



# OPTICAL GAS IMAGING



INFRARED CAMERAS FOR GAS LEAK DETECTION

# MAKE INVISIBLE GASES VISIBLE

## SAVE LIVES, REVENUE, AND THE DAY

Optical gas imaging cameras give you the power to spot invisible gases escaping into the environment faster and more reliably than traditional “sniffer” detectors. With a FLIR GF-Series camera, you can document gas leaks that lead to lost product, lost revenue, fines, and safety hazards.



SEE HYDROCARBON LEAKS CLEARLY



FIND SF<sub>6</sub> LEAKS EASILY

## METHANE AND HYDROCARBONS

Scan thousands of connections for natural gas (methane) and other hydrocarbon leaks quickly and from a safe distance to avoid regulatory violations, fines, and lost revenue.



DETECT LEAKS FROM HYDROGEN-COOLED GENERATORS

## HYDROGEN [CO<sub>2</sub> TRACER GAS]

Imaging the tracer gas, CO<sub>2</sub>, with an optical gas camera allows operators of hydrogen-cooled generators to efficiently find hydrogen leaks.

## SULFUR HEXAFLUORIDE

Scan substation circuit breakers for sulfur hexafluoride (SF<sub>6</sub>) leaks at a safe distance from high-voltage areas, without the need to shut down operations.



SPOT HARD-TO-FIND CO<sub>2</sub> LEAKS

## CARBON DIOXIDE

Prevent shut-downs by detecting carbon dioxide (CO<sub>2</sub>) leaks early in chemical production, manufacturing, and Enhanced Oil Recovery programs.



FIND LEAKS AT STEEL PLANTS

## CARBON MONOXIDE

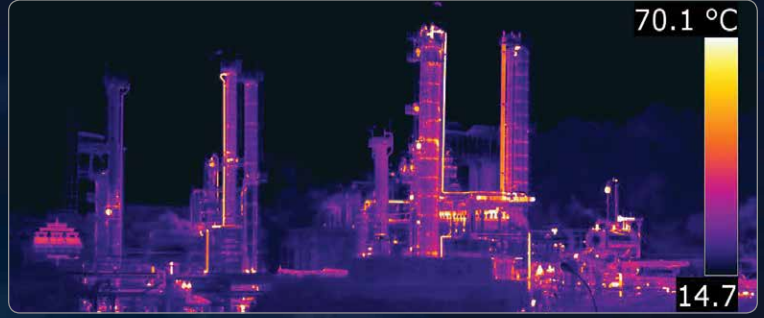
Protect workers and the environment from toxic levels of CO by pinpointing leaks quickly and efficiently.



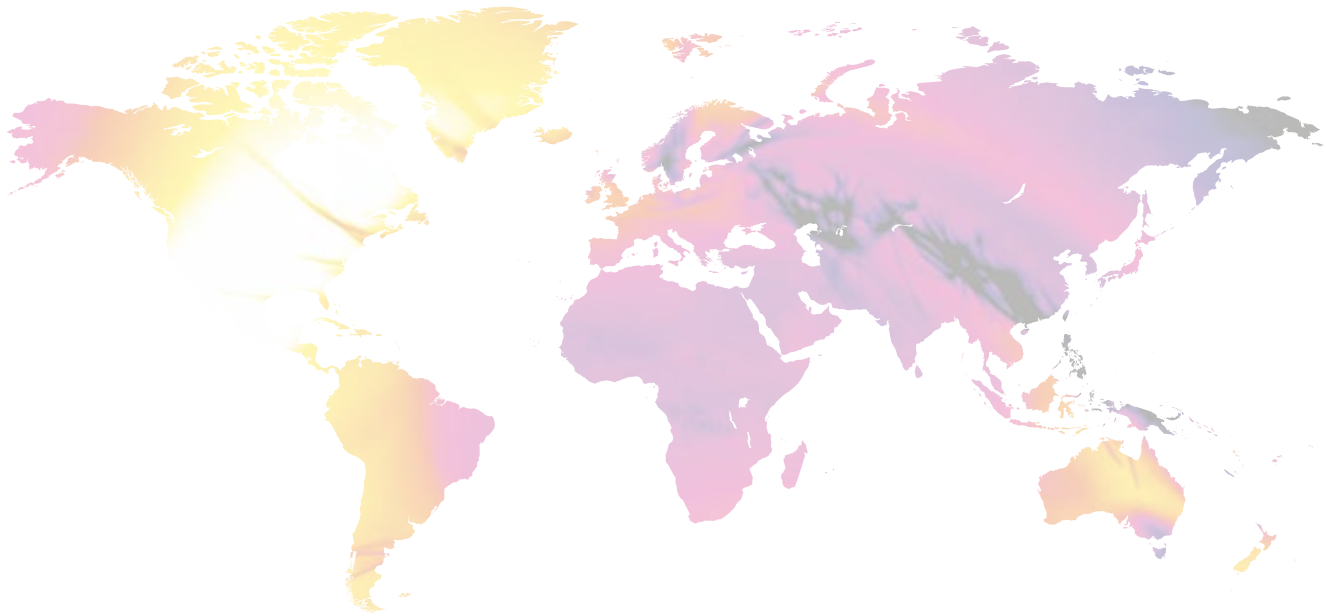
DETECT R-124 COMPRESSOR LEAKS

## REFRIGERANTS

Find leaks early to avoid interruptions in operations, prevent the loss of perishable products, and limit the environmental impact of toxic refrigerants.



FROM NATURAL GAS EXTRACTION TO PETROCHEMICAL OPERATIONS AND POWER GENERATION, COMPANIES HAVE SAVED MORE THAN \$10 MILLION ANNUALLY IN LOST PRODUCT BY INCLUDING FLIR OPTICAL GAS IMAGING IN THEIR LEAK DETECTION AND REPAIR (LDAR) PROGRAMS.



## FLIR: The world leader in thermal imaging cameras

FLIR is the world leader in the design, manufacturing and marketing of thermal imaging systems for a wide variety of commercial, industrial and government applications.

