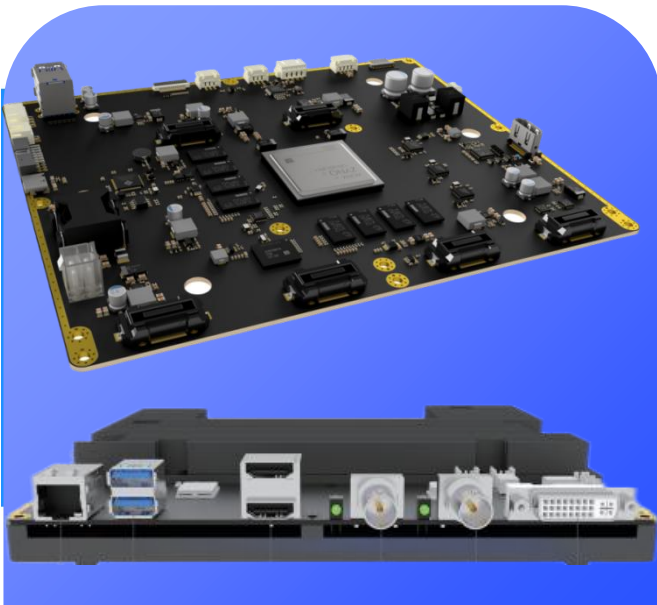


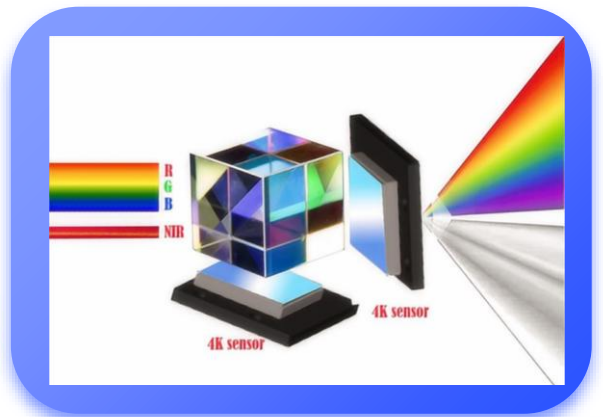
Dual-CMOS 4K FPGA ICG camera system

HW-ICG_V1.0

Dual-CMOS Camera head



FPGA image processor module



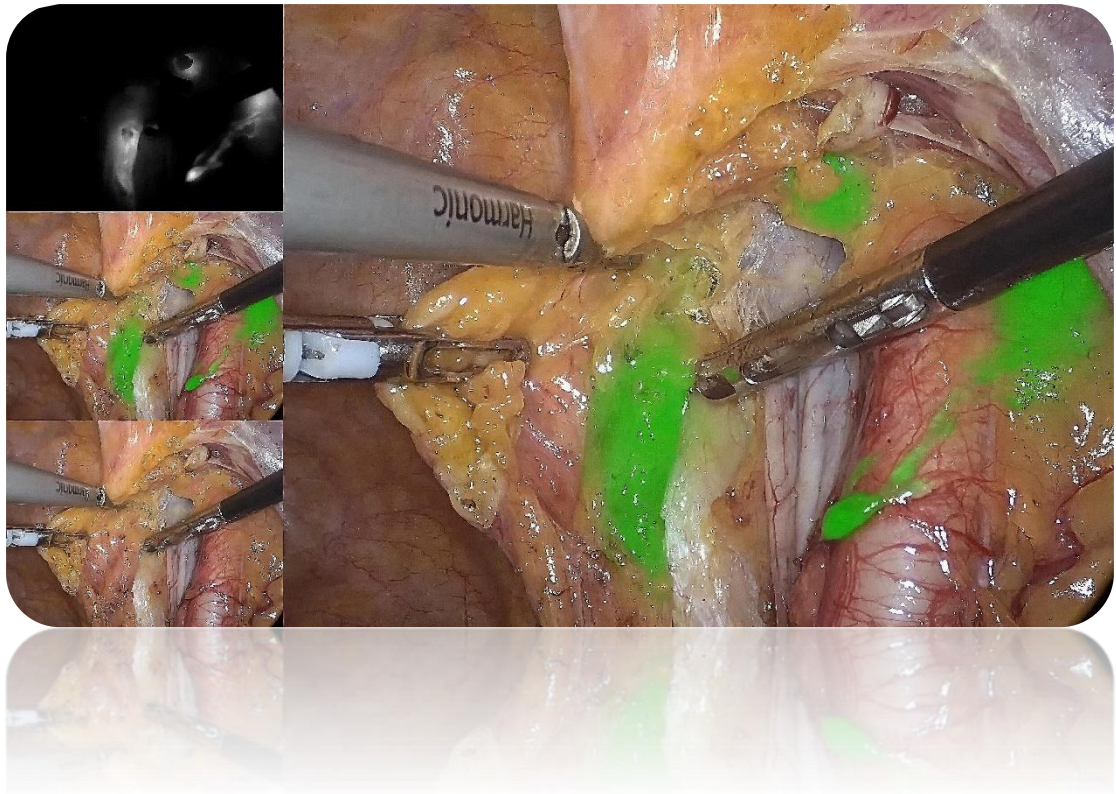
Fluorescence realization principle

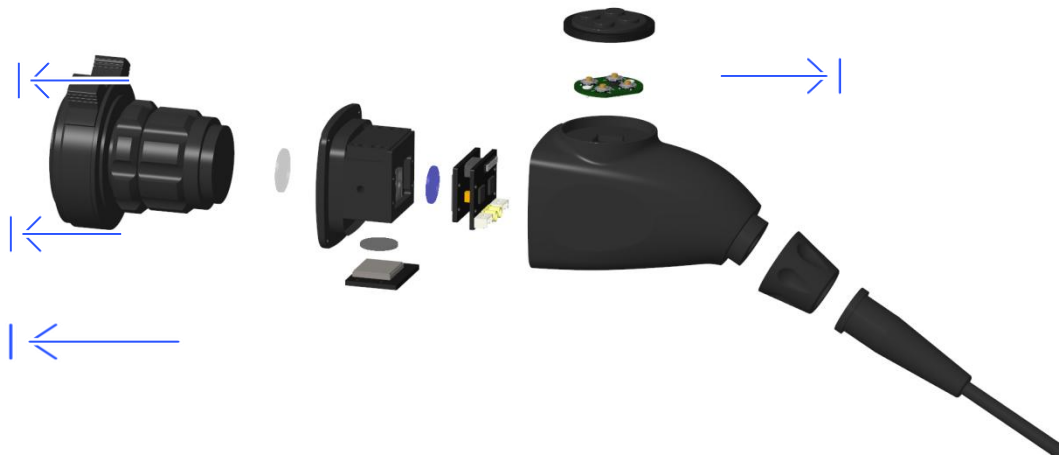
NO. V1.0

July, 2025

ICG camera system introduction

Product developed base on a Xilinx FPGA platform, it is the only one architecture in China to achieve 4K 60fps rate encoding and decoding on FPGA platform, eliminating the need for an ARM processor. It features a low-latency, low-power camera and high system integration, enabling real-time enhancement