Phoenix®

The premiere infrared solution for industrial, scientific and military applications

- Phoenix® Camera Family
- Talon® Data Acquisition
- Multiple Electronic Back End Options
- Infrared Optics

indigo™

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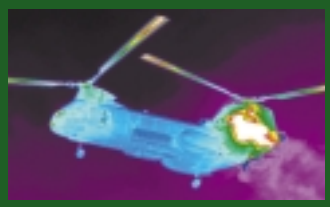
Phoenix® Advantages



- > Modular system with choice of two electronic back ends for turn-key flexibility
- > Covers three primary IR wavebands – NIR, MWIR and LWIR
- > Available in Mid- and Large- format
- > 14-bit extended dynamic range
- > High frame rate and windowing capability
- > Synchronization with external events
- > Snapshot exposure mode

Phoenix – The New Standard for IR Cameras

Indigo's Phoenix digital infrared camera line features 14-bit extended dynamic range, snapshot exposure mode, high frame rate capability and excellent resolution within a small, rugged package. Phoenix is a modular system, consisting of a camera head and a choice of two video signal processing electronics back ends, the Real-Time Imaging Electronics (RTIE) or Digital Acquisition System (DAS).

Advanced CMOS Sensor Design Features

Phoenix's infrared sensors are built using Indigo's own standard CMOS readout integrated circuits (ROICs). These ROICs offer many advanced features, including snapshot (simultaneous) pixel exposure, adjustable gain, variable exposure times, windowing, and invert/revert.

Selectable Resolution

All Phoenix camera heads are available in a 320 x 256 and 640 x 512 formats. All sensor types support windowing to allow high speed readout of sub-arrays. The same compact housing is used for each type of camera head, regardless of detector type or size. Designed for severe environments, the camera head offers both conductive and convective cooling for operation over wide ranges of temperature and altitude.

Standardized Interfaces

As with Indigo's Merlin® infrared cameras, a common electrical, software, and user interface is provided within the Phoenix line.

Indigo offers optics for Phoenix cameras ranging from microscopes to telescopes. All lenses are interchangeable.

Phoenix Applications

Indigo's Phoenix camera is ideal for any infrared industrial, scientific, or military use when flexibility and unequaled performance is vital. Typical Phoenix applications include;

Pulsed Laser Detection – Minimization of atmospheric back scatter is extremely important for actively illuminated, passive imaging systems. The ability to precisely "gate" the integration of return energy from a target, for very short time periods, at very low noise levels is what makes the Phoenix NIR camera perfect for this application.

Atmospheric Phenomenology – When flexible and high speed sampling rates are needed to successfully capture passive target signatures or signals from actively illuminated systems, through turbulent atmospheric paths; the Phoenix windowing modes are essential. Additionally, the camera's integrate-while-read mode maximizes sensitivity by allowing almost 100 percent of the frame time for integration of the signal.

Non-Destructive Testing – For applications where profiling the decay of the thermal signatures is required, the external synchronization and high speed, uninterrupted, sequence acquisition modes make Phoenix/Talon the ideal tool.

Long Range Surveillance – When high resolution and magnification are required for detection of thermal targets at long range, a large format Phoenix camera with a 60/180/500 mm telescope provides an optimum solution.

Real-Time Imaging Electronics (RTIE)

RTIE Electronics

The Real-Time Imaging Electronics (RTIE) is a dedicated electronics subsystem that provides both analog and digital video, at data rates up to 12.2 megapixels per second.

The RTIE furnishes real-time pixel gain and off-set corrections, and generates NTSC video (PAL optional), as well as S-Video. Phoenix employs a "split" architecture configuration under which the camera head is separated from the electronics by either a 10 or 50-foot interface cable.

Phoenix is designed to be remotely controlled through a graphical user interface (GUI) camera control application running on a user-furnished PC. The Phoenix architecture supports field installation of camera software updates.

Features supported include: windowing capability to allow frame rates greater than 13 kHz and 9 kHz for mid and large format FPAs, respectively; built-in programmable trigger delays; adjustable integration time; and a variety of synchronization modes to synchronize the camera to external events. Consult our interactive frame rate calculator on Indigo's website for performance predictions. (http://www.indigosystems.com/phoenix_calc.html)

Talon® Option for Phoenix RTIE

The 14-bit digital data is available from the RTIE for transfer to a frame grab board via a 37-pin D-sub connector. Indigo offers Talon® Ultra, a digital image acquisition and analysis system, consisting of a digital frame grab board, 10-foot interface cable, and all software required for image acquisition and analysis. These components are configured and delivered in a state-of-the-art Pentium™ class computer.

