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# *"FlareVIEW for Flare Stack Monitoring"*

## Overview

It's fairly easy to see how deeply chemical and petro-chemical industries have impacted the modern world. From the petroleum products that fuel our transportation and power systems, to the plastic in our consumer products, one could argue that the chemical industries – and the products they produce – are cornerstones to our contemporary way of life.

In geographical regions where oil, gas, and chemical plants are abundant, the sight of flare stacks is a familiar one. Oil refineries, chemical plants, oil and gas drilling operations, and waste disposal facilities are just a few examples of the places you are likely to see a flare stack.

In these industries, companies depend on flare stacks to safely dispose of waste gases produced as a result of normal operations. The waste gases may be by-products of regular production, or perhaps are the result of over-pressure during planned or unplanned outages. Regardless of the source, many of these gases are hazardous to humans, animals, plants, and natural systems. Simply venting these untreated toxic substances into the environment creates an unacceptable environmental hazard. However, burning off the excess gases in a carefully controlled incineration process neutralizes the hazardous compounds and minimizes the environmental impact.

## Managing Compliance

The key to minimizing environmental impact and maximizing public safety is ensuring that the flare stacks are operating within the prescribed operational and regulatory parameters. Since the flare stack is the last line of defense for ensuring that toxic hydrocarbons are neutralized before being released into the air, it is imperative that the stack is operating correctly at all times. Most countries with active petro-chemical sectors have a regulatory body to ensure compliance with the local regulations. In the US, the EPA (Environmental Protection Agency) has strict guidelines regarding flare stack operations. Companies that are found to be non-compliant face significant fines and sanctions. Therefore, having a reliable method to monitor and verify that all stacks are operating correctly, and within the prescribed operational limits, is critically important.



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## Flare Monitoring Technologies

The need for reliable flare stack monitoring is not new; this need has been around for several decades. Over the years, a number of methods have been adopted with varying degrees of success. Some of the earliest flare monitoring solutions incorporated stack-mounted thermocouples. While this continues to be a common solution, the adverse operating environment (created by reactive chemicals and the excessive heat of the flame) eventually causes the stack-mounted thermocouples to fail. Due to the location at the top of the flare stack, replacement is technically challenging and often very expensive.

When the limitations of thermocouples became apparent, pyrometers became a popular alternative. Pyrometer-based solutions are available from a variety of manufacturers. While off-stack pyrometers overcome some of the key issues associated with stack-mounted thermocouples, the effective measurement region is generally small, and fixed. Aligning pyrometers to a pilot flame can be challenging, and ensuring that the device is properly aimed and functional under all eventualities (such as windy conditions) can be challenging.

More sophisticated technologies, such as UV (ultraviolet) flame detectors and ionization spectrometers, have become available in recent years. While these solutions offer many advantages over the early thermocouple and pyrometer solutions, they tend to be more costly and more technically difficult to install, configure, and operate. Variable gas composition, low gas flow volumes, and/or the presence of excessive smoke can sometimes create difficulties for these technologies, resulting in inaccurate results or false alarms.

## Thermal Camera Solutions

Thermal Cameras have always been technologically well-suited to flare stack monitoring. These cameras are sensitive to the relatively disproportionate heat signature of the flame and surrounding areas in the image. Because they are looking for heat radiation, rather than a particular UV band, thermal cameras aren't blinded by smoke. And with greater coverage and greater resolution than a pyrometer, thermal cameras can detect – and differentiate between – the flare flame and the pilot flame. Furthermore, the spectral response and configuration of IR (infrared) cameras makes them able to detect the flame at varying moisture levels, and under virtually any environmental conditions.

Until recently, the cost of a thermal cameras was relatively high in comparison to thermocouple and pyrometer solutions. However, this has changed dramatically in recent years. Now, as falling camera costs and improvements in the IR sensor technology enable dramatically more power at a fraction of the previous system costs, thermal camera systems offer the best cost-to-performance ratio of all competing stack monitoring technologies

## The Thermal Image Advantage

Visible feedback isn't always useful for detecting whether a hydrocarbon flame is burning. A thermal image provides much more reliable feedback.

