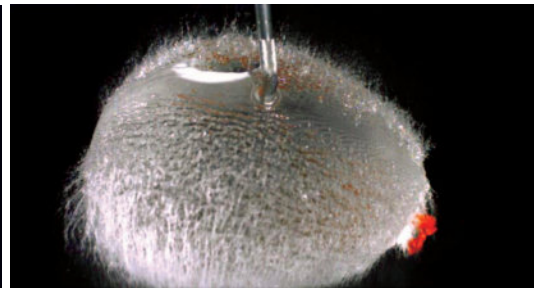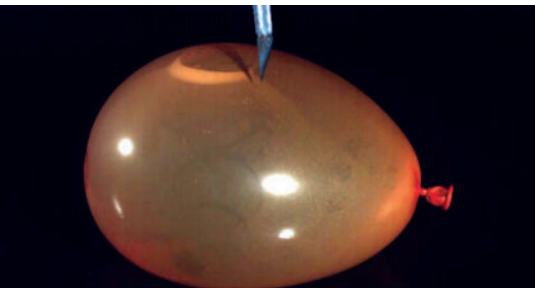# FASTCAM SA1.1
ULTRA HIGH-SPEED VIDEO SYSTEM

Next generation CMOS sensor technology providing 5,400 fps, 1024 x 1024 pixels

The Photron FASTCAM SA1 will meet the imaging requirements of the most demanding applications in research and development due to its unrivaled sensitivity, speed and resolution.

The FASTCAM SA1 uses the latest CMOS sensor to achieve sensitivity and speeds previously unattainable. With a top speed in excess of 600,000 fps (frames per second) and with true 12-bit dynamic range, the FASTCAM SA1 once again establishes Photron as the true leader of high speed imaging innovation.

With a global shutter operating independently of the frame rate selected; from 1/60th of a second to 1μs, and with the dead time between sequential frames less than a microsecond, the FASTCAM SA1 provides everything, yes, everything, even an SDI output as standard, that true high speed users demand.

For those not wanting to use a PC to control and operate the camera through the Gigabit Ethernet port, the FASTCAM SA1 can be controlled by an RS-422 remote control keypad with built-in 5" LCD monitor for complete camera set-up and operation.

For applications where ingress of dust or moisture would be hazardous, a sealed version (FASTCAM SA1 RV) is available.

Target applications include:

- Balistics
- Aerospace
- Materials research
- Fluid dynamics
- Defence
- PIV

Benefits

- Performance:

  - 1,024 x 1,024 pixels @ 5,400 fps
  - 832 x 608 pixels @ 10,800 fps
  - 640 x 480 pixels @ 18,000 fps
  - 512 x 512 pixels @ 20,000 fps
  - 256 x 256 pixels @ 67,500 fps
  - 256 x 16 pixels @ 500,000 fps
  - 64 x 16 pixels @ 675,000 fps

- Variable Region of Interest (ROI)

- Capture 12-bit uncompressed data

- One microsecond global shutter

- Composite and SDI video output for real time monitoring during set up, recording and playback

- Memory options include 8GB, 16GB, 32GB and 64GB
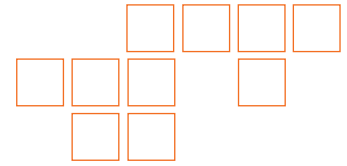
- Phase lock to IRIG/GPS

Photron

www.photron.com

FASTCAM SA1.1
HIGH SPEED VIDEO SYSTEM

Specifcations: Frame Rate / Recording Duration Table

FRAME RATE (fps)	MAXIMUM RESOLUTION		SHUTTER EXPOSURE TIME	RECORD DURATION (12-BIT)							
	Horizontal	Vertical		TIME (Sec.)				FRAMES			
				8GB	16GB	32GB	64GB	8GB	16GB	32GB	64GB
1,000	1,024	1,024		5.46	10.92	21.84	43.68	5,457	10,918	21,841	43,686
2,000	1,024	1,024		2.73	5.46	10.92	21.84	5,457	10,918	21,841	43,686
3,000	1,024	1,024		1.82	3.64	7.28	14.56	5,457	10,918	21,841	43,686
5,000	1,024	1,024		1.09	2.18	4.37	8.73	5,457	10,918	21,841	43,686
5,400	1,024	1,024		1.01	2.02	4.04	8.09	5,457	10,918	21,841	43,686
10,000	768	768	1/Frame Rate to 1µs	0.97	1.94	3.88	7.76	9,701	19,410	38,829	77,665
15,000	768	512		0.97	1.94	3.88	7.76	14,552	29,116	58,243	116,497
20,000	512	512		1.09	2.18	4.37	8.73	21,829	43,674	87,365	174,746
30,000	512	352		1.06	2.12	4.24	8.47	31,751	63,526	127,076	254,176
75,000	512	128		1.16	2.33	4.66	9.31	87,317	174,698	349,461	698,986
100,000	320	128		1.40	2.80	5.59	11.18	139,707	279,517	559,138	1,118,378
125,000	256	128		1.40	2.80	5.59	11.18	174,634	349,397	698,922	1,397,973
180,000	128	128		1.94	3.88	7.77	15.53	349,269	698,794	1,397,845	2,795,946
250,000	128	80		2.24	4.47	8.95	17.89	558,830	1,118,071	2,236,552	4,473,514
300,000	128	64		2.33	4.66	9.32	18.63	698,538	1,397,589	2,795,690	5,591,893
500,000	64	32		5.59	5.59	22.37	44.73	2,794,154	2,795,178	11,182,762	22,367,573
675,000	64	16		8.28	16.56	33.13	66.27	5,588,309	11,180,714	22,365,525	44,735,146

Sensor — 12-bit ADC (Bayer system color, single sensor) with 20µm pixel

Shutter — Global electronic shutter from 16.7ms to 1µs independent of frame rate is standard

Lens Mount — Interchangeable F-mount and C-mount using supplied adapters

Extended Dynamic Range — Selectable in twenty steps (0 to 95% in 5% increments) to prevent pixel over-exposure

Memory — 8GB (standard), 5,457 frames, 1.01 sec @ 5400fps
16GB (option), 10,918 frames, 2,02 sec @5400fps
32GB (option), 21,841 frames, 4.04 sec @5400fps
64GB (option), 43,686 frames, 8.09 sec @5400fps

Video Output 1 — NTSC/PAL composite VBS (BNC). Ability to zoom, pan and scroll within image via keypad. Live video during recording.