The Talon® software is based on a licensed version of Image Pro® software with custom extensions. This software provides a full range of utilities for processing, measurement, analysis, and image output. It is ideally suited for any research professional – using Indigo's Phoenix™ IR cameras – to capture, study, manipulate, and store images and data.

Digital Acquisition System (DAS)

DAS Electronics

The Digital Acquisition System (DAS) electronics is a portable PC based system. The DAS includes a proprietary camera interface/sync processor board capable of handling data rates up to a maximum of 40 megapixels per second.

Post acquisition non-uniformity compensation is performed within the DAS. The DAS can store at least 10 seconds of full bandwidth data from the Phoenix camera head.

To aid in aiming and focusing the camera, the DAS provides a pseudo-real-time video display in a VGA window.

User interface software is factory-installed. The camera architecture supports field installation of software updates.

The Phoenix system's "split" architecture configuration allows for 10 or 50-foot separation between camera head and DAS electronics. Synchronization modes, windowing capabilities and triggering features of the RTIE are common to the DAS system. One key difference between RTIE and DAS systems is a provision for two additional video channels in the DAS. This enables DAS electronics to capitalize on and extract the maximum performance capabilities of the FPA. Frame rates of 38 kHz and 22 kHz are supported for mid and large format FPAs respectively.

Camera Head Specifications

	Phoenix-Near			Phoenix-Mid		Phoenix-Long	
Detector	Indium Gallium Arsenide (InGaAs)			Indium Antimonide (InSb)		Gallium Arsenide (GaAs) Quantum Well Infrared Photodetectors (QWIP)	
Spectral Range	0.9 – 1.7 microns			1.5 – 5.0 microns		8.0 – 9.2 microns	
Cold Filter Bandpass	Not Required			3.0 – 5.0 μm standard		Not Required	
Resolution	320 (H) x 256 (V) pixels or 640 (H) x 512 (V) pixels			320 (H) x 256 (V) pixels or 640 (H) x 512 (V) pixels		320 (H) x 256 (V) pixels or 640 (H) x 512 (V) pixels	
Detector Size	30 x 30 μm for 320 x 256 25 x 25 μm for 640 x 512			30 x 30 μm for 320 x 256 25 x 25 μm for 640 x 512		30 x 30 μm for 320 x 256 25 x 25 μm for 640 x 512	
Well Capacity		High Gain	Low Gain	18 M electrons for 320 x 256 11 M electrons for 640 x 512			
	mid	107 K electrons	3.5 M electrons				
	large	93 K electrons	2.5 M electrons				
Integration Type	Snapshot			Snapshot		Snapshot	
Integration Time (Electronic Shutter Speed)	320 x 256: 500 nS to full frame time	640 x 512: 3 μS to full frame time		320 x 256: 9 μS to full frame time	640 x 512: <50 μS to full frame time	320 x 256: 9 μS to full frame time	640 x 512: <50 μS to full
Sensor Assembly f/#	Set by lens iris			f/2.5 standard, f/4.1 optional		f/2.5 standard	
Sensor Cooling	Thermoelectric (TEC) stabilization			Stirling closed cycle cooler; optional Liquid Nitrogen (LN_2)		Stirling closed cycle cooler	
Lens Mount	C-mount			Bayonet Twist-Lock		Bayonet Twist-Lock	
Power Dissipation	< 25 Watts steady-state (25 °C)			40 Watts steady-state (25 °C)		45 Watts steady-state (25 °C)	

