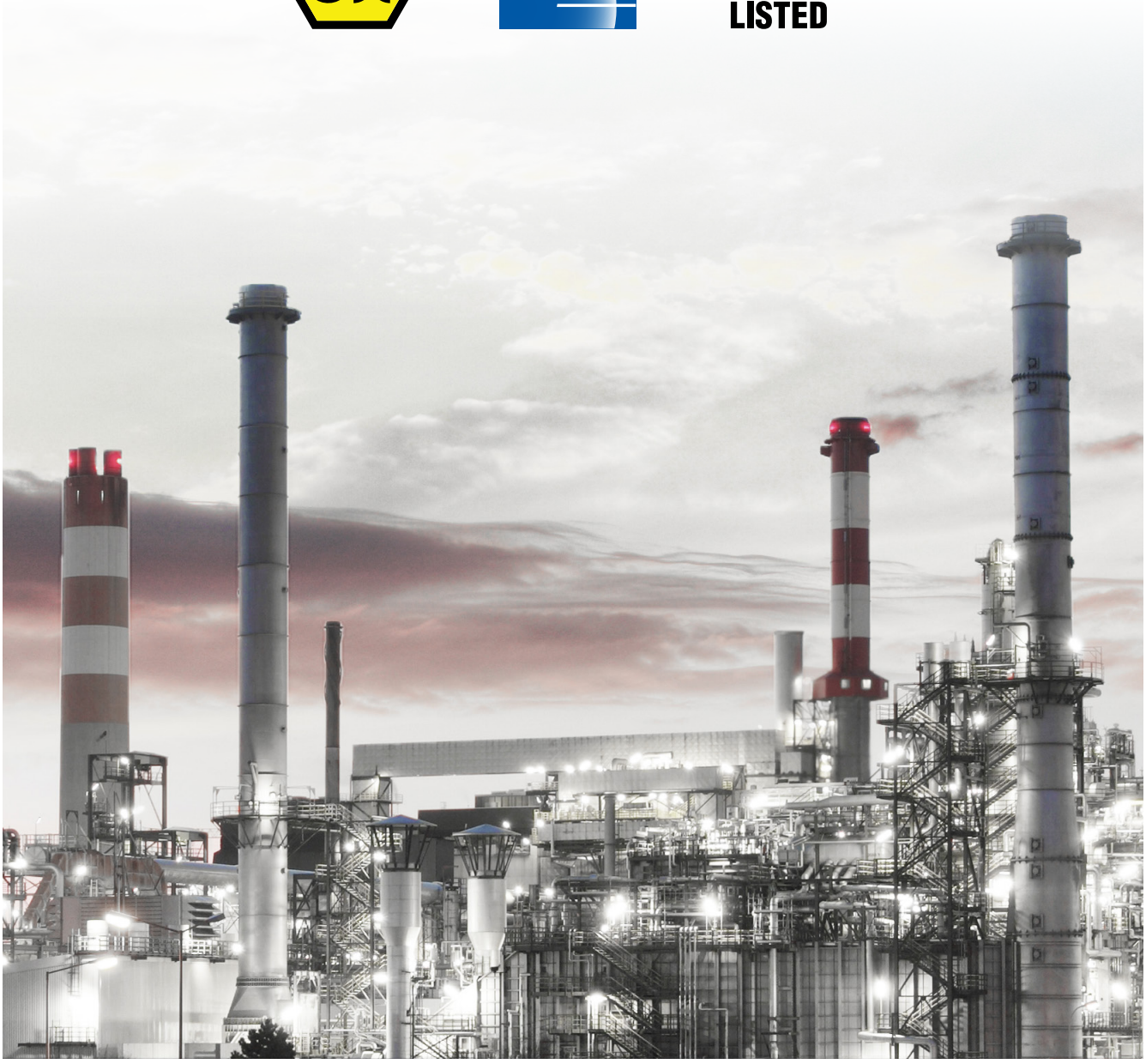
POSITAL

EXPLOSION-PROOF SENSORS EXPLAINED: ENSURING SAFETY IN HAZARDOUS ENVIRONMENTS

White Paper 2025



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1. Why Explosion-proof Technology Matters

Industrial automation continues to evolve toward higher productivity, connectivity, and precision. Yet many sectors – from petrochemical and marine to mining and food processing – operate in environments where a single spark can have catastrophic consequences. Flammable gases, combustible dust, or volatile vapors can transform an ordinary process into a serious hazard.