Thermal cameras capture temperature values for every image pixel, so alarms can be set to trigger when critical regions in the image drop below preset temperature thresholds.

Thermal cameras are less costly and technically challenging to install than competing technologies such as flame ionization spectrometers, UV flame detectors, and thermocouples. And because they provide a complete thermal snapshot of the flare and surrounding regions, thermal cameras can offer much better flame (and pilot flame) coverage than conventional pyrometer solutions.


### FLIR Thermal Imaging Cameras

Thermal cameras, such as the FLIR A310f (pictured here), are perfectly-suited to flare stack monitoring. They provide 24/7 remote monitoring under virtually any environmental conditions, making them both an effective, and a *cost-effective* solution for flare monitoring.

FLIR is a world leader in thermal imaging cameras. All of the benefits of the FLIR brand are leveraged by the inclusion of FLIR cameras in a flare monitoring solution.


## Meeting Industry Needs

Flare stacks are installed in wide range of industrial environments. Different industries, plants, and installations can have very different requirements and constraints. For example, where some sprawling facilities may have several types of flare stacks, others installations may be in remote locations with a single stack and a very small control room. Many chemical plants have certain areas where explosion-proof equipment is necessary, however other facilities may not have this concern, but may instead depend on advanced automation and highly-integrated data management systems to remain competitive.

To meet the diverse needs of flare stack operations across all industries, MoviTHERM has designed the FlareVIEW product line with maximum flexibility to meet these diverse needs.

### Flare Stack Monitoring System Design

What capabilities define a robust flare stack monitoring solution? This list provides a good place to begin:

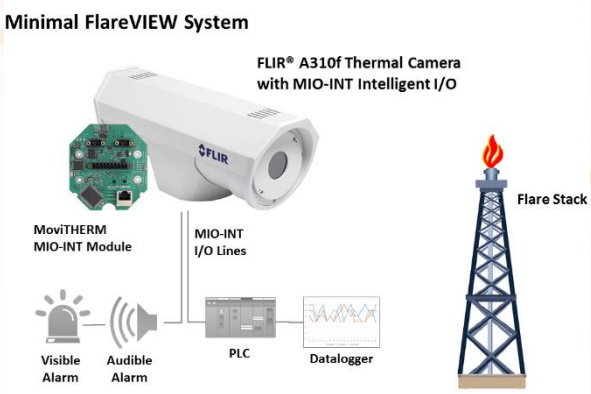
1) The system needs an accurate and reliable thermal detector that provides 24/7 availability.
2) The system should be easy to set-up and configure, and provide immediate alarm feedback when corrective action is required.
3) Data capture and archiving should either be integrated into the system, or alternatively the system should easily interface to existing plant infrastructure that provide these capabilities. This component is essential to verify continuous stack performance, and to substantiate regulatory compliance in the event of a dispute.

### MoviTHERM's FlareVIEW System

MoviTHERM is a FLIR Integration Partner located in Irvine, CA. MoviTHERM has designed the scalable FlareVIEW system to meet all of these criteria. Three basic configurations and several system options offer optimal flexibility for integration with existing plant facilities.

