

A process analyzer for analysis
of liquid and gas streams by photo
acoustic technology

TISOMIC

**H₂S, H₂O & CO₂
Analyzer**

Introduction

Hobré started working with the company Hilase Kft. in 2009, introducing the very robust and innovative photo acoustic technology in process analyzers for measurement of on-line H_2S , H_2O and CO_2 in gas and liquid streams in the highly demanding oil and gas industry. The acquisition of Hobré Laser Technology Kft in January 2014 has further strengthened and combined the unique expertise and technology of both companies.

The **TISOMIC, with PA-TDL technology**, is a proven and virtually maintenance-free online process analyzer used in a wide variety of applications and monitor levels at all stages. Featuring a 10cm path length cell which is heated and temperature-controlled, with no need for multi-pass mirrors. It is suitable for applications ranging from H_2S in well fluids, through separation and treatment, to sales gas and oil quality control.

Principle of Operation

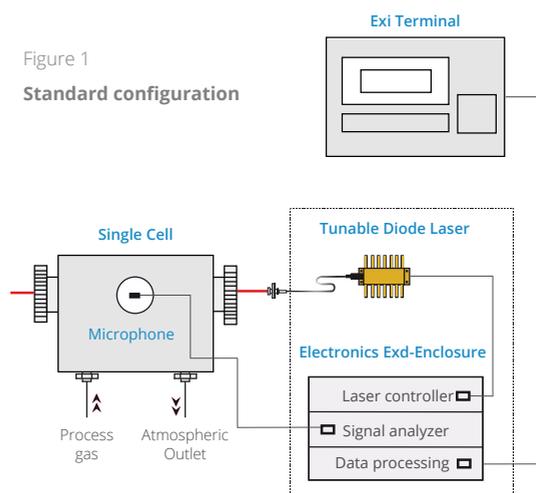
The TISOMIC can simultaneously measure H_2S , H_2O and CO_2 in liquids and gases. Technology-wise, the Hobré TISOMIC is a big step forward as it offers a combination of features not available in any other analyzer on the market. Its key features are the absence of moving parts, full separation of Photo Acoustic cell and electronics by use of a fiber optic cable, wide concentration range (over four decades), less than 200 sccm/min cell flow and close to zero maintenance. Compliance of supply with ATEX, IEC Ex and CSA is possible in the Exd version.

Technology

The analysis is based on the photo acoustic measurement principle. This technology has been developed to fully utilize the high precision of modern Tunable Diode Lasers (TDL), low-noise, of cutting-edge acoustic amplifiers and high-quality microphones. Different components are excited by tuning the laser diode to corresponding absorption and specific background wavelengths. The TDL's output power is modulated to the resonance frequency of the measurement cell. The modulation of the excitation level of the medium generates linear pressure waves corresponding with the concentration of the specific components. The pressure wave is amplified by the resonance

Figure 1

Standard configuration



chamber and measured as sound by the microphone. Background noise is removed by custom-designed acoustic mufflers and a secondary microphone dedicated to background filtering. The signal is amplified a second time by the acoustic amplifiers and is processed. As the TISOMIC does not use optical detection, the analysis is not sensitive to contamination or fouling.

Features

Close to zero maintenance, combined with absence of moving parts, ensures high availability. A high level of self diagnostics allows maintenance on demand and improves reliability. Multiple photo acoustic cells and/or dual lasers in a single analyzer allow simultaneous analysis of different components (H_2S , H_2O , CO_2) and multi-stream monitoring (e.g. before and after separators).

When used with a well-designed sample system, such as the Hobré HIFISC, the Hobré TISOMIC can run with a drift of typically less than 3% over a year. Automatic validation or manual calibration is required just once every few months. Designed to be maintenance-free for over five years, with power as its only utility, its cost of ownership is the lowest on the market.



Sample Conditioning System for H₂S and H₂O Analysis

H₂S and H₂O are reactive components, often present at low ppm levels. The measurement capabilities of the analyzer are only beneficial when it is used with a well-designed sample conditioning system. Since 1978 Hobr  Instruments has experience in the design and supply of such systems. Our designs are application-specific, based on the gas composition, the phase diagram of the process fluids and process upset conditions.

To overcome excessive time lags between the sample probe inlet and analyzer due to the volume of probe, block and bleed valves and sample lines, as well as liquid carry-over problems, Hobr  Instruments has developed the **HIFISC Modular Sampling System**.

