The model 902 H_2S / Total Sulphur analyzer from Galvanic Applied Sciences Inc. is designed to measure H_2S in gaseous streams. The 902 detection system is based on the lead acetate tape method. With the optional total sulphur furnace, the unit can measure alternate readings between H_2S and total sulphur. The 902 is capable of measuring up to eight streams.

The 902 is designed for simplicity of operation, with advanced features. Dual 4-20 milliamp outputs are standard. An optional Modbus communications card is available.

Calibration can be automatic* and can be initiated remotely, at the keypad or at timed intervals. The system can be calibrated with a bottled standard containing H_2S in N2.

The 902 is the most advanced tape analyzer on the market offering

- Windows based GUI software for configuration/monitoring
- Modem connection option
- Modbus communication RS232 and RS432
- 8 stream capability with dual mode (H_2S & Total Sulphur)
- Dual range with automatic switchover
- Up to 16 analog outputs available with optional serial card
- Automatic calibration feature
- Automatic reference gas feature
- Extended memory for event, maximum, and hourly, daily average archives

**Galvanic Applied Sciences can add a solenoid to automatically calibrate the 902 analyzer at a specified interval*

Features

- Solid State photodiode detector and light source
- Simplified direct tape drive
- Automatic sensor balance
- 8 stream capability with dual mode (H_2S & total Sulphur)
- Up to 16 analog outputs available with optional serial card
- Simple operation and low maintenance

Applications

- Refineries
- Gas processing facilities
- LPG's
- Natural Gas
- Pipeline custody transfer

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H_2S And Total Sulphur Using Lead Acetate

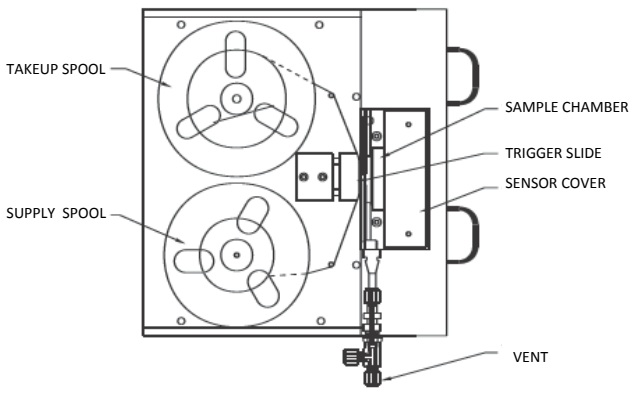
The lead acetate tape method for the detection of hydrogen sulphide (H_2S) in gaseous streams is based on the established principle that H_2S reacts specifically with lead acetate to form a lead sulphide brown stain. The concentration of H_2S is directly proportional to the rate of change of staining on the lead acetate tape. This principle is the basis for a number of ASTM methods. It is by far the most reliable and simple way to measure H_2S in process.

$$\mathbf{H_2S + Pb \rightarrow PbS + H_2O}$$

The analyzer moves the treated paper tape one section at a time. Depending on the sample concentration, the tape will begin to darken at a rate proportional to the concentration of H2S in the sample stream. The analyzer exposes a fresh section of tape to the sample inside the sample chamber every 3-4 minutes.

Galvanic Applied Sciences Inc. analyzers are designed with the following in mind:

- **Low maintenance**
- **Extended tape life**
- **Fast speed of response**
- **Low power consumption**
- **Optional total sulphur measurement**



Tape Transport System

902 analyzers use a common tape chassis unit. It is designed to handle up to 350 feet of lead acetate tape. The stepper motor advances the tape on microprocessor command. In the explosion proof models, the motor is located in an explosion proof box, and connected via a shaft through an explosion proof coupler. The shaft is fitted with a universal coupler to reduce alignment related problems. In the general purpose unit, the motor is mounted inside the chassis.

