



## OO/UC3M/25 - SELF-REFERENCED FIBRE-OPTIC SENSOR FOR LIQUID DETECTION AND/OR MEASUREMENT

The optical technology developed by the Spanish University Carlos III of Madrid is related with carrying out measurements on liquid tanks. It allows detecting the liquid level using light, in an intrinsically safe way, without the risk of explosion of the electronic type techniques. We are looking for the collaboration of companies devoted to the development of instrumentation systems, specifically instrumentation for the storage and distribution of flammable liquids, fuel tanks manufacturers, as well as instrumentation for aircrafts and vehicles.

### Description of the technology

The measuring can be remote, easy and low cost. It is based on the optical power variation in the detector when liquid passes and is independent from power variations transmitted by the source or from fibre attenuations. The sensor is made by 2 fibres, properly polished and bended, joined to make an optical coupler whose coupling coefficient, or relation between the optical power on the output fibres, varies as the liquid covers the coupling area. The sensor is excited with an optical transmitter whose light is taken to the measuring point through a fibre optical and the output optical power of the 2 fibres of the sensor is taken to 2 photodetectors for monitoring the coupling coefficient and detecting the level.

The optical power variations associated to fluctuations on the light source, or one variable attenuation caused on the fibre that leads the light to the measuring point, equally affect the optical power present on the 2 output fibres of the sensor, thus a differential measurement does not affect the output signal of the system. Both output fibres must cover a common trajectory so that they are equally affected by possible curvatures or changes on their attenuation. Being an intrinsically safe sensor, apt for tanks of flammable liquids, we would stress, among the potential uses, the measurement of the level of non-corrosive liquids in tanks in general.

### Innovative aspects

It allows detecting the liquid level using light, in an intrinsically safe way, without the risk of explosion of the electronic type techniques. The measuring at a certain distance from the physical location of the sensor is possible. Compared with other optical techniques for level detection with optical intensity sensors, it allows carrying out the measurement without it being affected by fluctuations of the optical power on the receiver not associated to the measurement itself which can lead into error. Said fluctuations take place if the optical source is not medium-power stabilized (as happens with low cost sources) or if there are bends on the fibre optic form the transmitter to the measuring point.

### Competitive advantages

Reduction of explosion risk compared with the measurement of the liquid level with electronic techniques. Possibility of remote monitoring of the level in the tank.

Reliability of the measurement with intensity optical sensor without need for stabilizing the measured power and monitoring the state of the cables, with the subsequent cost reduction.

The benefits arising from the use of this technology are the reduction of explosion risk, in addition to the reliability of the measurement.

**Current state of intellectual property:**  Patent applied

### Keywords

Sensors/Multisensors Technology, Instrumentation; Optics; Optical Technology related to measurements; Sensor Technology related to measurements.

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