testo 327
Flue gas analyser, country-specific version GB

Instruction manual   en

Contents

Safety and the environment

About this document

> Please read this documentation through carefully and familiarise yourself with the product before putting it to use. Keep this documentation to hand so that you can refer to it when necessary. Hand this documentation on to any subsequent users of the product.

> Pay particular attention to information emphasised by the following symbols:

⚠ · With the signal word Warning!:
Warns against hazards which could result in serious physical injury if the precautionary measures indicated are not taken.

⚠ · With the signal word Caution!:
Warns against hazards which could result in minor physical injury or damage to equipment if the precautionary measures indicated are not taken.

🛈 · Additional information.

Avoiding personal injury/damage to equipment

> Do not make measurements with the measuring instrument and its sensors on or near live components unless the instrument is expressly approved for current/voltage measurements!

> Never store the measuring instrument together with solvents and do not use any desiccants.

> Only operate the measuring instrument properly, for its intended purpose and within the parameters specified in the technical data. Do not use force.

> Only carry out the maintenance and repair work that is described in the documentation. Follow the prescribed steps exactly. Only use original spare parts from Testo.
Any additional work must only be carried out by authorised personnel. Testo will otherwise refuse to accept responsibility for the proper functioning of the measuring instrument after repair and for the validity of certifications.

> Temperatures given on probes/sensors relate only to the measuring range of the sensors. Do not expose handles and feed lines to any temperatures in excess of 70 °C unless they are expressly permitted for higher temperatures.

⚠ Products with Bluetooth◇ (Option)

Changes or modifications, which are not expressly approved by the responsible official body, can lead to a withdrawal of operating permission.

Interference with data transfer can be caused by instruments which transmit on the same ISM band, e.g. microwave ovens, DECT telephony, non-secure software in cellphones when telephoning, transmitting/receiving text messages etc.

The use of radio connections is not allowed in e.g. aeroplanes and hospitals. For this reason, the following point must be checked before entering:

▸ ▸ Deactivate Bluetooth function

  Main menue - Settings - Buetooth - deactivate Bluetooth (Off)

Protecting the environment

❯ Take faulty rechargeable batteries/spent batteries to the collection points provided for them.

❯ Send the product back to Testo at the end of its useful life. We will ensure that it is disposed of in an environmentally friendly manner.

Specifications

Functions and use

The testo 327 is a hand-held measuring instrument for the professional flue gas analysis of domestic and light commercial gas and oil boilers and appliances. This includes condensing boilers and gas heaters. The unit is designed to carry out tests shown in BS 7967, and has a timed tightness test, let by test and a timed CO function.

These systems can be adjusted using the testo 327 and checked for compliance with the applicable limit values.

The testo 327 is available in four versions; the scope of function varies according to the version:

· **testo 327 0₂:** Infrared interface
· **testo 327 C0:** Infrared interface
· **testo 327-1 (02, C0):** Infrared interface
· **testo 327-2 (02, C0):** Infrared / IRDA interface, memory, automatic sensor diagnosis, option: Bluetooth (data interface)

Warning The testo 327 must not be used in areas at risk of explosion, for long-term measurements or as a safety (alarm) device!

! The testo 327 with the Bluetooth option may only be operated in countries in which it is type approved (see Technical Data).

Technical data

Display variables [units]	Measuring range/resolution	Accuracy/response time [1]
Oxygen, via internal electro-chemical sensor (not 327 CO):		
O_2 content [%], O_2air supply [%], Reference value O_2 ref [%]	0...21% / 0.1%	±0.2% / t90 <40s
Carbon monoxide, 327-1:		
CO content [ppm, mg/m³] (H_2 share <10%)	0...4,000ppm / 1ppm	±20ppm (0...400ppm), ±5% of reading (401...1,000ppm), ±10% of reading (1,001...4,000ppm) / t90 <60s
Carbon monoxide, via internal electro-chemical sensor (only 327-2 with option COH2):		
CO content [ppm, mg/m³]	0...8,000ppm / 1ppm	±20ppm (0...200ppm), ±5% v. Mw. (201...2,000ppm), ±10% of reading (2001...8,000ppm) / t90 <40s
Ambient Carbon monoxide, via internal electro-chemical sensor:		
Ambient CO content **amCO** [ppm]	0...2,000ppm / 1ppm	±10ppm (0...100ppm), ±10% of reading (>100ppm) / t90 <40s
Temperature, via type K thermocouple of flue gas probe (NiCr-Ni):		
Flue gas temperature **FT**, Flue gas dew point **ATP**, Ambient air **AT**	-40...+600°C / 0.1°C, -40...1,112°F / 0.1°F	±0.5°C (-40...100°C), ±0.5% of reading (>100°C), ±0.9°F (-40...212°F), ±0.5% of reading (>212°F) / t98 <50s (TE 0.5mm); <100s (TE 1mm)
Temperature, via differential temperature set 0554 1208:		
Flue gas socket T1 [°C, °F], Sensor socket T2 [°C, °F]	-40...+600°C / 0.1°C, -40...1,112°F / 0.1°F	±0.5°C (-40...100°C), ±0.5% of reading (>100°C), ±0.9°F (-40...212°F), ±0.5% of reading (>212°F) / t98 <50s (TE 0.5mm); <100s (TE 1mm)
Pressure, via internal differential pressure sensor:		
Flue draught **Drght** [mbar, hPa, inW, in Hg]	-40...40hPa / 0.01hPa	±0.02hPa (-0.50...0.60hPa), ±0.03hPa (0.61...3hPa), ±1.5% of reading (>3hPa) / -
Flue draught **Drght**, with option of precision draught [Pa]	-100...100Pa / 0.1Pa	±3Pa / -
Pressure and tightness test via internal differential pressure sensor, with differential pressure set 0554 1203:		
Differential pressure **Δp** [hPa]	-200...200hPa / 0.1hPa (with option precision difference pressure: 0.01hPa)	±0.5hPa (0.0...50.0hPa) ±1% of reading (50.1...100.0hPa) ±1.5% of reading (100.1...200.0hPa)
Efficiency, calculated:		
Efficiency η [2] [%], Efficiency η+ [3] [%]	0...120% / 0.1%	±0.2% / -

