

testo 335 – New measurement engineering for monitoring emissions

How many ppm NO are there really?



Knut Hoyer,
Head of Product
Development
Gas

How sure can you really be that your analyzer measures exactly what it should be measuring? Our exclusive sensors, developed especially for

your respective applications, are unbeatable in terms of accuracy; confirmed also by independent test institutes such as TÜV.

The competence of our engineers is held in high esteem by expert groups and committees in Berlin and Brussels where they are involved in the developments of future guidelines in their capacity as representatives of industry.

A comprehensive exchange of knowledge and experience with official measurement institutes around the world (e.g. DKD for humidity, temperature) ensures that your Testo measuring instrument can hold up to any comparison of accuracy. Indeed, these efforts do have an objective: whoever uses Testo measurement engineering, can be assured that he is using the industrial standard.

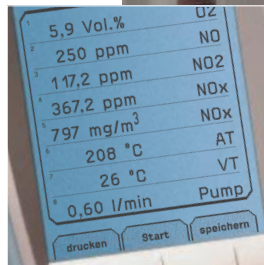
Of further benefit to you: We know today about the guidelines and test specifications we will be faced with in the future.



Flue gas probes in different lengths and diameters for all applications. Probe preliminary filters for dusty flue gases.



Highest flexibility – testo 335 with O₂ sensor as standard. Two additional toxic gas sensors such as CO, CO_{low}, NO, NO_{low}, NO₂, or SO₂ can be selected by the user.

