# PRODUCT DATASHEET

# NOVA R3-4K R5-4K

FASTCAM series by Photron




FASTCAM NOVA R3-4K / R5-4K

**9.4-megapixel CMOS Image Sensor:**
4096 x 2304 pixels (4K) at 750fps (NOVA R3-4K)
4096 x 2304 pixels (4K) at 1,250fps (NOVA R5-4K)
3840 x 2160 pixels (UHD) at 800fps (NOVA R3-4K)
3840 x 2160 pixels (UHD) at 1,440fps (NOVA R5-4K)

**Maximum Frame Rate:**
150,000fps (NOVA R3-4K)
200,000fps (NOVA R5-4K)

**Class Leading Light Sensitivity:**
ISO 3,200 monochrome
ISO 640 color

**Global Electronic Shutter:**
2µs independent of frame rate

**Dynamic Range (ADC):**
12-bit monochrome
36-bit color

**Compact and Lightweight:**
120mm (H) x 120mm (W) x 223.2mm (D)
4.72″ (H) x 4.72″ (W) x 8.78″ (D)
Weight: 3.5kg (7.7 lbs.)

**Internal Recording Memory:**
32GB, 64GB, 128GB

**Optional FASTDrive Removable High Capacity Data Storage:**
4TB High-speed Solid State Drive

**Fast 10-Gigabit Ethernet Interface:**
Provides camera control and high-speed image download to standard PC

**Fan Stop Function:**
Remotely switch off cooling fans to eliminate vibration when recording at high magnifications

## TWO COMPACT AND VERSATILE HIGH PERFORMANCE CAMERA SYSTEMS WITH 4K-UHD IMAGE RESOLUTION

FASTCAM NOVA R3-4K and R5-4K cameras bring together unique CMOS image sensor technologies and extensive high-speed digital imaging expertise to provide a camera with the flexibility to be used in a wide variety of applications.

Two performance level models - FASTCAM NOVA R3-4K and R5-4K - the cameras deliver 12-bit image recording rates up to 750fps and 1,250fps respectively at 4K image resolution and 800fps and 1,440fps respectively at UHD image resolution, with shutter speeds to 2µs. Recording rates to 200,000fps are available at reduced image resolutions for the FASTCAM NOVA R5-4K. All of this is available from two rugged, compact, and lightweight cameras that provide the best light sensitivity and image quality in their class.

Standard features of FASTCAM NOVA R3-4K / R5-4K cameras include an internal mechanical shutter to allow remote system calibration, a high-performance 10-Gigabit Ethernet interface for camera control and high-speed image download, memory segmentation that allows recording into one memory partition while downloading from another, and compatibility with a number of industry standard lens formats to allow the use of Nikon G-Type, C-mount, and Canon EF lenses.

FASTCAM NOVA R3-4K / R5-4K cameras also feature a “sealed body” design that prevents dust and corrosive particles from contaminating sensitive electronics. An optional FASTDrive SSD can be used for the download of images at up to 1GB per second.

Intuitive and feature rich Photron FASTCAM Viewer (PFV) software is included with each FASTCAM NOVA R3-4K / R5-4K camera. Also included is a Photron Device Control SDK that allows integration of the camera with user-specific software, and libraries for controlling the camera within a MATLAB® or LabView environment.



**Light Sensitivity:**

| FASTCAM NOVA R3-4K / R5-4K | |
|---|---|
| Monochrome models | ISO 3,200 |
| Color models | ISO 640 |

