FASTCAM *Mini WX100*

COMPACT HIGH-DEFINITION HIGH-SPEED CAMERA SYSTEM

PRODUCT FEATURES:

4MP CMOS Sensor:
2048x2048 pixels at 1080fps

Frame Rate Performance Examples:
- 1,080fps at 2048x2048 pixel resolution
- 2,000fps at 1980x1080 pixel resolution
- 2,250fps at 1280x1280 pixel resolution
- 3,200fps at 1024x1024 pixel resolution
- 3,600fps at 1280x800 pixel resolution

Compact and Lightweight:
120mm x 120mm x 99mm Camera body
Weight: 1.6Kg

True Region Of Interest (ROI):
Increase frame rate with a reduction in vertical and/or horizontal image resolution. Freedom to position ROI at any sensor position

High-G Compatible:
Operationally tested to 100G, 10ms, 6 axis.

High Light Sensitivity:
ISO 12232 Ssat (excluding IR response)
• ISO 6,400 monochrome
• ISO 2,000 colour

Dynamic Range (ADC):
12-bit Monochrome, 36-bit Colour

Global Electronic Shutter
1ms to 2.7 µsec independent of frame rate

Recording Memory Options:
4GB, 8GB and 16GB.

Fast Gigabit Ethernet Interface:
Provides reliable system communication and fast image download.

Fan Stop Function
Remotely switch off cooling fans to eliminate vibration – particularly important when capturing events at high-magnification.

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Compact lightweight camera system offering outstanding performance and ease of use in a wide range of high-speed imaging applications requiring high-resolution

The Photron FASTCAM Mini WX high-speed camera delivers exceptional high-resolution performance by providing 2048x2048 pixels (4MP) resolution at 1,080 frames per second (fps), full HD (1920x1080 pixels) at 2,000fps and up to 80,000fps at reduced image resolution.

A true Region of Interest (ROI) capability allows the user to not only match the image aspect ratio to the subject, but for applications such as microscopy it is possible to position the ROI at any location on the sensor thus removing the need to adjust the camera position.

The FASTCAM Mini WX is both compact and light weight with dimensions of just 120mm x 120mm x 99mm and weighing 1.6kg and also rugged - operationally tested to 100G , 10ms, 6 axis. This unique combination of high resolution performance in a compact, light but rugged package maximises the range of industrial and scientific applications to which the FASTCAM Mini WX may be applied .

The FASTCAM Mini WX utilises Photron's proprietary CMOS sensor technology providing 12bit monochrome or 36bit colour versions . With the utilization of micro-lenses this system delivers excellent light sensitivity and image quality. Recording memory options from 4GB - 16GB permit capture of up to 2.7 seconds un-compressed and un-interpolated data – this is sufficient duration for typical high-speed events.

Standard operational features of the FASTCAM Mini WX100 include Gigabit Ethernet interface for fast image download and the ability to switch off cooling fans to eliminate vibration when recording at high magnifications – in particular applications such as study of microfluidic flows within a "Lab-on-a-chip" device. Intuitive and feature rich Photron FASTCAM Viewer (PFV) software, SDK and support for operation within a MATLAB or LabVIEW environment are also provided as standard.

microscopy, microfluidics, fluid dynamics, PIV, material science, DIC, automotive safety testing – crash/ rollover/ pedestrian/ head impact, defence, aerospace, biomechanics, sport, life science
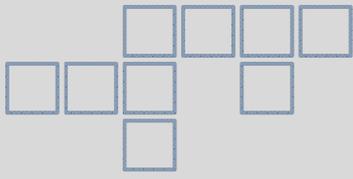
Light Sensitivity:

Expressions of light sensitivity in high-speed cameras can be confusing as a variety of differing measurement techniques are used. Photron publishes light sensitivity figures for it's products using the ISO 12232 Ssat standard.

FASTCAM Mini WX	ISO 12232 Ssat
Monochrome models	ISO 6,400
Color models	ISO 2,000

ISO 12232 values published by Photron for both monochrome and color cameras are measured excluding infra-red sensitivity as defined by the ISO standard.

Monochrome sensors used in FASTCAM Mini WX cameras are supplied without an IR filter, extending the camera spectral response beyond 900nm. When the sensitivity of the FASTCAM Mini WX camera is measured to tungsten light including near IR response an equivalent value greater than ISO 10,000 T is obtained.

