Application Report
Ceramic sensor lock-gate
for the toughest conditions

Knick

When nothing else will do

Highly viscous or pulpy process media, a high solids content, an extreme tendency to form deposits or simply chemically aggressive and corrosive substances: there are measuring tasks which seem almost impossible for sensors and their retractable fittings. But not for Ceramat: the ceramically sealed sensor lock-gate can withstand the toughest applications, also in the extra long version, CeraLong.

Knick first launched a ceramically sealed sensor lock-gate for sensors in 2004 – the Ceramat WA 150. This fitting enables automatic insertion and retraction of the sensor together with automatic cleaning and calibration. In extreme process media, this is the only way to guarantee maximum availability of the measuring point. The interior, made of pure aluminum oxide ceramic (sapphire), is almost as hard as diamond and extremely chemically resistant. This sealing makes the Ceramat sensor lock-gates ideal for use in heavy duty processes in which conventional push rod fittings or ball valves fail..

The ceramic retractable fitting has undergone extensive development and now forms a complete product family. Its most recent addition is a version with a specially extended immersion depth, the CeraLong. It rectifies one disadvantage – limited immersion depth – of the previous Ceramat.

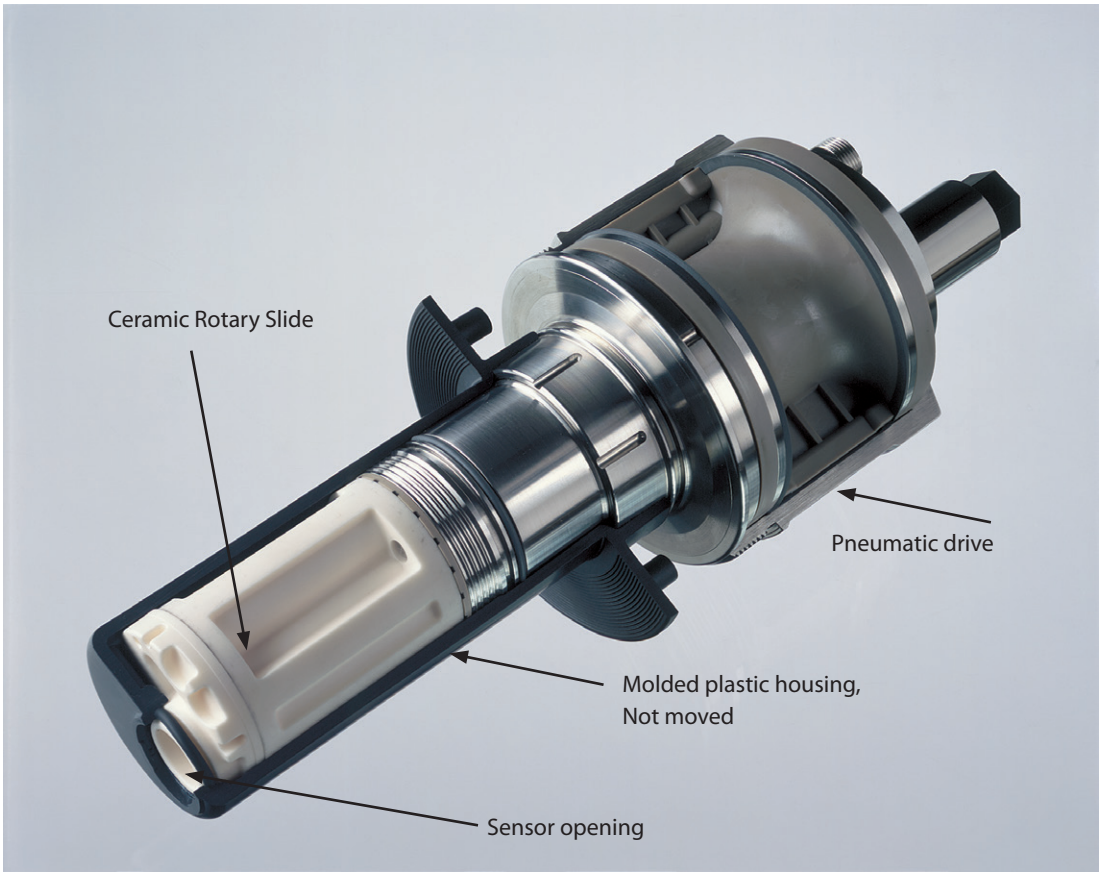
There is, however, considerable demand for measurements in gutter channels, in thick-walled thermally insulated reactors, or in large containers where measurement is required not at the outer wall but toward the middle of the container. The Ceralong WA 154 and WA 160 were developed to meet these demands.

The lock-gate's thermal and mechanical stability has also been further boosted. CeraLong was designed for a safety pressure of up to 40 bar at +140 °C. Stainless steel, Hastelloy and titanium are now also available as the process-wetted housing materials.