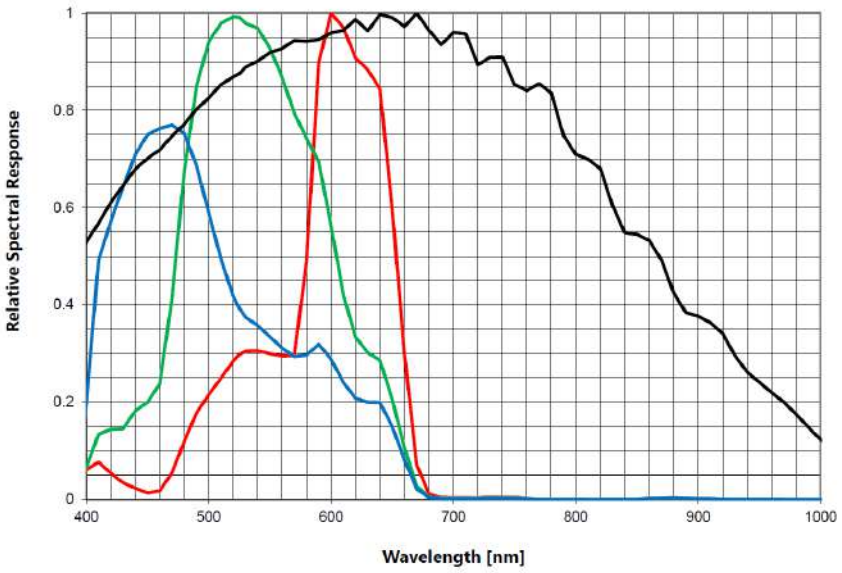
Image Sensor:
FASTCAM NOVA R3-4K / R5-4K cameras use an advanced CMOS image sensor optimized for light sensitivity and high image quality that is unique to Photron.

A 6.5-micron pixel pitch gives a sensor size at full image resolution of 26.62 x 14.98mm (diagonal 30.55mm).

Lenses designed for both FX (35mm full frame) and also Nikon DX (digital SLR) formats are compatible with the FASTCAM NOVA R3-4K / R5-4K at UHD-4K resolution.

| | |
|---|---|
| Sensor Type | Proprietary Design Advanced CMOS |
| Maximum Resolution (pixels) | 4096 x 2304 pixels |
| Sensor Size / Diagonal | 26.62 x 14.98mm / 30.55mm |
| Pixel Size (microns) | 6.5µm x 6.5µm |
| Quantum Efficiency | TBD |
| Fill Factor | TBD |
| Color Matrix | Bayer CFA (single sensor) |
| Light Sensitivity | ISO 3,200 monochrome<br>ISO 640 color |
| Shutter | Global Electronic Shutter 2.0µs<br>independent of frame rate |

**FASTCAM Nova R5 Relative Spectral Response Curves – Monochrome and Color**



**Camera Performance Specifications**

| Model | FASTCAM NOVA R3-4K | FASTCAM NOVA R5-4K |
|---|---|---|
| Full Frame Performance | 750fps<br>4096 x 2304 pixels | 1,250fps<br>4096 x 2304 pixels |
| Maximum Frame Rate | 150,000fps (2048 x 8 pixels) | 200,000fps (2048 x 8 pixels) |
| Minimum Exposure Time | Global electronic shutter to 2.0µs selectable independent of frame rate | |
| Ruggedized Mechanical Calibration Shutter | Standard feature | |
| Dynamic Range (ADC) | 12-bit monochrome 36-bit color | |
| Memory Capacity Options | 32GB, 64GB, 128GB | |
| Memory Partitions | Up to 128 memory segments | |
| Region of Interest | Selectable in steps of 128 pixels (horizontal) x 8 pixels (vertical) | |
| Trigger Inputs | Selectable +/- TTL 5V and switch input (may be configured NO or NC) | |
| Trigger Delay | Programmable on selected input / output triggers: 100ns resolution | |
| Input / Output | Input: Trigger (TTL/Switch), sync, ready, event, IRIG<br>Output: trigger, sync, ready, rec, exposure | |
| Trigger Modes | Start, end, center, manual, random, random center, random manual, record on command | |
| Time Code Input | IRIG-B (selectable at beginning or end of frame exposure) | |
| External Sync | +/- TTL 5Vp-p Variable frequency sync | |
| Camera Control Interface | High-speed 1/10 Gigabit Ethernet | |
| Image Data Display | Frame rate, shutter speed, trigger mode, date/time, status, real time / IRIG time, frame count, resolution | |
| Saved Image Formats | BMP, TIFF, JPEG, PNG, RAWW, MRAW, AVI, MOV | |
| Supported OS | Microsoft Windows operating system including: 8.1, 10, 11 (32/64-bit) | |