Image Sensor:

The FASTCAM Mini WX system uses an advanced CMOS image sensor that is unique to Photron. The pixel pitch of the sensor is 10 microns giving a sensor size at full resolution of 20.48 x 20.48 mm (diagonal 28.96mm).

Lenses designed for both FX (35mm full frame) and also DX (APS-C digital SLR) formats are compatible with the FASTCAM Mini WX at full image resolution.

Colour Filter Array (CFA):

The FASTCAM Mini WX employs a Colour Filter Array and proprietary colour processing algorithms to accurately reproduce colour

Image Sensor Technical Data:

Sensor Type	Proprietary Design Advanced CMOS
Maximum Resolution (pixels)	2048 x 2048 pixels
Sensor Size / Diagonal	20.48 x 20.48mm / 28.96mm
Pixel Size (microns)	10µm x 10µm
Micro-lenses	Yes
Quantum Efficiency	45% at 630nm
Full Well Capacity	32,000e-
Fill Factor	42%
Dark Noise	29e-
Sensor Dynamic Range	62.6 dB
Color Matrix	Bayer CFA (single sensor)
ISO 12232 Ssat sensitivity	ISO 6,400 mono, ISO 2,000 color (equivalent > ISO 10,000 T including near IR response)
Shutter	Global Electronic Shutter 1ms to 2.7µs independent of frame rate.

Image Sensor Spectral Response:
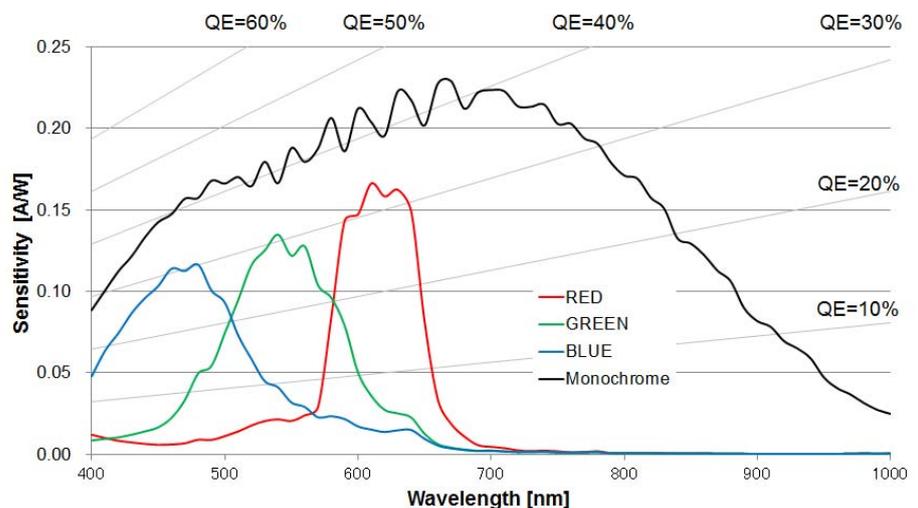
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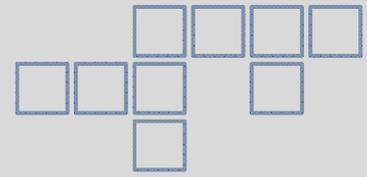
Camera Performance Specifications:

Frame Rate (full image resolution)	1,080fps at 2048 x 2048 pixels
Maximum Frame Rate (reduced image resolution)	80,000fps at 256 x 32 pixels
Shutter Time	Global shutter minimum exposure time independent of frame rate to 2.7µs
Inter-frame time (for PIV)	2593ns
Dynamic Range (ADC)	12-bit Monochrome 36-bit Colour
Memory Capacity Options	4GB: 678 frames at full resolution 8GB: 1,361 frames at full resolution 16GB: 2,726 frames at full resolution
Memory Partitions	Up to 64 memory segments
Ruggedized Mechanical Calibration Shutter	Standard feature
Cooling	Actively cooled
Disable Cooling Fans	Supported - Via Software
Trigger Inputs	Selectable +/- TTL and switch closure FET input 0V +/-12V (H level +2.5V to +12V)
Input / Output	**Input:** Trigger(TTL/SW), Sync, Ready, Event, IRIG **Output:** Trigger, Sync, Ready, Rec, Exposure
External Sync	+/- TTL Variable Frequency Synchronization FET input 0V +/-12V (H level +2.5V to +12V)
Trigger / Synchronization Outputs	For synchronisation of multiple cameras or external equipment +5V CMOS output, selectable POS/NEG polarity
Trigger Modes	Start, End, Centre, Manual, Random ,Image trigger and Time lapse.
Trigger Delay	Programmable on selected input/ output triggers: 100ns resolution
Time Code Input	IRIG-B
Camera Control Interface	High Speed Gigabit Ethernet
Image Data Display	Memory status, Frame rate, Shutter speed, Trigger Mode, Date/Time, Status, Real time / IRIG Time, Frame count, Resolution, LUT and Comment
Saved Image Formats	BMP, TIFF, JPEG, PNG, RAW, RAWW, MRAW, AVI, WMV, FTIF, MOV: Images can be saved with/ without recording data and user LOGO (in border or overlay) with/ without compression and in 8-bit / 16-bit or bit depth of sensor where supported
Supported OS	Microsoft®Windows® Operating System including XP, Vista, 7, 8, 8.1 (32/64-bit)

High-Speed PC Interface:

FASTCAM Mini WX100 camera system is equipped with a high-speed Gigabit Ethernet interface to provide reliable network communication and fast download of image data.

High-G Calibration Shutter:

The ruggedized mechanical shutter fitted as standard to the FASTCAM Mini WX100 camera allows sensor black balance calibration to be carried out remotely from the system control software.

Nikon 'G' Compatible Lens Mount:

The FASTCAM Mini WX100 camera is 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.
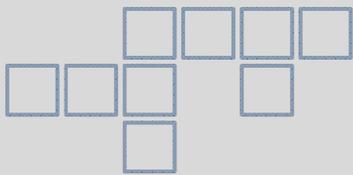

M42 Lens Support:

An optional M42 lens mount is available supporting a range of precision optics for suppliers such as Karl Zeiss.

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Dedicated I/O:

A dedicated BNC connection for a contact closure hardware trigger input is provided. In addition two programmable inputs and two programmable outputs provide direct connection for common tasks such as synchronization of multiple cameras and operation with Data Acquisition Hardware.
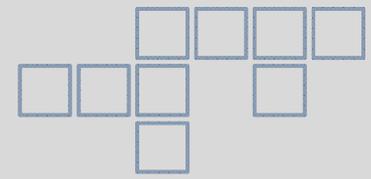
Multi-function Power Connector:

A multi-pin Lemo connection is fitted. This may be used as a standard power DC power input and is also compatible with Photron "J-box" hardware where a single connection provides not only power but also synchronization and trigger connections.

Camera Operation Features:

Dual Slope Shutter (Extended Dynamic Range)	Selectable in 20 steps (0 to 95% in 5% increments) to prevent pixel over exposure without post processing
Memory Partitions	Up to 64 memory segments allow multiple events to be stored in camera memory before downloading, with automatic progression to the next available partition
Download While Recording	In combination with Memory Partitions the FASTCAM Mini WX can be configured to downloading from one partition whilst simultaneously recording into another
Automatic Download	The system can be set to automatically download image data to the control PC, and when download is complete re-arm in readiness for the next trigger with automatically incremented file names
Low Light Mode	Operation at minimum frame rate with separately adjustable shutter time to allow easy camera set-up and focus in ambient lighting
Frame Synchronization	Accurate frame synchronization with other cameras and with external and unstable frequencies
IRIG Phase Lock	Enables multiple cameras to be synchronized together with other instrumentation equipment to a master external time source
Internal 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
Software Binning	Virtual pixel binning (2x2, 4x4 etc) allows increased light sensitivity with reduced image resolution without changing camera field of view

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Sample Frame Rate / Image Resolution:

Frame Rate (FPS)	Image Resolution (Pixels)	
	Horizontal	Vertical
1,080 fps	2048	2048
1,500 fps	2048	1472
2,000 fps	2048	1088
2,500 fps	1536	1024
3,000 fps	1536	864
3,200 fps	1024	1024
3,600 fps	1280	800
5,000 fps	1280	576
6,250 fps	1024	512
7,500 fps	768	480
9,000 fps	768	384
10,000 fps	512	416
15,000 fps	512	256
20,000 fps	512	192
30,000 fps	256	128
40,000 fps	256	96
80,000 fps	256	32