FLIR thermal imaging systems use state-of-the-art infrared imaging technology that detects infrared radiation - or heat. Based on detected temperature differences, thermal imaging cameras can create a crisp image. Advanced algorithms also make it possible to read correct temperature values from this image. We design and manufacture all of the critical technologies inside our products, including detectors, electronics, and special lenses ourselves.



FLIR, Stockholm



FLIR ATS, France



FLIR, Boston



FLIR Santa Barbara

### **Rapidly emerging markets and organisation**

Interest for thermal imaging has grown considerably over the last few years in a large variety of markets. To face this increased demand, FLIR has expanded its organisation drastically. Today we employ more than 3,200 people. Together, these infrared specialists realise a consolidated annual turnover of more than 1 billion US dollars. This makes FLIR the largest manufacturer of commercial thermal imaging cameras in the world.

### **Manufacturing capabilities**

FLIR currently operates 6 manufacturing plants: three in the USA (Portland, Boston and Santa Barbara, California) one in Stockholm, Sweden, one in Estonia and FLIR ATS - Advanced Thermal Solutions, near Paris, at Marne la Vallée.

### **More than a camera, a complete solution**

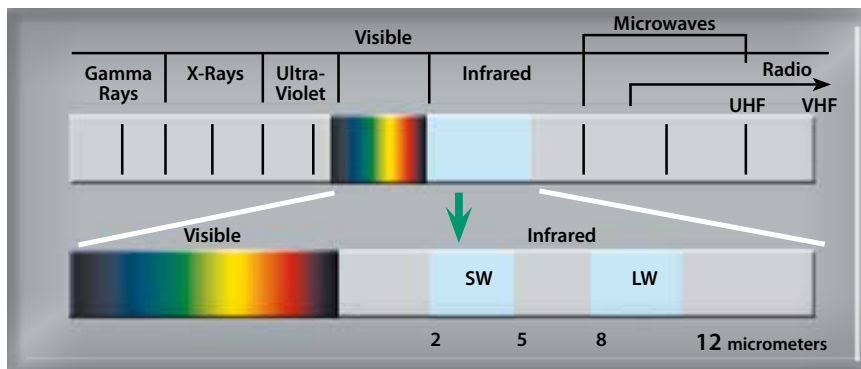
There is more to the world of thermal imaging than building a camera. FLIR is not only committed to providing you with the best camera, we are also able to offer you the best software, service and training to suit your thermal imaging needs.

## INFRARED: more than meets the eye

### Infrared - part of the electromagnetic spectrum

Our eyes are detectors that are designed to detect visible light (or visible radiation). There are other forms of light (or radiation) that we cannot see. The human eye can only see a very small part of the electromagnetic spectrum. At one end of the spectrum we cannot see ultraviolet light, while at the other end our eyes cannot see infrared. Infrared radiation lies between the visible and microwave portions of the electromagnetic spectrum. The primary source of infrared radiation is heat or thermal radiation.

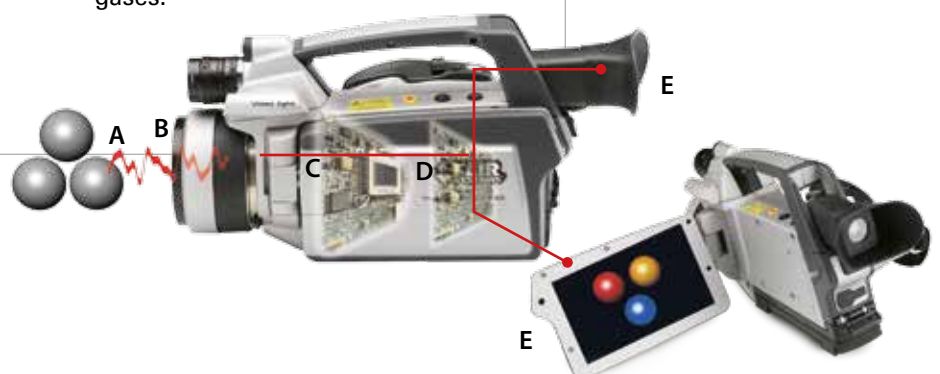
Any object that has a temperature above absolute zero (-273.15 degrees Celsius or 0 Kelvin) emits radiation in the infrared region. Even objects that we think of as being very cold, such as ice cubes, emit infrared radiation. We experience infrared radiation every day. The heat that we feel from sunlight, a fire or a radiator is all infrared. Although our eyes cannot see it, the nerves in our skin can feel it as heat. The warmer the object, the more infrared radiation it emits.



### The infrared camera

Infrared energy (A) coming from an object is focused by the optics (B) onto an infrared detector (C). The detector sends the information to sensor electronics (D) for image processing. The electronics translate the data coming from the detector into an image (E) that can be viewed in the viewfinder or on a standard video monitor or LCD screen.

Infrared thermography is the art of transforming an infrared image into a radiometric one, which allows temperature values to be read from the image. In order to do this, complex algorithms are incorporated into the infrared camera. Tuning (filtering) an infrared detector to specific wavelengths can also allow the camera to image a variety of invisible gases.



## Why use thermal imaging cameras?

Why would you choose a FLIR thermal imaging camera? There are other technologies available to help you find gases and measure temperatures in a non-contact mode. Gas sniffers and infrared thermometers for example.

### Gas sniffers versus thermal imaging cameras

In a complex petrochemical facility there may be many thousands of potential leak paths. Some may be leaking but most will not. Conventional leak detection equipment such as a Volatile Organic Compound meters (or sniffers) mean that the operator must visit and test each potential leak site. Each item must therefore be accessible or made accessible to be tested. Gas sniffers may expose inspectors to invisible and potentially harmful chemicals.

Using gas detection cameras allows the user to examine many potential leak sources in a short time and from a distance.

### Infrared thermometers vs thermal imaging cameras

Infrared (IR) thermometers are reliable and very useful for single-spot temperature readings, but, for scanning large areas or components, it's easy to miss critical components that may be near failure and need repair.

