PHASE**ONE**

INDUSTRIAL

Phase One Aerial Cameras
Fully Integrated
Aerial Photography Solutions

ALAVA INGENIEROS
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Phase One
Aerial Camera Systems

The Phase One aerial cameras are integrated medium format camera systems that were designed from the ground up exclusively for aerial photography.

Developed with leading experts and engineers in the field, Phase One aerial cameras are built to meet the exacting needs of aerial photography and streamline the entire capture and processing workflow.

The Phase One aerial cameras are easily integrated into existing systems, both onboard the aircraft and in post production. The medium format solution offers exceptional accuracy, image quality and features that rival large-format cameras at a fraction of the price.

With a product line of 15 cameras, nine lenses, controller complete with software, compatibility with leading flight management systems and GPS receivers, Phase One has a solution for everything from small UAVs to large manned aircraft.

Pinpoint Accuracy

A true metric calibrated camera depends on sophisticated engineering and structural integrity of the camera. Each Phase One camera design undergoes rigorous testing for vibrations and temperature ranges. Every camera is subjected to tests for functionality and performance as it goes through the assembly process.

All cameras employ mechanisms to solidly lock their lens to the camera body and secure lenses at infinity focus if necessary. Despite the inflight vibrations and sudden movements during takeoff or landing that the camera might be exposed to, the consistency and the rigidity of the camera and lens provide metric data with pinpoint accuracy for mapping and other applications.

o Proven accuracy

o Rugged and built to last

o Optional factory calibration

o Constructed of aircraft grade materials

o Workhorse built with fewer moving parts to reduce unnecessary wear

o Self-locking LEMO connectors

o Mirror-free system

o Camera is bolted to the pod with four M4 screws

Phase One iXU-R/iXU

The Phase One iXU-R/iXU aerial cameras are the world's smallest and lightest integrated digital medium format aerial cameras. All iXU-R/iXU cameras are equipped with internal electronically controlled central leaf shutters to provide the image quality expected from a dedicated aerial photography camera.

100 Megapixel sensors

Both the iXU-R 1000 and iXU 1000 are equipped with 100 MP CMOS sensors, offering large format coverage in a medium format body. The cameras deliver 11,608 pixels cross-track coverage, which is 12 percent greater than previously available medium format aerial camera systems.

Flying with an iXU-R 1000 or iXU 1000 enables users more coverage during a flight, while maintaining the same ground sample distance (GSD), or a lower GSD, while flying at the same height.

Widening Operational Hours

The CMOS technology of the iXU-R 1000, iXU 1000 and iXU 150 enables you to move from ISO 100 all the way up to 6400 providing quality images all across the ISO range. As weather conditions deteriorate or on days when you previously were unable to capture, the CMOS-based cameras provide the high sensitivities that can make a difference.
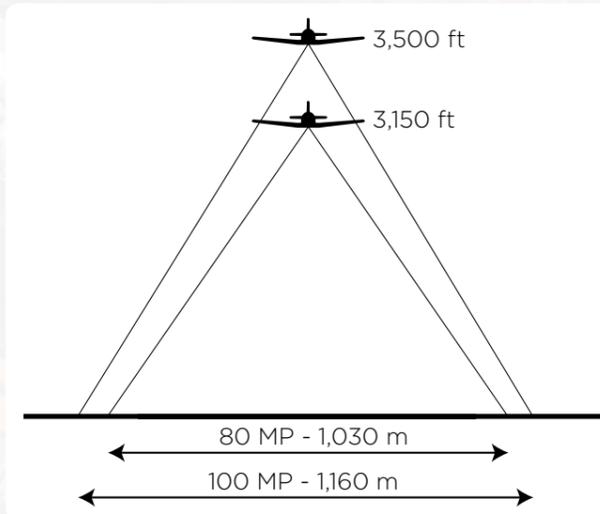
Phase One iXU-R series

The Phase One iXU-R cameras offer a small-bodied medium format camera with high performance Rodenstock optics. The small form factor make it an ideal camera for use as a standalone camera for photogrammetric work or as part of an array of multiple cameras, either to cover a larger swath or as part of an oblique camera system.

The iXU-R cameras are built with one of three Rodenstock lenses — 40 mm, 50 mm and 70 mm. The interchangeable lenses are individually inspected and factory calibrated for infinity focus.

