VISION RESEARCH

PHANTOM

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

DATA SHEET

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Phantom® v2512
Phantom® v2012
Phantom® v1612
Phantom® v1212

The world's fastest 1 Mpx ultrahigh-speed digital camera line now has the most memory.

Phantom v2512

Key Benefits:

The **Phantom ultrahigh-speed UHS-12 digital camera line** offers ultra high throughputs, superb sensitivity, and the most memory available on the market.

- **72GB, 144GB, and 288GB memory** options are available on all UHS-12 Series models. 288GB of memory provides over 7.6 seconds of recording time for a v2512 capturing images at 25Gpx/s.
- Like their predecessor UHS-11 Series, the UHS-12 Series offer **ultra high throughputs**. At full megapixel resolution of 1280 x 800:
  The **Phantom v2512** achieves over 25 Gpx/s and over 25,000 frames per second (fps)
  The **Phantom v2012** achieves over 20 Gpx/s and over 20,000 fps
  The **Phantom v1612** achieves over 16 Gpx/s and over 16,000 fps
  The **Phantom v1212** achieves over 12 Gpx/s and over 12,000 fps
- The UHS-12 Series also have **superb sensitivity** for better picture quality and more lighting flexibility. Using the ISO 12232 SAT method, all models are measured at:

v2512 - v2012 - v1612 - v1212 ISO	
	D (Daylight)
Monochrome	32,000
Color	6,400

And, these cameras are **built on the proven Phantom Ultrahigh-speed UHS-11 Series Camera Platform**, with the full array of **unique features** that let you take full advantage of their speed and flexibility.

Key Features:

1 Megapixel sensor (1280 x 800)

25Gpx/s throughput (v2512)

22Gpx/s throughput (v2012)

16Gpx/s throughput (v1612)

12Gpx/s throughput (v1212)

ISO (ISO 12232 SAT method):
Mono: 32,000 D
Color: 6,400 D

1µs minimum exposure standard

Camera	Minimum exposure with FAST option*
v2512	280 ns
v2012	305 ns
v1612	500 ns
v1212	500 ns

* Export controlled feature

Up to 228GB memory

Phantom CineMag® IV 1TB and 2TB compatible

AMETEK®
MATERIALS ANALYSIS DIVISION

The standard Capture Cable, which attaches to the Capture Port, provides the following signals:

- Ready (is high when camera is in capture mode, can be combined with other cameras to provide a "system ready" signal)
- Strobe (is low during frame exposure time)
- Auto-Trigger (a hardware trigger signal supplied by Image-Based Auto-Trigger)
- Pre-trigger/Memgate (a falling edge causes the camera to start acquiring pre-trigger frames and wait for a trigger – the camera goes into "capture" mode; or, if used in Memgate mode, frames acquired while low are discarded and not saved to memory allowing for selective recording)
- Video Out (NTSC or PAL composite video signal)

Or, use the optional Break-out-Box (BoB) connected to the Capture Port and have access to the following signals on the BoB.

- IRIG-In
- IRIG-Out
- Video Out
- Trigger
- Event (if low when Strobe goes high, the frame is marked with an event marker)
- Strobe
- Auto-Trigger (goes low when this camera is triggered by Image-Based Auto-Trigger allowing one camera to trigger other cameras based on an event detected in the live image)
- Pre-trigger/Memgate
- Ready

Phantom v1212 with CineMag®

Image Storage:

At ultrahigh-speeds, memory can become a limitation to recording duration. The **cameras can be equipped with 72GB, 144GB, or 288GB** of high-speed memory. A camera with 288GB of memory, recording at 10,000 fps at 1280 x 800 can record a single high-speed shot (called a *cine*) for up to **almost 20 seconds**. Or, **segment memory** into up to 63 segments and record shorter cines into each segment.

