PHANTOM®
KT-SERIES

AMETEK®
VISION RESEARCH

DATASHEET



PHANTOM KT1640 KT1240 KT840

HIGH-SPEED CAMERAS

2560 x 1664 at up to 3,750 fps (KT1640),
2,900 fps (KT1240), 1,850fps (KT840)
BSI sensor designed by Forza Silicon

PHANTOM HIGH-SPEED / FORZA SILICON AMETEK

FEATURES & BENEFITS

HIGH-SPEED, HIGH-RESOLUTION PRECISION

- 2560 x 1664 Back-side Illuminated (BSI) sensor ensures superior image performance due to increased pixel response
- Programmable I/O for advanced signals control, synchronization and precision triggering
- Sustained image throughput at up to 16 Gpx/s ensures maximum pixel resolution at any setting
- Reduce motion blur with exposure times down to 450 ns with Fast Option, independent of frame rate

SMALL SIZE, BIG IMPACT

- Increased throughput capacity in a compact platform (12.5 X 12.5 X 16.3 cm) benefits stereo imaging applications by reducing overall system size and complexity
- Lightweight (3.2 kg) with mounting points on 4 sides and a removable handle makes installation simple

WORKFLOW FLEXIBILITY

- Use 10Gb Ethernet for 7X faster data download directly from the camera's RAM buffer, up to 128 GB
- CF Express cards, SDI/HDMI video out and on-camera controls enable a secure and efficient untethered workflow

IMAGE & SENSITIVITY

Sensor Type	Proprietary BSI CMOS designed by Forza Silicon. Global Shutter.	
Maximum Resolution	2560 x 1664	Binned 1280 x 832
CAR Increments	512 x 32	Binned 256 x 64
Pixel Size (µm)	9.27	Binned 18.54
Sensor Size (mm)	23.7 x 15.4	
Bit Depth (ADCs)	12 bit	
	EMVA 1288 Measurements (at 533 nm) Standard Mode	Binned Mode
Quantum Efficiency (%)	88.7 mono 73.5 color	84.2 mono
Max. SNR (dB)	39.8	45.2
Absolute Sensitivity Threshold (e-)	24.5 mono 22.4 color	59.8
Saturation Capacity (e-)	9588 mono 9050 color	33,225
Temporal Dark Noise (e-)	24.0	59.2
Dynamic Range (dB)	51.9	54.9

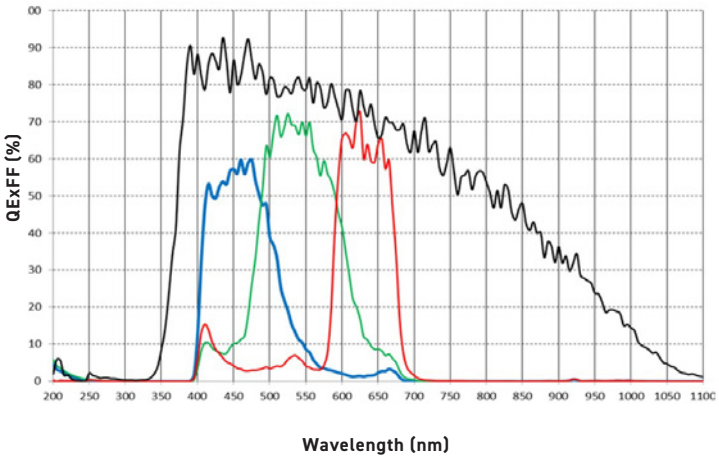
- *Reported measurements were taken at 533 nm with both monochrome and color cameras, using the EMVA 1288 4.0 standard*
- *Visit: www.phantomhighspeed.com/emva for more information on EMVA 1288*