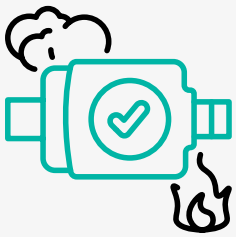
For almost two decades, POSITAL FRABA has been developing advanced sensor solutions for demanding applications. With extensive experience in motion control and Ex compliance, POSITAL provides engineers with certified encoders and inclinometers that combine performance, flexibility, and safety.

To minimize these risks, safety standards worldwide require explosion-proof-certified devices – components designed and tested to prevent ignition of explosive atmospheres.

2. Executive Summary

POSITAL's explosion-proof portfolio includes IXARC rotary encoders and TILTIX inclinometers engineered for hazardous environments where explosive gases or dust may be present. Certified under UL, ATEX, and IECEx standards, these sensors deliver:

Rather than one universal product, POSITAL offers a coordinated family of devices, each certified for specific regulatory frameworks and environmental conditions.



- **Reliable Operation in Hazardous Areas Containing Flammable Gases or Dust**

- **Compatibility with Global Industrial Networks and Mechanical Standards**

- **Rugged Construction to Withstand Vibration, Corrosion, and Temperature Extremes**

- **Clear Documentation for Regional Compliance**

Key Takeaway:

POSITAL's explosion-proof products deliver safety, precision, and adaptability across global markets, offering engineers certified, configurable solutions that meet local Ex requirements.

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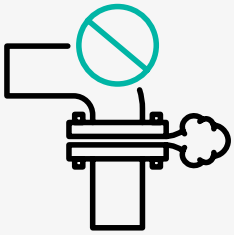
3. Understanding Hazardous Environments

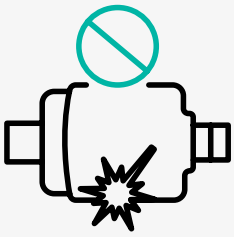
A “hazardous environment” is one where flammable gases, vapors, or dust may mix with air to create an explosive atmosphere. These conditions are found in oil and gas installations, chemical plants, grain mills, mines, and woodworking facilities.

POSITAL’s explosion-proof sensors embody key safety principles, featuring robust housings, high-quality seals, and non-sparking materials to maintain reliability in volatile environments. Certified electrical devices follow three core principles to prevent ignition, all reflected in this sensors.



