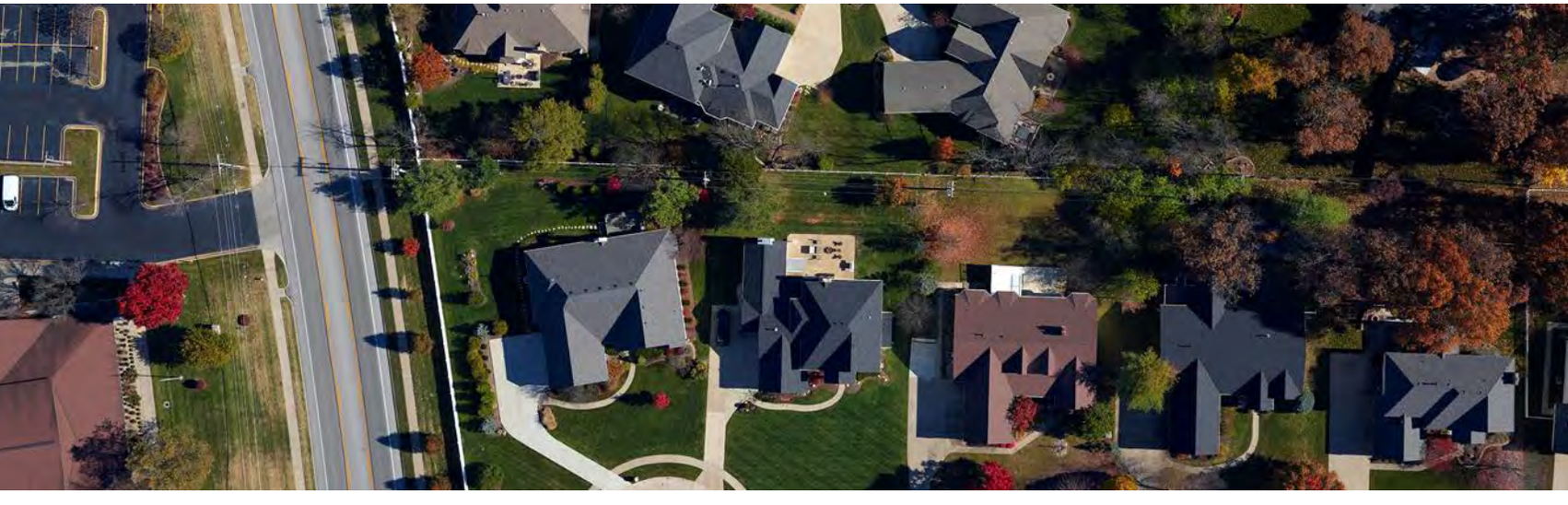
Phase One Industrial

Aerial Solutions



PHASEONE
INDUSTRIAL

From a Line of Aerial Cameras to Integrated Systems

We at Phase One Industrial continuously expand our offering and design the exact solutions that meet the requirements of the developing industrial and aerial imaging market. Our solutions specifically address the challenges of imaging data acquisition projects, helping our customers to increase productivity and reduce time and costs.

190 MP

150MP/100MP

iCapture

iX Plan

iX Flight

Controller

GNSS/IMU

Seeing the Large Picture - Medium Format Evolves

Phase One 190MP Aerial System

Phase One Industrial designed a powerful and fully integrated large format 190MP aerial system that enables customers to execute mapping projects faster and in a more efficient manner.

iXU-RS 1900

At the heart of the system is the new iXU-RS1900 – an advanced large format, dual lens metric camera, with technology designed specifically for the toughest demands of aerial imaging projects.

The iXU-RS1900 offers exceptional aerial image coverage, high accuracy and image quality, presenting an excellent alternative to traditional large format cameras in diverse aerial survey applications such as mapping, 3D City modeling, remote sensing, precision agriculture, disaster management and monitoring.

