

ABB MEASUREMENT & ANALYTICS | DATA SHEET

CEMcaptain GAA610-M

Advanced emission gas monitoring system for marine applications



Measurement made easy

Intelligently simple, simply intelligent

Robust system design dedicated for marine environment

- Reliable emission monitoring by proven technology NDIR Photometer
- Suitable for high ambient temperatures up to 55 °C and high vibration resistance
- Easy integration and alignment with scrubber operation procedure

Guarantee compliance with latest IMO regulations

- Certified system for emission monitoring in marine industry
- Type Approval of all major classification societies available

Decrease maintenance hassle by increased system uptime

- Simple system design
- Adjustment without test gas bottles minimize maintenance tasks
- Digitally enabled for smart services
- ABB Ability™ Remote Assistance

Overview

Application area

Emission monitoring for clean air on oceans brings maritime air pollution control closely in line with shore-based power plants, cement works and oil refineries, where continuous emissions monitoring systems (CEMS) have been used for decades.

As from the 1st January 2020, the low sulphur emission limits in the IMO regulations (Marpol Annex VI) became effective worldwide with 0.5 % and follow the emission control areas with SO_x emission limits of 0.1 %.

It is mandatory to monitor the SO₂/CO₂ ratio of emissions if an exhaust gas cleaning system, so called scrubbers, are used on board. Monitoring of further components like NO_x are required as well.

Device description

The GAA610-M is a multi-component analyzer system continuously providing real-time data of relevant pollutants like SO₂/CO₂ ratio.

It proves compliance of vessels to low emission limits of emission control areas (ECA zones) and global limits. The measurement can be used to control the exhaust gas cleaning system on board, so called scrubber as well.

The GAA610-M is proven for use on board by all major classification societies and complies with Marpol Annex IV requirements and NO_x Technical Code 2008. Reducing maintenance hassles during ship operation has been the guiding principle for development. An increased uptime is provided with the GAA610-M by its robust and simple design as well as its innovative digital features allowing for tailored services according your needs.

The GAA610-M analyzer system extracts the sample gas from the exhaust gas stream.

The gas analyzer cannot process the sample without further treatment as e.g. an excessive dust content, temperature and dew point, excessive or insufficient pressure and interference components in the sample gas can affect the operating ability of the gas analyzer and distort the measurement result.

Therefore, additional devices, such as the sampling probe, the sample gas line, the sample gas cooler, pumps and filters ensure that the sample gas entry conditions of the connected gas analyzer are met, and a proper measurement result is obtained regardless of the process and the local conditions.

The sample handling system is specific for the applied measuring principle.

The GAA610-M analyzer system is a complete turn-key solution with the following components:

- Probe and filter unit for proper gas sampling
- Heated sample gas line for feeding the sample to the gas analyzer
- Sample conditioning components like sample gas cooler, filters and pump to ensure the gas conditions for reliable measurement results
- AO2020-Uras26 gas analyzer (Advance Optima – AO2000 series) for measuring SO₂ and CO₂

The sample conditioning components and the gas analyzer are integrated into the analyzer cabinet of the analyzer system.

Available options are:

- Air conditioning unit for operation at ambient temperature 5 to 55 °C (41 to 131 °F). Higher ambient temperature during operation on request.
- Dual sampling for simultaneous measurement at two different sampling locations (on request)

Type approvals

- DNV GL
- Lloyd's Register
- Bureau Veritas
- ABS Group
- Korean Register of Shipping (KR)
- ClassNK

Measuring principle

The GAA610-M is based on ABB's proven NDIR (Non-Dispersive Infrared) measurement technology.

The analyzer module Uras26 allows for reliable measuring and monitoring of the limit values for SO₂ and CO₂ and reports the ratio as specified by the IMO (International Maritime Organization), and it can be employed for continuous monitoring of CO if required.

