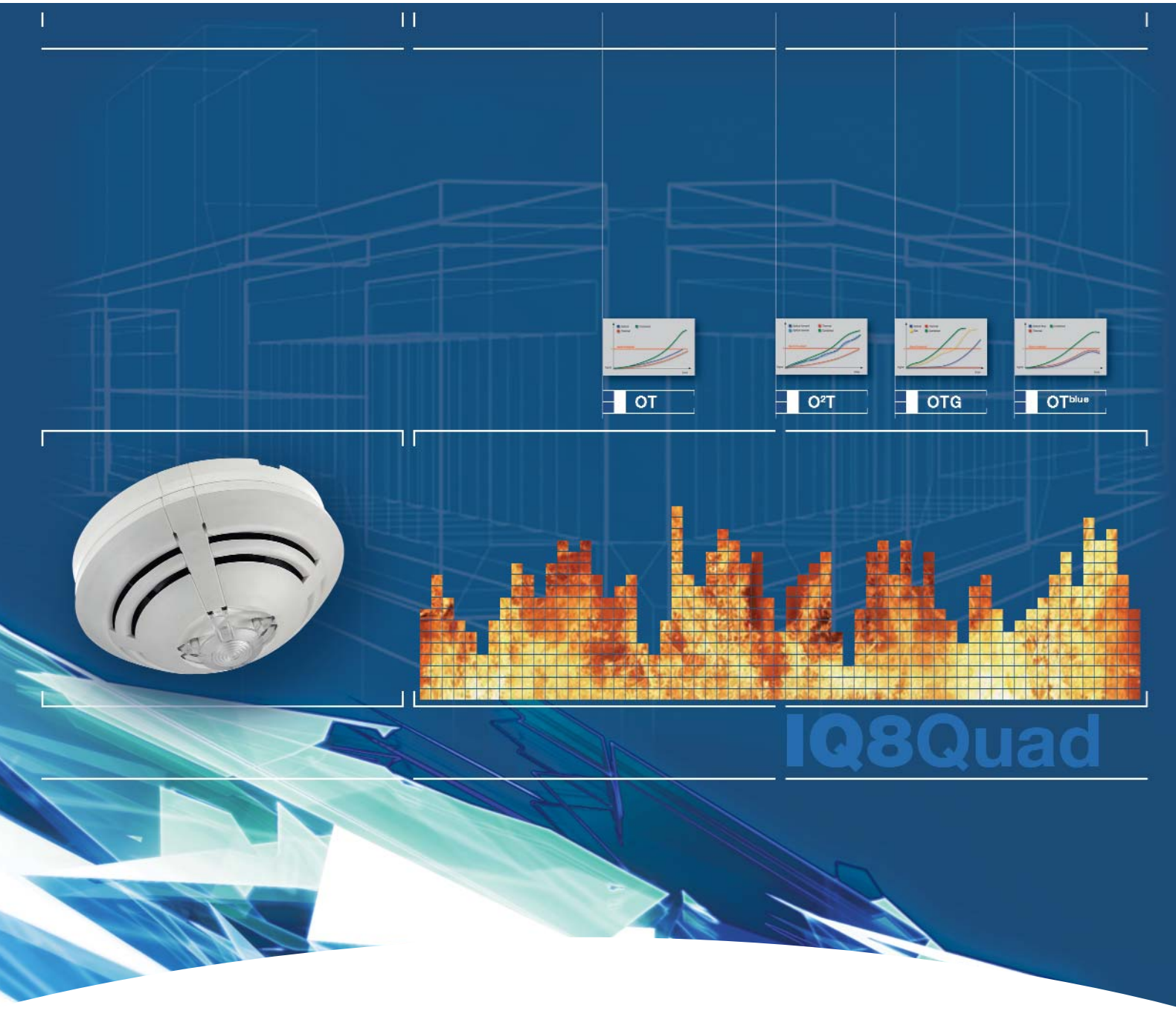
ESSER
by Honeywell



The right sensor for every environment

The detection principles of the **IQ8**Quad detector

▶ Fire detection technology

The right choice is decisive

No two fires are alike. The course and velocity of propagation are dependent on environmental conditions and the state of the flammable material. This is detected by means of the characteristic smoke, heat, or gas. A rule of thumb: the faster a fire is detected, the faster it is controllable and the more quickly people can be warned and evacuated.