Phase One iXU series

The Phase One iXU cameras are so small that their body is barely wider than their lens barrels. With camera weights starting at 1.3 kg with an 80 mm lens, they are well suited for users requiring a small, light camera with a broad range of focal lengths. The iXU cameras use removable Schneider-Kreuznach fast sync lenses, which are available in focal lengths from 28 mm to 240 mm.

UAV ready

Their light weight and small footprint make the iXU cameras perfectly suited for small aircraft and UAV integration. Using iX Link's RS-232 connectivity and internal CF storage, iXU cameras are able to capture thousands of images on a single mission. The iXU-R 1000, iXU 1000 and iXU 150, equipped with full HDMI output, can be guided to photograph specific objects seen by the operator on the ground.

3,500 ft
3,150 ft

80 MP - 1,030 m
100 MP - 1,160 m

Phase One iXA-R/iXA

Phase One aerial cameras are designed as the central hub in an open aerial data acquisition system, enabling users to choose "best-of-breed" components to complement the Phase One systems. The iXA-R and iXA cameras offer flexibility for users looking for a standalone camera or an array of multiple cameras.

Phase One iXA-R

The Phase One iXA-R aerial cameras iclude features such as; focal plane and central leaf shutters, optional Forward Motion Compensation, scalability to form multi-camera arrays, as well as easy integration with popular flight management systems and GPS/IMU receivers.

The cameras are built with one of three Rodenstock lenses — 40 mm, 50 mm and 70 mm. The interchangeable lenses are individually inspected and factory calibrated for infinity focus.

The three focal lengths cover most uses and are suitable for creating DTMs and DSMs for mapping as well as Orthophotos. The 50 mm lens, with its opening angle of 56.4°, is especially suited for capturing images alongside a LiDAR.

Phase One iXA

With a choice of 80 mp, 60 mp and 60 mp achromatic models, the iXA aerial camera is designed to easily incorporate into existing or new systems, making it the perfect solution for integrators or end users looking for a rugged, high-quality industrial-grade aerial camera system. The medium format solution offers exceptional image quality and features that rival large format cameras at a fraction of the price.

The Phase One iXA aerial cameras use removable Schneider-Kreuznach fast sync lenses, which are available in focal lengths from 28 mm to 240 mm.
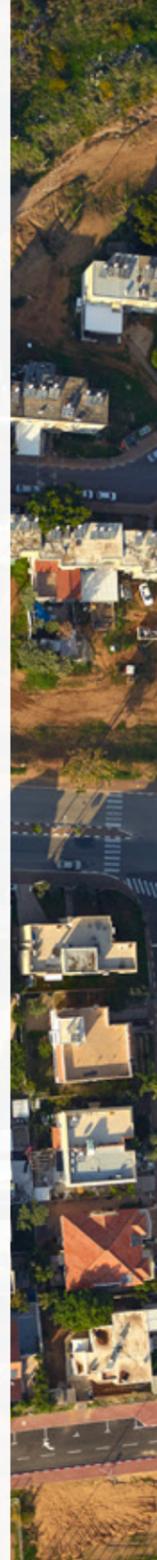
Forward Motion Compensation

The Phase One FMC solution employs Time Delayed Integration (TDI) to compensate for image blurring occurring as a result of slower shutter speeds, faster flight speeds or higher GSDs. This enables more flexibility when determining flight schedules and enhanced image quality under low light conditions.

The FMC option enables increased profitability through the ability to fly more days and under less optimal light conditions, compensating for issues with blurring and smearing.