Back Panel

SPECTRAL RESPONSE

Quantum Efficiency Monochrome and Color



CONNECTIVITY & SIGNALS

Ethernet	Gigabit and 10Gb Ethernet (standard)
Timecode	IRIG-B Modulated and Un-modulated
Rear Port Descriptions	Ethernet - Fischer 8-pin Power 20-28V - Fischer 6-pin RDIO Range data + 2 Programmable I/O - Fischer 8-pin 3 Dedicated BNCs for Trigger, Timecode-in and SDI Video 1 Dedicated BNC for Programmable I/O
Programmable I/O Signals	1 port on body, 2 ports through RDIO cable (sold separately). Signals include Strobe, Fsync, Ready, Timecode Out, Multi-Strobe, Auto Trigger (+mode 2), SW Trigger, Recording, Event In, Memory Gate In, Pretrigger In, Auxtrigger In, Range Data Corrp. Assign and define signals in PCC
Hardware Trigger	TTL (falling or rising edge), or High-Voltage (falling or rising edge). Dedicated BNC
Software Trigger	Trigger button; via Ethernet; via Image-based auto trigger (IBAT), via SDK command or telnet
Synchronization	External Sync (5V TTL) via Fsync or IRIG-B Timecode
Recording Features	External frame rate control, burst mode, continuous recording, multi-partitions, frame straddling
Video Output	3G-SDI via BNC (rear), Din and HDMI (front)
Accessory Power	4-pin Hirose (front) for 12V monitors up to 1 Amp

MEMORY & STORAGE

RAM Buffer	16GB, 32GB, 64GB, 128GB (KT840); 32GB, 64GB, 128GB (KT1240 & 1640)		
Capture Duration**	**KT1640:** 32GB 1.7s; 64GB 3.3s; 128GB 6.7s	**KT1240:** 32GB 2s; 64GB 4s; 128GB 8s	**KT840:** 16GB 1.7s; 32GB 3.3s; 64GB 6.7s; 128GB 13.3s
Multi-Cine	Up-to 63 Partitions		
Non-Volatile Media	CF Express type B Approved cards at launch: Exascend 1TB Esssential Series and Pro; Wise Advanced 1TB		
Media Transfer Rates	275 MB/s Full 32GB RAM save time = 2 minutes		

FRAME RATES & EXPOSURE

Top FPS at Max Resolution	**KT1640:** 3,750	**KT1240:** 2,900	**KT840:** 1,850 fps
Maximum FPS	**KT1640:** 421,000 **KT1640-E225:** 225,000 **KT1240:** 326,270 **KT1240-E225:** 225,000 **KT840:** 222,220		
Minimum FPS	100		
Frame Timer Clock	80 MHz		
Minimum Exposure	1.06 µs standard; 450 ns with FAST Option* Pulsed lighting techniques can reduce effective exposure to 200 ns or less		
PIV Features	Shutter-off mode with a straddle time of 250 ns (effective frame pair frequency of 4 MHz for frame straddling PIV)		
Exposure Features	Burst Mode; EDR (Extreme Dynamic Range); Auto-Exposure, Overexposure indication over video and in PCC		

FRAME RATE CHART

Table provides examples of common resolutions and the maximum frame rate.

MAXIMUM FRAME RATE - FPS

	KT1640		KT1240		KT840 16-32-64GB		KT840-128GB	
Resolution (H x V)	**Standard**	**Binned**	**Standard**	**Binned**	**Standard**	**Binned**	**Standard**	**Binned**
2560 x 1664	3,750	-	2,900	-	1,850	-	1,880	-
2560 x 1600	3,910	-	3,030	-	1,930	-	1,950	-
2560 x 1440	4,352	-	3,370	-	2,140	-	2,170	-
2560 x 256	24,390	-	18,900	-	12,040	-	12,190	-
2560 x 64	95,000	-	73,620	-	47,610	-	47,610	-
2048 x 1152	6,600	-	5,110	-	3,300	-	3,300	-
1536 x 1536	7,040	-	5,450	-	3,300	-	3,300	-
1024 x 1024	14,800	-	11,470	-	7,420	-	7,400	-
1280 x 832	-	15,037	-	11,650	-	7,420	-	7,510
1280 x 768	-	16,260	-	12,600	-	8,030	-	8,130
1024 x 832	-	18,223	-	14,120	-	9,130	-	9,110
1024 x 640	23,660	-	18,330	-	11,860	-	11,830	-
768 x 768	-	26,315	-	20,390	-	13,170	-	13,150
1024 x 512	29,500	-	22,860	-	14,810	-	14,760	-
768 x 640	-	31,496	-	24,400	-	15,810	-	15,740
1024 x 256	58,800	-	45,570	-	29,520	-	29,410	-
512 x 512	-	58,000	-	44,950	-	29,520	-	29,410
1024 x 128	115,900	-	89,820	-	58,820	-	57,970	-
512 x 128	-	222,200	-	172,200	-	115,940	-	111,110
1024 x 32	421,000***	-	326,270***	-	222,220	-	210,520	-
512 x 64	-	421,000*	-	326,270***	-	222,220	-	210,520

** Certain Phantom cameras are held to export licensing standards. Details available at: www.phantomhighspeed.com/export*
*** Record times shown are with the top FPS at max resolution*
****KT1640-E225 and KT1240-E225 maximum frame rate is 225,000 fps*

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, automatic file naming, advanced Image Tools including Crop & Resample, Tone Curves, Filters and more.