Earliest possible and reliable fire detection is indispensable, especially in areas where it is a question of the constant availability of technical installations or of protecting irretrievable valuables, and also under very difficult environmental conditions such as cold, waste gases, dust, or moisture. A fire detector should therefore be perfectly matched with its respective on-site conditions so that fires are recognized earlier and distinguished more reliably from disturbance variables. Only in this way can human lives and valuables as well as technical, structural, or architectural special features be optimally protected.

No two fires are the same

Disturbance variable: steam

Test fire: n-heptane

Test fire: cotton

The combustion products of a fire are decisive criteria for fire detection: due to material and energy conversion of the substances involved, smoke particles, gases, temperature rises, and radiation are suitable fire detection variables. In practical tests, so-called test fires are defined for the distinction of different types of fire.

List of test fires

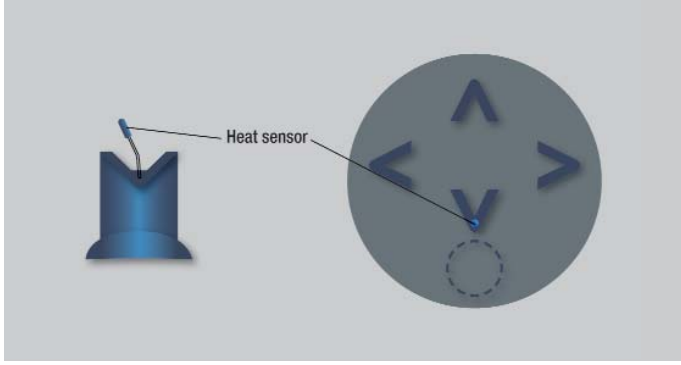
test fire	type of fire	flammable material	heat flow	airstream	smoke emission	aerosol characteristics
TF 1[1)]	cellulose open fire	wood	strong	strong	yes	dark
TF 2[2)]	pyrolysis smoldering fire	wood	negligible	weak	yes	bright, strong dispersive
TF 3[2)]	glowing smoldering fire	cotton	negligible	very weak	yes	bright, strong dispersive
TF 4[2)]	plastic open fire	polyurethane	strong	strong	yes	very dark
TF 5[2)]	liquid fire	n-heptane	strong	strong	yes	very dark
TF 6[1)]	liquid fire	ethanol	strong	strong	no	none
TF 8[3)]	liquid fire	decaline	negligible	weak	yes	very dark

[1)] Described in EN54-9. [2)] Described in EN54-7. [3)] EN54-15 in progress, currently the CEA Standard 4021 is valid.

Physical principles of the different sensors

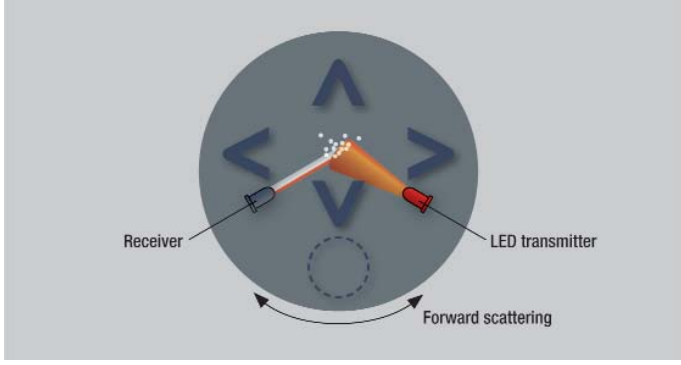
Thermodifferential/Thermomaximal principle

Heat detectors detect the temperature rise which takes place during combustion and react if the room temperature crosses a certain value (normally about 60 °C), or if within a certain time the ambient temperature goes up unusually quickly (thermodifferential evaluation). The maximum activating and operating temperature follows the classification of heat detectors according to EN 54-5.



