FLIR SOLUTION SERIES

# Flare Gas Monitoring Systems

Flare stacks are used in many industries to burn off unwanted waste gas byproducts, or flammable gases released by pressure relief valves during unplanned over-pressuring of plant equipment. Applications include oil and gas well drilling operations, oil refineries, chemical process plants, gas distribution infrastructure, and landfills. In many cases, federal or state EPA regulations require the monitoring of a stack's flame, or the pilot flame that ignites the gases, to avoid having unburned hydrocarbons enter the atmosphere. IR video cameras are an ideal monitoring tool, since they allow automated remote monitoring on a 24/7 basis in virtually any weather. In addition, IR cameras avoid many of the technical and cost-related problems associated with other technologies such as ultraviolet (UV) flame detectors, flame ionization spectrometers, thermocouples, and pyrometers.

## AVOID AIRBORNE POLLUTANTS

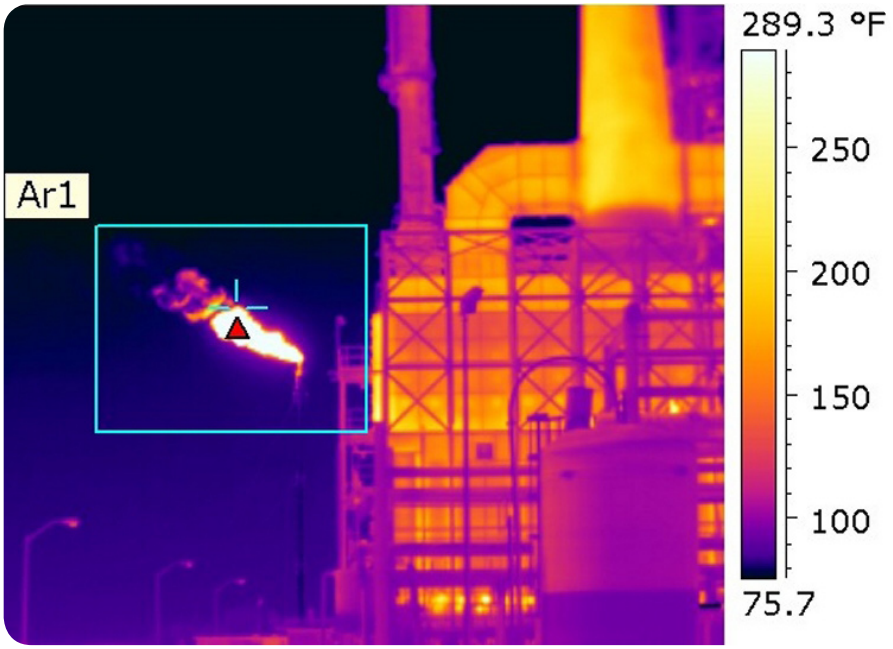
- Verify combustion, minimize unburned pollutants
- Instantly report loss of combustion with visual and audible alarms
- Remote visual monitoring with a TV or PC display
- Provides a quantitative temperature readout
- Notify plant management via email and intranet connections
- Camera connections to a central control room via Ethernet
- Works day or night in any weather – 24/7 operation


This publication is one of the FLIR Solution Series that describes important applications for IR camera systems. This Series is designed to show our customers how FLIR systems can be used to help reduce costs by protecting their assets, improving production automation and machine vision processes, and increasing the value of their predictive/preventative maintenance operations. The images, case histories, and system designs described in this Series are merely examples of the many possibilities available to users of FLIR IR cameras. Your feedback on the Series will be sincerely appreciated; you can respond by email to moreinfo@flir.com, by telephone to 800.464.6372, or by letter to FLIR Systems, Inc. 25 Esquire Rd. North Billerica, MA 01826.

## Flaring is a Complex Process

Flare systems are often a last line of defense that prevents dangerous hydrocarbon pollutants from entering the atmosphere. One example is methane, which is not only combustible, but is also 23 times more potent than $CO_2$ as a greenhouse gas. A plant manager needs to know immediately if flare stack combustion is lost, and get the flame reignited quickly to prevent a plant shutdown.

Various technologies have been tried for monitoring the pilot flame that ignites gas flow and detects the stack flame, with varying degrees of success. Many of these technologies are useless or poor at monitoring smoke from stake combustion, an important indicator of burn efficiency. One of the problems is that flare gas flows can range from low volumes during fuel gas purges in normal operations, to very large flows during emergency relief valve dumps or during total plant blowdowns. The size and brightness of the resulting stack flame, and the amount of smoke generated, depends on how much flammable material is released. Assist gases such as air or steam may be injected into the gas flow to improve combustion and help minimize smoke.