MECHANICAL

Housing Variants	N/A
Size	4.9 x 4.9 x 6.4 in (125 x 125 x 163 mm); handle adds 1.9 in (48 mm)
Weight	7 lbs (3.2 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 and M42. Mounts are easily interchangeable and can be removed to integrate with different optics.
Mounting Points	Standard 1/4x20 and 3/8" mounting points on bottom, with 1/4x20 and M5 mounting points on each side.
Internal Shutter	Standard, for remote black references
Cooling	Active cooling. Quiet mode disables fans during capture.

POWER

AC Power	100-240 VAC, 160W power supply included
Voltage Range	20-28V
Power Consumption	90W typical
Battery Options	Works with 24V battery sources only, input through primary power port

ENVIRONMENTAL

Operating Temperature	-10 to +50°C
Storage Temperature	-20 to +70°C
Operating Humidity	≤85% RH, 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	**Emissions** – CE Compliant EN 61326-1, Class A **Immunity** – CE Compliant EN 61326-1, Class A **FCC** – CFR 47, Part 15, Subpart B & ICES-0003, Class A **Safety** – IEC 62368-1

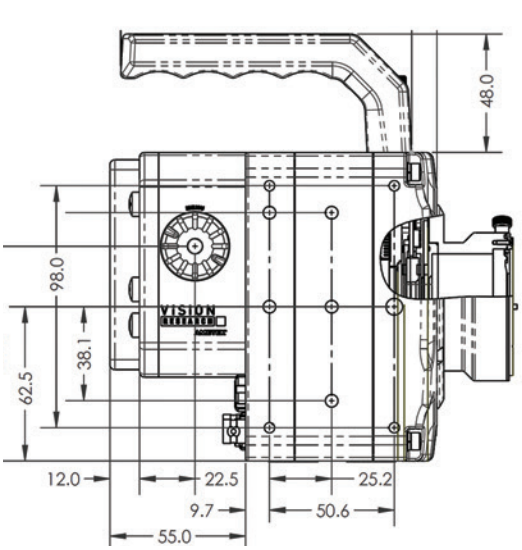
PHANTOM SERVICES

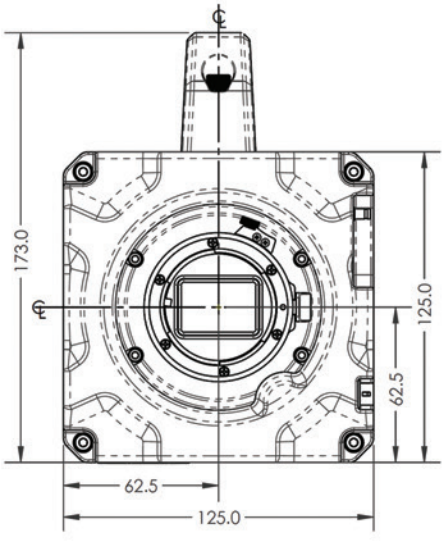
Phantom cameras are supported by an array of services engineered for users to get the most out of their Phantom camera, covering every stage from setup to analysis.

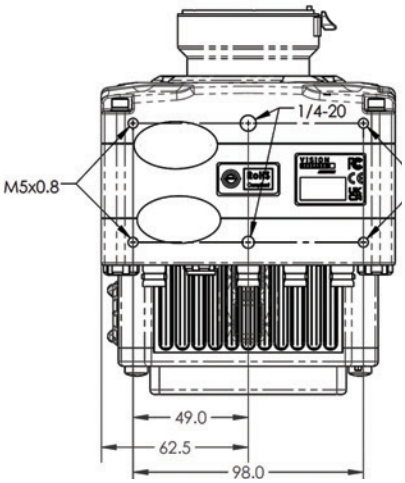
Phantom Care includes services to maintain optimal camera performance including flexible support plans, camera certification, rentals and upgrades

Phantom Analysis includes onsite application-specific testing, expert data analysis and custom Python module development

