIONS .....	4
3.2	FRONT- AND BACK VIEW .....	4
<b>4</b>	<b>CONTROL JUNCTION</b> .....	<b>5</b>
4.1	PIN CONNECTION OF THE CONTROL JUNCTION (15-PIN D-SUB JACK) .....	5
4.2	POWER SUPPLY .....	5
4.3	MODE INPUT (IMAGE ON DEMAND) .....	6
4.4	TRIGGER INPUT .....	6
4.5	EXPOSURE OUTPUT.....	7
4.6	LINE-SYNC-OUTPUT .....	7
4.7	FRAME-SYNC-OUTPUT .....	7
<b>5</b>	<b>DIGITAL DATA OUTPUT</b> .....	<b>8</b>
5.1	RS-644 PIN CONNECTION OF THE DIGITAL OUTPUT (37-PIN D-SUB JACK) .....	8
5.2	DIGITAL OUTPUT .....	9
5.3	LINE-ENABLE.....	10
5.4	FRAME-ENABLE (RESOLUTION 2048 X 2048) .....	10
5.5	FRAME-ENABLE (BINNING 2048(H) X 1024 (V)).....	10
5.6	TRIGGER INPUT TREX.....	11
5.7	INCREASING OF THE VIDEO GAIN .....	11
5.8	SWITCHING TO 15 IMAGES/SEC. (BINNING).....	11
<b>6</b>	<b>SPECTRAL SENSITIVITY</b> .....	<b>12</b>
6.1	AT THE CCD-4000UV.....	12

## 1 Introduction

### Features:

- 2048 (H) x 2048 (V) square pixels
- UV-sensitivity up to 190...200nm
- 7.5 frames/sec. at 2048 (H) x 2048 (V) pixels or  
15 frames/sec. at 2048 (H) x 1024 (V) pixels
- Progressive scan
- Interline-transfer sensor (IT)
- Asynchronous shutter up to 1/10000 sec.  
(image on demand)
- Effective camera dynamics:  $\geq 1:1000$  ( $\geq 60$  dB)
- Digital RS-644 output with 12-bit (LVDS)
- One output (40 Mpixel/s)
- Very compact design

With a resolution of 2048 x 2048 effective pixels, the **CCD-4000UV** is a further member of the high resolution VDS Vosskühler CCD camera family.

Due to a special CCD as well as the use of quartz glass as input window, the camera offers a good sensitivity up to the 190...200 nm UV-area.

The **CCD-4000UV** supplies 7.5 frames/sec. at a full resolution. Even 15 frames/sec. can be achieved in the binning mode 2048 (H) x 1024 (V).

By means of the progressive interline transfer sensor very short exposure times up to 1/10000 sec. can be achieved at a full resolution. The exposure time can be regulated in steps of approx. 64  $\mu$ s. Due to the asynchronous operation (image on demand) the exposure starts 15  $\mu$ s after an external trigger pulse. Therefore the camera is especially useful for recording moving objects.

The effective dynamics of the complete camera

$$D = \frac{Sat_{(count)} - Dark_{(count)}}{RMS\ Noise_{(count)}}$$

is more than 1000 and therefore offers reserves even for difficult lighting conditions or very short exposure times.

The RS-644 digital output supplies image data with 12-bit precision.

On the basis of the C-mount connection different C-Mount lenses and adapters for F-Mount can be used.

The **CCD-4000UV** is identical regarding the mechanic and pin-compatible to the CCD-1300 camera line.

## 2 Technical Data

### Technical Data:

- Resolution: 2048 (H) x 2048 (V) pixels
- Progressive scan
- Pixel size: 7.4  $\mu\text{m}$  x 7.4  $\mu\text{m}$
- Active sensor size:  
15.15 (H) mm x 15.15 (V) mm
- Interline transfer sensor  
(no mechanical shutter necessary)
- Electronic shutter up to 1/10000 sec.;  
adjustable in 64  $\mu\text{s}$  steps
- Image on demand
- Image rate: up to 7.5 frames/sec. (2048 x 2048) or  
up to 15 images/sec. (2048 x 1024)
- Effective dynamics:  $\geq 1:1000$  ( $\geq 60$  dB)
- Sensor saturation:  $\geq 40000$  e
- Anti-blooming circuit
- Exposure time up to approx. 1 sec.
- Digital output: 12-bit, RS-644
- Image system: 2082 lines
- Pixel clock: 40 MHz
- Video gain: 1 or 2 (+ 6 dB)
- Power supply: + 12 V (SELV), approx. 0.6 A
- Ambient air temperature: 0° to 40° C
- C-Mount lens connection or F-mount with  
adapter
- CE conform
- Made in Germany

### Please note:

The right polarization of the 12 V supply voltage has to be taken into consideration.