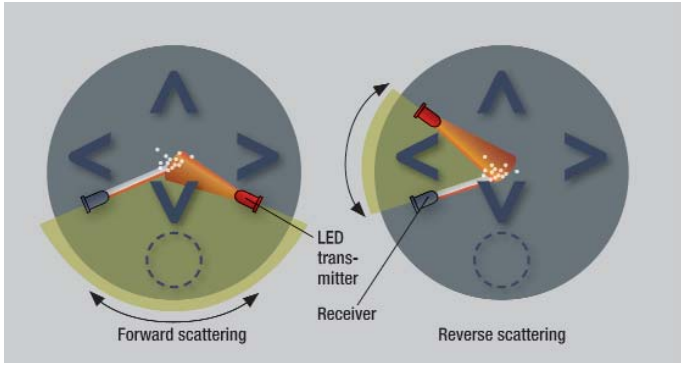
Optical principle with infrared light

Optical smoke detectors work using a scattered light procedure: a transmission LED and a receiver diode are positioned at a certain angle to each other. If visible aerosol particles from a fire penetrate the measuring chamber, a part of the light ray from the transmission LED will be scattered diffusely and the signal increase is evaluated inside the receiver.



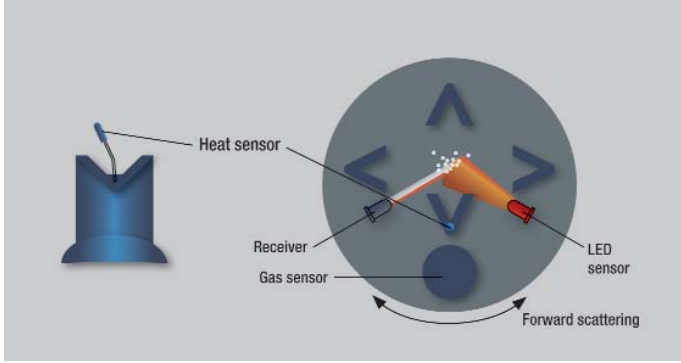
Optical two-angle principle

Unlike scattered light detectors, the O²T detector works with a two-angle technology and is therefore able to differentiate different particles within the measuring chamber. In this way, false variables are reliably distinguished from fire identifiers and different types of smoke can be distinguished within certain boundaries.



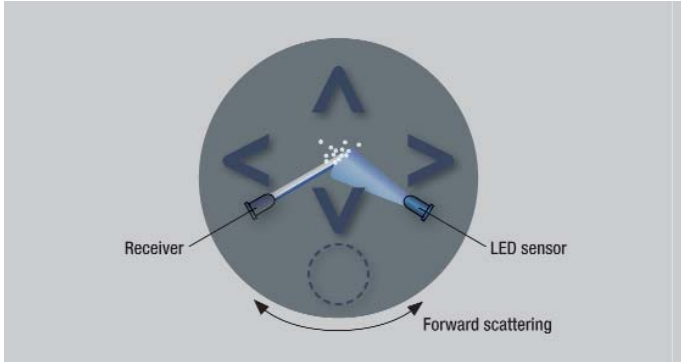
Gas detection with CO sensor

A fire gas detector will sound the alarm if the concentration of fire gases (for example CO) in a room crosses a certain value. With sensors that work according to this principle, gases are chemically bonded from the ambient air to the sensor surface. In this case, the gas molecules give electrical charges which increase the conductivity of the semiconductor. In order to provide secure fire detection, several optimized sensor elements are combined in one detector and are intelligently evaluated.



