OVERVIEW:
TURBINE SAFETY SOLUTIONS

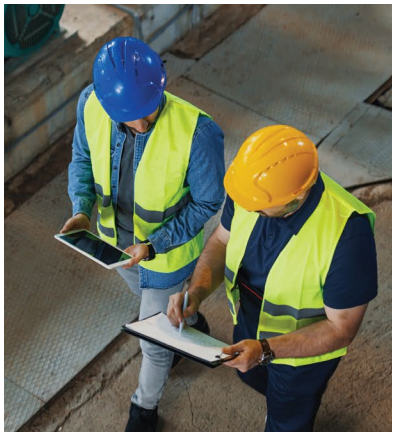
DET-TRONICS

CERTIFIED FIRE & GAS SAFETY SYSTEM FOR **GAS TURBINE ENCLOSURES**

Fire & gas detection and releasing system designed to monitor and protect gas turbines.

SAFETY IS WHAT WE DO. **PARTNER WITH US.**

det-tronics.com



Det-Tronics Industry-Leading Gas Turbine Solution

Det-Tronics offers an engineered fire and gas detection and releasing system designed to monitor and protect gas turbines. The components of this fire and gas safety system include high-performance flame and gas detection that is certified SIL2 capable and carries global certifications. Our detectors and system are paired with water mist or CO_2 suppression systems for an industry-leading solution.

- Single company solution for system design, detection, control and suppression
- Synergistic – all aspects are designed, assembled, approved and tested to perform seamlessly
- Reputable design engineering, high quality and reliability, dependable system performance

Det-Tronics expertise includes:

- Project consultation to define requirements
- Adherence to applicable codes and standards to ensure a compliant system
- System design service
- Formal submittal package provided for approval
- Manufacturing and full programming of system
- End-to-end testing to verify accuracy of cause-and-effect programming
- Electrical connection drawings provided for each system
- Project documentation retained indefinitely
- Project technical support provided indefinitely
- Worldwide network of support
- Option for field service engineering for system commissioning and periodic testing
- Option for Pre-Acceptance Testing / Final Acceptance Testing

Turbine Fire Safety Codes, Standards and Guidelines

There are multiple codes and standards applicable to turbine fire and gas safety systems. The National Fire Protection Association (NFPA) has recognized standards for turbine fire and gas safety systems. Det-Tronics can assist you by providing a listed system, resulting in a code-compliant solution.

- NFPA 37® – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
- NFPA 12® – Standard on Carbon Dioxide Extinguishing Systems
- NFPA 70® – National Electrical Code®
- NFPA 72® – National Fire Alarm and Signaling Code®
- Factory Mutual (FM) Global Property Loss Prevention Data Sheet 7-79 – Fire Protection for Gas Turbines and Electric Generators
- Factory Mutual Approval FM 5560: Water Mist Systems
- API STD 616 – Gas Turbines for the Petroleum, Chemical, and Gas Industry Services

Listed Fire & Gas Safety System for Gas Turbine Enclosures

Duct Mounted Combustible Gas Detector

Detects potential combustible gas leaks in the enclosure ventilation exhaust duct.

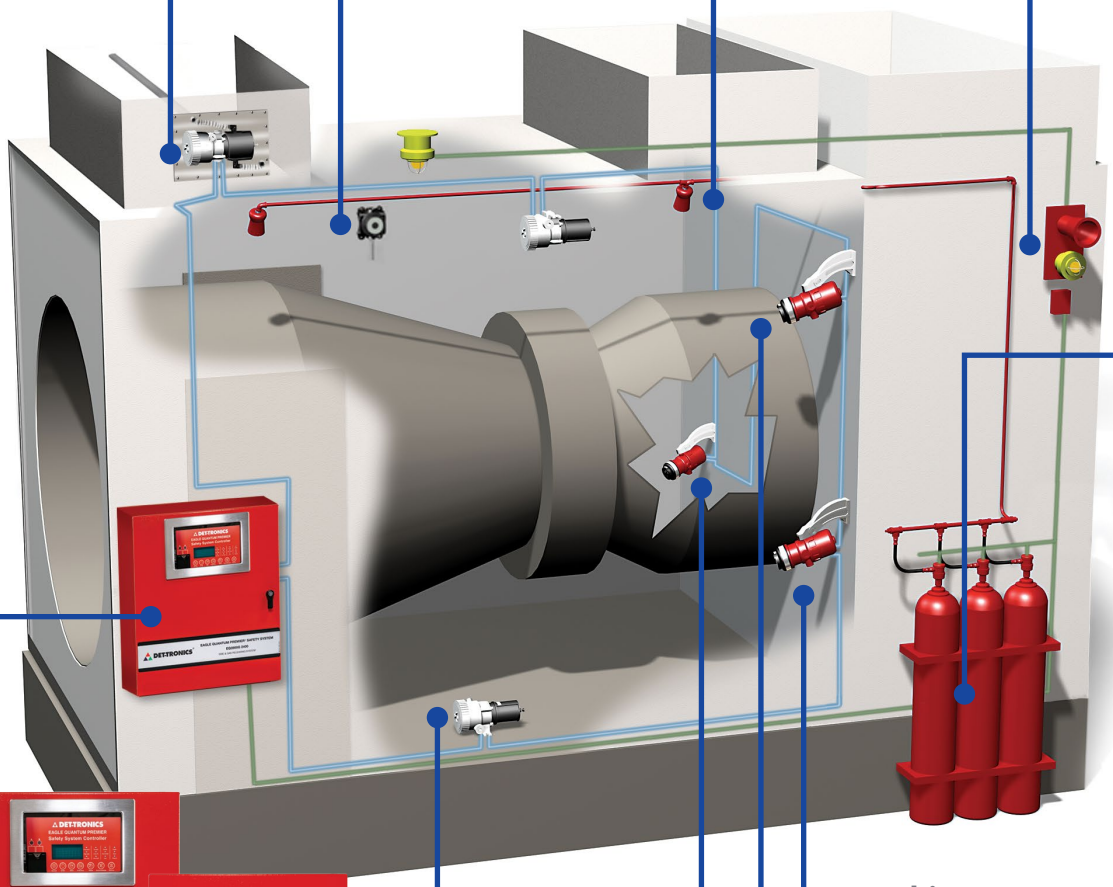
Heat Detector

Senses temperature and alarms if temperature exceeds the design set point.