The **HIFISC** system features an advanced combination of components and provides safety through full double block and bleed process isolation, superior response time, accuracy, low emissions, low maintenance and high availability and reliability. For trace levels of moisture and H₂S the system will give stable readings within minutes. The net result is a faster return on analyzer package investment and a reduced failure risk in safety-critical applications.

For customers using process gas chromatographs or any other analyzer, the installation of the **HIFISC** system has proven to be especially satisfactory. Another application for our system is in liquefied gas sampling, where we can provide a fast loop, returning the sample to the process with no need for a fast loop pump. For LPG-type samples, fast responding systems can be achieved with minimum system maintenance and low sample-to-flare flow rates.



Figure 2: HIFISC Modular Sampling System

Benefits

TISOMIC

- Close to zero maintenance
- No moving parts
- Stable and simple calibration
- Wide dynamic range
- Full separation of photo acoustic measuring cell and electronics
- MTBF of more than five years
- Detection range from low ppm to percentage levels
- No limitations in natural gas matrix
- Simultaneous multi-stream measurement of H₂S, H₂O and CO₂ possible.
- Analyzer cell flow of ± 200 sccm/min

HIFISC

- Hobr  Flow Impact Probe with fast loop driven by process velocity
- Heated DBB valves for safe isolation
- Hobr  HPFF multiphobic membrane filter removes all contaminants, for return to processing
- Filter on probe guarantees a clean sampling system
- Zero dead volume pressure reduction system
- HIFISC reduces stabilization time for trace H₂S and H₂O applications
- No dew point issues

The Hobr  TISOMIC and Hobr  HIFISC analyzer offers a unique design with reduced installation and maintenance costs.

Typical applications

- H₂S Multi-phase crude oil
- H₂S partial vapor pressure on separators / strippers
- H₂S / H₂O in export crude oil and condensate
- H₂S in liquid fuels
- H₂S / H₂O / CO₂ in (natural) gas treatment
- H₂S / H₂O / CO₂ in sales gas and pipeline monitoring
- H₂S monitoring before and after scavenger dosing
- H₂S and CO₂ in amine absorbers
- H₂S in refinery fuel gas and flare gas
- Gas turbine control
- Fuel gas and flare gas quality
- Natural gas blending

Gas Applications

For low ppm H₂S applications Hobr  uses a concept with two measuring cells in series. The first cell is used on process gas and the second on reference gas that comes from the scrubber. To ensure identical physical behavior through both cells a 'dummy' scrubber filled with glass beads is used for the process gas stream. The percentage of scrubber saturation is determined by the analyzer and is designed for a lifetime of at least six months. Applying this differential measurement on a continuous basis, offers the possibility of trending the background variations without compromising on the measurement itself.

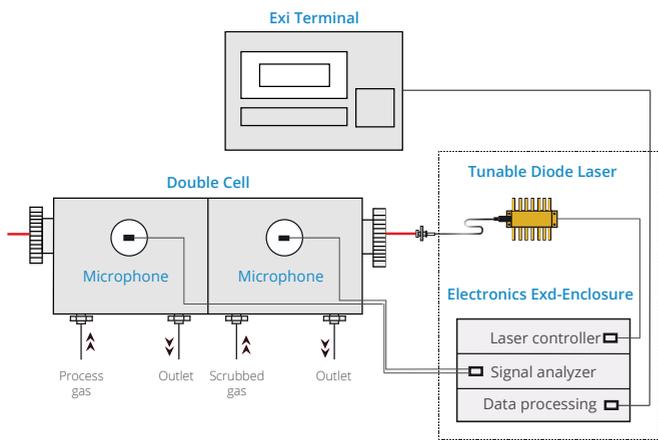


Figure 3 -Dual cell configuration

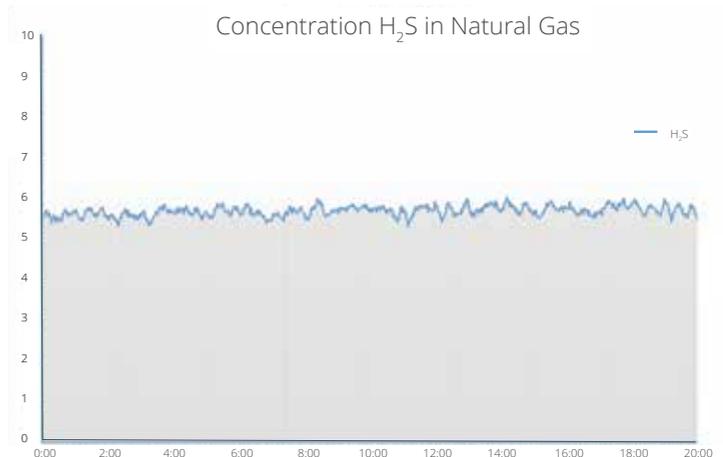


Figure 4 - H₂S in liquid analyzer system

The software of the Exi terminal is designed in such a way that we can configure the unit for each application: single stream, multi stream or multi component. Control of two Hobr  TISOMIC analyzers with a single Exi terminal is also a possibility.