**Optional Removable Data Storage:**
FASTCAM NOVA R3-4K / R5-4K cameras can be supplied with the Photron FAST-Drive high capacity removable SSD. The ultra-high data rate FASTDrive allows a 128GB camera recording to be transferred to a removable SSD drive in approximately 2 minutes. Recorded data can then be directly accessed while coupled to the camera or the drive may be removed and inserted into the portable FASTDock station connected to any Windows PC.




**High-Speed Gigabit Ethernet Interface:**
FASTCAM NOVA R3-4K / R5-4K cameras are equipped with a high-speed 10-Gigabit Ethernet Interface to provide reliable camera control and fast download of image data.

**Dedicated I/O:**
A dedicated BNC connection for a contact closure hardware trigger input supporting NO, NC opertion is provided. In addition, two programmable inputs and two programmable output channels provide direct connection for common tasks such as synchronization of multiple cameras and operation in conjunction with Data Acquisition (DAQ) hardware.



**Ruggedized Mechanical Calibration Shutter:**
The ruggedized mechanical shutter is fitted as standard to FASTCAM NOVA R3-4K / R5-4K cameras allows sensor black balance calibration to be carried out remotely from the system control software.

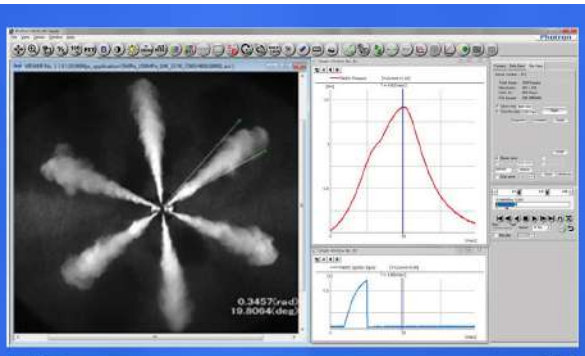
**Optional C-Mount and Canon EF Lens Mounts:**
In addition to the standard Nikon G type lens adapter, all FASTCAM Nova models support an optional C-mount lens adapter and an optional Canon EF lens adapter which, through Photron FASTCAM Viewer (PFV), not only enables remote operation of lens focus and aperture but also adds Auto-Focus capability.

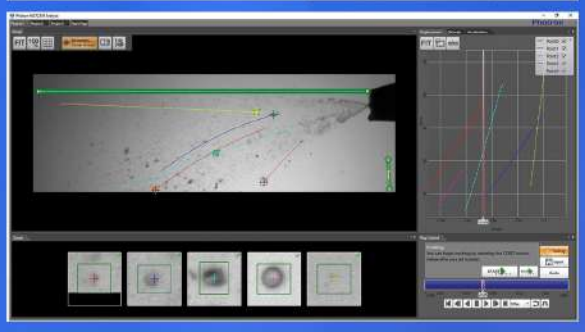
## Camera Operation Features

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|---|---|
| Frame Synchronization | Accurate frame synchronization with other cameras and with external and unstable frequencies. |
| Memory Partitions | Up to 128 memory segments. |
| Low Light Mode | Operation at minimum frame rate with separately adjustable shutter time to allow easy camera set-up and focus in ambient lighting. |
| Video Output (optional) | 1080p live and playback via HD-SDI output. |
| IRIG Phase Lock | Enables multiple cameras to be synchronized together with other instrumentation equipment or to a master external time source. |
| Internal Time Delay Generator | Allows programmable delays to be set on input and output triggers; 100ns resolution. |
| Event Markers | Up to ten user-entered event markers to define specific events within the recorded image sequence . |
| Download While Recording | FASTCAM NOVA R3-4K / R5-4K cameras support Partition Recording Mode, allowing image data captured in one memory partition to be downloaded while at the same time recording into another partition. |
| Automatic Download | The system can be set to automatically download image data to the control PC and, when download is complete to re-arm in readiness for the next trigger with automatically incremented file names. |
| Software Binning | Virtual pixel binning (2x2, 4x4 etc.) allows increased light sensitivity with reduced image resolution without changing camera field of view. |
| FASTDrive | 4TB solid state drive (SSD) memory pack provides ultra high data rate transfer to removable media. |

