



testo 320 basic - Flue gas analyzer

Instruction manual





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The product registration is valid for 30 days after purchase.

For product registration terms and conditions and participating countries, please go to www.testo.com/register

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2 Safety and the environment

2.1. About this document

Use

- > Please read this documentation through carefully and familiarize yourself with the product before putting it to use. Pay particular attention to the safety instructions and warning advice in order to prevent injuries and damage to the products.
- > Keep this document to hand so that you can refer to it when necessary.
- > Hand this documentation on to any subsequent users of the product.

Warnings

Always pay attention to information that is marked by the following warnings with warning pictograms. Implement the specified precautionary measures.

Representation	Explanation
 WARNING	Indicates potential serious injuries
 CAUTION	indicates potential minor injuries
NOTICE	indicates circumstances that may lead to damage to the products

Symbols and writing standards

Representation	Explanation
i	Note: Basic or further information.
1. ... 2. ...	Action: more steps, the sequence must be followed.
> ...	Action: a step or an optional step.
- ...	Result of an action.
[OK]	Control keys of the instrument or buttons of the program interface.

2.2. Ensure safety

- > The testo 320 basic must be checked before commissioning for any visible damage. Do not commission the testo 320 basic if there are signs of damage on the housing, mains unit or supply lines. Electrical risk.
- > Only operate the product properly, for its intended purpose and within the parameters specified in the technical data. Do not use any force.
- > Do not operate the instrument if there are signs of damage at the housing, mains unit or feed lines.
- > Do not perform contact measurements on non-insulated, live parts.
- > The testo 320 basic is not suitable for long-term measurements and should not be used as a safety (alarm) instrument.
- > Do not store the product together with solvents. Do not use any desiccants.
- > Carry out only the maintenance and repair work on this instrument that is described in the documentation. Follow the prescribed steps exactly. Use only original spare parts from Testo.
- > Any further or 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.
- > Only use the device in closed, dry rooms and protect it from rain and moisture.

- > 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.
- > Dangers may also arise from the systems being measured or the measuring environment: Note the safety regulations valid in your area when performing the measurements.

2.3. Protecting the environment

- > Dispose of faulty rechargeable batteries/spent batteries in accordance with the valid legal specifications.
- > At the end of its useful life, send the product to the separate collection for electric and electronic devices (observe local regulations) or return the product to Testo for disposal.

3 Specifications

3.1. Use

The testo 320 basic is a handheld measuring device for the professional flue gas analysis of combustion plants:

- Small combustion plants (burning oil, gas, wood, coal)
- Low-temperature and condensing boilers
- Gas water heaters

These systems can be adjusted using the testo 320 basic and checked for compliance with the applicable limit values.

The following tasks can also be carried out with the testo 320 basic:

- Regulating the O₂, CO and CO₂ values in combustion plants for the purpose of ensuring optimal operation.
- Draught measurement.
- Measuring and regulating the gas flow pressure in gas water heaters.
- Measuring and optimising the flow and return temperatures of heating systems.

3.2. Technical data

3.2.1. Examinations and licenses

As declared in the certificate of conformity, this product complies with Directive 2014/30/EC.

This product is TÜV-tested. The O₂ sensor and the sensors for temperature and pressure are TÜV-tested in accordance with EN 50379 part 2.

The measuring cell 0393 0053 (CO) is TÜV-tested as per EN 50379 part 3.

This product is EMC-tested as per DIN EN 61326-1.

3.2.2. Measurement ranges and resolution

Measurement parameter	Measuring range	Resolution
O ₂	0 to 21 Vol.%	0.1 vol. %
CO	0...4000 ppm	1 ppm
Draught ¹	-9.99 to 40.00 hPa	0.01 hPa
Fine draught ¹	-9.999 hPa to +40.000 hPa	0.001 hPa
ΔP (only with gas pressure set 0554 1203)	0 to 300 hPa	0.1 hPa
Fine pressure ¹¹ oben (only with gas pressure set 0554 1203)	0 to 300 hPa	0.01 hPa
temperature	-40 to 1200°C	0.1°C (-40.0 to 999.9°C) 1°C (from 1000°C)
Efficiency	0 to 120 %	0.1 %
Flue gas loss	0 to 99.9 %	0.1 %

3.2.3. Accuracy and response time

Measurement parameter	Accuracy	Response time (t ₉₀)
O ₂	±0.2 vol. %	< 20 s
CO	±20 ppm (0 to 400 ppm) ±5% of meas. val. (401 to 2000 ppm) ±10% of meas. val. (2001 to 4000 ppm)	< 60 s
Draught ¹	±0.02 ppm or ±5% of meas. val. (-0.50 to 0.60 hPa) ± 0.03 hPa (0.61 to 3.00 hPa) ±1.5% of meas. val. (3.01 to 40.00 hPa)	-

¹ Depending on the country version

Measurement parameter	Accuracy	Response time (t_{90})
Fine draught ¹¹ oben	± 0.02 ppm or $\pm 5\%$ of meas. val. (-0.50 to 0.60 hPa) ± 0.03 hPa (0.61 to 3.00 hPa) $\pm 1.5\%$ of meas. val. (3.01 to 40.00 hPa)	
ΔP (only with gas pressure set 0554 1203)	± 0.5 hPa (0.0 to 50.0 hPa) $\pm 1\%$ of meas. val. (50.1 to 100.0 hPa) $\pm 1.5\%$ of meas. val. (rest of range)	-
Fine pressure ¹ (only with gas pressure set 0554 1203)	± 0.5 hPa (0.0 to 50.0 hPa) $\pm 1\%$ of meas. val. (50.1 to 100.0 hPa) $\pm 1.5\%$ of meas. val. (rest of range)	
Temperature	$\pm 0.5^\circ\text{C}$ (0.0 to 100.0°C) $\pm 0.5\%$ of meas. val. (rest of range)	depending on the probe
Efficiency	-	-
Flue gas loss	-	-

3.2.4. Other instrument data

Feature	Values
Storage and transport temperature	-20 to 50°C
Operating temperature	-5 to 45°C
Ambient humidity	0...90 % rH, not condensing
Power supply	Rech. batt.: 3.7 V / 2.4 Ah Mains unit: 5.0 V/1000 mA
Protection class	IP40
Weight	573 g
Dimensions	240 x 85 x 65 mm
Memory	20 protocols

Feature	Values
Display	Graphic colour display, 240 x 320 pixels
Optimum rech. batt. storage conditions	Charge level: capacity at 50-80% ambient temperature: 10-20°C
Battery charge time	Approx. 5-6 h with mains unit supplied
Rechargeable battery life	Approx. 6 h (pump on, 20°C ambient temperature)
Data transfer	IrDA, USB
Sensor protection switch-off	4000 ppm
Warranty	Measuring instrument: 24 months O2 sensor: 24 months CO sensor: 24 months Flue gas probe: 24 months Thermocouple: 12 months Rech. batt.: 12 months Terms of warranty: see website www.testo.com/warranty