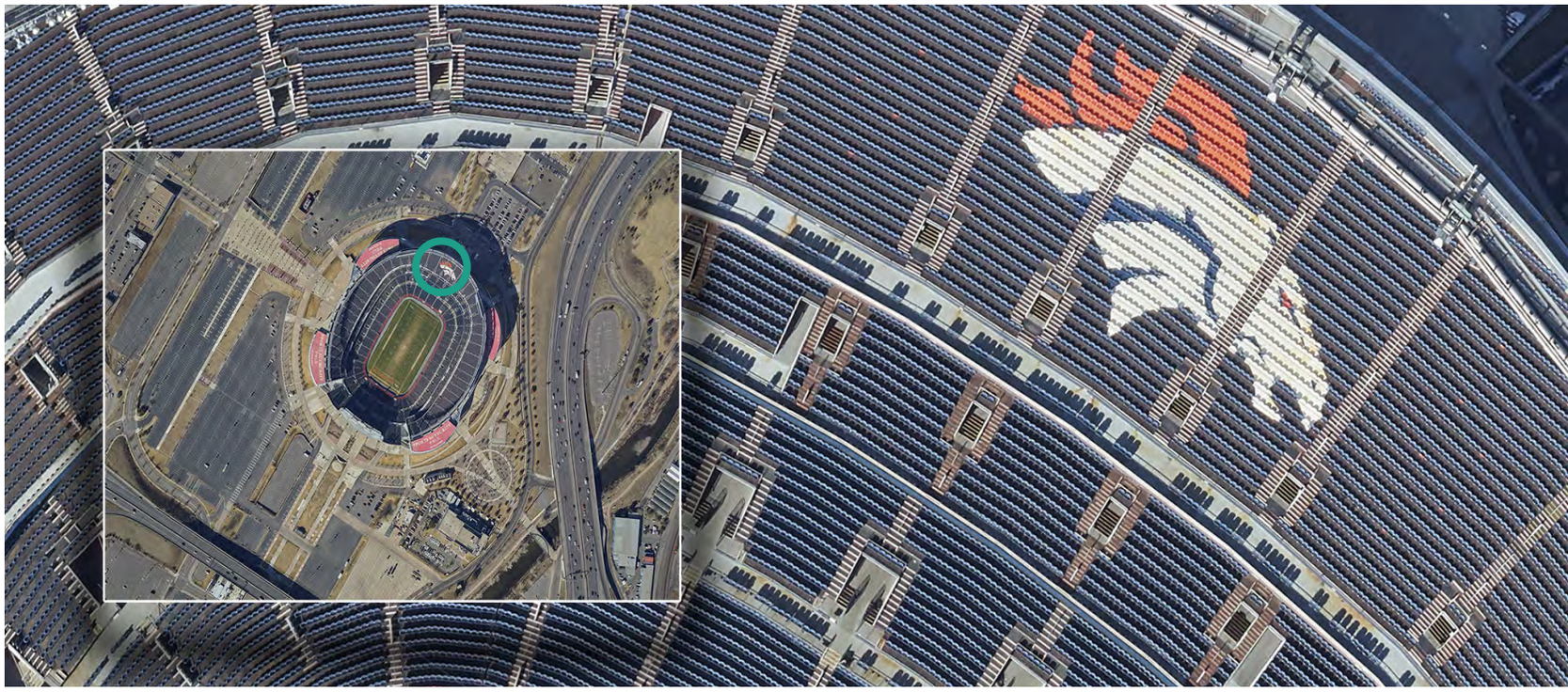
The Phase One iXU-RS1900 is built with dual 90mm lenses for capturing RGB information. Each sensor provides an image with 8,708 pixels across flight and 11,608 pixels along flight, and the two stitched images form a large frame with 16,470 pixels across the flight line and 11,540 pixels along the flight line, providing a 190MP image. This advanced optical integration and software development enable the generation of a 190MP single central projection image from two 100MP nadir images with equal ground resolution.

The camera is characterized by small pixel size (4.6 µm), large image area (190 MP), high image capture rate of 0.6 sec and exposure time of up to 1/2000, a focal length of 90 mm, and optional NIR channel.

Its relatively small size, light weight and low power consumption makes it compatible with all types of light aerial platforms. These factors significantly reduce the operational costs of mapping projects.

190 MP Aerial System's Unique Capabilities

- Large image coverage
- Aerial survey productivity increased by 43% (versus 100MP platforms)
- High stereoscopic accuracy due to large FOV along flight
- Flight at higher speed due to highly sensitive CMOS sensors and very short exposure time
- Large forward overlap for 3D City modeling and dense DSM due to high image capture rate
- Small size and light weight enable the use of light aircraft for mapping
- Factory metric calibration



4-Band Configuration 190 MP System

Phase One is expanding the camera's performance, offering additional configuration for simultaneous capturing RGB and NIR images. The iXU-RS1900 4-Band system comprises dual 90 mm lenses for capturing RGB information, and a 50 mm lens for capturing NIR information and thus providing 4-Band (R,G,B,NIR) or CIR imagery.

The integrated iX Capture software automatically generates distortion-free 4-Band images by performing an accurate matching of NIR image to an RGB image, creating precise and reliable output data.