Spray Head / Suppression Nozzle

Notification Appliances

Provide audible or visual notification of a gas leak and/or fire alarm.



Fire Suppression Agent Cylinders

Cylinders contain high-purity water for water mist systems or High-Pressure Carbon Dioxide for CO_2 suppression systems.

Multispectrum IR Flame Detector

Detects potential lube oil and fuel gas fires.

Flame & Gas Detection Releasing System

Supervises and controls the fire and gas detection and releasing system. Includes necessary controls and power supply.

Combustible Gas Detector

Detects potential combustible gas leaks using reliable IR technology.

Eagle Quantum Premier® EQP3900 Safety System

EQ3900G

- General purpose area certified
- Flexible device selection options
- Simple wire installation into terminal blocks
- Available in redundant controller configuration to increase availability of the safety system

EQ3900N

- Hazardous area-certified solution (non-incendive / non-sparking Class 1, Div 2, Zone 2 enclosure)
- Flexible device selection options
- Simple wire installation into terminal blocks
- Available in redundant controller configuration to increase availability of the safety system

EQ3900E

- Hazardous area certified solution (Class 1, Div 1 and Class 2, Div 1, Zone 1 enclosure)
- Flexible device selection options
- Simple wire installation into terminal blocks
- Available in redundant controller configuration to increase availability of the safety system

The Eagle Quantum Premier (EQP) system is a combined fire and gas safety system that is certified for annunciation and releasing. The EQ3900G system is suitable for use in general purpose locations while the EQ3900E and N systems are certified for installation in hazardous locations.

System components include an Eagle Quantum Premier (EQP) Safety System Controller and a number of addressable microprocessor-based field devices. The EQP Controller coordinates system device configuration, monitoring, annunciation, and control, while the various system modules and field devices communicate their status and alarm conditions to the EQP Controller.

The EQ3900 systems can be configured for redundancy, thereby increasing the availability of the system. Models that are certified SIL2 capable are available.

All Eagle Quantum Premier EQ3900 systems are listed by FM Approvals, allowing compliance with National Fire Alarm and Signaling Code requirements (FM 3010 in accordance with NFPA 72®, 2013 edition).

Benefits of an EQP System:

- Flexible – supports conventional or addressable wiring topologies
- Speed of response – when seconds count
- Multispectrum IR flame detection – models optimized for superior performance in turbine enclosures
- Point Infrared Gas Detection – long-term reliability and accuracy
- Robust design – proven in use in harsh industrial environments
- Fault-tolerant and fail-safe Class X LON Digital Communication – redundant pathway provides isolation and functions beyond single open, short and ground fault
- RFI/EMI resistant for reliable operation in industrial applications
- Field devices are programmed by the system – minimizing setup and configuration issues
- Redundant EQP Controller option – increased reliability in high-demand applications such as turbine enclosures
- Multiple system outputs enable interface with virtually any system (Modbus RS485, Ethernet DLR, ControlNet onboard relays)
- General purpose and explosion-proof enclosure options
- Installed as original equipment by leading turbine manufacturers

Performance and Reliability

Eagle Quantum Premier EQ3900G Safety System

The Eagle Quantum Premier Safety System Controller is the heart of the distributed addressable system. It coordinates system device configuration, monitoring, annunciation, and control functions, and includes numerous communication interface capabilities. Easy-to-read, scrolling display communicates status to the operator. Onboard event log function records system status, faults, alarms, and other vital information.

- The Eagle Quantum Premier (EQP) Safety System Controller is available in a redundant configuration to increase the availability of the system
- Selectable quantity of Enhanced Discrete Input Output (EDIO) modules, Analog Input Modules (AIM), and Relay Modules (RM)
- Available in models that are SIL2 capable
- Eagle Quantum Premier systems have provided a reliable solution for over 20 years
- Seamless integration and data transfer to the turbine HMI system
- Available communication protocols include Ethernet DLR, Control Net, RS485 Modbus, and onboard relays
- Communication allows for remote monitoring of the system

A variety of flexible options to meet the requirements of gas turbine applications

Enhanced Discrete Input Output Module EQ3730EDIO

- Eight channels of configurable input or output points that can be programmed for supervised or unsupervised operation
- Each input point can accept fire detection devices such as heat, smoke or manual pull stations
- Each output point can be configured for signaling or releasing output operation
- Each channel on the module is provided with individual indicators for active and fault conditions

Analog Input Module EQ3710AIM

- Connects devices with a calibrated 4-20 mA output signal to the Eagle Quantum Premier System
- Flame detector 4-20mA inputs are FM Approved as an NFPA 72 initiating device circuit
- Each channel on the module is provided with individual indicators for active and fault conditions

Relay Module EQ3720RM

- Provides eight relay output channels for use with non-supervised devices (PLCs, fans, dampers, motor control centers, etc.) or devices with their own supervision
- Each channel on the module is provided with individual indicators for active and fault conditions

Flame Detectors

X3301 / X3302 Multispectrum IR Flame Detectors

The Det-Tronics X3301 Radiant Energy-Sensing Flame Detector is ideally suited to detect hydrocarbon fires from fuel, diesel, or lube oil that may occur in gas turbines.

