

PHASE**ONE** INDUSTRIAL

Phase One Aerial Cameras Fully Integrated Aerial Photography Solutions



Phase One Aerial Camera Systems

Phase One Industrial is a market leader in research, development and manufacturing of 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 offer exceptional accuracy, image quality and coverage that rival large-format cameras at a fraction of the price.

With a product line of cameras, lenses and a powerful controller complete with software, compatibility with leading flight management systems and GPS receivers, Phase One provides a comprehensive solution that meets the exacting needs of aerial photography and streamlines the entire capture and processing workflow.

Built for use on everything from small UAVs to large manned aircraft, Phase One aerial cameras are easily integrated into existing systems, both onboard the aircraft and in post-production.

Exceptional Performance

A true metric calibrated camera depends on sophisticated engineering and structural integrity.

Subjected to rigorous testing for varying applications in different environments, such as vibration, light and temperature ranges, Phase One cameras ensure exceptional functionality, consistent performance, reliability and pinpoint accuracy.

All cameras employ mechanisms to solidly lock their lens to the camera body and secure lenses at infinity focus if necessary.

- Proven accuracy
- Reliability at high shutter speed
- Record breaking capture rate
- Distortion free images
- Rugged and built to last
- Solid locking mechanism
- Cost effective solution



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 diverse systems for:

- Mapping
- Oil and gas pipelines monitoring
- Critical infrastructure inspection
- Power line monitoring
- Coastal surveillance
- Wind turbine blade inspection
- Disaster site monitoring and mapping
- Iceberg monitoring
- Forestry, vegetation identification, agriculture crop monitoring
- Hydrometric mapping
- Asset management
- 3D modeling
- Entertainment and game market
- Crowd monitoring
- City Mapping
- City planning



iXU-RS 1000

The Phase One iXU-RS 1000 is the flagship product in our range of aerial cameras, presenting exceptional performance and advanced capabilities. Equipped with CMOS sensor technology and an innovative electromagnetic central leaf shutter, the iXU-RS 1000 provides enhanced capture rate and speed with zero latency, ensuring the precise image quality expected from a dedicated aerial photography camera.

Best Choice for Surveying

The Phase One iXU-RS aerial cameras include features such as: accurate metric calibration, central leaf shutters, scalability to form multi-camera arrays, as well as easy integration with popular flight management systems and GPS/IMU receivers.

The iXU-RS cameras are built with one of seven lenses — 32 mm, 40 mm, 50 mm, 70 mm, 90 mm, 110 mm or 150 mm. The interchangeable lenses are individually inspected and factory calibrated for infinity focus.

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

100 megapixel CMOS sensors

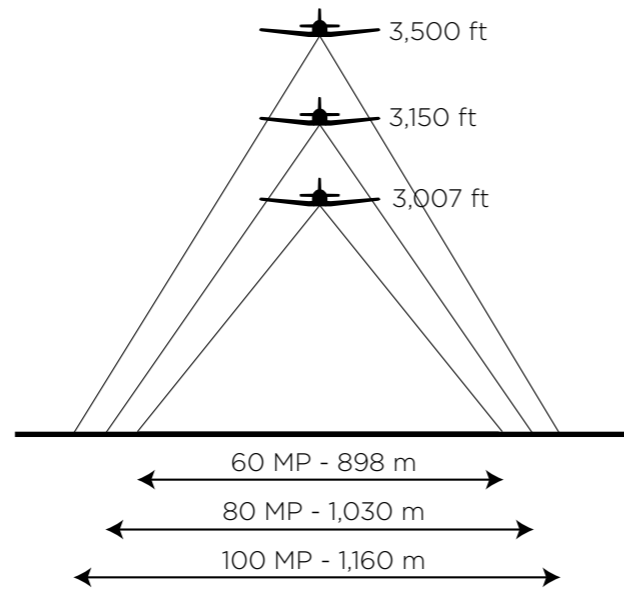
The CMOS technology of the iXU-RS 1000 enables you to move from ISO 50 all the way up to 6400, providing quality images all across the ISO range. As weather conditions deteriorate or on days when you previously were unable to capture, the CMOS-based cameras provide the high sensitivities that can make a difference.