Display variables [units]	Measuring range/resolution	Accuracy/response time [1]
Flue gas loss, calculated		
Flue gas loss qA[2] [%],	0...99.9% / 0.1%	- / -
Flue gas loss $qA+$[3] [%],	-20.0...99.9 / 0.1%	- / -
Air ratio (not 327 CO)		
Air ratio λ [-]	1...20 / 0.01	- / -
Carbon dioxide		
CO_2 content [%]	0...CO_{2max} / 0.01%	- / -

1) Recommended minimum duration of measurement to guarantee correct readings: 3min, 2) Calorific value range not taken into account,
3) Calorific value range taken into account

Calculation formulae for calculated display variables
· See Appendix

Fuels
· Quantity: 5
· Designation/fuel parameters: See Appendix

Ambient conditions
· Operating temperature: -5...45°C/23...113°F
· Storage temperature for measuring instrument:
  -20...50°C/-4...122°F,
  Li-ion rechargeable battery: 0...35°C/32...95°F

Housing
· Material: ABS/PA/TPU
· Dimensions: 240 x 90 x 58mm
· Weight: Approx. 620g
· Protection class: IP40

Voltage supply
· Current source: Li-ion rechargeable battery
  3.7 V/1.4 Ah (0515 0114) / 3.7 V/2.4 Ah (0515 0100),
  mains unit 6.3V/1.2A
· Battery life (measuring gas pump on, display light off):
  Approx. 4 h (0515 0114) / approx. 10h (0515 0100)
· Battery charge time: Approx. 5-6 h

Display
· Type: Illuminated LCD
· Updating of readings: 1/s

Directives, standards and tests
· EC Directive: 2004/108/EEC
· Tests: EN 50379, Part 2 (O2, °C, hPa),
  Part 3 (CO), testo 327-2 with option
  COH2 additionally: EN 50379, Part 2
  (CO)
  CO accuracy: independantly tested to
  BS7967

Warranty
· Measuring instrument, flue gas probe: 24 months
· Measuring cells: 24 months
· Thermocouple: 12 months
· Rech. batt.: 12 months

Option Bluetooth (testo 327-2 only)
· Type-designation: BlueNiceCom IV
· Bluetooth Qualified Product Notice:
  BNC4_HW2x_SW2xx
· Bluetooth listing identifier: B013784
· Bluetooth listing company: 10274
  Range <10m

Bluetooth®

Option Bluetooth® Certification
EU countries
Belgium (BE), Bulgaria (BG), Denmark (DK),
Germany (DE), Estonia (EE), Finland (FI), France (FR),
Greece (GR), Ireland (IE), Italy (IT), Latvia (LV),
Lithuania (LT), Luxembourg (LU), Malta (MT),
Netherlands (NL), Austria (AT), Poland (PL),
Portugal (PT), Romania (RO), Sweden (SE),
Slovakia (SK), Slovenia (SI), Spain (ES), Czech
Republic (CZ), Hungary (HU), United Kingdom (GB) and
Republic of Cyprus (CY).

Other EFTA Countries
Iceland, Liechtentein, Norway and Switzerland

Non-european countries
Japan, Columbia, Turkey

EC declaration of conformity

EG-Konformitätserklärung / EC declaration of conformity

Für die nachfolgend bezeichneten Produkte: / We confirm that the following products:

Testo 327-2
(bluetooth)

Best. Nr.: / Order No.: 0632 3202

wird bestätigt, daß sie den wesentlichen Schutzanforderungen entsprechen, die in der Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die **elektromagnetische Verträglichkeit** (2004/108/EG) festgelegt sind.

corresponds with the main protection requirements which are fixed in the EEC "Council Directive 2004/108/EC on the approximation of the laws of the member states relating to electromagnetic compatibility"
The declaration applies to all samples of the above mentioned product.