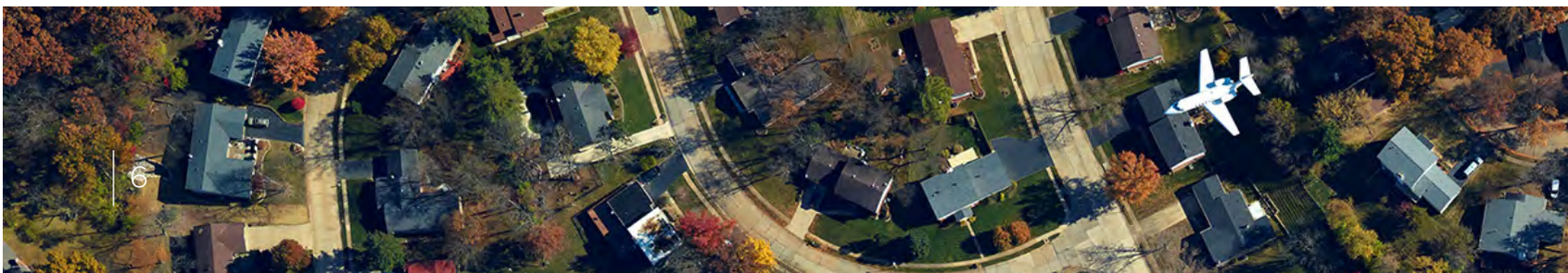
iX Capture outputs the following products in both TIFF and JPG formats:

- 4-Band RGB+NIR (RGBN)
- 3-Band CIR (Color Infra Red)
- NDVI (Normalized Difference Vegetation Index)
- Distortion-free / corrected RGB
- Distortion-free / corrected NIR

Technical Specifications

	iXU-RS 1900	iXU-RS 1900 4-Band
Frame geometry	Central projection	
Resolution	190MP 16470 x 11540	
Image formats	PhaseOne RAW, IIQ-L, IIQ-S	
Output formats	Distortion Free RGB in TIFF 8 and 16 Bit or JPEG	Distortion Free RGB, NIR, CIR, RGBN, NVDI in TIFF 8 and 16 Bit or JPEG
Pansharpen ratio	N/A	1:1.8
Frame width for 10 cm GSD (m)	1647	
Frame height for 10 cm GSD (m)	1154	
Frame area for 10 cm GSD (sq.km)	1.90	
Typical image size (MB) for TIFF (8 Bit)	570	760

Lenses type	Rodenstock	
Number of lenses	2	3
Focal length (mm)	90	90 & 50
FOV - across flight (°)	45.7	
FOV - along flight (°)	33	
Aperture range	f/5.6 - 11	
Exposure principle	Leaf shutter	
Shutter speed (sec)	Up to 1/2500	
Capture rate (fps)	1.6	
Light sensitivity (ISO)	50-6400	
Dynamic range (dB)	>84	
NIR range (nm)	N/A	720 - 1000
Events synchronization speed (µsec)	100	
Sensor Specifications		
Sensor type	CMOS	
Sensor number	2	3
Pixel size (µm)	4.6	
Array (pixel)	11608 x 8708	
Analog-to-digital-conversion (bit)	14	



	iXU-RS 1900	iXU-RS 1900 4-Band
Flight Specifications		
Maximal ground speed for 10 cm GSD with motion blur under 1 pixel (knot)	380	
Maximal forward overlap for 10 cm GSD at 150 knot (%)	96	
Maximal orthophoto angle for 20% side overlap (°)	37	
Flight altitude for 10cm GSD (Feet)	6400	
Operating Conditions		
Power input (V DC)	12-30	
Maximal power consumption (W) – camera only	20	30
Humidity - non-condensing (%)	15 to 80	
Temperature (°C)	-10 to 40	
Approvals	FCC (Class A), CE, RoHS	
System Specifications		
System weight (kg/Lb)	31 / 68.5	32.5 / 72
System size (mm/In)	460 x 430 x 440 / 18.1 x 16.9 x 17.3	
Pilot monitor for navigation (In)	7	
Operator monitor for camera management (In)	15	
Gyro-stabilizer SOMAG	DSM400	
GNSS / IMU Applanix	POS AV 210 / POS AV 510	
Power consumption	6 Amp at 28V	
iX Controller MK4		
Interfaces	USB3, Power and Control Ports for Camera, GNSS and Mount	
Storage capacity (TB)	1.0	
Storage type	SSD	
Storage exchangeability	Yes	

