

# HVDUO-5M Digital Color Camera with Foveon X3<sup>®</sup> Direct Color Image Sensor

## Description

The HVDUO-5M is a one-piece digital color camera capable of acquiring accurate, high-resolution color images using the Foveon FO18-50-F19 X3 direct color image sensor. The HVDUO-5M features 24-bit digital color output, real-time color processing, support for all sensor scan modes and a CameraLink interface. The HVDUO-5M is compatible with a wide range of standard C-mount optics. It includes an automatic internal dark-frame shutter and controls for synchronized illuminators. The HVDUO-5M is well suited for industrial, scientific, cinema, medical and communications applications requiring high-quality color images.

## Features

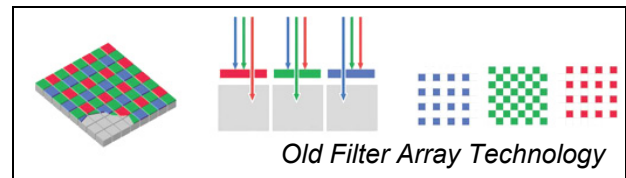
- 4.53 million pixels in a 1420 x 1064 x 3 matrix matches 3-chip color performance
- 5 micron square pixels accommodate an extensive selection of optics
- Flexible scanning methods support selection of resolution, raster size and speed from full resolution at 7 Hz to VGA at 30 Hz in the low-noise mode.
- Single-shot or continuous acquisition with selectable exposure offer optimum performance for still and motion images
- Camera control and image viewing software for Windows<sup>®</sup> facilitates rapid setup and acquisition
- Internal automatic shutter provides trouble-free dark frame acquisition
- 24-bit RGB CameraLink output easily connects to a wide variety of framegrabbers
- A compact housing, single power supply and diverse mounting options simplify installation.

## Sensor

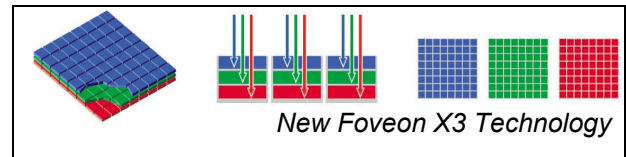
The HVDUO-5M camera provides true color performance through the use of the Foveon FO18-50-F19 X3 direct color image sensor, which incorporates the exclusive Foveon X3 color separation technology. Unlike color filter mosaic sensors, the Foveon FO18-50-F19 X3 image sensor detects full color at every pixel location.



In a typical mosaic sensor, each pixel is supplied with a filter that passes only one color band. One-half of the pixels detect green and only one-quarter detect red or blue. This wastes light and creates gaps in the color data, producing offsets among the color detection positions and artifacts when the missing data are estimated.



In image sensors using the Foveon X3 technology, three layers of photodetectors provide every pixel location with three stacked photodetectors so that every pixel location detects full color. No light is lost in filters and the detection locations for all three colors are coincident.



To make best use of the superior color detection capability of the X3 technology, the Foveon X3 5M image sensor also includes an extensive set of scan control registers to support scanning of selected rectangular regions of interest, grouping of pixels in both rows and columns and selective scanning of every  $n^{\text{th}}$  line to facilitate higher frame repetition rates.

## HVDUO-5M Digital Color Camera

The HVDUO-5M camera takes full advantage of these powerful sensor features by incorporating real-time color processing, full control of scan modes and three-channel, 12-bit video digitization.

### Shutter Mode Control

The HVDUO-5M provides two shutter modes to accommodate a broad variety of still and motion imaging applications. In either mode, scanning may be set to run continuously or triggered frame by frame on demand.

**Still Shot** – The still shot mode provides superior image quality in applications where the illumination can be externally timed. This includes the use of strobe or pulsed LED illumination or external shuttering.

**Rolling Shutter** – The rolling shutter mode is used where the illumination is continuous either for acquisition of single images or for video operation. Exposure time may be set from one line to one second.

### Image Processing

Three-channel analog video from the sensor is digitized to 12 bits to maximize dynamic range. After digitization, the image data is processed in real time to produce accurate color output. Control is provided for all video processing steps.

**Dark Frame** – The HVDUO-5M will automatically acquire a new dark frame whenever any setting is changed that invalidates the previously stored data. New dark frames may also be acquired manually at any time. An automatic internal dark frame subtraction mechanism (DSM) assures that the sensor is covered during the dark frame acquisition.

**Color Matrix** – Five color conversion tables for various lighting types are permanently stored in the camera. In addition, user-generated tables may be sent to the camera for special lighting or image processing situations.

### Image Timing

The HVDUO-5M operates from an internal crystal-controlled clock. Data is transmitted at constant frequency.

### Pixel Clock

40 MHz (13.3 MHz parallel RGB color at output).

### Scan Modes

The HVDUO-5M will operate in four scan modes.

Pixel Matrix	Shutter	Mode	FPS
1420 x 1064	Still	Sequential	7
1420 x 1064	Still	Differential	7
1420 x 1064	Rolling	Sequential	7
640 x 480	Rolling	Sequential	30

The differential mode offers reduced noise.