... Overview

System schematic

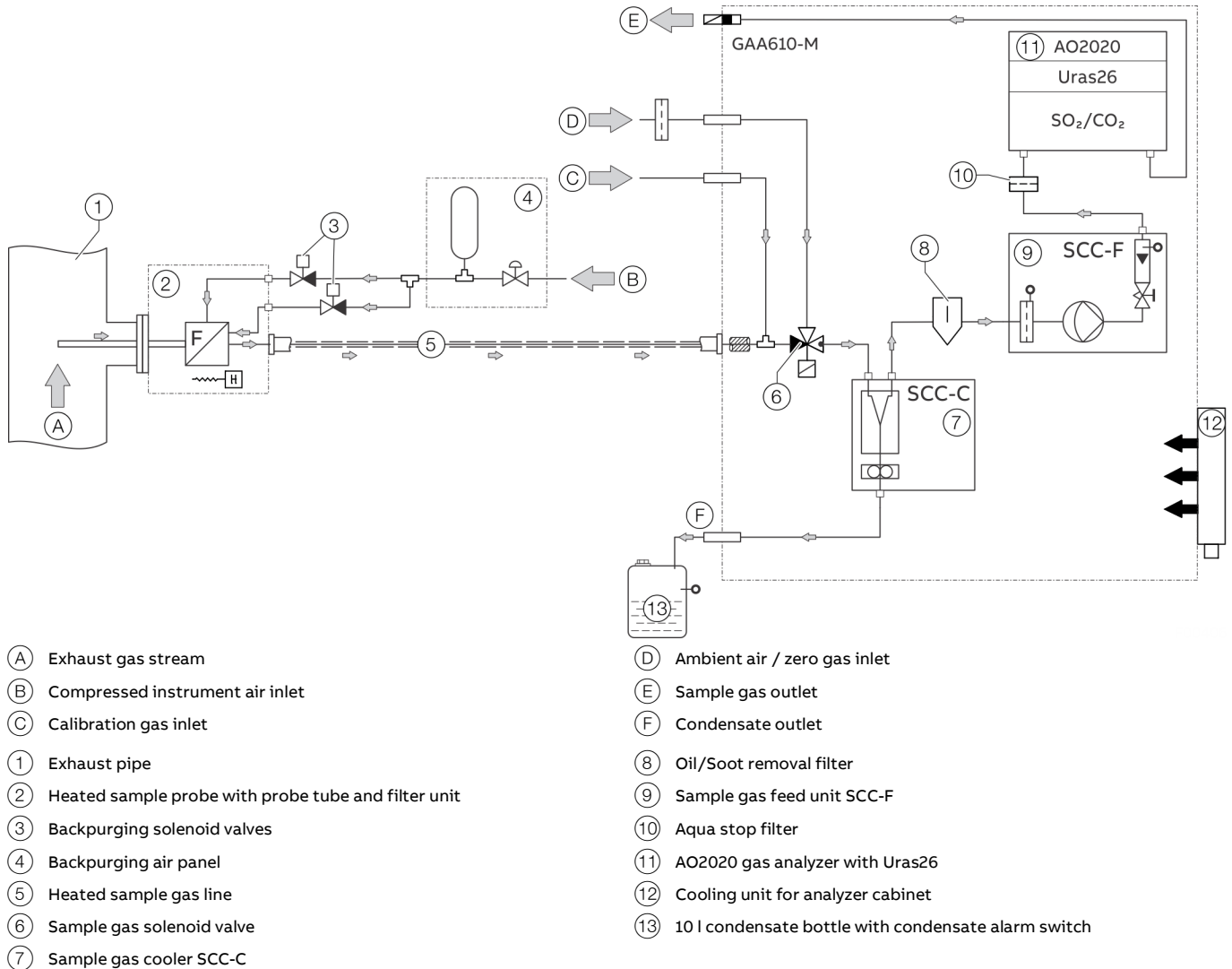


Figure 1: System schematic

Gas analyzer

Specifications

Measuring principle

NDIR for CO₂, SO₂, CO (option); electrochemical cell for O₂,
Extractive measurement (cold/dry).

Sample components and measuring ranges

Sample component	Standard measuring ranges
CO ₂	0 to 20 Vol.-%
SO ₂	0 to 250 ppm 0 to 500 ppm
SO ₂ /CO ₂ ratio	Calculated
O ₂ (option)	0 to 25 Vol.-%
CO (option)	0 to 500 ppm

Sample gas inlet conditions

GAA610-M – Sample gas inlet conditions

Temperature	Max. 500 °C (932 °F)
Pressure	850 to 1100 hPa (0.85 to 1.1 bar), (12.3 to 16 psi)

Instrument air supply

Compressed air for back-purging

GAA610-M – Instrument air inlet conditions

Quality	Oil free, dry with dew point < -20 °C (-4 °F)
Pressure	Min. 400 kPa (60 psig) Max. 600 kPa (90 psig)
Air consumption	< 0.2 Nm ³ /day

Ambient conditions

Ambient temperature

In operation: 5 to 55 °C* (41 to 131 °F)*

* Higher ambient temperature during operation on request.

Ambient temperature during transport / storage

- 2 to 60 °C (35.6 to 140 °F);
- -20 to 70 °C (-4 to 158 °F) after draining and drying parts in contact with condensate.