The warranty becomes void in case of unauthorized tampering or any manipulations not approved by the manufacturer.

### 3 Camera Construction

#### 3.1 Mechanic Dimensions

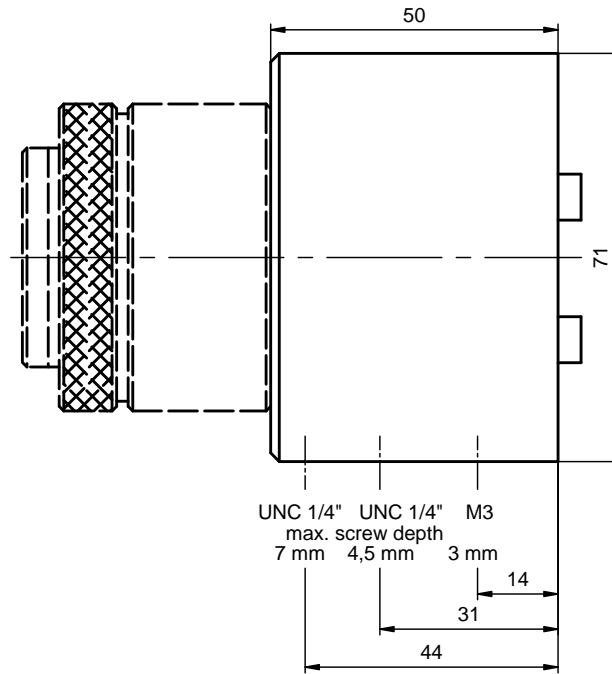


Abb. 1: Side view of the camera

#### 3.2 Front- and Back View

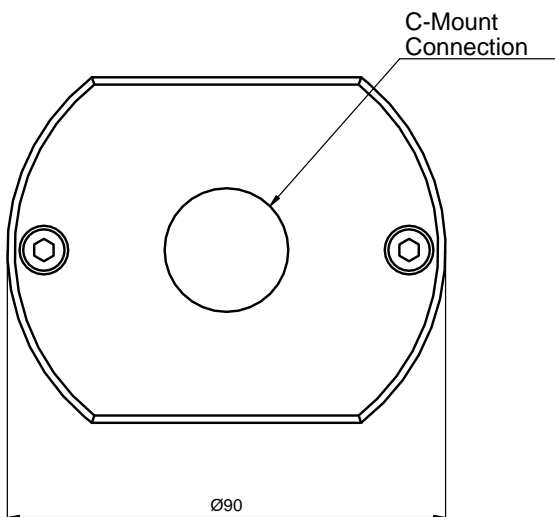


Fig. 2: Front view of the camera

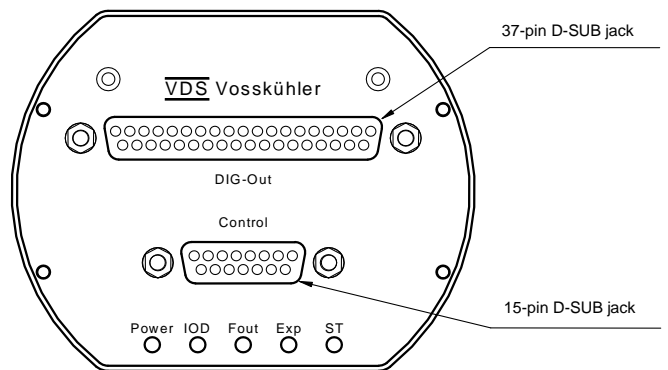


Fig. 3: Back view of the camera

## 4 Control Junction

### 4.1 Pin Connection of the Control Junction (15-pin D-SUB Jack)

This jack is intended for the power supply as well as for controlling the camera by the user.