A FLIR thermal imaging camera can scan entire motors, components, or panels at once - never missing any overheating hazards, no matter how small.



IR thermometer, temperature measurement in one spot

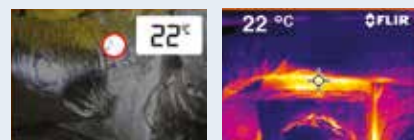


FLIR GF-Series, temperature in 76,800 spots

### Use thousands of gas sniffers and infrared thermometers at the same time

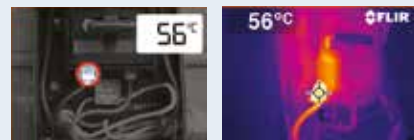
With an infrared thermometer you are able to measure the temperature at one single spot. FLIR thermal imaging cameras can measure temperatures on the entire image. FLIR GF-Series thermal imaging cameras produce an image with a resolution of 320 x 240 pixels, this means 76,800 pixels or using 76,800 infrared thermometers at the same time.

The same goes for the comparison with a gas sniffer. Using a gas sniffer, inspectors need to scan every point where gas leaks are possible, individually. A GF-Series thermal imaging camera gives the user a comprehensive overview of an entire area.



What an IR Thermometer sees.

What a thermal imaging camera sees.



What an IR Thermometer sees.

What a thermal imaging camera sees.

With a gas sniffer you can only scan one point at a time while a thermal imaging camera gives you a complete overview.

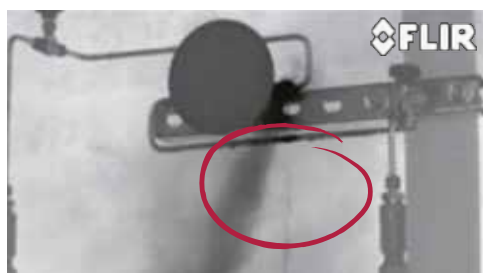


## Thermal imaging cameras for optical gas imaging (OGI) and seeing through flames

A thermal imaging camera for optical gas imaging visualizes and pinpoints gas leaks without the need to shut down the operation. The portable camera also greatly improves operator safety, by detecting gases at a safe distance, and helps to protect the environment by tracing leaks of environmentally harmful gases.



*Captured gas leak from production site.*



*A leaking pressure gauge.*



*Captured gas leak.*



*Gas leak is clearly visible on the thermal image.*

### Detecting gas leaks

Many chemical compounds and gases are invisible to the naked eye. Yet many companies work intensively with these substances before, during and after their production processes. Several gases have a high global warming potential and strict regulations govern how companies trace, document, rectify and report any leaks of harmful gaseous compounds, and how often these procedures are to be carried out.

#### Greatly Improved Efficiency

Experience shows that up to 84 percent of leaks occur in less than 1 percent of the components in a refinery\*. This means that 99 percent of what are expensive, time-consuming inspection tools are being used to scan safe, leak-free components.

Using a Gas Detection camera you get a complete picture and can immediately exclude areas that do not need any action. This means you can achieve enormous savings in terms of time and personnel.

Another advantage is that systems do not have to be shut down during the inspection. They can be carried out remotely and rapidly and – most important of all – problems can be identified at an early stage.

#### Increased worker safety

Leak detection of gases can be performed in a non-contact mode, and from a safe distance. This reduces the risk of the inspector being exposed to invisible and potentially harmful or explosive chemicals. With an optical gas imaging camera it is easy to scan areas of interest that are difficult to reach with conventional methods. The camera is ergonomically designed with a bright LCD and tiltable viewfinder, which facilitates its use over a full working day.

**Gases that can be detected are camera model dependant.**



### Thermal imaging cameras for OGI:

- Give you a full image of the situation
- Perform inspections when systems are under load
- Find the problems before real problems occur
- Save you valuable time and money
- Identify and locate the problem
- Tell you exactly what needs to be fixed
- Increase the worker safety
- Protects the environment
- Are as easy to use as a camcorder or a digital camera
- Measure temperatures
- Store information



Visual image is obstructed by flames.



Thermal image: due to the built in flame filter the FLIR GF309 thermal imaging camera can see through flames and even measures the temperatures behind the flames.

## Seeing through flames

A wide variety of industries relies on furnaces and boilers for manufacturing processes. But furnace and boiler equipment is prone to failures from a variety of mechanisms. These include coking that plugs the inside of tubes and impedes product flow, slag build-up on the outside of tubes, clinker damage, under- and over-heating, flame impingement on tubes due to burner misalignment, and product leaks that ignite and cause serious damage to the equipment.

These failures cause not only quality problems; they can also shut down an entire process line. FLIR thermal imaging cameras can detect most of these equipment problems during operation, and at an early stage, so failures can be prevented. This allows an orderly shutdown and component replacement, thereby reducing maintenance costs and production losses.

**The FLIR GF309 is the perfect tool for seeing through flames and will help you to keep your production running efficiently at all times.**



Overheated connections.

## Maintenance inspections

All FLIR GF-Series thermal imaging cameras are dual-use systems. They not only allow the user to detect gases or see through flames. They can also be used for industrial maintenance inspections. High- and low voltage electrical installations, mechanical installations, pipework and insulation, ovens and many more can all be inspected with a FLIR GF-Series thermal imaging camera.

Temperature differences that can lead to production losses or even fires can be detected before real problems occur.