The Det-Tronics X3302 Radiant Energy-Sensing Flame Detector is ideally suited to detect hydrogen and Syngas fuel fires.

- X3301 includes third-party performance listings to diesel, methane, and methanol – reliably detects conventional or synthetic lube oil fires
- X3302 includes third-party performance listings to hydrogen, Syngas, methane, and methanol fires
- Capable of detecting high-pressure gaseous fires from loose or cracked fittings or fuel line tubing
- Capable of detecting momentary flash fires that occur from auto-ignition scenarios
- Detects small fires while simultaneously viewing the intense infrared emissions from the turbine engine
- Highly resistant to unwarranted alarms from intense infrared emissions of the turbine engine

Why Multispectrum IR flame detectors?

When compared to common ultraviolet (UV) flame detection technology, Det-Tronics Multispectrum IR technology:

- is less affected by optical contamination from lube oil leaks
- is less affected by smoke that may precede or occur during a fire
- more readily detects partially obstructed fires common to gas turbines
- resistant to alarming to unwarranted sources, such as lighting or arc welding
- does not require a time delay to avoid nuisance alarms

- Automatic Optical Integrity (Oi®) performs automatic fail-safe checks on each sensor every 60 seconds, ensuring reliable operation
- Magnetic/Manual Optical Integrity (Oi) allows ease of annual end-to-end proof testing
- Provides an optimum balance between false-alarm rejection and flame detection capability
- Flexible outputs include Relay, 4-20mA, and LON, allowing interface with any wiring methodology
- 100% tested to live fire at the Det-Tronics Engineering Test Center
- Installed as OEM equipment by major turbine manufacturers
- Long-term reliablity and performance – Full 5-year warranty
- Rapid response <10 seconds to common sources of gas turbine fires
- Approvals allow for global installation in hazardous locations

FM Approval and Performance Report

X3301 T-Low Sensitivity detection capability example

Fuel	Size	Distance feet (m)	Average Response Time (seconds)[1]
n-Heptane	1 x 1 foot	50 (15.24)	<4
Methanol	1 x 1 foot	30 (9.1)	5
Methane	32-inch plume	30 (9.1)	3
Propane	32-inch plume	30 (9.1)	5

[1] Add 2 seconds for EQP model

X3302 Low Sensitivity detection capability example

Fuel	Size / Flow Rate	Distance feet (m)	Average Response Time (seconds)[1]
Hydrogen	30-inch plume / 100 SLPM[2]	35 (10.7)	4.7
Methanol	1 x 1 foot	17.5 (5.3)	5.1
Syngas[3]	30-inch plume / 120 SLPM[2]	25 (7.6)	5.1
Methane	30-inch plume / 40 SLPM[2]	15 (4.6)	5.1

[1] Add 2 seconds for EQP model
[2] Standard Liters Per Minute (standard conditions defined as +25°C and 14.696 PSIA)
[3] Syngas composition: 53% H_2, 24% CH_4, 11% N_2, 8% CO, 4% CO_2

Gas Detectors

PIRECL Infrared Combustible Gas Detector

The Det-Tronics PointWatch Eclipse® PIRECL Infrared Combustible Gas Detector detects hydrocarbon gas vapors from fuels and gases commonly found in gas turbines.

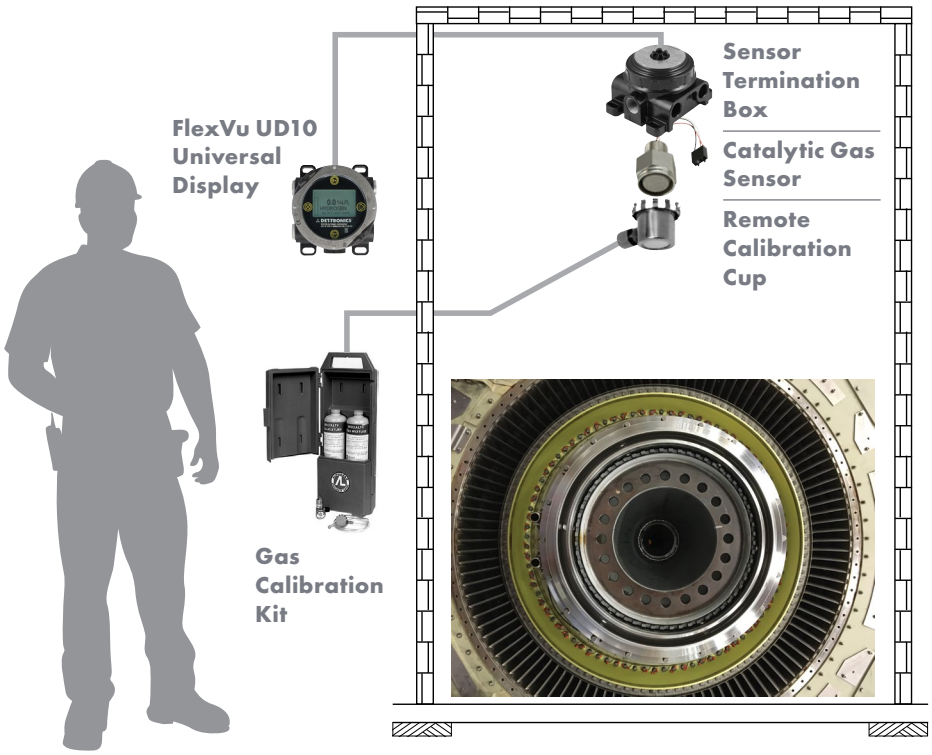
- Continuous optical monitoring, fail-safe operation
- Extremely reliable, and suitable for the detection of a wide range of hydrocarbon gases common to gas turbines
- Robust design, proven in-use for over 20 years in gas turbine applications
- Superior weather shield with built-in hydrophobic filter for resistance against common contaminants
- Reliable non-drifting output does not require routine gas calibration – "set and forget"
- Q900 Duct Mount Kit for monitoring enclosure ventilation exhaust duct air
- Flexible outputs including Relay, 4-20mA, and LON support conventional or addressable wiring methods
- Fast Response models available to provide T90 of <3.6 seconds (50% LFL gas applied)
- Approvals allow for global installation in hazardous locations