of endoscopic images. It also efficiently separates excitation light from emitted light (fluorescence), ensuring that even faint target fluorescence is clearly captured by the highly sensitive camera while avoiding strong interference from the excitation light.



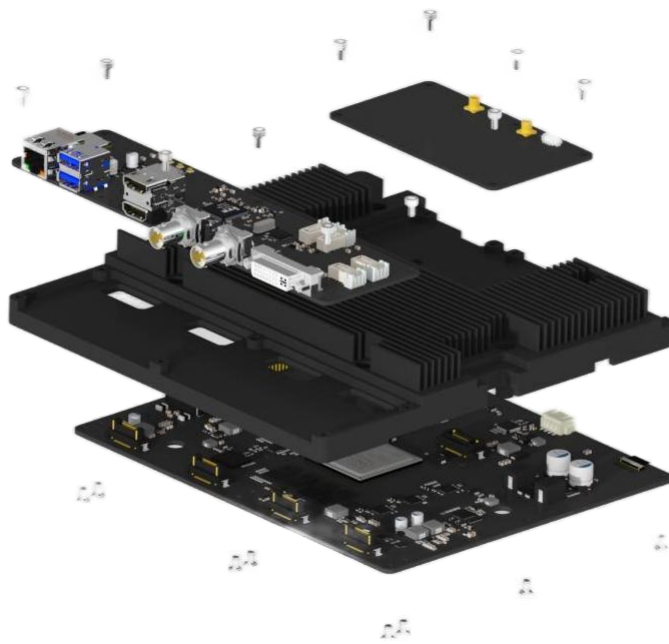


Dual-CMOS Camera head

Video output interface back board

Integrated die-cast aluminum radiator

FPGA image processor board



Camera signal receiving module

FPGA image processor module

1、 Image performance and advantages

- **Dual-CMOS Fully digital 4K Camera System :**
 - Built-in dual Sony original 1/1.8" large image area back-illuminated CMOS.

