



PHANTOM[®]
TMX SERIES

DATASHEET



PHANTOM TMX 7510 TMX 6410 TMX 5010

HIGH-SPEED CAMERAS

Up to 76,000 fps @ 1280 x 800 (TMX 7510)
Over 300,000 fps @ 1280 x 192 & 640 x 384
Extremely High Sensitivity

FEATURES & BENEFITS

DESIGNED FOR TRUE HIGH-SPEED APPLICATIONS

- 3 performance models with extremely high frame rates at larger resolutions.
TMX 7510 with up to 1.75 million fps* @ 1280 x 32 and 640 x 64. 1.04 μ s minimum exposure standard, 95 ns with 95 ns FAST* option. TMX 7510 & TMX 6410 can achieve 38 ns with 38 ns FAST* option.
- Real data for real results – actual frame rates without interpolation.
2 x 2 Binned Mode provides double the vertical resolution at high frame rates for added flexibility.
- Extremely high native light sensitivity made possible by the **BSI** (back side illuminated) sensor.

FOCUS ON DATA MANAGEMENT

- Record multiple experiments – up to 511 partitions with 512GB of memory.
- 10Gb Ethernet for the fastest data download directly from the camera's RAM buffer.
- Record video to a **Phantom CineMag 5e**[™] for up to 8TB of nonvolatile memory & fast image transfer.

* Export controlled FAST options.

HADLAND[®]
IMAGING

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FORZA
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VISION RESEARCH

HADLAND IMAGING x PHANTOM
GET CREATIVE
WITH HIGH-SPEED IMAGING SYSTEMS

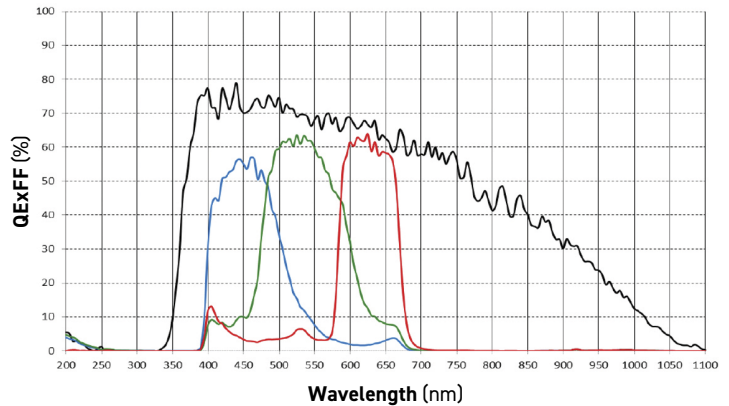
IMAGE & SENSITIVITY

Sensor Type	Forza Silicon CMOS BSI (back side illuminated) with Global Shutter	
Maximum Resolution	1280 x 800	640 x 384 Binned
CAR Increments	256 x 32	128 x 64 Binned
Pixel Size	18 µm	37 µm Binned
Sensor Size	23.7 x 15.4 mm	
Bit Depth	12-bit	
	EMVA 1288 Measurements @ 532 nm	
	Standard Mode	Binned Mode
Quantum Efficiency %	77.6% mono 70.9% color	72% mono
Max. SNR (dB)	39.9	45.2
Absolute Sensitivity Threshold (p)	31.8 mono 38.4 color	98.9
Saturation Capacity (e-)	8,736 mono 9,432 color	33,184
Temporal Dark Noise (e-)	24.18	70.69
Dynamic Range (dB)	51.0	53.4

Measurements recorded at 532 nm with monochrome & color cameras using the EMVA 1288 3.1 standard. Visit www.phantomhighspeed.com/emva for more about EMVA 1288.