FlexVu UD 10 Universal Display + Catalytic Gas Detector

The Det-Tronics FlexVu® Universal Display + Catalytic Gas Sensor detects hydrogen and hydrocarbon gas vapors.

- Proven catalytic bead sensor manufactured by Det-Tronics
- Reliably detects hydrogen vapors in turbine applications
- Duct Mount Enclosures, Sensor Separation Kits, and Remote Calibration Cups allow for remote calibration
- FlexVu UD10 Universal Display allows external status check and calibration, eliminating the need to enter the enclosure

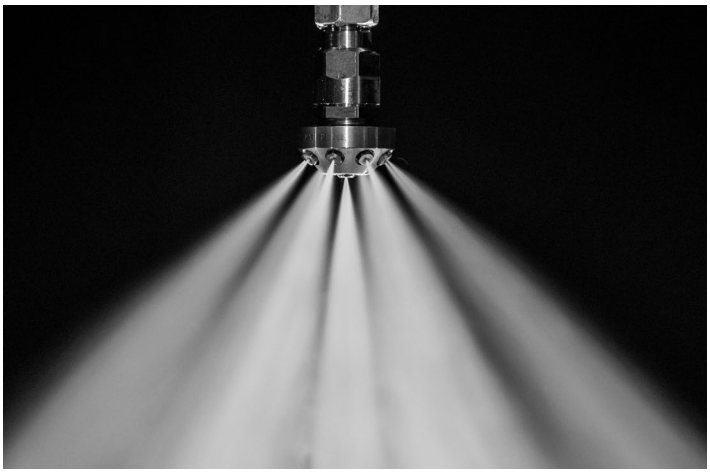
Graphic example of a Sensor Separation Kit

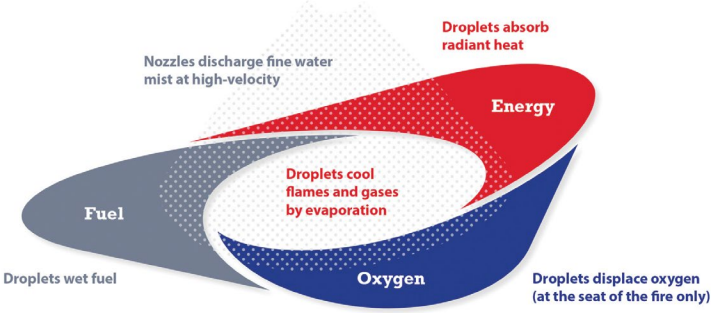


Water Mist Suppression

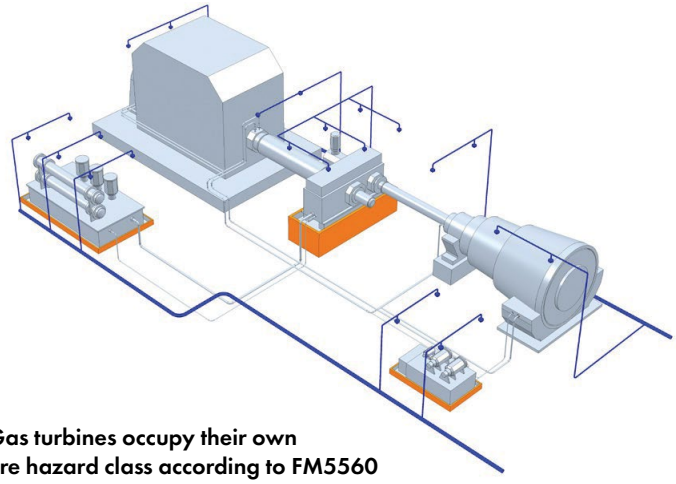
Water mist fire protection systems are safe for both people and the environment and provide superior fire protection performance.

- Water mist fire protection functions even if the acoustic enclosure door has been left open due to human error or if the integrity of the enclosure has deterioriated over the equipment's lifecyle
- Water mist quickly and gently cools down the fire and the structures below the flammable liquid flashpoint, thus preventing reignition
- Options include cylinder unit systems or an electric pump unit/systems as containerized modular solutions with minimal effort needed on site
- Water mist fire protection systems are optimized for aeroderivative and industrial gas turbines all the way to the largest utility scale heavy-duty gas turbines
- Immediate activation of the fire protection system is crucial because the high air flow used for cooling the turbine provides fuel to the fire; immediate activation helps prevent the fire from growing or spreading to surrounding areas
- High-quality system components help ensure a long system lifetime, making water mist systems a sensible choice both ecologically and economically
- Water mist systems protect hundreds of gas turbines globally





SOURCE: Marioff



Gas turbines occupy their own fire hazard class according to FM5560 approval protocol. The test protocol considers the fire harzards related to gas turbines, as well as the risk of discharging water mist onto a hot gas turbine. High pressure water mist is an ideal fire protection solution for power generation applications, as it can be activated immediately the moment the fire is detected while being entirely safe for people.