## FLIR IR Camera Solution

FLIR IR cameras recognize the difference in the heat signature of a flare stack flame and the surrounding background (usually, the sky or clouds). In addition to detecting stack flame, these cameras can be positioned to monitor the igniter flame. Typically, cameras are mounted on a pedestal or other rigid structure in moisture resistant housings to protect them from harsh weather conditions. The camera's spectral response and calibration allows it to see through moisture in the air to obtain a good image and relative temperature reading of the flare stack or pilot flame.

The images obtained with FLIR IR cameras allow an observer to detect stack flame that might not be visible to the naked eye because of its composition or low gas flow volume. This overcomes problems associated with UV flame detectors, which can be blinded by smoke. However, since the EPA considers excessive smoke an indication of poor combustion, IR cameras may be integrated with visual video cameras to monitor smoke. Thermographic and visual images can be transmitted in real time to a central control room as either analog or digitized data.

## Automated Control

In addition to visual monitoring of stack flame and smoke, automatic control of the assist gas to waste gas ratio is possible. When this ratio is properly adjusted, it improves combustion and minimizes smoke. Upset conditions require immediate adjustment of the air or steam volume to maintain proper combustion. As a bonus, automated assist gas injection control can help avoid excessive steam consumption, and provide significant cost savings.

The FLIR A320 cameras provide several features that facilitate automatic control. As a starting point, the camera senses flame temperature and size, key elements in a control scheme. This calibrated data can be communicated through the A320 Ethernet port to a PLC or PC running the assist gas control program, using either a wireless access point, fiberoptic cable, or CAT-6 Ethernet cable. If data falls outside the user's preset limits, the camera can send alarm signals to the control room via the data I/O port. In addition, A320 cameras can also be configured to automatically send numerical data and images via Ethernet to a PC via e-mail (SMTP) or FTP protocol whenever a data setpoint is reached, thereby creating a record for subsequent review.

For example, Aloatec, a system integrator in Calais, France specializes in vision systems that use the FLIR A320 for flare stack applications. Its solution, Aloa_DETECT, integrates visual and A320 camera systems with real-time control and analysis software. This system monitors flare stack and pilot flames to meet plant safety and environmental requirements. In addition, the system detects black smoke, and provides alarm functions through its web-based connectivity to a customer's intranet.

## Polution Control Requirements

Flare stack monitoring systems are increasingly important in meeting EPA pollution control and reporting requirements. In California, for example, San Francisco's Bay Area Air Quality Management District (BAAQMD) mandates the use of video monitoring of the flare stack flame (Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries). Texas and New Jersey also have stringent monitoring requirements, and many other states have regulations pertaining to emissions from flare stacks.

In landfills, the primary purpose of flare stacks is to burn the methane that results from the decomposition of organic material. In some countries operating under the Kyoto Treaty, garbage collecting companies are receiving a carbon bonus for installing flare stacks to burn the methane produced at their landfills. Here in the US, various EPA organizations ban the expelling of unburned methane into the atmosphere, and they want to know that gas going up a flare stack is efficiently burned. Mandated controls include pilot flame monitors and stack flame detectors. Ideally, they want systems that automatically reignite the flame in case it goes out.