**All FLIR GF-Series thermal imaging cameras can also be used for predictive maintenance inspections.**

# MAKE INVISIBLE GASES VISIBLE

## SAVE LIVES, INCREASE REVENUE

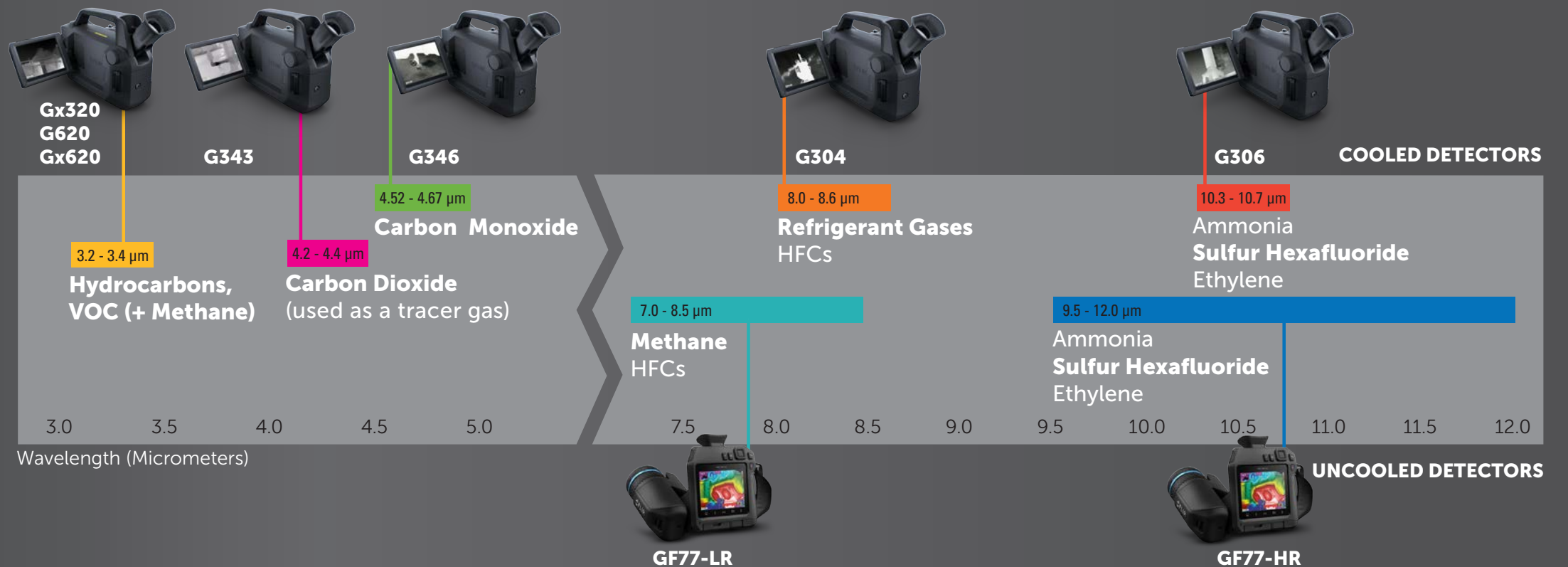
A facility can have thousands of connections and fittings that require regular inspection, but the reality is only a small percentage of these components will ever leak. Testing them all with a traditional "sniffer" takes a great deal of time and effort and may put the inspector in an unsafe environment.



Optical gas imaging cameras give you the power to spot invisible gases as they escape, so you can find fugitive emissions faster and more reliably than with sniffer detectors. With a FLIR G-Series camera, you can document gas leaks that lead to lost product, lost revenue, fines, and safety hazards.

From natural gas extraction to petrochemical operations and power generation, companies have saved more than \$10 million annually in lost product by including FLIR optical gas imaging in their leak detection and repair (LDAR) programs.

# KEY GASES DETECTED BY CAMERA



## MAIN INDUSTRY / APPLICATION

<b>Oil and Gas</b> Regulatory Compliance	<b>Utility</b> Hydrogen Leak Detection	<b>Steel</b> Safety & Environmental Stewardship	<b>Oil and Gas</b> Safety & Large Emission Event Detection	<b>Chemical</b> Safety & Environmental Compliance	<b>Utility</b> Environmental Stewardship	<b>Food &amp; Beverage</b> Safety & Productivity
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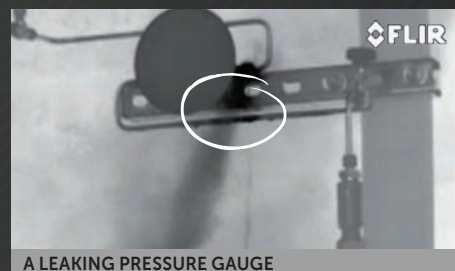


## TRACK LEAKS TO THEIR SOURCE

G-Series optical gas imaging cameras can detect natural gas, SF<sub>6</sub>, and CO<sub>2</sub> leaks quickly, accurately, and safely without the need to shut down systems, or the need for contact with the components. Gas leaks that are invisible to the naked eye look like smoke on infrared optical gas imaging cameras, making them easy to see – even from a distance.

### WITH FLIR OPTICAL GAS IMAGERS, YOU CAN:

- Scan broad areas quickly, from a safe distance
- Survey hard-to-reach connections and fittings
- Improve compliance with environmental regulations
- Check electro-mechanical systems for signs of failure, using temperature measurement capability
- Check tanks for leaks, level and efficiency



A LEAKING PRESSURE GAUGE



CAPTURED GAS LEAK



LEAK IS CLEARLY VISIBLE ON THE THERMAL IMAGE

## HANDHELD CAMERAS

When you need to survey large work areas for industrial gas or chemical leaks, a handheld optical gas imaging camera can help you get the job done quickly and efficiently. Cameras such as the Gx320, G306 and G346 allow you to check every component throughout multiple sites, and are ergonomically designed for comfortable, all-day use. These cameras also offer features such as temperature calibration for improved contrast between the gas compound and the background scene.

### G-SERIES HANDHELD CAMERAS ARE IDEAL FOR:

- Natural gas wellsites
- Chemical processing plants
- Electrical substations
- Manufacturing plants
- Power generators
- Refineries



## FIXED CAMERAS

Have a need for continuous monitoring or automated leak detection in critical areas? With thermal imaging cameras such as the G300a and GF77a, you can constantly monitor vital gas pipelines, installations, and critical components in remote or difficult to access zones. You will immediately see if a dangerous and costly gas leak appears. Monitoring is performed from a safe distance without the need to send technicians into potentially dangerous areas.

