



PHANTOM TMX

7510 UV

6410 UV

5010 UV

HIGH-SPEED
UV-VIS CAMERAS



High QE in UV and Visible wavelengths
Up to 76,000 fps at 1280 x 800 (7510),
over 300,000 fps at 1280 x 192 and 640 x 384

FEATURES & BENEFITS

BRINGING HIGH SPEED TO UV APPLICATIONS

- TMX UV cameras achieve up to over 70% QE at 300nm wavelength while offering the same frame rates and features as the standard TMX cameras
- Dual purpose: Phantom UV cameras have similar QE performance in the visible and near-IR wavelengths as their standard counterparts.

FOCUS ON DATA MANAGEMENT

- Record multiple experiments with up to 512GB of memory that can be partitioned up to 511 times.
- 10Gb Ethernet is standard for the fastest data download directly from the camera's RAM buffer.
- Use the Phantom CineMag 5e, for up to 8TB of nonvolatile memory and fast image transfer.

**with export controlled FAST options*

IMAGE & SENSITIVITY

Sensor Type	CMOS, Back Side Illuminated (BSI), with fused silica Global shutter Available in monochrome only	
Maximum Resolution	1280 x 800	Binned 640 x 384
CAR Increments	256 x 32	Binned 128 x 64
Pixel Size	18.5 mm	Binned 37 mm
Sensor Size	23.7 x 15.4 mm	
Bit Depth	12 bit	
	EMVA 1288 Measurements (at 532 nm)	
	Standard Mode	Binned Mode
Quantum Efficiency %	77.6%	72.0%
Max. SNR (dB)	39.4	45.2
Absolute Sensitivity Threshold (p)	31.8	98.9
Saturation Capacity (e ⁻)	8736	33,184
Temporal Dark Noise (e ⁻)	24.18	70.69
Dynamic Range (dB)	51.0	53.4

- Reported measurements were taken at 532 nm with monochrome camera, using the EMVA 1288 3.1 standard

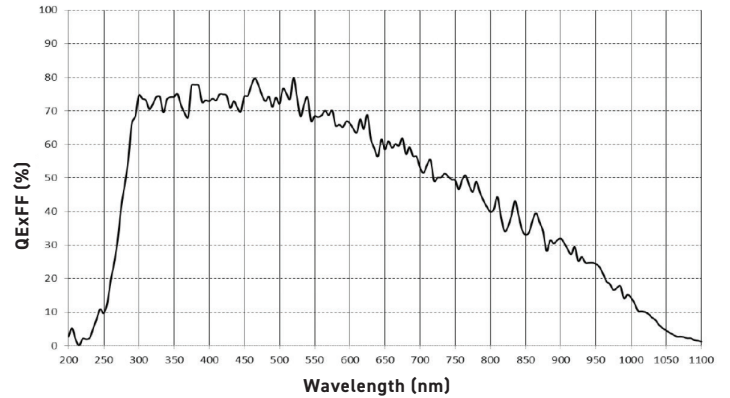
- Visit: www.phantomhighspeed.com/emva for more information on EMVA 1288



Back Panel

SPECTRAL RESPONSE

Quantum Efficiency Monochrome



CONNECTIVITY & SIGNALS

Ethernet	10Gb and Gigabit standard	
Timecode	IRIG-B modulated and un-modulated	
Port Descriptions	Ethernet	Locking RJ45
	Power	Fischer 3-pin
	Battery back-up	Fischer 3-pin
	VF (View Finder) Power	Hirose 4-pin
	Range Data	Fischer 8-pin
	Remote	Fischer 5-pin
	GPS	Fischer 6-pin
	Capture	Fischer 12-pin
	USB	Yes for WiFi dongle
	Video output	3G-SDI (2 BNCs)
Dedicated BNC	Trigger, Timecode-in, 3G-SDI	
Programmable I/O BNC	4 ports	
I/O Signals	Programmable I/O for Fsync, Strobe, Ready, Timecode-out, Event, Memgate, Pretrigger. Assign and define signals in PCC	
Hardware Trigger	Dedicated BNC	
Software Trigger	Trigger Button, via PCC over Ethernet, Remote Port, via Image-based auto trigger (IBAT)	
Synchronization	External Sync via FSync or IRIG Timecode	
Recording Features	Burst mode, Continuous recording & AutoSave to CineMag	
Video Output	3G-SDI	
Accessory Power	4-pin Hirose for 12V monitors up to 1 Amp	