Video Output 2 — SDI:D1 digital component 1 channel (BNC) industry standard digital output NTSC and PAL

Camera Control — Available Gigabit Ethernet and RS-422 keypad with built in 5″ LCD viewfinder

User Preset Switches — Four user selectable camera function control mounted on the cameras rear panel

Low Light Mode — Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera

Triggering — Selectable positive or negative TTL 5Vp-p or switch closure

Trigger Delay — Programmable delay on selected input and output triggers, 100ns resolution

Timing — Internal clock or external source such as IRIG or GPS

Phase Lock — Enables cameras to be precisely synchronized together, or to an external source, such as IRIG or GPS time codes

Event Markers — Ten user –entered event markers mark specific events within the image sequence in real time. Immediately accessible through software

Dual Speed Recording™ — Enables the recording speed to be changed up or down by a factor of 2,4 or 8 during a recording

Recording Modes — Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual and Dual Speed Recording

Saved Image Formats — JPEG, AVI, TIFF, BMP, RAW, RAWW, PNG and FTIF. Images can be saved with or without timing and comment data

Data Display — Frame Rate, Shutter Speed, Trigger Mode, Date or Time (can be switched), Status (Playback/Record), Real Time, Frame Count and Resolution

Partitioning — Up to 64 memory segments for multiple recordings in memory

Data Acquisition — Supports Photron MCDL and DAQ

Cooling — Actively cooled

Operating Temp. — 0-40 degrees C (Range version increases upper limit to 45C)

Mounting — 1x ¼-20 UNC, 1x 3/8-16 UNC, 6x M6

Dimensions and Weight — 160mm (6.30″)H x 153mm (6.02″)W x 242.5mm (9.55″)D *excluding protrusions   Weight 13 lbs (5.9 kg)

Power Requirements — 100V - 240V AC ~ 1.5A, 50-60Hz optional DC operation 20 to 36V DC. AC adaptor provided

Photron

FASTCAM SA2
HIGH-DEFINITION HIGH-SPEED VIDEO SYSTEM
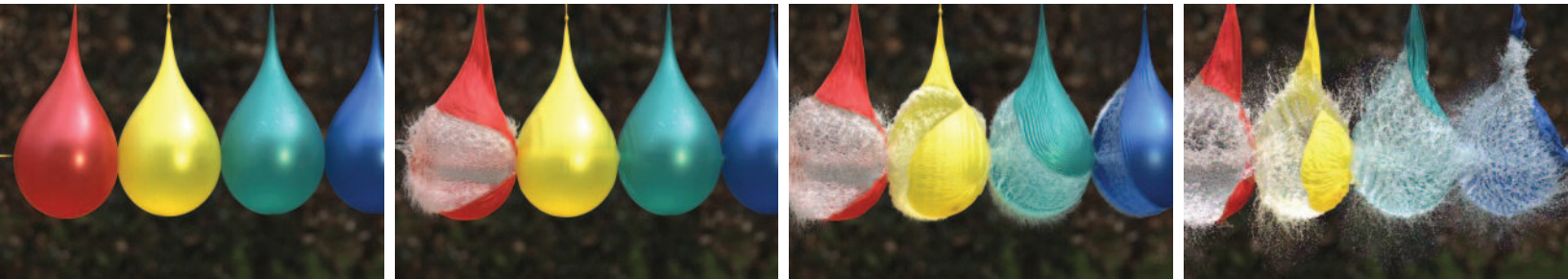
2,048 x 2,048 (4MEGA pixel) resolution, developed for a broad range of applications including automotive safety testing, defense, fluid dynamics and materials research

The FASTCAM SA2 has been engineered to provide the optimum speed and resolution required for detailed observation and analysis of high speed events occurring in large spatial areas or fields of view. The 10 μm pixels lend themselves perfectly to micro analysis applications such as Particle Image Velocimetry (PIV) or Digital Image Correlation (DIC).

Areas where a high degree of motion analysis precision is demanded, such as automotive safety testing, weapons performance testing, fluid dynamics and solid mechanics will benefit from the combination of very high resolution, high framing rates, and typical Photron reliability.

The ability to operate at full HD resolution (1920 x 1080 pixels) at up to 2,000 fps will be a huge benefit to broadcast applications, including sports, nature documentaries, advertising and motion picture entertainment. The FASTCAM SA2 builds on Photron's Emmy award winning experience and is backed by the industry's best reputation for reliability and support.

As with every Photron high speed camera, ease of use and attention to details make the difference, with the FASTCAM SA2 supplied with the very easy to use Photron FASTCAM Viewer (PFV) software, or for those applications where a computer is not an option, an RS-422 optional keypad for camera control and image review.

Benefits

- Performance examples:
  - 2,048 x 2,048 pixels @ 1,080 fps
  - 1,920 x 1,080 pixels @ 2,000 fps
  - 1,024 x 1,024 pixels @ 3,200 fps

- Full HD resolution (1,920 x 1080 pixels) to 2,000 fps

- Incorporates Peltier temperature stabilized sensor and on-chip microlens array for optimum image quality and light sensitivity

- Available with three memory configurations:
  - 8GB for 1.29 seconds at 2,000 fps @ 1,920 x 1080 pixels
  - 16GB for 2.58 seconds at 2,000 fps @ 1,920 x 1080 pixels
  - 32GB for 5.17 seconds at 2,000 fps @ 1,920 x 1080 pixels
  - 64GB for 10.35 seconds at 2,000 fps @ 1,920 x 1080 pixels

- Rear panel has dual HD-SDI and one RS-170 BNC outputs for real time monitoring during setup, recording and playback

- Photron FASTCAM Viewer (PFV) computer control via the Gigabit Ethernet port

- Four user selectable function buttons for easy rear panel control of camera

- Low-light mode for initial set up of camera position and focus

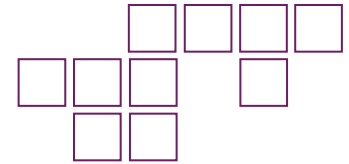- Monochrome or color sensor captures 12-bit (36-bit color) uncompressed data