### G620a AND GF77a CAMERAS ARE IDEAL FOR:

- Offshore oil platforms
- High value well sites
- Natural gas processing plants
- Underground storage facilities
- Biogas generation plants
- Critical pipeline crossings
- Petrochemical facilities
- Compression stations

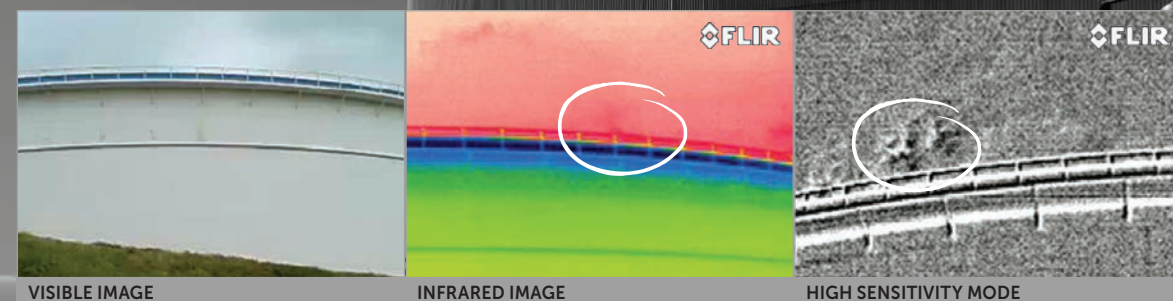
## HELPFUL ACCESSORIES

### FLEXIBLE SYSTEMS THAT MEET YOUR CHANGING NEEDS

No other thermal imaging camera manufacturer offers a wider range of accessories than Teledyne FLIR. Hundreds of accessories are available to customize our cameras for a wide variety of imaging and measurement applications, including a comprehensive range of lenses, LCD screens, remote control devices, and more.



### SCAN BROAD AREAS QUICKLY, FROM A SAFE DISTANCE



VISIBLE IMAGE

INFRARED IMAGE

HIGH SENSITIVITY MODE



## METHANE & HYDROCARBONS

### FLIR GF77™

#### Gas Find IR with LR lens

The FLIR GF77 with the LR (7-8.5 μm) lens—designed exclusively for the GF77 uncooled optical gas imaging camera—visualizes methane in real time for faster, more efficient gas leak surveys. This affordable solution is useful for both gas detection and radiometric temperature measurement, so you can safely locate leaks and perform accurate thermal inspections using one camera.



#### GF77 CAMERAS WITH LR LENSES ARE IDEAL FOR:

- Electric power utilities
- Oil and natural gas operations
- Chemical/manufacturing facilities
- First responders

### FLIR GF77a™

#### Fixed Gas Find IR

The FLIR GF77a provides continuous, autonomous leak detection for methane. This uncooled, fixed OGI camera can help you better maintain valuable capital equipment, avoid product loss, meet emissions reduction metrics, and ensure safer work practices. With advanced connectivity features that meet current industry protocols, this camera will integrate seamlessly into your current ecosystem.



#### GF77a CAMERAS ARE IDEAL FOR:

- Upstream oil and gas facilities
- Transportation terminals
- Power generation plants
- Midstream gas processing facilities

### FLIR G620a™

The FLIR G620a is a cooled, fixed camera that detects hydrocarbons and volatile organic compound (VOC) leaks that are harmful to the environment. It allows users to continuously monitor installations in remote areas or hazardous zones that are difficult to access, so inspectors can take immediate action to repair dangerous or costly leaks. The G620a is easily controlled over Ethernet from a safe distance and can be integrated in a TCP/ IP network. With a robust but small frame, the G620a also integrates to an aerial platform for OGI inspections from the sky.

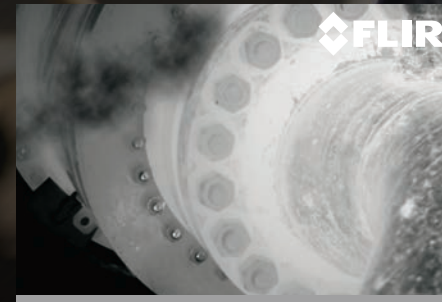


#### G620a CAMERAS ARE IDEAL FOR:

- Oil refineries
- Natural gas processing plants
- Offshore platforms
- Chemical/petrochemical complexes
- Biogas and power generation plants
- Regulatory compliance



VENTING STORAGE TANK PRESSURE RELIEF VALVE



NATURAL GAS LEAK ON COMPRESSOR VALVE



METHANE LEAK AT NATURAL GAS FACILITY SITE



## METHANE & HYDROCARBONS

FLIR Gx320™

FLIR G620™

FLIR Gx620™

The FLIR Gx320, G620, and Gx620 are cooled OGI cameras that are filtered to detect methane and hydrocarbon emissions from the production, transportation, and processing facilities in the oil and gas industry. Survey large areas up to nine times faster than with traditional gas sniffer methods to catch leaks early and reduce emissions.

Providing up to 640 × 480 IR resolution (G620 & Gx620) and highly accurate temperature measurements, inspectors can assess and improve thermal contrast between the gas cloud and the background.

The Gx320, G620, and Gx620 are verified to meet sensitivity standards defined in the US EPA's 0000a methane rule and meet reporting requirements by tagging each recording with GPS data. By finding leaks and fixing them quickly, companies can protect the environment while avoiding product losses and regulatory fines.

Safely scan for gases at great distances on difficult to monitor components, check thousands of connections quickly, and pinpoint the smallest leaks.

### HAZARDOUS LOCATIONS

The FLIR Gx320 and Gx620 allow you to quickly detect and visualize fugitive natural gas emissions while maintaining safety inside hazardous locations. These OGI cameras are certified for use in Class 1; Division 2 or Zone 2 **hazardous locations**, improving worker safety and potentially reducing pre-survey paperwork (depending on company protocols).