Pin	Function
1	] + 12 V DC (0.5 A max. 0.62 A)
2	
3	] GND
4	
5	test output (reserved)
6	-
7	-
8	(reserved)
9	Mode: (open) ⇒ continuous operation (GND) ⇒ image on demand
10	- ] trigger input (optocoupler)
11	
12	- ] exposure output (optocoupler)
13	
14	Line-sync-output (active low)
15	Frame-sync-output (active low)

### 4.2 Power Supply

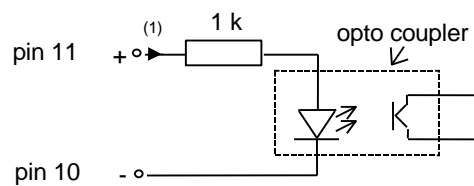
The camera requires 12 V +5 %, at a current capacity of maximum 620 mA. If the camera does not output an image in the image-on-demand mode, the current capacity decreases to approx. 500 mA.

### 4.3 Mode Input (Image on Demand)

The mode input serves for the switch between the continuous operation with 133 ms exposure time and the shutter- and image-on-demand operation and is shown by the LED IOD on the backside of the camera.

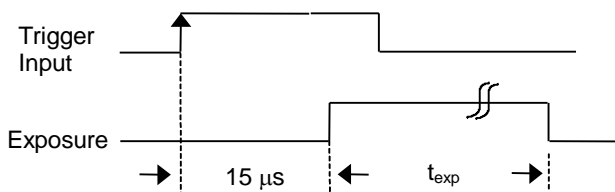
Input pin 9     open -> continuous operation  
                   GND -> image on demand

### 4.4 Trigger Input



<sup>(1)</sup> The current which flows through the opto coupler should be > 5 mA and should not exceed 20 mA.

The image record is started with 15  $\mu$ s delay due to the rising pulse edge at the trigger input.

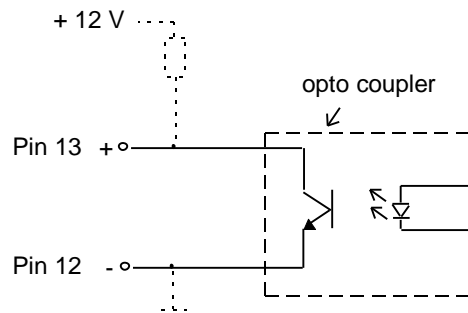


The shutter time  $t_{exp}$  can be regulated between 100  $\mu$ s and 5 ms via trimmer ST at the back of the camera. For the control an oscilloscope should be connected at the exposure output (wiring with a resistor on the supply voltage).

If the trigger input is active longer than the adjusted shutter time  $t_{exp}$ , the shutter time  $t_{exp}$  automatically extends to the active time at the trigger input. With this, also exposure times to the second area are achievable.

As further trigger- and exposure control input the /TRES input is available at the 37-pin digital output (see page 11).

#### 4.5 Exposure Output

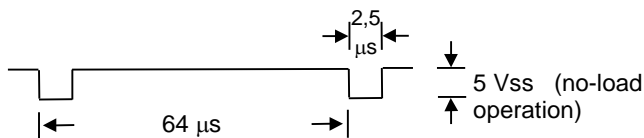


The current which flows through the opto coupler should not exceed 20 mA (at 12 V  $R \geq 600 \Omega$ ).

The exposure output indicates the active exposure time of the sensor in the image on demand operation. At the end of the exposure this output stays active 64  $\mu\text{s}$  (1 line) longer than the real exposure. The active exposure is also indicated by the LED Exp. on the backside of the camera.

After the image record the 2048 active lines of the image are given out at the digital output. This image output is shown by LED Fout on the backside of the camera.

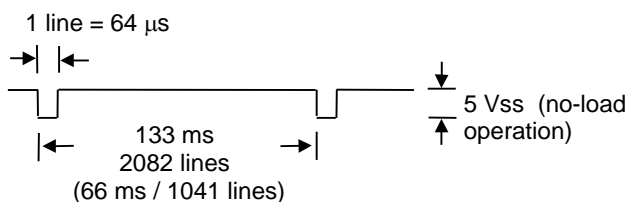
#### 4.6 Line-Sync-Output



The line-sync-output (active low) supplies approx. 900 mV at the termination with 75 ohms.