## MoviTHERM MIO: Low-Cost/High-Performance FlareVIEW Installations

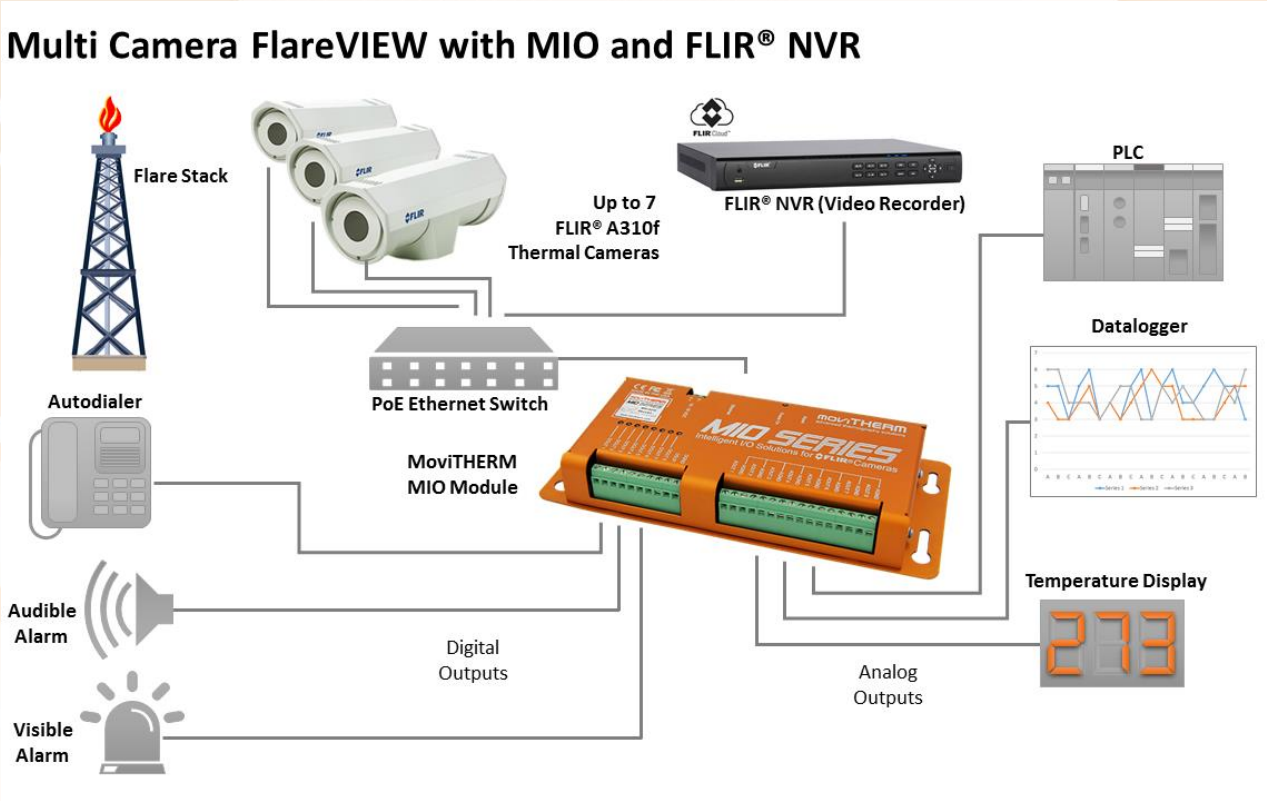
The simplest and lowest-cost FlareVIEW configurations are based on MoviTHERM's MIO intelligent I/O Modules. The most basic system consists of a single FLIR A310f camera with an integrated MIO-INT unit mounted inside the camera enclosure.




This economical but powerful configuration can be connected directly to a plant PLC via a standard Ethernet connection, and covers all of the key requirements – real-time temperature monitoring, alarming. Automated control opportunities and data-logging are also easily implemented if the PLC system supports these capabilities. And with the modest addition of a FLIR NVR (Network Video Recorder), the system can store timestamped video streams. The live 24/7 video data can be archived for several months at a time, enabling off-line validation and tangible, time-stamped video proof of regulatory compliance.