Large format advantages at medium format price

The Phase One iXU-RS camera, equipped with a 100 MP sensor, offers a small-bodied medium format camera with high performance optics. The camera delivers 11,608 pixels cross-track coverage, which is 12 percent greater than previously available medium format aerial camera systems, large format captures in a medium format body.

Flying with an iXU-RS 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.

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.



iXU-RS 180, 160 and 160 Achromatic

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 iXU-RS cameras are also made in 80 MP, 60 MP and 60 MP achromatic CCD versions for users looking for a standalone camera or an array of multiple cameras.

Phase One iXU-RS CCD Cameras

With a choice of models, the iXU-RS CCD-based aerial cameras are 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 iXU-RS aerial cameras, use one of seven lenses — 32 mm, 40 mm, 50 mm, 70 mm, 90 mm, 110 mm or 150 mm. The interchangeable lenses are individually inspected and factory calibrated for infinity focus.

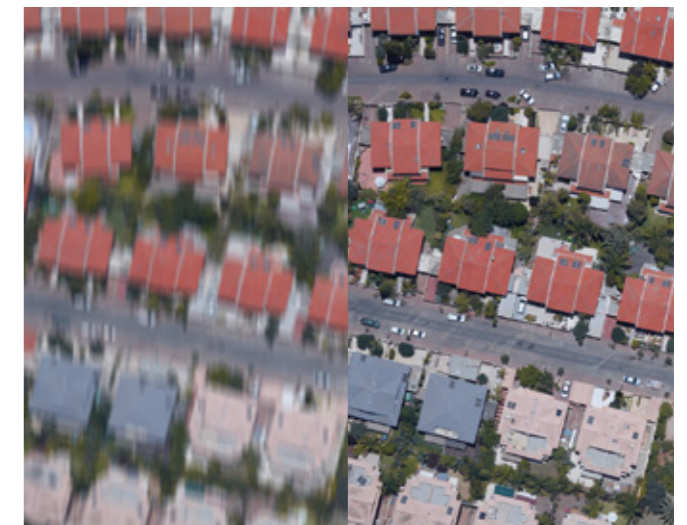
The range of focal lengths cover most uses and is suitable for creating DTMs and DSMs for surveying as well as Orthophotos. The 50 mm lens, with its opening angle of 56.4°, is especially suited for capturing images alongside a LiDAR.

Forward Motion Compensation

The Phase One forward motion compensation (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 the 80 MP and 60 MP iXU-RS and iXU cameras.



Without FMC

With FMC



Phase One iXU Series

The Phase One iXU aerial cameras are the world's smallest and lightest integrated digital medium format aerial cameras, available with a 100 MP or 50 MP CMOS sensor or an 80 MP, 60 MP and 60 MP achromatic CCD versions. All iXU cameras are equipped with internal electronically controlled central leaf shutters to provide the image quality expected from a dedicated aerial photography camera.

Small, light and high resolution

The Phase One iXU cameras are so small that their body is barely wider than their lens barrels. With camera weights starting at 1.25 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 55 mm to 240 mm.

More flying time

The CMOS technology of the iXU 1000 and iXU 150 enables you to use higher ISOs and capture images later in the day and with overcast weather, making the cameras a great choice for projects where light conditions can't be predicted.

Built for flexibility

Execution of different parts of a project can be accomplished in the same day and from the same location by simply changing the camera's lens. Projects that require very high resolution detail, such as inspections, using a focal length of 80 mm, 110 mm or 150 mm can be captured, while after swapping out the long lens, a shorter focal length lens, such as the 55 mm, can be used for wider views and 3D modeling. Lenses are mechanically locked to the camera body for ultimate stability and focus accuracy.



UAV Ready

The perfect choice for UAV platforms

With cameras weighing as low as 1.25 kg, Phase One metric cameras can be easily integrated into mini-UAVS and small aircraft.

