



*REFEX sensors provide a revolution in the reliability, accuracy and stability of pH measurement.*

## Reliability

REFEX-based pH sensors have an operational lifetime far exceeding traditional porous barrier technologies. 12 years of operational use show that each REFEX sensor lasts at least four times as long as traditional equivalents.

The ISO9001 certified quality control procedures used at REFEX's Ireland manufacturing facility includes testing of all sensors at multiple stages in the construction process to guarantee extremely low on-arrival and in-service failure rates.

**REFEX's long lifetime allows operators to realise savings in operational downtime caused by replacement and repair.**



## Accuracy

REFEX-based pH sensors provide highly accurate pH measurement. Due to the large electrochemically active surface area and its solid-state nature, this accuracy is maintained even in conditions where it is traditionally difficult, if not impossible, to maintain accurate pH measurement. An example is in cold low-ionic water where REFEX maintains an impressive accuracy of +/- 0.01pH. In addition to high levels of accuracy, REFEX delivers near-instantaneous response to pH changes.

**REFEX's fast response and accuracy allow operators to realise immense savings in overuse of dosing chemicals by tightening control loop constraints and eliminating measurement overshoot.**

## Stability

REFEX-based pH sensors represent a revolution in measurement stability. By allowing an electrochemical connection to the internal half cell without resorting to a porous junction, REFEX avoids the problems that plague traditional pH reference electrodes.

By eliminating the porous junction in favour of an advanced electrochemically active sensor body REFEX provides unmatched measurement stability. 12 years of operational use in the water treatment industry consistently shows that REFEX sensors suffer minimal signal drift over their two year operational life. Consequently, compared to the weekly recalibration required by many pH sensor installations, REFEX-based sensors only require a confirmation check every 90 days.

**REFEX's excellent long term measurement stability allows operators to realise large savings in the operational and manpower costs associated with constant sensor checks and recalibration**

REFEX electrodes are **designed specifically for reliable, accurate and stable measurement** of pH in harsh conditions. Their unique solid-state nature allows them to resist most of the problems that produce errors in traditional alternatives including chemical poisoning, sensor fouling/coating and ion diffusion. For more information on how REFEX can upgrade your pH measurement installations, contact us at the numbers below.





## Why REFEX?

pH measurement in the petrochemical industry is frequently extremely difficult. Frequently operating in high temperatures with highly reactive contaminants traditional pH reference electrodes can, in some roles, last only days.

REFEX reference sensors are designed for arduous applications particularly where fouling or poisoning conditions exist. The reference uses a highly stable non-porous polymeric interface in place of the traditional porous liquid junction used by all conventional reference electrodes. The active reference area is the whole of the outside surface of the electrode, this super large contact area means that the electrode is supremely resistant to coatings. Poisoning effects are eliminated because the polymeric reference material is ionically conductive, but is not porous, consequently electrolyte and process fluids are not exchanged.

The advanced solid-state nature of REFEX reference electrodes mean they remain extremely accurate and reliable across a wide range of conditions, including:

Temperature: 0 to 90°C

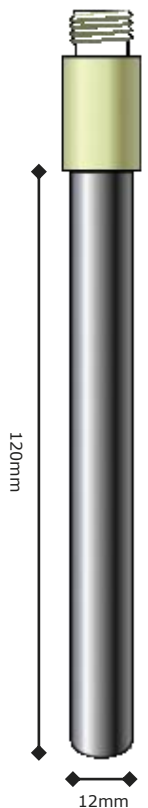
Pressure: 0 to 20 bar

In addition, REFEX reference electrodes are extremely resistant to chemical poisoning and sensor fouling

## Sensor Fouling

One of the major problems for traditional pH sensor technologies in the petrochemical industry is sensor fouling and deposit coating. **A layer of debris and/or an oily film** can develop over the surface of the sensor. Traditional porous junction reference electrodes are vulnerable to these issues as they rely on a small area to form the electrochemical connection between the process flow and the internal half-cell. If this restricted area is contaminated then the impedance at the junction increases substantially and the measurement becomes inaccurate.

In comparison, the entire sensor body of REFEX provides the electrochemical connection. As a result, REFEX-based sensors are highly resistant to the effects of fouling and coating. There is no specific small junction to become clogged and as long as the outside surface of the sensor remains wetted the signal from the sensor will remain stable.



In addition, as REFEX possesses an inherently higher junction impedance than most traditional reference electrodes the increase in impedance due to fouling has a much lower effect even when the fouling is advanced.

When cleaning is necessary, for instance when the coating becomes sufficient to affect the glass electrode, REFEX's chemically resistant body can be cleaned in exactly the same manner as the glass, whether by detergent, acid or a caustic wash.