#### 4.7 Frame-Sync-Output

The frame-sync-output is only active in continuous operation.



The frame-sync-output (active-low) supplies approx. 900 mV at the termination with 75 ohms.



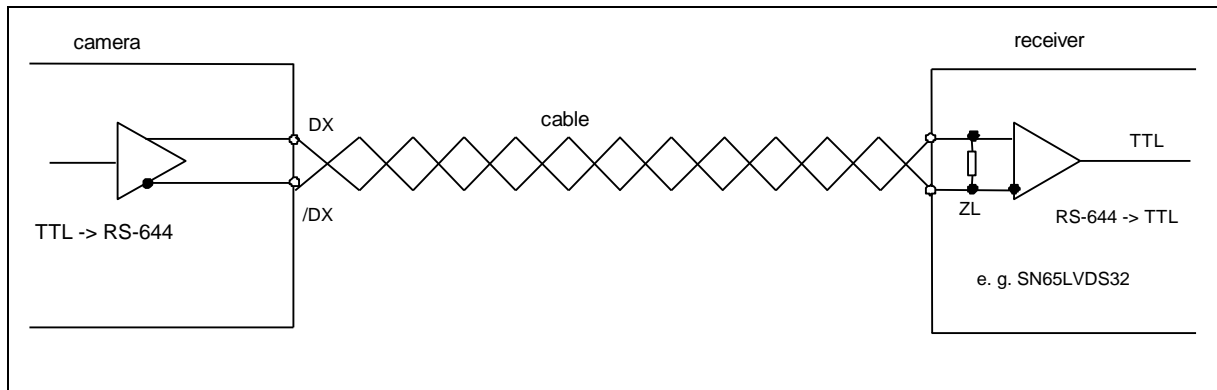
## 5 Digital Data Output

### 5.1 RS-644 Pin Connection of the Digital Output (37-pin D-SUB Jack)

Pin	Function	Pin	Function
1	PCLK	20	/PCLK
2	LEN	21	/LEN
3	FEN	22	/FEN
4	D0 (LSB)	23	/D0
5	D1	24	/D1
6	D2	25	/D2
7	D3	26	/D3
8	D4	27	/D4
9	D5	28	/D5
10	D6	29	/D6
11	D7	30	/D7
12	D8	31	/D8
13	D9	32	/D9
14	D10	33	/D10
15	D11 (MSB)	34	/D11
16	GND	35	GND
Control Input 17	/TRES (RS-422A) (trigger input; active low)	Control Input 36	TRES (RS-422A) (trigger input)
Control Input 18	/SV2 (gain * 2; active low)	Control Input 37	Mode high $\Rightarrow$ continuous low $\Rightarrow$ image on demand
Control Input 19	/BIN (binning active low)		

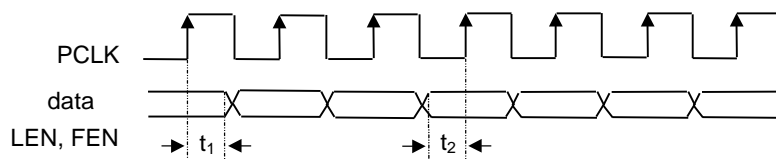
## 5.2 Digital Output

The digital output supplies digital image data with 40 Mpixels/sec. at a word width of 12-bit. The output has available differential RS-644 signals which can be passed on by twisted wire pair.



The terminating resistance ZL has to be adapted corresponding to the wave resistance of the line (usual size 100 ohms).