SOURCE: Marioff

Certifications

- Designs can support an extended FM Approval to provide fire protection for combustion turbines and machinery with enclosures up to 2300m3
- Ideal for installation in existing gas turbine enclosures

A sound investment

- Water mist systems make it possible to quickly return to operation after a fire
- The system can be reactivated once the operator has checked the system and the water tank has been re-filled
- No waiting for replacement or restoration after a fire
- Less downtime ensures a rapid return on investment

Comprehensive lifetime services

- Dedicated teams are at your service
- Our affiliates and dedicated partner companies have strong local presence and deep knowledge of the conditions in which their customers operate
- Our services help ensure systems continue to perform as designed throughout their lifetimes

High Pressure Carbon Dioxide (CO_2) Suppression

SOURCE: Kidde Fire Systems

High Pressure CO_2 systems are ideal for unoccupied spaces such as gas turbines and other industrial processes where flammable materials and vapors present a potential hazard.

- Widely accepted fire suppression reduces loss
- Non-corrosive, electrically non-conductive, and free of decomposition byproducts
- Fights small and large surface and deep-seated fires
- Responds rapidly – discharging within seconds to suppress fires
- An inexpensive and easy-to-access agent when refill is necessary
- Suppressant is delivered through a fixed piping network with specially-designed nozzles

A proven solution – superior fire suppression

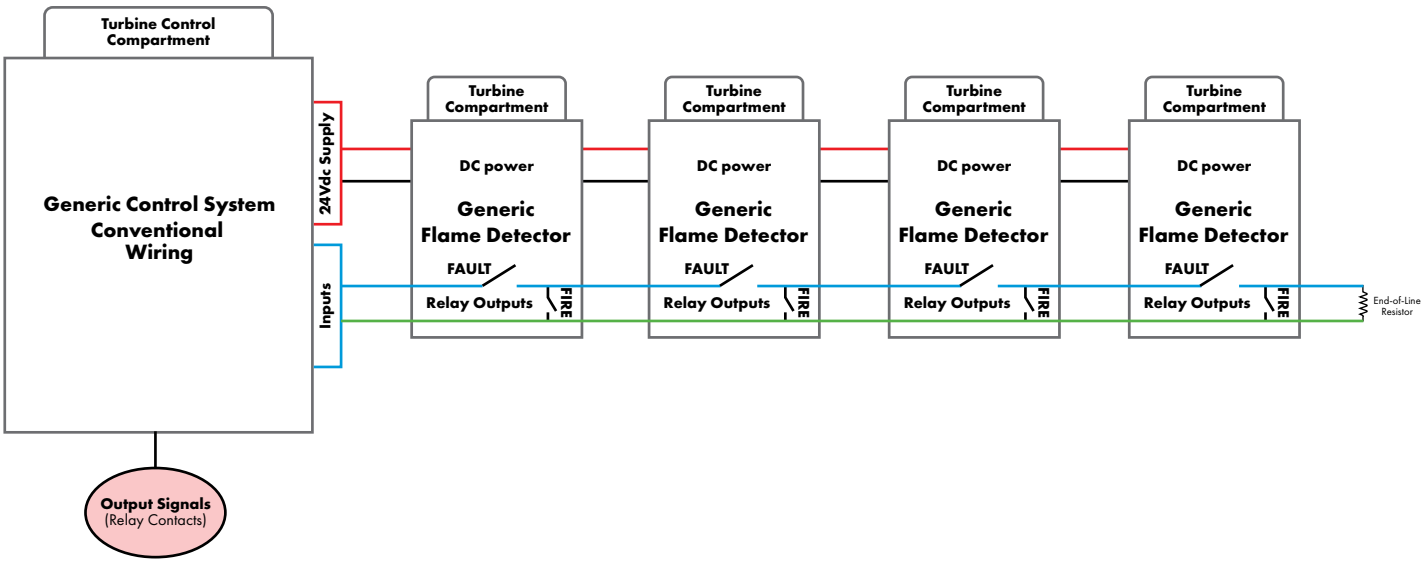
- CO_2 is a colorless, odorless, electrically nonconductive gas the density of which is approximately 50% greater than air
- CO_2 suppresses fire by providing a blanket of heavy gas that absorbs heat from the fire and reduces the oxygen content of the atmosphere to a point where combustion becomes impossible

Effective and reliable suppression solution

- A naturally occuring atmospheric element, CO_2 dissipates into the air allowing an almost immediate return to "business as usual"
- Less interruption, and no costly clean-up
- Eliminates damage to assets from suppressant residue
- Fewer repair costs and reduced downtime