SPECTRAL RESPONSE

Quantum Efficiency: Monochrome & Color



CONNECTIVITY & SIGNALS

Ethernet	Gigabit & 10Gb Ethernet
Timecode	IRIG-B modulated & unmodulated
Port Descriptions	Rear Ports VF PWR: HIROSE 4-pin for monitor/viewfinder REMOTE: Fischer 5-pin for RS-232 serial comm. HDSIA/VF: BNC – 3G-SDI video out RANGE DATA: Fischer 8-pin for input & embed frames with acquisition data HDSIB: BNC – 3G-SDI video out 5 READY: BNC – Programmable I/O 6 TC OUT: BNC – Programmable I/O GPS: Fischer 3-pin for Ground Positioning System USB: USB-A port for WiFi dongle ETHERNET: RJ45 port for control/data transfer 3 STROBE: BNC – Programmable I/O 4 FSYNC: BNC – Programmable I/O 1 TRIGGER: BNC – Trigger-In, TTL, switch closure 2 TC IN: BNC – Timecode-In for IRIG-B PRIMARY DC INPUT: Fischer 3-pin for main power BATTERY BACKUP: Fischer 3-pin; backup power CAPTURE: Fischer 12-pin for signal access CineMag Models CINEMAG PORT: on right side of camera for Phantom CineMag 5e 2TB & 8TB recording media
Programmable I/O Signals	Programmable I/O for FSync, Strobe, Ready, Timecode-Out, Event In, Memgate In, Pre-trigger, assign & define signals in PCC
Hardware Trigger	Dedicated BNC
Software Trigger	Trigger Button via Ethernet, Remote port & 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	HIROSE 4-pin for 12V monitors up to 1 Amp



Phantom TMX Series Rear Panel



MEMORY & STORAGE	
RAM Buffer	128GB, 256GB, & 512GB RAM options
Multi-Cine	Up to 511 partitions
Nonvolatile Media	Optional Phantom CineStation 5 , portable external CineMag drive & Phantom CineMag 5e ; 2TB & 8TB SSD capacities; hot-swappable; supports autosave, direct recording & video playback
Media Transfer Rates	2TB Phantom CineMag 5e = 1GP/s 8TB Phantom CineMag 5e = 1.2GP/s

FRAME RATES & EXPOSURE			
	TMX 7510	TMX 6410	TMX 5010
Top FPS @ Max Resolution	76,000 fps	65,940 fps	50,720 fps
Maximum FPS	744,670 fps	736,280 fps	583,330 fps
	FAST* options 1,750,000 fps	FAST* options 1,516,660 fps	FAST* option 1,166,660 fps
Minimum FPS	100 fps		
Minimum Exposure	1.04 µs	1.04 µs	1.10 µs
Minimum Exposure FAST* Option	95 ns with 95 ns FAST* option; 38 ns with 38 ns FAST* option (TMX 7510/TMX 6410)		
PIV Features	Shutter Off Mode with straddle time of 299 ns; supports Burst Mode		
Exposure Features	EDR (Extreme Dynamic Range) & autoexposure		

FRAME RATE CHART

Examples of common resolutions & frame rates. Record times (seconds) are for 256GB RAM at frame rate shown. Duration will be half for 128GB & double for 512GB RAM. Binned mode has monochrome output only.

MAXIMUM FRAME RATES FOR 256GB RECORD TIME IN SECONDS						
Resolution (H x V)	TMX 7510		TMX 6410		TMX 5010	
	Standard	Binned	Standard	Binned	Standard	Binned
1280 x 800	76,000 fps (2.2)		65,940 fps (2.5)		50,720 fps (3.3)	
1280 x 640	94,590 fps (2.2)		81,980 fps (2.5)		63,060 fps (3.3)	
1280 x 480	126,500 fps (2.2)		109,630 fps (2.5)		84,330 fps (3.3)	
1280 x 448	134,610 fps (2.2)		116,660 fps (2.5)		89,740 fps (3.3)	
1280 x 384	156,710 fps (2.2)		135,820 fps (2.5)		104,470 fps (3.3)	
1280 x 320	187,500 fps (2.2)		162,500 fps (2.5)		125,000 fps (3.3)	
1280 x 256	233,330 fps (2.2)		202,220 fps (2.5)		155,550 fps (3.3)	
1280 x 192	308,820 fps (2.2)		267,640 fps (2.5)		205,880 fps (3.3)	
640 x 384		308,820 fps (2.2)		267,640 fps (2.5)		205,880 fps (3.3)
1280 x 160	375,000 fps (2.2)		325,000 fps (2.5)		250,000 fps (3.3)	
640 x 320		375,000 fps (2.2)		325,000 fps (2.5)		250,000 fps (3.3)
1280 x 128	456,520 fps (2.2)		395,650 fps (2.6)		304,340 fps (3.4)	
640 x 256		456,520 fps (2.2)		395,650 fps (2.6)		304,340 fps (3.4)
1280 x 96	617,640 fps (2.2)		535,290 fps (2.6)		411,760 fps (3.3)	
640 x 192		617,640 fps (2.2)		535,290 fps (2.6)		411,760 fps (3.3)
1280 x 64	744,670 fps (2.9)		736,280 fps (2.9)		583,330 fps (3.5)	
640 x 128		744,670 fps (2.9)		736,280 fps (2.9)		583,330 fps (3.5)
FAST* OPTION						
1280 x 64	875,000 fps (2.3)		758,330 fps (2.7)		583,330 fps (3.5)	
640 x 128		875,000 fps (2.3)		758,330 fps (2.7)		583,330 fps (3.5)
1280 x 32	1,750,000 fps (2.3)		1,516,660 fps (2.7)		1,166,660 fps (3.5)	
640 x 64		1,750,000 fps (2.3)		1,516,660 fps (2.7)		1,166,660 fps (3.5)