The Phase One FMC feature is sold either as an option on a new system or as an upgrade to an existing camera. It is available on our 80 MP and 60 MP iXU-R, iXU, iXA-R and iXA cameras.
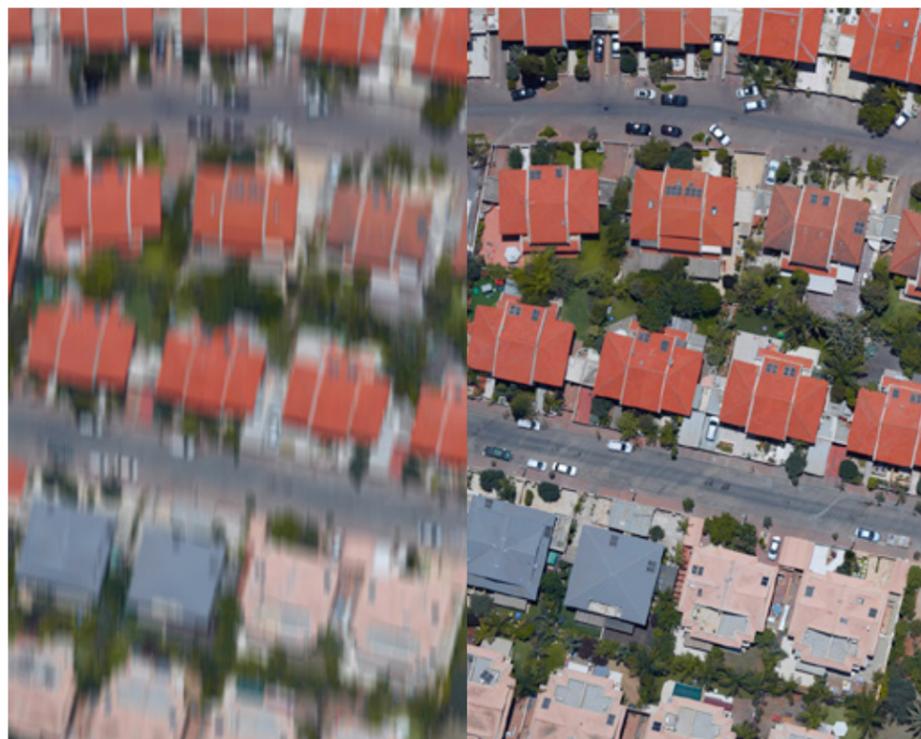
| Without FMC | With FMC |

Applications

Phase One cameras offer reliability and versatility for users looking for a full-featured medium format aerial camera. Easily integrated into existing or new setups, the camera offers maximum connectivity with systems for:

o Mapping

o Oil and gas pipelines monitoring

o Critical infrastructure inspection

o Power line monitoring

o Coastal surveillance

o Wind turbine blade inspection

o Disaster site monitoring and mapping

o Iceberg monitoring

o Forestry, vegetation identification, agriculture crop monitoring

o Hydrometric mapping

o Asset management

o 3D modeling

o Entertainment and game market

o Crowd monitoring

Highest resolution oblique systems

With a small form factor and medium format resolution, Phase One cameras offer users a solution for building arrays that can easily be mounted on a gyro stabilization mount and fit in the existing belly holes of many aircraft.

The increasingly popular high-resolution 3D city models require medium format cameras that can be integrated into small oblique systems that fit inside a gyro mount. Owners of ultralight planes or gyro copters are now able to build oblique systems and insert them into smaller belly holes with less interaction with the hull of the aircraft, which means an easier path to obtaining a supplemental type certificate (STC).

Nadir imaging

Whether you are operating a single camera or multiple cameras covering a large swath, Phase One aerial cameras are built to be flexible and the central hub in any aerial data acquisition system.

Near-Infrared

The Phase One iXU-R 1000, iXU 1000 and iXU 150 are also available with optical glass over the sensors for near infrared (NIR) applications. The cameras are suited for a variety of agricultural or forestry applications including detecting vegetation, analyzing illicit drug growth, determining harvesting periods, analyzing crop damage caused by insects, fungus or insufficient water or nutrients in the soil.

Phase One also offers achromatic versions of the iXU-R, iXA-R, iXA and iXU cameras. The 60 MP sensor is optimized for aerial photogrammetric applications and offers high sensitivity to visible light, including UV and IR ranges.

Both NIR and achromatic cameras can be used in single camera configurations or in dual-camera arrays in conjunction with an RGB camera. The images can be combined to create co-registered four-band (RGBN) imagery.

Software Solutions

Phase One offers a choice of software solutions to enable the integration of the camera with your existing workflow.

iX Capture

iX Capture is an aerial capture, control and RAW conversion application that was created exclusively for shooting with Phase One aerial camera systems. iX Capture was designed with an intuitive interface that displays key information such as exposure settings, histogram, GPS data and frame count. The image display can be paused at any time to enable operators to inspect images by zooming to 100 percent or to set white balance. iX Capture enables operators to track each capture and utilize real-time feedback to be confident that each image has been captured correctly.

Used together with Phase One aerial cameras, this professional capture and RAW converter software enables full control over one or multiple cameras, so that an operator can easily monitor and control every aspect of aerial data acquisition.

iX SDK

The iX SDK provides the tools for you to build your own custom applications. in Windows or Linux platforms. Using the SDK, you can control the camera as with iX Capture. With the iX SDK you have a high degree of control of which parameters to apply while capturing or processing images.

Image processing

Phase One also offers a choice of software solutions for image processing:

Capture One software

Capture One is the raw converter for ultimate image quality. It contains all the essential tools, in a single package, to enable you to organize, edit, process and convert images to industry standard formats, such as TIF and JPG.