## Automated Flare Stack Monitoring Systems

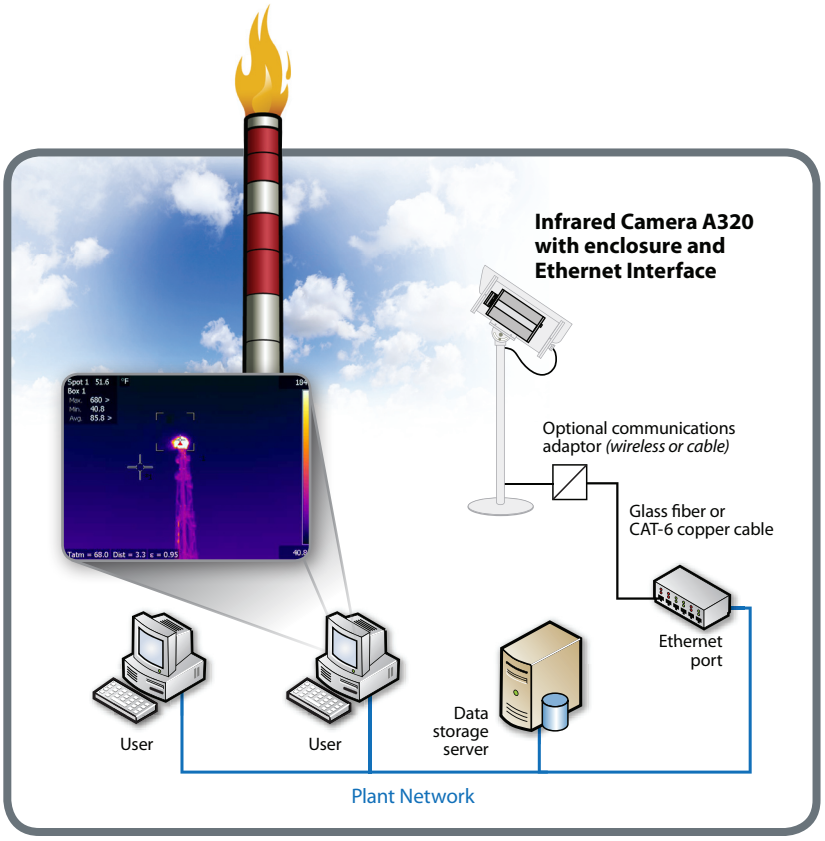
Contact FLIR for a free consultation on your flare stack monitoring application, and our recommendations for a FLIR camera system and software.

**Bay Area Air Quality Management District**

**939 Ellis Street**
**San Francisco, CA 94109**

**Regulation 12, Rule 11:**
**Flare Monitoring at Petroleum Refineries**

# Flare Gas Monitoring System




| Camera Specifications | |
|---|---|
| Detector | 320×240 pixel uncooled microbolometer focal plane array |
| IR Spectral Band | 7.5 – 13µm |
| Object Temperature Range (Selectable) | –20°C to +120°C or 0°C to +350°C |
| Accuracy | ±2% or 2°C of reading |
| Sensitivity | 0.07°C at 30°C |
| Field of View (FOV) | 25°(horz.) × 18.8°(vert.) |
| Focus | Auto and manual with electronic zoom |
| Min. Focus Dist. | 0.4m |
| Spatial Resolution (Instantaneous FOV) | 1.36mrad |
| Image Update Rate (Selectable) | 9 or 30 frames per second |
| A/D Converter | 14-bit |
| Interfaces | NTSC/PAL video, Ethernet, and Digital I/O (10-30VDC) |
| Electrical | 12/24VDC power |
| Physical | 170x70x70mm, 0.7kg |
| Mounting | Tripod (UNC ¼"x20) or 2xM4 threaded holes |
| Environmental | –15°C to +50°C operating range; 2g vib. / 25g shock per IEC 60068-2-6/29 |
| Optional Accessories | Lenses with different focal lengths and FOVs, various housings, and mounting options (consult factory) |
| Included Software | Allows easy camera setup, alarm configuration, thermal image and temperature data capture, trend analysis, and remote monitoring via Ethernet, ftp, and email. |

## WE KNOW INFRARED. LIKE NOBODY ELSE.

FLIR invented the infrared camera industry as we now know it. We brought the first commercial IR camera to market in the 1960s and have piled up more industry firsts in thermal imaging than anyone. Today we are the only global company totally dedicated to finding and fixing thermal problems through IR imaging systems. Our company's mission is to provide the most innovative systems available, with the highest possible quality, and show thermography practitioners how to get the most out of them. Our goals, now and in the future, are to provide greater insight into all types of thermal phenomena, and help our customers save money by applying this knowledge. This is supported by the most comprehensive and respected training courses in the industry.

FLIR's 'smart' IR cameras are used in basic research, non-destructive testing, product development, factory automation, equipment and building maintenance, asset protection, medical diagnostics, public safety, national defense, and a host of other applications. No other company offers the breadth of thermal imaging/temperature monitoring products supplied by FLIR, and none is as dedicated to technical excellence as our 350+ engineers. Within the past three years alone, FLIR has spent more than $230 million on R&D. Our customers are the primary beneficiaries of this investment, enjoying an ROI that amounts to millions of dollars a year in direct savings from operating efficiencies and loss avoidance. As a result of this leadership, FLIR is the most trusted name in the industry.

**For more information:**
Call: 1 800 464 6372
Web: goinfrared.com

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