4 Product description

4.1. Measuring instrument

4.1.1. Front view

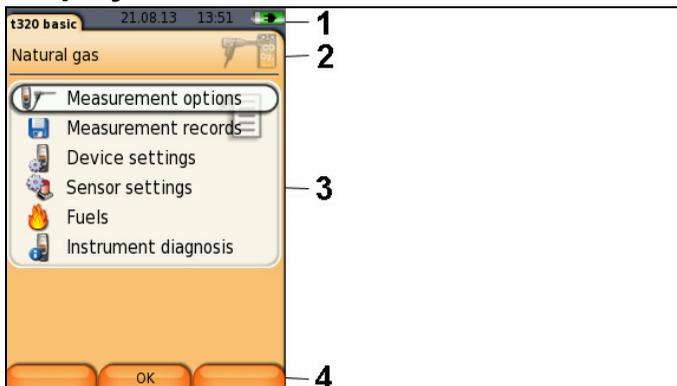


- 1 Display
- 2 Function keys
- 3 Keypad

4.1.2. Keypad

Button	Functions
 [⏻]	Switch measuring instrument on / off
[OK] Example	Function key (orange, 3x), relevant function is shown on the display
[▲]	Scroll up, increase value, navigate
[▼]	Scroll down, reduce value, navigate
[esc]	Back, cancel function
 [☰]	Open main menu
 [🖨️]	Transmit data to the Testo protocol printer.

4.1.3. Display



1 Status bar (dark grey background):

- Warning symbol  (only if there is an instrument error, display of error in instrument diagnosis menu), otherwise: Instrument designation.
- Symbol  (only if data is stored in the temporary memory).
- Display of date and time.
- Indication of Bluetooth® status, power supply and remaining rechargeable battery capacity:

Icon	Feature
	Battery operation Display of remaining rechargeable battery capacity by colour and fill level of the battery icon (green = 5-100%, red = < 5%)
	Mains operation Display of remaining rechargeable battery capacity: see above

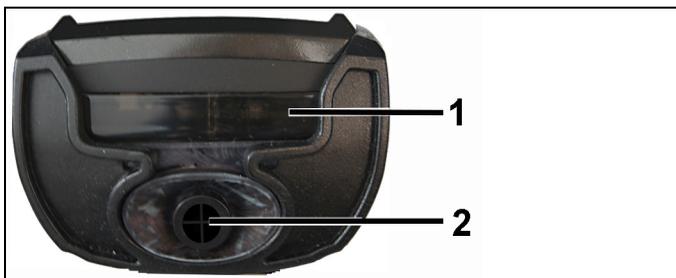
- 2 Info field of register tabs: Indication of chosen fuel and chosen measurement type.
- 3 Selection field for functions (selected function appears against a white background, unavailable functions are identified by grey font) or display of measured values.
- 4 Function display for function keys.

4.1.4. Instrument connections



- 1 Probe socket
- 2 Gas outlet
- 3 Probe socket
- 4 Micro USB socket (battery charging, data transfer)

4.1.5. Condensate outlet and interfaces



- 1 Infrared interface (IrDA)
- 2 Condensate outlet

4.1.6. Rear view



- 1 Attachment for carrying strap
- 2 Condensate trap
- 3 Magnetic holder

WARNING

Magnetic field

May be harmful to those with pacemakers.

- > Keep a minimum distance of 15 cm between pacemaker and instrument.

ATTENTION

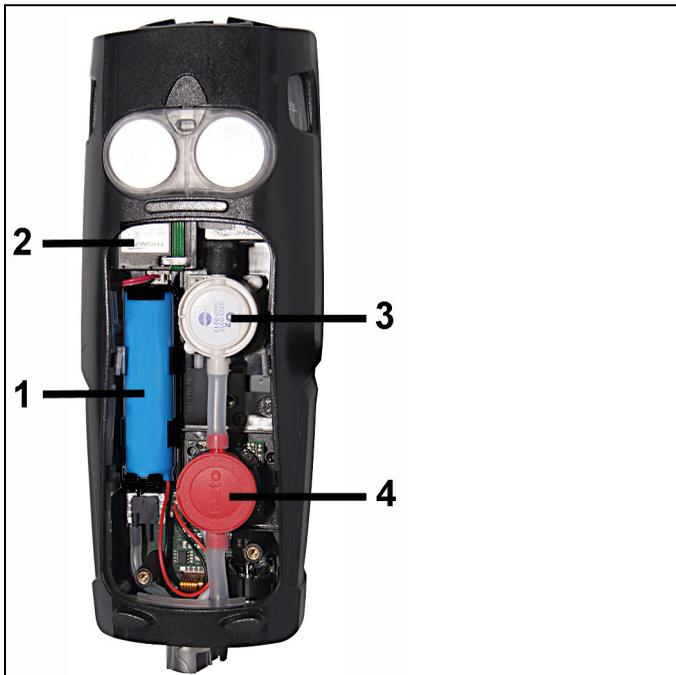
Magnetic field

Damage to other devices!

- > Keep a safe distance away from products which could be damaged by the effects of magnetism (e.g. monitors, computers or credit cards).

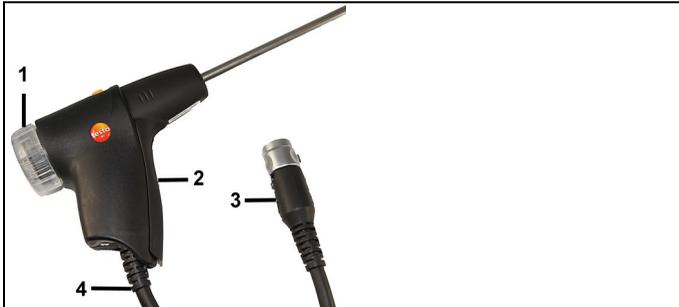
- 4 Service lid

4.1.7. Components



- 1 Rechargeable battery
- 2 Measured gas pump
- 3 Slot for O₂ sensor
- 4 Slot for CO sensor

4.2. Compact flue gas probe



- 1 Removable filter chamber with window and particle filter
- 2 Probe handle
- 3 Connector plug for measuring instrument
- 4 Connecting cable

5 First steps

5.1. Commissioning

The measuring instrument is supplied with a rechargeable battery already fitted.

- > Charge the rechargeable battery fully before using the measuring instrument, see Charging the battery, page 43.

