

Model 933 H₂S Analyzer

Introduction

The measurement of hydrogen sulfide (H₂S) is a critical quality control parameter in natural gas and other process industries. Conventional detection principles, such as lead acetate tape devices, require frequent maintenance intervention and disposal of potentially hazardous materials (used cassette tapes). Additional problems associated with lead acetate paper tape analyzers are: the inherent difficulty handling H₂S overload conditions during process or pipeline upsets, sensitivity to changes in ambient conditions and slow response speed.

The Solution

The AMETEK Western Research® Model 933 is a unique UV-based photometric analyzer system for H₂S analysis when present in concentrations below 100 ppm in natural gas and other applications. The Model 933 uses AMETEK Western Research's proprietary auto carrier chromatography sampling technique, combined with the exceptionally high resolution, multi-wavelength AMETEK 900 Series UV optical bench to provide an accurate, interference free measurement of H₂S. The result is a unique low level H₂S analyzer that is designed to operate unattended for six to nine months, or longer.



Class I, Div 1 and ATEX Zone 1 Version

Benefits

- ▶ Extended, unattended operation for 6 – 9 months or longer
- ▶ Self-recovery after high concentration H₂S events
- ▶ Fast response time to increasing or decreasing H₂S concentrations
- ▶ Concentration measurements of COS and methyl mercaptan (MeSH) optionally available
- ▶ No consumables, reagents, or disposables other than zero gas

Applications

- ▶ Gas sweetening
- ▶ Pipeline quality / custody transfer
- ▶ Synthetic natural gas (SNG)
- ▶ Blending stations
- ▶ CO₂ purity
- ▶ Biogas

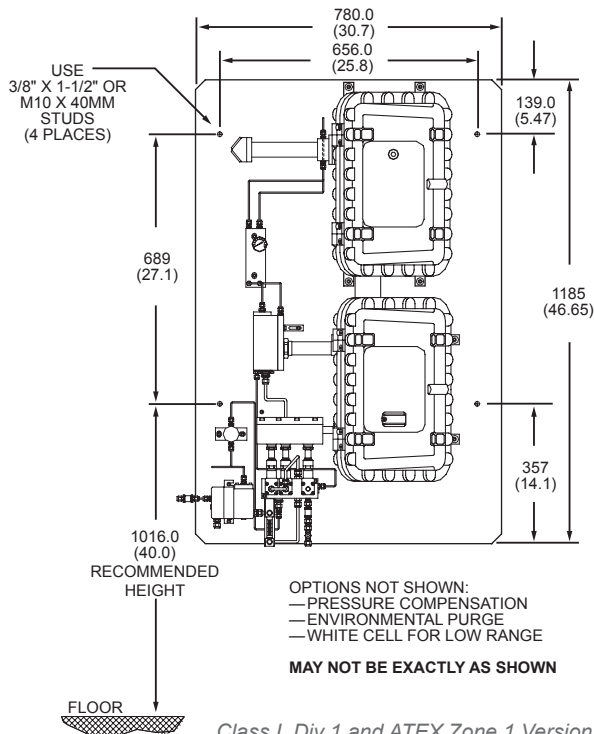
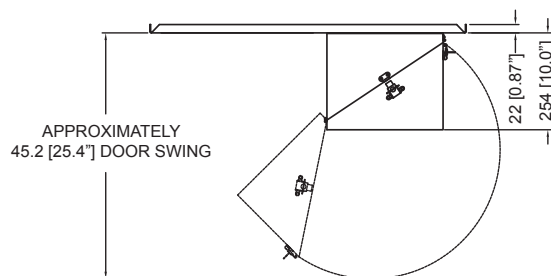
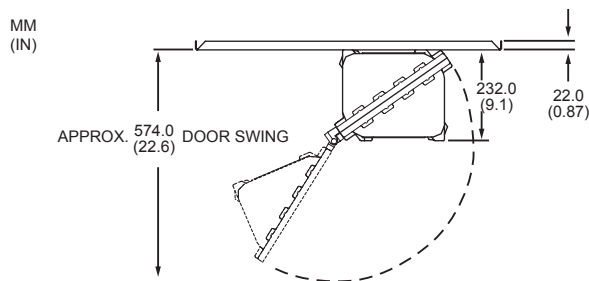
The Measurement

AMETEK Western Research's unique sample conditioning system uses auto carrier frontal elution chromatography to separate interfering species. This ensures an accurate analysis of the H₂S concentration in the gas via direct-UV absorption spectroscopy. H₂S is the first absorbing species to elute through the chromatography column, followed by carbonyl sulfide (COS) and methyl mercaptan (MeSH), which are also independently measured. In normal operation, the 933 uses the analysis of the COS and MeSH concentrations to provide real time compensation for the H₂S. Optionally, the 933 can be configured to output concentration values for these compounds.