Minimize cine save times with the Phantom CineMag option. With the ability to save 1GB/s of data to an attached CineMag IV, a 288GB shot can be saved in under 5 minutes. The cine is **securely stored in non-volatile memory.**

The contents of a CineMag can later be viewed on a PC, trimmed, played to video, and saved either by placing the CineMag back on the camera, or using our offline Phantom CineStation® – a simple CineMag reader that connects to your PC with 1Gb or 10Gb Ethernet.

Sensor Characteristics:

Phantom Ultrahigh-Speed Cameras are based on a Vision Research designed **custom CMOS sensor**. The **28 micron pixel size means high light sensitivity** and Vision Research's innovative design increases the sensitivity even more. Each pixel has a **bit depth of 12 bits** yielding 4,096 gray levels with high dynamic range. Each camera comes in monochrome or color versions.

Sensor resolution is 1280 x 800 "widescreen" format. The rectangular shape of the 1 Mpx sensor allows the user to keep moving objects in the frame longer and is compatible in aspect ratio with modern display technology. The physical size of the sensor is 35.8mm x 22.4mm.

These cameras have a **global electronic shutter** capable of exposures as fast as 1 µs on a standard camera, or up to 280 ns with the export controlled FAST option depending on the camera model. This truly "freezes motion" and eliminates **motion blur** in the most demanding of applications.

Command & Control:

You can set up and control your Phantom camera using several different tools.

A convenient way to use your Phantom ultrahigh-speed camera is with the standard **on-camera controls**. Simply connect a video monitor to the camera and use the intuitive user interface to control most common camera settings.

Our **Phantom Camera Control (PCC) software** is full-featured and easy to use. Set up and control one or many cameras from a single interface with easy access to even the most complex camera features. PCC even has a basic motion analysis and measurements package built-in. PCC also connects to our Phantom CineStation for offline work with our popular CineMag storage devices.

Phantom v2512, v2012 v1612, and v1212 - Back Panel

The **Phantom Remote Control Unit** (RCU) is a small full-featured camera controller that connects to the Remote port on the camera (or via Bluetooth using a Bluetooth adapter on the camera for wireless control). The LCD touchscreen gives access to all popular camera features with the tap of a finger. Connect the RCU to an HD-SDI video port and use it as a monitor, too!

Connectivity:

The Phantom v2512, v2012, v1612 & v1212 are **our most "connected" cameras ever!** On the back panel of the camera you will find:

BNC Connectors		9	Power Switch
1	Trigger	10	Range Data (input azimuth and elevation data from a tracker)
2	Time Code In (IRIG, SMPTE)	11	GPS (input time, location from an external GPS receiver)
3	I/O 1: Ready	12	Remote Control Port
4	I/O 2: F-SYNC	13	1 Gb Ethernet
5	I/O 3: Time Code Out (IRIG, SMPTE)	14	10 Gb Ethernet (UTP copper interface, RJ45 connector)
6	I/O 4: Strobe	15	Primary DC Input (20-28VDC)
7	HD-SDI 2	16	Backup DC Power
8	HD-SDI 1	17	Capture Port

The two HD-SDI ports can act as identical 4:2:2 HD-SDI ports with one port set up to provide an (optional) on-screen display to monitor the on-camera controls and camera operation. Or, they can be configured as a "single" 4:4:4 Dual-Link HD-SDI port.

LabView and Matlab development environments are also available.

Advanced Features:

- **10G Ethernet:** Download cines from the camera super fast. The 10G Ethernet transfers data at up to 600 MB/second on optimized systems, saving time and getting to your critical data faster.
- **Image-Based Auto-Trigger:** Trigger the camera (or even a number of connected cameras) from motion detected within the live image. This makes it easier to catch events that are not predictable and may occur infrequently.
- **Internal Mechanical Shutter:** All digital high-speed cameras require an occasional black reference to provide the highest quality images. A black reference is obtained by sampling a perfectly black image. With an internal mechanical shutter, no physical access to the camera is needed.

