VISION RESEARCH

PHANTOM

when it's too fast to see, and too important not to.®

DATA SHEET

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Phantom® Miro® Digital High-Speed Cameras

Advanced features in a compact camera at an affordable price

Phantom Miro M310 and Miro LC Series with Flip-out LCD Touchscreen Controls

Key Benefits:

WHEN IT'S TOO FAST TO SEE, AND TOO IMPORTANT NOT TO®

You will wonder how we packed so much capability in such a small package! Phantom Miro cameras have all the high-performance features you've come to expect from Vision Research in a compact, rugged camera. The M-Series models are ideal for laboratory and table-top environments where the camera is controlled from a laptop or Remote Control Unit. The LC-Series add a flip-out LCD touchscreen with on-camera controls for more portable applications.

The Miro 110 and Miro 310 are based on a 1 Megapixel (Mpx), 1280 x 800, custom-designed CMOS sensor from Vision Research. The Miro 110 has 1.6 Gigapixel/second (Gpx/s) throughput, yielding over **1600 frames-per-second** (fps) at full resolution. The Miro 310 doubles that for 3.2 Gpx/s throughput and over **3200 fps at full resolution.** With a 20 micron (µm) pixel size and 12-bit depth, these cameras feature **high-light sensitivity** and **great dynamic range.**

Key Features:

Flip-out LCD touchscreen for on-camera control and monitoring on LC-Series

1 Megapixel and 2 Megapixel custom-designed CMOS sensors

Up to 3.2 Gigapixels/second throughput

High light sensitivity

Compact, rugged design

Rechargeable battery

Phantom CineFlash® storage system
- 60GB, 120GB and 240GB CineFlash
- CineFlash Dock
- eSATA Connectivity

AMETEK®
MATERIALS ANALYSIS DIVISION

Miro® Digital High-Speed Cameras

Phantom Miro LC-Series with Flip-out LCD Touchscreen

Advanced Features:

CineFlash Storage System

Image-Based Auto-Trigger

Convenient Presets for Common Applications

User-definable Presets can be Saved and Retrieved

Burst Mode

Extreme Dynamic Range

Continuous Recording

Auto-Exposure

Measurements

Multi-cine Acquisition

Internal Mechanical Shutter

AutoSet

Miro M-Series Rear View shown with CineFlash

Maximum frame rates at reduced resolution are 400,000 fps for the Miro 110 and 650,000 for the Miro 310.

The Miro 120 is based on a >2Mpx sensor and 1.6 Gpx/s throughput. That translates to **730 fps at 1920 x 1200**, or **over 1200 fps at 1152 x 1152. The Miro 320S has 3.2 Gpx/s throughput. That's 1380 fps at 1920 x 1200.** These cameras use microlenses on their custom-designed CMOS sensors with 10 µm pixel pitch to achieve high light sensitivity. With 12-bit pixel depth, they also sport high dynamic range for excellent image quality. Maximum frame rate at reduced resolution is 250,000 fps for the Miro 120 and 325,000 for the Miro 320S monochrome.

Depending on model, the minimum exposure time is either 1 µs or 2 µs for **sharp, blur-free images** using a global electronic shutter. Vision Research's unique **Extreme Dynamic Range** (EDR) feature is standard on all models. With EDR enabled, each pixel in a frame will receive one of two exposure times – a short exposure for potentially overexposed pixels and a longer exposure for pixels receiving normal light levels. This dramatically increases dynamic range and gets you results even under the most demanding shooting conditions.

For PIV applications, using the Shutter Off mode allows for a **straddle time of 500 ns** on the Miro 110 and Miro 310 and **1.4 µs** on the Miro 120 and Miro 320S monochrome.

An integrated internal mechanical shutter for remote and automatic black references is another unique innovation from Vision Research that comes standard on all models. This means **each shot is properly referenced for maximum image quality**. And, there is no need to manually cap the lens or even touch the camera since the black reference can be done remotely or automatically before each shot.

A **Nikon F-mount is standard on the cameras.** Or, you can choose a **C-mount, PL-mount or EOS-mount**. The EOS mount enables the use of compatible EF and EF-S lenses, and focus and aperture can be adjusted via our Phantom Remote Control Unit (RCU), Phantom Camera Control software (PCC), or using an adjustment ring on the lens mount. Remote control of focus and aperture is a **huge benefit when cameras are remotely located and/or difficult to reach.**

Each camera model comes in three memory configurations: 3 Gigabytes (GB), 6 GB or 12 GB. The high-speed internal **memory can be segmented** into as many as 16 partitions for cine storage. (A *cine* is Vision Research's raw image format that stores all image data in a compact file.)