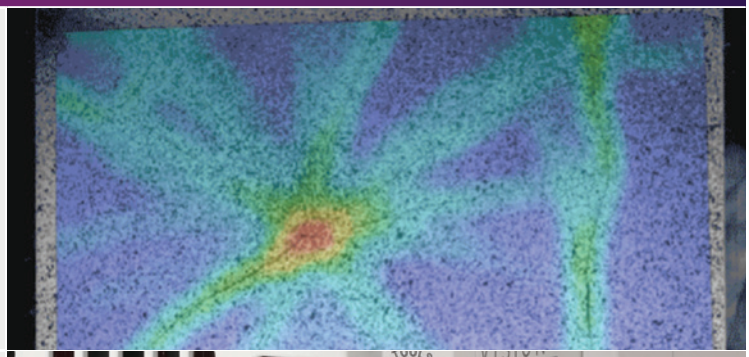
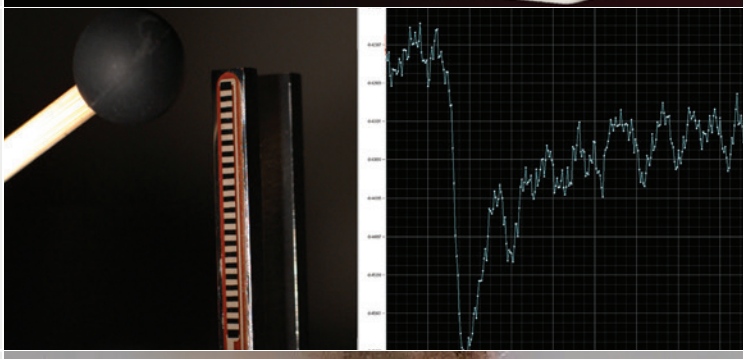
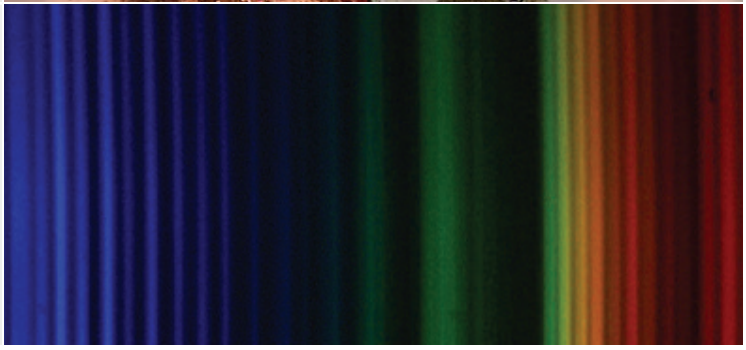
Phantom Academy Training courses for foundational and advanced applications are available for all experience levels



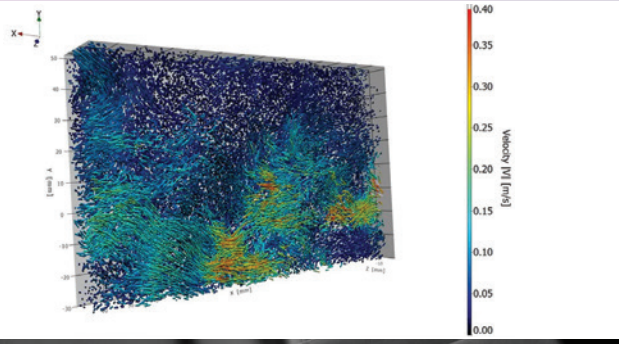
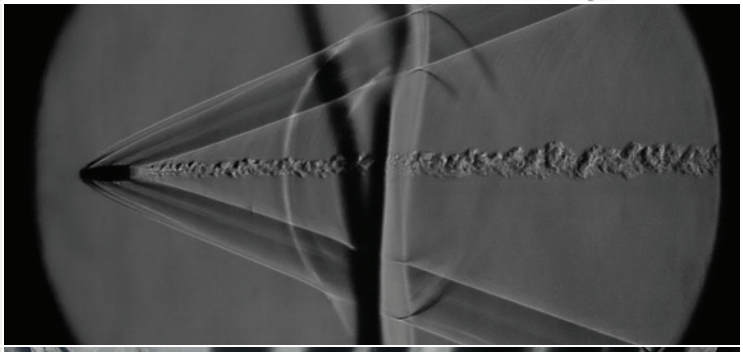
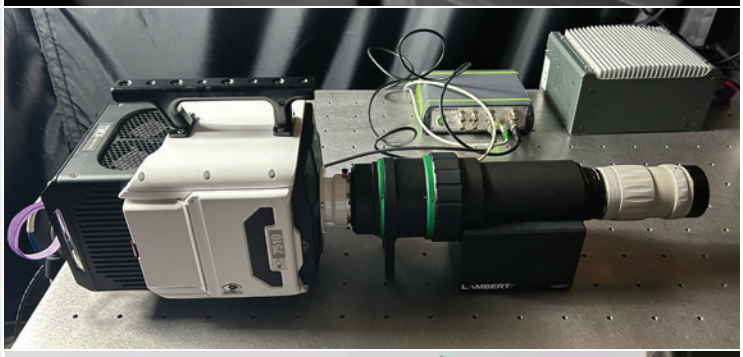
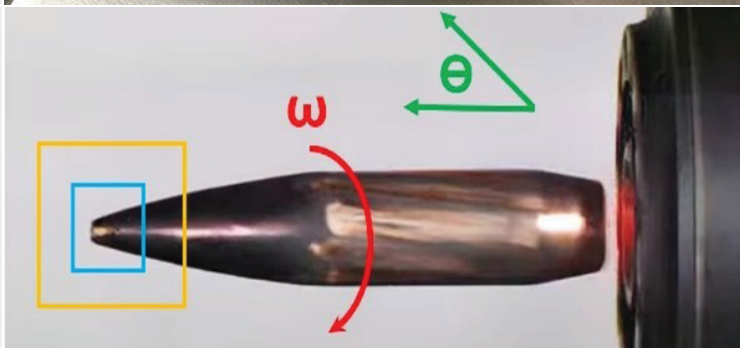




