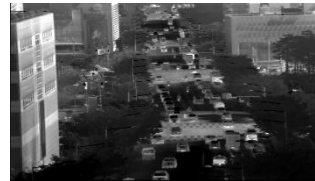


Longwave Infrared Thermal Imaging Camera



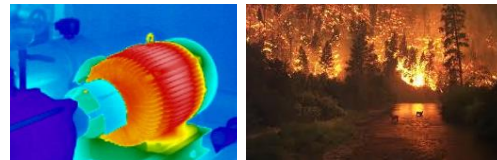
Security application cameras

384x288 resolution: CG300
640x480 resolution: CG600
1024x768 resolution: CX1000



Radiometric (Thermography) application cameras

384x288 resolution: CG320
640x480 resolution: CG640



Thermal network cameras transmitting video data and temperature data

384x288 resolution: CG320-IP
640x480 resolution: CG640-IP
1024x768 resolution: CX1000-IP (transmits video data only)

Thermal cameras for automotive night vision

384x288 resolution thermal camera for automotive night vision



Others

Lenses (variety of lenses from 4.8-250mm), zoom lenses, 2FOV, Athermalized, Macro
Housing with Ge window
PT Drive



#810, Hanwha Biz Metro 1-cha, 242, Digital-ro, Guro-gu, Seoul, Korea (Zip: 08394)
Phone: 82-2-857-3888, Fax: 82-70-7614-3871 E-mail: sales@coxcamera.com www.coxcamera.com

Radiometric application thermal cameras

All CG series radiometric models are with latest version of thermal detectors from ULIS, which are, QVGA Gen2 detector and VGA Gen2 detector, respectively. Those detectors have better NETD than detectors for former CX series models, and just several times of NUC in a day is good enough because they are shutter-less compatible. Even though we do not execute NUC every 5 minutes or 1 minute, image quality is much better than former CX series models.

By increasing processing capacity, CG series cameras has more detailed features in alarm setting and ROI settings which were only available in thermal imaging analyzer.

CG series radiometric thermal cameras are fully controlled by thermal imaging analyzer on PC.

SDK for thermal imaging analyzer, working in Windows and developed in C++ language, is provided for customers who develop own version of thermal imaging analyzer.

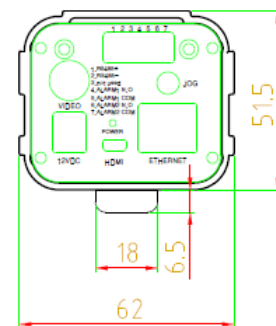
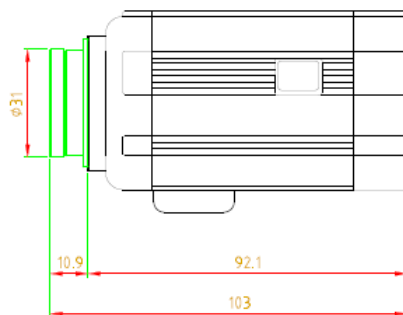
Radiometric models	CG320	CG640
Resolution(sensor pixels)	384x288	640x480
Thermal sensitivity of sensor (NETD)	40mK @ f1.0 30Hz 300K	50mK @ f1.0 30Hz 300K
Spectral response	8-14μm	8-14μm
Measurement accuracy in lab condition	±2°C or ±2% of reading (Accuracy is not guaranteed in measurement in the open air far apart from the object)	
Output	CVBS analogue video(BNC port) Temperature raw data from all pixels(Giga Ethernet)	
Temperature detection mode		
Normal temperature detection	-20~120°C	-20~120°C
High temperature detection(Dual)	0~650°C	0~650°C
PC software included	Thermal imaging analyzer: Radiometric analysis PC software Camera controller: Access to camera via Ethernet for set-up Thermal report: help preparing report	
Lenses	From 4.8 to 250mm/Manual focus or motorized focus Zoom, 2 FOV, Athermalized, Macro-lens for PCB inspection	
Application	Medical/Fire Prevention/Preventive maintenance/PCB inspection/R & D/Process control/others	



