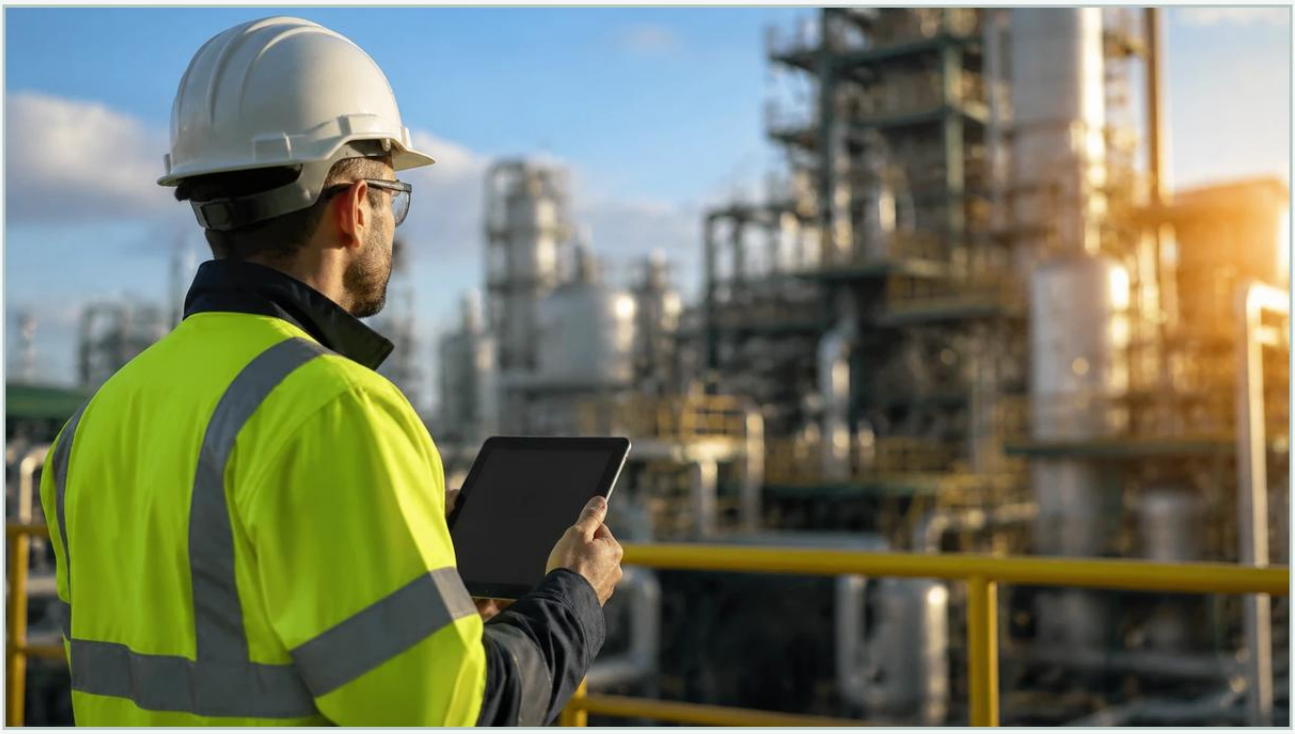
Atex Sensor

A practical guide to atex sensor, covering the reader intent, the relationship to atex sensor, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



levelmeter.org
Main topic: Main Page
https://www.level-meters.com/

In industrial environments such as oil refineries, chemical processing plants, and wastewater treatment facilities, the presence of flammable gases, mists, vapors, or combustible dust creates a significant risk of explosion. To mitigate these risks, specialized instrumentation known as an atex sensor is required. These devices are designed and certified to operate safely in potentially explosive atmospheres, ensuring that the electrical energy or thermal output of the sensor does not become an ignition source.

As a professional manufacturer, Welk provides a range of level measurement solutions specifically engineered for these hazardous locations. Understanding the technical requirements, zoning classifications, and measurement principles is essential for engineers and procurement professionals tasked with maintaining safety and accuracy in volatile processes. For a comprehensive overview of our industrial instrumentation and certified solutions, please visit our Main Page.

Understanding ATEX Certification and Zoning Principles

ATEX is derived from the French "Atmosphères Explosibles" and refers to two European Union directives (Directive 2014/34/EU for manufacturers and Directive 1999/92/EC for users) that govern equipment and workplace safety in explosive environments. An atex sensor must be classified according to the specific type of hazardous environment it will encounter.