CMOS technology enables high quality live view functions to be viewed remotely. Controlling all aspects of operation and exposure, with direct connection to a remote monitor on the ground, is made possible by Phase One's iX Link Protocol and HDMI output.



Applications

Phase One solutions open doors to new mission types and assignments. Whether for inspection projects such as wind turbines, bridges, roof inspection, smoke stacks and agriculture or for photogrammetry, map-making and homeland security purposes, the combination of a UAV and Phase One medium format cameras enable users to offer professional results, without compromise.

Easy Integration

Phase One cameras are easily integrated with UAVs. Comprehensive documentation, including 2D and 3D drawings is available in our website Downloads section for physical and electronic connection with the aircraft. All Phase One aerial cameras have predefined settings for the most popular GNSS receivers and have the ability to write the IMU/GNSS data directly to the EXIF of each file, creating geo-tagged images and thus reducing the chances of error. Many users have found that they were able to integrate Phase One medium format, metric cameras into their systems within a few hours.



Phase One RS Shutter Setting New Records

The new RS Lens shutter was designed especially for the tough demands of aerial imaging. It uses an innovative direct drive concept with electronic charging that enhances exposure speed as fast as 1/2500s, guaranteeing half a million exposures - a record breaking capture rate and life span longer than ever seen before.

The blades in the RS shutter are produced of specially made carbon fiber material, as used in the aerospace industry, driven by a linear motor and controlled in real time for absolute precision of exposure time.

The reliance of the RS shutter's capacity of 500,000 cycles along with the exposure time of 1/2500s enables faster flying, and allows customers to execute and manage the most demanding aerial photography missions with higher operational efficiency, reliability, and in a cost effective manner.



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

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.

Solid state drives

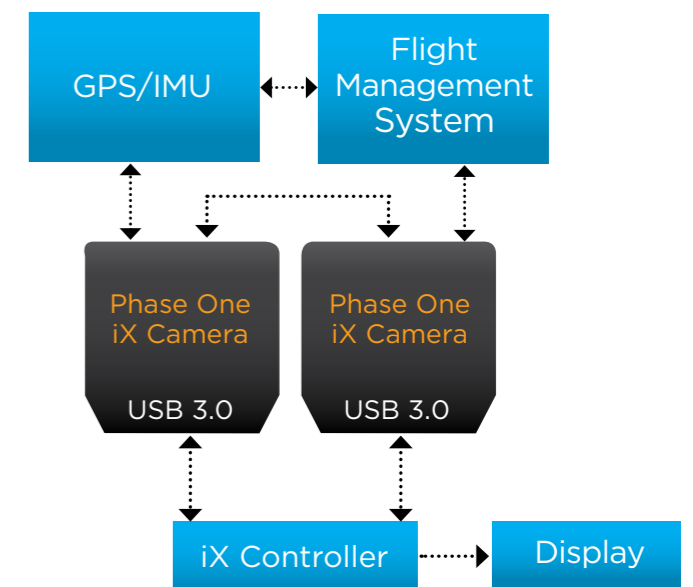
The iX Controller employs two removable SSD drives, which have especially high write speeds to ensure you capture and record every image quickly and reliably. When the mission is over, the compact and light SSD drives are easily removed from the iX Controller and sent for processing.



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.