MEMORY & STORAGE	
RAM Buffer	128GB, 256GB, 512GB RAM options
Multi-Cine	Up to 511 Partitions
Non-Volatile Media	Phantom CineMag 5e optional. Supports auto-save, direct record and video playback.
Media Transfer Rates	2TB CineMag 5e = 1,000 Mpx/sec 8TB CineMag 5e = 1,200 Mpx/sec

FRAME RATES & EXPOSURE			
Top FPS at Max Resolution	7510: 76,000	6410: 65,940	5010: 50,725
Maximum FPS	7510: 744,670 1,750,000 with FAST options*	6410: 736,280 1,516,660 with FAST options*	5010: 583,330 1,166,660 with FAST option*
Minimum FPS	100		
Minimum Exposure (Standard)	7510: 1.04 µs	6410: 1.04 µs	5010: 1.1 µs
Minimum Exposure (FAST)	95ns with 95ns FAST option* 38ns with 38ns FAST option* (TMX 7510 / 6410)		
PIV Features	Shutter-off mode with a straddle time of 229ns Supports Burst Mode		
Exposure Features	Extreme Dynamic Range (EDR), Auto Exposure		

FRAME RATE CHART

Table provides examples of common resolutions and frame rates. The record times shown are for 256GB RAM at the frame rate shown. Duration will be 1/2 for 128GB and double for 512GB.

MAXIMUM FRAME RATE - FPS; (256GB RECORD TIME - SEC)						
Resolution (H x V)	TMX-7510		TMX-6410		TMX-5010	
	Standard	Binned	Standard	Binned	Standard	Binned
1280 x 800	76,000 (2.2)		65,940 (2.5)		50,725 (3.3)	
1280 x 640	94,590 (2.2)		81,980 (2.5)		63,060 (3.3)	
1280 x 480	126,500 (2.2)		109,630 (2.5)		84,330 (3.3)	
1280 x 448	134,610 (2.2)		116,660 (2.5)		89,740 (3.3)	
1280 x 384	156,710 (2.2)		135,820 (2.5)		104,470 (3.3)	
1280 x 320	187,500 (2.2)		162,500 (2.5)		125,000 (3.3)	
1280 x 256	233,330 (2.2)		202,220 (2.5)		155,550 (3.3)	
1280 x 192	308,820 (2.2)		267,640 (2.5)		205,880 (3.3)	
640 x 384		308,820 (2.2)		267,640 (2.5)		205,880 (3.3)
1280 x 160	375,000 (2.2)		325,000 (2.5)		250,000 (3.3)	
640 x 320		375,000 (2.2)		325,000 (2.5)		250,000 (3.3)
1280 x 128	456,520 (2.2)		395,650 (2.6)		304,340 (3.4)	
640 x 256		456,520 (2.2)		395,650 (2.6)		304,340 (3.4)
1280 x 96	617,640 (2.2)		535,290 (2.6)		411,760 (3.3)	
640 x 192		617,640 (2.2)		535,290 (2.6)		411,760 (3.3)
1280 x 64	744,670 (2.9)		736,280 (2.9)		583,330 (3.5)	
640 x 128		744,670 (2.9)		736,280 (2.9)		583,330 (3.5)
FAST OPTION						
1280 x 64	875,000 (2.3)		758,330 (2.7)		583,330 (3.5)	
640 x 128		875,000 (2.3)		758,330 (2.7)		583,330 (3.5)
1280 x 32	1,750,000 (2.3)		1,516,660 (2.7)		1,166,660 (3.5)	
640 x 64		1,750,000 (2.3)		1,516,660 (2.7)		1,166,660 (3.5)

*Certain Phantom cameras are held to export licensing standards. Details available at: www.phantomhighspeed.com/export

CONTROL

Software & OS	Phantom PCC (Windows 64); SDK available for C/C++, C#, Python, MatLab and LabView
On-camera Controls	Standard Feature. Access menu system with encoder, viewed on video monitor. Buttons for trigger, play and save
Primary File Format	Phantom Cine RAW (.cine)
Alternative File Formats	Easily convert to formats including .mp4, Apple ProRes .mov, .avi, Tiff, JPG, PNG and many more using PCC. Cine files are directly compatible with many major video editing and motion analysis programs
Highlighted Software Features	Integrated Data Acquisition (NI-DAQ), DIC Calibration Support with Sync-Snapshot menu, Continuous recording, Image Processing

