



FLAME DETECTION & FLAME SENSOR MONITORING SYSTEMS FOR CNG FACILITIES

**System hardware, software development, programming & smart-device application
developed by ANGI Energy Systems**

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OVERVIEW

Compressed Natural Gas (CNG) & Renewable Natural Gas (RNG) as a vehicle fuel has proven to be a cost-effective, supply stable, clean-burning and environmentally friendly fuel for heavy-duty fleet operators.

When dispensing flammable fuels some degree of fire safety systems and emergency notification protocol is typically required. More advanced fire safety systems, including flame detection, and emergency notification systems can add asset protection for fleet operators and fuel station owners.

This publication details recommended best practices for flame detector monitoring, maintenance and operational use.

DISCLAIMER – The advice contained herein is intended as general best practices and should not be interpreted as appropriate for any specific situation. Fire monitoring should be approached on a case-by-case basis with a qualified vendor.

APPLICATION

Use of flame detection sensors may or may not be required by code or all authorities having jurisdiction (AHJ). From an asset management perspective, the value of a functional flame detector monitoring system should not be overlooked. Adding flame detectors to a CNG fueling facility can be an economical safety investment that could reduce the severity of damage and loss in the event of a fire.

FLAME DETECTOR SELECTION¹

IR2: This Flame Detector is for inside use only and where the fastest detection is required. It can be used through glass but note there will be a small drop off in the range of the Flame Detector.

UV/IR2: This Flame Detector is the best choice for being used outside as it can be used in sun light (care must be taken to ensure the sun does not flicker on the Flame Detector) and has the highest immunity to false alarms as it needs both IR and UV to activate. The UV/IR2 cannot be used through windows.

IR3: This Flame Detector can be used inside or outside and is the best choice for a dirty environment. If it is being used outside, care should be taken that the sun does not shine on the Flame Detector as this can cause false alarms. Again, the IR3 can be used through windows, but there is a small drop in range.

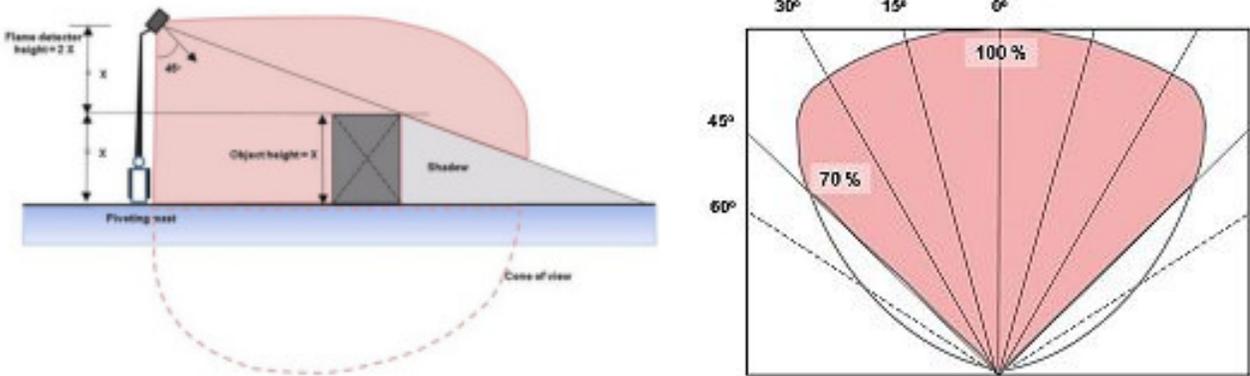
We recommend using an IR3 type Flame Detector. They can detect hydrocarbon fuel and gas fires at long distances. With its triple spectrum design, it provides protection against false alarms by using “guard band” wavelength detection.



Sample IR3 Flame Detector Image²

SITE LAYOUT

Once your detector has been selected and you know the capable field of view range, you can begin your site layout to ensure complete coverage over the fueling area and your assets. You can see from the site layout below that one lane has no overlap, while adding a fourth pole on the lower lane could offer complete coverage. The decision to install flame detection is currently up to the facility, but it should be kept in mind that the sooner a flame is detected, the sooner the fuel sources can be isolated, and the sooner emergency responders can be notified of an issue.