### Frame Triggering

Individual images may be acquired by triggered scanning. A connector is supplied at the camera for real-time lighting synchronization.

### Sensor Characteristics

#### Pixel Geometry

Pixel Locations – 1420 columns x 1064 rows active

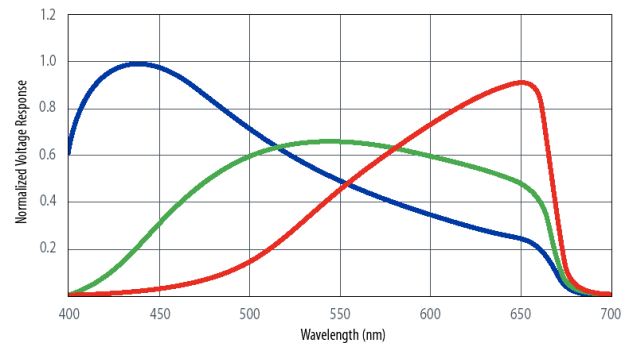
Spacing – 5 x 5  $\mu\text{m}$  square

Raster Area – 7.2 mm (H) x 5.3 mm (V) active

Fill Factor – approximately 77% with microlenses

#### Spectral Response

The spectral characteristics of the sensor in the HVDUO-5M camera are determined by the absorption properties of silicon and are not subject to aging, bleaching or wear of filter materials.



These curves include the effects of a 400-660 nm visible bandpass filter. Approximate total quantum efficiency at 600 nm is 45% including visible pass filter losses and the effect of fill factor.

## Image performance

(At 25C)

Specification	Value
PRNU	$\pm 3 \text{ DN}_8$ (after dark subtraction)
FPN	$\pm 3 \text{ DN}_8$ (Row) $\pm 2 \text{ DN}_8$ (Column)
S/N Ratio	Limited by 8-bit output
Dynamic Range	Limited by 8-bit output
Sensitivity	Equivalent to ISO 100
Anti-blooming	100x, minimum

## Environmental Tolerance

Operating Temperature – 0 to +40C  
Humidity – 10 to 90%, non-condensing  
Storage Temperature – -20 to +60C

## Software

The camera includes a CD-ROM with all software necessary for setup and control through the framegrabber serial port. Framegrabbers may require additional control and setup software.

### Control Software

The HanVision Camera Control Tool (HCCT) controls camera setup and operation. Runs under Windows XP

- Controls camera setup
- Loads and saves setup files
- Reads camera status

## Optical Configuration

Image Size:	7.2 mm (H) x 5.3 mm (V) active
Sensor Window:	Glass, uncoated
Lens Mount:	“C” mount with internal filter holder, visible pass filter installed
Sensor Alignment:	$\pm 0.01 \text{ mm}$ (H & V), $\pm 2 \text{ mrad}$ (rotation), $\pm 0.01 \text{ mm}$ (flatness)

## Viewer Software

The HanVision Viewer software supplies basic image acquisition and analysis functions

- Save image, format: BMP
- Line profile display
- Zoom in and out
- Simple image processing: brightness, contrast and geometric transform
- Single and continuous grab

## Electrical Interface

### Power Supply

The HVDUO-5M includes a small packaged 5-volt regulated universal input supply for operation from 90-240 volt, 45-65 Hz mains. The power supply carries worldwide safety certifications.