APPLICATION-SPECIFIC FEATURES

Digital Image Correlation	The combination of a **4.2 Mpx** High resolution image sensor and low sensor noise of **24.5 e-** permits the capability of measuring ultra-low strain floors, extraction of low-amplitude vibrational modes and displacements. The camera system natively exports .CINE and .tiff stacks for importing into any DIC software, commercial and open-source.	
OEM Integrability	Camera is designed to be completely integrated into larger systems, from both software (via **SDK**) and hardware. Can be mount ready for integrating into microscopes, intensifiers, spectrometers, X-ray systems, flight followers and/or schlieren systems. Hardware signals are available for complete external camera control.	
Data Fusion	Precision TTL inputs and outputs enable synchronization with external data acquisition systems. Natively compatible with select list of National Instruments DAQ units. Range Data feeds the camera digital data during the recording, and gets included with Cine raw files. A graphic interface is included in Phantom camera control software for plotting DAQ data and tracked points. Utilize the built-in report features to visualize external data and images together.	
Timing Accuracy	With a base clock of **80 Mhz**, the timing granularity of the clock is down to **12.5 ns,** with sync and timing accuracy down to 1 clock cycle. Timing validation data for fps, exposure and sync via high-speed LED-clock available by Vision Research team.	
Radiometry	Linearity of **1.12%** and PRNU of **0.4** (EMVA 1288) of for radiometric measurements use in spectroscopy, pyrometry and light profiling.	

APPLICATION-SPECIFIC FEATURES

Particle Image Velocimetry	Designed for ease of integration into pulse laser systems, KT-series cameras are capable of direct integration into complex PIV-setups (both time-resolved and frame straddling). With a straddle time of **250 ns**, resolution of frame pairs can be down to **4 MHz**. Natively exports .Cine raw files and .tiff stacks for importing into any PIV software, commercial and open source. Avoid the need for complicated external timing boxes with built-in programmable IO with delay, inversion, filtering and pulse width control.	
Ballistics & Range	Dynamic range of **51.9 dB** enables the characterization of extremely luminous events, coupled with the EDR feature to further extend dynamic range when needed. High fidelity triggering and synchronization are ideal for easily and accurately capturing weapon body mechanics, muzzle shots, projectile flight and impacts. **IRIG-B** is used to share a common time code between connected high-speed data-collection systems.	
Low-light Tests	With a read noise of **24 e-** and absolute sensitivity threshold (AST) of **24.5 e-**, this sensor can pick up ultra-small signals generated by fluorescence experiments, screen inspections, scintillators, bioluminescent events or any challenging light-starved application.	
Object Tracking & Measurement	A **4.2 MPx** high resolution image sensor and low sensor noise of **24 e-** permits the accurate measurement of flight tracking.	

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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