Photron

www.photron.com

FASTCAM SA2
HIGH-DEFINITION HIGH-SPEED VIDEO SYSTEM

Specifications: Partial Frame Rate / Recording Duration Table

FRAME RATE (fps)	MAXIMUM RESOLUTION Horizontal	MAXIMUM RESOLUTION Vertical	MAXIMUM SHUTTER SPEED	RECORD DURATION (12-BIT) TIME (Sec.) 8GB Model	16GB Model	32GB Model	64GB Model	FRAMES 8GB Model	16GB Model	32GB Model	64GB Model
1,000	2,048	2,048		1.36	2.73	5.46	10.91	1,361	2,726	5,457	10,918
1,080	2,048	2,048		1.26	2.52	5.05	10.10	1,361	2,726	5,457	10,918
1,500	2,048	1,472		1.26	2.53	5.06	10.12	1,894	2,793	7,592	15,191
2,000	2,048	1,080		1.29	2.59	5.17	10.35	2,581	5,170	10,348	20,705
2,500	1,536	1,024		1.45	2.91	5.82	11.64	3,630	7,271	14,552	29,116
3,000	1,024	1,024		1.82	3.64	7.28	14.55	5,445	10,906	21,829	43,674
3,200	1,024	1,024	2.76 µs	1.70	3.41	6.82	13.64	5,445	10,906	21,829	43,674
4,000	1,024	768	1/367,000 sec	1.82	3.64	7.28	14.55	7,260	14,542	29,105	58,232
5,000	1,024	640		1.74	3.49	6.99	13.97	8,712	17,450	34,926	69,879
6,250	1,024	512		1.74	3.49	6.99	13.97	10,890	21,813	43,658	87,349
7,200	768	512		2.02	4.04	8.08	16.17	14,520	29,084	58,211	116,465
8,000	512	512		2.72	5.45	10.91	21.83	21,781	43,626	87,317	174,698
10,000	512	416		2.68	5.37	10.75	21.50	26,807	53,694	107,467	215,013
16,000	512	256		2.72	5.45	10.91	21.83	43,562	87,253	174,634	349,397
18,000	256	256		4.84	9.69	19.40	38.82	87,125	174,506	349,269	698,794
20,000	256	224		4.98	9.97	19.96	39.93	99,571	199,436	399,164	798,622
30,000	256	128		5.81	11.63	23.28	46.58	174,250	349,013	698,538	1,397,589
43,200	256	96		5.38	10.77	21.56	43.13	232,334	465,351	931,384	1,863,452
54,000	256	64		6.45	12.93	25.87	51.76	348,501	698,026	1,397,077	2,795,178
86,400	256	32		8.07	16.16	32.34	64.70	697,002	1,396,053	2,794,154	5,590,357

Sensor — 10 µm pixels, temperature stabilized, 12-bit ADC (Bayer system color, single sensor) with microlenses

Shutter — Global electronic shutter from 16.7ms to 2.76 µs independent of frame rate

Lens Mount — Interchangeable F-mount and C-mount using supplied adapters, optional PL and B4 lens mounts

Extended Dynamic Range — Selectable in twenty steps (0 to 95% in 5% increments) to prevent pixel over-exposure

Memory — 8GB (standard: 1,361 frames @ Maximum resolution)
16GB (option: 2,726 frames @ Maximum resolution)
32GB (option: 5,457 frames @ Maximum resolution)
64GB (option: 10,918 frames @ Maximum resolution)

Video Outputs — Live and playback video thorough Dual HD-SDI or single RS-170 (NTSC/PAL) outputs. Ability to zoom, pan and tilt within image via keypad.

Camera Control — Through optional keypad with integrated viewfinder and Gigabit Ethernet or RS-422

User Preset Switches — Four user selectable camera function controls mounted on the camera's rear panel

Low Light Mode — Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera

Triggering — Selectable positive or negative TTL 5Vp-p or switch closure

Trigger Delay — Programmable delay on selected input and output triggers, 100ns resolution

Timing — Internal clock or external source

Phase Lock Event Markers — Enables cameras to be synchronized precisely together to a master camera or external source
Ten user entered event markers mark specific events within the image sequence in real time. Immediately accessible through software

Dual Speed Recording — Enables the recording speed to be changed up or down by a factor of 2, 4 or 8 during a recording

Trigger Modes — Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual and Duals Speed Recording

Saved Image Formats — JPEG, AVI, TIFF, BMP, RAW, PNG, MOV and FTIF. Images can be saved with or without image or comment data

Data Display — Frame Rate, Shutter Speed, Trigger Mode, Date or Time, Status (Playback/Record), Real Time, Frame Count and Resolution

Partitioning — Up to 64 memory segments for multiple recording in memory

Data Acquisition — Supports Photron MCDL and DAQ

Cooling — Actively cooled

Operating Temperature — 0-40 degrees C (32 - 104 degree F)

Mounting — 1 x 1/4 - 20 UNC, 1 x 3/8 - 16 UNC, 6x M6

Dimensions — 165mm (6.5")H × 153mm (6.02")W × 250mm (9.84")D

Weight — 6.9 kg (15.21 lbs)

Power Requirements — 100V-240V AC ~ 1.5A, 50-60Hz
DC operation 18-36 V DC, 100VA

Specifications subject to change without notice

Photron
SLOW MOTION IMAGING SOLUTIONS

FASTCAM SA5
ULTRA HIGH-SPEED VIDEO SYSTEM

High-Speed Video System
Next generation CMOS sensor
technology providing 7,500 fps,
1K x 1K pixels

The Photron FASTCAM SA5 will meet the requirements of the most demanding applications in research and development due to its unrivaled sensitivity, frame rate and resolution.

This high performance will permit the SA5 to be applied to areas of research once dismissed as unsuitable for digital high-speed imaging.

Building on the success of Photron's Emmy award winning high speed cameras our sensor design improves sensitivity, image quality and color reproduction.

The FASTCAM SA5 delivers mega-pixel resolution at 7,500 fps, an impressive maximum frame rate of 775,000 fps and a 1 microsecond exposure time. Optional one million fps and 369 ns shutter capabilities are available subject to export restrictions.