MECHANICAL

Housing Variants	CineMag and non-CineMag compatible variants
Size (Without Handle)	Non-CineMag: 7 x 7 x 11.7" (17.8 x 17.8 x 29.7 cm) CineMag: 7 x 7.4 x 11.7" (17.8 x 18.6 x 29.7 cm)
Weight	20 lbs (9.1 kg)
Lens Mounts	F-Mount standard (aperture support for Nikon G-style lenses). Also available: Canon EF (with electronic focus and iris control), C-mount, M42-Mount
Mounting Points	2 (4 total) on the bottom, 2 (4 total) on side, 4 (8 total) on handle
Internal Shutter	Standard, for remote black references
Cooling	Active cooling. Quiet mode disables fans during capture

POWER

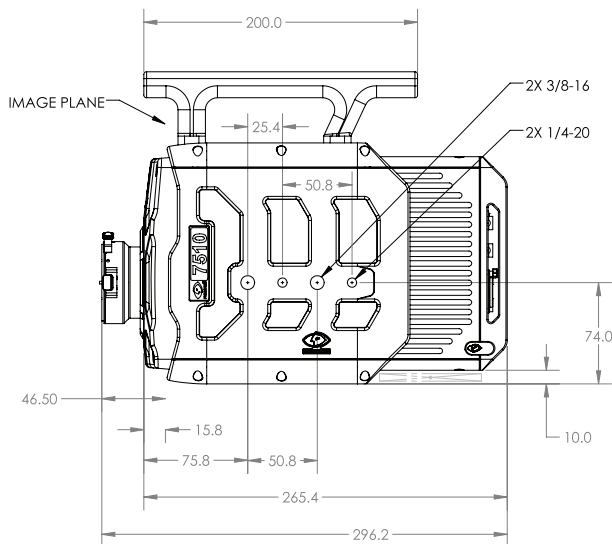
AC Power	100-240 VAC, 400W power supply included
Voltage Range	20-28VDC Primary and Secondary
Power Consumption	325W typical, 395W maximum with accessories (Max frame rate, CineMag, View Finder, Remote)

ENVIRONMENTAL

Operating Temperature	-10 to +50°C
Storage Temperature	-20 to +70°C
Operational Shock	Rated 30G; sawtooth wave, 11ms, +/- 10 pulses all axes
Operational Vibration	MIL-STD-202H Method 214-i; Test Condition A. Rated 5.3 Grms; 15 min/axis
Regulatory	Made in the USA Emissions – CE & UKCA Compliant EN 61326-1 Immunity – CE & UKCA Compliant EN 61326-1 FCC – CFR 47, Part 15, Subpart B & ICES-0003, Class A KC Emissions – KC Compliant KN32 KC Immunity – KC Compliant KN35 Safety - IEC 60950-1

GLOBAL SUPPORT NETWORK

Phantom cameras are supported by Vision Research's Global Service and Support network, providing PhantomCare services from multiple sites around the globe.



ABOUT VISION RESEARCH

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



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PHANTOM T3610 UV T2410 UV

HIGH-SPEED UV-VIS CAMERAS

1Mpx at 38,040 fps (T3610)

1Mpx at 24,270 fps (T2410)

BSI sensor with optimized response for
250-1000nm wavelengths

FEATURES & BENEFITS

BRINGING HIGH-SPEED TO UV APPLICATIONS

- Responsive at ultraviolet wavelengths with over 70% QE_{EFF} at 300nm, while offering the same frame rates and features as standard T-Series cameras
- Dual purpose: Phantom UV cameras have similar QE performance in the visible and near-IR wavelengths as their standard monochrome counterparts

WORKFLOW FLEXIBILITY

- The convenient T-Series platform provides premium I/O connectivity and workflow features in a compact housing
- 10Gb Ethernet allows for the fastest data download directly from the camera's RAM buffer, up to 256 GB
- On-camera controls and an optional CineMag interface allows for complete standalone operation, eliminating the need for a computer. Offload later from the camera body or a dedicated CineStation

IMAGE & SENSITIVITY

Sensor Type	CMOS, Back Side Illuminated (BSI) with fused silica, global shutter	
Maximum Resolution	1280 x 800	Binned 640 x 384
CAR Increments	256 x 32	Binned 128 x 64
Pixel Size	18.5 μm	Binned 37 μm
Sensor Size	23.7 x 14.8 mm	
Bit Depth	12 bit	
	EMVA 1288 Measurements (at 532 nm)	
	Standard Mode	Binned Mode
Quantum Efficiency %	80.3% mono	74.1% mono
Max. SNR (dB)	39.8	45.5
Absolute Sensitivity Threshold (p)	29.7 mono	77.2
Saturation Capacity (e ⁻)	9,469 mono	35,581
Temporal Dark Noise (e ⁻)	23.34	56.63
Dynamic Range (dB)	52.0	55.9