5.2. Getting to know the product

5.2.1. Mains operation

If the mains unit is connected, the measuring instrument is automatically powered from the unit.

1. Connect the mains unit instrument plug to the instrument's micro USB socket.
2. Connect the mains plug of the mains unit to a mains socket.

i In mains operation the battery is automatically charged.

5.2.2. Connecting probes

i Probe detection at the flue gas socket is carried out continuously. New probes are recognised automatically.

Connecting flue gas probes/gas pressure adapters/temperature adapters



- > Insert the connector plug into the flue gas socket and lock by slightly turning it clockwise (bayonet lock).

i There must be no more than one extension lead (0554 1201) between measuring instrument and flue gas probe.

Connecting other sensors



- > Insert the connector plug of the probe into the probe socket.

5.2.3. Switching on

- > Press **[⏻]**.
- The start screen is displayed (duration: approx 15 s).
- During commissioning, when the instrument is switched on, the **Country version** menu is displayed.
Set the country version:
 1. Select the country version: **[▲], [▼] → [OK]**.
 2. Confirm confirmation request: **Yes → [OK]**
 - The testo 320 switches off.
 3. Restart instrument: Press **[⏻]**.
- If the voltage supply was interrupted for a longer period: The Date/time menu opens.
- The gas sensors are zeroed.
- There is an instrument error: The **Error diagnosis** is displayed.
- The **Measurement options** menu is displayed.

5.2.4. Calling up the function

1. Select function: **[▲], [▼]**.
 - The selected function appears in a frame.
2. Confirm selection: **[OK]**.
 - The selected function is opened.

5.2.5. Entering values

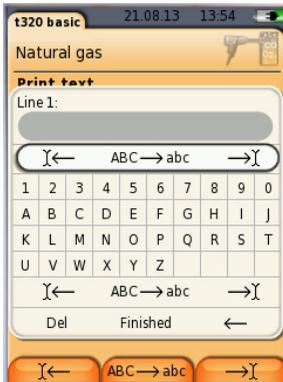
Some functions require values (numbers, units, characters) to be entered. Depending on the selected function, the values are entered either via a list field or an input editor.

List field



1. Select the value to be changed (numerical value, unit): [**▲**], [**▼**], [**◀**], [**▶**] (depending on the selected function).
2. Press [**Edit**].
3. Set value: [**▲**], [**▼**], [**◀**], [**▶**] (depending on the selected function).
4. Confirm the entry: [**OK**].
5. Repeat steps 1 and 4 as required.
6. Save the entry: [**Finished**].

Input editor



1. Select the value (character) to be changed: [**▲**], [**▼**], [**◀**], [**▶**].
2. Apply value: [**OK**].
 - Options:
 - > Toggle between upper/lower case:
select **I← ABC→&\$/ →I**: [**▲**], [**▼**] → [**ABC→&\$/**].
 - > Position the cursor in the text:
select **I← ABC→&\$/ →I**: [**▲**], [**▼**] → [**I←**] or [**→I**].
 - > Delete character before or after the cursor:
select **← next →** → [**▲**], [**▼**] → [**←**] or [**→**].
3. Repeat steps 1 and 2 as required.
4. Save the entry: Select **← next →** → [**▲**], [**▼**] → [**Next**].

5.2.6. Printing/saving data

Data is printed out via the key . Data is saved via the **Options** menu. The **Options** menu is accessed via the left function key and is available in many different menus.

To assign the right function key with the **Save** function or see Assigning the right function key, page 26.

Only measured values that have a display field assigned in the measurement view are saved/printed out.



The measurement data can be printed out parallel to the saving process, while a measurement program is running.

To be able to transfer data to a record printer via infrared, printer used must be enabled.

5.2.7. Saving data to the clipboard (temporary memory)

Using the clipboard, measurement results from various measurement types can be combined to produce a common record, which can then be printed out (see above). Data is saved to the clipboard via the **Options** menu and the **Clipboard** command.

If there is data in the clipboard, the status bar shows the symbol .

If there is data in the clipboard and the **Print** command is triggered, all data in the clipboard will be printed out.

i > **[Options]** → **Delete clipboard**: Any data saved to the clipboard is deleted.

5.2.8. Confirming an error message

If an error occurs, an error message is shown on the display.

> Confirming an error message: **[OK]**.

Errors that have occurred but have not yet been rectified are indicated by a warning symbol () in the header.

Error messages that have not yet been cancelled can be displayed in the **Error diagnosis** menu, see Instrument diagnosis, page 25.

5.2.9. Switching off

i Unsaved measured values are lost if the flue gas analyser is switched off.

> Press .

- Depending on the instrument status, the pump starts and the sensors are rinsed until the switch-off thresholds ($O_2 > 20\%$, other measurement parameters < 50 ppm) are reached. Rinsing lasts no more than 3 minutes.
- The measuring instrument switches off.

5.3. Measurement records

Call up function:

>  → **Measurement records** → **[OK]**.

Displaying a record:

1. Choose the required record from the detailed view.
2. Print **[Data]**.

Displaying a record:

1. Choose the required record from the detailed view.

2. Print **[Data]**.

Printing all records for a location:

1. Select measuring location: **[▲], [▼]**
2. Start printout: .

 - All records for the location are printed out.

Options:

- > **[Options]** → **Delete Record**: delete the selected record.
- > **[Options]** → **Delete all Records**: delete all saved records for a location.

5.4. Instrument diagnosis

Important operating values and instrument data are displayed. The status of the sensors and any instrument errors not yet rectified can be displayed.

Call up function:

- >  → **Instrument diagnosis** → **[OK]**.

Displaying instrument errors:

- > **Error diagnosis** → **[OK]**.
- Unrectified errors are displayed.
 - > Display next/previous error: **[▲], [▼]**.

Displaying sensor diagnosis:

1. **Sensor diagnosis** → **[OK]**.
2. Select sensor. **[▲], [▼]**.

 - The status of the sensor is indicated by a traffic light.

Displaying instrument information

- > **Device information** → **[OK]**.
- Information is displayed.

6 Using the product

6.1. Performing settings

6.1.1. Assigning the right function key

The right function key can have a function from the **Options** menu assigned to it. The menu **Options** is accessed via the left function key and is available in many different menus. This assignment is only valid for the currently opened menu / the opened function.

✓ A menu / function is open in which the **Options** menu is displayed on the left function key.

1. Press **[Options]** .
2. Select option: **[▲]**, **[▼]**.

Depending on the menu / function from which the **Options** menu was opened, the following functions are available.

3. Assign the selected function to the right function key: Press **[Config. Key]**.

6.1.2. Instrument settings



It is assumed that the contents of the chapter **First steps** (see **First steps**, page 20) are known.