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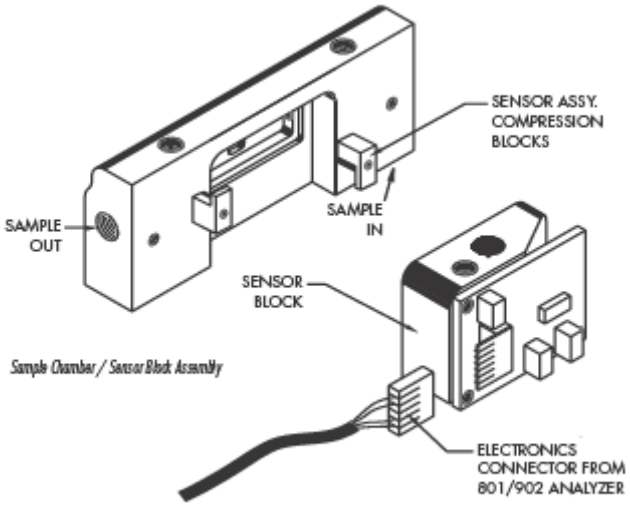
Sample Chamber Assembly

The sample chamber has a removable aperture that can be changed for various gas concentrations. Typically, the higher the gas concentration to be measured, the smaller the aperture. This aperture restricts the amount of H_2S reacting on the tape. The photo detector is a silicon photo diode that converts the darkness to an electric signal amplified at the sensor board to a 0 to 250 millivolt signal. This signal is scaled at the micro-processor. The system uses a single light emitting diode (red) as a light source to illuminate the tape.



Sample Chamber / Sensor Block Assembly

Calibration

The system is self zeroing at every tape advance, therefore calibration is only required every 3-4 months. The units can be calibrated manually or automatically with an optional “autocal” solenoid.
Four types of calibration procedures are available:

1. ***Analyzer zero:*** potentiometer adjusting of the sensor balance (self adjusting on 902 series) note: the analyzer reading is zeroed every cycle (3-4 min) since the measurement is based on rate of change.
2. ***Manual span calibration:*** applying a known gas reference to the analyzer and manually adjusting the gain factor.
3. ***Manual calibration with auto gain adjustments:*** applying a known reference to the analyzer. The analyzer then calculates the gain factor internally
4. ***Auto calibration:*** a known gas sample is continuously connected to the calibration inlet port and measured on a user programmed time period. The analyzer automatically calibrates to the known sample.

H_2S or COS in a N2 background provides the most stable and convenient calibration source. It is normally recommended to calibrate the analyzer at 60-80% of scale or close to the most critical value such as the alarm limit. Disposable and refillable bottles are available from most laboratory gas suppliers.

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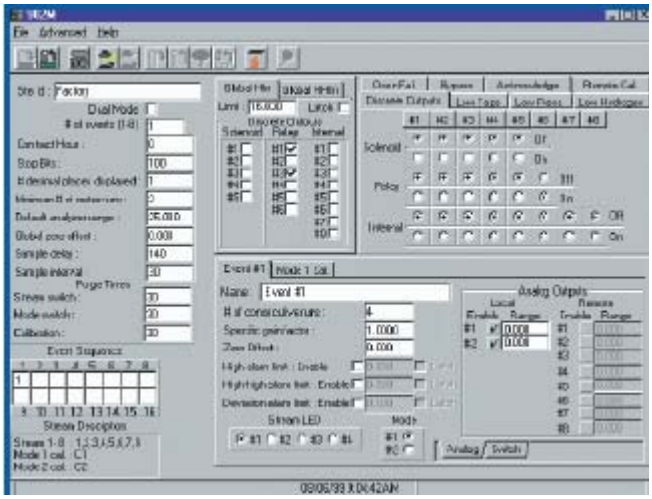
Software



A Windows based GUI complete with help files is standard with our 902 analyzer. This allows the full use of data manipulation and report generation functions via the modbus port.

The package provides easy configuration via laptop and downloading capability, as well as real time monitoring. The system can be accessed via an RS232 modem.

