PRODUCT DATASHEET

Mini R3-4K R5-4K

FASTCAM series by Photron



FASTCAM MINI R3-4K / R5-4K

9.4-megapixel CMOS Image Sensor:
4096 x 2304 pixels (4K) at 750fps (MINI R3-4K)
4096 x 2304 pixels (4K) at 1,250fps (MINI R5-4K)
3840 x 2160 pixels (UHD) at 800ps (MINI R3-4K)
3840 x 2160 pixels (UHD) at 1,440fps (MINI R5-4K)
1920 x 1080 pixels (FHD) at 3,000fps (MINI R3-4K)
1920 x 1080 pixels (FHD) at 5,280fps (MINI R5-4K)

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

Class Leading Light Sensitivity:
ISO 4,000 monochrome
ISO 800 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 94.4mm (D)
4.72″ (H) x 4.72″ (W) x 3.71″ (D)
Weight: 2.1kg (4.63lbs.)

Internal Recording Memory:
16GB, 32GB, 64GB

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

High-G Rated:
Suitable for application in high-G environments. Operation tested to 100G, 10ms, 6-axes

COMPACT AND VERSATILE HIGH PERFORMANCE 4K-UHD CAMERA SYSTEM

This new generation of the popular FASTCAM Mini series with a proprietary 4K/ UHD sensor is ideally suited for applications where observation of a large spatial area without loss of image quality is required - applications such as automotive safety testing (car-to-car, pedestrian testing, barrier/ roll-over testing and curtain airbag), fluid dynamics (PIV, microfluidics) material testing (DIC, drop testing) are some of the main applications for this product.

With the FASTCAM MINI R-4K cameras, users can enjoy 12-bit image recording rates of up to 750fps (MINI R3-4K) and 1,250fps (MINI R5-4K) at 4K resolution, with impressive shutter speeds that go as low as 2µs. For even higher frame rates, the camera offers recording rates of up to 150,000fps (MINI R3-4K) and 200,000fps (MINI R5-4K) at lower image resolutions. The FASTCAM MINI R-4K cameras are compact, rugged, lightweight, and provides the best light sensitivity and image quality – truly setting it apart from other cameras in its class.

Key features of the FASTCAM MINI R-4K include an internal mechanical shutter that allows for remote system calibration, a high-performance 10-Gigabit Ethernet interface for seamless camera control and fast image download, memory segmentation that enables recording into one memory partition while downloading from another, and compatibility with various industry-standard lens formats such as Nikon G-Type, C-mount, and Canon EF lenses.

Additionally, the design of the FASTCAM MINI R-4K boasts a “sealed body” construction to safeguard sensitive electronics against dust and corrosive particles. This ensures optimal performance and longevity for the camera.

Intuitive and feature rich Photron FASTCAM Viewer (PFV) software is included with each FASTCAM MINI 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.

In conclusion, the FASTCAM MINI R5-4K camera is unrivaled in its flexibility and versatility due to its advanced technology and intelligent design. It delivers exceptional light sensitivity, image quality, and functionality across diverse applications.



Light Sensitivity:

FASTCAM MINI R5-4K	
Monochrome models	ISO 4,000
Color models	ISO 800

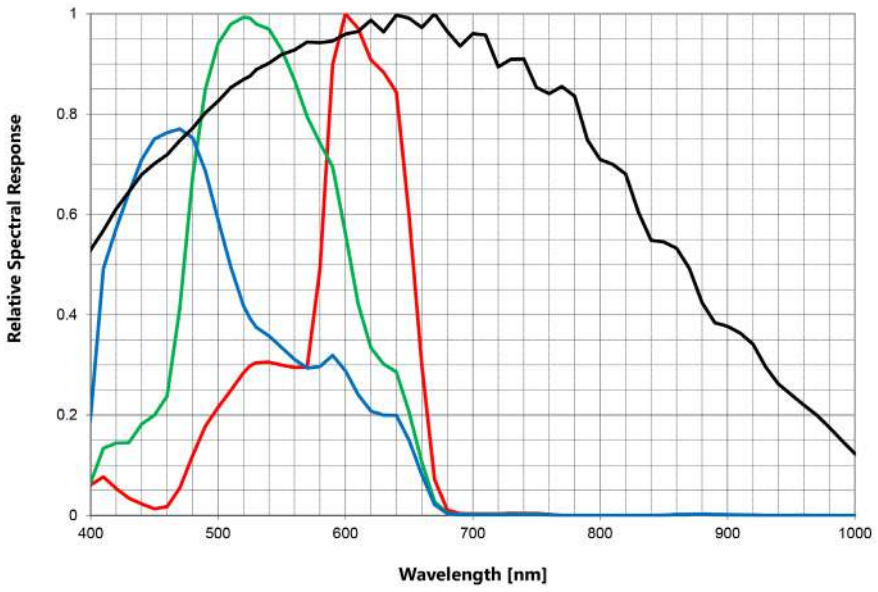
Image Sensor:
The FASTCAM MINI R3-4K / R5-4K cameras use an advanced CMOS image sensor optimized for light sensitivity and high image quality that is unique to Photron.

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 MINI 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 4,000 monochrome ISO 800 color
Shutter	Global Electronic Shutter 2.0µs independent of frame rate

FASTCAM MINI R3-4K / R5-4K Relative Spectral Response Curves - Monochrome and color



Camera Performance Specifications

Model	FASTCAM MINI R3-4K	FASTCAM MINI R5-4K
Full Frame Performance	750fps 4096 x 2304 pixels	1,250fps 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	16GB, 32GB, 64GB	
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 Output: trigger, sync, ready, rec, exposure	
Trigger Modes	Manual, random reset, random manual	
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, GRAW	
Supported OS	Microsoft Windows operating system including: 8.1, 10, 11 (32/64-bit)	

Mechanical and Environmental Specifications

High-Speed Gigabit Ethernet Interface:
The FASTCAM MINI R-4K cameras include 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 on all FASTCAM MINI R-4K cameras, allowing sensor black balance calibration to be carried out remotely from the system control software.