Max. permissible humidity

Year-round average max. 75%, short-term max. 95%, occasional slight condensation is permitted.

IP rating

IP 54

Vibration resistance in accordance with IEC 60068-2-6

Vibrations according the below tested conditions showed negligible influence on measurement value.

Test Fc:

±1.0 mm, 2⁺³₋₀ Hz up to 13.2 Hz;

0.7 g at 13.2 Hz up to 100 Hz

Installation site requirements

- The analyzer system is intended for installation aboard a ship.
- The installation location height is naturally limited to sea level.
- The analyzer cabinet is only suitable for installation indoors below deck in well ventilated areas.

... Gas analyzer

Measuring accuracy

Linearity

< 2 % of reading or max. 0.3 % of span whichever is greater

Precision

- Precision for measuring ranges < 100 ppm:
< ± 2 % of span
- Precision for measuring ranges > 100 ppm:
< ± 1 % of span

Drift

- Zero drift SO₂, CO₂: ≤ 2 % of span per week
- Span drift SO₂, CO₂: ≤ 2 % of measured value per week

Output fluctuation (2 σ)

< 1 % of span

Warm up time

30 minutes for analyzer (thermostat)

Validation / Calibration

- Automatic validation and adjustment with internal gas filled cells
- Manual calibration with calibration gas bottle

Sound level

Cooling unit

Max. 67 dB(A)

Housing

Dimensions

- System including air conditioner (W × D × H):
944 × 730 × 1000 mm (37.2 × 28.7 × 39.4 in)
- Air conditioner (W × D × H):
430 × 287 × 735 mm (17.0 × 11.3 × 29.0 in)

See also **Location diagram** on page 14.