1 Avoid

Prevent Gas or Dust Accumulation and Eliminate Ignition Sources



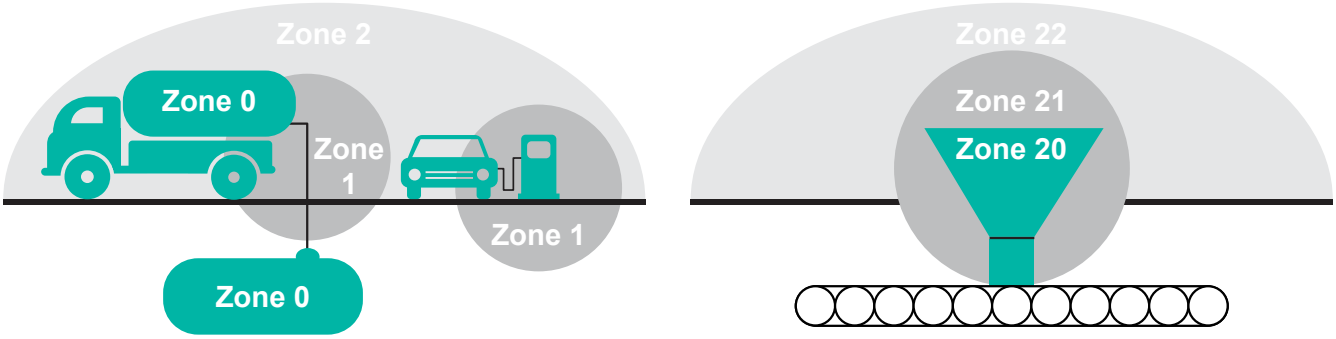
2 Reduce

Lower Ignition Probability Through Certified Explosion-proof Designs

3 Contain

Ensure that, if Ignition Occurs, it Remains Enclosed Within the Device

4. Explosion-proof Standards Explained



Different regions apply different frameworks to certify equipment used in explosive atmospheres. All aim to ensure devices cannot ignite hazardous gases or dust.

ATEX
(European Union)

The ATEX Directives 2014/34/EU and 1999/92/EC define requirements for electrical equipment used in explosive atmospheres. Devices are divided into "zones" depending on the likelihood of exposure:

- **Zone 0 / 20**
  Continuous Presence of Explosive Atmosphere
- **Zone 1 / 21**
  Likely Presence During Normal Operation
- **Zone 2 / 22**
  Rare or Abnormal Presence

IECEx
(International Standard)

The IECEx Scheme, managed by the International Electrotechnical Commission, harmonizes testing and documentation processes to support international trade. POSITAL's IECEx-certified sensors ensure consistent safety validation across multiple markets.

UL / CSA
(North America)

In the U.S. and Canada, explosion-proof certification follows UL1203 and CSA C22.2 standards, which classify areas by Class (type of hazard) and Division (frequency of hazard presence):

- **Class I, Div. 2**
  Flammable Gases and Vapors
- **Class II, Div. 2**
  Combustible Dust
- **Class III**
  Ignitable Fibers and Flyings

ATEX
(European Union)

Zone – Gases / Zone – Dusts

Zone 0 / Zone 20
Constant Danger / Very High
Explosive Hazard Always Present

Zone 1 / Zone 21
Potential Danger / High
Explosive hazard Occasionally Present During Normal Working Practices

Zone 2 / Zone 22
Minor Danger / Normal
Explosive Hazard Not Likely or Only for Short Periods

UL / CSA
(North America)

Classes – Define the Type of Hazardous Material Present

Class I
Flammable Gases, Vapors, or Liquids

Class II
Combustible Dusts

Class III
Flammable Gases, Vapors, or Liquids

Divisions – Define the Likelihood or Frequency of the Hazard Being Present

Division 1
Hazardous Material is Present Under Normal Operating Conditions

Division 2
Hazardous Material is Present Only Under Abnormal Conditions (Such as Equipment Failure or Leaks)

Groups – Define the Specific Type of Hazardous Material Within Each Class

Class I (Gases / Vapors)
Group A: Acetylene
Group B: Hydrogen or Gases of Equivalent Hazard
Group C: Ethylene, Ether, etc.
Group D: Propane, Gasoline, Methane, etc.

Class II (Dusts)
Group E: Conductive Metal Dusts (Aluminum, Magnesium, etc.)
Group F: Carbonaceous Dusts (Coal, Carbon Black, etc.)
Group G: Grain, Flour, Starch, Plastic Dusts, etc.

Class III
No Groups Defined (Handled Generally as One Category)

5. POSITAL Product Families and Their Certification Scope

To help customers navigate this complexity, POSITAL aligns each explosion-proof product family with the relevant certification framework and risk zone:

Together, these families form a global offering – locally certified for each regulatory framework yet unified by POSITAL's shared design standards and modular engineering.