Electrical Interface

	Real-Time Imaging Electronics (RTIE)	Digital Acquisition System (DAS)
Analog Video	NTSC (PAL optional) via BNC connector; S-Video	DAS furnishes digital video only, via a VGA window on the PC display
Digital Video	14-bit parallel, RS-422 compatible	14-bit parallel/LVDS
Output Data Rate	12.2 Mpixels/sec (14.75 Mpixels/sec PAL)	40.0 Mpixels/sec
Record Time	N/A	Up to 10 seconds at full 40-Mpixel data rate
Non-Uniformity Compensation (NUC) Tables	8 for 320 x 256; 3 for 640 x 512; non-volatile memory	Limited by hard drive size;
External Sync Inputs (TTL)	Frame sync; composite sync in (Genlock) via BNC	Frame sync in via BNC
External Sync Outputs (TTL)	Frame sync; via BNC	Frame sync; integration valid via BNC
External Sync I/O (RS-422)	Same as TTL plus clock out, D-sub connector	Same as TTL plus clock out, D-sub connector
Camera Control	Via standard 9-pin RS-232 serial port and PC-based control program	Via locally hosted user interface program on PC
Power Dissipation	< 15 Watts	< 200 Watts
Input Power	100/220 VAC	110/220 VAC

Optics – MWIR and LWIR

Lens Focal Length	320 x 256 Resolution	640 x 512 Resolution
	Field of View, HxV	Field of View, HxV
Microscope*	1x, 2.5x, and/or 4x	1x, 2.5x, and/or 4x
13 mm	40.5 x 32.9 degrees FoV	63.2 x 52.4 degrees FoV
25 mm	21.7 x 17.5 degrees FoV	35.5 x 28.7 degrees FoV
50 mm	11.0 x 8.8 degrees FoV	18.2 x 14.6 degrees FoV
100 mm	5.5 x 4.4 degrees FoV	9.1 x 7.3 degrees FoV
Dual Field of View* (50/250 mm)	50 mm (11 x 8 degrees FoV) 250 mm (2.2 x 1.8 degrees FoV)	50 mm (18.2 x 14.6 degrees FoV) 250 mm (3.7 x 2.9 degrees FoV)
Triple Field of View* (60/180/500 mm)	60 mm (9.1 x 7.3 degrees FoV) 180 mm (3.1 x 2.4 degrees FoV) 500 mm (1.1 x 0.9 degrees FoV)	60 mm (15.2 x 12.2 degrees FoV) 180 mm (5.1 x 4.1 degrees FoV) 500 mm (1.8 x 1.5 degrees FoV)

A variety of NIR lenses available. * MWIR only.

Physical Specifications

	Phoenix Camera Head	RTIE Electronics	DAS Electronics
Size (L x W x H)	7.5" x 4.4" x 5.2"	6.0" x 6.0" x 5.0"	13" x 10" x 17"
Weight	7 lbs.	6 lbs.	34 lbs.
Base Mounting	1/4" x 20" w/ guide pin notch	1/4" x 20" w/ guide pin notch	Portable PC
Thermal Management	Conductive & Convective	Conductive & Convective	Convective
Temperature/Altitude Range, Operational	-20 to +60°C 0 to 40,000 feet	-20 to +60°C 0 to 40,000 feet	Commercial/Industrial Environment
Temperature/Altitude Range, Non-Operational	-55 to +80 °C 0 to 70,000 feet	-55 to +80 °C 0 to 70,000 feet	Commercial/Industrial Environment
Shock	20g, 11mS half sine pulse	20g, 11mS half sine pulse	Commercial/Industrial Environment
Vibration	6.7 G RMS random vibe, all 3 axis		Commercial/Industrial Environment
Humidity	< 95% Relative Humidity	< 95% Relative Humidity	Commercial/Industrial Environment

Camera Specifications

	Phoenix-Near	Phoenix-Mid	Phoenix-Long
Performance Figure of Merit	Noise Equivalent Irradiance (NEI)	Noise Equivalent Temperature Difference (NEdT)	Noise Equivalent Temperature Difference (NEdT)
Spec Performance	Low Gain: ≤ 3E-10W/cm^2 High Gain: ≤ 1.5E-7W/cm^2	< 25 milliKelvin	< 35 milliKelvin
Operability	> 99.5% > 99.8% typical	> 99.5% > 99.8% typical	> 99.5% > 99.8% typical
Dynamic Range	14 bits	14 bits	14 bits
Max Frame Rates with DAS Electronics fps = frames per sec	320 x 256: 345 fps in full frame; 38 kHz in smallest window (2 x 128) 640 x 512: 100 fps in full frame; 22 kHz in smallest window (4 x 128)		
Max Frame Rates with RTIE Electronics fps = frames per sec	320 x 256: 120 fps in full frame; 13.6 kHz in smallest window (2 x 64) 640 x 512: 30 fps in full frame; 9.55 kHz in smallest window (4 x 64)		

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