All the other features of the shorter Ceramat have been retained, including the integrated internal rinse function for sensitive processes with high safety requirements. All relevant seals and the rinsing chamber can be accessed without special tools. With Ceramat, it is possible to replace the drive unit while the process is running.

A safety aspect which users value greatly. A Ceramat, like all of Knick's retractable fittings, thus always reliably seals off the process, also when inserting or retracting the sensor. It's worth remembering that an ostensibly reliable ball valve cannot do this. A washable sensor which is inserted into the process using a ball valve is in 90% of cases in the measuring position, i.e. open. The result is that the process pressure is applied directly to the rinsing chamber. In this position, the ball valve has no closing function. Also new is the version with lock protection for fiber-optic probes, used for example to connect a Raman spectrometer. It is important that optical probes can have a full view into the process, something which is generally not possible with conventional push rod fittings.

With pulpy media and a high level of abrasive solids content, fertilizer and ore production are examples of areas which make the toughest demands on mechanical systems. Slurried ore sediments precipitate into flotation tanks based on their pH values. Aggressive cleaning with hydrochloric acid is regularly required. A classic application for the Ceramat with extended immersion depth. Use in dye synthesis. When synthesizing dyes, practically all the key reaction steps are pH-dependent, meaning that optimizing product yield demands a reliably working and low-maintenance pH measurement. The diazotization is strongly hydrochloric and correspondingly corrosive. The reactors are lined with enamel for protection, the coupling reactors are also rubber-coated. The extreme conditions for the measuring point are pH 1 at +90 °C and a pressure of 6 bar.



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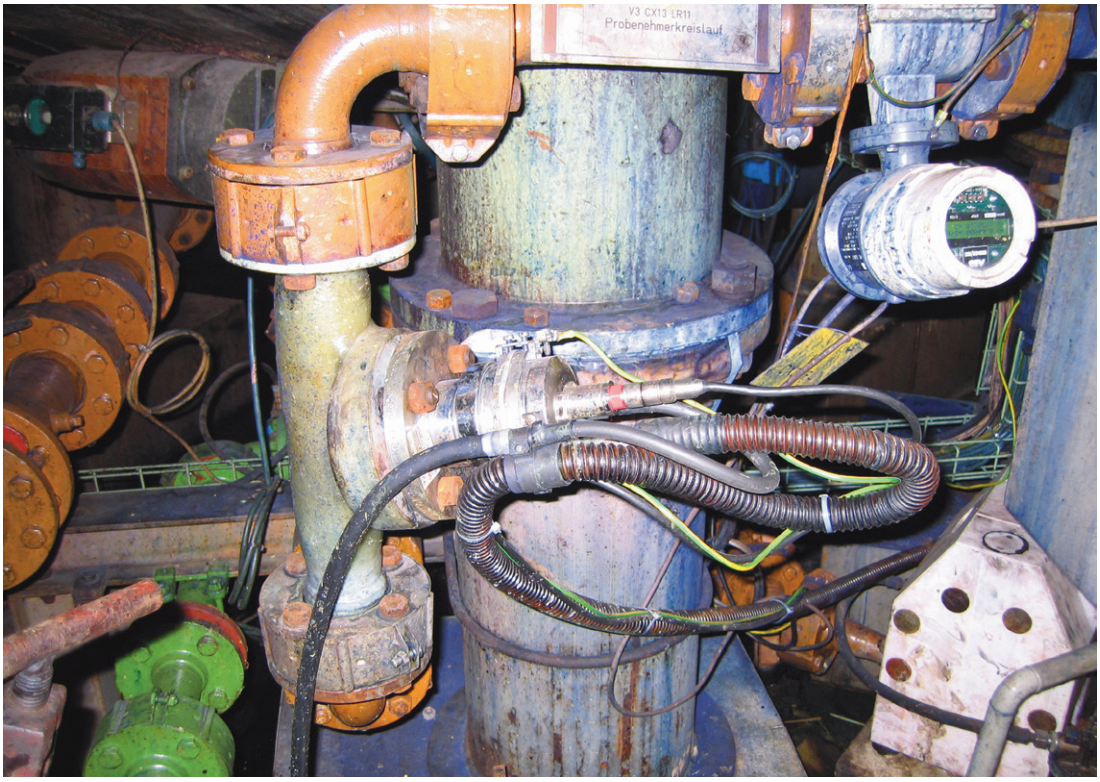