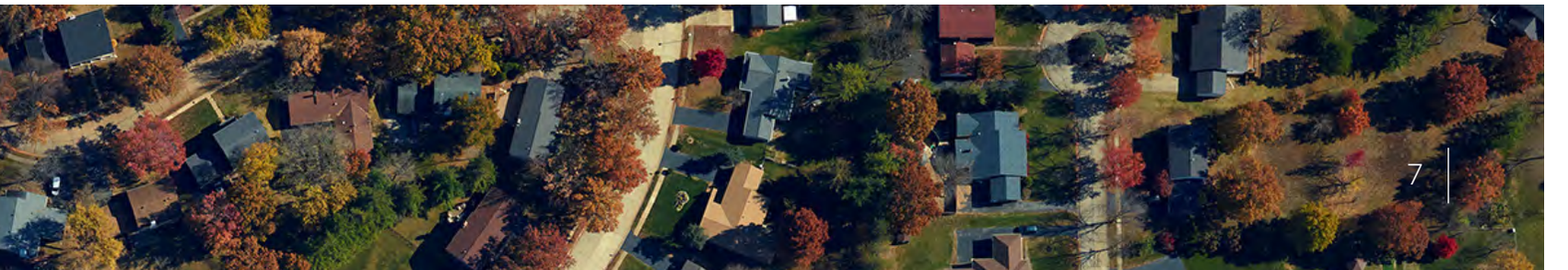


Image taken with 190MP Aerial System (RGB)

Image taken with 190MP Aerial System (CIR)

Phase One 150MP/100MP Aerial System

Phase One 150MP and 100MP Aerial Systems are fully integrated systems based on the newly designed iXM-RS150F and the iXM-RS100F high-resolution metric cameras respectively. Each Aerial System includes the camera and additional components, such as: the iX Controller, Somag stabilizer, Applanix GPS/ IMU unit and the Phase One flight planning and management software iX Plan and iX Flight.

IXM-RS150F

The new iXM-RS150F is a highly productive 150-megapixel aerial survey camera.

Equipped with a new full frame sensor (14204 x 10652), and with a 3.76-micrometer pixel size it enables higher ground resolution from a higher flight altitude and provides a larger aerial coverage resulting in higher aerial survey productivity.

The camera uses backside-illuminated CMOS sensor technology with a high dynamic range of 83 dB allowing higher image quality even in low light conditions, enabling more flight hours a day and more flight days a year.

A very fast image capture rate of 2 frames per second enables flights with larger forward overlap, required for high quality 3D city models.

The camera comes with one of eight RS lenses ranging from 32mm to 180mm focal length, equipped with a central leaf shutter to ensure geometrically correct aerial image.

Designed and built for aerial photography by Rodenstock and Schneider Kreuznach, the lenses are factory calibrated for infinity focus and equipped with a central 1/2500 sec. leaf shutter, offering high capture speed of 2 fps for an array of flight conditions. The RS lenses opening angle is specially fitted for oblique and Lidar systems.

150 MP Aerial System's Unique Capabilities:

- Fully integrated Phase One Aerial System
- Large image coverage
- Exceptional accuracy and image quality
- Optional 4-band Aerial System with dual frame sensors for RGB and NIR imaging
- Light weight
- Low power

4-Band Solution 150MP/100MP Aerial System

The four-band solution comprising the RGB and Achromatic camera models, in which images are captured in RGB and NIR bands simultaneously, and then processed automatically to generate distortion-free images and perform fine co-registration of the pixels from NIR to the RGB images. This function is extremely useful for remote sensing and mapping applications in the field of agriculture, forestry and environment monitoring.

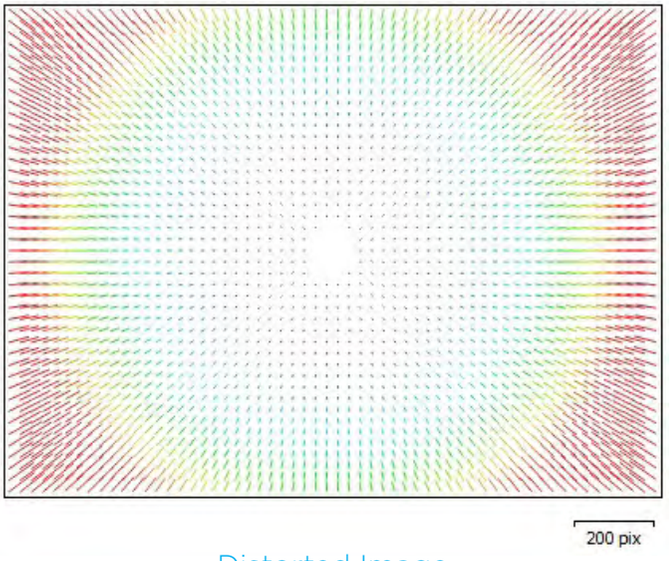
The 4-Band solution includes two synchronized cameras (RGB and NIR) in addition to the iX Controller, Somag stabilizer, Applanix GPS/IMU unit and the Phase One flight planning and management software iX Plan and iX Flight as well as iX Capture software to control camera during flight.

iX Capture software is also used to generate distortion-free images and to perform accurate matching of the NIR image to the RGB image.