Each detector brand and model will have a capable field of view^{3,4}



Sample Image of a Flame Detector Site Layout

INSTALLATION

It is common to install the flame detectors on parking lot light poles. Check with the flame detector installation instructions for proper height and angle mounting. Flame detectors mounted too level will often be plagued with nuisance trips from the rising or setting sun. This may not occur until a seasonal change when the angle of the sun has become lower on the horizon.

It is important to label the light poles with the flame detector numbers at the base so service personnel will know which flame detector is located above. The PLC simply calls out a flame detector number, but it is important to be able to walk the site and confirm where the detectors are located.



Sample Image of Flame Detector installed on a parking lot pole⁵

PLC MONITORING

Due to the nature of flame detectors having nuisance trips or issues with environmental conditions, we have chosen to develop a PLC monitored flame detection system with call out notification. The flexibility for the PLC to monitor the analog value of the flame detectors offers the ability to have a timed bypass feature. This way a maintenance provider could evaluate the system and easily turn off monitoring a single faulted detector without rewiring or disabling the entire system offline. The timed bypass feature gives the maintenance provider time to order replacement parts and secure a manlift to complete the repair. During this time, the rest of the system is actively monitoring while only the problematic detector is left out of the system. If the maintenance provider fails to complete the repair before the bypass timer expires, the system would then begin monitoring all detectors and shutdown to a safe condition. In addition to the flexibility of the individual bypass timer, the PLC offers individual remote monitoring of all detector states and values. Customers can remotely monitor live data and determine when a sensor lens needs cleaning. PLC data logging can also help determine if individual sensors are plagued with repeated issues. Faults are logged with time / date stamps, and all detector values are constantly recorded for the life of the system.



Sample Image of a PLC Flame Detection Monitoring Panel – This is not a Fire Alarm Panel, but better serves the industry and offers flexibility to maintain fueling and overall site safety when a detector has an issue.

TESTING

After installation is complete a site test of the flame detection system should be performed. This procedure will require using a flame simulator. It is critical that the same type of emitted spectrum matches that of the selected flame detector.



Sample image of a Flame Simulator – Correct Spectrum must match your flame detectors⁶

A person will walk the coverage area to ensure that from each test location one or more detectors will trigger the system. Having two people perform this procedure is best, as one can walk the area with the flame simulator, and the second person can tell the first person when the system has been triggered and then perform the system reset. If any sensors are adjusted after testing, the evaluation of that area should be repeated.

UPS BACKUP POWER

It is suggested that the Flame Detection, ESD and Remote Monitoring System have a backup power system using a double conversion online uninterruptable power supply (UPS). This will allow limited flame detection even during a loss of power as well as calling out to indicate a power outage. Regardless of how long the UPS can back up power it is also important to have a remote call out when the UPS batteries are getting low. This will offer service personnel indication before the system will become unmonitored as total site power will soon be failing. The disadvantage of a UPS is in the range of operating temperature, so it is important to protect this component by installing both a heating and air conditioning unit on its enclosure. It is recommended to have a high enclosure temperature callout if the enclosure becomes too hot.

MAINTENANCE

Different conditions will affect the ability for the flame detectors to operate properly. Rain, sleet, snow and dirt will all cause issues with the ability to detect. It is important to research that your flame detectors are equipped with internal lens heaters and self-calibration features to combat the ever-changing environment. However, it is also important to have a maintenance plan in place for a routine cleaning of the detector lens. Because of the nature of the detectors being mounted high, keeping your employees safe is the most important consideration. Many fleet and maintenance providers have invested in a lightweight carbon fiber extension pole specifically designed for cleaning security cameras. This offers a nonconductive simple way to service the detector lens while keeping personnel safely on the ground. A more costly alternative would be to have a manlift available when maintenance or service is required. Most detectors will be at heights where ladders are not recommended to be used. Specific site conditions and manufacturers requirements will determine cleaning and calibration intervals.