Specification of Thermography Cameras CG320 and CG640

	CG320	CG640	Remark
Resolution(pixels)	384x288	640x480	
Spectral response	8-14μm		Un-cooled LWIR micro-bolometer
Thermal Detector	Pixel Pitch		17μm
	Thermal Sensitivity (NETD) of sensor		<40mK @f1.0, 30Hz, 300K <50mK @f1.0, 30Hz, 300K
	Operating temperature (ambient temperature)		-10°C to 60°C (Installing thermal cameras inside housing with built-in fan and heater to keep inside temperature in a certain range, for example, 15 to 25°C, is recommended for use in out of operating temperature range for accuracy in measurement)
Range of temperature measurement	CG320 & CG640: Normal temperature detection mode: -20 ~ 120°C High temperature detection mode: 0 ~ 650°C		Thermal camera set at normal temperature detection mode has better accuracy in measurement
Control of focus/zoom	CG series cameras include circuit for controlling lens motors for focusing and zooming respectively. Thermal imaging analyzer for CG320 and CG640 has icons for focusing "+"/"-" and zooming "+"/"-".		CG series model itself controls lens motor for focusing and zooming, and no extra control board is not necessary for control of lens motors.
System	Video Output		BNC connector(composite), HDMI
	Temperature data output		via Ethernet port(Giga E)
	Data refresh rate		30Hz & 50Hz
	Video frame Rate		BNC connector(composite): NTSC 30Hz, PAL 25Hz HDMI: Selectable
	Ethernet		Giga Ethernet(10/100/1000Mbps)
Lens	4.8mm to 250mm lenses, manual/motorized focus, zoom		Athermalized/Macro lens available
PC Software	CG320/CG640: Thermal imaging analyzer Camera controller Thermal report		Thermal imaging analyzer for CG320/CG640(1:1 connection): End of Sep., 2016 Thermal imaging analyzer for CG320/CG640(Multi-connection): end of Mar. 2017

CG320 with 13.6m f1.0 manual lens

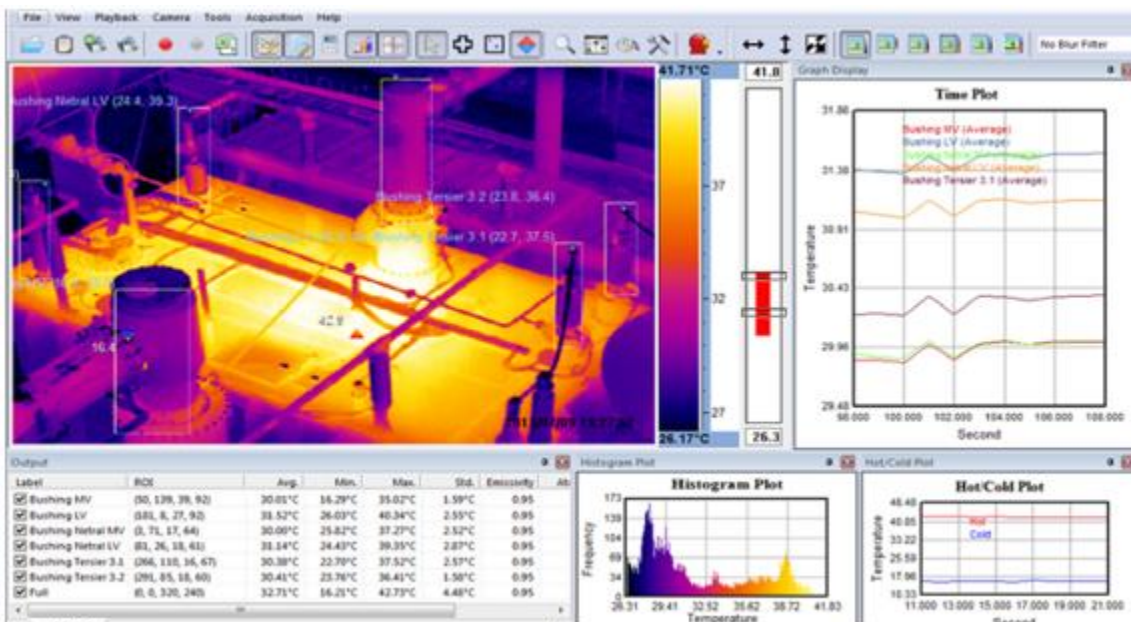


Size of camera case for 320 and CG640 is identical.

