

Model 933-C Reliable H₂S Analyzer for the Contactor Overhead

THE NEED

A critical measurement of natural gas quality is the concentration of hydrogen sulfide (H₂S). Remarkably, the common technique for making this measurement, lead acetate tape, is at least 70 years old. Use of this archaic technology requires that the sample gas be relatively free of moisture or dry. These analyzers must be installed, not on the outlet of the sweetening process they are meant to control, but far downstream — after the dryers.

This installation location builds tremendous lag time into the feedback control loop of the sweetening process. Significant time is consumed waiting for the results of an operational change to travel from the sweetening unit's outlet, the contactor overhead, through the entire drying system and finally into the H₂S analyzer. In natural gas processing, upset time equals lost revenue because out-of-spec gas must typically be destroyed. These losses are maximized by the lag time built into the current control strategy required by the lead acetate analyzer's dependence on dry sample gas.

AMETEK Western Research has responded to the need for a low maintenance, reliable, and rugged H₂S analyzer that can sample upstream of the dryers — directly from the sweetening unit's contactor overhead line. The Model 933-C uses our proprietary frontal elution chromatography sampling technique along with a heated sample handling system to continuously analyze the very wet natural gas exiting the sweetening unit through the contactor overhead. The sample handling technology of the 933-C combines with our exceptionally high resolution multiwavelength UV optical bench to provide you an extremely reliable analyzer. The 933-C is designed to operate unattended for six months or more.

By measuring the H₂S exiting the sweetening unit, you will be able to instantly respond to a process upset resulting in tremendous cost savings. This savings is repeated each and every time an upset occurs.

THE MEASUREMENT

AMETEK Western Research's unique sample conditioning system uses frontal elution chromatography to separate and eliminate interfering species. This ensures an accurate analysis of the gas via direct-UV absorption spectroscopy. In sales gas applications, H₂S and COS are the first absorbing species to elute through the chromatography column. These compounds are analyzed photometrically. The next species to elute is



Model 933-C in standard fiberglass enclosure

methyl mercaptan, which is also measured, and finally, the interfering ethyl mercaptan. Interference by ethyl mercaptan is prevented by terminating the sample analysis before it elutes, and then switching to a fresh column so that the analysis may continue. Two columns are employed in the 933-C. While one column is conditioning the gas sample, the other is automatically regenerated.

Optionally, the 933-C can be configured to output concentration values for COS and methyl mercaptans.

The Model 933-C utilizes two on-board microprocessors that provide concentration calculations, data processing, calibration, sophisticated self-diagnostics, and column switching control.

APPLICATION

- Natural Gas Sweetening

BENEFITS

- Operates immediately after the sweetening unit, upstream of the dryers
- Extended, unattended operation for up to 6 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 optionally available
- No consumables, reagents, or disposables other than zero gas

For water dew point or concentration, please refer to AMETEK's Model 3050-OLV quartz crystal moisture analyzer. For hydrocarbon dew point measurement, please refer to our Western Research Model 241CE analyzer.

PERFORMANCE SPECIFICATIONS

Methodology: Proprietary frontal elution sampling; nondispersive 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 minimum, to 0 to 100 ppm maximum
COS option: 0 to 100 ppm minimum, to 0 to 500 ppm maximum
MeSH option: 0 to 50 ppm minimum, to 0 to 250 ppm maximum

Low range:

H₂S: 0 to 5 ppm minimum, to 0 to 50 ppm maximum
COS option: 0 to 25 ppm minimum, to 0 to 250 ppm maximum
MeSH option: 0 to 15 ppm minimum, to 0 to 100 ppm maximum

Measurement accuracy:

Standard range: ±2% of full scale
Low range: ±5% 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: greater than 80% methane, less than 10% ethane, less than 3% propane, less than 1.25% total butanes, less than 0.5% C₅₊. Maximum water content is 0.6%*.

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

Sample pressure requirement: 120 psig to 2000 psig (830 kPag to 13790 kPag)

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

Outputs: Up to 4 isolated 4 to 20 mA, loop or self-powered; 4 nonisolated 1 to 5 V; 5 independent sets of SPDT, Form C, potential free relay contacts, 2 A at 250 VAC

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

Electrical requirements: 115 VAC ±10%, 47 to 63 Hz; 230 VAC ±10%, 47 to 63 Hz

Maximum start up power: 750W

Ambient temperature: 0° to 40°C (32° to 104°F)

Enclosure protection: IP65/fiberglass (other options available)