Weight

240 kg (441 lb), depending on configuration

Material

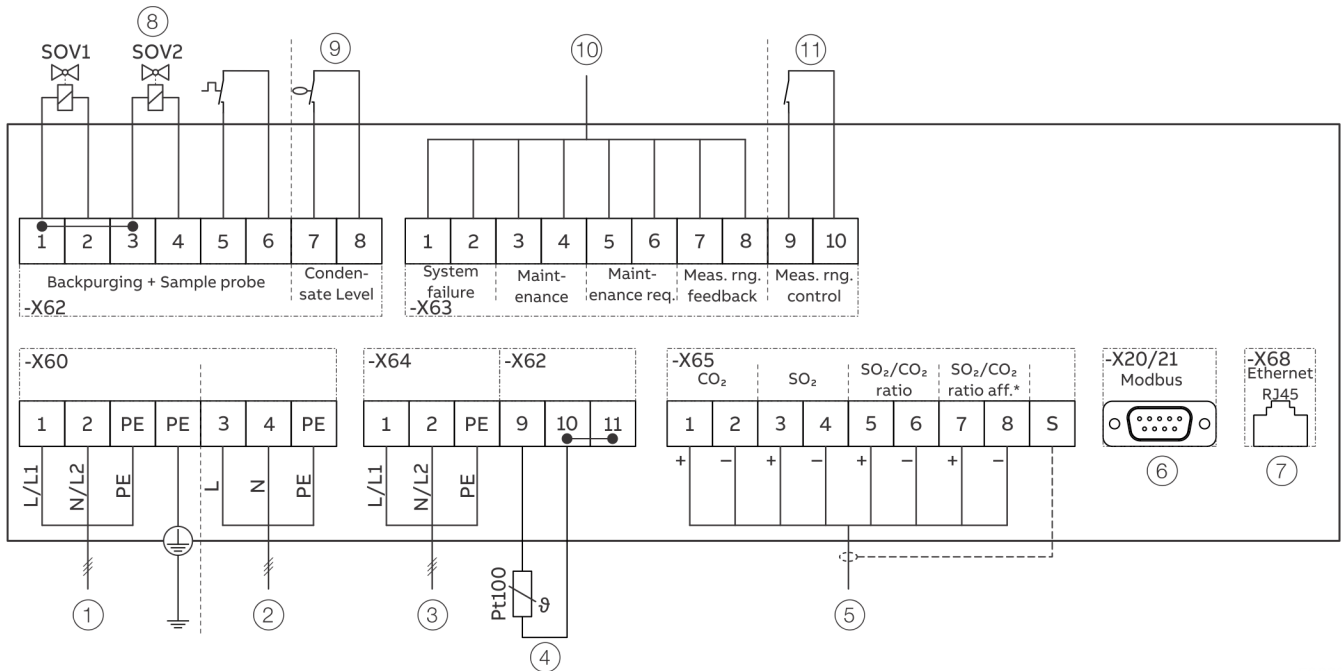
Painted electro galvanized (EG) steel

Installation

Wall mounted / Rack mounted

Electrical connections

Terminal assignment



- ① Power supply
- ② Power output for heated sample gas probe
- ③ Power output for heated sample gas line TBL01
- ④ Pt100 temperature sensor from heated sample gas line TBL01
- ⑤ Analogue outputs 4 to 20 mA
- ⑥ Modbus® interface
- ⑦ Ethernet interface
- ⑧ I/O for sample probe and backpurgig
- ⑨ Digital input for condensate bottle level monitoring
- ⑩ Digital outputs
- ⑪ Digital input for SO₂ measuring range control

* SO₂/CO₂ ratio aff.: Ratio calculation of SO₂/CO₂ to ensure plausible values on zero level. Signal is to be used for operation.

Figure 2: Electrical connections –Overview

Electrical Data

Power supply	
Terminals	-X60: L, N, PE or L1, L2, PE
Operating voltage	230 V AC, ±10 %
Frequency	50 / 60 Hz, ±3 Hz
External fuse	25 A
Power consumption	
System cabinet	500 w
Air conditioner	1600 W
Sampling probe	300 W
Heated sample gas line	Approx. 90 W/m

Heated sample gas line		
Terminals	Power supply:	-X64 – 1, 2, PE
	Three-Wire Pt100:	-X62 – 9, 10, 11
	Two-Wire Pt100	-X62 – 9, 10, Bridge between 10+11
Power supply output		230 V AC
Maximum output current		12 A
Maximum output power		2.7 kW
Internal fuse protection		RCD 16 A, 30 mA

Sample gas probe & heated filter unit		
Terminals	Power supply:	-X60 – 3, 4, PE
	Probe heater alarm:	-X62 – 5, 6
Power supply output		230 V AC
Maximum output current		1.3 A
Maximum output power		300 W
Internal fuse protection		6 A

... Electrical connections

Backpurging unit		
Terminals	Valve 1:	-X62 – 1, 2
	Valve 2:	-X62 – 3, 4
Power supply output		24 V DC
Maximum output current		1 A
Internal fuse protection		2 A slow blow

Current outputs		
Terminals	CO ₂ , 0 to 20 %	-X65 – 1+, 2-
	SO ₂ , 0 to 250 ppm:	-X65 – 3+, 4-
	SO ₂ /CO ₂ ratio, 0 to 250	-X65 – 5+, 6-
	—	-X65 – 7+, 8-
	Shield	-X65 – S
Current output		4 to 20 mA
Maximum load		750 Ω
Resolution		16 bit
Design	Joint minus pin, electrically isolated, randomly groundable	

Cable specification

Note

All cables entering the system must comply with the flammability class VW1, FT1 or EN60332-1-2/-2-2.

Power supply lines

Analyzer cabinet supply	<ul style="list-style-type: none"> 230 V AC, 50 / 60 Hz, Single Phase NON-UPS power supply; fuse (external) 25A Cable Entry: M25 Cable gland for customer supply cable; Cable Type: 3×10 mm² Grounding cable: > 6 mm²
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Connecting cables between analyzer cabinet and sample handling components

Sample probe power supply	<ul style="list-style-type: none"> 230 V AC 50/60 Hz; Cable Entry: M20 Cable gland for customer supply cable; Cable Type: 3×2.5 mm²
Probe Heater Alarm Signal	<ul style="list-style-type: none"> Cable Entry: M20 Cable gland for customer supply cable Cable Type: 2×0.75 mm²
Back-purge Unit Solenoid Valves (SOV1/SOV2)	<ul style="list-style-type: none"> Cable Entry: M20 Cable gland for customer supply cable Cable Type: 2×1.5 mm²

Signal lines (Connection between CEMS cabinet and scrubber system)

Analogue Signals to DCS (only, if hardwired connection is required)	<ul style="list-style-type: none"> Shielded cables for the analog outputs (current outputs) Cable Entry: M25 Cable gland for customer supply cable Cable Type: 6×1 mm²
Digital Signals to DCS (only, if hardwired connection is required)	<ul style="list-style-type: none"> Cable Entry: M20 Cable gland for customer supply cable Cable Type: 2×1 mm² (System failure) Cable Type: 2×1 mm² (Maintenance) Cable Type: 2×1 mm² (Maintenance Request) Cable Type: 2×1 mm² (Measuring Range Feedback SO₂)
Modbus Signal to DCS	Cable Entry: M20 Cable gland for customer supply cable
Ethernet to DCS	Cable Entry: M20 Cable gland for customer supply cable

Note

Further signal lines might be needed, please check your specific wiring diagram.