Recordable Image Count (12bit)

Image Resolution (pixels)			4GB Memory (frames)	8GB Memory (frames)	16GB Memory (frames)
2048	x	2048	678	1,361	2,726
2048	x	1472	944	1,894	3,793
2048	x	1088	1,277	2,562	5,132
1536	x	1024	1,809	3,630	7,271
1536	x	864	2,144	4,302	8,617
1024	x	1024	2,714	5,445	10,906
1280	x	800	2,779	5,576	11,168
1280	x	576	3,860	7,744	15,511
1024	x	512	5,429	10,890	21,813
768	x	480	7,721	15,488	31,023
768	x	384	9,652	19,361	38,779
512	x	416	13,364	26,807	53,694
512	x	256	21,717	43,562	87,253
512	x	192	28,956	58,083	116,337
256	x	128	86,869	174,250	349,013
256	x	96	115,825	232,334	465,351
256	x	32	347,477	697,002	1,396,053

Region of Interest mode:

True Region of Interest (ROI) or sub-windowing, allows an increase in frame rate following a reduction of either vertical **or** horizontal pixel resolution. The Photron FASTCAM Mini WX allows horizontal increments of 256 pixels and vertical increments of 32 pixels to build the ROI and achieve the desired frame rate.

Unlike sensors that have a digital output, the selected ROI of the FASTCAM Mini WX may be moved to any position on the sensor; the benefit of this is that without physically moving the camera position the user may image a different region of the subject – this is particularly beneficial when working with microfluidic "lab-on-a-chip" type devices.

Square Image Sensor Format:

With broadcast and media applications image formats such as 16:9 have now become standard; whereas in scientific and industrial imaging applications an image sensor with a 1:1 image format is generally accepted to be advantageous. To capture the maximum useful image data in applications including microscopy, detonics, combustion imaging and many others a 1:1 sensor format provides greater flexibility than 'letterbox' image formats.

The FASTCAM Mini WX image sensor allows the user to choose either square or rectangular image formats in order to obtain the maximum subject information.

External Frame Synchronization:

The FASTCAM Mini WX camera can be fully synchronized with an external event 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 a rapidly accelerating or decelerating engine to be recorded and studied.
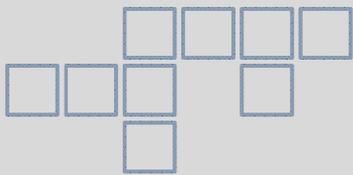
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Photron FASTCAM Viewer:

Photron FASTCAM Viewer (PFV) software provides a robust and reliable interface for control of the FASTCAM Mini WX camera. Clear on-screen controls provide intuitive operation of FASTCAM Mini WX camera functions. Advanced operation menus provide access to features for enhanced camera operation, image replay and export. PFV software provides tools allowing image calibration and simple measurement of angle and distances from image data.

National Instruments DAQ support:

A software plug-in is available for the FASTCAM Mini WX to support National Instruments USB-6361 / USB-6363 BNC DAQ modules. Optimized for superior accuracy and fast sampling rates, the system allows up to 32 channels (single ended) and 16 channels (differential) analogue data at sampling rates up to 2MS/s to be captured alongside high speed image data from the FASTCAM camera. This option allows a graphic display of DAQ data to be replayed in PFV software precisely synchronized and automatically linked with high speed images. 'Level Detection Triggering' allows the system to monitor data acquisition signals from an event and automatically trigger the high speed camera to start or stop recording images when levels exceed user pre-set reference values, allowing unpredictable and intermittent events to be reliably captured.

Motion Analysis:

PFV software allows image sequences to be exported directly to optional PFA Motion Analysis software. This entry level Motion Analysis software with an on screen 'step by step guide' function launches automatically from Photron FASTCAM Viewer software, and provides automated tracking of up to 5 points using either a correlation or centre of gravity algorithm for the analysis of motion within an image sequence. Measurements of displacement, velocity and acceleration are automatically calculated and displayed and these may later be exported as comma separated values (csv files) to MS Excel etc. for further processing.