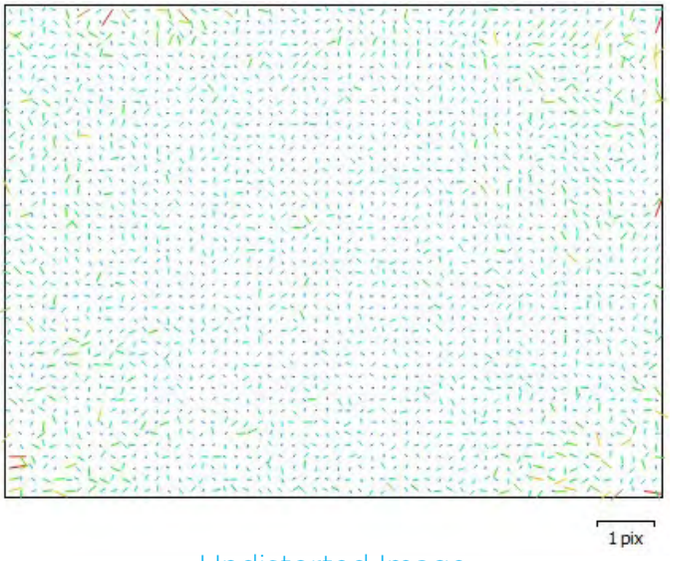
iX Capture outputs the following products:

- 4-Band combined NIR and RGB (RGBN)
- 3-Band (CIR) combined NIR and RGB (NRG)
- NDVI (Normalized Difference Vegetation Index)
- Original and distortion-free RGB & NIR images

Camera Distortion Model



Distorted Image



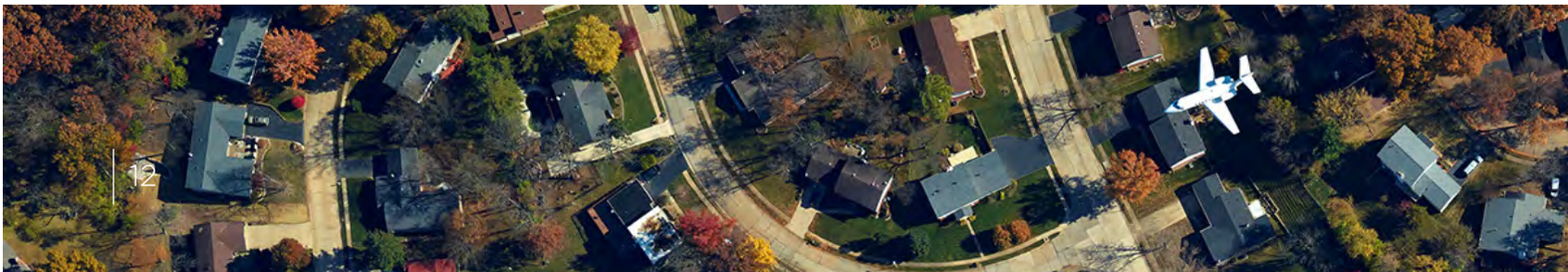
Undistorted Image

1. The distortion model of the camera corresponds to a standard Brown-Conrady symmetric radial distortion model.
2. Images captured with the camera may be easily transformed to an undistorted image with a maximal residual of less than 1 µm.

