Critical Vessel Monitoring

Many fluid vessels, such as chemical reactors, storage tanks, and piping systems, need to be monitored to spot abnormal temperatures and trends that warn of product loss or unsafe conditions. Traditionally, this has been accomplished with point contact temperature sensors such as thermocouples or RTDs. Since individual sensors only monitor “pin point” areas, there is always a concern about non-uniform temperatures throughout a vessel and across its surface. FLIR’s Critical Vessel Monitoring (CVM) Systems offer a better solution. A few IR cameras can observe and measure the temperature of the entire vessel surface, sending real time images and alarms to a control room. This application flyer describes how these systems can be designed and used to prevent huge monetary losses due to spoiled product, or worse yet, explosions, fires, loss of life, and production downtime.

REMOTE MONITORING OF CRITICAL VESSELS

- Non-contact temperature measurement
- Spots problems without onsite personnel
- A few cameras cover entire vessel surface
- Eliminates or minimizes point contact sensors
- Helps detect abnormal process variations before product is ruined
- Earliest possible warning with trend analysis software
- Complements other fire and explosion prevention systems
- Also used for torpedo (submarine) car monitoring
- Works day or night – 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.
**How It Works**

Infrared radiation (IR) is emitted by all objects at temperatures above absolute zero, and is detectable by IR cameras. Smart IR cameras (those with built-in logic, memory, and data communications) can compare the temperatures obtained from their thermographic images with user-defined settings for critical vessels. Since these cameras have various means of communicating thermographic images and temperatures to remote locations, they are ideal for unattended monitoring of chemical reactors, storage tanks, and other critical vessels. With camera firmware and/or computer software, they can spot dangerous temperatures and abnormal trends to help prevent product loss and improve safety.

**Improved Temperature Monitoring**

This approach to critical vessel monitoring (CVM) eliminates or minimizes the installation of point contact temperature sensors such as thermistors, thermocouples, RTDs, or solidstate devices. Since individual sensors can only monitor “pin point” areas, there is always a concern about non-uniform temperatures throughout a vessel and across its surface. It’s always a bit of guessing game whether contact sensors are placed in the correct location relative to process flows and reaction locations. A few IR cameras eliminate this concern by monitoring the entire vessel surface, providing instantaneous non-contact temperature measurements. Their firmware allows them to output a digital signal for alarm and control purposes, while also providing live thermographic images.

**FLIR CVM System Features**

FLIR’s CVM Systems can be programmed to set the temperatures at which alarm signals are generated, and multiple target spots and alarms can be defined for each camera. FLIR’S IR MONITOR software allows a computer to display up to nine camera images at a time, and switch between additional camera groups as needed. The cameras’ outputs can be wired directly to an alarm device, annunciator, programmable logic controller (PLC), or PC-based monitoring and control system. When an alarm occurs, personnel can then go to the visual monitor to verify the problem and its exact location. Because they are detecting a vessel’s heat signature, they support 24/7 operation. The cameras can be installed in all-weather or hazardous area enclosures.

Although these systems can provide a signal directly to an audible or visual alarm device, they can also be combined with a PLC or PC controller to create a monitoring system with advanced features. With FLIR’s IR camera firmware, or PC-based software, these features can include:

- Multiple target spots or areas
- High, low, and average temperatures in an image
- High-Low temperature set-point alarms
- Hysteresis function to prevent alarms from turning off prematurely
- Delays to ignore temporary temperature excursions
- Temperature trend analysis to reveal problems before a set-point is reached
- Ethernet connections to a central controller
- Alarm messages and images via Ethernet, email, or ftp

**SABIC Innovative Plastics Case History**

SABIC Innovative Plastics produces a wide range of engineered thermoplastic resins, films and shapes for almost any application. To keep processes running smoothly and safely, its plant near
Burkville, Alabama has been using FLIR IR cameras for CVM over the past several years. Initially, these cameras were deployed as mobile instruments manned by operators who roamed the plant, periodically taking temperature readings on critical vessels.

Recently, the plant upgraded its Carbone Lorraine hydrochloric acid synthesizer. The upper part of the synthesizer has a combustion chamber where gases are mixed and burned. Cooling water is used to maintain the proper temperature in the chamber. Because this temperature is so critical, and the plant is striving to optimize the process, it was decided to shift from periodic mobile monitoring to fixed position remote monitoring.

This installation has two FLIR IR video cameras on opposing sides of the combustion chamber. Both cameras provide a color video output representing the temperatures across their field of view, with an adjacent color scale denoting the temperature range of interest (70-200°C). These images are presented on a flat screen display, providing 24/7 monitoring in the control room. In addition to video outputs, 4-20mA outputs scaled to the critical temperature range are used for alarm purposes. These signals are fed into the plant’s distributed control system, which provides an alarm if the temperature gets outside the critical range.

David Philleo, a SABIC Process Engineer, notes that “The real-time monitoring of our new CVM system is providing actual control functions, not just preventative maintenance, as in the case of mobile camera deployment. Remote monitoring also saves a lot of manpower.” This is just one of many ways that FLIR IR cameras can be used for CVM. Another use is the monitoring of storage tanks for petrochemicals, and pipes carrying gases.

Unlike visible image cameras that require adequate light to detect liquid leakage and smoke, IR video cameras do not need lighting. In addition to recording the a tank’s surface temperature, they can see liquid and gas leaks because of temperature differences between the fluids and their surroundings.

Automated CVM Systems

The image on this page depicts a typical automated CVM system configuration using the FLIR A-320 Camera. Although analog video and digital I/O outputs allow it to operate as a standalone smart sensor, many warehouse applications also use its digital data stream, sent over Ethernet lines to a PLC or PC controller. When used in this manner, the temperature data is one of the primary inputs to the PLC or PC controller that is part of a broader facility monitoring and control system.

In conjunction with its alarm setpoint capabilities, the A-320’s Ethernet communication can supply a digital compression of the camera’s analog video signal to virtually anywhere a PC is running monitoring software. Increasingly, the TCP/IP protocols of the A-320 cameras are used to facilitate monitoring from multiple locations. They can automatically send temperature data and images to a PC via e-mail (SMTP) or FTP protocol whenever a temperature warning threshold is reached. Safety personnel at designated locations can open a password protected web browser to access the camera’s web server for basic control functions, and view live video of the monitored area.

Automated CVM Systems

Contact FLIR for a free consultation on your critical vessel application, and our recommendations for a CVM Monitoring System.
Critical Vessel Monitoring

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