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FASTCAM Mini WX Operation Software Features:

Image Calibration	2D image calibration allows the measurement of distances and angle from the image. A calibration grid can be superimposed on the image
Image Overlay	A stored reference image may be overlaid on the live image to ensure continuity of setup from a previous test. Alternatively two stored sequences may be directly compared by using this function
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
Motion Detector	In order to highlight subtle changes in an image Motion Detector allows a reference image to be subtracted from a recorded sequence. Details including propagation of shock waves and surface changes during impact can be visualised using this feature
Line Profile	A line profile representing grey levels along a line drawn across any region of the image is displayed. In live mode 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.
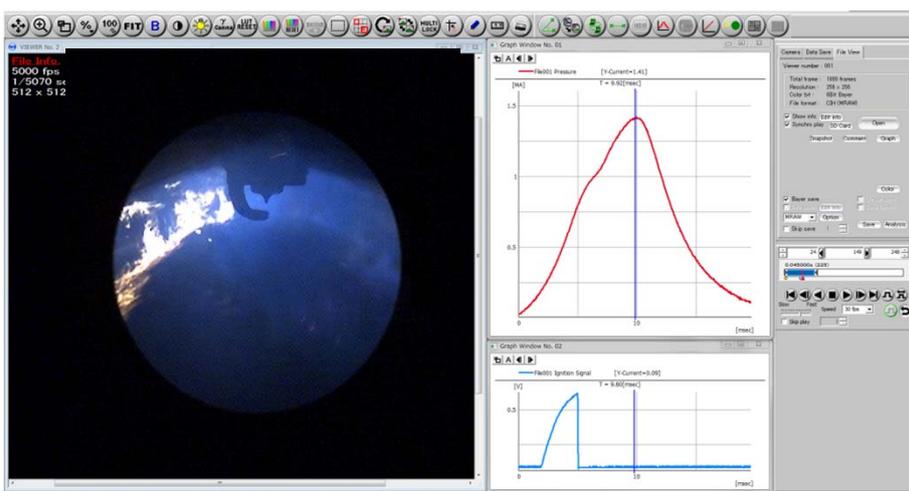
Photron FASTCAM Viewer image display together with synchronized data acquisition measurement

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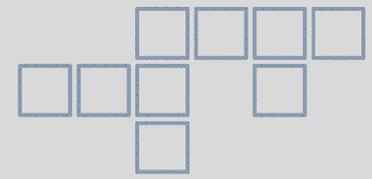
Mechanical and Environmental Specifications:

Mechanical	
Lens Mount	F mount (G-type lens compatible) and C mount provided. Optional lens mounts available include M42 adapter
Camera Mountings	2x ¼ - 20 UNC (base and top) 4x M5 (base)
External Dimensions	(excluding protrusions)
Camera Body	120 (H) x 120 (W) x 98.9 (D) mm 4.72" (H) x 4.72" (W) x 3.89" (D)
Weight	
Camera Body	1.6kg / 3.52 lbs
Environmental	
Operating Temperature	0 ~ 40 deg. C 32 ~ 104 deg.F
Storage Temperature	-20 ~ 60 deg C.
Humidity	85% or less (non condensing)
Cooling	Internal fan cooling (Fan-off mode supported)

Power	
AC Power (with supplied adapter)	100 ~ 240V, 50 ~ 60 Hz, 210W
DC Power	22 ~ 32V, 40VA

All dimension are given in millimeter

Rugged Design:

The FASTCAM Mini WX can be used in conditions where it may be subject to mechanical shock and has been operationally tested to operate at 100G, 10ms, 6 axis.
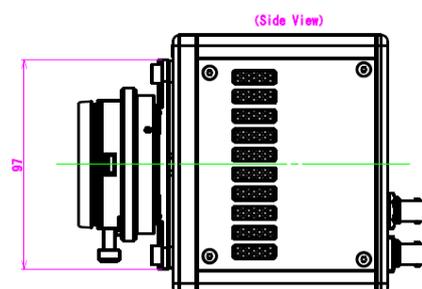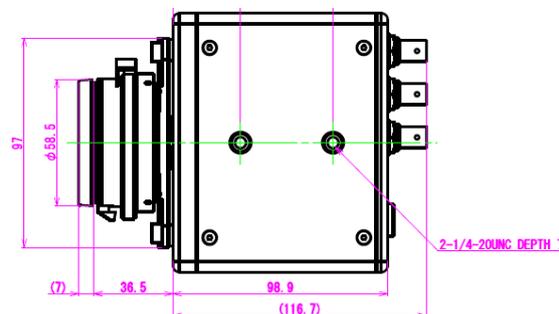
Ruggedized Lens Support:

For operation with the FASTCAM Mini WX a range of fixed focal length Ruggedized Schneider Compact lenses are available. Providing a 24mm image circle they support Full HD operation at 2,000fps. Focal lengths currently available include 20mm, 24mm and 35mm with an aperture of f/2.0
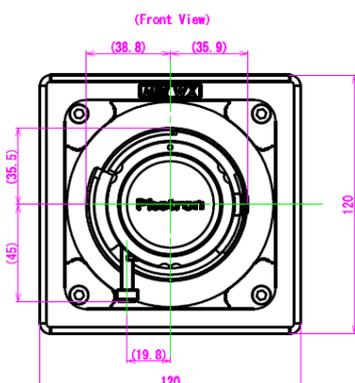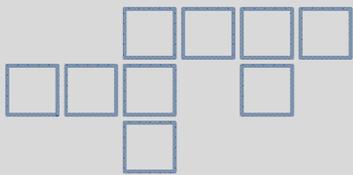
Coupling to other lens systems:

A combination of small physical size, low weight and small pixel size allow the FASTCAM Mini WX to be coupled to a range of optical systems such as scientific and long distance microscopes , rigid endoscopes or borescopes, for applications ranging from imaging flows in microfluidic devices to engine diagnostics.

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Contacts:

PHOTRON LIMITED

Kanda Jinbo-cho 1-105
Chiyoda-Ku, Tokyo 101-0051
Japan
Tel: +81 (0) 3 3518 6271
Fax: +81 (0) 3 3518 6279
Email: image@photron.co.jp
www.photron.co.jp

PHOTRON (SHANGHAI) LIMITED

Far East International Plaza 302A
No.319 XianXia Road,
ChangNing District,
Shanghai 200051
China
Tel: +86 (0) 21 6235 1288
Email: image@photron.cn.com
www.photron.cn.com

PHOTRON USA, INC.

9520 Padgett Street, Suite 110
San Diego, CA 92126-4446
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
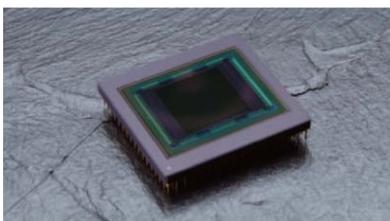Buckinghamshire, HP14 4BS
United Kingdom
Tel: +44 (0) 1494 481011
Fax: +44 (0) 1494 487011
Email: image@photron.com
www.photron.com

High-Speed Imaging Solutions

Credibility and reputation through technological achievement:

Developments in advanced imaging technologies pioneered by Photron over the past 20 years are now being utilized in high-speed camera systems designed for a range of scientific and industrial development applications. Photron has invested in the development of unique advanced CMOS image sensors, the core technology of high speed photography. Innovations in this area have lead to a rapid increase in camera performance, allowing high-speed imaging to be applied to important new subject areas.

The highest quality design, manufacturing and support:

As an ISO9001:2008 certified manufacturer, Photron manufactures it's full range of imaging systems at it's own facility located in Yonezawa City

Yamagata Prefecture, Japan. International technical support centres located in the USA, Europe and China, staffed by factory trained engineers and holding a full range of support equipment, ensure fast and professional local support for Photron camera users around the world.

FASTCAM, the leading name worldwide in high speed imaging:

Used internationally in renowned research facilities in more than 30 countries worldwide, Photron FASTCAM high speed cameras are trusted to provide high quality results in the most challenging applications and environments. Photron continues to utilise the latest technological innovations to further advance product performance in order to meet the most demanding requirements from users around the world.

Specialist high-speed imaging applications knowledge:

For more than 30 years, Photron has focussed on the design and application of high-speed imaging products. Photron's specialist applications engineers have a wealth of knowledge and experience in demanding imaging requirements and are able to advise both new and experienced users on high-speed imaging solutions and imaging techniques to achieve the optimum results.