## Operation Software Features

| | |
|---|---|
| Image Calibration | 2D image calibration allows the measurement of distance and angle from the image. A calibration grid overlay can be superimposed on the image. |
| Image Overlay | A stored reference image may be overlaid on the live image to allow accurate camera positioning to achieve the same view as a previous test. |
| Import of Multiple Image Sequences | Multiple image sequences can be loaded and simultaneously replayed. Timing of image sequences can be adjusted to create a common time reference. Time based synchronization allows images captured at different frame rates to be synchronized. |
| High Dynamic Range Mode | Making use of the full sensor dynamic range, HDR mode allows enhanced detail in both light and dark areas of an image to be displayed simultaneously. |
| Background Subtraction | In order to highlight subtle changes in an image, Background Subtraction allows a reference image to be subtracted from a recorded sequence. Details including propagation of shock waves and surface changes during impact can be visualized using the feature. |
| Line Profile | A line profile representing grey levels along a line drawn across any region of the image is displayed. In live mode the Line Profile can be used to ensure optimum image focus is achieved. |
| Histogram | A histogram displaying grey levels within a user-defined image area is displayed. In live mode the Histogram can be used to ensure that optimum exposure levels are set for the scene being recorded. |





**Photron FASTCAM Viewer:**
Photron FASTCAM Viewer software (PFV) has been designed to provide an intuitive and feature rich user interface for the control of Photron high-speed cameras, data saving, image replay and simple motion analysis. Advanced operation menus provide access to features for advanced camera operation and image enhancement. Tools are provided to allow image calibration and easy measurement of angles and distances from image data. Also included are a C++ SDK and wrappers for LabView and MATLAB ®.

An optional software plug-in module provides synchronization between Photron high-speed cameras and data acquired through National Instruments data acquisition systems. Synchronized data captured by the DAQ system provides waveform information which can be viewed alongside high-speed camera images.

**Photron FASTCAM Analysis:**
PFV software allows image sequences to be exported directly to optional Photron FASTCAM Analysis (PFA) Motion Analysis software. This entry level Motion Analysis software with an on screen ‘step by step guide’ function provides automated tracking of up to 5 points using feature or correlation tracking algorithms for the automated analysis of motion within an image sequence.

| FASTCAM NOVA R3-4K / R5-4K | | |
|---|---|---|
| **Resolution** | **Maximum Frame Rate** | |
| (h x v pixels) | **NOVA R3-4K** | **NOVA R5-4K** |
| 4096 x 2304 | 750 | 1,250 |
| 4096 x 1504 | 1,000 | 2,000 |
| 4096 x 1024 | 1,650 | 2,880 |
| 4096 x 512 | 3,000 | 5,500 |
| 4096 x 256 | 6,000 | 11,250 |
| 4096 x 128 | 12,000 | 20,000 |
| 4096 x 64 | 20,000 | 40,000 |
| 4096 x 8 | 100,000 | 158,400 |
| 3840 x 2160 | 800 | 1,440 |
| 2048 x 2048 | 1,650 | 2,880 |
| 2048 x 1024 | 3,000 | 5,500 |
| 2048 x 512 | 6,000 | 11,250 |
| 2048 x 256 | 12,000 | 20,000 |
| 2048 x 128 | 20,000 | 40,000 |
| 2048 x 64 | 40,000 | 72,000 |
| 2048 x 8 | 150,000 | 200,000 |
| 1920 x 1080 | 3,000 | 5,280 |
| 1280 x 720 | 4,000 | 8,000 |
| 1024 x 1024 | 3,000 | 5,500 |
| 640 x 480 | 6,000 | 12,000 |
| 512 x 512 | 6,000 | 11,250 |

* Specifications subject to change without notice.