PC software for CG series radiometric cameras

CG320(384x288 resolution) and CG640(640x480 resolution) models have two different outputs, that is, CVBS analogue video data from BNC port and temperature raw data of each pixel from Ethernet port. All CG series thermography models are supplied with PC software for easy analysis with temperature raw data from thermal camera via Ethernet.

- **Thermal Imaging Analyzer**



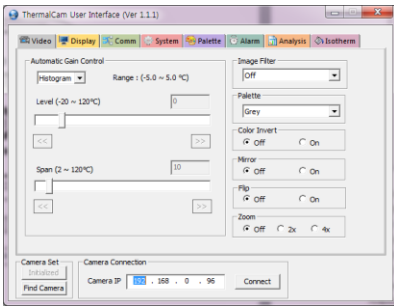
Thermal imaging analyzer on PC receives temperature raw data of all pixels via Ethernet from the camera connected to PC, and analyzes temperature data in various ways as user wants.

User can set ROI (Region of Interest) in different patterns to analyze just in ROI or to exclude specific area in the scene, and thermal imaging analyzer create alarm signal and play wave file or frame of image is glittering as set and two alarm relay-outs are available from the camera in addition to alarms on PC, when alarm conditions are met.

Multi-connection thermal imaging analyzer to which user can connect multi-cameras simultaneously shall be released early 2017.

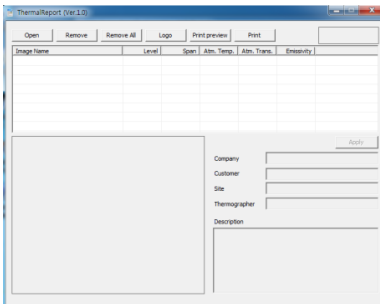
COX provides customers who develops own thermal imaging analyzer with SDK with sample program, working in Windows, prepared in C++ program language with technical support.

● Camera controller



With camera controller, user can access to the camera via Ethernet apart from the camera and change different settings.

● Thermal report



Using thermal report program, user can load radiometric jpeg file generated by thermal imaging analyzer, add description to each file, and make a thermal report easily.

COX provides users who want to develop own thermal imaging analyzer with SDK and sample program developed in C++ language.

FOV of COX thermal cameras

COX thermal cameras are supplied with different kinds of lenses to meet customers' requirements for the projects. Focal length from 4.8mm to 250mm is available, manual or motorized lens. Various continuous zoom lenses, 2FOV lenses, and athermalized lenses are also available. COX thermography cameras with macro-lenses to measure temperature of very small part, like pins of chip on PCB in SMT line are also available.

HFOV and VFOV for all COX cameras

Focal length (mm)	CX300/CX320/CM300-PAL		CX300/CX320/CM300-NTSC		CG300/CG320/CG320-IP PAL/NTSC		CX600/CX640/CX610/CM600-PAL/NTSC		CG600/CG640/CG640-IP PAL/NTSC		CG1000-PAL/NTSC	
	HFOV(°)	VFOV(°)	HFOV(°)	VFOV(°)	HFOV(°)	VFOV(°)	HFOV(°)	VFOV(°)	HFOV(°)	VFOV(°)	HFOV(°)	VFOV(°)
4.8	100.4	84.0	90.0	73.7	68.4	54.0	97.1	80.7	97.1	80.7		
5					66.3	52.2						
8	61.9	48.5	53.1	41.1	44.4	34.0	68.4	54.0	68.4	54.0		
8.16					43.6	33.4						
12	43.6	33.4	36.9	28.1	30.4	23.1	48.8	37.6	48.8	37.6		
13.6					27.0	20.4						
20					18.5	14.0						
20	27.0	20.4	22.6	17.1	18.5	14.0	30.4	23.1	30.4	23.1		
35	15.6	11.8	13.0	9.8	10.7	8.0	17.7	13.3	17.7	13.3	27.9	21.1
50	11.0	8.2	9.2	6.9	7.5	5.6	12.4	9.3	12.4	9.3	19.8	14.9
75	7.3	5.5	6.1	4.6	5.0	3.7	8.3	6.2	8.3	6.2	13.2	10.0
100	5.5	4.1	4.6	3.4	3.7	2.8	6.2	4.7	6.2	4.7	10.0	7.5
130	4.2	3.2	3.5	2.6	2.9	2.2	4.8	3.6	4.8	3.6	7.7	5.8
150	3.7	2.8	3.1	2.3	2.5	1.9	4.2	3.1	4.2	3.1	6.6	5.0
200	2.8	2.1	2.3	1.7	1.9	1.4	3.1	2.3	3.1	2.3	5.0	3.7
210	2.6	2.0	2.2	1.6	1.8	1.3	3.0	2.2	3.0	2.2	4.8	3.6
250	2.2	1.7	1.8	1.4	1.5	1.1	2.5	1.9	2.5	1.9	4.0	3.0