- Reported measurements were taken at 532 nm with a monochrome camera, using the EMVA 1288 3.1 standard

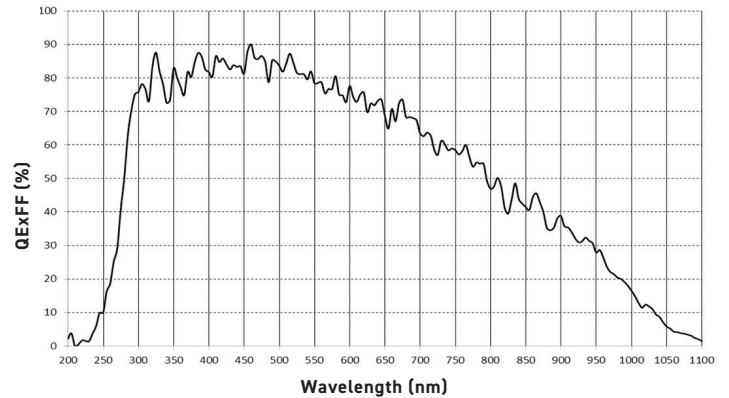
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Back Panel

SPECTRAL RESPONSE

Quantum Efficiency Monochrome



CONNECTIVITY & SIGNALS

Ethernet	Gigabit and 10Gb Ethernet (standard)
Timecode	IRIG-B Modulated and Un-modulated
Port Descriptions	Fischer 8-pin Ethernet; Fischer 3-pin for Primary and Backup Power; Fischer 5-pin for Remote; Fischer 8-pin for Range Data; USB for WiFi Dongle; 3 Dedicated BNCs for Trigger, Timecode-in and SDI Video; 3 BNCs for Programmable I/O
I/O Signals	Programmable I/O (3 ports) for Fsync, Strobe, Ready, Timecode-out, Event, Pretrigger Assign and define signals in PCC
Hardware Trigger	Dedicated BNC
Software Trigger	Trigger button; via Ethernet; via Remote port; via Image-based auto trigger (IBAT)
Synchronization	External Sync via FSync or IRIG Timecode
Recording Features	Burst Mode; Image-based Auto Trigger, Continuous Recording
Video Output	3G-SDI via BNC (rear), Din (front); Micro HDMI type D
Accessory Power	4-pin Hirose (front) for 12V monitors up to 1 Amp



MEMORY & STORAGE	
RAM Buffer	64GB, 128GB, 256GB RAM Options
Multi-Cine	Up to 63 Partitions
Non-Volatile Media	Phantom CineMag 5 optional. Supports auto-save, direct record and video playback.
Media Transfer Rates	2TB CineMag = 1 Gpx/s 8TB CineMag = 1.3 Gpx/s

FRAME RATES & EXPOSURE		
Top FPS at Max Resolution	3610: 38,040	2410: 24,270
Maximum FPS	3610: 525,000 (875,000 w/ FAST Option*)	2410: 525,000 (558,330 w/ FAST Option*)
Minimum FPS	100	
Minimum Exposure	1.1 µs Standard, 190ns with FAST Option*	
PIV Features	Shutter-off mode with a straddle time of 364ns; Supports Burst Mode	
Exposure Features	EDR (Extreme Dynamic Range); Auto-Exposure	

FRAME RATE CHART

Table provides examples of common resolutions and frame rates. Additional resolutions are available, reducing horizontal resolution increases record time. The record times shown are for 128GB RAM at the frame rate shown. Duration will be ½ for 64GB and double for 256GB RAM.