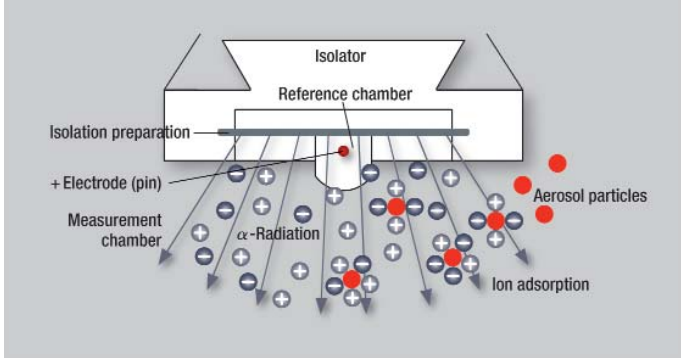
Optical principle with blue light

Instead of infrared light, a detector with blue light uses a blue LED. The shorter optical wavelength facilitates the detection of the smallest particles which up to now were recognized only by ionization detectors. The entire smoke spectrum is detected by the far higher sensitivity: from invisible up to large aerosols. Unlike ionization detectors, detectors with blue light function without radioactive elements and therefore these days usually replace ionization detectors.



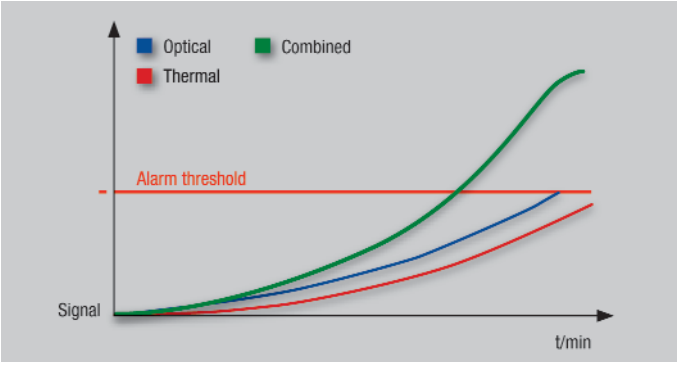
Ionization principle

Ionization detectors work with a radioactive source which produces ions between two charged electrodes. If smoke particles reduce the current flow between these electrodes, the detector will sound the alarm. Due to the radioactive radiation, ionization detectors are only currently used in special cases. The conditions for the proper disposal and processing of radioactive sources are strict and can cause high costs in the case of fire.



ESSER detectors in the test phase: which detector for which type of fire?

The classics: proven safety with IQ8Quad T, O & OT



IQ8Quad OT detector response in TF 4

IQ8Quad T detectors

Heat detectors are suitable for areas in which an emergency situation could consist of quick-burning open fires, as they do detect the temperature rise but not the smoke and fire gases. In modern buildings, however, smoldering fires with strong smoke formation frequently arise through the use of different materials before an open fire breaks out. Heat detectors are mainly used for the protection of property and are less suitable for personal safety.

A sleeping person would suffocate from fire gases before the heat detector could detect a temperature rise.

IQ8Quad O detectors

Optical detectors cannot detect any invisible aerosol particles, for example as they arise from an open wood fire. This type of detector is preferably used where an outbreak of fire (smoldering fire) would produce mainly cold smoke.

IQ8Quad OT detectors

With the OT detector, the optical light scattering principle was combined with the thermomaximal and thermodifferential principles. The linking of the data of both detector functions facilitates the reliable recognition of smoldering fires and fires with high heat development. This ensures a substantial improvement in detection security and that the danger of false alarms is clearly reduced. One detection principle alone does not often suffice if for example stored material with different combustion characteristics are kept under one roof, as for example cable material, textiles, cleaning agents, and solvents. Here the “multiple criterion principle” proves to be of optimal protection.