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

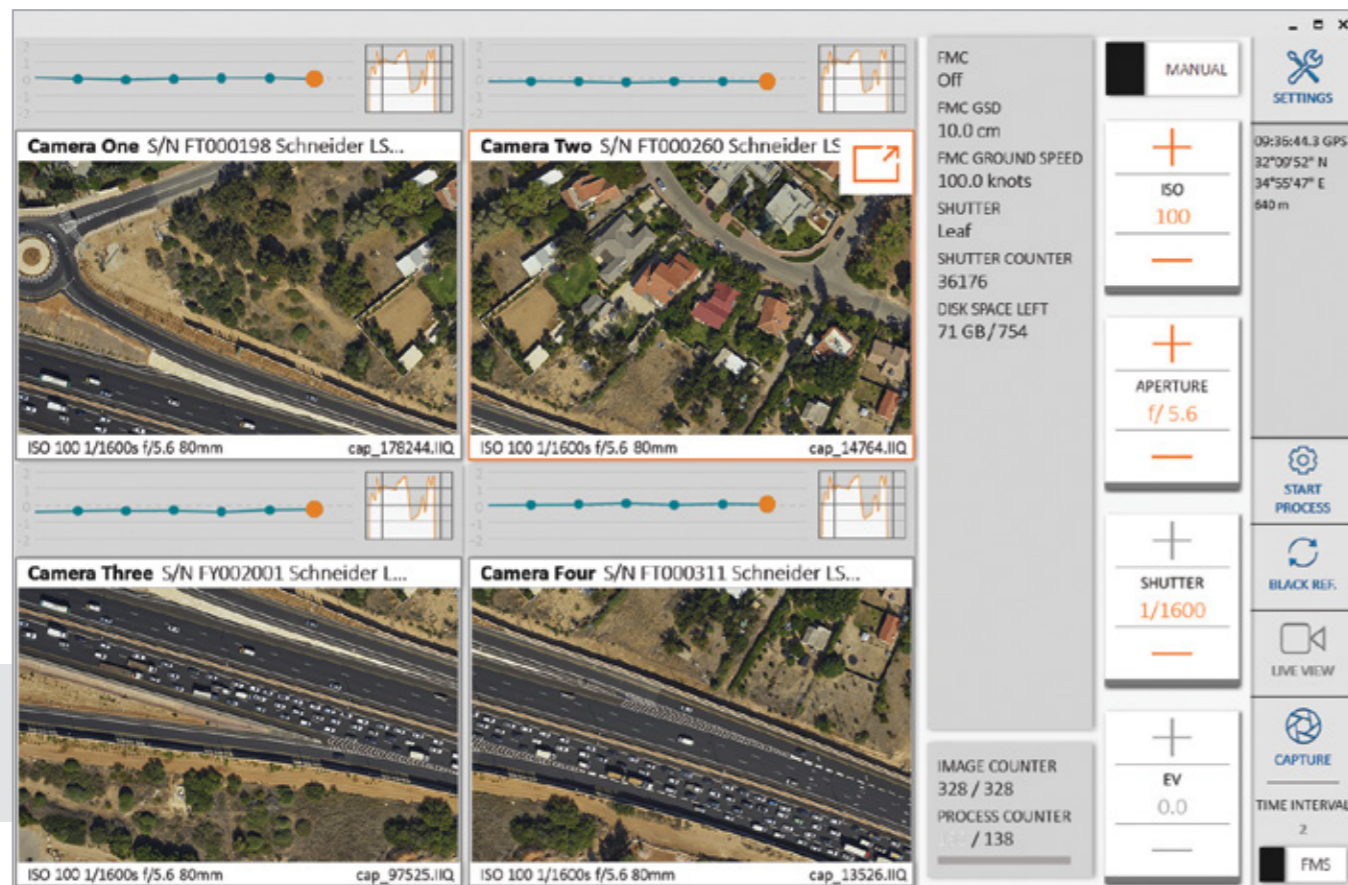
Phase One also offers a choice of software solutions for image processing:

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.



4-Band Solution

With the increasing demand for combined NIR and RGB aerial imagery for applications such as crop analysis for growth optimization, vegetation health and environmental contamination as well as projects including city observation for green site monitoring, Phase One has developed a fully automatic solution for capturing and processing 4-Band imagery*, using two high-resolution Phase One aerial cameras, specifically designed for the photogrammetric airborne market.

Simplifying your workflow

The 4-Band solution includes two synchronized Phase One metric calibrated cameras (RGB and NIR) mounted side by side on a specially designed base plate, an iX Controller computer and the iX Capture software.

The software automatically generates distortion-free images and performs fine co-registration of pixels from the NIR to the RGB images, including processing different image sizes.