Calling up a function:

> **[Menu]** → **Device Settings**.

see **First steps**, page 20

6.1.2.1. Measurement view

The parameters/units and the display (number of measured values shown per display page) can be set.

The settings are only valid for the currently chosen measurement type, which is indicated by the symbol in the info field.

Total overview of selectable measurement parameters and units (available selection depends on the set country version and selected measurement type):

Display	Measurement parameter
FT	Flue gas temperature
AT	Combustion air temperature
GT	Instrument temperature

O2	Oxygen
CO2	Carbon dioxide
qA	Flue gas loss without due consideration of the calorific value range
η	Efficiency without consideration of the heat value range
qA+	Flue gas loss with due consideration of the calorific value range
η+	Efficiency with due consideration of the calorific value range
CO	Carbon monoxide
COunv	Carbon monoxide undiluted
λ	Air ratio
COumg	Ambient carbon monoxide
O2ref	Oxygen reference
Draught	Draught measurement
ΔP	Differential pressure measurement
Dew Pt	Flue gas dew point temperature

Calling up the function:

- >  → **Device settings** → **[OK]** → **Measurement view** → **[OK]**

Changing the parameter/unit in a line:

1. Select the line: **[▲]**, **[▼]** → **[Edit]**
2. Select the parameter: **[▲]**, **[▼]** → **[OK]**
3. Select the unit: **[▲]**, **[▼]** → **[OK]**
4. Save changes: **[OK]**

Options:

- > **[Options]** → **Number of lines**: change the number of measured values per display page.
- > **[Options]** → **Blank line**: insert a blank line in front of the selected line.
- > **[Options]** → **Delete line**: delete the selected line.
- > **[Options]** → **Factory setting**: reset the measured value display to the factory settings.

6.1.2.2. Alarm limits

Alarm limits can be set for several display parameters. An audible alarm signal is triggered when the alarm limit is reached.

Calling up the function:

>  → **Device Settings** → [OK] → **Alarm Limits** → [OK]

Switching alarm signals on / off, changing alarm limits:

1. Select function or parameter: [▲], [▼] → [Edit].
 2. Set parameter: [▲], [▼] and partly [◀], [▶] → [OK].
 3. Save changes: [Finished].
- > Reset the enabled value to the factory setting: [Standard].

6.1.2.3. Date / time

Date, time mode and time can be set.

Calling up the function:

>  → **Device Settings** → [OK] → **Date/Time** → [OK]

Setting date/time:

1. Select parameter: [◀], [▲], [▼] → [Edit].
2. Set parameter: [▲], [▼] and partly [◀], [▶] → [OK].
3. Save changes: [Save].

6.1.2.4. Power Options

Automatic instrument shutdown (Auto-Off) and switching off of the display light in battery operation can be set.

Calling up the function:

>  → **Device settings** → **Power Options** → [OK]

Making settings:

1. Select function or parameter: [▲], [▼] → [Change].
2. Set parameter: [▲], [▼] and partly [◀], [▶] → [OK].
3. Save changes: [Finished].

6.1.2.5. Display brightness

The intensity of the display illumination can be set.

Calling up the function:

>  → **Device Settings** → [OK] → **Display Brightness** → [OK]

Performing settings

> Set parameter: [**◀**], [**▶**] → [OK].

6.1.2.6. Printer

The headers (lines 1-3) and the footers for the printout can be set.

The printer that is used can be activated.

Calling up the function:

>  → **Device Settings** → [OK] → **Printer** → [OK]

Activating the printer:

1. **Select Printer** → [OK].
2. Select the printer: [**▲**], [**▼**] → [OK].
 - The printer is activated and the menu **Printer** is opened.

Configuring the print text:

1. **Print text** → [OK].
2. Select function: [**▲**], [**▼**] → [Edit].
 - > Enter values for **Line 1**, **Line 2**, **Line 3** and the **Footnote**
 - > Print out system data and/or customer data: 
3. Save the entry: select [**Finished**].

6.1.2.7. Language

The menu language can be set. The number of available languages depends on the activated country version.

Calling up the function:

>  → **Instrument Settings** → [OK] → **Language** → [OK]

Activating the language:

> Select the language → [OK].

6.1.2.8. Country version

Changing the country version may alter the basis for calculation and therefore also the displayed measurement parameters, fuels, fuel parameters and calculation formulas.

The selection of the country version influences the menu languages that can be enabled.

For information concerning the assignment table, the basis for calculation and the country version, see www.testo.com/download-center (registration required).

Calling up the function:

>  → **Device Settings** → [OK] → **Country Version** → [OK]



This action can be password protected. A password is specified in the menu **Password Protection**, see see Password protection, page 30.

Possibly:

> Enter the password: [Enter] → Enter password → [Next] → [OK].

Setting the country version:

1. Select the country version: [, ] → [OK].
 2. Confirm the confirmation request: **Yes** → [OK]
- The system is restarted.

6.1.2.9. Password protection

The password protection is only valid for functions identified by the following symbol:  or .

Password protection can be activated / deactivated, the password can be changed.

To deactivate the password protection change the password to **0000** (factory setting).

Calling up the function:

>  → **Device Settings** → [OK] → **Password Protection** → [OK]

Possibly:

> Enter the currently valid password:
[Enter] → Enter password → [Next] → [OK].

Changing the password:

1. **[Edit]**.
2. Enter the new password → **[Next]**.
3. **[Edit]**.
4. Enter the new password again to confirm → **[Next]**.
5. Save changes: **[Finished]**.

6.1.3. Sensor settings**6.1.3.1. O₂ reference**

The O₂ reference value can be set.

The O₂ reference value setting may be password protected.

Call up function:

>  → **Sensor settings** → **O₂ reference** → **[Edit]**.

Possibly:

> Enter the password: **[Enter]** → Enter password → **[Next]** → **[OK]**.

Setting the O₂ reference:

> Set value → **[OK]**.

6.1.3.2. Recalibration/adjustment

The CO sensor can be recalibrated and adjusted.

For recalibration/adjustment, Testo recommends using calibration adapter 0554 1205 or sending the instrument off to Testo Customer Service.



If obviously unrealistic measured values are displayed, the sensors should be checked (calibrated) and, if required, adjusted.

Adjustments made with low gas concentrations can lead to accuracy deviations in the upper measuring ranges.

Call up function:

>  → **Sensor settings** → **Recalibration** → **[OK]**.

Possibly:

> Enter the password: **[Enter]** → Enter password → **[Next]** → **[OK]**.

- Gas zeroing (30 s).

Performing recalibration/adjustment:

 **WARNING**

Dangerous gases

Danger of poisoning!

- > Observe safety regulations/accident prevention regulations when handling test gas.
- > Use test gases in well ventilated rooms only.