Total Sulphur Option

The addition of a hydrogenation reaction furnace allows a standard Galvanic Applied Sciences Model 902 H_2S analyzer to measure total sulphur concentration. The sample is mixed with a hydrogen stream and heated to approximately 900°C. At this temperature in the presence of hydrogen all sulphur compounds will be converted to H_2S. Also, any hydrocarbon heavier than methane will be cracked to form methane.

Examples of the sulphur reaction are:

Carbonyl Sulphide

$COS + 4H_2 \rightarrow H_2S + C_1H_4 + H_2O$

900°C

Ethyl Sulphide

$(C_2H_5)_2S + 4H_2 \rightarrow H_2S + 4C1H4$

900°C

Methyl Sulphide

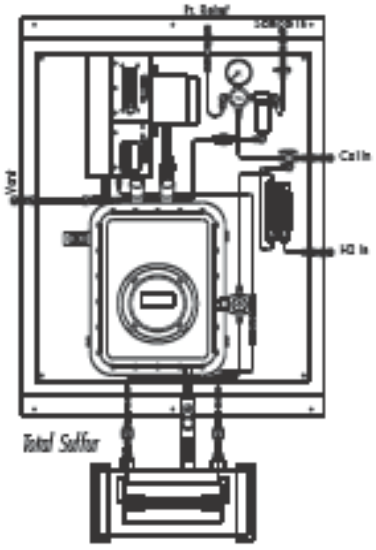
$(CH_3)_2S + 2H_2 \rightarrow H_2S + 2C_1H_4$

900°C

Example of Cracking

$C_4H_{10} + 2H_2 \rightarrow 4C_1H_4$

900°C



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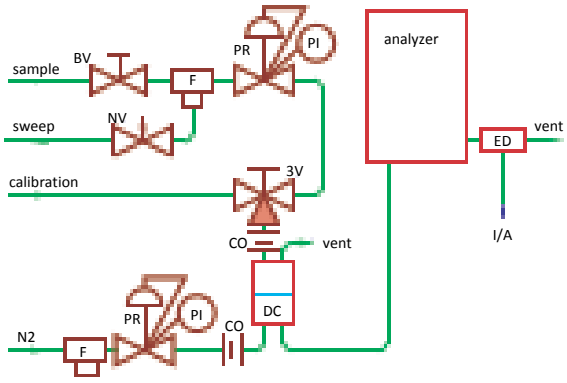
Permeable Membrane Dilution

A permeation dilution device (PDD) consists of two chambers formed within a cylindrical housing by a permeable membrane. The membrane blocks particulates and mist droplets, while allowing only gas or volatile components to transfer into a clean dry carrier gas or liquid sweeping the opposite side of the membrane. Compounds such as H_2S permeate the membrane at a known rate, proportional to concentration over a given area. The size of the membrane can be designed to provide a ratio between the input and output concentration as low as 10:1 and up to 10,000:1. These systems have proven to be very reliable and stable over time with very little temperature dependency.

Flow Diagram

3V. 3 Way Valve
BV. Block Valve
CO. Critical Orifice
DC. Dilution Cell
ED. Eductor
F. Filter
NV. Needle Valve
PI. Pressure Indicator
PR. Pressure Regulator



Range Extension Systems

Our lead acetate tape analyzers are usually limited to a maximum 50 ppm H_2S concentration at around 100 cc/min sample flow. Galvanic Applied Sciences offers a permeable membrane dilution system to allow the measurement in the % range. These dilution systems can be mounted at the analyzer or near the sample point to avoid bringing high concentration H_2S or other sulphurs near the analyzer.

Custom Systems

Galvanic Applied Sciences can supply custom designs and field commissioning for their systems. Complete analyzer shelters, data acquisition, and sample conditioning panels are part of a total solution integration to the user.

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Lead Acetate Tape

Our controlled plant environment ensures top quality in our lead acetate tapes. Our automated process and constant quality checks ensure consistent product. All our tapes are cleaned after treatment to minimize problems caused by paper dust. We can customize our tapes up to three hundred and fifty feet. Analyzers run cleaner and smoother with our tape.