5mm, 8.16mm, 13.6mm, and 20mm indicated in different color are lenses designed just for CG300 and CG600, and it is used just for CG300 and CG600.

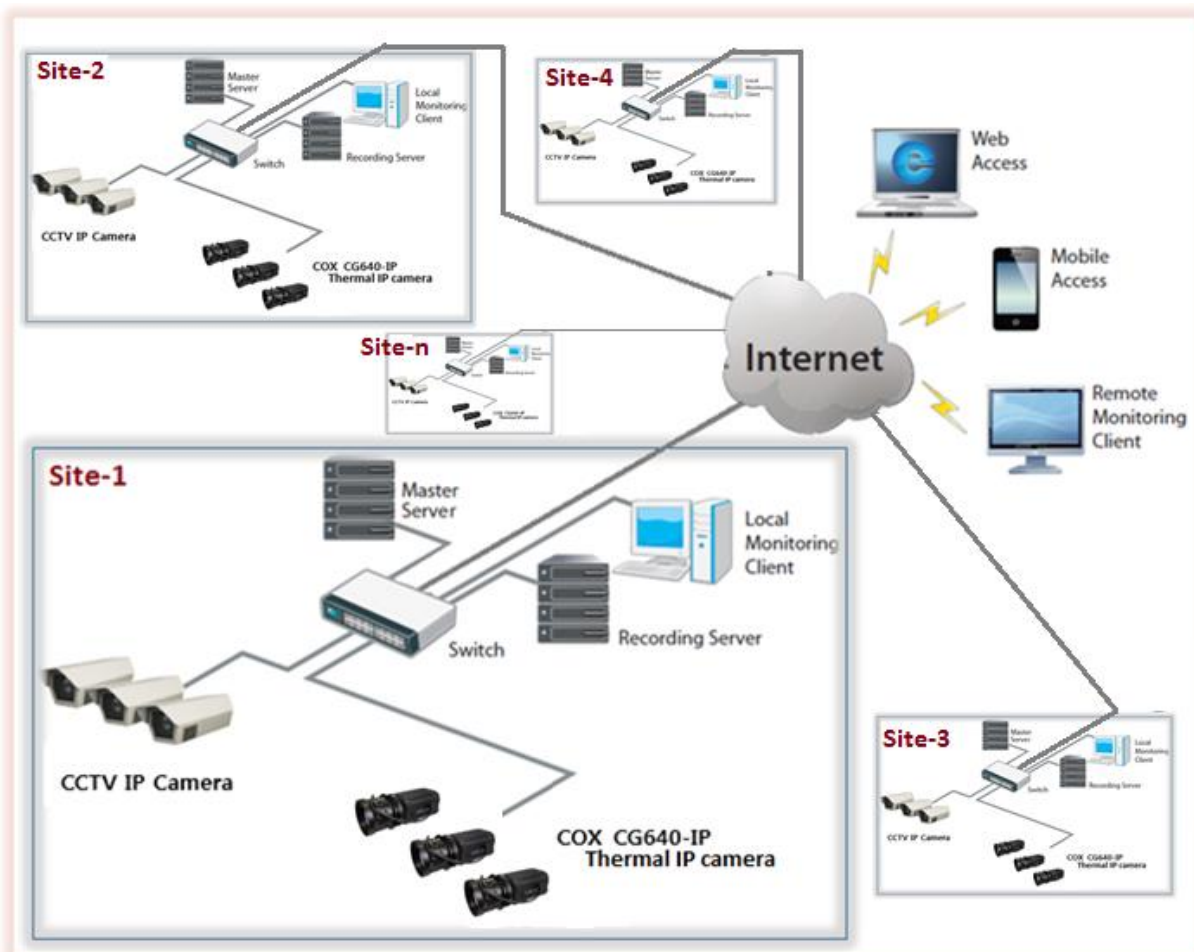
Radiometric thermal network cameras

(Thermal network cameras of measuring temperature in 300 ROIs)