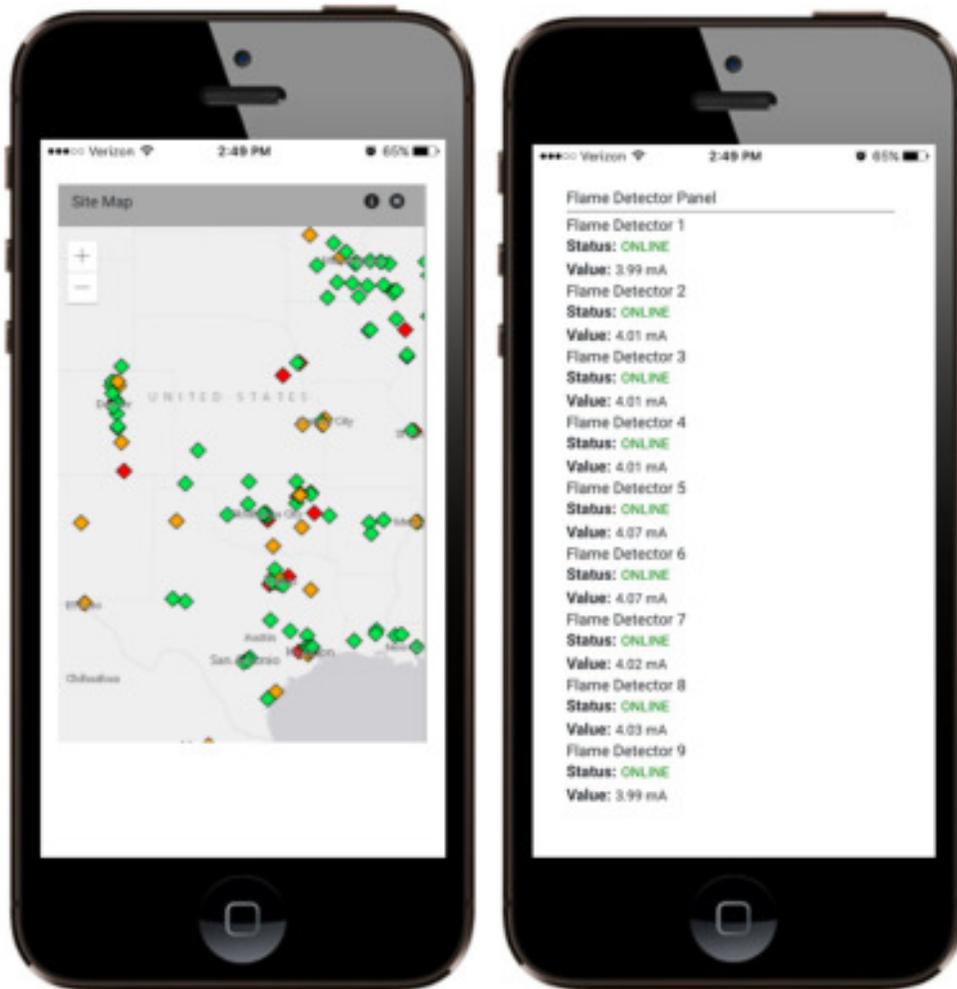
Sample Image of a lightweight carbon fiber extension pole specifically designed for cleaning security cameras⁷

ANGI DATA ACCESSABILITY

Due to the critical nature of the flame detection monitoring system, real-time access to flame detector signals, system status and notifications is paramount. These types of fire detection safety systems should have the ability to output data through the internet. Once connected to a network the ANGI operating program sends the flame sensor data & status to the 'ANGI Portal', both a web and smart device application, viewable on mobile devices like iPhone, iPad, Android, etc. CNG facility owners / operator and service personnel have unobstructed access to site status and notification of alarms or shutdowns.

The ANGI operating program has adjustable setpoints to accommodate for any manufacturer's flame detector and can react in the following manner:

- Send alarm and / or trigger an Emergency Shutdown (ESD)
- Notification to email and / or text message distribution list
- Notification to Corporate or 3rd party security
- Option for Notification to local Fire Response
- Option for high signal alarm activate fire suppression system (if present)



Sample Image of ANGI Portal Remote Monitoring from a smart device

Sources

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