Zur Beurteilung der Erzeugnisse hinsichtlich elektromagnetischer Verträglichkeitim Kleingewerbebereich wurden folgende Normen herangezogen:

For assessment of the product following standards have been called upon:

Störaussendung / *Pertubing radiation*: DIN EN 50270:2000-01 Typ 1
Störfestigkeit: / *Pertubing resistance*: DIN EN 50270:2000-01 Typ 1

R&TTE Richtlinie:
EN 300 328 V1.7.1 (2006-10)
EN 301 489-1 V1.6.1 (2005-09)
EN 301 489-17 V1.6.1 (2002-08)

Sicherheits-Richtlinie:
EN 60950-1 (2006-11)

Diese Erklärung wird für: / *This declaration is given in responsibility for:*

Testo AG
Postfach / *P.O. Box* 1140
79849 Lenzkirch / Germany
www.testo.com

abgegeben durch / *by*:

Herr Walleser / *Mr. Walleser*
(Name) / *(name)*

Vorstand / *Managing Director*
(Stellung im Betrieb des Herstellers) / *(Position in the company of the manufacturer)*

Lenzkirch, 10.12.2008
(Ort, Datum / *place, date*)

Der Hersteller betreibt ein zertifiziertes Qualitätssicherungssystem nach DIN ISO 9001

The manufacturer operates a certified quality assurance system according to DIN ISO 9001

(Rechtsgültige Unterschrift / *Legally valid signature*)

Product description

At a glance: Measuring instrument

① Head: IR interface (327-2: IRDA) for connection to Testo protocol printers, ON/OFF switch ((⏻)), condensate outlet.

> ⚠ **Caution!** Risk of injury from infrared beam!
>
> ❯ Do not point infrared beam at people's eyes!

② Display.

Display symbols

🔋 : Battery capacity(🔋: full, 🪫: empty)
🖨 : Print function: sends data

③ Control keys

Key functions

◯ : Function keys (3x): shows relevant function on the display.

🔼
🔽 : Up/down keys: changes display view.
🔆 : Light key: switches display light on/off.
📑 : Menu key.
esc : Cancel key.

④ Sensor socket for TC temperature probe, flue gas socket for flue gas probe, gas outlet, mains socket

⑤ Sides: window of condensate trap with fill level display

⑥ Rear: service compartment (battery, measuring cells)

⑦ Rear: magnets for fixing measuring instrument to metallic surfaces.

> ⚠ **Warning!** Strong magnets can cause damage!
>
> ❯ Keep well away from products which could be damaged through the effects of magnetism (e.g. pacemakers, monitors, computers, credit cards).

⑧ Rear: eyelet for attaching a carrying strap (accessory).

At a glance: Flue gas probe
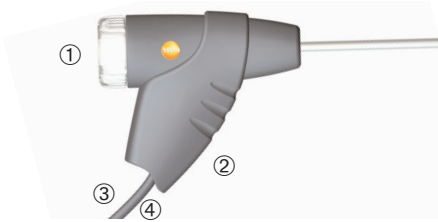
① Removable filter chamber with window
   and particle filter

② Probe handle

③ Connecting cable

④ Connector for measuring instrument

First steps

Charging rechargeable battery

Charge the rechargeable battery fully before using the measuring instrument.

The rechargeable battery can only be charged at an ambient temperature of 0...+35 °C. If the rechargeable battery pack has discharged completely, the charging time at room temperature is approx. 5-6 hrs.

➤ Charging the rechargeable battery in the measuring instrument:

✓ The measuring instrument must be switched off.

1 Connect the plug of the mains unit to the mains unit socket on the measuring instrument.

2 Connect the mains plug of the mains unit to a mains socket.

- The charging process will start. The charge status will be shown on the display. The charging process will stop automatically when the rechargeable battery is fully charged.

➤ Charging the rechargeable battery in charger 0554 1087 (accessory):

Refer to the documentation that comes with the charger.

Operation with the mains unit

If the mains unit is connected, the measuring instrument is automatically powered from the mains unit. It is not possible to charge the rechargeable battery in the measuring instrument during operation.

1 Connect the plug of the mains unit to the mains unit socket on the measuring instrument.

2 Connect the mains plug of the mains unit to a mains socket.
- The measuring instrument is powered via the mains unit.
- If the instrument is switched off and a rechargeable battery is inserted, the charging process will start automatically. Switching the measuring instrument on has the effect of stopping rechargeable battery charging and the measuring instrument is then powered via the mains unit.

Switching on/off

➣ Switching the instrument on:

› Press ⏻.
- Initialisation phase:
  · All display segments are lit (length of time: 3 s).
  · Serial number, firmware version, instrument designation, date, time and country-specific version of instrument are displayed (length of time: 5 s).
- The **Measure** flue gas option is displayed.

➣ Switching the instrument off:

› Press ⏻.
- sometimes: The pump starts and the measuring cells are rinsed until the switch-off thresholds (O_2 >20 %, other parameters 50 ppm) are reached. Rinsing lasts no more than 2 minutes.

Performing instrument settings

➣ Performing settings:

1 Press 📖.

2 Select **Settings** using ▲/▼ and confirm entry with the **OK** function key.

3 Select the required function using ⏶/⏷ and confirm entry with the **OK** function key.

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Functions

1. **Displ. seq**: selects parameters and units of measurement and assigns a position number for the display/protocol printouts.
2. **Date/Time**: sets the date and time
3. **Language**: sets the language.
4. **Printer**: sets the printer to be used.
- The selected function is opened and the position number (**Displ. seq** function only) or parameter which can be set flashes.
5. **Bluetooth** (327-2 with option Bluetooth only): activate/deactivate interface.

4 Set the position number (**Displ. seq** function only)/parameter:

> For **Displ. seq** function only: Select the position number to be changed using ⏶/⏷ and confirm with the **Change** function key.
Alternatively: Delete the position number with **Del.** and insert a new position number using **Ins.**.