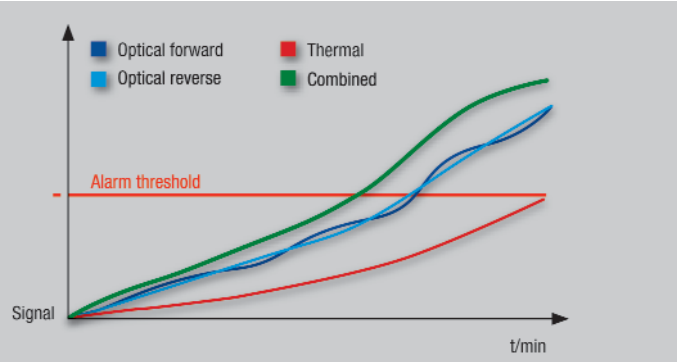
Areas of application

T detectors are very often employed in smoky or dusty rooms with normal temperature structures in which smoke detectors could activate false alarms due to disturbance variables, for example in workshops or kitchens, while the O detector is suitable particularly for the secure early recognition of fires with strong smoke formation in areas where personal safety is at the forefront.

your home

small offices

Protection from false alarms: IQ8Quad O²T early fire detection with disturbance variables



IQ8Quad O²T detector response in TF 5

Test fire 5: liquid fire (n-heptane)

IQ8Quad O²T detector

The O²T detects fires arising from the most diverse flammables with a constant sensitivity. It is ideally suitable for objects for which intense disturbance variables must be considered, such as for example steam and dust. Due to its two-angle technology, both dark and bright smoke is recognized reliably. In comparison to an optical detector, the O²T offers some considerably more constant response characteristics when dealing with different types of smoke. Through the refined observation and evaluation of forwards and reverse scattering, the O²T detector can reliably recognize false variables and thus minimizes the risk of false alarms.

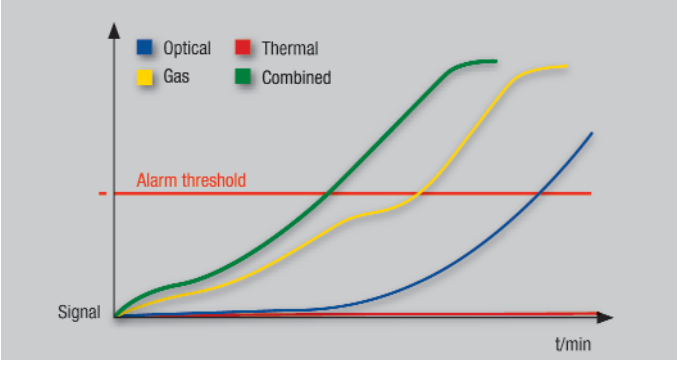
Areas of application

Anywhere that intense disturbance variables can be a factor, the O²T detects reliably with no danger of false alarms. Some examples: fine dust which is used in printing plants in order to coat freshly printed paper sheets; steam from shower cells in hotel rooms; microparticles from humidifiers in museums; or also dust in sawmills, bakeries, or other manufacturing enterprises.

damp rooms

sawmills

The lifesaver: IQ8Quad OTG inhibits smoke poisoning



IQ8Quad OTG detector response in TF 3

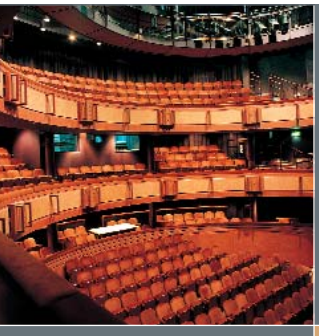
Test fire 3: glowing smoldering fire (cotton)

IQ8Quad OTG detector

The OTG is a multisensor detector and integrates an optical sensor chamber, a heat sensor, and an electrochemical element for carbon monoxide analysis. In this way it largely covers the spectrum of the relevant fire scenarios and additionally offers great protection from false alarms due to the “multisensor principle”. The areas of application of the OTG detector are especially those in which people are constantly present, since the early recognition of the dangerous combustion gases is the most important thing here: studies prove that 95% of deaths in fire victims were caused during the smoldering phase of the fire – while the victims were sleeping. In four out of five fire victims, toxic smoke is the cause of death.