- Output resolution no less than 3840 × 2160P60 frames, progressive scan, pixels ≥8 million.
- **Multiple fluorescence imaging modes:**
 - The number of sensor is ≥ 2 , capable of capturing visible light and near-infrared light images simultaneously.
 - Supports 4K ultra-high-definition white light, 4K standard fluorescent light, multi-mode fluorescent light and other modes on the same screen.
 - Suitable for indocyanine green (ICG) angiography with excitation at $785\text{nm}\pm 10\text{nm}$ and $808\pm 10\text{nm}$.
- **High QE response performance sensor + high transmittance optical system design:**
 - Signal-to-noise ratio $\text{SNR} > 50\text{dB}$, fluorescence response dynamic range $\geq 20\text{dB}$ (signal-to-background ratio $\text{SBR} > 3$).
 - Minimum detection concentration $\leq 200\text{nmol/L}$, ensuring sensitive capture of low concentration ICG.
- **Unique patented algorithm and dual-channel exposure time control:**
 - High Efficiency solve the traditional fluorescence drift phenomenon, ensuring accurate and real-time synchronization of fluorescence development position.
- **Pixel-level six-axis fluorescence fusion technology and ultra-high precision image registration algorithm:**
 - Optical stereo registration with ultra-high precision up to $1\mu\text{m}$.
 - Software algorithm accurately superimposes fluorescence images without ghosting or deviation, preserving image details.
- **With fluorescent light source adjustment and self-test functions:**

- The fluorescent camera system and fluorescent light source are dynamically linked in real time, and the camera handle can also manually adjust the light source brightness.

2、 Software Features

- FPGA algorithm: Image enhancement (edge enhancement) 、 Improved dark areas (dynamic range) 、 Fiberscope moiré removal (grid removal) 、 16-axis color phase matrix、 Dynamic automatic linkage of light sources, etc.
- Through the menu, you can switch between single and multi-window fluorescence display, fluorescence display color, main window display white light/infrared/fusion mode, fluorescence gain, fluorescence brightness, fluorescence saturation, fluorescence contrast, etc.
- The camera head shortcut keys can be customized to take photos, record videos, white balance, brightness, freeze, zoom, and adjust light brightness.
- supports USB firmware upgrade and LOGO upgrade.

3、 Interface and output

● USB interface and video recording function :

- The camera has 2 USB3.0 interfaces on the front and 2 USB3.0 interfaces on the back, which can realize 4K photo and video recording functions. The video resolution is at least 4K and the capture pixel is 8 million.

● Multiple output ports :

- Supports 4K UHD and 1080P FHD simultaneous output to connect different monitor to meet the different equipment in the surgical operating room.
- 2 HDMI2.0 outputs 4K60 frame real-time video images.
- 2 12G SDI outputs 4K60 frame real-time video images.

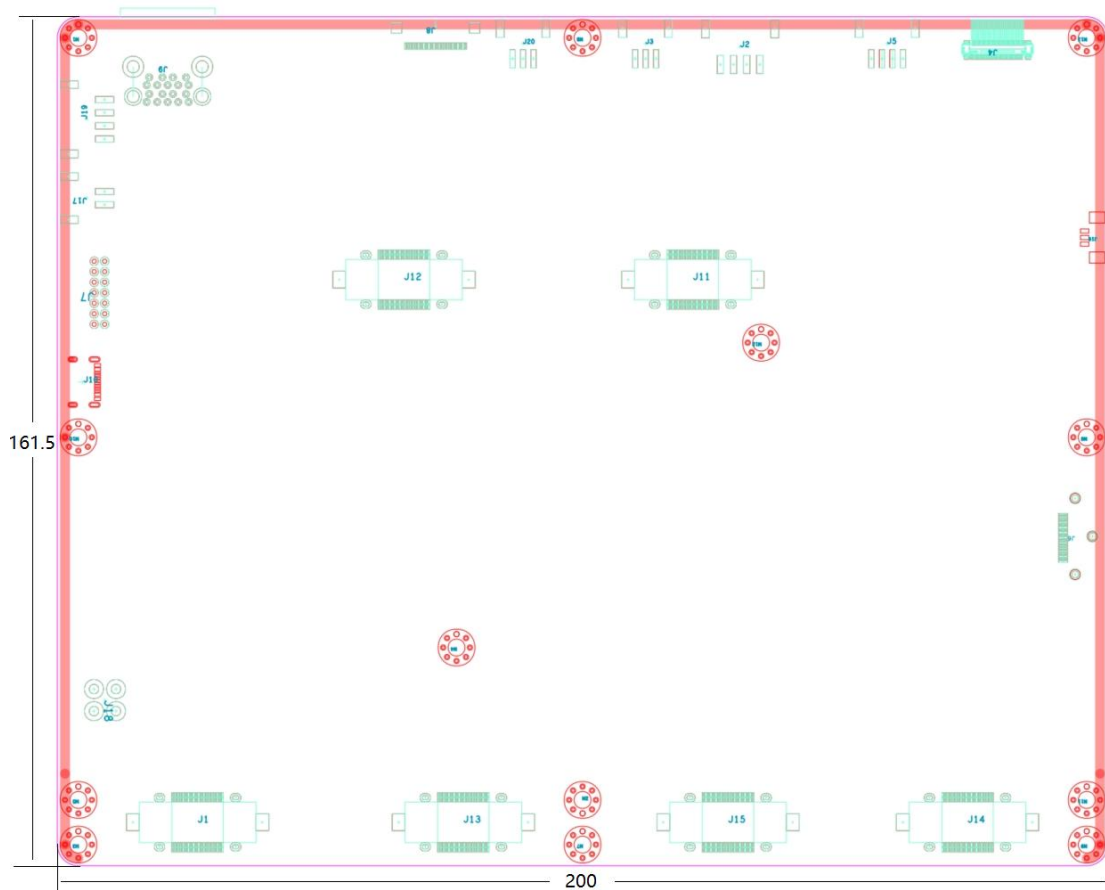
- 1 DVI output 1080P60 frame real-time image.
- RJ45 network port [reserved interface and used for internal debugging which not for external data transmission].
- **Control method:**
 - The operation menu can be controlled by USB mouse, LCD touch screen, keypad, The operation menu can be controlled by USB mouse, LCD touch screen, keypad, etc.
 - Reserved external communication serial port, which can be linked with external equipment light source, pneumoperitoneum machine, etc.