ℹ️ **Displ. seq** function: Only parameters and units of measurement which are assigned to a position number appear in the display and on printouts. A maximum of 20 position numbers can be activated.

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Key functions

- ⏶⏷ : Change parameters.
- ◀▶ For **Date/Time** function: changes between hours, minutes, day, month and year.
- ◀▶ For **Displ. seq** function: changes between parameter and unit of measurement (only available if there are several units of measurement for the selected parameter).
- **OK** for **Displ. seq** function and a flashing position number: confirms setting and moves to next display position.
- **OK** for **Displ. seq** and **Finish** flashing: confirms settings and leaves the function.
- **OK** for **Date/Time**, **Language**, and **Printer**: functions: confirms setting and leaves the function.
- **esc**: leaves the parameter or function without applying the changes.

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Example: "Change display position"

✓ The position number to be changed has been selected.

1 Press ⏶/⏷ several times until the required parameter flashes.
2 Press the ◀ or ▶ function key to go to the menu for selecting the unit of measurement.
3 Press ⏶/⏷ several times until the required unit of measurement flashes.
4 Press the **OK** function key to confirm the setting and move to the next display position.
5 At the end of performing the settings: Press ⏶/⏷ several times until **Finish** flashes (appears after the last position number) and confirm entry with **OK**.

Using the product

Preparing for measurement

Connecting probes/sensors

The instrument needs to detect which probes or sensors are connected, before switch on. If you fail to do this simply turn off instrument connect probe and re-start unit.

➢ **Connecting the probes:**

> ❯ Insert the connector into the flue gas socket and lock by turning it clockwise gently (bayonet lock).
>
> 🅸There must be no more than one extension lead (0554 1201) between the measuring instrument and the flue gas probe.

➢ **Connecting the sensor:**

If no ambient air temperature sensor is connected, the temperature measured by the thermocouple of the flue gas probe during the zeroing phase is used as the ambient air temperature. All dependent parameters are calculated using this value. This method of measuring ambient air temperature is sufficient for systems dependent on ambient air. However, ensure that the flue gas probe is near the intake duct of the burner during the zeroing phase.

If an ambient air temperature sensor is connected, the ambient air temperature is measured continuously by this sensor.

> ❯ Insert the connector of the sensor into the sensor socket.

Using the flue gas probe

➢ **Checking the thermocouple:**

The thermocouple of the flue gas probe must not lie against the probe cage.

> ❯ Check before use. Bend the thermocouple back if necessary.

➤ **Aligning the flue gas probe:**

The flue gas must be able to flow freely past the thermocouple.

❯ Align the probe by turning it as required.

The tip of the probe must be in the centre of the flue gas flow.
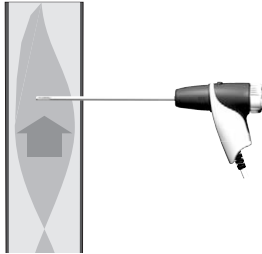
❯ Align the flue gas probe in the flue gas duct so that the tip is in the centre of the flow (area of the highest flue gas temperature).

Activating the required functions

➤ **Switching the instrument on:**

❯ Press ⏻.

➤ **Activating fuel:**

1 Press ▤.

2 Select **Fuel** using ⬆/⬇ and confirm entry with the **OK** function key.

3 Select the fuel to be measured using ⬆/⬇ and confirm entry with the **OK** function key.

➣ Activating measuring function:

1 Press 🖲.

2 Select **Measure** using ⬤/⬤ and confirm entry with the **OK** function key.

3 Select the required measuring function using ⬤/⬤ and confirm entry with the **OK** function key.

Functions

1. **Flue gas**: flue gas measurement with flue gas probe and central measurement menu for displaying/printing out all readings obtained from the various measuring functions.

2. **Let by**: timed measurement of differential pressure with differential pressure set (accessory).

3. **tightness**: timed measurement of differential pressure with differential pressure set (accessory).

4. **Draught**: flue draught measurement with flue gas probe and differential pressure measurement with gas pressure set (accessory).

5. **Smoke/Oild**: enter smoke number/oil derivative (only available if a liquid fuel has been activated).

6. **HCT**: enter the heat carrier temperature.

7. **Diff-press**: measurement of differential pressure with differential pressure set (accessory).

8. **Diff-temp**: measurement of differential temperature with differential temperature set (accessory).

9. **Ambient CO**: timed measurement of ambient CO with flue gas probe.

ℹ **Flue gas** function: When the measuring cells are first called up after the measuring instrument is switched on, they are zeroed (length of time: 30 s). Exception: the **Ambient CO** function has already been started.
During the zeroing phase, the fuel can be selected. Any connected probe must be in the open air during the zeroing phase!

Performing the measurement

➣ Measuring:

✓ The steps described in the chapter Preparing for measurement have been completed.

ℹ **Let by** and **tightness** function: The Diff Press Kit (0554 1203) must be connected.

⚠ **Warning!** Risk of explosion due to dangerous mixture of gases!

❯ Make sure there are no leaks between the sampling point and the measuring instrument.

❯ Do not smoke or use naked flames during measurement.