Product Family	Certification Type	Typical Application Zone / Division
OCE / UCE	ATEX & IECEx	Zone 1 / 21 – Gas and Dust Environments
OCM / UCM	ATEX Mining (Group I)	Underground Mining and Tunneling
UCF / OCF / UTF	ATEX & IECEx	Zone 2 / 22 – Lower-risk Hazardous Areas
UCU	UL / CSA	Class I, Division 2, Groups A, B, C, D Class II, Division 2, Groups F, G Class III – North American Markets

6. IXARC Explosion-proof Rotary Encoders

The IXARC family represents POSITAL's long-standing expertise in rotary motion sensing. These encoders are available in both incremental and absolute versions, allowing system designers to select the optimal technology for their needs.

Incremental Models (HTL/TTL)

Deliver pulse signals corresponding to shaft rotation – ideal for monitoring speed and relative position in motion-control systems.

Absolute Models (Singleturn/Multiturn)

Provide a unique position value for every shaft angle.

- **Magnetic Absolute Encoders**
  Feature the Wiegand Sensor System, which Harvests Energy from Rotation to Power the Multiturn Counter Without Batteries – Ensuring Maintenance-free Operation.
- **Optical Absolute Encoders**
  Use a precision Gearbox for Multiturn Tracking, Offering Superior Resolution for Demanding Industrial Tasks.

Interfaces

ANALOG SSI PROFINET PROFIBUS J1939
Modbus CANopen EtherCAT
INCREMENTAL EtherNet/IP IO-Link

Certifications and Construction

All IXARC explosion-proof encoders comply with ATEX, IECEx, or UL standards.

- Shock resistance: Up to 100 g
- Vibration: Up to 10 g Continuous
- Operating Temperature: –40°C to +70°C
- Protection Class: IP65/66/67
- Housings: Aluminum or Stainless Steel 303/316L

Programming and Configuration

Incremental and absolute encoders of the UCE, UCF, UCM, and UTF families can be configured using the UBIFAST programming tool.

UBIFAST supports encoders with incremental, SSI, and analog interfaces, enabling adjustments to resolution, output type, and counting direction directly in the field.

Key Takeaway:

IXARC explosion-proof encoders combine precision, flexibility, and a wide range of mechanical and electrical configurations – including various shaft sizes, flange styles, and connector or cable orientations – ensuring easy integration across industries and environments.

7. TILTIX Explosion-proof Inclinometers

TILTIX series expands POSITAL's explosion-proof portfolio into angular measurement applications. Certified under ATEX and IECEx, these inclinometers deliver accurate angle monitoring in environments with explosive gases or dust.

Features

- Ranges: ±80° Dual-axis or 0 – 360° Single-axis
- Accuracy: 0.1°; Resolution: 0.044°
- Interfaces: CANopen, J1939, Analog (Voltage/Current)
- Housing: Anodized Aluminum or Stainless Steel 316L
- Resistant to Shock, Vibration, and Corrosion

Key Takeaway:

TILTIX inclinometers deliver stable, precise, and certified angular feedback for industries such as mining, offshore, and construction – ensuring reliable performance in challenging Ex conditions.

8. Simplifying the Certification Challenge

The global certification landscape can be complex, with varying regional standards and documentation requirements. Rather than one "global" product, POSITAL offers a coordinated portfolio of locally certified devices. Each product family – such as OCE/UCE for ATEX/IECEx Zone 1/21, UCF/OCF/UTF for Zone 2/22, OCM/UCM for mining, and UCU for UL Class I & II Div. 2 – addresses specific regulatory needs while maintaining shared design and quality standards. Through decades of collaboration with OEMs and integrators, POSITAL has developed deep expertise in certification processes. The company works with customers to extend certifications for new markets, adapting products and documentation as needed.

Key Takeaway:

POSITAL simplifies Ex compliance by combining local regulatory certification with global engineering consistency – offering confidence, flexibility, and reduced project complexity.