Technical Specifications

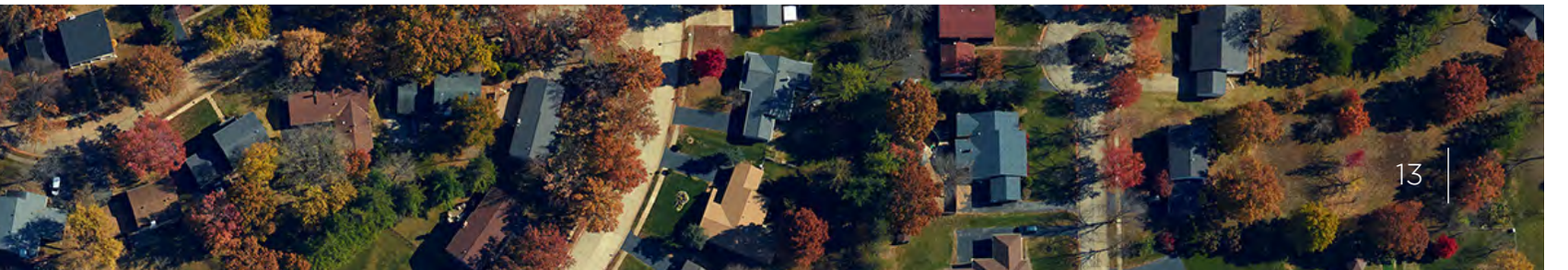
	iXM-RS150F	iXM-RS150F 4-Band
Frame geometry	Central projection	
Resolution	150MP 14204 x 10652	
Image formats	PhaseOne RAW IIQ-L, IIQ-S	
Output formats	Distortion Free RGB in TIFF 8 and 16 Bit or JPEG	Distortion Free RGB, NIR, CIR, RGBN, NVDI in TIFF 8 and 16 Bit or JPEG
Pansharpen ratio	N/A	1:1.8
Frame width for 10 cm GSD (m)	1420	
Frame height for 10 cm GSD (m)	1065	
Frame area for 10 cm GSD (sq.km)	1.51	
Typical image size (MB) for TIFF (8 Bit)	450	600

Lenses type	Rodenstock / Schneider-Kreuznach							
Number of lenses	1				2			
Focal length (mm)	32	40	50	70	90	110	150 MK II	180
FOV - across flight (°)	77.8	65	54.6	41.8	33	27.6	20.2	16.9
FOV - along flight (°)	62.3	51	42.3	31.9	25.1	20.9	15.2	12.7
Aperture Range	f/5.6 - 22							f/6.3 - 22
Exposure principle	Leaf shutter							
Shutter speed (sec)	Up to 1/2500				1/2000	Up to 1/2500		1/2000
Capture rate (fps)	2.0							
Light Sensitivity (ISO)	50-6400							
Dynamic Range (dB)	83							
NIR Range (nm)	N/A				720 - 1000			
Events synchronization speed (µsec)	100							
Sensor Specifications								
Sensor type	CMOS							
Sensor number	1				2			
Pixel size (µm)	3.76							
Array (pixel)	14204 x 10652							
Analog-to-digital-conversion (bit)	14							



	iXM-RS150F	iXM-RS150F 4-Band
Flight Specifications		
Maximal ground speed for 5cm GSD with motion blur under 1 pixel (knot)	240	
Maximal forward overlap for 5cm GSD at 150 knot (%)	93	
Maximal orthophoto angle for 20% side overlap (°)	27 for 90mm focal lens	
Flight altitude for 5cm GSD (Feet)	3926 for 90mm focal length	
Operating Conditions		
Power input (V DC)	12-30	
Maximal Power consumption (W) – camera only	16	32
Humidity - non-condensing (%)	15 to 80	
Temperature (°C)	-10 to 40	
Approvals	FCC (Class A), CE, RoHS	
System Specifications		
System weight (kg/Lb)	8.5 / 19	31 / 68.5
System size (mm/In)	(*)290 x 275 x 121 / 11.4 x 10.8 x 4.7	460 x 430 x 440 / 18.1 x 16.9 x 17.3
Pilot monitor for navigation (In)	7	
Operator monitor for camera management (In)	15	
Gyro-stabilizer SOMAG	CSM40	DSM400
GNSS/IMU Applanix	POS AV 210	POS AV 210 / POS AV 510
Power consumption	6 Amp at 28V	
iX Controller MK4		
Interfaces	USB3, Power and Control Ports for Camera, GNSS and Mount	
Storage capacity (TB)	1.0	
Storage type	SSD	
Storage exchangeability	Yes	
Weight (kg/Lb)	5.11 / 2.5	
Size (mm/In)	9.8 x 3.4 x 4.11 / 225 x 109 x 2	