ℹ **Draught** function: The pressure sensors are zeroed when the **Draught** function is started (length of time: 5 s). The measuring instrument must not be pressurised during zeroing!
To help position the flue gas probe in the centre of the flow (area of the

highest flue gas temperature), the flue gas temperature measured is
shown graphically.
Do not measure for longer than 5 minutes, as the readings may fall
outside of the tolerances due to a possible drift of the pressure sensor.

🛈 **Smoke/Oild** function: Only available if a liquid fuel has been activated.

🛈 **Diff-temp.** function: The differential temperature set (0554 1208)
must be connected. The ambient air sensor must be unplugged (located
bottom left of unit) before connecting the T1 sensor. Be aware that the
connector is a firm fit, when disconnecting.
The differential temperature is calculated from T1 - T2.

🛈 **Diff-press** function: The gas pressure set (0554 1203) must be connected.
The pressure sensors are zeroed when the **Diff.-press** function is started
(length of time: 5 s). The measuring instrument must not be pressurised
during zeroing!
Do not measure for longer than 5 min, as a drift of the pressure sensor
may result in readings outside the tolerance limits.

🛈 **Ambient CO**: When the measuring cells are first started after the measuring
instrument is switched on, they are zeroed (length of time: 30 s).
Exception: The **Flue gas** function has already been called up.
Any connected probe must be in the open air during the zeroing phase!

🛈 The measurement values from the functions **Draught, Diff.-temp.**, **Diff.-press**
and **Smoke/Oild** are transferred to the the central measurement menu **Flue
gas** and must therefore be carried out before the flue gas measurement.

Flue gas function:

1 Start the measurement with the **Start** function key.
   - The current readings are displayed.

Ensure flue is at normal operating temperature and the readings are steady,
before accepting flue gas measurements.

2 Stop the measurement with the **Stop** function key.

Let by and **tightness** function:
   - The time value is blinking.

1 Set measuring time (from 1 to 15 minutes) using ⊙/⊙ and confirm with
   the **Start** function key.
   - The message **Zeroing without operating pressure** is displayed.
   - After zeroing, the message **Attach to the system and start** is displayed.

2 Start the measurement with the **Start** function key only when the required gas pressure of 10mbar (**Let by**) or 20mbar (**tightness**) is displayed.
- **p1** displays the start pressure in mbar, **p2** displays the actual value in mbar.

3 After measuring time, the pressure difference is displayed (**p2** - **p1** on let by test, **p2** - **p1** on tightness test).
Option:
Stop the measurement with the **Stop** function key.

Draught, **Diff.-temp.**, and **Diff.-press** functions:

1 Start the measurement with the **Start** function key.
- The current readings are displayed.

2 Stop the measurement with the **Stop** function key.

3 Transfer the readings to the central **Flue gas** measurement menu using the **OK** function key.

Smoke/Oild and **HCT** functions:

Recording values with the smoke pump and manual input:

1 Select the value to be changed using ⏶/⏷ and confirm with the **change** function key.

2 Set the value using ⏶/⏷ and confirm entry with the **OK** function key.

3 Once all values have been input, select **Finish** using ⏶/⏷.

4 Transfer the readings to the central **Flue gas** measurement menu using the **OK** function key.

ⓘ The values entered are not shown in the central Flue gas measurement menu. However, they can be printed out together with the readings from other functions.

Recording values with the smoke tester testo 308 and wireless transfer:

- The testo 308 must be in data transfer mode (**Data** lights up).

1 Press function key **t308** .
- The values recorded by the smoke tester are transferred.

2 Once all values have been input, select **Finish** using ⏶/⏷.

3 Transfer the readings to the central **Flue gas** measurement menu using the **OK** function key.

ⓘ The values entered are not shown in the central Flue gas measurement menu. However, they can be printed out together with the readings from other functions.

Ambient CO function:

- The time value is blinking.

1 Set measuring time (from 1 to 30 minutes) using ⏶/⏷.

2 Start the measurement with the Start function key.

- The following values are displayed:
  AmbCO: current ambient CO value in ppm.
  aver.:average ambient CO value in ppm. Every minute the average value is calculated. If the measured value is lower than the min value, the min value will be set to the current value. If the measured value is higher than the max value, the max value will be set to the current value.
  min: minimum ambient CO value in ppm.
  max: maximum ambient CO value in ppm.
- Alarmlevels:
  Current value > 10 ppm: The value blinks (1 sec on / 1 sec off).
  Current value > 30 ppm: The value blinks (0.5 sec on / 0.5 sec off).
- After measuring time the average ambient CO value is displayed.
  Option:
  Stop the measurement with the **Stop** function key.

➣ Printing readings:

ℹ To print out the readings recorded in the instrument, you need Testo protocol printer 0554 0545 or 0554 0547. You must also follow the operating instructions for the printer!

ℹ The **Print** function key is only available if a printout is possible in the instrument's current status.

❯ Start the printout with the **Print** function key.

- Printing out from **Flue gas** function: All readings taken since the instrument was last switched on and transferred to the central **Flue gas** measurement menu are printed out.
  Printing out from other functions: Only those readings taken using the respective measuring function are printed.

➣ Saving readings (327-2 only):

ℹ The **Save** function key is only available if saving is possible in the instrument's current status.

❯ Start saving with the **Save** function key.

➤ Printing/deleting/displaying measurement data (327-2 only):

There are 20 memory locations (**Position 1** to **Position 20**) to which one measurement data record can be saved per location. Memory locations that have already been assigned are indicated by the display of the date/time of saving.