Capture One Processing Engine

Capture One Processing Engine (COPE) provides components for you to automate image processing with your settings. Batch process files with specific parameters including lens correction and save images in industry standard formats. Using COPE, post-processing can happen in parallel to the capture process, saving valuable time on the ground.

iX Controller

Phase One offers a choice of hardware and software solutions to enable the integration of the camera with your existing workflow.

Ultimate speed and control

Phase One introduced the iX Controller as the perfect companion for the iX Capture application or SDK-based application.

Designed to provide the ultimate in speed, and with the ability to control up to six Phase One aerial cameras, the iX Controller is a rugged, fanless PC, based on the 4th Generation Intel® Core™ i7 Processor.

With a small footprint and easily integrated into any aircraft, the Phase One iX Controller acts as a central hub of your aerial camera system controlling multiple cameras

Multiple display configuration

The iX Controller can be configured to connect to a display via an HDMI or display cable. Use a touch display to control the cameras with a touch of a button

Solid state drives

The iX Controller employs two removable SSD drives, which have especially high write speeds to ensure you capture and record every image quickly and reliably. When the mission is over, the compact and light SSD drives are easily removed from the iX Controller and sent for processing.

Multiple Camera Configuration

Phase One aerial cameras are truly scalable systems, allowing you to adapt to different needs and scale the system to match diverse requirements. Whether the need is a single camera for small area mapping, or a two-, four-, five- or more camera configuration for large area mapping, Phase One cameras are the perfect choice to build your solution.

Use a Phase One camera by itself or in a multiple camera configuration to capture synchronized images and eliminate post production sync issues. The cameras are daisy-chained together to reduce unnecessary cabling and simplify connectivity with the FMS, GPS and iX Controller.
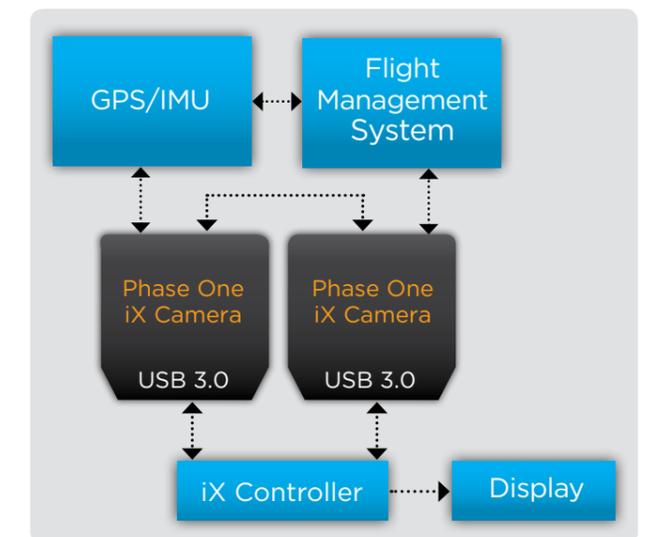
Rodenstock Lenses

Phase One iXU-R and iXA-R cameras are equipped with Rodenstock lenses. Each lens/shutter combination is adapted for aerial photography and offers low distortion, high MTF and excellent contrast. The opening angles shown below are for the iXU-R 1000 cameras.

Lenses	Weight	Opening angle (short side)	Opening angle (long side)
Rodenstock 40 mm f/4.0	730 g	53.2°	67.4°
Rodenstock 50 mm f/4.0	800 g	43.7°	56.2°
Rodenstock 70 mm f/5.6	580 g	31.9°	41.8°

Schneider-Kreuznach Fast Sync Lenses

Phase One's range of Schneider-Kreuznach leaf shutter lenses are compatible with both the iXA and iXU camera systems. The opening angles shown below are for the iXU 1000 cameras.