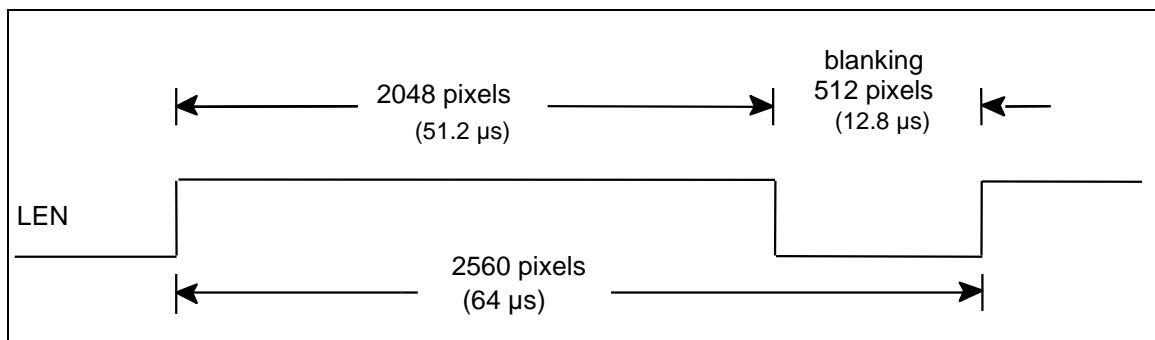
Timing:



- |          |                        |                         |
|----------|------------------------|-------------------------|
| 1. data: | $t_1 \geq 6\text{ ns}$ | $t_2 \geq 10\text{ ns}$ |
| 2. LEN:  | $t_1 \geq 6\text{ ns}$ | $t_2 \geq 10\text{ ns}$ |
| 3. FEN:  | $t_1 \geq 6\text{ ns}$ | $t_2 \geq 10\text{ ns}$ |

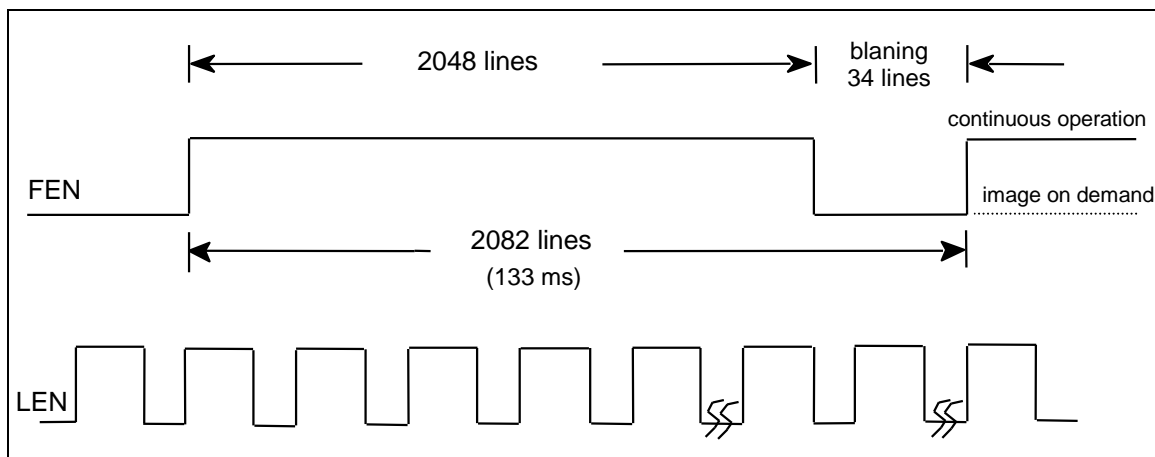
### 5.3 Line-Enable

The line-enable becomes active at each line of an image (active high).