Areas of application

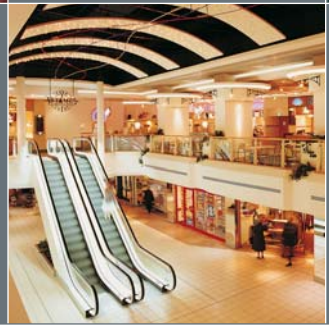
The OTG detector is the first choice where human lives must be protected and personal safety is at the forefront. It detects invisible and odorless carbon monoxide before a fire becomes visible. Because of this, it can already sound the alarm in a very early phase and thus prevents smoke poisoning, the most frequent cause of death in fire victims. Areas of application are for example hospitals, senior citizen and care homes, hotels, and youth hostels.



event rooms

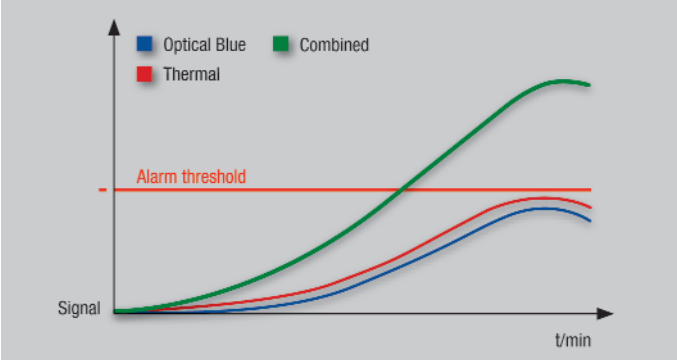
hospitals

shopping centers



airports

The quick and multitalented IQ8Quad OT^{blue}: recognizes even the smallest particles



IQ8Quad OT^{blue} detector response in TF 1

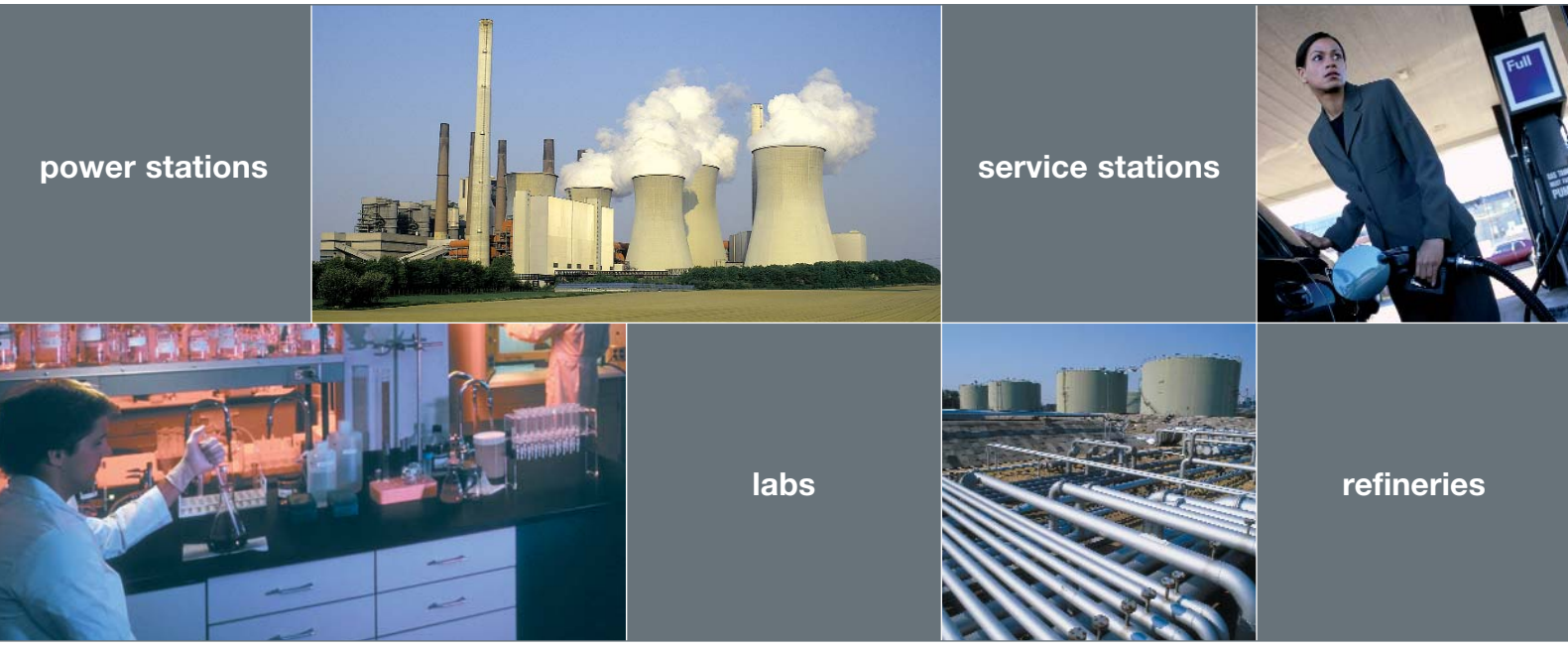
Test fire 1: cellulose open fire (wood)