(*) Weight of controller not included

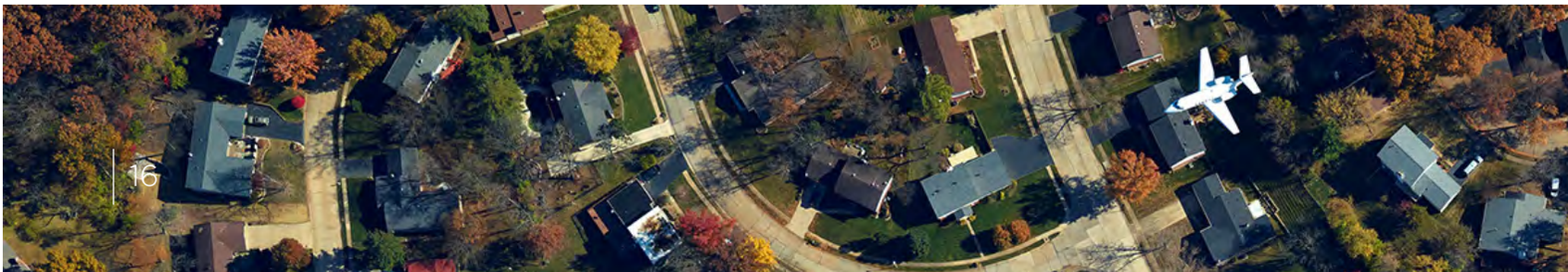


Technical Specifications

	iXM-RS100F	iXM-RS100F 4-Band
Frame geometry	Central projection	
Resolution	100MP 11608 x 8708	
Image formats	PhaseOne RAW IIQ-L, IIQ-S	
Output formats	Distortion Free RGB in TIFF 8 and 16 Bit or JPEG	Distortion Free RGB, NIR, CIR, RGBN, NVDI in TIFF 8 and 16 Bit or JPEG
Pansharpen ratio	N/A	1:1
Frame width for 10 cm GSD (m)	1161	
Frame height for 10 cm GSD (m)	871	
Frame area for 10 cm GSD (sq.km)	1.01	
Typical image size (MB) for TIFF (8 Bit)	300	400

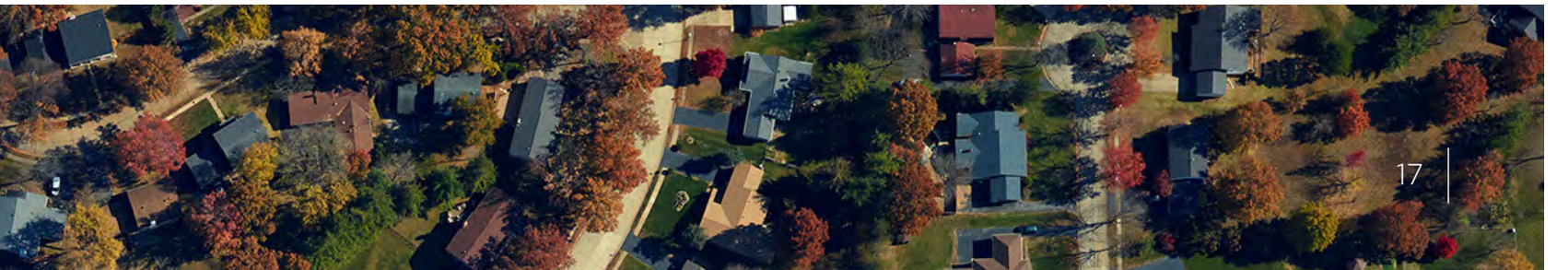
Lenses type	Rodenstock / Schneider-Kreuznach							
Number of lenses	1				2			
Focal length (mm)	32	40	50	70	90	110	150 MK II	180
FOV - across flight (°)	77.8	65	54.6	41.8	33	27.6	20.2	16.9
FOV - along flight (°)	62.3	51	42.3	31.9	25.1	20.9	15.2	12.7
Aperture Range	f/5.6 - 22							f/6.3-22

Exposure principle	Leaf shutter		
Shutter speed (sec)	Up to 1/2500	1/2000	Up to 1/2500
Capture rate (fps)	1.6		
Light Sensitivity (ISO)	50-6400		
Dynamic Range (dB)	84		
NIR Range (nm)	N/A	720 - 1000	
Events synchronization speed (µsec)	100		
Sensor Specifications			
Sensor type	CMOS		
Sensor number	1	2	
Pixel size (µm)	4.60		
Array (pixel)	11608 x 8708		
Analog-to-digital-conversion (bit)	14		