Target applications include:

- Materials research
- Combustion
- Ballistics
- Cavitation
- Aerospace
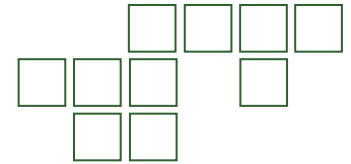- Fluid dynamics
- PIV

Benefits

- Performance examples:
  - 1,024 x 1,000 pixels @ 7,500 fps
  - 512 x 512 pixels @ 25,000 fps
  - 256 x 256 pixels @ 87,500 fps
  - 128 x 128 pixels @ 262,500 fps
  - 128 x 24 pixels @ 775,000 fps

- Variable Region of Interest (ROI)

- Capture 12-bit uncompressed data

- $20\mu m$ pixels ensure best light sensitivity for demanding high-speed or low light applications

- Equivalent ISO light sensitivity 10,000 (monochrome), 4,000 (color) measured to ISO12232 S sat

- Phase lock to IRIG/GPS

- Composite and SDI video output for real time monitoring during set up, recording and playback

- Optional remote keypad control with integrated viewfinder

- 8GB, 16GB, 32GB or 64GB memory options

- Gigabit Ethernet interface

Photron

www.photron.com

FASTCAM SA5
ULTRA HIGH-SPEED VIDEO SYSTEM

Specifications: Partial Frame Rate / Recording Duration Table

FRAME RATE (fps)	MAXIMUM RESOLUTION Horizontal	Vertical	MAXIMUM SHUTTER SPEED	RECORD DURATION (12-BIT) TIME (Sec.) 8GB	16GB	32GB	64GB	FRAMES 8GB	16GB	32GB	64GB
1,000	1,024	1,024		5.46	10.92	21.84	43.68	5,457	10,918	21,841	43,686
2,000	1,024	1,024		2.73	5.46	10.92	21.84	5,457	10,918	21,841	43,686
4,000	1,024	1,024		1.36	2.73	5.46	10.92	5,457	10,918	21,841	43,686
5,000	1,024	1,024		1.09	2.18	4.37	8.73	5,457	10,918	21,841	43,686
7,000	1,024	1,024		0.78	1.56	3.12	6.24	5,457	10,918	21,841	43,686
7,500	1,024	1,000		0.75	1.49	2.98	5.96	5,588	11,180	22,365	44,735
9,300	1,024	800	1 μs	0.75	1.50	3.01	6.01	6,985	13,975	27,956	55,918
10,000	1,024	744		0.75	1.50	3.01	6.01	7,511	15,027	30,061	60,127
15,000	960	528	1/1,000,000 sec	0.75	1.51	3.01	6.02	11,289	22,587	45,182	90,374
20,000	832	448		0.77	1.54	3.07	6.14	15,352	30,716	61,443	122,898
30,000	768	320		0.78	1.55	3.11	6.21	23,284	46,586	93,189	186,396
50,000	512	272		0.82	1.64	3.29	6.57	41,090	82,211	164,452	328,934
75,000	320	264		0.90	1.81	3.61	7.22	67,737	135,523	271,097	542,244
100,000	320	192		0.93	1.86	3.73	7.45	93,138	186,345	372,758	745,585
150,000	256	144		1.03	2.07	4.14	8.28	155,230	310,575	621,264	1,242,642
300,000	256	64		1.16	2.33	4.66	9.31	349,269	698,794	1,397,845	2,795,946
420,000	128	64		1.66	3.33	6.66	13.31	698,538	1,397,589	2,795,690	5,591,893
525,000	128	48		1.77	3.55	7.10	14.20	931,384	1,863,452	3,727,587	7,455,857
775,000	128	24		2.40	4.81	9.62	19.24	1,862,769	3,726,904	7,455,175	14,911,715
930,000	128	16	369 ns	3.00	6.01	12.02	24.05	2,794,154	5,590,357	11,182,762	22,367,573
1,000,000	64	16	1/2,712,000 sec	5.59	11.18	22.37	44.73	5,588,309	11,180,714	22,365,525	44,735,146

OPTION SUBJECT TO EXPORT LICENSE CONTROL RESTRICTIONS WHERE APPLICABLE

Sensor	12-bit ADC (Bayer system color, single sensor) with 20 μm pixel
Shutter	Global electronic shutter from 16.7ms to 1 μs independent of frame rate
Lens Mount	Interchangeable F-mount and C-mount using supplied adapters
Extended Dynamic Range	Selectable in twenty steps (0 to 95% in 5% increments) to prevent pixel over-exposure
Memory	8GB (standard: 5,457 frames @ maximum resolution) 16GB (option: 10,913 frames @ maximum resolution) 32GB (option: 21,841 frames @ maximum resolution) 64GB (option: 43,686 frames @ maximum resolution)
Video Output 1	NTSC/PAL composite VBS (BNC). Ability to zoom, pan and tilt within image via keypad. Live video during recording
Video Output 2	HD-SDI: HD-SDI 2 channel (BNC) digital output
Camera Control	Through optional keypad with integrated viewfinder and Gigabit Ethernet or RS-422
User Preset Switches	Four user selectable camera function controls mounted on the camera's rear panel
Low Light Mode	Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera
Triggering	Selectable positive or negative TTL 5Vp-p or switch closure
Trigger Delay	Programmable delay on selected input and output triggers, 100ns resolution
Timing	Internal clock or external source
Phase Lock	Enables cameras to be synchronized precisely together to a master camera or external source, such as IRIG/GPS time codes

Event Markers	Ten user entered event markers mark specific events within the image sequence in real time. Immediately accessible through software
Dual Speed Recording	Enables the recording speed to be changed up or down by a factor of 2, 4 or 8 during a recording
Trigger Modes	Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual and Duals Speed Recording
Saved Image Formats	JPEG, AVI, TIFF, BMP, RAW, PNG, MOV and FTIF. Images can be saved with or without image or comment data
Data Display	Frame Rate, Shutter Speed, Trigger Mode, Date or Time, Status (Playback/Record), Real Time, Frame Count and Resolution
Partitioning	Up to 64 memory segments for multiple recording in memory
Data Acquisition	Supports Photron MCDL and DAQ
Cooling	Actively cooled
Operating Temperature	0 - 40 degrees C (32 - 104 degree F)
Mounting	1 x 1/4 - 20 UNC, 1 x 3/8 - 16 UNC, 6 x M6
Dimensions	165mm (6.50")H×153mm (6.02")W×242.5mm (9.55")D *excluding protrusions
Weight	6.2 kg (13.67 lbs)
Power Requirements	100V-240V AC ~ 1.5A, 50-60Hz DC operation 18-36 V DC, 100VA

Specifications subject to change without notice

Photron
SLOW MOTION IMAGING SOLUTIONS

FASTCAM SA6
HIGH-DEFINITION HIGH-SPEED CAMERA SYSTEM

The FASTCAM SA6 has been developed to permit high definition recording and detailed high speed analysis of large spatial areas in applications such as automotive safety testing, fluid dynamics and solid mechanics. The system provides 1920x1440 pixel image resolution at all frame rates up to 1,125fps, 1920x1080 full HD resolution at frame rates up to 1,500fps and recording rates up to 75,000fps at reduced resolution.

The system utilizes a high performance CMOS image sensor to provide excellent light sensitivity allowing high speed recordings to be made with the minimum of additional lighting. The utilization of 12bit dynamic range output yields exceptional image quality and superior color fidelity. Photron's experience in the field of high quality broadcast imaging provides a stable camera operation and superior imaging performance.