1. Connect the calibration adapter to the flue gas socket.
2. Enable CO measurement parameter: **[OK]**.
3. **[Edit]** → Enter the test gas concentration (nominal value).
4. Attach the connecting line of the test gas bottle to the calibration adapter.
5. Apply test gas to the sensor.
6. Start recalibration: **[Start]**.
7. Apply the target value once the actual value is stable (adjustment): **[OK]**.
-or-
Cancel (no adjustment): **[esc]**.
8. Save changes: **[Finished]**.

6.1.4. Fuels

The fuel can be selected. The fuel-specific coefficients and limits can be set.



In order to maintain the measuring accuracy of the instrument, the correct fuel must be selected or configured.



Correct representation of measuring results is only assured if the threshold values for the ideal range of the corresponding measurement task have been set correctly.
The pre-set threshold values are typical values for the selected system type and the chosen type of fuel.

Call up function:

- >  → **Fuels** → **[OK]**.

Activating fuels:

- > Select the fuel → **[OK]**.
- The fuel is activated and the main menu is opened.

Setting coefficients:

1. Select the fuel → **[Coeff.]**.
2. Select the coefficients: **[Edit]**.

Possibly:

- > Enter the password: **[Enter]** → Enter password → **[Next]** → **[OK]**.
3. Set values → **[OK]**.
4. Save changes: **[Finished]**.

Setting limits:

1. Select limit → **[Edit]**.
2. Set values → **[OK]**.
3. Save changes: **[Finished]**.

6.2. Measuring

6.2.1. Preparing for measurement



The **First steps** chapter (see First steps, page 20) must have been read.

6.2.1.1. Testing for leaks

The entire measurement system (probe, condensate trap, hoses and connections) must be tested for leaks before each measurement to avoid incorrect measurements due to the infiltration of external air. Testing is carried out while the pump is running and may be performed by attaching a compressed balloon pump. The measurement system is leak-tight if the balloon pump is not filled with air.

6.2.1.2. Zeroing phases

Measuring the combustion air temperature

If no combustion air temperature probe is connected, during the zeroing phase, the measured temperature of the flue gas probe is taken as the combustion air temperature.



The flue gas probe should not be in the flue gas duct during the zeroing phase.

All dependent parameters are calculated using this value. This method of measuring combustion air temperature is sufficient for systems dependent on ambient air.

If a temperature probe is connected, the combustion air temperature is measured continuously via this probe.

Gas zeroing

When the instrument is switched on, the measurement menu is opened and the gas sensors are zeroed.

i The flue gas probe must be in fresh air during the zeroing phase!

Draught/pressure zeroing

The pressure sensors are zeroed when a pressure measuring function is called up.

i The flue gas probe must be in the fresh air during the zeroing phase / the instrument must not be pressurised during zeroing.

6.2.1.3. Using the modular flue gas probe

Checking the thermocouple



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

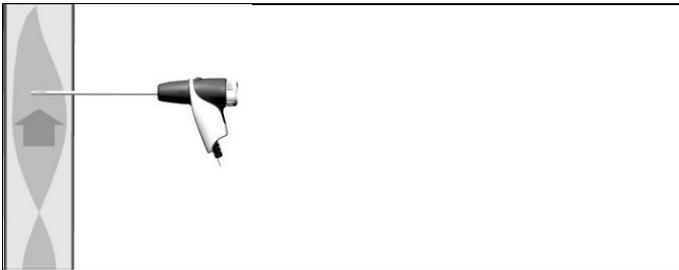
> Check before use. Bend the thermocouple back if necessary.

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 core current (area of the highest flue gas temperature).

6.2.1.4. Measurement view

Only those parameters and units that are enabled in the measured value display appear in the measured value display, in the saved measurement records and on the record printouts.

- > Before carrying out measurements, set up the measured value display in such a way that the required parameters and units are enabled, see Measurement view, page 26.

6.2.1.5. Setting the fuel

Before carrying out measurements, the fuel must be correctly selected, see Fuels, page 32.

6.2.2. Flue gas



To achieve usable measurement results, the measurement period of a flue gas measurement should be approx. 3 min and the measuring instrument should display stable measuring values.

Call up function:

1. → **Measurement options** → **[OK]** → **Flue Gas** → **[OK]**.
2. Select the fuel → **[OK]**.

Carrying out the measurement:

1. Start measurement: .



If a draught measurement has already been carried out separately, the value obtained is applied.

- The measured values are displayed.

2. End measurement: .

Options

- > **[Options]** → **Clipboard**: Data is saved to the clipboard.
- > **[Options]** → **Delete clipboard**: Any data saved to the clipboard is deleted.
- > **[Options]** → **Save**: The measured values are saved in a record.
- > **[Options]** → **Number of lines**: Change the number of measured values per display page.
- > **[Options]** → **Recalibrate**: The gas sensors are set to zero.
- > **[Options]** → **Measurement view**: (This function is not available during a measurement): The measured value display menu is opened.

6.2.3. Draught measurement

Call up function:

✓ A flue gas probe must be connected.

1. [F1] → **Measurement options** → [OK] → **Draught** → [OK].

Carrying out the measurement:



During the zeroing phase, the flue gas probe must be outside the flue gas duct.

Do not measure for longer than 5 min, as a drift of the pressure sensor means that the measured values may be outside the tolerance limits.

1. Start measurement: [▶].
 - Draught zeroing is carried out.
2. Position the flue gas probe in the hot spot (area of the highest flue gas temperature).

The display showing the maximum measured flue gas temperature (**AT max**) helps when positioning the probe.

 - The measured value is displayed.
3. End measurement [■].

Options:

- > [Options] → **Clipboard**: Data is saved to the clipboard.
- > [Options] → **Delete clipboard**: Any data saved to the clipboard is deleted.
- > [Options] → **Save**: The measured values are saved in a record.
- > [Options] → **Measurement view**: (This function is not available during a measurement): The measured value display menu is opened.

6.2.4. Smoke number/HCT

Calling up the function:

- > [F1] → **Measurement options** → [OK] → **Smoke number/HCT** → [OK].
-



The parameters **Smoke No.** and **Oil depos.** are only available for oil fuels.

Determine smoke tester no./smoke nos./oil depos. with the smoke pump and enter manually:

1. Select parameter → **[Change]**.
2. Enter data or values → **[OK]**.

Determine smoke tester no./smoke nos./oil depos. with the smoke tester testo 308 and transmit wirelessly:

- The testo 308 must be in data transfer mode ( lights up).
- > **[Options]** → **t308**.
- The values recorded by the smoke tester are transferred to the testo 320 basic.

Entering the heat carrier temperature:

- > **Heat carrier.** → **[Change]** → enter value → **[OK]**.