This fully automatic process is supported by Phase One's iX Capture software, ensuring these 4-Band images offer a precise output data you can rely on when combined NIR and RGB aerial images are the only solution for your project.

iX Capture outputs the following products:

- 4-Band combined NIR and RGB (RGBN) TIFF (4-Band CIR)
- 3-Band combined NIR and RGB (NRG) TIFF (3-Band CIR)
- NDVI (Normalized Difference Vegetation Index) TIFF
- Distortion-free / corrected RGB TIFF
- Distortion-free / corrected NIR TIFF
- RGB TIFF
- NIR TIFF



RGB image



NIR image



NDVI Image



CIR Image



Phase One iXU-RS Lenses

Lenses	Maximum shutter	Opening angle (long side)	Opening angle (short side)	Lens type	Weight	Dimensions
32 mm f/4.0	1/2500	79.7°	64.1°	Rodenstock	970 g/2.13 lb	97.4 x 93.7 x 181.5 mm 3.8 x 3.7 x 7.15 in
40 mm f/4.0	1/2500	67.4°	53.2°	Rodenstock	730 g/1.60 lb	97.4 x 93 x 170.5 mm 3.8 x 3.7 x 6.7 in
50 mm f/4.0	1/2500	56.2°	43.7°	Rodenstock	800 g/1.76 lb	97.4 x 93 x 177 mm 3.8 x 3.7 x 7.0 in
70 mm f/5.6	1/2500	41.8°	31.9°	Rodenstock	580 g/1.27 lb	97.4 x 93 x 175.3 mm 3.8 x 3.7 x 6.9 in
90 mm f/5.6	1/2000	33°	25.1°	Rodenstock	1150 g/2.53 lb	97.4 x 93 x 218 mm 3.8 x 3.7 x 8.6 in
110 mm f/4	1/2500	27.3°	20.6°	Schneider-Kreuznach	620 g/1.37 lb	97.4 x 93 x 185.5 mm 3.8 x 3.7 x 7.3 in
150 mm f/5.6	1/2500	20.2°	15.2°	Schneider-Kreuznach	630 g/1.39 lb	97.4 x 93 x 190.3 mm 3.8 x 3.7 x 7.5 in

Phase One iXU Lenses

Lenses	Maximum shutter	Opening angle (long side)	Opening angle (short side)	Lens type	Weight	Dimensions
55 mm f/2.8	1/1600	51.8°	40.0°	Schneider-Kreuznach fast sync	630 g/1.38 lb	77.6 x 86.5 mm 3 x 3.4 in
80 mm f/2.8	1/1600	36.9°	28.1°	Schneider-Kreuznach fast sync	480 g/1.06 lb	64.4 x 86.5 mm 2.5 x 3.4 in
110 mm f/2.8	1/1600	27.3°	20.6°	Schneider-Kreuznach fast sync	635 g/1.40 lb	83.3 x 86.5 mm 3.3 x 3.4 in
150 mm f/3.5	1/1600	20.2°	15.2°	Schneider-Kreuznach fast sync	650 g/1.44 lb	87.1 x 86.5 mm 3.4 x 3.4 in
240 mm f/4.5	1/1000	12.7°	9.5°	Schneider-Kreuznach fast sync	1600 g/3.52 lb	173.2 x 104.2 mm 6.8 x 4.1 in

The Phase One lenses are easily interchanged, adapted for aerial photography and offers low distortion, high MTF and excellent contrast.