The camera may be controlled via the optional remote local keypad or over a Gigabit Ethernet network, and is fully compatible with the Photron J-BOX for multiple camera installations. Integrated capping shutter to facilitate automated calibration and automated lens control options further extend the ease of system operation. The system is supplied with intuitive Photron FASTCAM Viewer (PFV) software and Photron Device Control SDK (software development kit) allowing integration with user specific software.

Benefits

■ Performance examples:

- 1,125 fps at 1920x1440 pixel resolution
- 1,500 fps at 1920x1080 pixel resolution
- 2,000 fps at 1280x1024 pixel resolution
- 3,000 fps at 1024x768 pixel resolution
- 5,000 fps at 768x512 pixel resolution

■ Low noise, high quality imaging and superior color fidelity

■ Composite and HD SDI video output for real time monitoring during set-up, recording and playback

■ Options to enhance system operation include remote keypad with integrated viewfinder, integrated calibration shutter and automated lens control options and Nikon G type lenses

■ GigaBit Ethernet interface and compatibility with Photron J-BOX for multiple camera installations
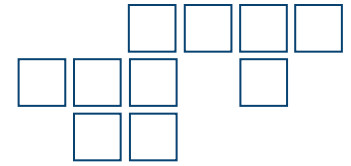
Target applications include:

- Automotive safety testing
- Solid Mechanics (DIC)
- Fluid dynamics (PIV)
- Defense and aerospace research

Photron

www.photron.com

FASTCAM SA6
HIGH-DEFINITION HIGH-SPEED CAMERA SYSTEM

Specifications: Partial Frame Rate / Recording Duration Table

FRAME RATE (fps)	MAXIMUM RESOLUTION Horizontal	Vertical	MAXIMUM SHUTTER SPEED	RECORD DURATION (12-BIT) TIME (Sec.) 8GB	16GB	32GB	64GB	FRAMES 8GB	16GB	32GB	64GB
50	1,920	1,440		38.72	77.54	155.22	310.56	1,936	3,877	7,761	15,528
60	1,920	1,440		32.26	64.61	129.35	258.80	1,936	3,877	7,761	15,528
125	1,920	1,440		15.48	31.01	62.08	124.22	1,936	3,877	7,761	15,528
250	1,920	1,440		7.74	15.50	31.04	62.11	1,936	3,877	7,761	15,528
500	1,920	1,440		3.87	7.75	15.52	31.05	1,936	3,877	7,761	15,528
1,125	1,920	1,440	2.76 µs	1.72	3.44	6.89	13.80	1,936	3,877	7,761	15,528
1,500	1,920	1,080		1.72	3.44	6.89	13.80	2,581	5,170	10,348	20,705
2,000	1,280	1,024	1/367,000 sec	2.17	4.36	8.73	17.46	4,356	8,725	17,463	34,939
3,000	1,024	768		2.42	4.84	9.70	19.41	7,260	14,542	29,105	58,232
4,000	1,280	512		2.17	4.36	8.73	17.46	8,712	17,450	34,926	69,879
4,500	1,024	512		2.42	4.84	9.70	19.41	10,890	21,813	43,658	87,349
5,000	768	512		2.90	5.81	11.64	23.29	14,520	29,084	58,211	116,465
8,000	512	384		3.63	7.27	14.55	29.11	29,041	58,168	116,423	232,931
12,000	512	256		3.63	7.27	14.55	29.11	43,562	87,253	174,634	349,397
25,000	256	128		6.97	13.96	27.94	55.90	174,250	349,013	698,538	1,397,589
45,000	256	64		7.74	15.51	31.04	62.11	348,501	698,026	1,397,077	2,795,178
75,000	256	32		9.29	18.61	37.25	74.53	697,002	1,396,053	2,794,154	5,590,357

Sensor — 10 µm pixels, temperature stabilized, 12-bit ADC (Bayer system color, single sensor) with micro lenses

Shutter — Global electronic shutter from 16.7ms to 2.76 µs independent of frame rate

Lens Mount — Interchangeable F-mount, C-mount using supplied adapters, Nikon G lens mount (optional), PL lens mount (optional), B4 lens mount (optional)

Extended Dynamic Range — Selectable in twenty steps (0 to 95% in 5% increments) to prevent pixel over-exposure

Memory — 8GB (standard: 1,936 frames @ maximum resolution) 16GB (option: 3,877 frames @ maximum resolution) 32GB (option: 7,761 frames @ maximum resolution) 64GB (option: 15,528 frames @ maximum resolution)

Video Output — Live and playback video through Dual HD-SDI or Single RS-170 (NTSC/PAL) outputs. Ability to zoom, pan and tilt within image via keypad

Camera Control — Through Optional keypad with integrated viewfinder and Gigabit Ethernet or RS-422

User Preset Switches — Four user schedulable camera function controls mounted on the camera's rear panel

Low Light Mode — Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera

Triggering — Selectable positive or negative TTL 5Vp-p or switch closure

Trigger Delay — Programmable delay on selected input and output triggers, 100ns resolution

Timing — Internal clock or external source

Phase Lock — Enable cameras to synchronized precisely together to a master camera or external source

Event Markers — Ten user entered event markers mark specific events within the image sequence in real time. Immediately accessible through software

Dual Speed Recording — Enables the recording speed to be changed up or down by a factor of 2, 4 or 8 during a recording

Trigger Modes — Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual and Dual Speed Recording

Saved Image Formats — JPEG, AVI, TIFF, BMP, RAW, PNG, MOV and FTIF. Images can be saved with or without image or comment data

Data Display — Frame Rate, Shutter Speed, Trigger Mode, Date or Time, Status (Playback/Record), Real Time, Frame Count and Resolution

Partitioning — Up to 64 memory segments for multiple recording in memory

Data Acquisition — Supports Photron MCDL and DAQ

Cooling — Actively cooled

Operating Temperature — 0 - 40 degrees (32 - 104 degree F)

Mounting — 1 x 1/4 - 20 UNC, 1 x 3/8 - 16 UNC, 6 x M6

Dimensions — 165mm (6.5")H×153mm (6.02")W×250mm (9.84")D

Weight — 15.21 lbs (6.9 kg)