Options:

- > **[Options]** → **Clipboard**: data is saved to the clipboard.
- > **[Options]** → **Delete clipboard**: any data saved to the clipboard is deleted.
- > **[Options]** → **Save**: the measured values are saved in a record.
- > **[Options]** → **Reset values**: The entered values are deleted.

6.2.5. Pressure

- ✓ The gas pressure set (0554 1203) must be connected.

Call up function:

- >  → **Measurement options** → **[OK]** → **Pressure** → **[OK]**.

Carrying out the measurement:

 WARNING	
Dangerous mixture of gases	
Danger of explosion!	
>	Make sure there are no leaks between the sampling point and the measuring instrument.
>	Do not smoke or use naked flames during measurement.

-  Do not measure for longer than 5 min, as the drift of the pressure sensor could mean that the measured values are outside the tolerance limits.

1. Connect the gas pressure set to the probe socket.
2. Start measurement: .

- Pressure zeroing is carried out (system must be unpressurised).
- 3. Pressurise the system.
- The measured value is displayed
- 4. End measurement: [].

Options:

- > [Options] → **Clipboard**: Data is saved to the clipboard.
- > [Options] → **Delete clipboard**: Any data saved to the clipboard is deleted.
- > [Options] → **Save**: The measured values are saved in a record.
- > [Options] → **Measurement view**: (This function is not available during a measurement): The measured value display menu is opened.

6.2.6. Differential temperature

- ✓ The differential temperature set (0554 1208) must be connected.

Call up function:

- > [] → **Measurement options** → [OK] → **Differential temperature** → [OK].

Carrying out the measurement:

1. Start measurement: [].
 - The measured values and the calculated differential temperature (T1 - T2) are displayed.
2. End measurement: [].

Options:

- > [Options] → **Clipboard**: Data is saved to the clipboard.
- > [Options] → **Delete clipboard**: Any data saved to the clipboard is deleted.
- > [Options] → **Save**: The measured values are saved in a record.
- > [Options] → **Measurement view**: (This function is not available during a measurement): The measured value display menu is opened.

6.2.7. Ambient CO

This function is not available when the **Spain** country version is selected.

✓ A flue gas probe must be connected.



CO ambient measurement cannot be done with the external CO ambient probe.



Cigarette smoke influences the measurement by more than 50 ppm. The breath of a smoker influences the measurement by about 5 ppm.

When using an ambient CO probe, note that:

The direction of flow of the gas has an effect on the accuracy of measurement. Frontal flow onto the probe leads to higher measured values. The best measurement results are achieved when the probe is moved gently backwards and forwards.

When using the ambient CO probe and the flue gas probe, note that:

the probe must be in the fresh air (CO-free) during the zeroing phase!

Call up function:

>  → **Measurement options** → **[OK]** → **CO ambient** → **[OK]**.

Carrying out the measurement:

1. Start measurement: .
- The measurement starts and the measured value is displayed graphically (trend display).
- An audible alarm signal is triggered when the alarm limit is reached.
2. End measurement: .
3. Confirm the message: **[OK]**.

Options:

- > **[Options]** → **Clipboard**: data is saved to the clipboard.
- > **[Options]** → **Delete clipboard**: any data saved to the clipboard is deleted.
- > **[Options]** → **Save**: the measured values are saved in a record.
- > **[Options]** → **Set alarm limits**: the alarm limits menu is opened.

6.3. Transferring data

6.3.1. Report printer

To be able to transmit data via infrared interface to a Testo report printer, the printer to be used must have been activated, see Printer, page 29.

Printing out data takes place via [Print] or . The function is only available if a printout is possible.

i Representation of the available characters per line is limited on the printout. Thus, the unit **mg/KWh** is displayed on the printout as **mg/k**.

6.3.2. PC

Data transfer to a PC can take place via USB. You must also refer to the documentation that comes with the software.

7 Maintaining the product

7.1. Cleaning the measuring instrument

- > If the housing of the measuring instrument is dirty, clean it with a damp cloth. Do not use any aggressive cleaning agents or solvents! Mild household cleaning agents and soap suds may be used.

7.2. Replacing the rechargeable battery

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

Change the rechargeable battery within 2 minutes so that instrument settings (e.g. date/time) are not lost.

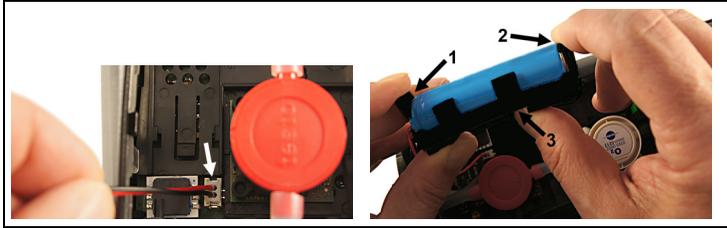
1. Place the measuring instrument on its front.



2. Unscrew, lift up and remove the service cover.



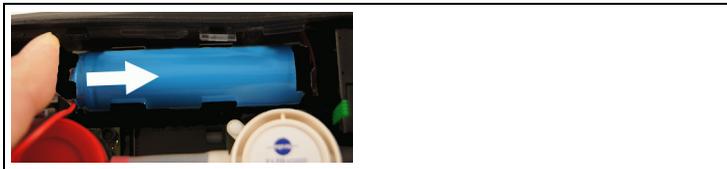
3. Press down on the holder lightly with your fingers. □ Pull the retaining clip in the direction of the arrow until the catch is released. Remove holder.



4. Unplug the plug-in connection from the slot.
5. Carefully pull the retaining clips (1, 2) outwards and push rechargeable battery up and out of the holder (3).



6. Insert the new rechargeable battery in the holder. Make sure that the plug-in connection cable is routed out of the holder at the side. Press the rechargeable battery into the holder until the retaining clips click into place.
7. Plug the new rechargeable battery plug-in connection into the slot.



8. Insert the holder into the guide rail and slide it in the direction of the arrow until the holder clicks into place.
9. Refit and close the service cover.

7.3. Charging the battery

The rechargeable battery can only be charged at an ambient temperature of ± 0 to $+35^{\circ}\text{C}$. If the rechargeable battery has been completely discharged, the charging time at room temperature with the testo mains unit is approx. 6 h.

Charging in the measuring instrument

1. Connect the mains unit instrument plug to the instrument's micro USB socket.
2. Connect the mains plug of the mains unit to a mains socket.
- The charging process will start. The charging process will stop automatically when the battery is fully charged.

Battery care

- > Do not fully exhaust rechargeable batteries.
- > Store rechargeable batteries only in charged condition and at low temperatures, but not below 0°C (best storage conditions with a charge level of 50-80%, at an ambient temperature of $10 - 20^{\circ}\text{C}$, recharge completely before use).