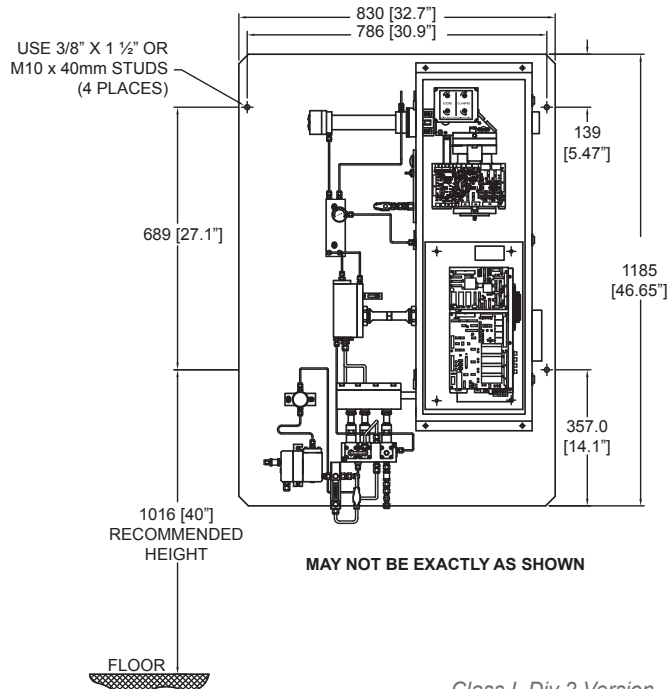
Two columns are employed in the 933, providing virtually continuous monitoring of the H₂S concentration. While the first column is conditioning the gas sample, the standby column is automatically regenerated. AMETEK's unique frontal elution chromatography sampling system eliminates the need for carrier gas, as the sample background gas is used as the carrier. The Model 933 utilizes two onboard microprocessors that provide concentration calculations, data processing, calibration, sophisticated self-diagnostics, and column switching control.



Class I, Div 2 Version



Class I, Div 1 and ATEX Zone 1 Version



Class I, Div 2 Version

Performance Specifications

Methodology: Proprietary auto carrier frontal elution sampling; non dispersive ultraviolet analysis for hydrogen sulfide (H₂S), carbonyl sulfide (COS) and methyl mercaptan (MeSH)

Full Scale Ranges: ppm ranges are standard; mg/Nm³ and other ranges are available

Standard Range:

H₂S: 0 to 25 ppm min. to 0 to 100 ppm max.
 COS option: 0 to 100 ppm min. to 0 to 500 ppm max.
 MeSH option: 0 to 50 ppm min. to 0 to 250 ppm max.
 Higher ranges are available upon request

Low Range:

H₂S: 0 to 5 ppm min. to 0 to 50 ppm max.
 COS option: 0 to 25 ppm min. to 0 to 250 ppm max.
 MeSH option: 0 to 15 ppm min. to 0 to 100 ppm max.

Accuracy:

Standard range: ±2% of full scale
 Low range: ±5% of full scale

Repeatability: Standard range: ±2% of full scale

Zero Drift:

Standard range: less than ±2% of full scale in 24 hours
 Low range: less than ±5% of full scale in 24 hours

Response Time, Excluding Sampling System

H₂S: less than 30 seconds to 90% response
 COS: less than 60 seconds to 90% response
 MeSH: less than 180 seconds to 90% response

Sensitivity: 0.5% of full scale

Cross-interference: H₂S concentration measurement—less than 2% of the sum of COS and MeSH

Sample Stream Requirements: Published specifications are valid for operation in standard pipeline quality natural gas and amine based contactor overheads. Performance specifications may vary based upon review of detailed stream composition for use in non-standard applications, consult AMETEK for details

Zero Gas: Instrument zero purity carbon dioxide; UHP nitrogen, or UHP methane. Minimum auto-zero interval is once per 24 hours.

Sample Pressure Requirement: 830 kPag to 13790 kPag (120 psig to 2000 psig)

Typical Flow: 2.5 L/min. (5 SCFH)

Outputs: Up to 4 isolated 4-to-20 mA, loop or self-powered; 4 non-isolated 1 to 5 VDC; 5 independent sets of SPDT, Form C, potential free alarm relay contacts, 2 A at 240 VAC

Digital Communication: RS485 Modbus port; RS232/RS485 service port

Power Consumption: <500 W (excluding sample & vent line)

Power: 104 to 132 VAC, 47 to 63 Hz, <3A
 207 to 264 VAC, 47 to 63 Hz, <2A

Ambient Temperature: 0°C to 50°C (32°F to 122°F)

Dimensions: HxWxD

1185 x 780 x 254 mm (46.65 x 30.7 x 9.97 in.)

Weight: Approximately 100 kg (220.5 lbs)

Approvals and Certifications:

CEC Class I, Division 1, Groups C & D; Ex d IIB T3
 NEC Class I, Division 1, Groups C & D; AEx d IIB T3
 Optional Class I, Division 2, Groups A, B, C, D purged system available
 ATEX II 2G EEx d IIB T3
 EMC
 Russian Ex Proof Certification; 1ExdIIBT3 X
 Russian Gosstandart Pattern Approval
 Complies with all relevant European directives

Options:

- ▶ Pressure compensation
- ▶ Various sample probe configurations
- ▶ Heated and unheated inlet pressure regulation
- ▶ Filters
- ▶ Sample conditioning for non-standard applications (includes sample pumps, sample chiller/hydrocarbon removal)
- ▶ Additional COS and MeSH component outputs
- ▶ Integrated CO₂ sensor
- ▶ Sample and vent lines
- ▶ Environmental protection (free standing enclosure or shelter)



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