Lenses	Dimensions	Weight	Opening angle (short side)	Opening angle (long side)
Schneider-Kreuznach fast sync 28 mm f/4.5 Aspherical	90 x 136 mm/ 3.5 x 5.5 in	1046 g/2.31 lb	71.2°	87.3°
Schneider-Kreuznach fast sync 55 mm f/2.8	77.6 x 86.5 mm/ 3 x 3.4 in	628 g/1.38 lb	40.0°	51.8°
Schneider-Kreuznach fast sync 80 mm f/2.8	64.4 x 86.5 mm/ 2.5 x 3.4 in	482 g/1.06 lb	28.1°	36.9°
Schneider-Kreuznach fast sync 110 mm f/2.8	83.3 x 86.5 mm/ 3.3 x 3.4 in	633 g/1.40 lb	20.6°	27.3°
Schneider-Kreuznach fast sync 150 mm f/3.5	87.1 x 86.5 mm/ 3.4 x 3.4 in	651 g/1.44 lb	15.2°	20.2°
Schneider-Kreuznach fast sync 240 mm f/4.5	173.2 x 104.2 mm / 6.8 x 4.1 in	1600 g/3.52 lb	9.5°	12.7°

Technical Specifications
iXU-R/iXU

	iXU-R 1000 / iXU 1000	iXU-R 180 / iXU 180	iXU-R 160 / iXU 160	iXU-R 160 Achromatic / iXU 160 Achromatic	iXU 150
Resolution	100 MP 11608 x 8708	80 MP 10328 x 7760	60.5 MP 8984 x 6732	60 MP 8964 x 6716	50 MP 8280 x 6208
Dynamic range	>84 db	>72 db			>84 db
Aspect ratio	4:3				
Pixel size	4.6 micron	5.2 micron	6.0 micron		5.3 micron
CCD size effective	53.4 x 40.0 mm	53.7 x 40.4 mm	53.9 x 40.4 mm	53.8 x 40.3 mm	43.8 x 32.9 mm
Lens factor	1.0				1.3
Light sensitivity (ISO)	50-6400	35-800	50-800	200-3200	100-6400
Camera type	Medium format camera for aerial photography				
Lens mount	- Phase One R dedicated mount — for iXU-R cameras - Phase One SK dedicated mount — for iXU cameras				
Shutter speed	Leaf shutter: up to 1/1600 second*				
Shutter control	1/3 f-stop increments				
Interfaces	- USB 3.0 - Secured power input (LEMO) - Camera trigger - Mid-exposure pulse - Camera status - iX Link				
Live View/HDMI	iXU 1000 - 1920 x 1080 25p/30p - 1280 x 720 50p/60p				- 1920 x 1080 25p/30p - 1280 x 720 50p/60p
GPS/IMU support	Applanix, NovAtel, IGI, NMEA Devices				
Forward Motion Compensation	N/A	TDI controlled		N/A	
Data storage	- 1 TB SSD storage (optional iX Controller) - CompactFlash card Type I/II including UDMA 6 and 7				
Syncronization speed in multiple camera configuration	100 microseconds with factory calibrated (FS) lenses				

Capture rate — full resolution frame	iXU-R	iXU	iXU-R	iXU	iXU-R	iXU	iXU-R	iXU	iXU
	0.85 s	0.95 s	1.25 sec	1.6 sec	1.1 sec	1.45 sec	1.1 sec	1.45 sec	0.85 sec

RAW File compression	IIQ large: 100 MB IIQ small: 65 MB	IIQ large: 80 MB IIQ small: 54 MB	IIQ large: 60 MB IIQ small: 40 MB		IIQ large: 50 MB IIQ small: 33 MB

	iXU-R 1000 / iXU 1000	iXU-R 180 / iXU 180	iXU-R 160 / iXU 160	iXU-R 160 Achromatic / iXU 160 Achromatic	iXU 150
Lens + technology optimizes	- Color cast - Light falloff - Chromatic aberration - Fringing - Sharpness falloff - Lens distortion				
Output format	Phase One Raw, TIF and JPG				
Post processing	- iX Capture - Capture One Pro - Capture One Processing Engine				
IR cut-off filter	Camera system available either with or without IR filter				
Connection to pod	Four M4 bolts				
Tripod sockets	N/A				
Power input	12 – 30 V DC				
Maximum power consumption	10 W	12 W			10 W
Dimensions iXU (excluding lens)**	97.4 x 93 x 110 mm (w x h x l)				
Dimensions iXU-R (including lens 40)**	97.4 x 93 x 170.5 mm (w x h x l)				
Dimensions iXU-R (including lens 50)**	97.4 x 93 x 177 mm (w x h x l)				
Dimensions iXU-R (including lens 70)**	97.4 x 93 x 175.3 mm (w x h x l)				
Weight iXU (excluding lens)	.930 kg/2.05 lb — for iXU-R				.750 kg/1.7 lb
Weight iXU (with 80 mm lens)	1.430 kg/3.15 lb				1.25 kg/2.8 lb
Weight iXU-R	iXU-R 40 1.600 kg/3.5 lb iXU-R 50 1.700 kg/3.7 lb iXU-R 70 1.450 kg/3.2 lb				
Approvals	FCC (Class A), CE, RoHS				
Operating Conditions					
Temperature	-10° to 40°C (14° to 104°F)				
Humidity	15 to 80% (non-condensing)				

* 240 mm leaf shutter speed is 1/1000s.

