

TELEDYNE ANALYTICAL INSTRUMENTS

application bulletin

APPLICATION:

- Trace moisture analysis in chlorine alkali, toluene diisocyanate (TDI), and polyurethane industries
- Trace moisture analysis in electron dichloride (EDC), carbon tetrachloride, and MCB in PVC and MDI industries

TAI SOLUTION:

Model LGA-3500 Laser Analysis System for Moisture

Trace Moisture Analysis System

- Non-contact measurement, strong adaptability and reliability
- In-situ measurement, quick response time
- Highly accurate, trace (ppm) moisture analysis
- Small drift, long calibration / maintenance interval

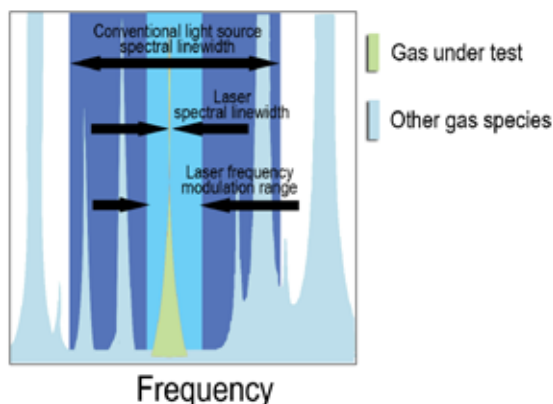
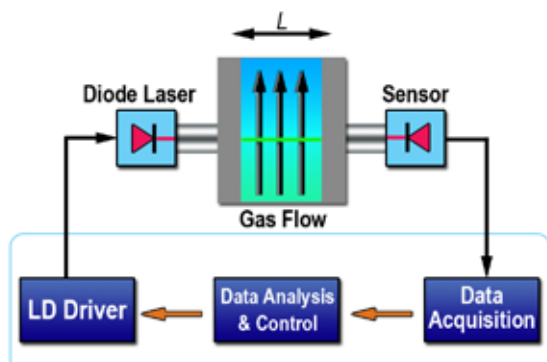
General Introduction

Online measurement of trace moisture in a harsh environment -- highly corrosive and toxic -- is a requirement of the chlorine alkali industry, toluene diisocyanate (TDI), and polyurethane. Teledyne has developed the LGA-3500 Trace Moisture Analysis System to satisfy the increasing needs of technique optimization and safety control.

Compared to conventional analyzers, the LGA-3500 was developed through reliable and field proven technology. With TAI's proprietary Diode Laser Absorption Spectroscopy (DLAS) technology, as well as non-contact optical measurement, the system provides high reliability, quick response, low costs, and excellent sensitivity.

Technical Advantages

A beam from a diode laser passes through the process gas and is selectively absorbed by trace moisture. By detecting and analyzing the absorption spectrum, LGA-3500 achieves non-contact measurement of trace moisture within an adverse environment, solving problems such as probe erosion and shortening the response time.



Schematic of "Single-line" Spectroscopy Measurement Principle

"Single Line" Spectroscopy Technology - no cross interference

Due to its monochromatic nature, a diode laser has line-widths of less than 0.0001nm. By scanning and selecting a specific absorption spectrum, an absorption that only covers a single spectral line of the gas under test can be obtained to eliminate cross interference (i.e., CH₄).

Laser Spectral Scanning Technology - automatically corrects for dust and optical window contamination

The LGA-3500 uses laser spectral scanning technology. This means it periodically scans the tested gas with a modulation frequency range larger than the absorption spectral line-width. Therefore, within one scan period, there are two distinctive areas. Area I is unaffected by the gas absorption and shows T_d , whereas Area II is effected and shows T_gd . The transmittance of the gas under test is then calculated accurately by $T_g = T_gd / T_d$. The interference from dust and optical window contamination is, therefore, automatically screened.

Temperature/Pressure Compensation Technology - eliminating the influence of process conditions (temperature and pressure) variance

The LGA-3500 uses a precise compensation algorithm and unique spectra database to compensate for temperature and pressure, realizing accurate trace moisture measurement under high temperature.

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Technical Specifications

Measurement range	Min.: 0-5 ppm Max.: 0-5000 ppm (within a practical operation environment)
Gas temperature:	≤ 400 DegC
Response time:	≤ 1 S
Optical path length:	≤ 15 m
Linear accuracy:	≤ ±1% FS
Span drift:	≤ ±1% FS
Zero drift:	Negligible
Calibration:	< Twice/year
Enclosure protection	IP65
Explosion protection:	ExpmD II CT5

Signal Interfaces

Analogue output:	2-channel 4-20mA (isolated, 750)
Analogue input:	2-channel 4-20mA (temperature, pressure compensation)
Digital output:	RS485 (Bluetooth/GPRS optional)
Relay output:	3-channel output (24V, 1A)

Operation Conditions

Power:	24VDC (220VAC optional), <20 W
Ambient temperature:	-30 DegC to 60 DegC

Installation

Installation:	DN50/PN2.5
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Note: Detailed measurement ranges are made to order.

Technology Comparison

Item	Diode Laser Absorption Spectroscopy	Infrared	Electrochemical Process
Measurement method	Non-contact optical laser spectrum analysis, can be applied in highly corrosive environment	Non-contact optical NIR spectrum analysis, can be applied in most corrosive environments	Contact electrochemical measurement (P2O5, AL2O5), can be applied in environments with little corrosive properties
Adaptability	Can be applied in high temperature and high pressure, no cross interference from other gas species, dust and optical window contamination	Measures under stable temperature and pressure, the gas should be clean	Cannot work under high temperature, has strict requirements on gas flow and cleanliness
Response time	Online analysis, millisecond response	Quick response but influenced by the sample conditioning system	Slow response, influenced by measurement principle and dynamic range
Accuracy	Highly accurate and stable	Accuracy and stability are influenced by other gas species, dust, and parameter variation; sensitivity cannot meet requirements of certain applications	High sensitivity but influenced by operation conditions, temperature, and pressure variation
Calibration & Maintenance	Long calibration / maintenance interval (>1 year)	Easily influenced by light source variation, optical window contamination; Calibration maintenance schedule cycle: 3 months	Sensors are subject to drift and aging; Calibration maintenance schedule cycle: 1 month
Operation Cost	Simple configuration, low operation cost	Complicated sample conditioning system, many moving parts and spares, high operating cost	Limited by sensors' life, high operating cost