1 Press ⬛.

2 Select **Memory** using ⬥/⬦.

- The memory capacity and available memory locations are displayed.

❭ To print the memory: press the **Print** function key.

❭ To delete the whole memory: press the **Del** function key and confirm entry with the **Yes** function key.

3 Press **OK**.

4 Select memory location using ⬥/⬦.

❭ To display the measurement data record: press the **Value** function key.

❭ To print the measurement data record: press the **Print** function key.

❭ To delete the measurement data record: press the **Del** function.

➤ Transfer data to a Pocket PC (327-2 only):

Data can be transferred to a Pocket PC via infrared or Bluetooth.
You must also refer to the documentation that comes with the software.

Checking the instrument

➤ Performing an instrument diagnosis:

1 Press ⬛.

2 Select **Diagnosis** using ⬥/⬦ and confirm entry with the **OK** function key.

3 Select the required function using ⬥/⬦ and confirm entry with the **OK** function key.

Functions

1. **Info**: displays instrument information: serial number, instrument temperature, operating hours, qA version, last service

2. **Error**: displays list of errors.

3. **Rech. batt**: displays the battery capacity.

4. **Sens. Diag** (327-2 only): performs sensor diagnosis.

Key functions for Sens. Diag function (327-2 only)

· ⬥⬦ : select sensor.

· **Read**: performs sensor diagnosis and displays results of diagnosis.

Maintaining the product

Condensate trap

The fill level of the condensate trap can be read from the markings on the condensate trap.

➤ Emptying the condensate trap

Flue Gas condensate consists of a weak mix of acids. Avoid contact with the skin. Make sure that the condensate does not run over the housing.

⚠ Caution! Failure to empty the condensate trap when the fill level is reached results in condensate entering the sensors and pump. This voids the warranty and results in costly repairs and replacements.

> **❯ Do not empty the condensate trap while the flue gas pump is in operation!**

1 Keep measuring instrument in an upright position (condensate outlet pointing upwards).

2 Open the condensate outlet on the condensate trap: pull out approx. 7 mm to the stop.

3 Let the condensate run out into a sink.

4 Mop up any remaining drops on the condensate outlet using a cloth.

5 Close the condensate outlet.

The condensate outlet must be completely closed, otherwise measuring errors could occur if external air gets in. It is advisable to empty water trap at regular intervals, (preferably daily).
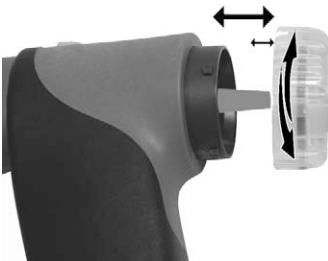
Particle filter

➢ **Checking the particle filter:**

> › Check the particle filter of the flue gas probe for contamination at regular intervals: check visually by looking through the window of the filter chamber. Replace the filter if there are signs of contamination.

➢ **Replacing the particle filter:**

The filter chamber may contain condensate.

1 Open the filter chamber by turning it gently anticlockwise.

2 Remove spent filter and fit new filter (0554 0040).

3 Fit the filter chamber and lock it by turning it gently clockwise.

Housing

➢ **Cleaning the housing:**

> › Clean the housing with a damp cloth (soap suds) if it is dirty. Do not use aggressive cleaning agents or solvents!

Rech. batt.

➢ **Rechargeable battery care:**

> › If possible, always discharge the rechargeable battery fully before recharging it.

> › Do not store the rechargeable battery for long periods when discharged. The best storage conditions are at 50 - 80 % charge level and 10 - 20 °C ambient temperature; charge fully before further use.

➢ Changing the rechargeable battery:

✓ The measuring instrument must not be connected to a mains socket via the mains unit. The measuring instrument must be switched off.

1 Place the measuring instrument on its front.

2 Undo the screws with a cross-head screwdriver and remove service lid.

3 Open the battery lock by pressing the button and pushing in the direction of the arrow.

4 Remove the rechargeable battery and insert new rechargeable battery.

5 Close the battery lock by pressing the button and pushing against the direction of the arrow until the battery engages.

6 Replace service lid and fasten with screws.

Measuring cells

Used measuring cells must be disposed of as special waste!

➢ Changing the measuring cells (327 CO, 327 O2, 327-1):

A slot bridge (0192 1552) must be inserted in slots which do not have a measuring cell. Used measuring cells must be disposed of as special waste!

✓ The measuring instrument must be switched off.

1 Place the measuring instrument on its front, facia.

2 Loosen the screws with a cross-head screwdriver and remove service lid.

3 Pull hose connections from the faulty measuring cell.

4 Remove the faulty measuring cell/bridge from the slot.
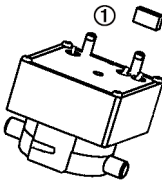
CO measuring cell only: Remove the shorting jumper ①.

Do not remove shorting jumpers of the new measuring cells until immediately before installation. Do not leave the measuring cells without a shorting jumper for longer than 15 minutes.

5 Insert a new measuring cell in the slot.

6 Attach hose connections to the measuring cell.

7 Replace service lid and fasten with screws.

8 Continue with *calibration of O$_2$ measuring cell* and/or *input of cell coefficients for CO measuring cell.*

➤ **Calibrating the O₂ measuring cell (327 O2, 327-1):**

After replacing an O_2 measuring cell, wait for an stabilisation period of 60 minutes to elapse before starting the calibration.