Safety

According to EN 61010-1:2010, AMD1:2016

Protection class

I (protective earth conductor)

Overvoltage category

II

Pollution degree

2

Safe isolation

The power supply is electrically isolated from other circuits by means of reinforced or double insulation. Operational low voltage (PELV) on low-voltage side.

Electromagnetic compatibility

In accordance with EN 61326-1

Noise immunity

Inspection level: industrial area, fulfills at least the evaluation criteria according to Table 2 of EN 61326-1.

Emitted interference

Limit values class B for electromagnetic radiation disturbance and conducted disturbance are met.

Digital communication**Modbus® communication**

Transmission of measured values and status signals as well as analog input, digital input and digital output signals to host systems, e.g. standard Windows applications via M-DDE server.

Modbus slave protocol in the RTU (Remote Terminal Unit) mode via the RS485 interface.

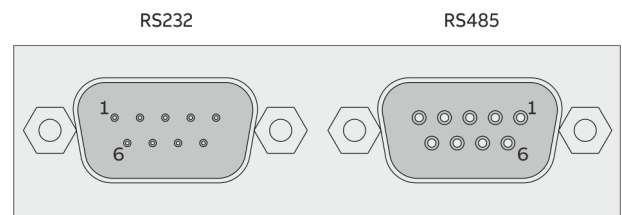


Figure 3: Modbus module

RS232 Interface

Version: 9-pin sub-D male connector

Pin	Signal
2	RxD
3	TxD
5	GND

RS485 interface

Version: 9-pin sub-D female connector

Pin	Signal
2	RTxD-
3	RTxD+
5	GND

Ethernet communication

Transmission of measured values and status signals as well as analog input, digital input and digital output signals to host systems, via Modbus/TCP.

Version: RJ45 connector, EIA/TIA 568B standard

Pin	Signal	Colour
1	Rx+	Orange/White
2	Rx-	Orange
3	TX+	Green/White
6	TX-	Green

Gas connections

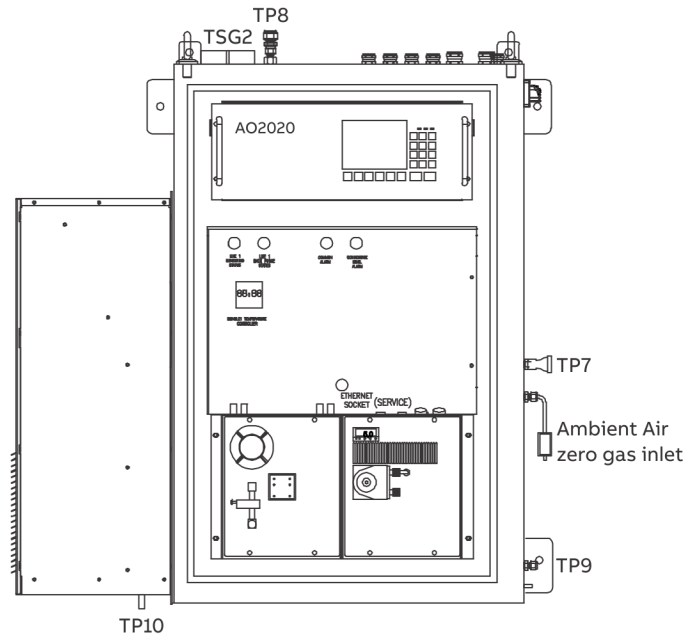


Figure 4: Gas connections GAA610-M

Pos.	Connection	Additional Information	Design
TSG2	Sample gas inlet	For heated sample gas line TBL01 with outer diameter of 48 mm	Tube fitting 4/6 × 1 mm
TP7	Calibration gas inlet	—	Tube fitting for PTFE pipe 4/6 × 1 mm
TP8	Sample gas outlet / Analyzer cabinet ATM vent	Vent out room safety area	Tube fitting for PTFE pipe 10/12 × 1 mm
TP9	Condensate water drain port	—	Tube fitting DN 6 / 4 mm, PVDF
TP10	Condensate water drain port	From air condition	10 mm tube
—	Instrument air inlet	Located at the backpurgig panel, see Backpurgig Unit on page 13	10 mm O.D. Tube fitting for stainless steel pipe or compressed-air hose (plus pressure gauge and shut-off valve)