Liquid Applications

The TISOMIC PA-TDL technology is suitable for measurement of molecules in the gas phase. Since there are no standards available on the market for calibration of H₂S in liquid streams, Hobr  has developed different H₂S extrusion systems in combination with the Hobr  TISOMIC. The design for an H₂S extrusion system is application-dependent. Extrusion can take place by stripping the H₂S from the liquid by use of a counter-current stripper system, and measurement of H₂S in stripper gas, or by use of membrane filtration. H₂S extrusion systems can be supplied for crude oil, glycol, water and other applications. In the photo on the right, a typical dual compartment H₂S in liquid analyzer system is shown with a high-temperature sample conditioning system and separate electronics compartment.

Typical repeatability on a Natural Gas application, having 0–10 ppm H₂S is 0,25 ppm. The above graph shows a stability trend on a 5,6 ppm hydrocarbon stream over 20 hours.



Figure 5 - H₂S in liquid analyzer system

Operation, Service and maintenance

The TISOMIC can be installed outdoors in a heated cabinet to prevent dew point issues, but protected against direct sunlight by use of a sunroof or three-sided shelter giving access for the minimal maintenance and operator intervention required. The stable calibration factors require a single-point validation or calibration just once every six months. There are no moving parts, no consumables, and power is the only utility required. Full separation between the photo acoustic cell and the electronics allows maintenance of the cell assembly without the need for a hot work permit or power shut-off. The analyzer can be supplied with a 50  C cell assembly or 80  C depending on the process requirements.

Technical Specifications

TISOMIC with PA-TDL technology

Excitation	Tunable Diode Laser (TDL)
Detection	Photo Acoustic (PA)
Components	H ₂ S, H ₂ O, CO ₂
Number of lasers	Up to 4
Number of process streams	Up to 2
Sample wetted parts	SS316 (as standard) *
Electronics housing / protection	Aluminium (salt water proof according to EN 13195-1) / IP65 NEMA 4x
Cell housing / protection	SS316 / IP65
PA cell dimensions	± 100 mm (width)
PA cell temperature	50 °C (80 °C optionally)
PA cell pressure	Atmospheric
Flow through PA cell	< 200 cm ³ /min
Calibration	Once every 3 - 6 months
Analog outputs	4 x 4 - 20 mA
Communication	1 x MODBUS RTU over RS485 and 1 x modbus RTU over TCP/IP
Digital outputs	6V, 24V or potential free, 1 x analyzer fault, 5 x programmable output
Hazardous area execution built to	ATEX II 2G Ex db op pr [ib] IIB+H2 T3 Gb IECEX Ex db op pr [ib] IIB+H2 T3 Gb CSA Class 1 Zone 1 BCD T3
Ambient conditions	Operating temperature range -20 to 45°C**
Utilities	Power: 110 - 240 VAC / 40 - 60Hz
Analyzer dimensions	1200 x 600 x 500 mm (LxWxD)
Analyzer weight	± 150 kg
Range	Low precision: 0 - % Levels (programmable) High precision: 0 - 100 ppm (programmable)
Repeatability	Low precision: 1% of full scale High precision: 0,3 ppm
HMI	Exi terminal

* Consult factory for others
** Depends on application request



HOBRE INSTRUMENTS

SINCE 1978 HOBRE IS A WORLDWIDE MARKET LEADER IN THE DESIGN, MANUFACTURING AND MAINTENANCE OF ONLINE ANALYZERS AND SAMPLING SOLUTIONS. HOBRE SERVES THE OIL, GAS, DAIRY, METAL MINING & REFINING, ENERGY, RENEWABLES, STEEL AND GLASS INDUSTRY. ENSURING OUR CUSTOMERS OPTIMAL EFFICIENCY, WHILE CONTRIBUTING TO ENVIRONMENTAL PROTECTION.



HOBRE SERVICES

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- COMMISSIONING, SAT AND START-UP
- TRAINING
- PREVENTATIVE AND CORRECTIVE FIELD SERVICES
- IN-HOUSE MAINTENANCE AND REPAIR
- SPARE PARTS AND SUPPLY
- REMOTE SUPPORT



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