During the calibration, any flue gas probes that are connected must be in the open air.

1 Press 🔟.

2 Select **Sensors** using ⬆/⬇ and confirm entry with the **OK** function key.

3 Select **O₂-Sensor** using ⬆/⬇ and confirm entry with ⬆+⬇ (press simultaneously).

   - Instrument performs calibration (30s) and is then ready for use again.

➤ **Inputting cell coefficients for CO measuring cell (327 CO, 327-1):**

ℹ If you do not enter the correct cell coefficients, you will get incorrect readings! You will find the cell coefficients on the leaflet enclosed with the spare measuring cell. If you enter incorrect coefficients:

   ❯ Abort the process using 🔘 and enter cell coefficients again.

1 Press 🔟.

2 Select **Sensors** using ⬆/⬇ and confirm entry with the **OK** function key.

3 Select **CO Sensor** using ⬆/⬇ and confirm entry with ⬆+⬇ (press simultaneously).

   - The first number of the first cell coefficient flashes.

4 Press **Change** function key and set number using ⬆/⬇.

5 Change to further digits by pressing the ◀ ▶ function keys one after the other and confirm entry with **OK** function key.

   - Instrument automatically changes to the second cell coefficient

6 Repeat steps 4 and 5. Confirm the input with the **OK** function key.

7 Complete the entry with the **OK** function key.

➤ **Replacing measuring cells, testo 327-2:**

   ✓ The measuring instrument must be switched off.

1 Place the measuring instrument on its front facia.

2 Loosen the screws with a cross-head screwdriver and remove service lid.

3 Pull hose connections from the faulty measuring cell.

4 Remove the faulty measuring cell from the slot.
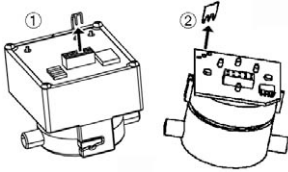
CO measuring cell only: Remove shorting jumper (① 0390 0095, ② 0390 0109).

Do not remove shorting jumpers of the new measuring cells until immediately before installation. Do not leave the measuring cells without a shorting jumper for longer than 15 minutes.

5 Insert a new measuring cell/bridge in the slot.

6 Attach hose connections to the measuring cell/bridge.

7 Replace service lid and fasten with screws.

After replacing an O2 measuring cell, wait for an stabilisation period of 60 minutes to elapse before starting a new measurement.

Thermocouple

➤ **Replacing the thermocouple of the flue gas probe**
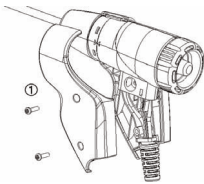
1 Loosen and remove halfshell handles (①).
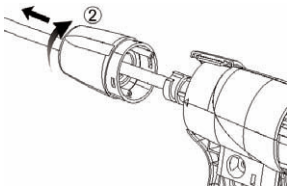
2 Turn sealing cap clockwise as far as it will go and remove (②).
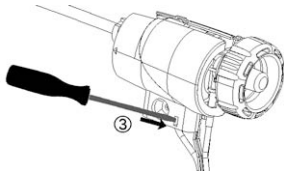
3 Unlock halfshell elements and remove (③).
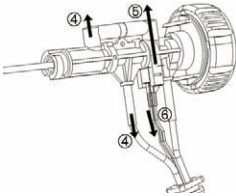
4 Remove adaptor and hose (④), Push thermocouple out of its holder (⑤) and disconnect cable from thermocouple (⑥).
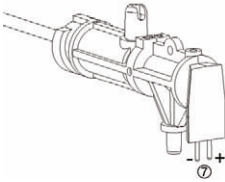
5 Connect lines to the new thermocouple (⑦, white -, green **+**) and push thermocouple into holder again.
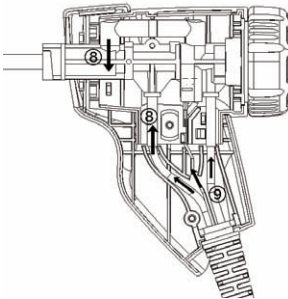
6 Connect adaptor and hose to thermocouple (⑧). Adjust lines and hoses (⑨) and attach halfshells.

7 Attach sealing cap and turn anticlockwise (as far as possible, note markings).

8 Attach halfshell handles and close screws.

Tips and assistance

Questions and answers

Measuring instrument switches itself off or will not switch on?

· Rechargeable battery is low: charge battery or connect mains unit.

· On 327-2 models condensate trap is full, red lights indicate.

Battery capacity seems to be faulty?

· Rechargeable battery was repeatedly not fully discharged/charged: discharge rechargeable battery (until measuring instrument switches itself off) and then charge fully.

---- appears instead of a reading?

· Sensor/probe is not plugged in: connect the sensor/probe

· Sensor/probe or measuring cell faulty: check sensor/probe or measuring cell.

Message: Pump flow rate too high?

· Gas outlet is blocked: make sure that the gas outlet is clear.

Message: ERROR + two-digit no. and service?

Device error: switch off the instrument and contact your dealer or Testo Customer Service.