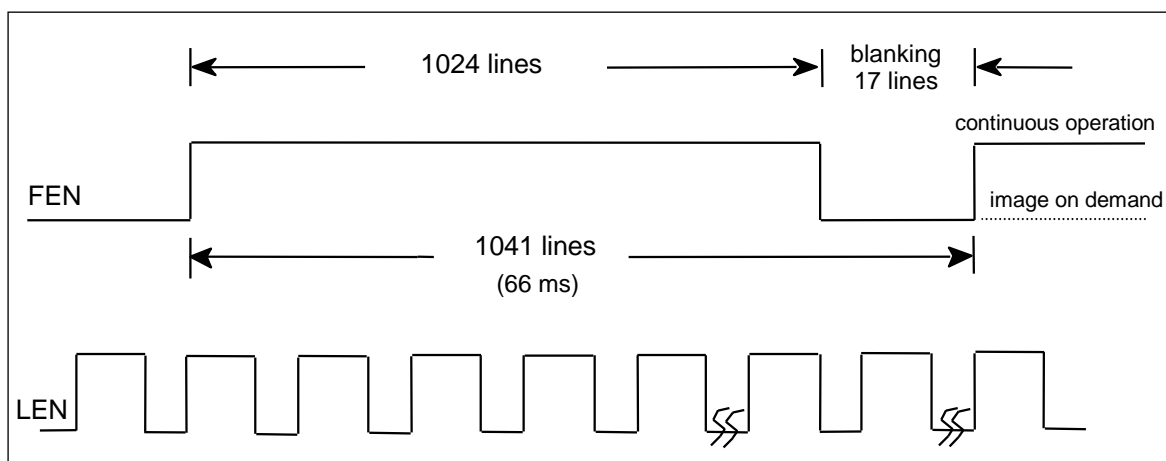


### 5.4 Frame-Enable (Resolution 2048 x 2048)

The frame-enable is active for 2048 lines (active high).



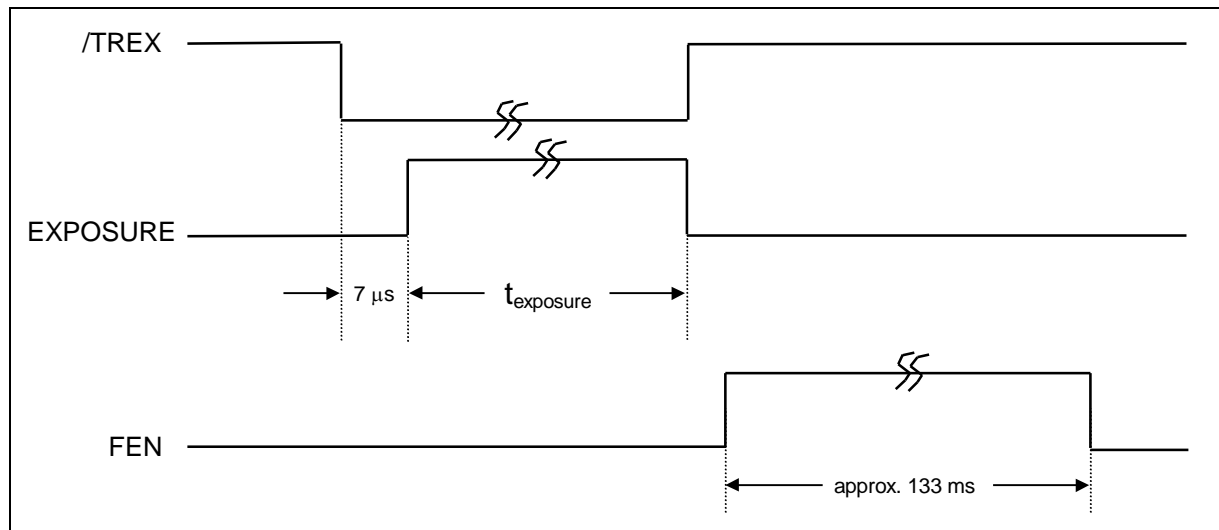
### 5.5 Frame-Enable (Binning 2048(H) x 1024 (V))



## 5.6 Trigger Input TREX

Via trigger input /TREX the shutter time of the camera at the image on demand operation can also be fixed. The input can be used either as RS-422A input (TREX and /TREX) or only as /TREX active-low input. For the RS-422A operation a termination resistance of 100 ohms can be connected internally in the camera.

Activating the TREX input, the active exposure of the sensor starts with 15  $\mu\text{s}$  delay and stays active as long as the TREX input is active. So the exposure time can be indicated spaciouly by the user.



## 5.7 Increasing of the Video Gain

The analog video gain of the camera can be increased by factor 2 (+ 6 dB) via input /SV 2 (active low). This is advantageous especially at very short shutter times or bad lighting conditions. The input is TTL – compatible (high > 2V, low < 0.8 V).

## 5.8 Switching to 15 Images/Sec. (Binning)

With the trigger input /BIN (active low) it is possible to switch up to 15 images/sec. at 2048 (H) x 1024 (V) pixels. At an opened input it is possible to give out 7.5 images/sec. at full resolution. The input is TTL – compatible (high > 2V, low < 0.8 V).

## 6 Spectral Sensitivity

### 6.1 At the CCD-4000UV