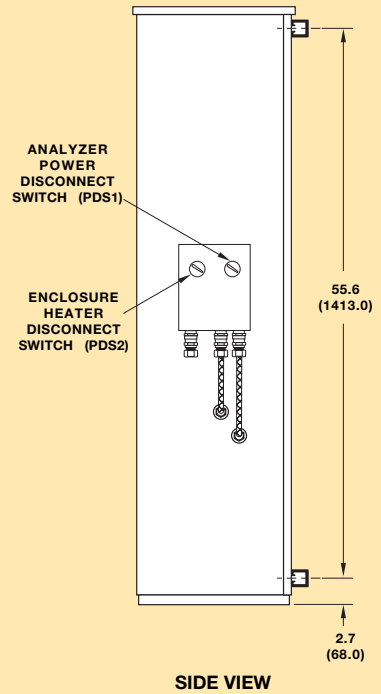
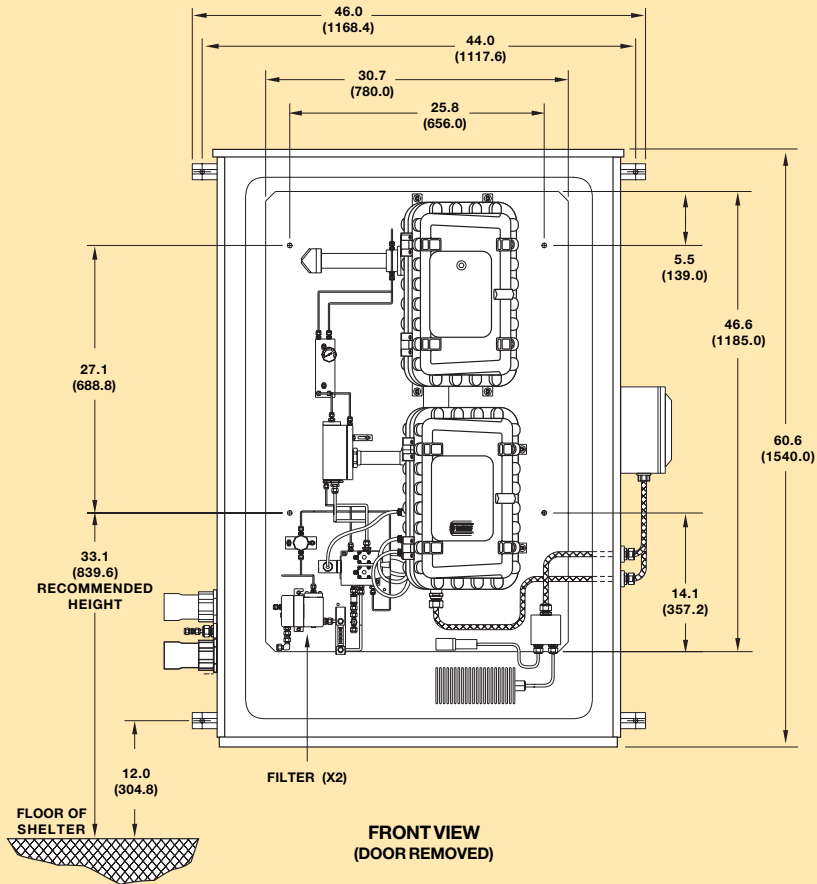
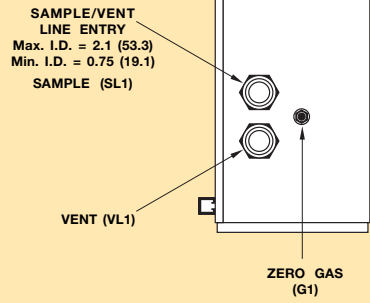
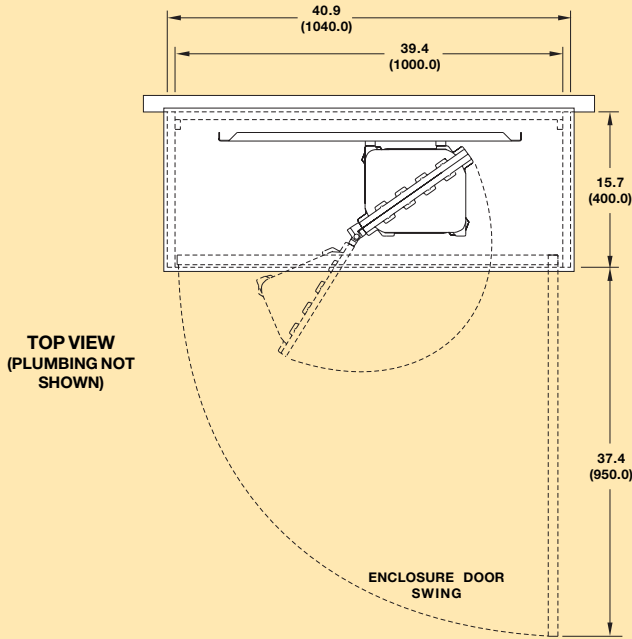
Approvals and certifications:

CEC Class I, Division 1, Groups C & D; Ex d IIB T3
NEC Class I, Division 1, Groups C & D; AEx d IIB T3
CENELEC EEx d IIB T3
EMC and LVD
GOST 1Ex d IIB T3 X

Options: Other measuring ranges, COS and methyl mercaptan measurement, pressure compensation, environmental purge kit, aluminum enclosure, and stainless steel (304) enclosure

* 0.6% maximum water content is based on a 35°C maximum water dew point temperature at 120 psig (830 kPag).

IN
(MM)



NOTE: COMPONENTS MAY NOT BE EXACTLY AS SHOWN.
ZONE 1 VERSION SHOWN. OTHER VERSIONS SLIGHTLY DIFFERENT.

One of a family of innovative process analyzer solutions from AMETEK Process Instruments. Specifications subject to change without notice.

AMETEK[®]
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