If the above information does not solve the problem, please contact your dealer or Testo Customer Service. For contact data, see back of this document or web page www.testo.com/service-contact

Accessories and spare parts

Designation	Article no.
Probes/sensors	
Compact flue gas probe, 180 mm, Ø 6 mm, TC 1 mm, incl. cone, up to 500 °C / 932 °F	0600 9740
Compact flue gas probe, 300 mm, Ø 6 mm, TC 1 mm, incl. cone, up to 500 °C / 932 °F	0600 9741
Thermocouple for compact flue gas probe, 180 mm,	0430 0383
Thermocouple for compact flue gas probe, 300 mm,	0430 0382
O_2 annular gap probe	0632 1260
Ambient air temperature (AT) probe, 300 mm	0600 9791
Ambient air temperature (AT) probe, 190 mm	0600 9787
Ambient air temperature (AT) probe, 60 mm	0600 9797
Pipe wrap probes	0600 4593
Surface probes	0600 0194
Differential temp kit (adaptor, 2 x pipe wrap probes)	0554 1208
Differential pressure set	054 1203
Pipe wrap probe	0600 0020
Thermocouple adaptor	0440 1261
B1 gas cooker grill probe (BS7967)	300002 7967
B2 angled probe for open flue applications (BS7967)	300001 7967
Spare measuring cells	
O_2 measuring cell for testo 327-1	0390 0047
CO measuring cell for testo 327-1	0390 0046
O_2 measuring cell for testo 327-2	0390 0092
CO measuring cell for testo 327-2	0390 0095
CO/H2 measuring cell for testo 327-2	0390 0109
Miscellaneous	
Rechargeable battery for testo 327-02, 327-CO, 327-1	0515 0114
Rechargeable battery for testo 327-2	0515 0100
Protocol printer, IrDA	0554 0547
Spare thermal paper for protocol printer, long-term legibility for up to 10 years	0554 0568
Charger with spare rechargeable battery	0554 1087
Smoke tester for measuring soot in flue gas	0554 0307
Spare particle filter, 10 pcs.	0554 0040

For a complete list of all accessories and spare parts, please refer to the product catalogues and brochures or look up our website at: www.testo.co.uk

Appendix

Fuel parameters

Fuel	CO_2 MAX (%)	O_2ref [%]	Kgr [1/K]	Knet [1/K]	K1 [−]	H [% by weight]	MH_2O [% by weight]	Qgr [MJ/kg]	Qnet [MJ/kg]
Natural Gas	11.9	3	0.35	0.39	40	24.4	0.0	53.42	48.16
Light Oil	15.5	3	0.48	0.51	53	13.0	0.0	45.60	42.80
Heavy Oil	15.8	3	0.51	0.54	54	11.5	0.2	42.90	40.50
Propane	13.8	3	0.42	0.45	48	18.2	0.0	50.00	46.30
Butane	14.1	3	0.43	0.46	48	17.2	0.0	49.30	45.80
Kerosene	15.4	3	0.47	0.51	52.36	13.6	0.0	46.56	43.12

Calculation formulae

Carbon dioxide:
$$CO_2 = \frac{CO_{2max} \times (21\% - O_2)}{21\%}$$

CO_2max: Fuel-specific carbon dioxide value
21%: Oxygen content of the air
O_2: Measured oxygen content as %

Carbon monoxide:
$$CO \text{ [mg/m}^3] = \frac{21\% - O_2 \text{ ref}}{21\% - O_2} \times CO \text{ [ppm]} \times 1.25$$

21%: Oxygen content of the air
O_2: Measured oxygen content as %
O_2 ref: Fuel-specific oxygen reference number as %

Ratio:
$$\text{ratio} = \frac{CO}{CO_2 \times 10000}$$

CO: carbon monoxide
CO_2: carbon dioxide

Efficiency referred to Gross Efficiency:

$$Effg = 100 - \left(\left(\frac{K_{gr} \times (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \times H) \times (2488 + 2.1 \times FT - 4.2 \times AT)}{Q_{gr} \times 1000} \right) + \left(\frac{K1 \times CO}{CO_2 + CO} \right) \right)$$

Efficiency referred to Nett Efficiency:

$$Effn = 100 - \left(\left(\frac{K_{net} \times (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \times H) \times (210 + 2.1 \times FT - 4.2 \times AT)}{Q_{net} \times 1000} \right) + \left(\frac{K1 \times Q_{gr} \times CO}{Q_{net} \times (CO_2 + CO)} \right) \right)$$

Kgr/Knet/Qgr/Qnet/K1/MH2O/H: Fuel-specific factors
FT: Flue gas temperature
AT: Ambient temperature
CO: Measured carbon monoxide value in %
CO_2: Calculated carbon dioxide value in %

Excess Air (ExAir):

$$= \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: Oxygen level of air
O_2: Measured oxygen level in %

Air ratio:

$$\lambda = \frac{CO_2 max}{CO_2}$$

CO_2max: Fuel-specific carbon dioxide value
CO_2: Calculated carbon dioxide value

Carbon monoxide undiluted:

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide value
λ: Calculated air ratio

Flue gas dew point temperature:

$$FTP = \frac{\ln \left(\frac{FH20 \times PAbs}{610.78} \right) \times 234.175}{\ln \left(\frac{FH20 \times PAbs}{610.78} \right) - 17.08085}$$

FH20: Flue gas specific water vapour level in Vol.%
PAbs: Absolute pressure in mbar/hPa