** 2D and 3D drawings for integration of cameras are available from http://industrial.phaseone.com/downloads

Technical Specifications
iXA-R/iXA

	iXA-R 180 iXA 180	iXA-R 160 iXA 160	iXA-R 160 Achromatic iXA 160 Achromatic
Resolution	**80 MP** 10328 x 7760	**60.5 MP** 8984 x 6732	**60 MP** 8964 x 6716
Dynamic range	>72 db		
Aspect ratio	4:3		
Pixel size	5.2 micron	6.0 micron	
CCD size effective	53.7 x 40.4 mm	53.9 x 40.4 mm	53.8 x 40.3 mm
Lens factor	1.0		
Light sensitivity (ISO)	35-800	50-800	200-3200
Camera type	Medium format camera for aerial photography		
Lens mount	- Phase One R dedicated mount — for iXA-R cameras - Phase One SK dedicated mount — for iXA cameras		
Shutter speed	- Focal plane: up to 1/4000 second - Leaf shutter: up to 1/1600 second*		
Shutter control	1/3 f-stop increments		
Interfaces	- USB 3.0 - Secured power input (LEMO) - Camera trigger - Mid-exposure pulse - Camera status		
GPS/IMU support	Applanix, NovAtel, IGI, NMEA Devices		
Forward Motion Compensation	TDI controlled		
Data storage	- 1 TB SSD storage (optional iX Controller) - CompactFlash card Type I/II including UDMA 6 and 7		
Syncronization speed in multiple camera configuration	100 microseconds with factory calibrated (FS) lenses		
Capture rate — full resolution frame	1.5 sec	1.3 sec	1.3 sec
RAW File compression	IIQ large: 80 MB IIQ small: 54 MB	IIQ large: 60 MB IIQ small: 40 MB	

* 240 mm leaf shutter speed is 1/1000s.

	iXA-R 180 iXA 180	iXA-R 160 iXA 160	iXA-R 160 Achromatic iXA 160 Achromatic
Lens + technology optimizes	- Color cast - Light falloff - Chromatic aberration - Fringing - Sharpness falloff - Lens distortion		
Output format	Phase One Raw, TIF and JPG		
Post processing	- iX Capture - Capture One Pro - Capture One Processing Engine		
IR cut-off filter	Camera system available either with or without IR filter		
Connection to pod	Four M4 bolts		
Tripod sockets	Two 3/8 inch		
Power input	12 – 30 V DC		
Maximum power consumption	20 W		
Dimensions iXA (excluding lens)*	132 x 114 x 128.5 mm/5.2 x 4.4 x 5 in (w x h x l)		
Dimensions iXA-R (including lens 40)**	128.5 x 114 x 190.5 mm/5.06 x 4.48 x 7.5 in (w x h x l)		
Dimensions iXA-R (including lens 50)**	128.5 x 114 x 199 mm/5.06 x 4.48 x 7.83 in (w x h x l)		
Dimensions iXA-R (including lens 70)**	128.5 x 114 x 191 mm/5.06 x 4.48 x 7.51 in (w x h x l)		
Weight (excluding lens)	1.75 kg/3.86 lb — for iXA cameras 1.73 kg/3.81 lb — for iXA-R cameras		
Weight iXA-R (camera and lens)	iXA-R 40 2.5 kg/5.4 lb iXA-R 50 2.5 kg/5.6 lb iXA-R 70 2.3 kg/5.1 lb		
Approvals	FCC (Class A), CE, RoHS		
Operating Conditions			
Temperature	-10° to 40°C (14° to 104°F)		
Humidity	15 to 80% (non-condensing)		

* 240 mm leaf shutter speed is 1/1000s.

** 2D and 3D drawings for integration of cameras are available from http://industrial.phaseone.com/downloads

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About Phase One

Phase One A/S is based in Copenhagen with offices in New York, London, Cologne, Tokyo and Hong Kong. Phase One Industrial is a division of Phase One and is dedicated to research, development and manufacturing of advanced hardware and imaging software solutions that meet the unique requirements of aerial photography users.

To find out more about Phase One products, please visit http://industrial.phaseone.com and set up an appointment with one of our aerial photography experts for a demonstration.

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