Following cleaning traditional sensors often require time consuming recalibration. In comparison, the solid-state nature of Refex results in a return to consistent readings with only a 15 minute delay to allow readjustment from cleaning to process conditions.

As a result of these improvements REFEX-based sensors can provide a revolution in pH sensor integrity, thereby allowing operators to massively reduce the constant work of maintaining their pH measurement systems.



## Sensor Poisoning

One of the most common issues with the use of traditional pH reference electrodes in the petrochemical industry is the poisoning of the porous barrier by compounds within the process flow. For instance, sulphides can penetrate through the porous junction and cause silver precipitation in the junction and in the internal silver-chloride half-cell. Ammonia and cyanide can similarly contaminate the reference cell and form a complex with the silver ions. Either of these conditions inevitably lead to highly inaccurate readings.

In comparison, REFEX's advanced solid-state construction, by eliminating the porous barrier in favor of an impermeable electrochemically active body, is extremely resistant to all such contamination as there is no route for process chemicals to contaminate the internal reference half-cell.

As an example, stripping towers used to remove sulphides and ammonia from sour water operate at around 80°C with high levels of contamination. Traditional porous junction reference electrodes may last only days as the conditions drive fast contamination and poisoning. In the same conditions REFEX-based pH would be expected to last many months.

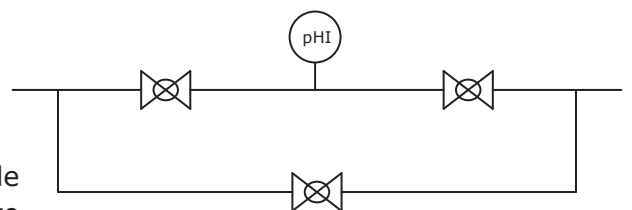
REFEX-based pH measurement systems are extremely reliable with long accurate lives even in unusually harsh conditions.

## The REFEX Approach

REFEX can provide sensors and installations for any operational pH measurement requirement. Your regional REFEX agent will advise you on the ideal solution for your process including:

- An appropriate ¾" pH/REFEX combination probe
- A ¼" 316 stainless steel piping installation with bypass
- PTFE high temperature corrosion resistant measurement flow cell
- pH signal transmitter from one of our recommended manufacturers

In addition to full new installations, REFEX is available ready for retrofitting with guaranteed compatibility to common transmitters in many existing installations.



### **Retrofit Connectors**

- IP65 Fixed cable
- Euro Cap Connector System with PGI3.5 (S.7 type)
- Yokogawa Head Cap System
- ABB/Emerson 1" NPT process mounting
- ¾" flow cell process mounting

### **Existing pH Installations**

- ABB/TBi
- Emerson
- Yokogawa
- Endress and Hauser

Contact us now to discover more about how REFEX can improve your process quality and reliability through long-life, accurate and stable pH measurement.



*When pH is the question – REFEX is the answer...*



**REFEX has replaced the need to have a liquid junction and acts as both an immobilised electrolyte and also as an non-porous protective interface separating the medium under test from the internal silver-chloride half-cell. The entire outside surface of the REFEX electrode is electrochemically active.**

Among the many benefits of this revolutionary design is extremely high resistance to fouling. REFEX-based electrodes do not foul even when completely coated in traditionally problematic measurements such as oily waste water pH.

Due to its non-porous nature, REFEX continues to perform from vacuum to 20 bar pressure and in temperatures from 0 to 100°C without degrading.



### Applications

**Sulphides** — Sour waters with H<sub>2</sub>S, flue gas desulphurisation, gas scrubber water

**Ultra Pure Water** — Resistance to diffusion potential error

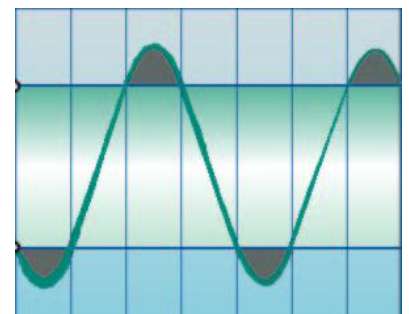
**Highly Acidic and Basic Streams** — REFEX is highly resistant to the most extreme pH conditions

**Cooling Water Treatment** — Extremely long life even in cold low ionic water with trace metals such as magnesium and iron

**Effluent** — Highly resistant to fouling

### Instant Response

The REFEX solid state reference system responds instantaneously to pH changes. This results in substantial quality improvements quality in critical areas such as titrations and chemical dosing. The entire outside surface is electrochemically active, resisting fouling, so the reliable instant response prevents pH measurement over-shoot and unnecessary wastage of dosing chemicals.



REFEX electrodes are a unique technology produced exclusively by Refex Sensors Ltd in their production facility located in Westport, County Mayo, Ireland.

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