At the end of any shot, save your cine to the removable Phantom CineFlash storage media at about 4GB/minute. CineFlash allows you to **save a copy of your cine to non-volatile memory** for later retrieval, and **avoid costly downtime**

	Phantom Miro 110	Phantom Miro 310	Phantom Miro 120	Phantom Miro 320S
Maximum Resolution	1280 x 800	1280 x 800	1920 x 1200	1920 x 1200
Maximum Frame Rate at Maximum Resolution	1600 fps	3200 fps	730 fps	1380 fps
Throughput (Gpx/s)	1.6 Gpx/s	3.2 Gpx/s	1.6 Gpx/s	3.2 Gpx/s
Sensor Size	25.6mm x 16.0mm	25.6mm x 16.0mm	19.8mm x 12.0mm	19.8mm x 12.0mm
Pixel Pitch	20 µm	20 µm	10µm	10µm
Minimum Exposure	2 µs	1 µs	1 µs	1 µs
ISO (12232 SAT Method)	11,100 T Mono 1800 T Color	11,100 T Mono 1800 T Color	8900 T Mono 1100 T Color	8900 T Mono 1100 T Color

	Phantom Miro 110		Phantom Miro 310		Phantom Miro 120		Phantom Miro 320S Mono		Phantom Miro 320S Color	
	FPS	Secs*	FPS	Secs*	FPS	Secs*	FPS	Secs*	FPS	Secs*
1920 x 1200	N/A	-	N/A	-	730	4.7	1,380	2.6	1,380	2.6
1920 x 1080	N/A	-	N/A	-	800	4.8	1,540	2.6	1,530	2.6
1152 x 1152	N/A	-	N/A	-	1,220	4.9	2,250	2.8	2,240	2.8
1024 x 1024	N/A	-	N/A	-	1,530	4.9	2,780	2.8	2,770	2.9
1280 x 800	1,630	4.7	3,260	2.3	1,600	4.8	2,960	2.6	2,940	2.7
1280 x 720	1,810	4.7	3,630	2.3	1,780	4.8	3,280	2.6	3,200	2.7
896 x 720	2,520	4.9	5,040	2.4	2,450	5.0	4,400	2.8	4,300	2.9
640 x 480	5,090	5.1	10,100	2.5	4,910	5.3	8,490	3.0	8,300	3.3
512 x 512	5,790	5.2	11,500	2.6	5,540	5.5	9,330	3.2	9,200	3.4
384 x 288	12,900	5.6	25,900	2.7	12,200	5.9	19,600	3.6	19,000	3.9
256 x 256	19,800	6.1	39,700	3.0	18,300	6.6	27,600	4.4	26,400	4.8
128 x 128	60,400	8.0	120,700	4.0	52,400	9.3	69,000	7.0	62,000	8.1
128 x 64	113,200	8.6	226,300	4.3	95,300	10.2	121,900	8.0	102,000	9.7
64 x 8	400,000	19.5	650,000	12.0	250,000	31.0	325,000	25.0	240,000	45.0

* Record time into maximum memory of 12GB.

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Phantom® Miro® Digital High-Speed Cameras

while you download from camera memory to a computer hard disk. When done with an experiment, just remove the CineFlash from the camera, insert it into its docking station connected to a PC, and drag-and-drop cines from the CineFlash onto your computer disk.

Using PCC, you can then **view, edit, enhance and analyze** cine files. Easily extract still shots, or convert cines into web- and presentation-compatible formats for sharing with colleagues and documenting experiments. Use PCC's measurement tools to **determine distances, angles and speed.** Advanced tools let you **crop, scale, rotate and enhance** cine files to get to the information and insight you seek in images that have never before been seen.

Control your camera with an extensive suite of tools in PCC via a Gb Ethernet connection, or use the Phantom RCU and its **easy-to-learn and easy-to-use touchscreen interface.**

The LC-Series models have a **flip-out LCD touchscreen for on-camera control and monitoring**. Camera settings can be changed with a few taps on the touchscreen which doubles as a monitor for live preview and cine playback from internal memory. The LCD user interface is available in multiple languages.

Advanced control signals are available including a Frame Synchronization signal (FSYNC) on the camera back panel. Trigger, Ready, IRIG In, Video Out, IRIG Out and an Auxiliary signal connection (Event, Strobe, Memgate) are all available on the standard capture cable.

Video Out is either **NTSC or PAL on the Miro 110, Miro 310 and Miro 120. An HD-SDI port is available on the Miro 320S.** And, a live image is always available in PCC, on the RCU or LC-Series touchscreen. You can adjust the video to fill the available monitor space for framing a shot, and then zoom to a 1:1 pixel representation (center-cropped) for focusing using the Autoset button on the front of the camera.

Applications for the Phantom Miro cameras are as broad as your imagination. Study flow dynamics in PIV applications; improve micro- and nano-designs through small object imaging; diagnose and troubleshoot problems with high-speed machinery; improve product designs by characterizing materials and products under stress; any application that demands high-speed image capture at one- to two-megapixel resolution with high light sensitivity is a candidate for the Miro family of digital high-speed cameras.

Additional Features:

Gb Ethernet

Rechargeable Battery (Sony BP-U30 or BP-U60)

Dimensions: (without handle or lens)
19 x 8.8 x 10 cm, 7.5 x 3.5 x 4 inches (M-Series),
19 x 9.8 x 10 cm, 7.5 x 3.85 x 4 inches (LC-Series)

Weight: 3.0 lbs, 1.4 kg (without CineFlash, battery or lens)

Operating Temperature and Humidity: 0° C to 40° C @ 8% to 80% relative humidity, non-condensing

Tiered Service Contracts to protect your investment

Phantom Miro M310

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