### THE Gx320/G620/Gx620 DETECT NEARLY 400 GASES, INCLUDING:

- Methane
- Methanol
- Propane
- Benzene
- Ethane
- Propylene
- Ethanol
- Pentane
- 1-Pentene
- Isoprene
- Butane
- Ethylbenzene
- MEK
- MIBK
- Toluene
- Octane
- Heptane
- Xylene
- Ethylene
- Hexane



### THE Gx320, G620, AND Gx620 ARE IDEAL FOR:

- Offshore platforms
- Liquid natural gas shipping terminals
- Oil refineries
- Natural gas wellheads and processing plants
- Compressor stations
- Bio-gas and power generation plants

### Gx320 & Gx620: SAFETY ZONE COMPLIANT

At offshore rigs, well sites, and production plants, there's often a risk of gas collecting and igniting with a stray spark or hot surface. Working in these areas requires special clothing and equipment – if it's possible.

The oil and gas industry has long awaited a gas detection solution such as the Gx320 & Gx620, because its hazardous location designation allows the user to work confidently and focus on the job at hand.

### THE Gx320 AND Gx620 HAVE THE FOLLOWING CERTIFICATIONS:

ATEX/IECEx, Ex ic nC op is IIC T4 Gc II 3 G  
ANSI/ISA-12.12.01-2013, Class I Division 2  
CSA 22.2 No. 213, Class 1 Division 2



## THE MOST ADVANCED GAS VISUALIZATION AND IN-CAMERA GAS LEAK QUANTIFICATION

At Teledyne FLIR, we understand that the work you do is critical and dangerous. That's why we designed the FLIR G-Series to help you do your job safer and more efficiently.

FLIR G-Series OGI cameras bring you wireless connectivity, interchangeable lens options, an ergonomic rotating touchscreen, and in-camera gas quantification\* to expand your inspection capabilities.

- Quantify gas leak size and type within the camera, eliminating the need for a secondary device\*
- Comfortably inspect from any distance with quick-swap interchangeable lenses
- Streamline the inspection process with Multi-REC (recording mode), which allows you to record across various video types including infrared, high sensitivity mode (HSM), and visual
- Instantly connect to smartphones or tablets with advanced built-in Wi-Fi and Bluetooth®
- Automatically upload and store saved images/videos to FLIR Ignite cloud software while in the field

\*Gx320, Gx620, and G620 models only

## CARBON DIOXIDE

### FLIR G343™

The G343 lets you see carbon dioxide (CO<sub>2</sub>) leaks quickly and accurately, whether the gas is the result of a production process, part of an Enhanced Oil Recovery program, or being used as a tracer gas for hydrogen. CO<sub>2</sub> is a primary greenhouse gas, with emissions resulting not only from the combustion of fossil fuels, but also from industrial processes, oil production, and manufacturing. Reliable non-contact CO<sub>2</sub> detection allows plants to inspect equipment while it is still online in the course of normal operations, avoiding unplanned outages. It also helps keep operations safe while moving towards carbon-neutral capture and storage operations.



#### G343 CAMERAS ARE IDEAL FOR:

- Enhanced Oil Recovery programs
- Hydrogen-cooled power generators
- Carbon capture systems
- Ethanol producers
- Industrial tightness testing

## CARBON MONOXIDE

### FLIR G346™

The FLIR G346 exposes invisible, odorless carbon monoxide (CO) emissions from a safe distance. CO leaking from vent stacks or pipes can be deadly, especially if the gas is allowed to collect in an enclosed area. The G346 can quickly scan broad areas and pinpoint even small leaks from several meters away, increasing worker safety and protecting the environment.



#### G346 CAMERAS ARE IDEAL FOR:

- Steel industry
- Bulk chemicals manufacturing
- Packaging systems
- Petrochemical industry

#### G346 DETECTS CARBON MONOXIDE AND THE FOLLOWING GASES:

- |                        |                      |
|------------------------|----------------------|
| • Acetonitrile         | • Ethenone           |
| • Acetyl cyanide       | • Ethyl thiocyanate  |
| • Arsine               | • Germane            |
| • Bromine isocyanate   | • Hexyl isocyanide   |
| • Butyl isocyanide     | • Ketene             |
| • Chlorine isocyanate  | • Methyl thiocyanate |
| • Chlorodimethylsilane | • Nitrous oxide      |
| • Cyanogen bromide     | • Silane             |
| • Dichloromethylsilane |                      |

## REFRIGERANTS

### FLIR G304™

The FLIR G304 detects refrigerant gas leaks without interrupting or shutting down operations. Most modern refrigerants are organofluorine compounds, and while they are not ozone-depleting, some blends contain Volatile Organic Compounds (VOCs). Refrigerants are used in a variety of systems, including food production, pharmaceutical storage, and air conditioning.

#### G304 DETECTS THE FOLLOWING REFRIGERANT GASES:

- |         |          |         |
|---------|----------|---------|
| • R22   | • R245fa | • R417A |
| • R125  | • R404A  | • R422A |
| • R134A | • R407C  | • R507A |
| • R143A | • R410A  |         |

## SULFUR HEXAFLUORIDE AND AMMONIA

### FLIR G306™

The FLIR G306 detects SF<sub>6</sub> – used to insulate high voltage circuit breakers – as well as the industrial refrigerant and fertilizer anhydrous ammonia (NH<sub>3</sub>). SF<sub>6</sub> is a potent greenhouse gas, with a global warming potential that's 22,000 times greater than CO<sub>2</sub> over a 100-year period. By detecting and repairing SF<sub>6</sub> leaks, energy producers can avoid costly damage to circuit breakers while protecting the environment.