	iXM-RS100F	iXM-RS100F 4-Band
Flight Specifications		
Maximal ground speed for 5cm GSD with motion blur under 1 pixel (knot)	240	
Maximal forward overlap for 5cm GSD at 150 knot (%)	91	
Maximal orthophoto angle for 20% side overlap (°)	27 for 90mm focal lens	
Flight altitude for 5cm GSD (Feet)	3209 for 90mm focal length	
Operating Conditions		
Power input (V DC)	12-30	
Maximal Power consumption (W) – camera only	16	32
Humidity - non-condensing (%)	15 to 80	
Temperature (°C)	-10 to 40	
Approvals	FCC (Class A), CE, RoHS	
System Specifications		
System weight (kg/Lb)	8.5 / 19	31 / 68.5
System size (mm/In)	(*)290 x 275 x 121 / 11.4 x 10.8 x 4.7	430 x 430 x 440 / 18.1 x 16.9 x 17.3
Pilot monitor for navigation (In)	7	
Operator monitor for camera management (In)	15	
Gyro-stabilizer SOMAG	CSM40	DSM400
GNSS/IMU Applanix	POS AV 210	POS AV 210 / POS AV 510
Power consumption	6 Amp at 28V	
iX Controller MK4		
Interfaces	USB3, Power and Control Ports for Camera, GNSS and Mount	
Storage capacity (TB)	1.0	
Storage type	SSD	
Storage exchangeability	Yes	
Weight (kg/Lb)	9.8 x 3.4 x 4.11 / 225 x 109 x 2	
Size (mm/In)	5.11 / 2.5	

(*) Weight of controller not included



Aerial System Components

Hardware

iX Controller MK4

Designed to enable rapid data transfer, the iX Controller MK4 has the ability to control up to six Phase One aerial cameras independently. Built as a workhorse, the system boasts a small footprint and easily integrates into any aircraft.

The iX Controller MK4 includes robust removable protective SSD tray for convenient and secure transfer and handling.

Acting as a central hub to phase One Aerial Systems, it controls the cameras, the gyro-stabilizing mount, the GNSS/IMU system and runs iX Capture and iX Flight software. iX Controller MK4 includes and I/O port to enable accurate activation of multiple cameras by iX Flight, pre-installed on the iX Controller.

The iX Controller MK4 supports triple monitors, one for the pilot and two for the operator so both can monitor and observe different views of the set up simultaneously.

	IIQ-L Format	IIQ-S Format
Camera	Number of images	
190 MP	4700	7000
150 MP	6000	9000
100 MP	9000	13500

Gyro Stabilized Mounts

SOMAG DSM400 - was specifically designed for the Phase One 190MP Aerial System. With a low weight of 14 kg and a high payload of 35 kg, the mount supports the reduction of the angular rate, provides optimal stabilization of the system and allows efficient and precise image capturing. This stabilizer is also used for 4-band configuration.

SOMAG CSM40 – a small modular stabilization device that was specifically designed for the Phase One 100MP/ 150MP Aerial System. With a low weight of 5.2 kg and a high payload of 15 kg, the special mount system is particularly suitable with ultralight aircrafts.

GNSS/IMU system

The Phase One 100MP and 190MP Aerial Systems are equipped with an Applanix' POS AV 210 / 510 system that enables direct georeferencing of aerial images. By integrating precision GNSS with inertial technology, POS AV enables precise determination of position and attitude, as well as the completion of geospatial projects in a more efficient and cost effective manner. The Phase One 100MP and 190MP Aerial Systems are also compatible with additional GNSS/IMU systems.

Software Package

iX Capture

The iX Capture is an aerial capture, control and image processing software with an intuitive interface that displays key information such as exposure settings, histogram, GNSS/IMU data and frame count. It provides the operator with real-time feedback and the confidence that each image has been captured correctly. The post processing capabilities and advanced workflow enable the fast production of distortion free RGB and CIR images, and exclusively support the processing of 190MP images.

iX Flight

The iX Flight is an interactive and intuitive flight management system for precise execution of a mission, and comes uploaded to the iX Controller.

Controlled and operated with ease, iX Flight enables the planning, positioning and sensors' management / triggering - reducing aerial survey operational costs and increasing productivity. During the flight, iX Flight collects log files that enable post processing, mission analysis, and post-flight reports.

With two display screens for both the pilot and the operator, each has the exact information they need for a successful aerial-image acquisition.

The Phase One Aerial Systems are also compatible with additional Flight Management systems.

iX Plan – Flight Planning System

With its intuitive GUI and multiple control functions, the iX Plan application enables users to simply generate flight plans. It enables fast import of the digital terrain model (DTM), base map, project shape, and ground control points. It also includes all Phase One sensors characteristics.

iX Plan automatically calculates flight lines and trigger points, based on sensor parameters, project parameters and mapped terrain height.

iX Plan displays the planning results used during a flight as maps and tables, which can also be used for calculating project's costs.

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About Phase One Industrial

Phase One Industrial is a division of Phase One A/S that researches, develops, and manufactures specialized industrial camera systems and imaging software solutions. The company focuses on specific applications such as aerial mapping; and surveying; ground and aerial inspection; agriculture; machine vision and homeland security.

Phase One Industrial is a registered trademark of Phase One A/S.

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