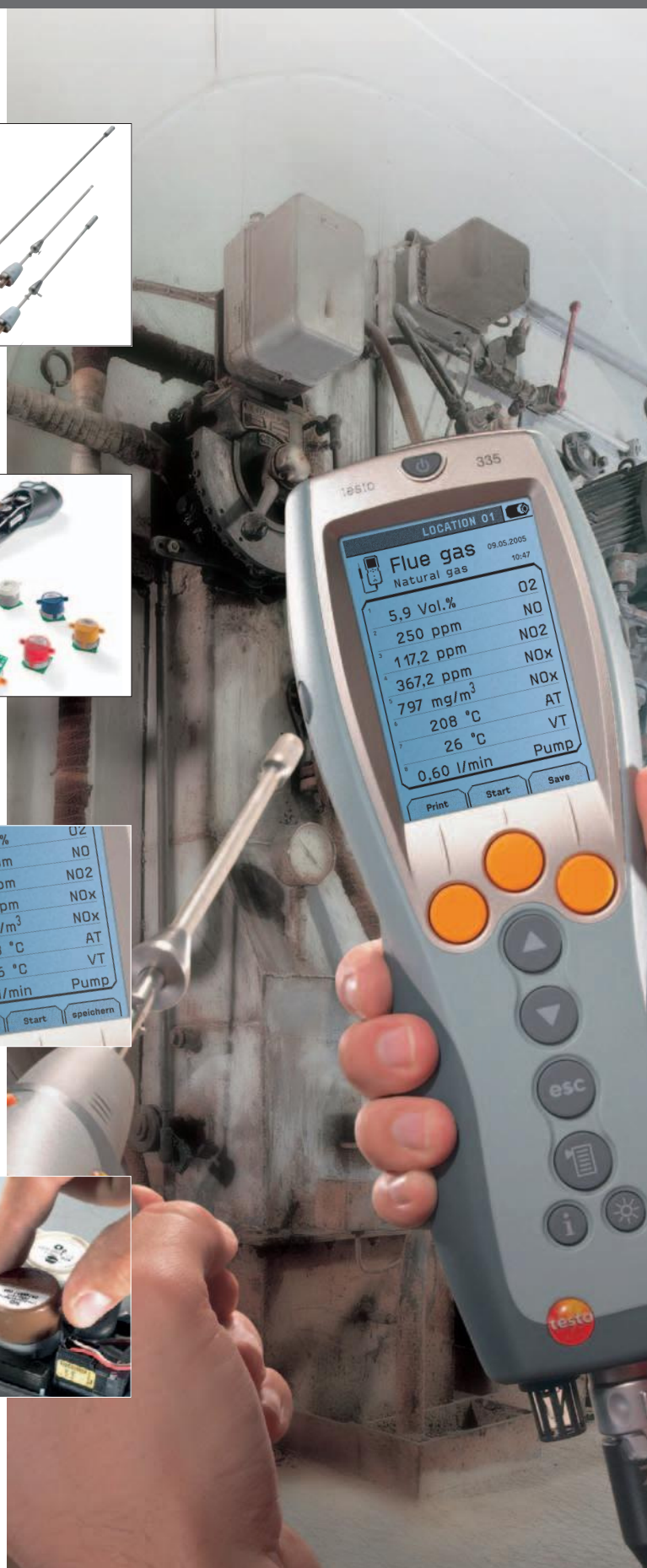


Powerful, automatically controlled diaphragm pump

Pump flow is shown in the display. In addition, pumping capacity is automatically controlled (audibly) over a wide negative or positive pressure range (-200 to +50 mbar) or pump flow is kept constant.



Gas sensor can be changed quickly and easily by user on-site



Compact flue gas analyzer

testo 335

testo 335 is the new generation flue gas analyzer, specially tailored to industrial applications' requirements. testo 335 can be used for all emission monitoring applications by the operators of industrial furnaces such as processing and power plants, by service technicians for burner/furnace manufacturers, for plant construction as well as for stationary motors. Even spot measurements for up to 2 hours are possible.

• **Two toxic sensors freely selectable** – CO, CO_{low}, NO, NO_{low}, NO₂, SO₂

• **Two different measurement range extensions** – To continue measurement despite high CO concentrations

- Standard: Single dilution Slot 2 (CO, NO₂, SO₂) with dilution factor 5

- Option: Dilution for all sensors with dilution factor 2

• **Option: Parallel ΔP or m/s measurement for flue gas analysis** – Simultaneous, convenient flow or mass flow measurement

• **Powerful, automatically controlled diaphragm pump** – Benefits:

- Constant pump flow over a wide negative or positive pressure range (-200 to +50 hPa)

- Gas sampling hose up to max. 7.8 m long (corresponds to two hose extensions, each 2.8 m)

• **18 standard fuels and an additional 10 user-defined fuels**

– Fuel data is calculated using the new “easyEmission” software

• **Industrial probes with a new probe preliminary filter**
Up to max. 1000 °C

• **Graphic representation of sensor calibration data**

• **Calculated flue gas dewpoint parameter**

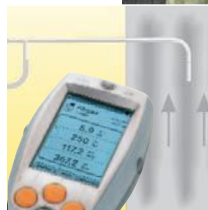
• **Logger function** – Records data in analyser for up to 2 hours

• **Initialisation of gas sensors without removing probe from flue**

• Accuracy approved for O₂, CO₂, CO, NO, NO_{low}, °C, hPa to EN Standard 50379 Part 2



Logger function – Records data in analyser for up to 2 hours



Optional: Simultaneous ΔP and m/s measurement for flue gas analysis (e.g. for mass flow calculation)



Measurement in dusty flue gases with probe preliminary filter

testo 335

testo 335 flue gas analyzer, rechargeable battery and calibration protocol included, equipped with O₂ sensor

Part no. 0632 3350

A second gas sensor must be fitted in testo 335, the instrument will not be able to function otherwise. A maximum of two additional sensors can be fitted.

See Ordering Data on Page 10

Good reasons for flue gas analysis

Flue gas duct

testo 335's easy handling and its independence of the power supply system (battery operation) enable measurements at difficult-to-access points in a flue gas duct. Filter function is checked quickly and easily using differential pressure measurement (optional).

Monitoring emissions

Flow speed is also measured during quick emission checks. It is possible, for example, to check the position of a stationary sampling probe. testo 335 can be calibrated very accurately with test gas when measuring emission levels.

Combustion chamber analysis

testo 335 has very wide measurement ranges to reliably detect CO “nests” and check for reducing atmosphere. Sampling probes can be used at temperatures up to 1800 °C.

Tuning burners

For the purpose of efficient burner tuning, testo 335 calculates air ratio and efficiency. Combustion chamber pressure (optional) is measured at the same time as flue gas values. This is particularly important for multi-stage burners.

Accessories

Versatile infrared printer

The IRDA printer – wireless with infrared interface – saves data for printing which saves time since the analyser is ready to operate immediately after data transfer. The printer can be used anywhere.