CG320-IP and CG640-IP are thermal network cameras transmitting video data and temperature data simultaneously. Core of these thermal network cameras is exactly same as CG320 and CG640, with normal temperature detection mode (measure up to 120°C) or high temperature detection mode (measure up to 650°C), respectively, and they are new concept of thermal network camera and fundamentally different from other thermal network cameras already in the market.

CG320-IP and CG640-IP are very unique thermal network cameras transmitting compressed video data and temperature data of each section in the image including temperature alarm data simultaneously via IP network. User can set alarm temperature in each section which is 32 pixels x 32 pixels area in the image (20 sections x 15 sections in case of CG640-IP and it corresponds to 300 even size of ROIs) or in the group of sections in min., max., or average temperature. If temperature of any section or group of sections exceeds set temperature, corresponding camera sends alarm data in addition to compressed video data to alarm management software. Then alarm management software starts to record for set period of time (alarm recording) and pop up corresponding channel to show image in bigger size with detail data including section number and temperature in the section where measured temperature exceeded set temperature.

Alarm management software has the same structure of VMS which is very popular in CCTV field. Alarm management software is based on VuRix which is developed by Innodet Inc. who is the biggest VMS company in Korea and competing with Genetec or Milestone in the world market.



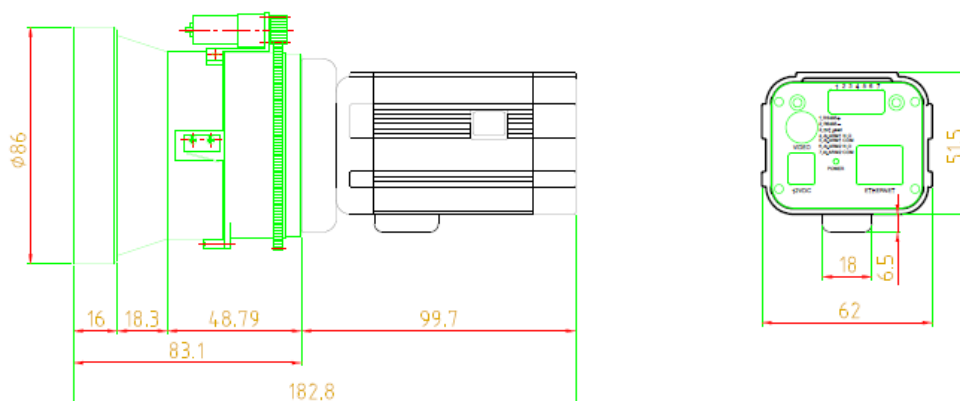
Specification of thermal network cameras CG320-IP and CG640-IP

Radiometric thermal network camera	CG320-IP	CG640-IP
Resolution(sensor pixels)	384x288	640x480
Thermal sensitivity (NETD) of sensor	<40mK @ f1.0 30Hz 300K	<50mK @ f1.0 30Hz 300K
Spectral response	8-14μm	8-14μm
Measurement accuracy in lab condition	±2°C or ±2% of reading (Thermal camera with normal temperature detection mode has better accuracy than camera with high temp. mode)	
Output	Compressed video data, Simplified format of temperature data (min., max., or average temperature in each section or group of sections), Alarm signal	
Detection mode(thermal core)		
Normal temperature detection	-20~120°C	-20~120°C
High temperature detection(Dual)	0~650°C	0~650°C
PC software included	Alarm management software as VMS in CCTV field (single site and up to 16 channels version is supplied free of charge and multi-site version and more than 16 channel version shall be charged min. level of cost) Windows version of SDK provided for customers who develop own software	
Lenses	From 4.8 to 250mm/Manual focus or motorized focus Zoom, 2 FOV, Athermalized	
Application	Fire prevention, Preventive maintenance, Intrusion detection (human, animal) and other general analysis application	