7.4. Replacing sensors

- ✓ The measuring instrument must be switched off.
1. Place the measuring instrument on its front.



2. Unscrew, lift up and remove the service cover.
3. Disconnect the hose connections from the faulty sensor/bridge.
4. Remove the faulty sensor/bridge from the slot.
5. Install new sensor / new bridge in the slot.
6. Push the hose connections on to the sensor/bridge.
7. Refit and close the service cover.



After replacing an O₂ sensor, wait for an equalisation period of 60 min to elapse before using the instrument again.

When retrofitting a sensor, the associated measurement parameter and unit must be enabled, see Sensor settings, page 31.

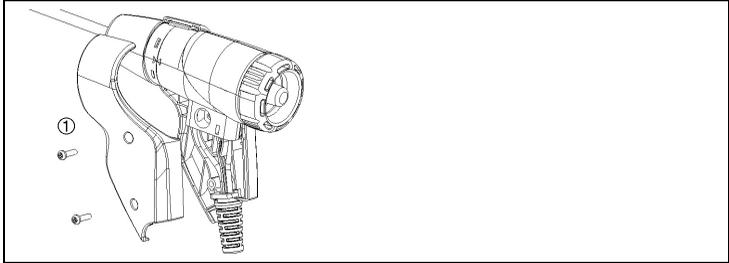
7.5. Recalibrating/adjusting sensors

See Recalibration/adjustment, page 31.

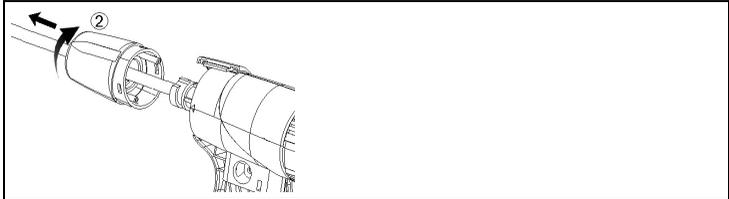
7.6. Compact flue gas probe

7.6.1. Cleaning the probe shaft

✓ Disconnect the flue gas probe from the measuring instrument.



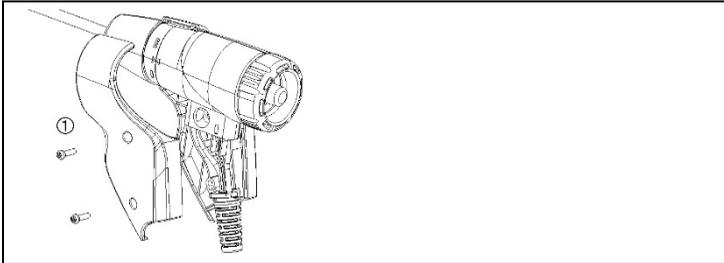
1. Loosen and remove halfshell handles (1).



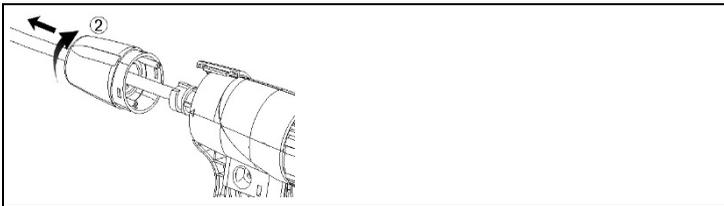
2. Turn the sealing cap (2) clockwise as far as it will go and remove probe shaft.
3. Blow compressed air through the probe shaft.
4. Replace the probe shaft and lock the sealing cap (2) by tightening it anti-clockwise (as far as it will go, observe markings).
5. Replace halfshell handles and secure with screws.

7.6.2. Replacing the thermocouple

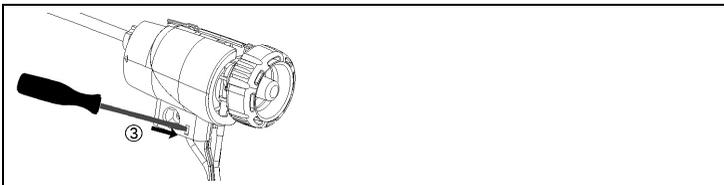
- ✓ Disconnect the flue gas probe from the measuring instrument.



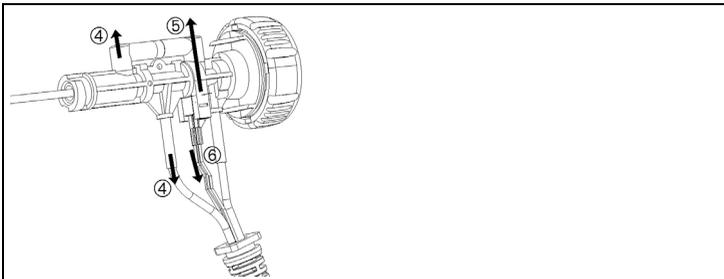
1. Loosen and remove halfshell handles (1).



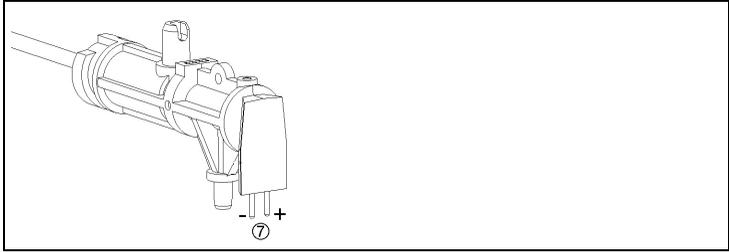
2. Turn the sealing cap (2) clockwise as far as it will go and remove probe shaft.



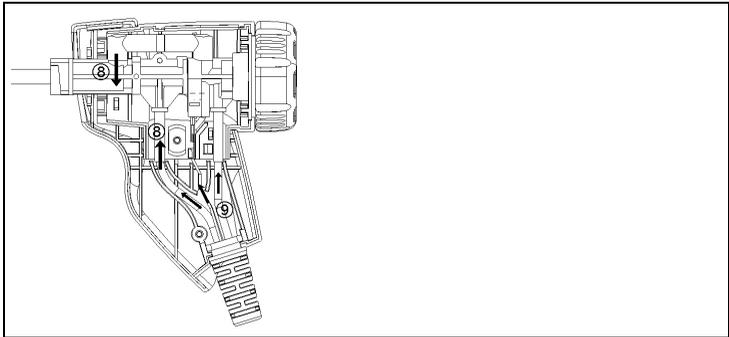
3. Release halfshell elements (3) and remove.