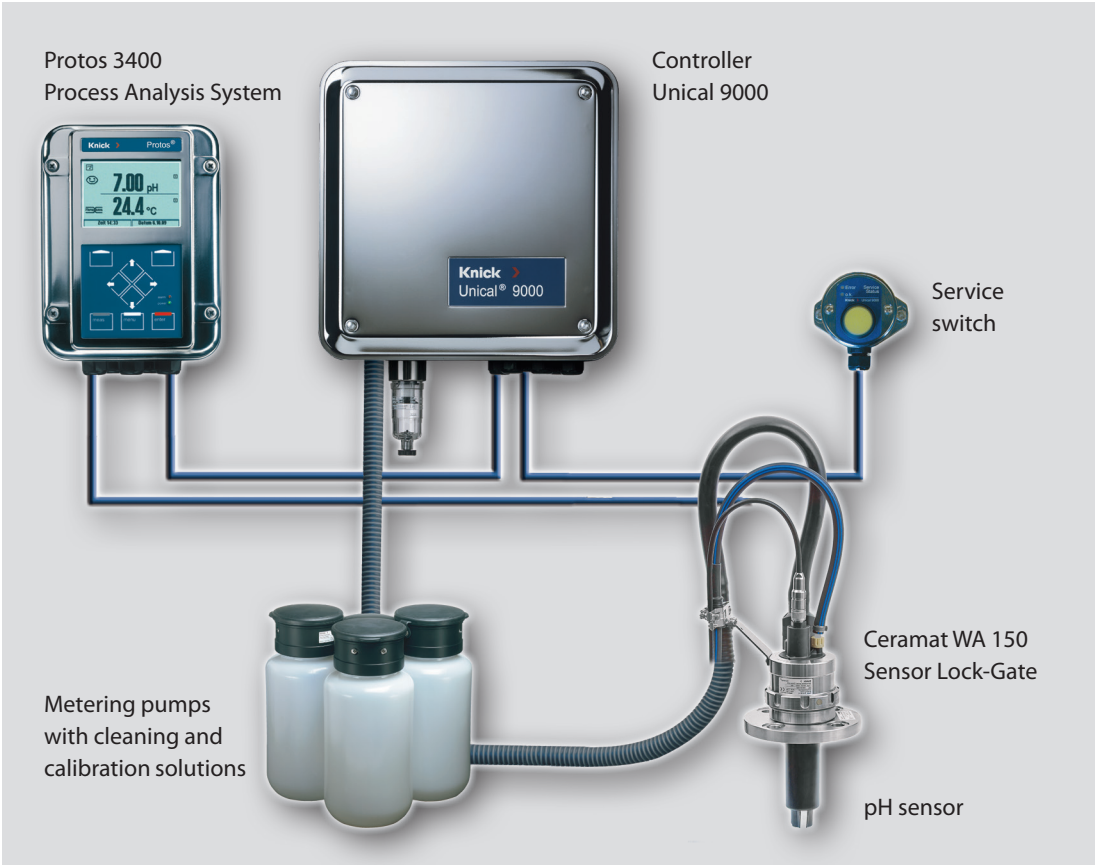
The conditions for synthesis of dyes are tough and colorful. An ideal application for the use of the Ceramat.

The Ceramat makes the use of sensitive sensors possible, even if the service life of the electrodes is only between 8 hours and a few weeks. Fully automated safety measurements with no staff and maximum availability are another application for the retractable fitting. A process medium may temporarily contain phosgene as well as organic solvents, and is therefore extremely aggressive and poisonous. Retractable probes made of either Hastelloy or plastics have not proven satisfactory here.

In addition to highly toxic processes, systems for monitoring wastewater in areas far away from civilization with maximum availability fall within the domain of the CeraLong. Ceramat is available for Knick as a turnkey system, a robust solution for pH measurement which automates both regular cleaning and calibration. The pH measurement and analysis system comprises the Ceramat retractable fitting, the Protos 3400 modular process analysis system and the Uniclean 900 automatic cleaning or Unical 9000 cleaning and calibration system. The system is ready for connection to process control technology with Profibus PA or FF interfaces, also for hazardous areas. Measurement accuracy and reliability in the running process, insensitivity to contamination and suitability for problematic media increase process safety and open up specific applications to automation for the first time.

Numerous possible applications

A typical application for the use of a Ceramat sensor lock-gate can be found in flue gas desulfurization plants. There, wastewater treatment is monitored at three measuring positions with average pH values of between 2 and 10. The deposits which occur in this pH range (gypsum, $CaSO_4$) place great stresses on the measuring points and require extensive regular maintenance. At the prescrubber measuring point, the medium is sulfuric at c. pH 1 and +50 °C, and at the same time contains high concentrations of chloride and fluoride. Automation was previously not possible due to the lack of suitable (mechanically and chemically resistant) fittings. The solids content is approximately 2% to 15% and the alkaline scrubbing solution encourages the formation of deposits. At the same time, the aggressive scrubbing solution reduces the electrode life.
Due to the heavy formation of deposits, the pH sensors must be cleaned frequently. For these reasons, automated measuring equipment greatly simplifies the process. The specific challenge in chlorine production using membrane electrolysis is the high temperature in combination with free chlorine. Neither plastic nor conventional metal fittings display the stability required here. The Ceramat has mastered this measuring task. A further example is refinery wastewater or naphtha fractions in distilling towers. In these cases, deposits containing oil or tar require aggressive organic detergents. The retractable fitting can also perform these tasks.



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