Sampling system

Type 40 probe tube and filter unit

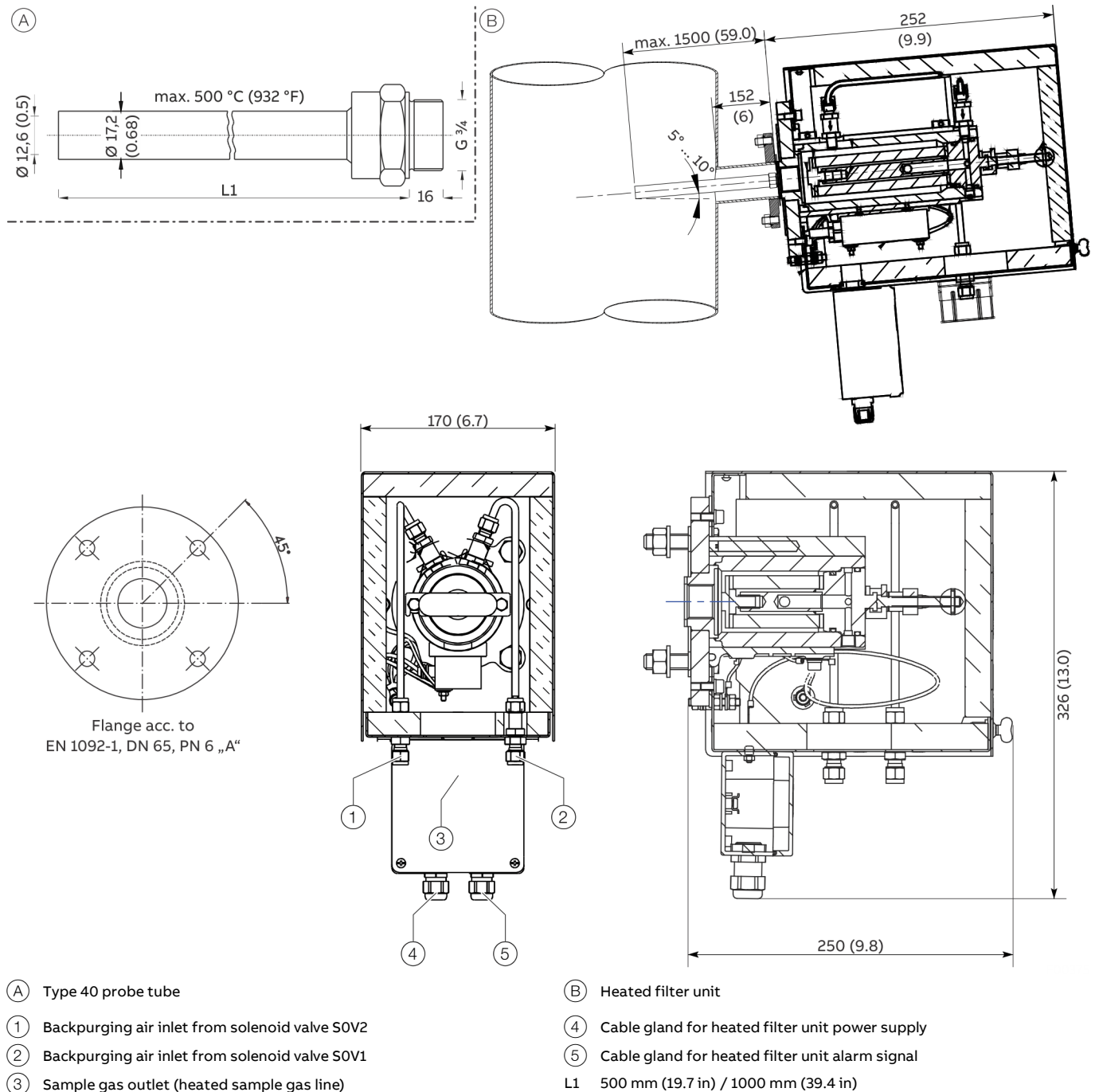


Figure 5: Type 40 probe tube and filter unit

... Sampling system

Filter unit

The filter unit is heated.