4. Remove the adapter (4) and hose (5), push the thermocouple out of its holder and disconnect the cable (6) from the thermocouple.



5. Connect cables to the new thermocouple (white -, green +) (7) and push the thermocouple back into the holder.



6. Connect the adapter and hose to the thermocouple (8). Adjust cables and hoses (9), refit halfshell elements.
7. Replace the probe shaft and lock the sealing cap by tightening it anti-clockwise (as far as it will go, observe markings).
8. Replace halfshell handles and secure with screws.

7.6.3. Checking the particle filter

- > Check the particle filter of the compact flue gas probe regularly for contamination:

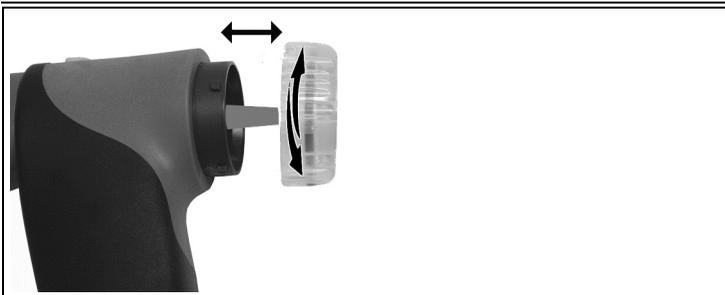


- > Carry out a visual inspection through the window in the filter chamber.
- Replace the filter if there are any signs of contamination.

7.6.4. Replacing the particle filter



The filter chamber may contain condensate.



1. Open the filter chamber: turn slightly anti-clockwise.
2. Remove the filter cartridge and replace it with a new one (0554 0040).
3. Attach the filter chamber and lock it: turn slightly clockwise.

7.7. Condensate container

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

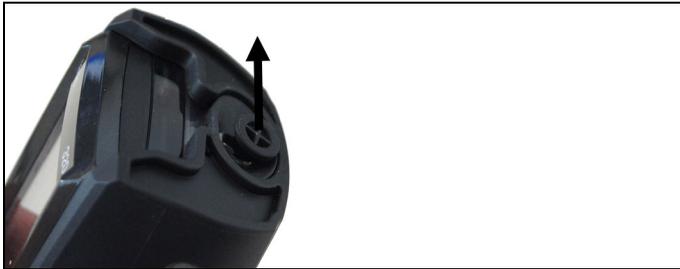
Draining the condensate container

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

ATTENTION

Damage to the sensors and the flue gas pump due to condensate entering the gas path!

> Do not empty the condensate container while the flue gas pump is in operation.



1. Open the condensate outlet on the condensate trap: Pull out the plug as far as it will go.



2. Let the condensate run out into a sink.
3. Wipe off any drops still on the condensate outlet with a cloth and close the condensate outlet.

i The condensate outlet must be completely closed (marking), otherwise measuring errors could be caused by infiltrated air.

8 Tips and assistance

8.1. Questions and answers

Question	Possible causes/solution
Rechargeable battery low	> Switch to mains operation.
Measuring instrument switches off automatically or cannot be switched on	Batteries/rechargeable batteries empty. > Charge rechargeable battery or switch to mains operation.
Error message: Cell protection enabled	The shutdown limit of the CO sensor was exceeded. > Remove the probe from the stack.
Error message: Printing not possible	<ul style="list-style-type: none"> • Wrong printer enabled. • Printer switched off. • Printer outside wireless transmission range. > Enable printer to be used. > Switch on printer. > Move printer into wireless transmission range.

If we could not answer your question, please contact your dealer or Testo Customer Service. For contact details, see back of this document or the website www.testo.com/service-contact.

8.2. Accessories and spare parts

Printer

Description	Article no.
Infrared high-speed printer	0554 0549
Spare thermal paper for printer (6 rolls)	0554 0568

Compact flue gas probes

Description	Article no.
Compact flue gas probe 180 mm, 500°C, thermocouple 1.0 mm, probe shaft diameter: 6 mm incl. cone	0600 9740
Compact flue gas probe 300mm, 500°C, thermocouple 1.0 mm, probe shaft diameter: 6 mm incl. cone	0600 9741
Flexible compact flue gas probe, length 330 mm, Tmax. 180 °C, short-term 200 °C, bending radius max. 90° for measurements at difficult to access locations	0600 9742
Cone, 8mm, steel	0554 3330
Cone, 6mm, steel	0554 3329
Multi-hole probe shaft, length 300 mm, Ø 8 mm, for CO averaging	0554 5762
Multi-hole probe shaft, length 180 mm, Ø 8 mm, for CO averaging	0554 5763
Flexible probe shaft module	0554 9770
Hose extension 2.8 m, extension line probe - instrument	0554 1202

Probe modules/accessories for compact flue gas probes

Description	Article no.
Spare thermocouple for 0600 9740	0430 0383
Spare thermocouple for 0600 9741	0430 0382
Particle filter for compact flue gas probe, 10 pieces	0554 0040

Temperature probe

Description	Article no.
Combustion air temperature probe, 300 mm	0600 9791
Combustion air temperature probe, 190 mm	0600 9787
Combustion air temperature probe, 60 mm	0600 9797
Fast reaction surface sensor	0604 0194
Miniature ambient air sensor	0600 3692

Other probes

Description	Article no.
O2 annular gap probe	0632 1260
Gas pressure set: Draught path adapter, silicone hose 4 mm / 6 mm, reducing cones	0554 1203
Smoke tester incl. oil, soot plates, for measuring soot in flue gas	0554 0307

Spare sensors

Description	Article no.
O2 sensor	0393 0005
CO sensor	0393 0053

Cases

System case with double floor (height:180 mm) for instrument, probes and accessories	0516 3301
System case (height: 130 mm) for instrument, probes and accessories	0516 3300

Other accessories

Description	Article no.
Mains unit incl. micro USB cable	0554 1105
Spare rechargeable battery	0515 0046
Draught set	0554 3150
ISO Calibration Certificate Flue Gas	0520 0003

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

8.3. Updating the instrument software

Under www.testo.com/download-center you can download the current instrument software (Firmware) for testo 320 basic (registration required).

> Unplug the micro USB cable and switch off the testo 320 basic.

1. Hold down [▲].

2. Reconnect the micro USB mains cable to the testo 320, continue holding down [▲].

- The display shows **Firmware update** along the bottom edge.

3. Release [▲].

- Your PC recognises the testo 320 basic as a removable medium.

4. Copy the new file (ap320br.bin) to the detected removable medium.

- On the display the status bar progresses from left to right. This process may take a few minutes.

- Once the instrument software (firmware) has been updated, the system will automatically reboot and is ready for use.

5. Disconnect the connecting cable from the testo 320 basic.

