

For problem-free, reliable pH measurements in flue gas scrubbers

Industrial flue gases contain pollutants such as sulfur oxides (SO_x), hydrogen chloride (HCl), hydrogen fluoride (HF), heavy metals and flue ash with greatly varying composition at high concentration. These flue gases may be harmful to humans and the environment and must therefore be cleaned before they reach the atmosphere.

Pollutants are removed from the flue gas by wet flue gas cleaning in flue gas scrubbers. Two-stage scrubbers are used to clean the flue gas. After the dust is filtered out, the first stage cools off the flue gas and scrubs out a number of pollutants – hydrogen chloride (HCl), hydrogen fluoride (HF) and heavy metals. The pH value must not be above 2 in this stage. Sulfur dioxide (SO₂) with pH values below 2 can pass almost completely through this stage. It is not removed until the second stage when milk of lime (Ca(OH)₂) is added. The resulting compound has a pH value between 5 and 6 and is washed out.

Since the pH value plays an important role in separating pollutants, it must be continuously measured and regulated as required. Lower pH values, high temperatures and high concentrations of dust pose great challenges for pH measurements. The pH electrode that is selected can determine whether or not the pH measurement will work. JUMO's high-quality tecLine pH electrode with perforated diaphragm is a reliable solution for this requirement. The perforated diaphragm is not a diaphragm at all. It is actually an open transition between the solid electrolyte and process medium. It is practically impossible for the diaphragm used in this pH electrode to become blocked because the JUMO solid electrolyte used in the medium swells up somewhat, which results in a self-cleaning effect. This reduces the outflow of electrolyte, which in turn cuts maintenance overhead.

However, difficult process conditions can have a negative effect on the service life of a pH electrode. Regular maintenance and cleaning of the pH electrode are essential to prevent this and increase the service life of the electrode. If the pH electrode becomes dirty in a very short time, as it will in a flue gas scrubber, an automatic cleaning system makes good sense financially and operates more reliably. The crucial element in this type of system is the JUMO pneumatic quickchange fitting type 202823, which connects the pH sensor to the process. It functions as a "sluice" and makes it possible to clean the pH electrode outside of the process without interrupting it.

Functionality of the JUMO pneumatic quick-change fitting

The pH electrode is fastened in a movable immersion tube (3). To move it into the process, compressed air is introduced through the pneumatic connections in the drive unit (1) of the fitting. The pneumatic drive moves the immersion tube together with the sensor into the process medium. A mechanical safety device prevents the immersion tube from being inserted when there is no pH electrode installed. This protects the operator from accidentally coming in direct contact with the process medium. When the “measuring” end position is reached, it is reported to the connected controller via pneumatic positional feedback. In this position, the terminal head of the sensor is concealed in the drive unit, making it impossible to remove the sensor.

If the pH electrode needs to be cleaned, it is moved out of the process and into the “service” position in the rinsing chamber (5) of the fitting. The immersion tube closes off the chamber from the process. It is protected by seals so that no process liquid can get in. When the “Service” position is reached, the sensor tip is now in the rinsing chamber of the quick-change fitting. Four nozzles at this point direct a cleaning liquid from opposite sides directly at the sensor. This ensures optimum cleaning with removal of coatings and dirt from the sensor. After cleaning is complete the drive unit moves the sensor back to the “measuring” position.

Advantages of the JUMO pneumatic quick-change fitting

One special advantage of the JUMO fitting type 202823 for this application is the short stroke of just 36 mm. It places very little dynamic load on the sealing elements. In addition, a Teflon scraper, pre-tensioned by an O-ring, prevents particles in the medium that adhere to the immersion tube from being drawn with it into the rinsing chamber. This combination makes the fitting a reliable partner, especially in challenging and critical applications.

The JUMO pneumatic quick-change fitting 202823 is available in high-quality materials such as stainless steel, PVDF or PEEK. It can be used up to 140 °C and 10 bar. O-rings are available in FPM, EPDM or FFMK. This selection is ideal for adapting to different process conditions.

A controller monitors and controls the measuring and cleaning cycles of the JUMO pneumatic quick-change fitting fully automatically. It contains a preconfigured cleaning sequence with pre- and post-cleaning function, proven effective in practical applications. The cleaning times for up to two cleaning solutions, measuring intervals and start times can be adapted to different requirements.

For use in abrasive and highly adherent media, such as those used in flue gas scrubbers, activation of the “locking water function” is recommended. When this option is selected, the valve opens before the fitting is moved and water goes into the rinsing chamber. However, the outflow valve remains closed. Now when the fitting is moved, water is forced from the rinsing chamber into the process. This prevents particles from adhering to the immersion tube while the sensor is moving. The internal O-rings of the fitting are reliably protected.

Especially with highly process media, or media susceptible to precipitation, which could therefore impair the functionality of the sensor, the controller can be programmed so that the sensor is only immersed in the process for a limited time.

The sensor remains in the rinsing chamber of the fitting for the rest of the time. In this case the cleaning solution is also left in the rinsing chamber. The liquid is used to keep the sensor moist and to prevent it from drying out.

The JUMO pneumatic quick-change fitting is connected with the fitting controller by means of pneumatic hoses. Color coding (6) and hoses of different sizes on the fitting make it easy to place the system in operation with no errors. The controller monitors all the positional feedback from the quick-change fitting via the integrated inputs. This ensures that the immersion tube is actually in the “service” position and the sensor can be removed for calibration. Automatic cleaning is started via an additional input. This can be done for example using the washing contact of the JUMO dTRANS pH 02 transmitter/controller.

pH transmitter/controller

The new JUMO dTRANS pH 02 transmitter/controller makes the current pH value available to the gas scrubber control room. It is a compact, modular device with mounting dimensions 96 mm x 48 mm x 90 mm (W x H x D).

The device can also be used simultaneously as a controller, for example to control dosing of acids and bases. In addition to the measuring input for the pH value, the JUMO dTRANS pH 02 transmitter/controller also has a second measuring input for temperature. It is used for temperature compensation of the main parameters.

Plain text operation together with the LC graphic display with background lighting makes it almost possible to operate the device without the operating manual. A setup program is available for convenient configuration via PC. You can use it to create and edit data records, transfer them to the device and export them from it. Data can be stored and printed. The device can also be

integrated into a data network by means of an RS422/485 or Profibus DP interface.

Summary:

As the performance of a flue gas scrubbing system depends heavily on the pH value, it is very important to monitor the pH value. However, difficult process conditions can have a negative effect on the service life of a pH electrode. Regular, automated cleaning of the pH electrode can significantly increase its service life in gas scrubbers and reduce maintenance costs. JUMO type 202823 pneumatic quick-change fittings are used wherever sensors are exposed to exceptional loading.