Power Requirements — 100V-240V AC ~ 1.5A, 50-60Hz DC operation 18-36 VDC, 100VA
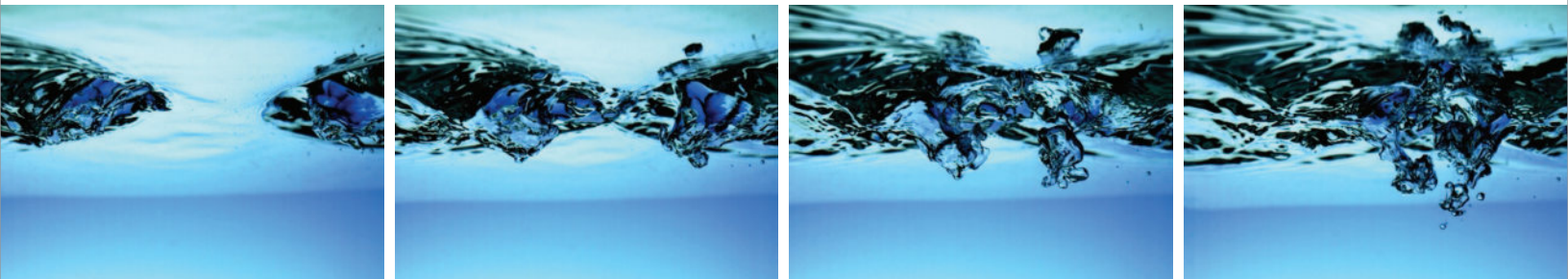
Specifications subject to change without notice

Photron
SLOW MOTION IMAGING SOLUTIONS

FASTCAM SA-X2
HIGH PERFORMANCE HIGH-SPEED CAMERA SYSTEM

To meet the requirements of the most demanding high-speed imaging applications, a balance of high frame rate, image resolution, dynamic range and light sensitivity is required. The FASTCAM SA-X2 high-speed camera system provides an optimal combination of these critical parameters, with sufficient performance to capture high quality 12-bit megapixel images at up to 13,500 frames per second (fps).

Taking advantage of the very latest CMOS sensor technology, the FASTCAM SA-X2 utilizes large 20 μm square pixels to capture more light than any other high-speed camera. It is rated to ISO 25,000 (against the accredited ISO 12232 Ssat measurement standard) for monochrome 12-bit cameras and ISO 10,000 for 36-bit color (Bayer system, single sensor) cameras. Higher light sensitivity means less additional lighting is required, or higher framing rates or faster shutter speeds can be used with existing lighting conditiors.

The FASTCAM SA-X2 is controlled remotely through Photron's FASTCAM Viewer (PFV) software over a high-speed Gigabit Ethernet network, or locally via an optional handheld keypad. If a PC connection is available, then images can be downloaded via dual industry standard Gig-E ports. Alternatively, two SD card slots allow for the download of recorded image data from the camera without the need for a PC connection.

As with other FASTCAM SA series cameras, the SA-X2 includes both a C-mount and a Nikon G type compatible F-mount, as well as optional support for Canon EF lenses with remote control of aperture and focus, through our PFV software. Wrappers for both LabVIEW™ and MATLAB™ are available with PFV, as is our new automated motion analysis plug-in software — Photron FASTCAM Analysis (PFA).

Target applications include:

- Materials Science
- Combustion Research
- Fluid dynamics (PIV)
- Defense and aerospace research
- Ballistic Imaging
- Shock Waves and Detonations

Benefits

- Frame Rate Performance examples:

  - 12,500 fps at 1024x1024 pixel resolution
  - 13,500 fps at 1024x1000 pixel resolution
  - 40,000 fps at 640x488 pixel resolution
  - 100,000 fps at 384x264 pixel resolution
  - 1,000,000 fps at 128x8 pixel resolution (Model 1000K only)

- Market leading light sensitivity (ISO Ssat 12232 standard) ISO 25,000 monochrome / ISO 10,000 color

- High Speed Dual Gigabit Ethernet interface provides reliable system communication and image download rates

- Two SD card slots allow fast image transfer without a PC connection

- Flexible frame synchronization permits synchronization to devices with non-stable external frequencies

- Four Internal Memory Configurations are available to support all application requirements: 8GB, 16GB, 32GB, 64GB

- Integrated mechanical calibration shutter, Nikon F-mount (compatible with Nikon G type lenses), and optional Canon EF mount

- Optional Range Version provides sealed enclosure for electronics, thereby preventing contamination from dust and other materials

Photron

www.photron.com

FASTCAM SA-X2
HIGH PERFORMANCE HIGH-SPEED CAMERA SYSTEM
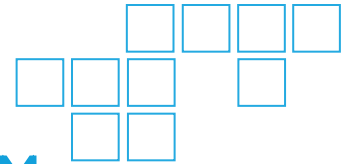
Specifications: Partial Frame Rate / Recording Duration Table

FRAME RATE (fps)*	MAXIMUM RESOLUTION Horizontal	Vertical	RECORD DURATION (12-BIT) TIME (Sec.) 8GB	16GB	32GB	64GB	FRAMES 8GB	16GB	32GB	64GB
Model 480K										
1,000	1,024	1,024	5.45	10.91	21.83	43.68	5,455	10,916	21,839	43,684
2,000	1,024	1,024	2.72	5.45	10.91	21.84	5,455	10,916	21,839	43,684
5,000	1,024	1,024	1.09	2.18	4.36	8.73	5,455	10,916	21,839	43,684
10,000	1,024	1,024	0.54	1.09	2.18	4.36	5,455	10,916	21,839	43,684
12,500	1,024	1,024	0.43	0.87	1.74	3.49	5,455	10,916	21,839	43,684
13,500	1,024	1,000	0.41	0.82	1.65	3.31	5,586	11,178	22,363	44,733
18,000	896	848	0.41	0.83	1.67	3.34	7,529	15,066	30,140	60,287
22,500	768	768	0.43	0.86	1.72	3.45	9,699	19,408	38,827	77,663
40,000	640	488	0.45	0.91	1.83	3.66	18,320	36,656	73,327	146,670
45,000	512	512	0.48	0.97	1.94	3.88	21,827	43,672	87,363	174,744
50,000	640	384	0.46	0.93	1.86	3.72	23,282	46,584	93,187	186,394
75,000	512	296	0.50	1.00	2.01	4.03	37,756	75,543	151,116	302,262
100,000	384	264	0.56	1.12	2.25	4.51	56,445	112,934	225,912	451,868
200,000	256	152	0.73	1.47	2.94	5.88	147,058	294,227	588,564	1,177,238
400,000	256	48	1.16	2.32	4.65	9.31	465,690	931,724	1,863,791	3,727,926
480,000	384	24	1.29	2.58	5.17	10.35	62,091	1,242,299	2,485,056	4,970,569
Model 1000K										
720,000	256	8	3.88	7.76	15.53	31.06	2,794,152	5,590,355	11,182,760	22,367,571
900,000	128	8	6.20	12.42	24.85	49.70	5,588,307	11,180,712	22,365,523	44,735,144
1,000,000	128	8	5.58	11.18	22.36	44.73	5,588,307	11,180,712	22,365,523	44,735,144

