



## Paradigm Shift

ProLine and MicroLine cameras using the e2v CCD47-10 deep depletion have been a standard for near infrared research for nearly a decade. The Kepler KL400 with back-illuminated CMOS provides an alternative with a higher signal-to-noise ratio (SNR) and much higher frame rates.

Though the ML4710 deep depletion has nearly 60% higher overall QE from 700 to 1000nm, the KL400's lower noise and dark current give it a big advantage in signal-to-noise ratio.

The table below is a comparison of the Kepler KL400 TVISB and ML4710 deep depletion cameras, using a low flux value of 1 photon/pixel/second (without regard to pixel size) and the average quantum efficiency between 700 and 1000 nm. If flux to the smaller pixel of the KL400 is scaled by pixel area, the 400's SNR remains 65% higher than the 4710.

### Signal-to-Noise Ratio KL400 vs. ML4710 DD

Exposure (sec)	400 (1 pps)	400 (0.72 pps)	4710
3600	27.7	21.3	9.9
1800	19.6	15.0	7.0
900	13.9	10.6	4.9
600	11.3	8.7	4.0

KL400 images can be stacked with little effect on SNR, either automatically or after sorting for quality.

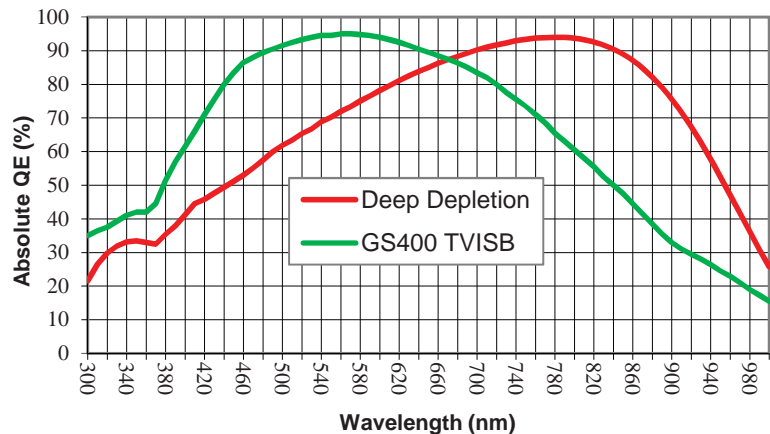
Exposure (sec)	400 (1 pps)	4710
1 x 600	11.3	5.2
5 x 120	11.2	5.1
10 x 60	11.1	4.9

## Kepler KL400 versus MicroLine ML4710 DD

	KL400 TVISB	ML4710 Deep Depletion
Sensor Type	Back illuminated CMOS	Back illuminated CCD
Active Pixels	2048 x 2048	1024 x 1024
Pixel Size	11 x 11 microns	13 x 13 microns
Effective Area	22.5 x 22.5 mm	13.3 x 13.3 mm
Sensor Diagonal	31.9 mm	18.8 mm
Full Well Capacity	90000 electrons	100000 electrons
Frame rate (rolling)	24 fps HDR	2 seconds/frame
Read Noise (rolling)	1.6 e- HDR	11 e- (700 kHz)
Dynamic Range	93 dB HDR	79 dB (500 kHz)
Peak QE	95% (570nm)	94% (780nm)
Cooling	Air (Optional Liquid)	
Dark Current	0.6 eps at -20C	21 eps at -35C
Interface	USB 3.0	USB 2.0
Interface (Optional)	QSFP <sup>1</sup>	NA
Data Bit Depth <sup>2</sup>	16 bit	
Optional Mount	F-mount	
Video size	2.4"	1.2"
Subarray Readout	Yes	
Electromechanical Shutter	Optional 45mm	Standard 45mm
Ex Trigger In	Yes	
Ex Trigger Out	Yes	
Software	FLI Pilot	FLIGrab
SDK	Open Source	
List Price	\$19,995	\$16,295

<sup>1</sup> QSFP=Quad Small Form factor Pluggable: high speed fiber optic interface.

<sup>2</sup> 16-bit data is merged from two 12 bit converters.



## Quality. Cooled. Cameras.

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