ONVIF and POE supported



CG320-IP/CG640-IP with
75mm f1.0 motorized
lens

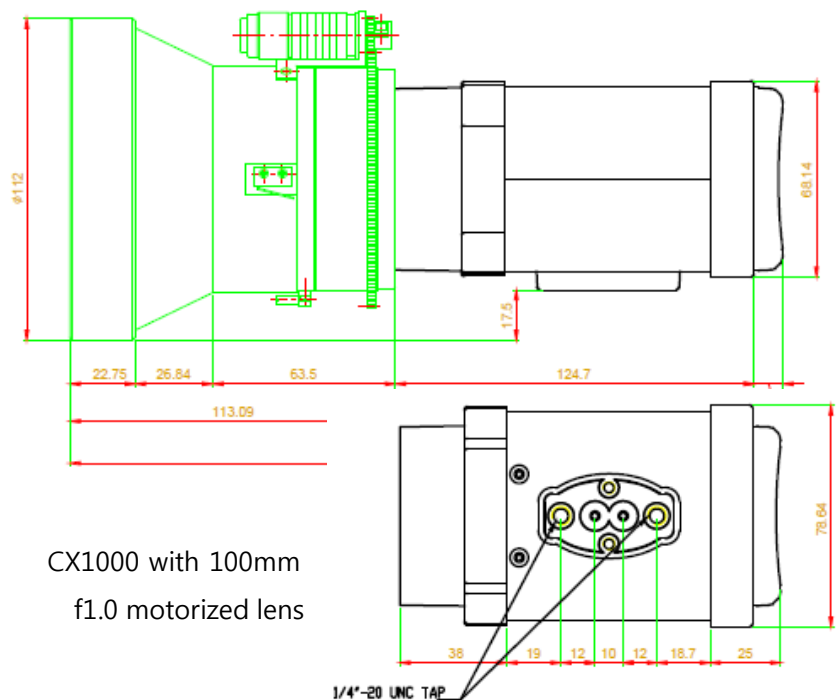


High resolution thermal camera

COX released CX1000 which is with XGA Gen2 thermal sensor, 1024 x 768 pixels 17µm pixels pitch. It is another latest version of thermal sensor from ULIS, in addition to QVGA Gen2 and VGA Gen2, and COX completed new thermal cameras products mix with Gen2 series thermal sensors from ULIS.

CX1000 is security application thermal camera which has the same interface as CG300 and CG600, and CX1000-IP is thermal network camera based on CX1000. CX1000-IP transmits video data only, and does not transmit temperature data or temperature alarm data as CG320-IP or CG640-IP thermal network cameras. Both CX1000 and CX1000-IP are very suitable to observe wide area with very high image quality.

High resolution thermal camera	CX1000	CX1000-IP
Resolution(sensor pixels)	XGA (1024 X 768)	
Thermal sensitivity (NETD) of sensor	<50mK @ f1.0 30Hz 300K	
Spectral response	8-14µm	
Output	CVBS analogue video HDMI	Compressed video data (ONVIF)
Lenses	From 4.8 to 250mm/Manual focus or motorized focus Zoom, 2 FOV, Athermalized	
Application	Security (analogue camera)	Surveillance over IP network



CX1000 with 100mm f1.0 motorized lens

Camera case of CX1000 and CX1000-IP is identical

Security application thermal cameras

COX completed full line up of security application thermal cameras, which are, QVGA model, VGA model, and XGA models, all with Gen2 series of thermal sensor which are latest version of thermal sensor from ULIS, France.

