

XTP601 for use monitoring oxygen in Pharmaceutical & Specialty Chemical Reactors

Application Background

Pharmaceuticals and Specialty Chemicals are typically produced in batches by mixing several components in a reactor. These reactors vary in size from table top glass jars to large stainless steel or glass lined vessels with a mixer (like a giant domestic food blender). The vessel will be subjected to a nitrogen blanket prior and during batch production and oxygen levels need to be monitored at all times for plant and operator safety. In the past companies used to just permanently feed N₂ to the process and not worry about the oxygen level. However, N₂ is a consumable with an associated cost that can and should be limited. This is achieved by monitoring the oxygen level and shutting the N₂ feed when the O₂ levels are safe.



Why is oxygen measurement important?

There are generally solvents or powders present in the reactor which could create an explosive atmosphere. In order to prevent explosions the process will be blanketed by nitrogen to ensure the Minimum Oxygen Concentration (MOC)*, of the particular solvent vapor, is not reached. The signal from the oxygen analyzer/system will be used to control the flow of N₂ and/or shut the plant down. A loss of flow of N₂ will be detected as the O₂ level raises and the analyzer will trigger an alarm, preventing a potentially dangerous scenario.

Typical Solvents used in Pharmaceutical plants	
Acetic acid	Ethyl Alcohol
Acetone	Heptane
Acetonitrile	Isopropyl Acetate
1- Butanol	Methanol
t-Butanol	Methyl Ether Ketone
Cyclohexane	1-Propanol
Dimethyl Ether	2-Propanol
Ethanol	Toluene
Ethylene Glycol	Xylenes
Ethyl Acetate	Ethyl Acetate

* MOC is the lowest amount of oxygen present to sustain combustion and is different for each background gas. For example the MOC for **Methyl Ether Ketone (MEK)** is between 11.0 – 11.4% O₂.



Measurement & Sampling Technique

The thermo-paramagnetic sensor in the XTP601 is ideal for measuring percent level oxygen and is very robust. Unlike electrochemical sensors that require routine replacement, the XTP601 sensor will last the life of the instrument in normal operation. The analyzer should be ranged 0-21% or 0-25% to allow the operator to see the process go from air point down to safe oxygen levels. Dependant on the plant the client may want to use the second mA output to monitor/control the alarm as it can be set to a smaller range and therefore have greater resolution for tighter control. Alternatively the 2 off SPCO alarm relays for concentration can be utilized to switch on/off the N2 purge flow.

In the event of any failure within the analyzer, the application software (via MODBUS RTU over RS485 protocol) will show an alarm present and what type of alarm it is.

Note: It is recommended that the High Speed Response function should be enabled as the unit is being used to trigger an alarm. A flow alarm (ideally placed after the measuring cell) must be included in any sample system to give the customer added confidence in the measurement (this technology requires flow to function).

Due to the fact that solvents will most likely be present, Kalrez o-rings (chemically resistant) should be selected for these plants. The pressure in the reactors is typically atmospheric, so a pump or eductor will be required. Certain plants may have highly corrosive conditions, consideration to system materials and filtration prior to the analyzer is critical.

The analyzer is supplied in an IP66 NEMA 4X enclosure and is suitable for hosing down (as is typical in many of these plants). Any sample handling equipment that will be located in a wash down area and may require being housed in an IP66 box or enclosure.

The sample system may have to be heated to avoid condensation forming. The sample cell can be set at 50°C, 55°C or 60°C and would ideally be at least 5°C, but preferably 10°C above the dew point of the sample and the rest of the sample system. An alternative if cooling water is present on site is to use a condenser probe straight on the vessel to ensure any moisture is immediately condensed and can drain back into the process, making the sample panel much simpler.

Advantages of the XTP601

The XTP601 analyzer is available with ATEX & IECEx or cCSAus certification to enable it to be used in hazardous areas around the world.

Having the option of an integrated display and HMI allows greater flexibility in operation. With "through the glass" capacitance buttons, the analyzer can be fully operated, interrogated and calibrated without the need to open the lid or obtain a hot work permit.

The unit requires no routine maintenance and with three-monthly calibration intervals needs very little user intervention with single- or two-point calibration is available to the user.

The XTP601 can also be operated via the application software, which is included in the price. With 2 off 4-20mA outputs the analyzer allows monitoring of the overall range and greater resolution around the oxygen level of interest. For example the primary range can be 0-25% O₂, while the second range could be set to 2 – 6 % O₂.



The IP66 NEMA 4X case offers protection against weather or hosing down of the area meaning an enclosure is not always required.

The XTP601 has a small foot print (approx. 20 x 20 cm) making it easy to integrate on a panel or in a cabinet.



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