### More Camera Options and More I/O

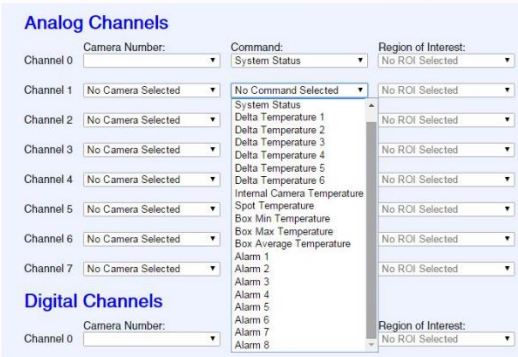

For installations that require multiple thermal cameras and/or more flexible I/O options, the MoviTHERM MIO-A310 Module offers connectivity for up to seven FLIR A310f cameras, along with eight digital output channels (24VDC) and eight 4-20mA analog outputs per module. The modular system design permits system scaling by simply adding new modules and new cameras. Very large installations of 100 or more cameras can easily be accommodated simply by adding cameras and MIO-A310 modules as needed. As noted with the MIO-INT system (above), the MIO-A310 modules can easily integrate with an existing PLC (or PC) network. One or more FLIR NVR (network video recorders) can also be added for 24/7 video stream archiving – up to 16 cameras per NVR unit.




## Browser-Based MIO Configuration

All MIO-based systems are configured using a standard web browser. The browser-based configuration utility enables quick system set-up and on-the-go configuration changes.

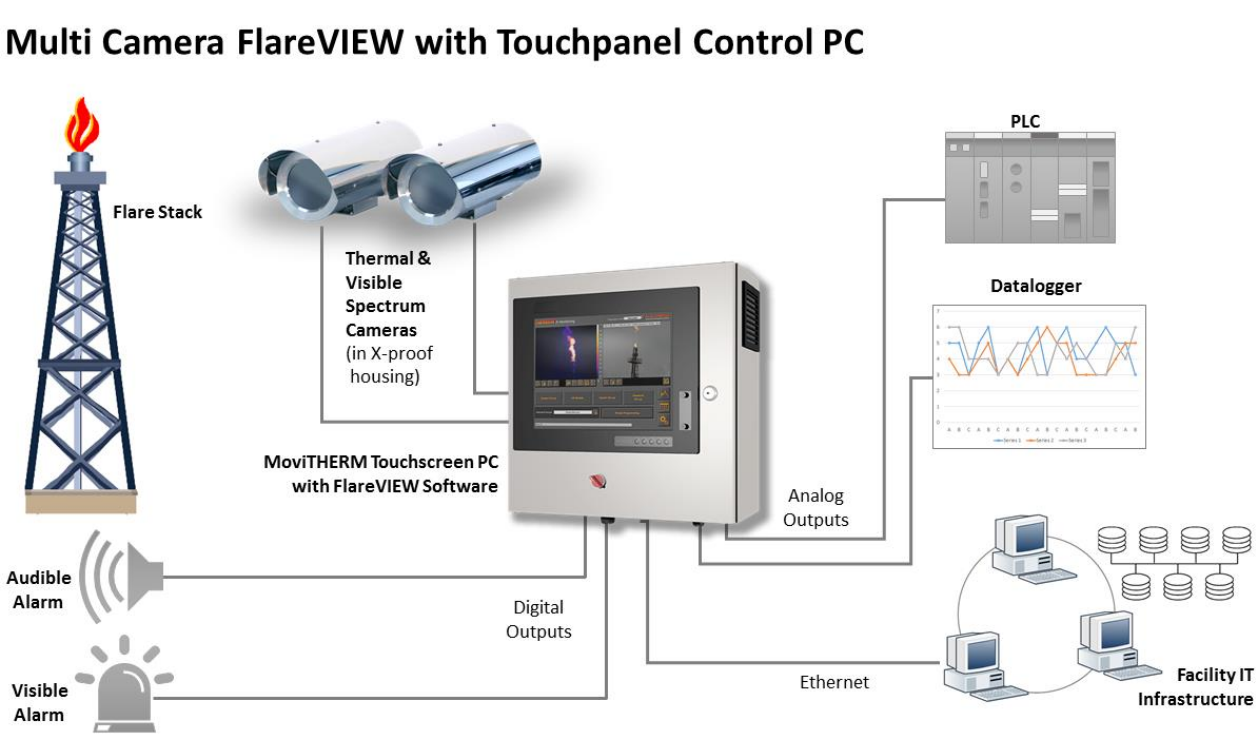
The MIO can be configured for a wide range of behaviors, from passing temperature values in the selected Region of Interest to one of the 4-20mA outputs, to changing digital output values based on internal alarm conditions generated by the FLIR A310 cameras.