Security models	CG300	CG600	CX1000
Resolution(sensor pixels)	384x288	640x480	1024X768
Output	CVBS analogue video(BNC port)/HDMI		
Lenses	4.8mm/8mm/12mm/20mm/35mm/50mm/75mm 100mm/110mm/120mm/130mm/150mm/200mm/250mm Manual/Motorized focus/Zoom/Athermalized lenses/2FOV		
Control of focus and zoom	No separate lens motor control board required/Camera itself controls lens motor for focus and zoom	Separate lens motor control board required	
Application	Security and surveillance		



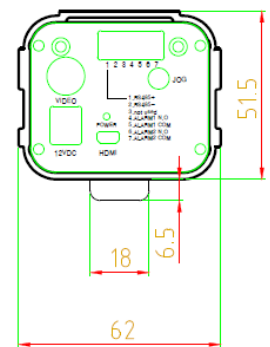
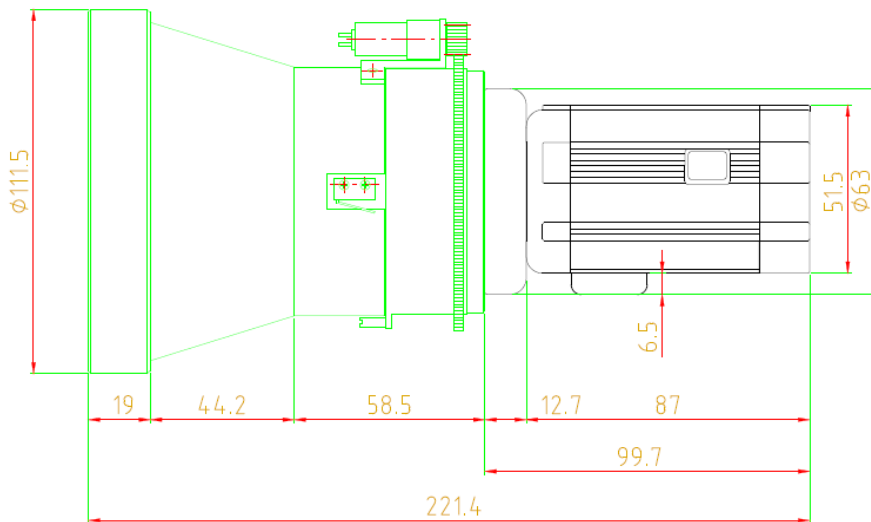
CG300 with 35mm manual lens



CG600 with 100mm motorized lens



CX1000 with 75mm manual lens



CG300/CG600 with 100mm f1.0 motorized lens

Specification of Security Cameras CG300, CG600, and CX1000

	CG300	CG600	CX1000	
Resolution(sensor pixels)	384x288	640x480	1024x768	
Pixel Pitch	17µm			
Detector Type	LWIR, Uncooled a-Si micro-bolometer			
Thermal Sensitivity of Detector(NETD)	<40mK @f/1.0, 50Hz, 300K	<50mK @f/1.0, 30Hz, 300K	<50mK @f/1.0, 30Hz, 300K	
Spectral Range	8 - 14 µm (Long-wave IR)			
Color Variation(Palette)	10 colors(Grey,Iron, Rain_v1,2,3/Half_Grey/Yellow/MidGrey/Fire/BlueRed)			
Image Setting	AGC, Level & Span, NUC, Mirror, Flip, Invert, Image Filter on Screen Menu			
Digital zoom	2x & 4x Digital Zoom			
Focus	Manual, Motorized, Athermalized			
Function	Hot/Cold tracker, Center indicator			
System	TV Mode	NTSC/PAL Compatible		
	Protocol	COX own proprietary		
	OSD menu control	Pelco-D(RS485)		
	Video Output	Standard BNC Connector(Composite), HDMI		
	Frame Rate	BNC connector(composite): NTSC 30Hz, PAL 25Hz HDMI: 50Hz or 60Hz (selectable)	50Hz	
	Start-up	<2 Seconds	<2 Seconds	<2 Seconds
Modular Type	Available (For customers who want to integrate COX thermal cameras into own system, COX supplies cameras without camera cases with technical documents)			
Optional	Outdoor housing w/ Germanium window (IP 66), Motorized, athermalized and optic zoom lens, module type available			
Input Voltage	AC(110 to 220V) to DC(12V) adaptor			
Operating Temperature	-20°C to 70°C (Housing with built-in fan and heater is recommended for use in the open air)			
Storage Temperature	-40°C to 70°C			

Lenses for COX thermal cameras

COX supplies thermal cameras with variety of lens to meet customers' requirements for projects.

COX keeps a certain quantity of lenses from 8mm to 75mm in focal length on stock for quick delivery.