IQ8Quad OT^{blue} detector

The OT^{blue} detector can be used everywhere an ionization detector has been in use up to now. It detects everything from liquid fires, open wood fires, and invisible aerosols to particles which up to now only ionization smoke detectors could recognize. In addition, it offers much faster response characteristics than standard optical smoke detectors and has a considerably smaller sensitivity to disturbance variables in comparison to an ionization detector, as with for example air flows and moisture. Due to its quick alarm, it is especially suitable for areas in which high-energetic fires can arise. Unlike the ionization detector, the OT^{blue} functions without a radioactive source and thus saves the high costs of proper disposal in the case of fire.

Areas of application

Everywhere highly flammable materials are stored or processed and where a split-second alarm is necessary – for example in oil refineries, power stations, motor vehicle workshops, computer rooms, or laboratories – the OT^{blue} is highly recommended.



Overview of detector suitability with different types of fire

There are a great number of different detector types. During the project planning of fire alarm systems, it is important to correctly choose the detector which suits one's actual needs in order to cover all potential fire scenarios. Currently there is still no fire detector which can be successfully used for all kinds of fire. In order to recognize the type of fire early on, it is important to determine its optimal characteristics and thus choose the correct detector by means of its individual response characteristics.

Test fire according to DIN EN 54 T9	Optical smoke detector	Thermo-differential detector	OT detector	O^2T detector	OTG detector	OT^{blue} detector
Cellulose open fire (TF 1)	●	●	●	●	●	●
Pyrolysis smoldering fire (TF 2)	●	●	●	●	●	●
Glowing smoldering fire (TF 3)	●	●	●	●	●	●
Plastic open fire (TF 4)	●	●	●	●	●	●
Liquid fire 1 (TF 5)	●	●	●	●	●	●
Liquid fire 2 (TF 6)	●	●	●	●	●	●
Liquid fire 3 (TF 8)	●	●	●	●	●	●

Legend: ● highly suitable ● suitable ● unsuitable

On the job

Multisensor detector characteristics in short:

OT – well-proven criteria combined: optical recognition and heat recognition.

O²T – highest false alarm security through the refined evaluation of forward and reverse scattering (two-angle principle).

OTG – highest personal safety through the early recognition of CO concentrations in the surrounding environment.

OT^{blue} – earliest possible detection of even the finest particles through optical measurement using the “Blue Principle”. The first to replace the ionization detector.

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Part No. 797989.G0
September 2008
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