Standard lengths are	Part #
100 ft (standard core)	CO0081
100 ft (801P small core)	CO1704
250 ft	CO1460
300 ft	CO0329
350 ft	CO1693

Sulphur Measurement ASTM Methods

ASTM	TITLE	APPLICATION
D 2420-96	Hydrogen sulphide in liquefied petroleum (LP) gases (lead acetate method)	Manual pass/fail test for ppm of sulphur using lead acetate paper tape
D 4045-99	Sulphur in petroleum products by hydrogenolysis and rateo-metric colorimetric	Injection by syringe 20 ppb to 10 ppm by weight of sulphur in liquids into a lead acetate paper tape H_2S analyzer equipped with a hydrogen reaction furnace
D 4084-99	Analysis of hydrogen sulphide in gaseous fuels (lead acetate method)	Covers 1 ppm to 16 ppm (up to 100% using dilution methods) by volume of sulphur in gaseous fuels using a lead acetate H_2S analyzer.
D 4323-97	Hydrogen sulphide in the atmosphere by rate of change of reflectance	Covers 1 to 3000 ppb by volume H_2S in air using a lead acetate H_2S analyzer.
D 4468-95	Total sulphur in gaseous fuels by hydrogenolysis and rateo-metric colorimetric.	Covers 1 ppb to 20 ppm by volume of sulphur in gaseous fuels using a lead acetate H_2S analyzer equipped with hydrogen reaction furnace.
D 4810-99	Hydrogen sulphide in natural gas using length-of-stain detector tubes	Covers .5 ppm to 40% H_2S in natural gas using lead acetate in glass tubes. (commonly referred to the Drager test)
D 5504-98	Standard test method for determination of sulphur compounds in natural gas and gaseous fuels by gas chromatography and chemiluminescence.	Covers 0.07 ppm to 690 ppm of individual sulphur compounds in gaseous fuels including natural gas, using sulphur chemiluminescence.
D 5623-99	Standard test method of sulphur compounds in light petroleum liquids by gas chromatography . and sulphur selective detection.	Covers 0.07 to 690 ppm of individual sulphur compounds in light petroleum gases using sulphur chemiluminescence.

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SPECIFICATIONS -902 ATEX

Ranges between	0-100 ppb to 0-50 ppm 50 pm to 100% with dilution	Response time	3 minutes to 90% 10 second response to alarm
Streams	1 standard plus calibration Up to 8 optional	Linearity	±1% of full scale or 0-30ppm ±5 for all other ranges
Total Sulphur	Optional	Power consumption	10 Watts @ 24 VDC or 120 VAC 60 Hz
Electrical Approvals	ATEX EEx d [ia] ia IIB+H_2 T3(TA5a) Russian Ex Proof Certification IEx d[ia} ia IIB + H_2T4 Russian Gosstandart pattern approval complies with all relevant European directives	Tape Life	4-8 weeks, depending on application. Typical tape life given 3 minute cycle time is 5 weeks. Can be extended to as much 3 months at low concentration.
Outputs	2 isolated 4–20 ma scaled to range 6 relay contact (SPDT - 5 amps, 250 VAC max) 5 Solenoid driver (120 VAC - max @ 2 amps) Enron Protocol Optional: 1 Modbus RS232/ RS-485 communication card	Electronic hardware	87 C530 microprocessor @ 24 MHz 20 bit A/D 128 KB RAM - up to 1MB with memory expansion card 64K FLASH EEROM 16 Bit analog out (4-20 ma) Handheld keypad interface
Repeatability	±2% of full scale	Accuracy	±2% of full scale for standard ranges
Ambient	40 - 120^0 F / 10-50^{o}C (without enclosure)	Zero drift	None (auto zero)
Modes of operations	Dual range H_2S and Total sulphur, H_2S	Weights	40 pounds (XP version 80 lbs)
Dimensions	28”Hx16”Wx16”D		

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