**Variable Region of Interest:**
Region of Interest (ROI) or sub-windowing allows a user-specified portion of the sensor to be defined to capture images. By using a reduced portion of the image area, the frame rate at which images are recorded can be increased. FASTCAM NOVA R3-4K / R5-4K cameras allow the ROI to be set in increments of 128 pixels horizontal and 8 pixels vertical.

**External Frame Synchronization:**
FASTCAM NOVA R3-4K / R5-4K cameras can be fully synchronized with an external source to allow the timing of when each individual image is captured to be precisely referenced. The camera can be accurately synchronized to unstable frequencies allowing complex events such as combustion in rapidly accelerating or decelerating engines to be recorded and studied.

**Record During Download Operation:**
FASTCAM NOVA R3-4K / R5-4K cameras recording memory can be divided into multiple active sections. The user can record an on-going event in one memory partition while at the same time downloading a previously recorded image sequence in order to improve workflow and optimize camera operation.



# Mechanical and Environmental Specifications

| Mechanical and Environmental Specifications | |
|---|---|
| **Mechanical** | |
| Lens Mount | F-mount (G-type lens compatible)<br>Optional lens mounts include C-mount, Canon EF remote control mount, and M42 adapter. |
| Camera Mountings | 3/8 - 16 UNC, 1/4 - 20 UNC & 4 x M6 (base and side), 2 x 1/4 - 20 UNC (top) |
| **External Dimensions** | |
| Camera Body<br>(excluding protrusions) | 120mm (H) x 120mm (W) x 223.2mm (D)<br>4.72" (H) x 4.72" (W) x 8.78" (D) |
| **Weight** | |
| Camera Body | 3.5kg (7.2lbs) |
| **Environmental** | |
| Operating Temperature | -10 to 45C, 14˚ to 113˚F |
| Storage Temperature | -20 to 60C, -4˚ to 140˚F |
| Humidity | 85% or less (non-condensing) |
| Cooling | Internal fan cooling (fan-off mode supported) |
| Operational Shock | 30G, 11ms, 6-axes 10 times/axis |
| **Power** | |
| AC Power (with supplied adapter) | 100 to 240V, 50 to 60Hz |
| DC Power (primary input) | 22 to 32V, 120VA |
| DC Power (battery input) | 22 to 32V, 120VA |




**Nikon G-Type Compatible Lens Mount:**
FASTCAM NOVA R3-4K / R5-4K cameras are equipped with an objective lens mount compatible with readily available Nikon G-type lenses. Controls provided within the lens mount allow the control of lens aperture on lenses without external iris control.

**Optional C-Mount and Canon EF Lens Mounts:**
In addition to the standard Nikon G type lens adapter, all FASTCAM Nova models support an optional C-mount lens adapter and an optional Canon EF lens adapter which, through Photron FASTCAM Viewer (PFV), not only enables remote operation of lens focus and aperture but also adds Auto-Focus capability.

**Operation Environments:**
The 'sealed body' design of FASTCAM NOVA R3-4K / R5-4K cameras ensure optimum air flow and prevents dust and corrosive particles from being ingested within the internal camera body where they can damage sensitive electronics. The fans may be disabled during recording for any vibration sensitive measurements.

FASTCAM NOVA R3-4K / R5-4K cameras have been extensively tested to ensure operation for extended periods in ambient temperatures up to 45C.

**Fan Stop Function:**
Remotely switch off cooling fans to eliminate vibration when recording at high magnifications.

Specifications subject to change without notice.


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