* FPS = Frame Per Second

OPTION SUBJECT TO EXPORT LICENSE CONTROL RESTRICTIONS WHERE APPLICABLE
Frequency settings above 900,000 fps require external synchronization
Model 1000K providing frame rates above 480,000 fps subject to export licence control

Sensor	20 μm pixel size, 12-bit ADC (Bayer system color, single sensor)
Shutter	Global electronic shutter from 1ms to 1μs independent of frame rate (293ns shutter available subject to export license control)
Lens Mount	Interchangeable Nikon F-mount (compatible with Nikon G type lenses), C-mount using supplied adapters. Optional Canon EF remote control mount
Extended Dynamic Range	Selectable in twenty steps (0 to 95% in 5% increments) to prevent pixel over-exposure
Memory	8GB (standard: 5,455 frames @ maximum resolution) 16GB (option: 10,916 frames @ maximum resolution) 32GB (option: 21,839 frames @ maximum resolution) 64GB (option: 43,684 frames @ maximum resolution)
Recording bit depth	Selectable 8-bit or 12-bit recording
Video Output	Live and playback video through Two HD-SDI or Dual RS-170 (NTSC/PAL) outputs
Nonvolatile Data Storage	Two SD card slots
Camera Control	Remote computer control via high-speed dual port Gigabit Ethernet or optional local control via handheld keypad with LCD monitor
User Preset Switches	Four user selectable camera function controls mounted on the camera's rear panel
Low Light Mode	Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera
Triggering	Selectable positive or negative TTL 5Vp-p or switch closure
Trigger Delay	Programmable delay on selected input and output triggers, 100ns resolution
Timing	Internal clock or external source
Phase Lock	Enables cameras to synchronize precisely to a master camera or external signal source, such as IRIG/GPS time code
Event Markers	Ten user specified event markers indicate specific events within an image sequence in real time. Immediately accessible through software
Trigger Modes	Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual, Image Trigger
Saved Image Formats	JPEG, AVI, TIFF, BMP, RAW, RAWW, MRAW PNG, MOV and FTIF. Images can be saved with or without image or comment data
Data Display	Frame Rate, Shutter Speed, Trigger Mode, Date or Time, Status (Playback/Record), Real Time, Frame Count, Resolution and IRIG time stamp
Partitioning	Up to 64 memory segments for capturing multiple recordings into camera memory
Data Acquisition	Supports Photron and National Instruments™ DAQ options
Operating Temperature	0 - 40 degrees (32 - 104 degree F)
Mounting	1 x 1/4 - 20 UNC, 1 x 3/8 - 16 UNC, 6 x M5
Dimensions	177.7mm (7.0")H × 160mm (6.3")W × 350mm (13.78")D *excluding protrusions
Weight	9.9 kg (21.3 lbs)
Power Requirements	100V - 240V AC 50-60Hz DC operation 18 - 36 VDC, 210VA

Specifications subject to change without notice

Photron

SLOW MOTION IMAGING SOLUTIONS

FASTCAM SA-Z
HIGH PERFORMANCE HIGH-SPEED CAMERA SYSTEM
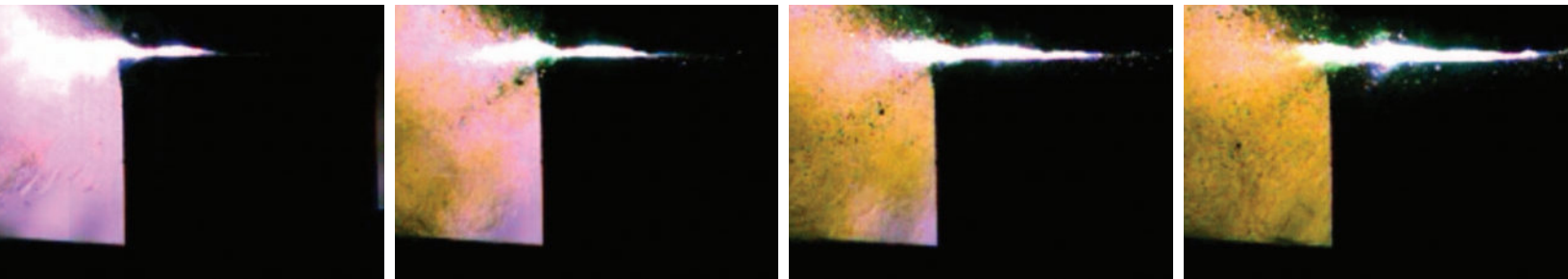
The Photron FASTCAM SA-Z offers scientists, researchers and engineers the ability to capture high resolution digital images at ultra-high speeds to see and understand previously invisible processes and events. Using Photron's proprietary CMOS image sensor technology, FASTCAM SA-Z combines high recording rates with outstanding light sensitivity and excellent image quality to provide the most versatile ultra-high speed digital camera available today.

The ultra-high speed FASTCAM SA-Z provides mega pixel resolution to a blistering 21,000 frames per second (fps) from it's very light sensitive (ISO 25,000) 20 μm square pixels, with 12-bit pixel depth (ADC) delivering incredible image quality. The FASTCAM SA-Z can operate at reduced resolution beyond two million frames per second.

A global electronic shutter, 1μs standard, but capable of operating down as fast as 159 nanoseconds (export restrictions apply) ensures the 12-bit monochrome, 36-bit color images are crystal clear and blur free as you have come to expect from Photron high speed imaging products.

The square image format is ideal for any application requiring recording through a round or square viewing ports, such as combustion research, and has the added benefit of enabling users to rotate their camera if required without having to sacrifice horizontal resolution as is required when a camera with a rectangular aspect ratio is mounted on its side. Tools within Photron's PFV camera control / replay/ editing software allow the displayed image to be rotated to reflect the true view.