Hazardous Area Zoning

Hazardous areas are categorized into zones based on the frequency and duration of the occurrence of an explosive atmosphere:

Zone 0 (Gas) / Zone 20 (Dust): An area in which an explosive atmosphere is present continuously, for long periods, or frequently. Sensors placed inside fuel tanks or chemical reactors usually require Zone 0 certification.

Zone 1 (Gas) / Zone 21 (Dust): An area in which an explosive atmosphere is likely to occur in normal operation occasionally.

Zone 2 (Gas) / Zone 22 (Dust): An area in which an explosive atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Protection Methods

To achieve ATEX compliance, sensors utilize various protection methods, the most common being:

1. Intrinsic Safety (Ex i): This method limits the electrical and thermal energy within the sensor circuit to levels below those required to ignite a specific hazardous atmospheric mixture. It often requires the use of a galvanic isolator or Zener barrier located in a safe area.

2. Flameproof/Explosion-Proof (Ex d): The sensor is housed in an enclosure capable of withstanding an internal explosion of a gas or vapor, and preventing the transmission of the explosion to the surrounding explosive atmosphere.

3. Encapsulation (Ex m): Parts that could ignite an explosive atmosphere are enclosed in a resin to isolate them from the explosive environment.

Measurement Principles for ATEX-Rated Level Sensors

Before selecting an atex sensor, it is critical to understand the underlying measurement principles. Each technology offers distinct advantages depending on the physical properties of the medium and the environmental conditions of the hazardous zone.

Radar Level Measurement (Non-Contact)

Radar level meters use high-frequency electromagnetic waves, typically in the 26 GHz or 80 GHz range. The sensor emits a signal that travels to the surface of the medium, reflects, and returns to the receiver. The time-of-flight (ToF) or Frequency Modulated Continuous Wave (FMCW) shift is used to calculate the distance. Because radar waves do not require a medium for propagation, they are unaffected by vacuum, high pressure, or temperature fluctuations, making them ideal for volatile chemical storage.

Ultrasonic Level Measurement

Ultrasonic sensors emit high-frequency sound pulses. The time taken for the echo to return from the liquid or solid surface is proportional to the distance. While cost-effective, ultrasonic atex sensors are sensitive to air temperature changes (requiring compensation), heavy foam, and vacuum conditions, as sound requires a medium to travel.

Hydrostatic Pressure Measurement

Hydrostatic level transmitters measure the pressure exerted by a liquid column. The principle is based on the formula $P = \rho \cdot g \cdot h$, where P is pressure, ρ is density, g is gravity, and h is the height of the liquid. In hazardous areas, submersible hydrostatic sensors must be intrinsically safe to prevent electrical faults from traveling through the liquid medium.

Magnetic Level Gauges and Switches

Magnetic level gauges use a float containing a permanent magnet that moves with the liquid level. This float interacts with an external indicator or a series of reed switches. Because the electrical components are isolated from the process medium by a solid chamber wall, they provide a robust mechanical solution for high-pressure ATEX applications.

Comparing ATEX Sensor Technologies

Selecting the correct technology involves balancing safety requirements with process conditions. The following table provides a comparison of common level measurement technologies used in hazardous areas.

Technology	Typical ATEX Zones	Medium Type	Accuracy	Key Advantage
Radar (80 GHz)	Zone 0, 1, 2	Liquids, Slurries, Solids	±1 mm	High precision; unaffected by vapor/dust
Ultrasonic	Zone 1, 2	Clean Liquids	±0.25% of range	Non-contact; cost-effective
Hydrostatic	Zone 0, 1, 2	Liquids	±0.1% to 0.5%	Simple installation in deep wells/tanks
Magnetic Gauge	Zone 0, 1, 2	Liquids	±5 mm to 10 mm	No power required for local indication
Level Switch	Zone 0, 1, 2	Liquids/Solids	N/A (Point Level)	Overfill protection; highly reliable

Critical Selection Criteria for Explosive Atmospheres

When specifying an atex sensor, engineers must look beyond the basic measurement range. Several factors influence the safety and longevity of the device:

Gas and Dust Groups

ATEX equipment is classified into groups. Group I is for mining, while Group II is for surface industries. Within Group II, gases are categorized (IIA, IIB, IIC) based on their ignition energy, with IIC (e.g., Hydrogen) being the most volatile. Similarly, dust is categorized as IIIA, IIIB, or IIIC. Ensure the sensor rating matches or exceeds the requirements of the specific substances present.