* Export controlled FAST options.



CONTROL

Software & OS	Phantom Camera Control (PCC) – Windows 64; SDK for C/C++, C#, Python, MatLab & LabView
On-Camera Controls	Standard Feature. Access menu system with encoder, viewed on video monitor. Buttons for trigger, play & save.
Primary File Format	Phantom Cine RAW (.cine)
Alternative File Formats	Easily convert to formats including MP4, Apple ProRes, MOV, AVI, TIFF, JPG, DNG & more using PCC. Cine files compatible with video editing & 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 & more.

MECHANICAL

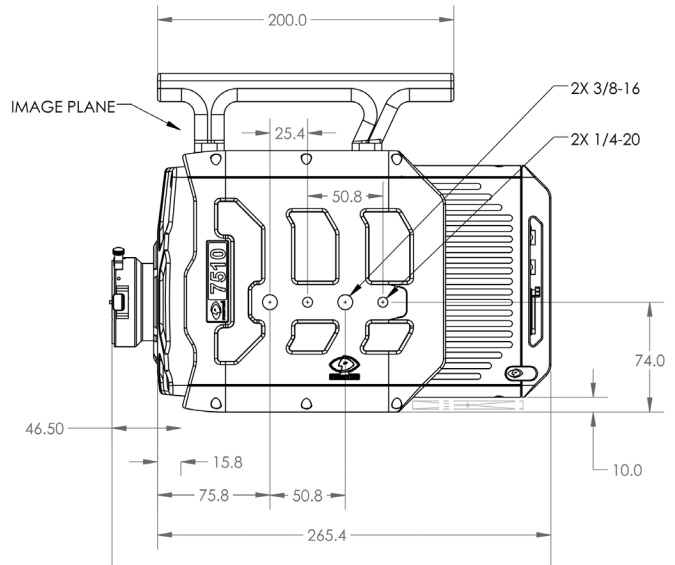
Housing Variants	CineMag & non-CineMag
Dimensions	CineMag: 7 x 7.4 x 11.7 inches (17.8 x 18.6 x 29.7 cm) Non-CineMag: 7 x 7 x 11.7 inches (17.8 x 17.8 x 29.7 cm)
Weight	20 lb (9.1 kg)
Lens Mounts	Nikon F mount (aperture support for G style lenses) Canon EF mount (with electronic focus & iris control) C mount M42 mount
Mounting Points	1/4-20: 8 total – 2 bottom, 2 side & 4 on handle 3/8-16: 8 total – 2 bottom, 2 side & 4 on handle
Internal Shutter	Standard, for remote black references
Cooling	Active cooling; Quiet Mode disables fans during video capture

POWER

AC Power	100V to 240V AC, 400W power supply included
Voltage Range	20V to 28V DC Primary & Secondary
Power Consumption	325W typical; 395W max with accessories (Max Frame Rate, CineMag, View Finder & Remote)

ENVIRONMENTAL

Operating Temperature	14° to 122° F (-10° to 50° C)
Storage Temperature	-4° to 158° F (-20° to 70° C)
Relative Humidity	≤85% noncondensing
Operational Shock	30G, 11 msec sawtooth, ±10 pulses all axes
Operational Vibration	MIL-STD-202H Method 214-i; Test Condition A. Rated 5.3 gRMS; 15 min/axis
Regulatory	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



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Specifications subject to change.

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