Technical data heated filter unit

Mounting position	5° to 15° incline (recommended), torsion angle max. 45°
Ambient temperature	-20 to 60 °C
Dust load	max. 1 g/m ³ , flow dependent
Temperature	approx. 180 °C; Low temperature threshold / Contact: 150 °C
Sample gas inlet	G ¾" female thread
Sample gas outlet	½" NPT female thread
Backpurge gas connection	10 mm bulkhead fitting
Power supply	115 to 230 V AC 50/60 Hz, 300 W
IP rating	IP 43, junction box: IP 65
Weight	9 kg

Type 40 probe tube

L1 = 500 / 1000 mm

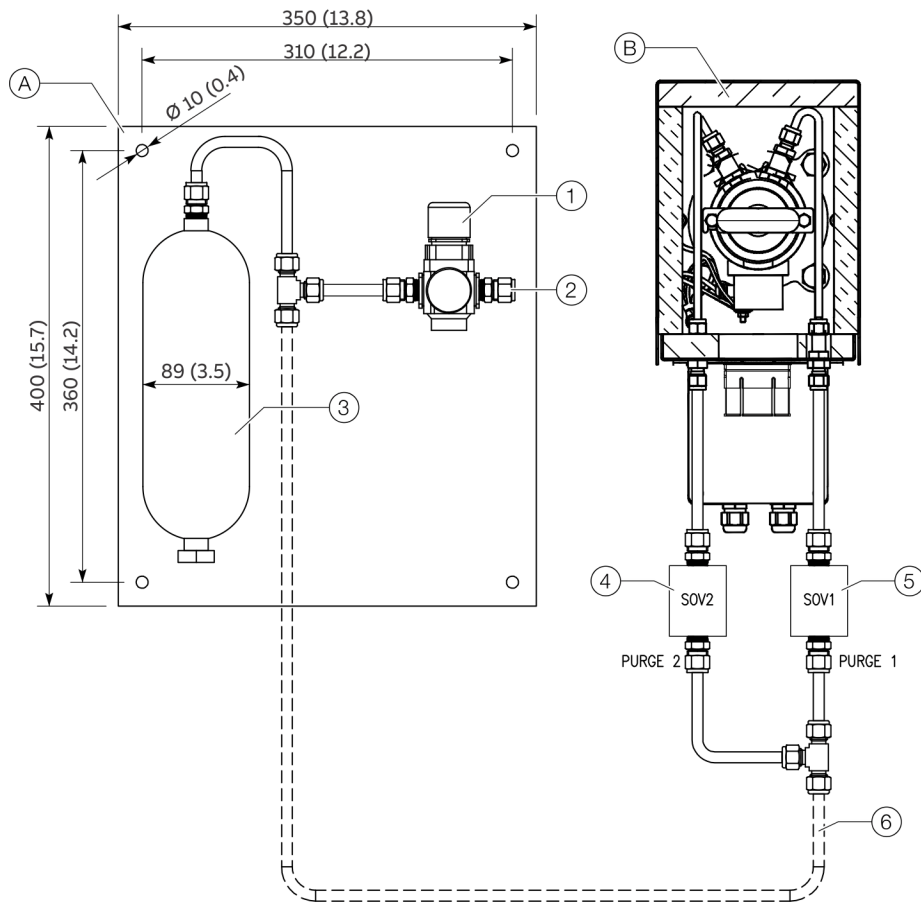
Sample gas line

Heated sample gas line with regulated heating.

Technical data heated sample gas line

Outer covering	Polyamide corrugated tubing
Medium-carrying pipe	PTFE pipe 6×4×1 mm
Power supply	230 V or 120 V, 50/60 Hz
Heat output	90 W/m
Temperature	180 °C (356 °F)
Outer diameter	43 mm (1.69 in)
Line duct	M48
Minimum bending radius	200 mm (7.9 in)
Maximum length	max. 30m (98.4 ft)
Weight	Approx. 1 kg/m
Electrical connection for heater and Pt 100	Fixed, 3×2.5 mm ² and 2×0.14 mm ² , length 5 m