9. Real-world Applications

Explosion-proof encoders and inclinometers are essential wherever safety and motion control intersect. POSITAL sensors are deployed in numerous industries where ignition prevention, mechanical reliability, and precision feedback must coexist.

Oil and Gas Exploration and Drilling

Used on drawworks, top drives, and pipe-handling systems for precise position and speed feedback. Combined with electric or hydraulic motors, IXARC encoders enable safe drill-string movement under ATEX Zone 1/21 or UL Class I, Div. 2 conditions.

TILTIX inclinometers support mast alignment, derrick tilt, and platform leveling.

Marine and Offshore

On winches, cranes, active gangways, and ram tensioners, POSITAL sensors withstand salt, vibration, and pressure variations. TILTIX inclinometers stabilize gangways; IXARC encoders ensure accurate torque and motion control during lifting operations.

Chemical and Paint Processing

Explosion-proof encoders control mixers, dosing systems, and agitators, while TILTIX inclinometers verify vessel alignment and tilt during production. 316L stainless-steel housings resist corrosion and chemical exposure.

Mining and Bulk Material Handling

In conveyors, bucket elevators, and shaft hoists, IXARC encoders provide reliable speed and position control under ATEX Mining Group I certification. TILTIX inclinometers monitor alignment, maintaining structure stability in dusty, gas-prone areas.

Agriculture, Milling, and Biomass

Used in silos, conveyors, and dryers, magnetic encoders provide non-contact sensing immune to dust contamination – certified for Zone 21/22.

Renewable Energy and Green Technologies

Applied in offshore wind, hydrogen, and biomass plants, POSITAL sensors support torque control, yaw alignment, and valve actuation under Ex conditions.

Key Takeaway:

These examples represent only part of the many potential applications. POSITAL's modular Ex portfolio enables safe and precise motion control across countless other industries where reliability and explosion protection are essential.

10. Customer Value and Benefits

☑ Local Compliance, Global Expertise

POSITAL offers a globally coordinated but locally certified portfolio, ensuring each product line meets its region's Ex requirements while maintaining consistent quality and performance.

☑ Rugged & Corrosion Resistant Design

POSITAL offers a globally Explosion-proof housings in anodized aluminum or stainless steel 316L ensure long-term operation in marine, offshore, and chemical environments.

☑ Maintenance-Free Operation

POSITAL's magnetic absolute encoders use the Wiegand Sensor System, eliminating batteries and enabling maintenance-free multiturn position tracking.

☑ Easy Customization and Configuration

The UBIFAST tool supports configuration for UCE, UCM, UCF, UTF, UCU families with incremental, SSI, and analog interfaces – allowing on-site parameter setup and reducing inventory complexity.

☑ Mechanical and Installation Flexibility

A broad range of shaft types, flange geometries, and connector or cable orientations ensures easy integration into new or existing machines.

☑ Future-Ready Industrial Integration

POSITAL supports modern communication standards such as IO-Link, PROFINET, EtherCAT, and EtherNet/IP, ensuring compatibility with legacy and next-generation control architectures.

Key Takeaway:

POSITAL delivers certified, reliable, and easily adaptable explosion-proof sensors that integrate seamlessly into diverse industrial environments worldwide.

11. Conclusion

In environments where safety and reliability are critical, POSITAL's explosion-proof sensors provide dependable, certified performance.

By harmonizing UL, ATEX, and IECEx certifications, POSITAL offers a portfolio that supports global operations through locally compliant product lines.

Short lead times and global manufacturing capabilities ensure rapid product replacement – minimizing downtime and supporting efficient MRO operations.

With a legacy of innovation and a focus on continuous improvement, POSITAL remains a trusted partner for safe, precise, and future-ready motion control solutions.

Customers can identify suitable models quickly via the POSITAL Product Finder

- IXARC Incremental Encoders
- TILTIX Inclinometers
- IXARC Absolute Encoders
- Explosion-proof Accessories

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