Target applications include:

- Materials Science
- Combustion Research
- Fluid dynamics (PIV)
- Ballistic Imaging
- Defense and aerospace research
- Plasma and arc studies
- Shock Waves and Detonation

Benefits

- Powerful performance with many usable resolution and speed combinations, including:
    - 20,000 fps at 1,024 x 1,024 pixels resolution
    - 40,000 fps at 1,024 x 512 pixel resolution
    - 100,000 fps at 640 x 280 pixel resolution
    - 200,000 fps at 384 x 176 pixel resolution

- Reduced resolution operation to over 2M frames per second

- Market leading light sensitivity (ISO Ssat 12232 standard)
    - ISO 25,000 monochrome
    - ISO 10,000 color

- Global electronic shutter as fast as 159ns (dependant on frame rate selected), freezing the fastest motion without blur

- Two SD card slots and dual Gigabit Ethernet ports enable easy and very fast image off load

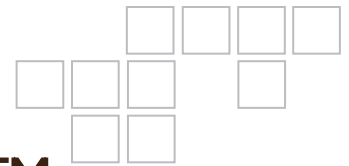- Available with four onboard memory options: 8GB, 16GB, 32GB, 64GB

Photron

www.photron.com

FASTCAM SA-Z
HIGH PERFORMANCE HIGH-SPEED CAMERA SYSTEM

Specifications: Partial Frame Rate / Recording Duration Table

FRAME RATE	MAXIMUM RESOLUTION		RECORD DURATION (12-BIT)							
			TIME (Sec.)				FRAMES			
(fps)	Horizontal	Vertical	8GB	16GB	32GB	64GB	8GB	16GB	32GB	64GB
Model 480K										
50	1,024	1,024	109.10	218.32	436.78	873.68	5,455	10,916	21,839	43,684
500	1,024	1,024	10.91	21.83	43.68	87.37	5,455	10,916	21,839	43,684
1,000	1,024	1,024	5.46	10.92	21.84	43.68	5,455	10,916	21,839	43,684
2,000	1,024	1,024	2.73	5.46	10.92	21.84	5,455	10,916	21,839	43,684
5,000	1,024	1,024	1.09	2.18	4.37	8.74	5,455	10,916	21,839	43,684
10,000	1,024	1,024	0.55	1.09	2.18	4.37	5,455	10,916	21,839	43,684
20,000	1,024	1,024	0.27	0.55	1.09	2.18	5,455	10,916	21,839	43,684
21,000	1,024	1,000	0.27	0.53	1.07	2.13	5,586	11,178	22,363	44,733
25,000	1,024	840	0.27	0.53	1.07	2.13	6,650	13,308	26,623	53,254
40,000	1,024	512	0.27	0.55	1.09	2.18	10,912	21,835	43,680	87,371
60,000	640	488	0.31	0.61	1.22	2.45	18,320	36,656	73,327	146,670
75,000	512	456	0.33	0.65	1.31	2.62	24,508	49,036	98,092	196,204
100,000	640	280	0.32	0.64	1.28	2.56	31,931	63,887	127,801	255,627
120,000	512	264	0.35	0.70	1.41	2.82	42,333	84,700	169,433	338,900
200,000	384	176	0.42	0.85	1.69	3.39	84,669	169,402	338,869	677,803
480,000	512	56	0.42	0.83	1.66	3.33	199,580	399,309	798,766	1,597,681
Model 2100K										
525,000	384	64	0.44	0.89	1.78	3.55	232,844	465,861	931,894	1,863,962
700,000	256	56	0.57	1.14	2.28	4.57	399,162	798,620	1,597,535	3,195,365
900,000	128	56	0.89	1.77	3.55	7.10	798,327	1,597,242	3,195,073	6,390,733
1,008,000	256	24	0.92	1.84	3.69	7.39	931,382	1,863,450	3,727,585	7,455,855
1,200,000	128	32	1.16	2.33	4.66	9.32	1,397,075	2,795,176	5,591,379	11,183,784
2,100,000	128	8	2.66	5.32	10.65	21.30	5,588,307	11,180,712	22,365,523	44,735,144

Model 2100K subject to export license control restrictions where applicable

Sensor — 20 μm pixel size, 12-bit ADC (Bayer system color, single sensor)

Shutter — Global electronic shutter from 1ms to 1 μs independent of frame rate (sub-microsecond shutter available subject to export license control)

Lens Mount — Interchangeable Nikon F-mount (compatible with Nikon G type lenses), C-mount using supplied adapters. Optional Canon EF remote control mount

Extended Dynamic Range — Selectable in twenty steps (0 to 99% in 5% increments) to prevent pixel over-exposure

Memory — 8GB (standard: 5,455 frames @ maximum resolution)
16GB (option: 10,916 frames @ maximum resolution)
32GB (option: 21,839 frames @ maximum resolution)
64GB (option: 43,684 frames @ maximum resolution)

Recording bit depth — Selectable 8-bit or 12-bit recording

Video Output — Live and playback video through Two HD-SDI or Dual RS-170 (NTSC/PAL) outputs

Nonvolatile Data Storage — 2x SD/SDHC/SDXC memory Card drives provided. Compatible with UHS-I (SDR104)

Camera Control — Remote computer control via high-speed dual port Gigabit Ethernet or optional local control via handheld keypad with LCD monitor

User Preset Switches — Four user schedulable camera function controls mounted on the camera's rear panel

Low Light Mode — Low light mode drops the frame rate and shutter time to their maximum values, while maintaining other set parameters, to enable users to position and focus the camera

Triggering — Selectable positive or negative TTL or switch closure

Trigger Delay — Programmable delay on selected input and output triggers, 100ns resolution

Timing — Internal clock or external source

Phase Lock — Enables cameras to synchronize precisely to a master camera or external signal source

Event Markers — Ten user specified event markers indicate specific events within an image sequence in real time. Immediately accessible through software

Trigger Modes — Start, End, Center, Manual, Random, Random Reset, Random Center, Random Manual

Saved Image Formats — JPEG, AVI, TIFF, BMP, RAW, RAWW, MRAW PNG, MOV and FTIF. Images can be saved with or without image or comment data

Data Display — Frame Rate, Shutter Speed, Trigger Mode, Date or Time, Status (Playback /Record), Real Time, Frame Count and Resolution

Partitioning — Up to 64 memory segments for capturing multiple recordings into camera memory

Data Acquisition — Supports Photron and National Instruments DAQ options

Operating Temperature — 0 - 45 degrees

Mounting — 3 x 1/4-20 UNC, 3 x 3/8-16 UNC

Dimensions — 261mm (10.2")H × 150mm (5.9")W × 375mm (14.7")D *excluding protrusions

Weight — 10.4 kg (22.93 lbs) *excluding protrusions

Power Requirements — 100V-240V AC 50-60Hz
DC operation 20-36 VDC, 230VA

Specifications subject to change without notice

Photron
SLOW MOTION IMAGING SOLUTIONS