Maximum Frame Rate - FPS; (128GB Record Time - Sec)				
Resolution (H x V)	T3610		T2410	
	Standard Mode	Binned Mode (Mono Output Only)	Standard Mode	Binned Mode (Mono Output Only)
1280 x 800	38,040 (2.2)	-	24,270 (3.5)	-
1280 x 640	47,510 (2.2)	-	30,310 (3.5)	-
1280 x 480	63,250 (2.2)	-	40,360 (3.5)	-
1280 x 384	78,940 (2.2)	-	50,370 (3.5)	-
1280 x 320	94,590 (2.2)	-	60,360 (3.5)	-
1280 x 256	117,970 (2.2)	-	75,280 (3.5)	-
1280 x 192	156,710 (2.2)	-	100,000 (3.5)	-
1280 x 128	233,330 (2.2)	-	148,880 (3.5)	-
1280 x 96	308,820 (2.3)	-	197,050 (3.6)	-
1280 x 64	456,520 (2.3)	-	291,300 (3.6)	-
1280 x 32	525,000 std; 875,000 w/ FAST* (2.3)	-	525,000 std; 558,330 w/ FAST* (3.6)	-
640 x 384	-	156,710 (2.3)	-	100,000 (3.5)
640 x 256	-	233,330 (2.3)	-	148,880 (3.6)
640 x 192	-	308,820 (2.3)	-	197,050 (3.6)
640 x 128	-	456,520 (2.3)	-	291,300 (3.6)
640 x 64	-	525,000 std; 875,000 w/ FAST* (2.3)	-	525,000; 558,330 w/ FAST* (3.6)

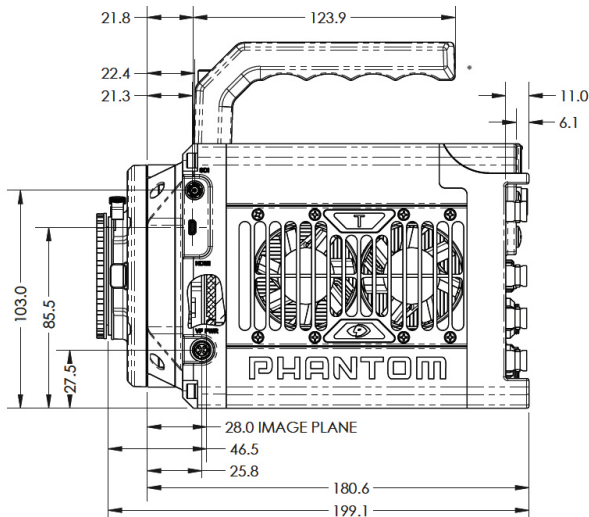
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CONTROL

Software & OS	Phantom PCC (Windows x64); SDK available for C/C++, C#, Python, MatLab and LabView
On-Camera Controls	Standard Feature. Access menu system with encoder, viewed on video monitor. Buttons for trigger, play and save - Color indicates current camera state.
Primary File Format	Phantom Cine RAW (.cine)
Alternative File Formats	Easily convert to formats including .mp4, Apple ProRes .mov, .avi, Tiff, JPG, DNG and many more using PCC. Cine files are directly compatible with many major video editing and motion analysis programs.
Software Features	Continuous Recording for automated workflows, Integrated Data Acquisition (NI-DAQ), support for DIC Calibration with Sync-Snapshot menu, advanced Image Tools including Crop & Resample, Tone Curves, Filters and more.

MECHANICAL

Housing Variants	CineMag and Non-CineMag Compatible Variants
Size	5 x 5 x 8" (12.7 x 12.7 x 20.3 cm) <i>(Not including handle. Handle adds 2" (5 cm) to height.)</i>
Weight	9.4 lbs (4.3 kg)
Lens Mounts	F-Mount standard (aperture support for Nikon G-style lenses). Also available: Canon EF (with electronic focus and iris control), PL, C-mount and universal M42 mount
Mounting Points	Standard 1/4 x 20 and 3/8" mounting points on bottom (2 each). Remove handle and add cheese plate for top mounting. Side mounting bracket available for vertical positioning.
Internal Shutter	Standard, for remote black references
Cooling	Active cooling. Quiet mode disables fans during capture.



POWER

AC Power	100-240 VAC, 280W power supply included
Voltage Range	20-28V
Power Consumption	225W max with CineMag; 170W max typical without CineMag
Battery Options	Works with 20-28V battery sources only, input through dedicated backup power port

ENVIRONMENTAL

Operating Temperature	-10 to +50°C
Storage Temperature	-20 to +70°C
Relative Humidity	≤85% non condensing
Operational Shock	30G, 11msec sawtooth, 3 axes, 2 directions per axis, 10 shocks per direction (60 pulses total)
Operational Vibration	7.5 Grms, 50Hz-2KHz, 3 axes, 15 min/axis, IAW MIL-STD-202H Method 214-I, Test Condition B
Regulatory	Made in the USA CE Emissions - CE Compliant EN 61326-1, Class A CE Immunity - CE Compliant EN 61326-1, Class A FCC - CFR 47, Part 15, Subpart B & ICES-003, Class A Safety - IEC 60950-1 (2012)

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