Conventional Wiring Options

Conventional fire detection system field wiring



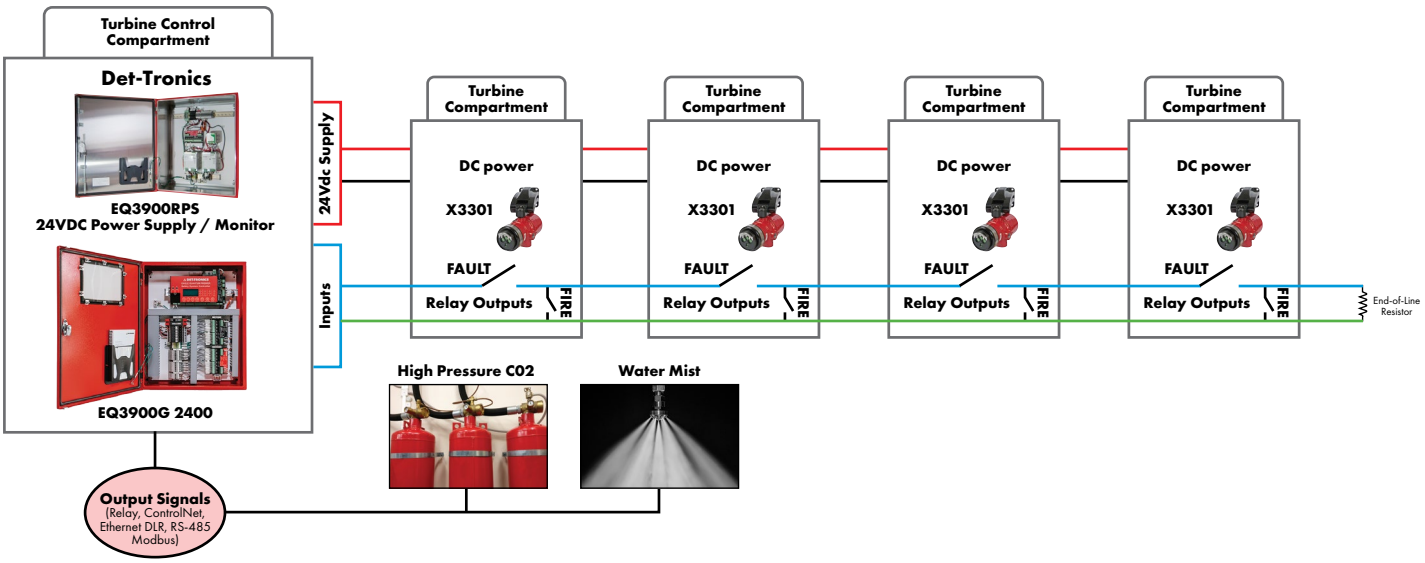
Benefits:

- Traditional fire alarm system
- Less expensive control system
- Less expensive detectors
- Less programming required
- Less field wiring

Limitations:

- Cannot differentiate signals to the control system
- Limited status information – Fault or Alarm only
- Does not allow voting of fault or alarm signals
- A single open may bring down entire input circuit

Det-Tronics – Conventional fire detection system using existing field wiring

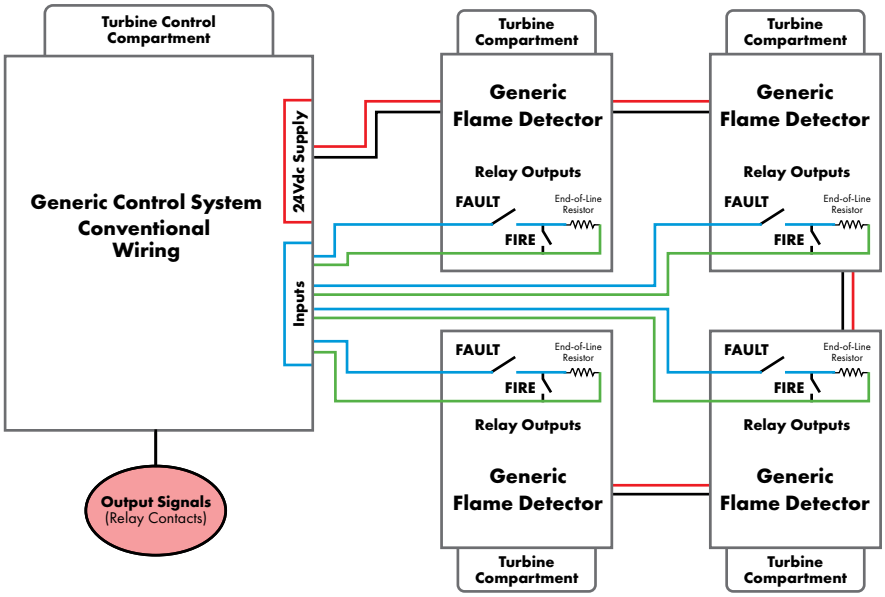


Flexibility:

- Option for utilizing existing wiring topology: if field wiring can be reused, this option helps to save installation cost

Conventional Wiring Options

Conventional fire detection system – discrete field wiring



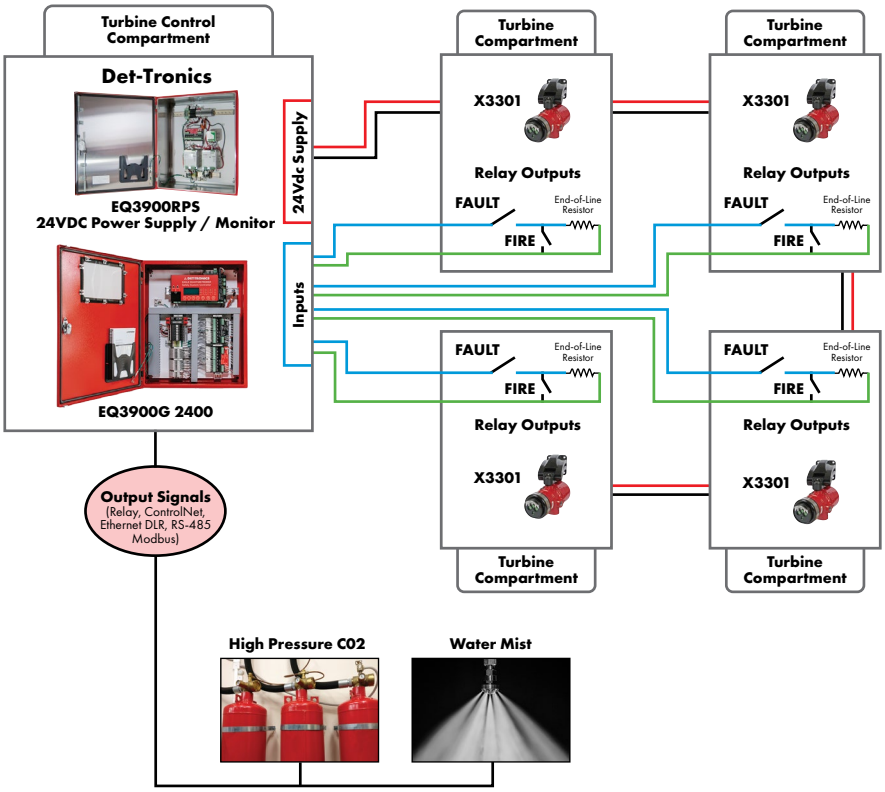
Benefits:

- Traditional fire alarm system
- Less expensive control system
- Less expensive detectors
- Differentiates between detectors
- Depending on control system, may allow for voting

Limitations:

- More wiring and conduit are required – increasing cost
- More manpower for installation – increasing cost
- Limited status information – Fault or Alarm only
- Increased knowledge required to install and program

Det-Tronics – Options for existing conventional discrete field wiring

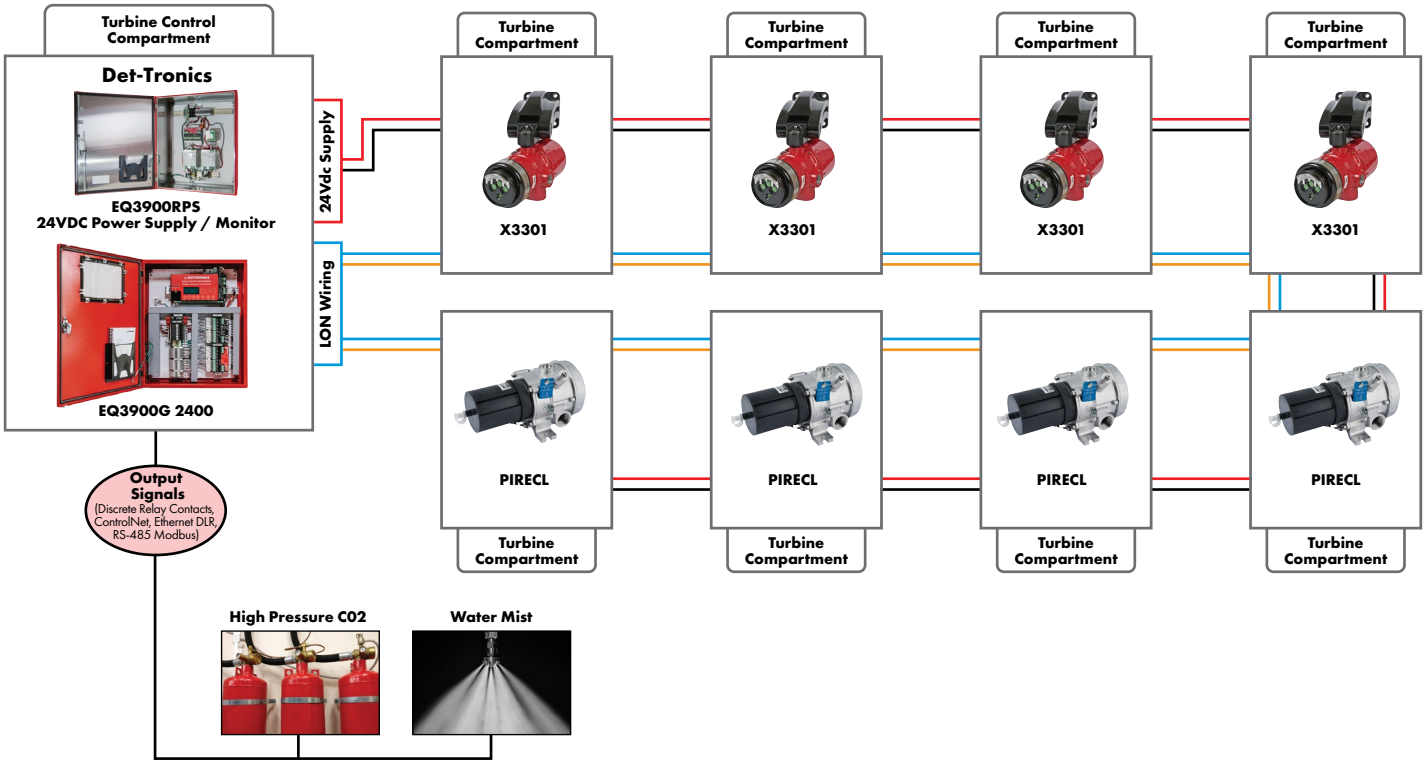


Flexibility:

- Option for utilizing existing wiring topology: if field wiring can be reused, this option helps to save installation cost
- Field devices can be upgraded, or system functionality can be changed