Lenses for COX thermal cameras

- Focal length from 4.8mm to 250mm
- Manual focus or motorized focus
- Continuous zoom lenses
- Athermalized lenses (focus remain unchanged in long use in frequent ambient temperature changes)
- Macro-lens for measuring very small parts under 1mm
- 2 FOV lenses
- Germanium window
- AR or DLC coating as per request



Thermal camera for automotive night vision

COX developed thermal cameras for automotive night vision application, just as FLIR Path Finder II, and started to supply to motors companies in cooperation with LG group company who developed tracking software detecting human or animal in the image on both sides of road in front of car in the dark. Processing algorithm of thermal camera for automotive night vision is prepared in such a way that tracking software detect human or animal which have a certain body temperature in very high probability.

Specification of COX automotive night vision system

Thermal Imaging Performance	
Sensor type	Uncooled micro bolometer developed specially for automobile application
Field of view	19.4° x 14.6°
Spectral band	8 – 14 um
Resolution	384 x 288 pixels
Time to Image	< 10 sec.
Pixel pitch and NETD of sensor	17 um, 40mK @ f1.0, 30Hz, 300K
Focal length and focus range	18.8 mm f1.0 athermalized lens, 2.4 m to infinity
IP rating, lens protection	IP67, Ge window with built-in heater for defrosting
Outputs	
Video (from ECU)	CVBS analogue(NTSC/PAL), HDMI(480p, 576p, 720p, 1080i, 1080p selectable)
Connector type	BNC Connector for Video out 8-pin custom connector for power in, audio out
Frame Rate	PAL: 25 fps, NTSC: 30fps, HDMI(Selectable)
Power	
Power requirements	12 VDC nominal (range 9V to 60V)
Environmental	
Operating Temperature	-40°C to +85°C for camera -20°C to +70°C for ECU The operating temperature range of the Camera is -40°C to +85°C when operating in a closed compartment with heat sink to chassis. In a ventilated area, the heat sink between ECU and vehicle chassis may be removed, in which case the temperature range is -40°C to +70°C.
Storage Temperature	Ambient temperature, storage:-55°C to +95°C limited by the environmental temperature diurnal.
Impact protection/Water resistance	ES95400(Engineering specification of Hyundai Motors Company)
EMI/EMC	ES96200(Engineering specification of Hyundai Motors Company)



Components of automotive night vision

- Thermal imager
- ECU and tracking software
- (Display unit)
- LVDS cable between camera and ECU
- Video cable (HDMI or Composite)
- Power cable (cigar jack)



Thermal camera for automotive night vision

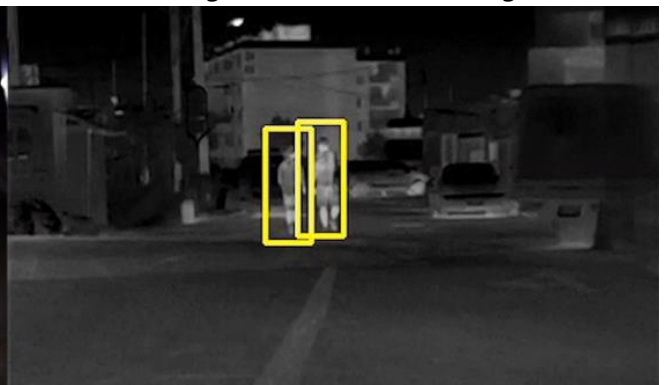
- Thermal sensor 384 x 288 pixels, 17µm pixel pitch
- Athermalized lens 18.8mm f1.0
- HFOV 19.4°, VFOV 14.6° (Specially designed for automotive night vision)
- 2t, 32mm Ge window with DLC coating with built-in heater for defrosting
- IP67
- Size: 57mm (W) x 57mm (H) x 65.4mm (L)

Images by thermal camera for automotive night vision (without tracking software)



Low luminance camera (visible camera)

Automotive night vision (with tracking software)



Only with eye identification with headlights on, driver cannot detect two men on the center line of road

Tracking software of automotive night vision detects two men on the center line of road

We can apply thermal cameras for automotive night vision for other application. We are working on a special project installing those thermal cameras with wider view angle lens, FOV about 50°, on military vehicles in operation, for driving at relatively slow speed without turning on headlights.



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