Testo printer with wireless IRDA and infrared interface, 1 roll of thermal paper and 4 AA batteries

Part no. 0554 0547

IRDA printer saves data – Instrument is ready to operate immediately after data transfer

Software: "easyEmission"

The complete solution to manage data for flue gas analysis

- User-defined measurement intervals (1 measurement/second up to 1 measurement/hour)
- Readings transmitted in seconds to Microsoft EXCEL®
- User-defined fuels
- Readings are shown in table or graphics form
- Easy generation of customer-specific measurement protocols

"easyEmission" software for testo 335, with USB cable to connect instrument to PC

Part no. 0554 3334



Software with analysis and graphics functions, online measurement

Holster (SoftCase)

The holster (SoftCase) protects the instrument from impact. It is made of elastic plastic and a practical strap facilitates easy transport.



Holster (SoftCase) for testo 335 with belt

Part no. 0516 0335

Case

Transport case for safe and convenient storage of measuring instrument, probe, accessories. Flue gas probe is positioned in lid.



Transport case

Part no. 0516 3350

Transport case, easy-find storage of instrument, probes and accessories

Instrument/Options

testo 335 flue gas analyzer, rechargeable battery and calibration protocol included, equipped with O₂ sensor

Part no.

0632 3350

A second gas sensor must be fitted in testo 335, the instrument will not be able to function otherwise. A maximum of two additional sensors can be fitted.

Option: CO gas sensor, 0 to 10000 ppm

0440 3988

Option: COlow sensor, 0 to 500 ppm

0440 3936

Option: NO gas sensor, built-in in analyser box, 0 to +3000 ppm NO

0440 3935

Option: NOlow gas sensor, 0 to +300 ppm NO

0440 3928

Option: NO₂ gas sensor, 0 to +500 ppm NO₂

0440 3926

Option: SO₂ gas sensor, 0 to +5000 ppm SO₂

0440 3927

Option: dilution of all sensors

0440 3350

Option: pressure/flow measurement (not upgradable)

0440 3351

Accessories

100-240 V mains unit, for mains operation or batt. recharging in analyser

Part no.

0554 1086

"easyEmission" software for testo 335, with USB cable to connect instrument to PC

0554 3334

Testo printer with wireless IRDA and infrared interface, 1 roll of thermal paper and 4 AA batteries

0554 0547

Spare thermal paper for printer (6 rolls), permanent ink, measurement data documentation legible for up to 10 years

0554 0568

Spare thermal paper for printer (6 rolls)

0554 0569

Holster (SoftCase) for testo 335 with belt

0516 0335

Spare rech. batt. w/ charging station

0554 1087

Spare particle filter (10 off)

0554 3385

Instrument cleaner (100 ml), for hassle-free and fast removal of dirt from housing, display screen, keypad, probe handle and probe cable

0554 1207

Multiple licence software "easyEmission" for testo 335

0554 3338

Software upgrade of "easyEmission" testo 350-S/-XL to "easyEmission" testo 335

0450 3334

Software upgrade of "easyEmission" testo 335 to "easyEmission" testo 350-S/-XL

0450 3335

Cases

Transport case, for measuring instrument and probes

Part no.

0516 3350

Calibration Certificates

ISO calibration certificate/flue gas, calibration points 2.5% O₂; 100 and 1000 ppm CO; 800 ppm NO; 80 ppm NO₂; 1000 ppm SO₂

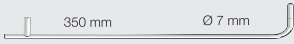

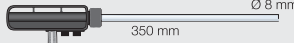
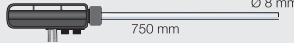
Part no.

0520 0003

Instrument options as upgrades

Information about instrument upgrades and prices available on request.