#### G306 DETECTS THE FOLLOWING GASES:

- |                            |                                   |                              |
|----------------------------|-----------------------------------|------------------------------|
| • Acetic acid              | • Ethyl cyanoacrylate (superglue) | • Propenal                   |
| • Acetyl chloride          | • <b>Ethylene</b>                 | • Propene                    |
| • Allyl bromide            | • Freon-12                        | • <b>Sulfur hexafluoride</b> |
| • Allyl chloride           | • Furan                           | • Tetrahydrofuran            |
| • Allyl fluoride           | • Hydrazine                       | • Trichloroethylene          |
| • <b>Anhydrous ammonia</b> | • Methylsilane                    | • Uranyl fluoride            |
| • Bromomethane             | • Methyl ethyl ketone (MEK)       | • Vinyl chloride             |
| • Chlorine dioxide         | • Methyl vinyl ketone             | • Vinyl cyanide              |
|                            |                                   | • Vinyl ether                |

### FLIR GF77™

#### Gas Find IR with HR lens

The FLIR GF77 with the HR (9.5-12 μm) lens—designed exclusively for use with this uncooled OGI camera—detects and visualizes sulfur hexafluoride (SF<sub>6</sub>), ethylene, and ammonia. This affordable solution is useful for both gas detection and radiometric temperature measurement, so you can safely locate leaks and perform accurate thermal inspections using one camera.



#### G304 CAMERAS ARE IDEAL FOR:

- Food production, storage, and retail
- Automotive production and repair
- Air conditioning
- Pharmaceutical production, transport, and storage



#### G306 CAMERAS ARE IDEAL FOR:

- Utilities
- Ammonia plants
- Industrial refrigeration systems
- Chemical plants



#### GF77 CAMERAS WITH HR LENSES ARE IDEAL FOR:

- Electric power utilities
- Oil and natural gas operations
- Chemical/manufacturing facilities
- Food and agriculture
- First responders

## SPECIFICATIONS



	Gx320	Gx620	G620	G343	G346	G304	G306	GF77
Primary Gas Seen	Hydrocarbons (CxHx)	Hydrocarbons (CxHx)	Hydrocarbons (CxHx)	Carbon dioxide (CO <sub>2</sub> )	Carbon monoxide (CO)	Refrigerants	Sulfur hexafluoride (SF <sub>6</sub> ), ammonia (NH <sub>3</sub> )	LR lens: methane, R-134a, R-152a HR lens: sulfur hexafluoride (SF <sub>6</sub> ), ammonia (NH <sub>3</sub> ), ethylene
Detector Type	Cooled InSb	Cooled InSb	Cooled InSb	Cooled InSb	Cooled QWIP	Cooled QWIP	Cooled QWIP	Uncooled microbolometer
Spectral Range	3.2 μm to 3.4 μm	3.2 μm to 3.4 μm	3.2 μm to 3.4 μm	4.2 μm to 4.4 μm	4.52 μm to 4.67 μm	8.0 μm to 8.6 μm	10.3 μm to 10.7 μm	LR lens: 7 μm to 8.5 μm HR lens: 9.5 μm to 12 μm
Resolution	320 × 240 (76,800 pixels)	640 × 480 pixels (307,200 pixels)	640 × 480 pixels (307,200 pixels)	320 × 240 (76,800 pixels)	320 × 240 (76,800 pixels)	320 × 240 (76,800 pixels)	320 × 240 (76,800 pixels)	320 × 240 (76,800 pixels)
Quantification in Camera	Yes	Yes	Yes	No	No	No	No	No
Thermal Sensitivity	<10 mK at 30°C (86°F)	20 mK at 30°C (86°F)	20 mK at 30°C (86°F)	15 mK at 30°C (86°F)	15 mK at 30°C (86°F)	15 mK at 30°C (86°F)	15 mK at 30°C (86°F)	25° lens: <25 mK at 30°C (86°F) 6° lens: <40 mK at 30°C (86°F)
Accuracy	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±2% of reading for temperature range (>100°C, >212°F)	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±2% of reading for temperature range (>100°C, >212°F)	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±2% of reading for temperature range (>100°C, >212°F)	N/A	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±1% of reading for temperature range (>100°C, >212°F)	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±2% of reading for temperature range (>100°C, >212°F)	±1°C (±1.8°F) for temperature range (0°C to 100°C, 32°F to 212°F) or ±2% of reading for temperature range (>100°C, >212°F)	±5°C (±9°F) for ambient temperatures 15°C to 35°C (59°F to 95°F)
Noise Equivalent Concentration Length (NECL) [ΔT=10°C, Distance= 1 m]	Methane - 13 ppm-m	Methane - 29 ppm-m	Methane - 29 ppm-m	Carbon dioxide (CO <sub>2</sub> ) - 5.6 ppm-m	Carbon monoxide (CO) - 6.3 ppm-m	-	Sulfur hexafluoride (SF <sub>6</sub> ): 0.3 ppm-m, Ethylene (C <sub>2</sub> H <sub>4</sub> ): 6.3 ppm-m	LR lens: CH <sub>4</sub> : <100 ppm × m R-134a: <20 ppm × m R-152a: <100 ppm × m HR lens: SF <sub>6</sub> : <1 ppm × m C <sub>2</sub> H <sub>4</sub> : <20 ppm × m NH <sub>3</sub> : <20 ppm × m
Minimum Laboratory Leak Rate (MLLR) [known gases]	Methane: 0.6 g/hr Propane: 0.6 g/hr Butane: 0.4 g/hr	Methane: 0.6 g/hr Propane: 0.6 g/hr	Methane: 0.6 g/hr Propane: 0.6 g/hr	-	-	-	Sulfur hexafluoride (SF <sub>6</sub> ): 0.026 g/hr Ammonia: 0.127 g/hr	Methane: 2.7 g/hr Sulfur hexafluoride (SF <sub>6</sub> ): 0.74 g/hr
Temperature Range	-20°C to 350°C (-4°F to 662°F)	-20°C to 350°C (-4°F to 662°F)	-20°C to 350°C (-4°F to 662°F)	-	-20°C to 350°C (-4°F to 662°F)	-20°C to 250°C (-4°F to 482°F)	-40°C to 500°C (-40°F to 932°F)	-20°C to 80°C (-4°F to 176°F), 0°C to 250°C (32°F to 482°F) 100°C to 500°C (212°F to 932°F)
Available Lenses	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm); 6° × 4.5° (92 mm)	24° × 18° (23 mm); 14.5° × 10.8° (38 mm)
Zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–8× continuous, digital zoom	1–6× continuous, digital zoom
Focus	Manual	Manual	Autofocus, manual	Autofocus, manual	Autofocus, manual	Autofocus, manual	Autofocus, manual	Continuous (laser), one-shot (laser), one-shot contrast, manual
<b>Display</b>								
Adjustable Viewfinder	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	4", 640 × 480 pixel rotatable, touchscreen LCD	Dragontrail® Touchscreen (QVGA), 640 × 480 pixels
Visual Camera w/ Lamp	3.2 MP	3.2 MP	3.2 MP	3.2 MP	3.2 MP	3.2 MP	3.2 MP	5 MP
Laser Pointer	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2 Semiconductor AlGaInP diode laser, 1 mW, 635 nm (red)	Class 2, dedicated button, used in focus and distance measurement
Video Out	HDMI, DVI	HDMI, DVI	HDMI, DVI	HDMI, DVI	HDMI, DVI	HDMI, DVI	HDMI, DVI	DisplayPort over USB Type-C
<b>Certifications</b>								
Hazardous Locations	ATEX/IECEX, Ex ic nC op is IIC T4 Gc II 3 G - ANSI/ISA-12.12.01-2013, Class I Division 2 - CSA 22.2 No. 213, Class I Division 2	ATEX/IECEX, Ex ic nC op is IIC T4 Gc II 3 G - ANSI/ISA-12.12.01-2013, Class I Division 2 - CSA 22.2 No. 213, Class I Division 2	-	-	-	-	-	-
US EPA 0000a	Yes	Yes	Yes	-	-	-	-	-
Image Analysis	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	-	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	10 spots, 5 boxes with max/min/average, 1 line, Delta T, measurement corrections	3 spot and boxes in live mode
Annotations	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen	Voice: 60 secs with Bluetooth on still images and video Text from predefined list or soft keyboard on touchscreen
Communication Interfaces	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth via headset, Wi-Fi, HDMI	USB 2.0, Bluetooth, Wi-Fi, DisplayPort
Data Storage	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite	Removable SD card, cloud via FLIR Ignite
File Format	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, MJPEG, MPEG4, H.264, RTRR(.csq)	Standard JPEG, RTRR(.csq)
MultiREC Recording	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	Record multiple files automatically in customizable order	-
GPS	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS; data logging feature	Location data automatically added to every still image; first frame in video from built-in GPS