The MIO offers a number of different strategies for gene-rating useful I/O responses.

## Integrated Hardware and Software Systems

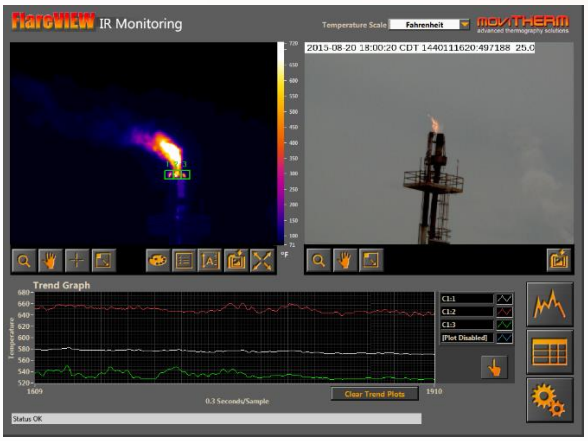
The MIO-based systems are well-suited to applications that require either simple alarming, or connectivity to a pre-existing plant PLC or DMS (Data Management System). However, if your application can benefit from more flexible image analysis, more complex alarm logic, integrated on-line data-logging, and/or a wider range of camera and lens options, then a fully-integrated FlareVIEW Touchpanel Control System may be more appropriate to your needs.




Integrated Touchpanel FlareVIEW systems include a dedicated touchscreen panel PC for set-up, configuration, and review. The electrical components are housed in the same compact electrical enclosure as the touchscreen panel PC, simplifying installation and minimizing the system footprint. The enclosure can be mounted in a control room close to the camera location, or at a distance from the camera, using fiber-optic connectivity.

## Intuitive Touchscreen Control

All Touchscreen-enabled FlareVIEW systems come with the ***FlareVIEW Monitoring and Control*** software pre-installed. The standard




package includes password security, 24/7 alarm monitoring, analog and digital I/O, and data-logging. An unlimited number of regions of interest (ROIs) can be defined inside the thermal image area, and specific alert criteria can be

assigned to each region. Parameters such as highest temperature, lowest temperature, average temperature, and standard deviation can be logged and plotted on-screen for each region. All software functions are touchscreen-enabled and optimized for operation in the field.

Dual-thermal camera, or thermal-plus-visible camera configurations are available.

## Modular System Design and Flexible Configuration Options

The modular design of the FlareVIEW product line has been optimized for maximum flexibility. The scalable MIO configurations provide a cost-effective way to interface FlareVIEW technologies with your existing PLC installations. If you have more specialized requirements, the integrated FlareVIEW Panel PC systems offer greater performance and capability. Either way, FlareVIEW is designed to integrate seamlessly into your existing plant infrastructure.

Explosion-proof control panel and/or camera enclosures are available for all FlareVIEW configurations.

## Conclusion

Flare stacks are used by many industries to prevent hydrocarbon pollutants from escaping into the environment. However, increasing public awareness about the impact of greenhouse gas emissions has led to increased media vigilance and regulatory scrutiny. Accurate and reliable stack monitoring has become essential for companies that want to maintain a favorable public image and long-term fiscal viability.

MoviTHERM's FlareVIEW product line offers a range of cost-effective Stack Monitoring solutions. Easier to install and service that stack-mounted thermocouples, more resistant to false readings due to smoke than UV flame detectors, and offering more area coverage than conventional pyrometer solutions, FlareVIEW effectively addresses the limitations of all competing technologies. Whether your objective is 24/7 monitoring of the pilot flame, or tracking and logging the size and temperature during a relief value purge, the modular FlareVIEW system can effectively meet your needs.

Markus Tarin
President & CEO
MoviTHERM – "Advanced Thermography Solutions"
15540 Rockfield Blvd., Suite C100
Irvine, CA 92618, USA
Phone/Direct 949.699.6600 x111
m.tarin@movitherm.com