Additional Accessories/Sets

Pitot tubes	Illustration	Meas. range	Probe type	Part no.
Pitot tube, 350 mm long, stainless steel, for measuring flow velocity		Oper. temp. 0 to +600 °C		0635 2145
Pitot tube, 1000 mm long, stainless steel, for measuring flow velocity		Oper. temp. 0 to +600 °C		0635 2345
Pitot tube, stainless steel, 350 mm long, measures flow speed with temperature, 3 x hoses (5 m long) and heat protection plate		-40 to +1000 °C	Type K (NiCr-Ni)	0635 2041
Pitot tube, stainless steel, 750 mm long, measures flow speed with temperature, 3x hoses (5 m long) and heat protection plate		-40 to +1000 °C	Type K (NiCr-Ni)	0635 2042
Calibration Certificates				Part no.
ISO calibration certificate velocity, hot wire, vane anemometer, Pitot tube; calibration points 1; 2; 5; 10 m/s				0520 0004
ISO calibration certificate/Velocity, hot wire, vane anemometer, Pitot tube; calibration points 5; 10; 15; 20 m/s				0520 0034
Additional probe accessories				Part no.
Connection hose, silicone, 5m long, max. load 700 hPa (mbar)				0554 0440

Affordable basic set



The compact flue gas analyzer, testo 335, provides an affordable introduction to industrial flue gas analysis engineering. It can be used to carry out spot check measurements lasting up to 2 hours in pure gas, for burner tuning or process monitoring.

Benefits:

- Measurement range extension for CO to continue measuring even in high CO concentrations
- Automatically controlled gas pump for constant pump flow at a negative pressure of -200 mbar up to a positive pressure of max. 50 mbar

Affordable basic set

- testo 335 flue gas analyzer (equipped with O₂ and CO), incl. rechargeable battery and calibration protocol
- Modular flue gas probe, immersion depth 335 mm, Ø 8mm, Tmax 1000°C
- Mains unit 100-240 V for mains operation or recharging rechargeable battery in analyser
- Spare particle filters (10 off)
- Transport case

Part no. 0563 3317 70

Recommended set: Professional set for measuring emissions

During quick checks on emissions, flow speed is also measured simultaneously with flue gas. In this way, for example, the position of a stationary sampling probe can be checked or mass flow can be calculated simultaneously.

Benefit:

- Measurement range extension for all sensors - gas sensors can be protected in the case of unexpectedly high concentrations of different gases and the measurement can continue

Recommended set: Professional set for measuring emissions

testo 335 flue gas analyzer, rechargeable battery and calibration protocol included, equipped with O ₂ sensor	0632 3350
Option: CO gas sensor	0440 3988
Option: NO gas sensor	0440 3935
Option: dilution of all sensors	0440 3350
Option: pressure/flow measurement	0440 3351
Modular flue gas probe, immersion depth 335 mm, Ø 8 mm, Tmax 1000°C	0600 8764
Pitot tube, stainless steel, 350 mm long, measures flow speed with temperature, 3 x hoses (5 m long) and heat protection plate	0635 2041
100-240 V mains unit, for mains operation or batt. recharging in analyser	0554 1086
Spare particle filter (10 off)	0554 3385
Connection hose, silicone, 5m long, max. load 700 hPa (mbar)	0554 0440
Transport case	0516 3350

Technical data

	Meas. range	Accuracy	Resolution	Response time
O ₂ measurement	0 to 25 Vol. %	±0.2 Vol. %	0.01 Vol. %	t ₉₀ <20 s
CO measurement (H ₂ compensated)	0 to 10000 ppm	±10 ppm or ±10% of mv (0 to 200 ppm) ±20 ppm or ±5% of mv (201 to 2000 ppm) ±10% of mv (2001 to 10000 ppm)	1 ppm	t ₉₀ <40 s
CO _{low} measurement (H ₂ compensated)	0 to 500 ppm	±2 ppm (0 to 39.9 ppm) ±5% of mv (remaining range) ^x	0.1 ppm	t ₉₀ <40 s
NO measurement	0 to 3000 ppm	±5 ppm (0 to 99 ppm) ±5% of mv (100 to 1999 ppm) ±10% of mv (2000 to 3000 ppm)	1 ppm	t ₉₀ <30 s
NO _{low} measurement	0 to 300 ppm	±2 ppm (0 to 39.9 ppm) ±5% of mv (remaining range)	0.1 ppm	t ₉₀ <30 s
NO ₂ measurement*	0 to 500 ppm	±10 ppm (0 to 199 ppm) ±5% of mv (remaining range)	0.1 ppm	t ₉₀ <40 s
SO ₂ measurement*	0 to 5000 ppm	±10 ppm (0 to 99 ppm) ±10% of mv (remaining range)	1 ppm	t ₉₀ <40 s

^xData correspond to 20°C ambient temperature. Additional temperature coefficient 0.25% of mv/K.