Environmental Specs:

Power:	100 - 240 VAC, 280 Watt power supply included
Weight (without lens):	17 lbs, 8 oz. (8.1 Kg)
Operating Temperature:	-10 to +50 C
Storage temperature:	-20 to + 70 C
Humidity:	95% non-condensing
Altitude:	
Operational	0 to 10 k feet above sea level
Non-Operational	-500 to 50 k feet above sea level
Magnetic Field Immunity:	500 amp-meter
Regulatory:	EMI/RFI
Emissions	EN 55022, FCC part 15
Conducted	EN 55022
Immunity	EN 55024
ESD	IEC 61000-4-2
Random Vibration:	
Operational	0.25G, 5 –500 – 5Hz, 1.0 Octave/min 10 Sweeps (5 Cycles)
Non-Operational	1.2G, 5 – 500Hz, 1.0 Octave/min 10 Sweeps
Shock:	
Operational	5.5G, 11mSec half-sine with 10 shocks in all axis.
Non-Operational	33G, 11mSec half-sine with 10 shocks in all axis
Natural Frequency:	Operational 5-200 Hz
Safety:	IEC 60950

- **Multi-Cine:** Partition internal memory into segments and make shorter recordings back-to-back without missing any action.
- **Continuous Recording:** Do you need to record many occurrences of an event, especially an event that happens rarely or is unpredictable? Continuous recording mode automatically saves a recorded cine to a disk drive on a connected PC immediately after it is recorded then re-arms the camera and waiting for the next cine. A recording can be triggered manually, from an event detection system, or even by our Image-Based Auto-Trigger. The number of recordings is limited only by the amount of available disk storage.
- **PIV features:** Particle Image Velocimetry and similar measurement techniques like Particle Tracking Velocimetry (PTV), Laser Induced Florescence (LIF), and Digital Image Correlation (DIC) require extremely accurate timing and the ability to take images in a very stable and predictable way. The straddle time on the v2512 is 375ns, on the v2012 is 400ns, on the v1612 is 425ns, and on the v1212 is 550ns.
- **Burst Mode:** Many experiments require taking images at precisely the same time during the experiment. For example, combustion studies may require images at each 1° turn in a crankshaft. Our unique burst mode allows you to trigger the camera at 0° and then take a burst of images at precise time delays.
- **Quiet Fans:** Turns the fans off to eliminate vibration which might interfere with some applications, especially when image magnification is required.

v1612 with 2TB CineMag

Vision Research Global Support - for wherever you are

Our ultrahigh-speed camera line is supported by Vision Research's Global Service and Support network offering AMECare Performance Services from multiple sites around the globe. Maximize the value of your Phantom camera with a full menu of professional support services. Learn more about our service and support options at www.visionresearch.com/Service--Support

Phantom v2512, v2012, v1612 & v1212

RESOLUTION					
		v2512	v2012	v1612	v1212
H	V	Max FPS	Max FPS	Max FPS	Max FPS
1280	800	25,600	22,500	16,600	12,600
1280	720	28,500	25,100	18,400	14,000
1024	800	30,500	26,900	19,700	15,000
1024	512	47,300	41,800	30,700	23,400
896	800	33,600	29,800	21,800	16,600
768	768	39,100	34,700	25,300	19,300
640	480	69,900	62,400	45,500	34,700
512	512	75,400	67,700	49,100	37,500
512	384	99,500	89,000	65,000	49,600
384	256	170,600	154,200	112,300	85,700
256	256	205,000	187,200	135,400	103,600
256	128	375,700	343,500	253,000	193,900
128	64	764,700*	708,800*	538,400	415,500
128	32	1,000,000*	1,000,000*	840,000*	653,000*
128	16	1,000,000*	1,000,000*	1,000,000*	820,000*

**Assumes FAST option is installed*

Maximum v2512 standard: 677,000 fps

Maximum v2012 standard: 666,000 fps

Maximum v1612 standard: 646,000 fps

Maximum v1212 standard: 570,000 fps

Learn more at:

Focused

Since 1950, Vision Research has been shooting, designing, and manufacturing high-speed cameras. Our single focus is to invent, build, and support the most advanced cameras possible.

VISION RESEARCH

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