iXU-RS Technical Specifications

	iXU-RS 1000	iXU-RS 180	iXU-RS 160	iXU-RS 160 Achromatic
Resolution	100 MP 11608 x 8708	80 MP 10328 x 7760	60.5 MP 8984 x 6732	60 MP 8964 x 6716
Dynamic range	>84 db	>72 db		
Aspect ratio	4:3			
Pixel size	4.6 micron	5.2 micron	6.0 micron	
Sensor 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
Lens factor	1.0			
Light sensitivity (ISO)	50-6400	35-800	50-800	200-3200
Camera type	Medium format camera for aerial photography			
Lens mount	Phase One RS dedicated mount			
Shutter speed	Leaf shutter: up to 1/2500 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	<ul style="list-style-type: none"> • 1920 x 1080 25p/30p • 1280 x 720 50p/60p 			
GPS/IMU support	Applanix, NovAtel, IGI, GGS, NMEA Devices			
Forward Motion Compensation	N/A	TDI controlled		
Data storage	<ul style="list-style-type: none"> • 1 TB SSD storage (optional iX Controller) • CompactFlash card Type I/II including UDMA 6 and 7 			
Synchronization speed in multiple camera configuration	100 microseconds			
Capture rate — full resolution frame	0.6 s	1.25 sec	1.1 sec	1.1 sec
RAW File compression	I/Q large: 100 MB I/Q small: 65 MB	I/Q large: 80 MB I/Q small: 54 MB	I/Q large: 60 MB I/Q small: 40 MB	
Lens + technology optimizes	Color cast; Light falloff; Chromatic aberration; Fringing; Sharpness falloff; Lens distortion			
Output formats	Phase One RAW, TIF, JPG, CIR and NDVI			
Post processing	<ul style="list-style-type: none"> • iX Capture • Capture One Pro • Capture One Processing Engine 			
IR cut-off filter	Available either with or without IR filter			
Connection to pod	Four M4 bolts			
Power input	12 - 30 V DC			
Maximum power consumption	10 W	12 W		
Weight iXU-RS (excluding lens)	.930 kg/2.05 lb			
Weight iXU-RS 50 mm	1.700 kg/3.7 lb			
Approvals	FCC (Class A), CE, RoHS			
Operating Conditions				
Temperature	-10° to 40°C (14° to 104°F)			
Humidity	15 to 80% (non-condensing)			

iXU Technical Specifications

	iXU 1000	iXU 180	iXU 160	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
Sensor 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 SK dedicated mount				
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	<ul style="list-style-type: none"> • 1920 x 1080 25p/30p • 1280 x 720 50p/60p 				<ul style="list-style-type: none"> • 1920 x 1080 25p/30p • 1280 x 720 50p/60p
GPS/IMU support	Applanix, NovAtel, IGI, GGS, NMEA Devices				
Forward Motion Compensation	N/A	TDI controlled			N/A
Data storage	<ul style="list-style-type: none"> • 1 TB SSD storage (optional iX Controller) • CompactFlash card Type I/II including UDMA 6 and 7 				
Synchronization speed in multiple cameras	100 microseconds with factory calibrated (FS) lenses				
Capture rate — full resolution frame	0.95 s	1.6 sec	1.45 sec	1.45 sec	0.85 sec
RAW File compression	I/Q large: 100 MB I/Q small: 65 MB	I/Q large: 80 MB I/Q small: 54 MB	I/Q large: 60 MB I/Q small: 40 MB		I/Q large: 50 MB I/Q small: 33 MB
Lens + technology optimizes	Color cast; Light falloff; Chromatic aberration; Fringing; Sharpness falloff; Lens distortion				
Output formats	Phase One RAW, TIF, JPG				
Post processing	<ul style="list-style-type: none"> • iX Capture • Capture One Pro • Capture One Processing Engine 				
IR cut-off filter	Available either with or without IR filter				
Connection to pod	Four M4 bolts				
Power input	12 - 30 V DC				
Maximum power consumption	10 W	12 W			10 W
Weight iXU (excluding lens)	.930 kg/2.05 lb				.750 kg/1.7 lb
Weight iXU (with 80 mm lens)	1.430 kg/3.15 lb				1.250 kg/2.8 lb
Approvals	FCC (Class A), CE, RoHS				
Operating Conditions					
Temperature	-10° to 40°C (14° to 104°F)				
Humidity	15 to 80% (non-condensing)				





About Phase One

Phase One A/S is based in Copenhagen with offices in New York, London, Cologne, Tokyo, Tel Aviv 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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