Measurement range extension

Single dilution factor 5 (standard)

CO measurement (H ₂ compensated)	Meas. range Accuracy Resolution	700 ppm to 50000 ppm ±10 % of mv (additional error) 1 ppm
CO _{low} measurement (H ₂ compensated)	Meas. range Accuracy Resolution	500 ppm to 2500 ppm ±10 % of mv (additional error) 0.1 ppm
NO ₂ measurement	Meas. range Accuracy Resolution	200 ppm to 2500 ppm ±10 % of mv (additional error) 0.1 ppm
SO ₂ measurement	Meas. range Accuracy Resolution	500 ppm to 25000 ppm ±10 % of mv (additional error) 1 ppm

Dilution of all sensors, Factor 2 (option, Part no. 0440 3350)

O ₂ measurement	If measurement range extension is activated on all sensors: Accuracy: ±1 vol.% additional error (0 to 4.99 vol.%) ±0.5 Vol.% additional error (5 to 25 vol.%)	
CO measurement (H ₂ compensated)	Meas. range Accuracy Resolution	700 ppm to 20000 ppm ±10 % of mv (additional error) 1 ppm
CO _{low} measurement (H ₂ compensated)	Meas. range Accuracy Resolution	500 ppm to 1000 ppm ±10 % of mv (additional error) 0.1 ppm
NO measurement	Meas. range Accuracy Resolution	500 ppm to 6000 ppm ±10 % of mv (additional error) 1 ppm
NO _{low} measurement	Meas. range Accuracy Resolution	300 ppm to 600 ppm ±10 % of mv (additional error) 0.1 ppm
NO ₂ measurement	Meas. range Accuracy Resolution	200 ppm to 1000 ppm ±10 % of mv (additional error) 0.1 ppm
SO ₂ measurement	Meas. range Accuracy Resolution	500 ppm to 10000 ppm ±10 % of mv (additional error) 1 ppm

	Meas. range	Accuracy	Resolution
Temperature meas. Probe type Type K (NiCr-Ni)	-40 to +1200 °C	±0.5 °C (0 to +99 °C) ±0.5 % of mv (remaining range)	0.1 °C
Draught measurement	-40 to +40 hPa	±0.03 hPa (-2.99 to +2.99 hPa) ±1.5 % of mv (remaining range)	0.01 hPa
Differential pressure measurement	-200 to 200 hPa	±0.5 hPa (-49.9 to 49.9 hPa) ±1.5 % of mv (remaining range)	0.1 hPa
Absolute pressure measurement	600 to +1150 hPa	±10 hPa	1 hPa
Derived parameters			
Efficiency	0 to 120 %		0.1 %
Flue gas loss	0 to 99.9 %		0.1 %
Flue gas dewpoint	0 to 99.9 °C		0.1 °C
CO ₂ measurement (calculation from O ₂)	0 to CO ₂ max.	±0.2 Vol. %	0.1 Vol. %
Response time t ₉₀ = < 40 s			

General technical data

Memory	Maximum Per folder Per site Max. number of protocols is determined by the number of folders or sites	100 folders max. 10 sites max. 200 protocols
Controlled diaphragm pump:	Pump flow Hose length Max positive pressure/Flue gas Max negative pressure/Flue gas	0.6l/min (controlled) max. 7.8 m (corresponds to two probe hose extensions) +50 mbar -200 mbar
User-defineable fuels	10 user-defineable fuels incl. test gas as fuel	
Weight	600 g	
Dimensions	270 x 90 x 65 mm	
Storage temp.	-20 to +50 °C	
Oper. temp.	-5 to +50 °C	
Display	Graphics display: 160 x 240 pixels	
Power supply	Rech. block: 3.7V/2.2Ah Power: 6.3 V/1.2A	
Material/Housing	TPE PC	
Protection class	IP40	
Warranty	Analyzer 2 years (excluding wearing parts, e.g. gas sensors) Rech. batt. 1 year Gas sensors CO, CO _{low} , NO, NO _{low} , NO ₂ , SO ₂ 1 year O ₂ gas sensors: 1.5 years	

*Max. measurement duration of 2 hours should not be exceeded in order to avoid absorption.

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