4、 Technical Specifications

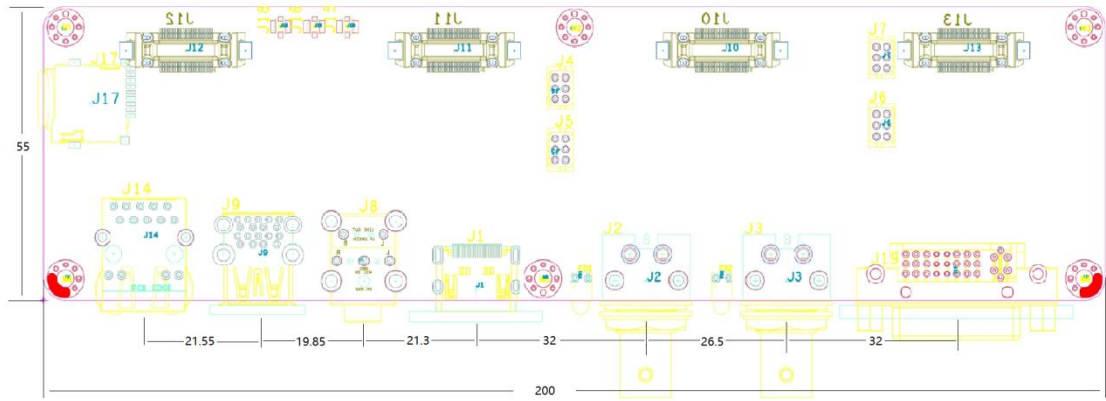
Camera Head	
Sensor	1/1.8"Sony CMOS x2
Effective pixels	8 million
Output resolution	3840*2160P 60fps
Camera head shortcut key	4 customized
IPX Level	IP68
Disinfection method	High temperature and high pressure, hydrogen peroxide low temperature plasma, ethylene oxide
Prism design	
Excitation Wavelength	785±10nm or 808±10nm)
spectral band	400~850±30nm
Fluorescence mode	Colored white light, standard fluorescent light, multimode fluorescent light
Fluorescence settings	Fluorescence gain, fluorescence brightness, fluorescence saturation, fluorescence contrast
Camera Host	
Menu	Scene, white balance, brightness, chroma, sharpness, saturation contrast, dynamic range, edge enhancement, gain, gamma, remove grid, Photo, Videos, Zoom in
Video Format	MP4
Photo Format	JPG

Coding Technology	H265
Performance indicators	
Signal-to-Noise Ratio (SNR)	50dB, tolerance -20%
Brightness response characteristic	Linear fit coefficient no less than 0.98
Spatial Frequency Response (SFR)	If SFR is 50% , 41C (°) ; if SFR is 30% , 50C (°) ;
(MTF)	MTF 50% : 2100LW/PH=243 lp/mm, tolerance -20%
Static image latitude	DR=96, tolerance -20%
Output interface	2x HDMI2.0, 2x 12G SDI, 1x DVI 4x USB3.0, 1x RJ45

5、 Dimensional drawings



❖ FPGA Camera Processor Board



❖ Video output interface back panel board