Backpurging Unit

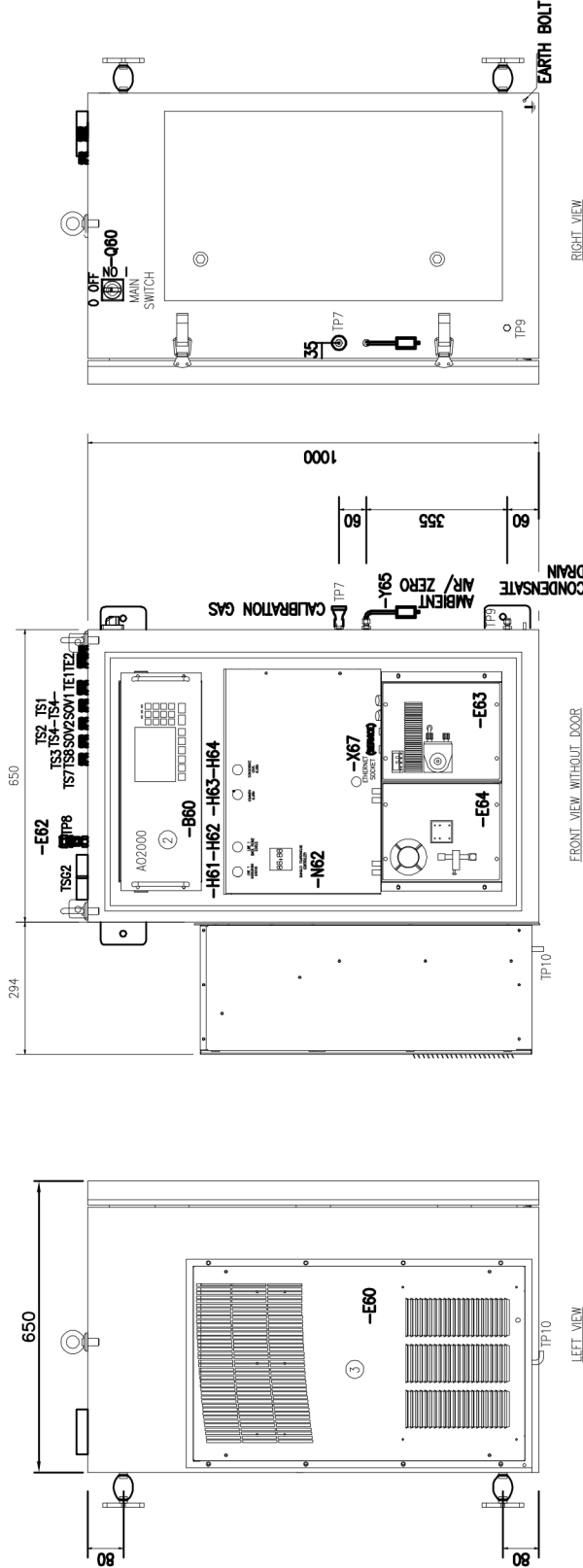


- (A) Backpurging panel
- (1) Pressure regulator
- (2) Instrument air inlet, 10 mm O.D. Tube fitting for stainless steel pipe
- (3) Pressure buffer tank
- (B) Filter unit
- (4) Backpurging solenoid valve SOV2
- (5) Backpurging solenoid valve SOV1
- (6) Stainless steel pipe 10 mm O.D., to be intalled by customer

Figure 6: Backpurging panel

Appendix

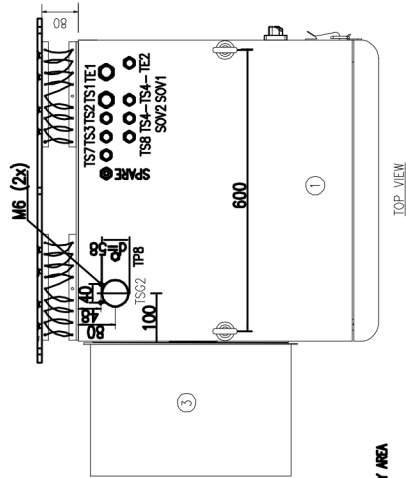
Location diagram



ITEM	QTY	DESCRIPTION
1	1	CABINET (650W x 1000H x 610D mm)
2	1	ANALYZER A02000 SERIES
3	1	AIR CONDITION

NOTES:
1. ALL DIMENSIONS ARE IN mm.

LEGEND:
ELECTRICAL:
TE1: ANALYZER POWER SUPPLY CABLE
TE2: ANALYZER POWER SUPPLY CABLE
TE3: ANALYZER POWER SUPPLY CABLE
TE4: ANALYZER POWER SUPPLY CABLE
TE5: ANALYZER POWER SUPPLY CABLE
TE6: ANALYZER POWER SUPPLY CABLE
TE7: ANALYZER POWER SUPPLY CABLE
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TE98: ANALYZER POWER SUPPLY CABLE
TE99: ANALYZER POWER SUPPLY CABLE
TE100: ANALYZER POWER SUPPLY CABLE



TP7: CALIBRATION GAS 6mm OD SS TUBE FITTING
 TP8: ANALYZER POWER SUPPLY CABLE
 TP9: CONDENSATE WATER DRAIN POINT (1/4" TUBE FITTING) 10 mm TUBE
 TP10: AIR CONDITION CONDENSATE WATER DRAIN POINT, 10 mm TUBE
 TS02: SAMPLE 1 INLET, AL-FINNE FOR HATED LINE OD 40 mm



Trademarks

Modbus is a registered trademark of Schneider Automation Inc.

Sales



Service



Notes

Notes



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For more product information, visit:

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