For an overview of the specifications for the FLIR GF77a and G300a please visit [FLIR.com](http://FLIR.com)

## FLIR PORTABLE INFRARED AND ACOUSTIC CAMERA SOFTWARE

FLIR helps you work more efficiently and boost productivity with a robust software suite, routing plugins, and cloud storage.

### SOFTWARE AND CLOUD SOLUTIONS

FLIR Thermal Studio Pro, FLIR Ignite Cloud storage, and FLIR route management provide the total solution your team needs to streamline inspections, analysis, and reporting.

FLIR Thermal Studio Pro: Build an efficient survey roadmap with the FLIR Route Creator software plugin, then download and run it using the Inspection Route feature on your camera. Once your inspection is complete, bring the images back into FLIR Thermal Studio for processing, analysis, and reporting.

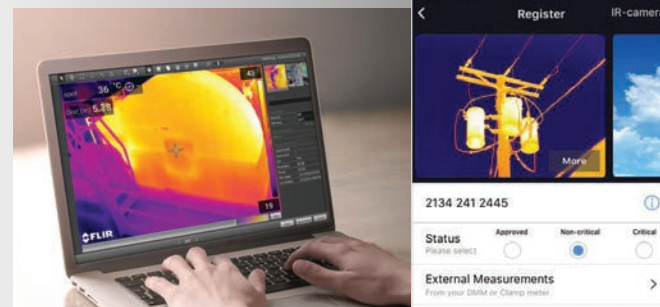
For acoustic imaging, the FLIR Si124 comes with a software plugin for FLIR Thermal Studio Pro that allows you to calculate critical decision-making data such as leak rates, costs, and level of threat from partial discharge.

FLIR Ignite: Upload images wirelessly to this cloud-based service, which automatically manages the safe and secure back-up of your data and instantly shares the content with authorized team members.



### FLIR SOFTWARE DEVELOPMENT SOLUTIONS

FLIR's Software Development Kit (ATLAS SDK) allows companies to use their own Computerized Maintenance Monitoring Systems (CMMS) to support read-out of thermal measurements as well as inclusion of METERLiNK® data, GPS, compass, and other important parameters embedded within the image.



# THE INFRARED TRAINING CENTER

### THERMAL AND OPTICAL GAS IMAGING VALUE

The greater your knowledge of thermal and optical gas imaging, the greater the dividends you'll realize for your company and your career. That's why the Infrared Training Center (ITC) offers classes for many industry applications—from free online courses to advanced certification training.

### ITC courses include:

- Optical Gas Imaging Certification Course
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## WORLD-CLASS INFRARED TRAINING

ITC thermography certification courses help prepare you to take a leadership role in an infrared or optical gas inspection program. Level I certifies that you know how a thermal camera or optical gas imager works and how to use it. Level II cranks up your credibility with more in-depth concepts and intensive labs. Level III asserts that you have the knowledge and skills to develop and administer your company's thermography or optical gas imaging program. These certifications offer strong validation to support the work you do.

ITC offers classes at training centers around the globe, at locations within your country, at your company's facility, and even online. On-site training is encouraged if your company needs to certify a group of 10 or more. ITC's on-site training courses are the best way to accommodate a large group on a limited budget. Our instructors will travel directly to your facility to limit your travel costs by keeping staff on site, reducing downtime and short staff issues.

Visit <https://flir.com/ITC-onsite-training> for more information about on-site training. For a complete list of courses and a current schedule, visit [infraredtraining.com](http://infraredtraining.com).



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Specifications are subject to change without notice

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NASDAQ: TDY