### Digital Output

**Data Configuration** –The 24-bit RGB output interfaces to CameraLink framegrabbers in 24-bit RGB Base mode.

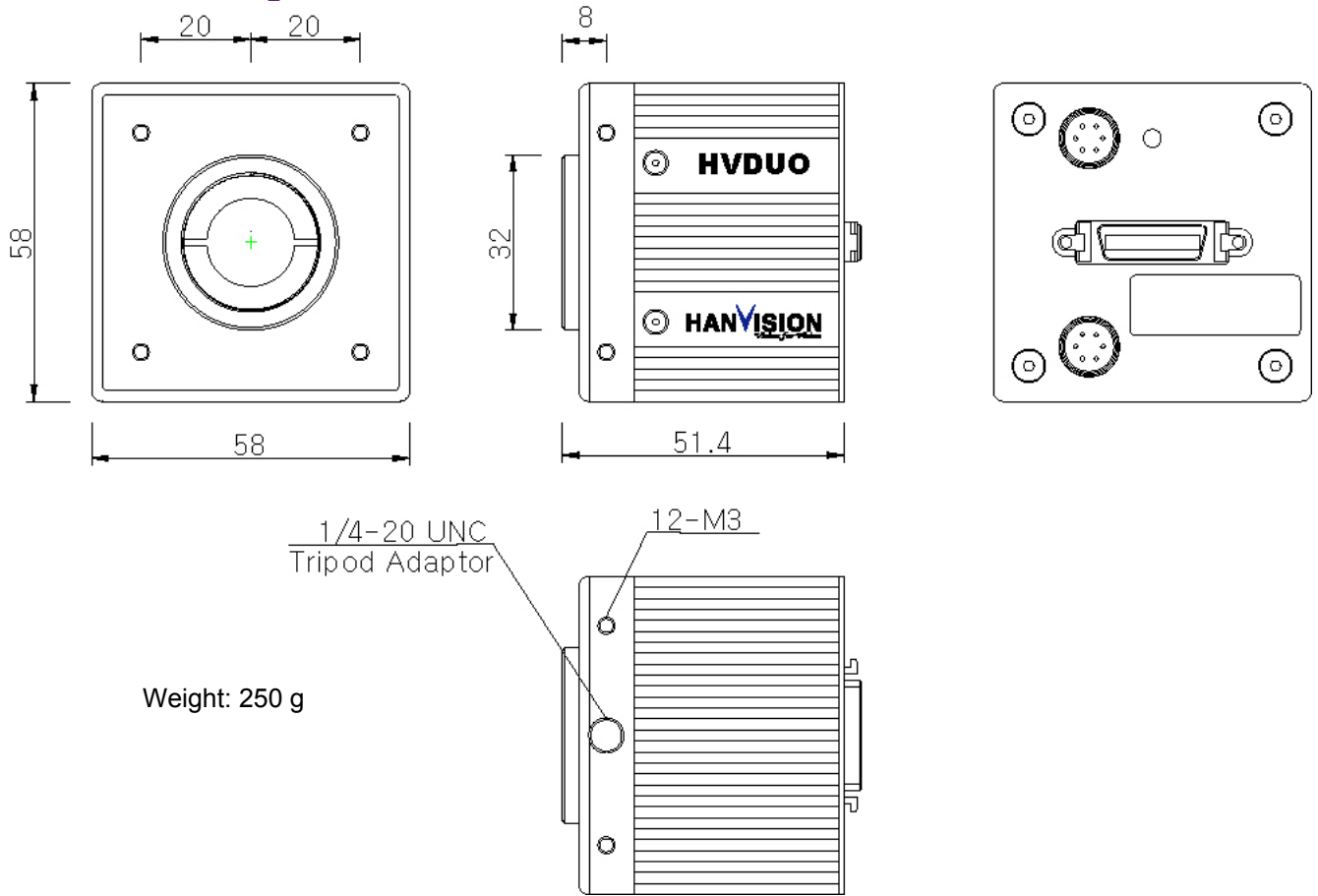
**Data Control** – Supports LVAL, FVAL, Pixel Clock and bidirectional serial communications

**Light Source Control** – The HVDUO-5M camera provides output and optoisolated input connections for synchronization with pulsed illuminators or external shutters.

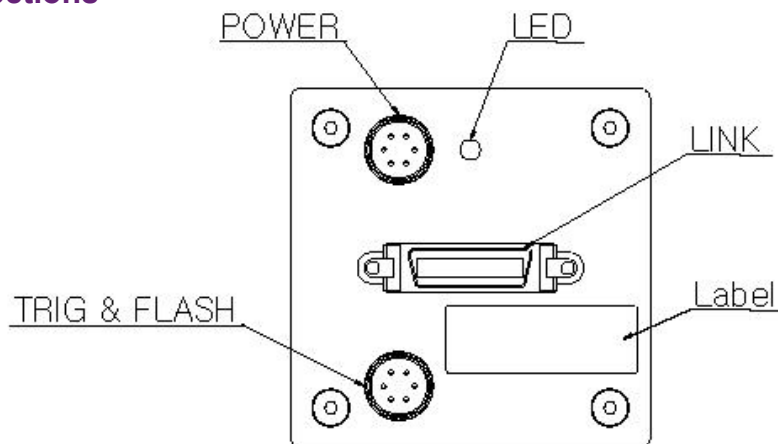
### Infrared and Special Filters

The camera includes an 20 mm diameter, 1 mm thick infrared cut filter behind the lens to provide the correct spectral passband for color imaging. The filter may be removed for imaging in the infrared or replaced by custom filters for other applications.

**Mechanical Configuration**



**Rear Panel Connections**



## HVDUO-5M Digital Color Camera

Power:	Connector - 6-pin Hirose HR-10A
	Input - 5 VDC $\pm$ 5%, 1A max, AC adapter included
	Consumption - 4 W (typical)
	Indicator - Green LED
Digital Video Out:	Format - 24-bit RGB, CameraLink Base mode
	Connector - MDR-26P
External Triggering:	Signals - Frame trigger in, Flash sync out
	Connector - 6-pin Hirose HR-10A

### Ordering Information

For orders placed with Alternative Vision, use the following part numbers:

Part No.	Description
3331-0004-01-00	40 MHz clock, IR cut filter, FO18-50F19 sensor, 24-bit CameraLink, DSM*

\*DSM – Dark frame subtraction mechanism

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#### For further information:

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##### Local Representative

HanVision reserves the right to make changes in configuration and specifications without prior notice to support improvements in components, performance or compatibility. Specifications are representative of camera performance but may not represent sensor limits.

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