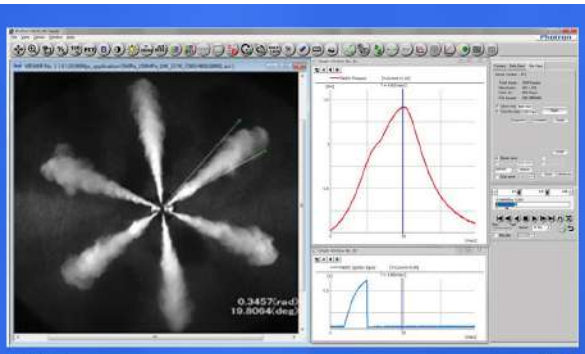
Optional C-Mount and Canon EF Lens Mounts:
In addition to the standard Nikon G type lens adapter, all FASTCAM MINI R-4K cameras, support an optional C-mount lens adapter and an optional Canon EF lens adapter which, through Photron FASTCAM Viewer (PFV), not only enables remote operation of lens focus and aperture but also adds Auto-Focus capability.

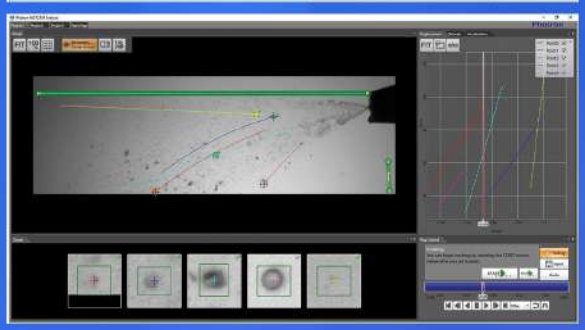
Camera Operation Features

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.
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 MINI 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.

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 MINI R3-4K / R5-4K					
Resolution	**Maximum Frame Rate**	**Maximum Frame Rate**			
(h x v pixels)	**MINI R3-4K**	**MINI R5-4K**	**64GB**	**32GB**	**16GB**
4096 x 2304	750	1,250	4,827	2,399	1,186
4096 x 1504	1,000	2,000	7,395	3,677	1,817
4096 x 1024	1,650	2,880	10,862	5,401	2,670
4096 x 512	3,000	5,500	21,725	10,803	5,341
4096 x 256	6,000	11,250	43,452	21,607	10,684
4096 x 128	12,000	20,000	86,906	43,215	21,370
4096 x 64	100,000	40,000	173,813	86,432	42,741
4096 x 8	800	158,400	1,390,516	691,465	341,940
2048 x 2048	1,650	2,880	10,862	5,401	2,670
2048 x 1024	3,000	5,500	21,725	10,803	5,341
2048 x 512	6,000	11,250	43,452	21,607	10,684
2048 x 256	12,000	20,000	86,906	43,215	21,370
2048 x 128	20,000	40,000	173,813	86,432	42,741
2048 x 64	40,000	72,000	347,628	172,865	85,484
2048 x 8	150,000	200,000	2,781,033	1,382,932	683,881
1920 x 1080	3,000	5,280	22,066	11,019	5,496
1024 x 1024	3,000	5,500	43,452	21,607	10,684
640 x 480	6,000	12,000	148,320	73,755	36,472
512 x 512	6,000	11,250	173,813	86,432	42,741

* 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. The FASTCAM MINI R3-4K / R5-4K cameras allow the ROI to be set in increments of 128 pixels horizontal and 8 pixels vertical.

External Frame Synchronization:
The FASTCAM MINI 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:
The FASTCAM MINI 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	
Lens Mount	F-mount (G-type lens compatible) 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 (excluding protrusions)	120mm (H) x 120mm (W) x 93mm (D) 4.72" (H) x 4.72" (W) x 3.66" (D)
Weight	
Camera Body	2.1kg (4.63lbs)
Environmental	
Operating Temperature	-10 to 40C, 14˚ to 104˚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	100G, 11ms, 6-axes 1000 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 MINI 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 MINI R-4K cameras, 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 the FASTCAM MINI 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.

The FASTCAM MINI R3-4K / R5-4K cameras have been extensively tested to ensure operation for extended periods in ambient temperatures up to 40C.

Specifications subject to change without notice.

PHOTRON USA, INC.
9520 Padgett Street, Suite 110
San Diego, CA 92126
USA

Tel: 858.684.3555 or 800.585.2129
Fax: 858.684.3558
Email: image@photron.com
www.photron.com

PHOTRON EUROPE LIMITED
The Barn, Bottom Road
West Wycombe
Bucks. HP14 4BS
United Kingdom

Tel: +44 (0) 1494 481011
Fax: +44 (0) 1494 487011
Email: image@photron.com
www.photron.com

PHOTRON (Shanghai)
Room 20C, Zhao-Feng
World Trade Building
No. 369, JiangSu Road
Chang Ning District
Shanghai, 200050 China
Tel: +86 (21) 5268-3700
Fax: +86 (21) 5268-3702
Email: info@photron.cn.com
www.photron.cn.com

PHOTRON LIMITED
21F, Jinbocho Mitsui Bldg.
1-105 Kanda Jimbocho
Chiyoda-ku, Tokyo 101-0051
Japan

Tel: +81 (3) 3518-6271
Fax: +81 (3) 3 3518-6279
Email: image@photron.co.jp
www.photron.co.jp

REV# 25.08.18