Temperature Classes (T-Ratings)

The surface temperature of the sensor must never exceed the ignition temperature of the surrounding atmosphere. T-ratings range from T1 (450°C) to T6 (850°C). A T6-rated sensor is the safest, as it maintains a lower maximum surface temperature.

Material Compatibility

In chemical or oil and gas applications, the sensor wetted parts (the parts in contact with the medium) must be chemically resistant. Common materials include 316L stainless steel, PTFE, Hastelloy, and PVDF. In ATEX zones, anti-static materials are often required for plastic components to prevent the buildup of electrostatic discharge (ESD).

Installation and Wiring Requirements for ATEX Compliance

The safety of an atex sensor is only as good as its installation. Failure to follow specific wiring and mounting protocols can void the certification and create a hazard.

1. Earthing and Grounding: Proper equipotential bonding is mandatory to prevent potential differences between the sensor and the tank, which could cause sparks.

2. Cable Glands and Conduits: Only ATEX-certified cable glands must be used. These glands provide a seal to prevent explosive gases from entering the sensor housing or traveling through the conduit system.

3. Intrinsic Safety Barriers: If using an "Ex i" sensor, an associated apparatus (barrier) must be installed in the non-hazardous area. This barrier limits the current and voltage sent to the sensor. The "Entity Parameters" (Ui, Ii, Pi, Ci, Li) of the sensor must be matched with the barrier's output parameters (Uo, Io, Po, Co, Lo).

4. Segregation of Cables: Intrinsically safe wiring must be physically separated from non-intrinsically safe wiring, often using blue-colored cables or separate cable trays, to prevent induction or accidental contact.

Operational Limitations and Maintenance Best Practices

While an atex sensor is designed for durability, it is not immune to environmental stressors. Regular maintenance is a requirement under most safety regulations.

Environmental Limits: Extreme ambient temperatures can affect the electronics. Most ATEX sensors have a specified operating range (e.g., -40°C to +80°C). If the process temperature exceeds this, cooling fins or remote electronics may be necessary.

Signal Interference: For radar and ultrasonic sensors, internal tank structures like agitators, ladders, or heating coils can create false echoes. Advanced software filtering (false signal suppression) is often required during commissioning.

Inspection Intervals: Periodic inspections should check for corrosion on flameproof paths, integrity of seals, and the tightness of cable glands. Any damage to the housing of an explosion-proof sensor requires immediate replacement, as its ability to contain an internal blast may be compromised.

Frequently Asked Questions

Q: Can I use a standard industrial sensor in a Zone 2 area if it is inside a sealed box?

A: No. Equipment used in any hazardous zone must be specifically tested and certified by a notified body. A standard sensor lacks the necessary internal safety features and documented thermal limits required for ATEX compliance.

Q: What is the difference between ATEX and IECEx?

A: ATEX is a mandatory legal requirement within the European Union. IECEx is an international certification scheme. Many Welk sensors carry both certifications, allowing them to be used globally while meeting local European safety laws.

Q: Do I need to recalibrate my atex sensor after opening the housing?

A: Opening the housing for maintenance does not necessarily require recalibration, but it does require extreme care. If the sensor is flameproof (Ex d), the "flame path" (the threaded or flanged joint) must be kept clean and undamaged. If the sensor is in a Zone 0 or 1 area, the power must be disconnected before opening the enclosure unless the device is intrinsically safe.

Q: How do I choose between 26 GHz and 80 GHz radar for a hazardous tank?

A: 80 GHz radar offers a narrower beam angle, which is better for avoiding internal obstructions and measuring through narrow nozzles. However, 26 GHz radar may be more effective in extremely dusty environments or where heavy condensation is present. Both are available with ATEX certification.

Conclusion

Implementing an atex sensor is a critical step in ensuring the safety of personnel and infrastructure in high-risk industrial environments. By understanding the zoning requirements, selecting the appropriate measurement principle—whether radar, ultrasonic, or hydrostatic—and adhering to strict installation guidelines, operators can achieve reliable level data without compromising safety.

Welk continues to innovate in the field of hazardous area instrumentation, providing robust, certified solutions tailored to the complexities of modern industrial automation. For technical support or to view our full product catalog, please visit our Main Page.