Addressable Wiring for Gas Turbine Enclosure Safety Systems

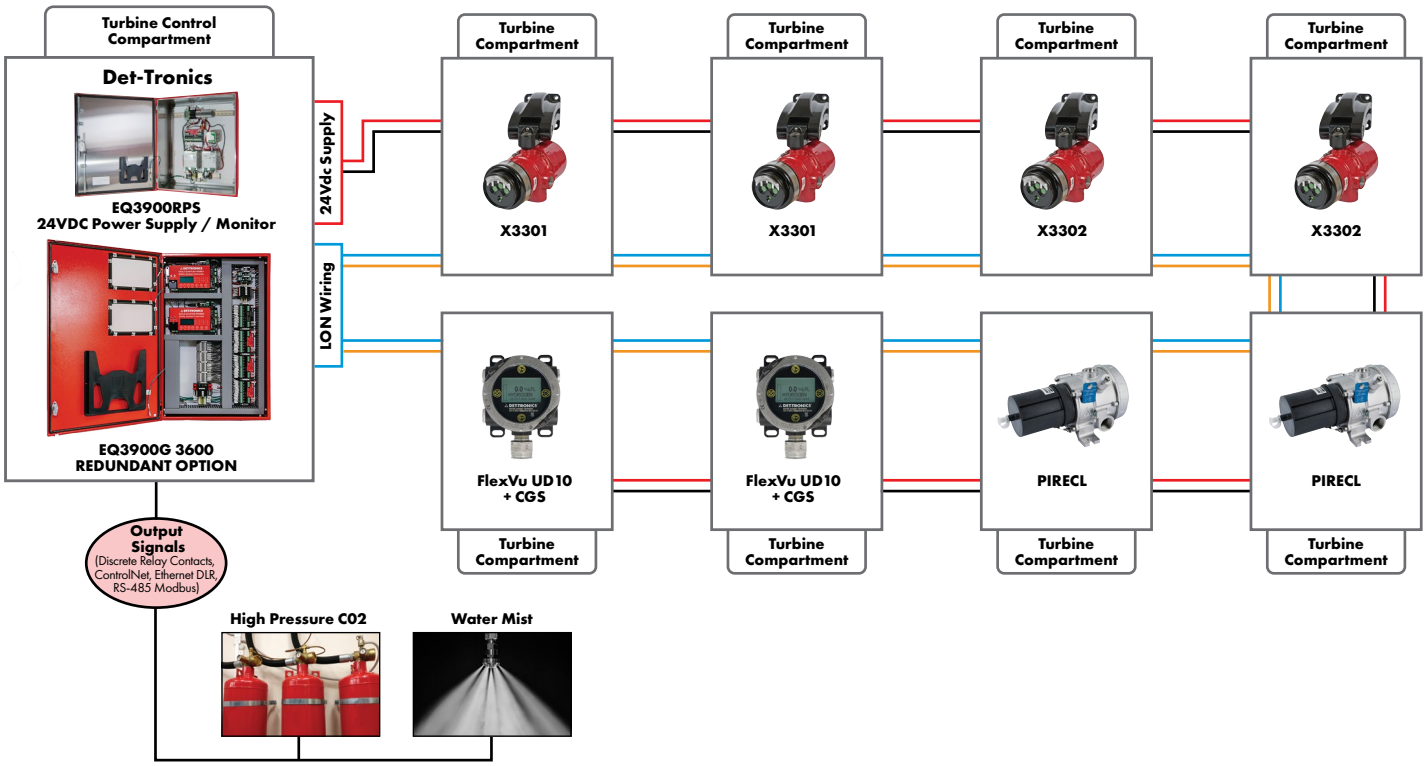
Option 1



Benefits:

- Differentiates field devices – provides complete status information for each device
- Flexible & versatile – each system accepts up to 246 nodes
- User Logic allows flame/gas voting, timing delays, timing executions, latching conditions, alarm and trouble notification, suppression control, condition control, and process shutdown notification
- Event log provides detailed event analysis
- Vacuum fluorescent text-based display clearly communicates system status
- Bi-directional, fault-tolerant digital communication Signaling Line Circuit - Class X
- Full approved flame and gas detection and releasing system – SIL2
- Less wiring = less conduit = less installation time = less cost
- Seamless integration with other turbine system control components
- Provides increased safety level and increased reliability over conventional wiring
- Long-term value and return on investment

Option 2



Benefits:

- In addition to the benefits on the previous page, the system allows for a mix of detection technologies to suit gas turbine applications with multiple gas types
- This example demonstrates how different technologies can be combined in a single system to detect fire from lube oil and hydrogen as well as hydrocarbon and hydrogen gas vapors

Limitations:

- Higher upfront cost than conventional system
- Requires training to program

Important considerations

For detection:

- What fuel(s) are present?
- Has a formal risk analysis been performed?
- Are there openings in the enclosure that cannot be closed?
- Minimum/maximum operating temperatures?
- Minimum/maximum storage temperatures?
- Might gas detection be beneficial in the enclosure ventilation air duct?

For extinguishing agents:

- Dimensions of gas turbine enclosure?
- Is there any ventilation air flow that is unstoppable? If so, what rate?
- What fuel(s) are present?
- Are there openings in the enclosure that cannot be closed?
- Minimum/maximum operating temperatures?
- Minimum/maximum storage temperatures?
- Beyond intentional design aspects, are there leaks present in the enclosure?

A Global Leader in Fire & Gas Safety Systems

Utilizing our licensed Fire Protection Engineers (FPEs), Det-Tronics provides expertise in design of detection and releasing systems for gas turbines, ensuring a code-compliant system.

Each project is assigned a project manager who carefully follows each project from design to delivery. Our design services include generation of system cause-and-effect diagrams, electrical connection drawings, power calculations, and all suppression system calculations. The documentation that is generated for each project is retained indefinitely, allowing future support.

A worldwide support network is available to assist in system commissioning and for any service requirements.

Det-Tronics Engineering Test Center
Savage, MN

Det-Tronics Systems Manufacturing Center
Bloomington, MN

92-1085-2.0 (US)

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