testo 320 · Flue gas analyzer
testo 320 LX · Flue gas analyzer

Instruction manual

1 Contents

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
	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

> 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 flue gas analyzer 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.

> The flue gas analyzer must be checked before commissioning for any visible damage. Do not commission the flue gas analyzer if there are signs of damage on the housing, mains unit or supply lines. Electrical risk.

> 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.

i	Use distilled water, or alternatively mild solvents such as isopropanol to clean the flue gas analyzer. If using isopropanol, please refer to the instruction leaflet for the product. Isopropanol fumes have a slight narcotic effect, and typically cause irritation of the eyes and sensitive mucous membranes. When using it, please ensure that there is adequate ventilation.
i	Do not store any objects that have come into contact with solvents and/or degreasers (e.g. isopropanol) in the case. Evaporating or leaking solvents and/or degreasers may cause damage to the instrument and to the sensors.
i	The use of strong or harsh alcohol or brake cleaner can result in damage to the instrument.

For products with Bluetooth® (optional)

Changes or modifications that have been made without the explicit consent of the responsible approval authority, may cause the retraction of the type approval.

Data transfer may be disturbed by equipment that uses the same ISM-band, e.g. WLAN, microwave ovens, ZigBee.

The use of radio communication links is not permitted, among others, in aeroplanes and hospitals. For this reason the following points must be ensured before entering:

> Switch off the device:

> Isolate the device from any external power sources (mains cable, external rechargeable batteries, ...).

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 flue gas analyzer is a handheld measuring device for the professional flue gas analysis of combustion plants:

- Small combustion plants (burning oil, gas, wood, coal)

> The solid fuel measurement adapter (0600 9765) is required for measurements on solid fuel systems. The adapter protects the measuring instrument from harmful substances (dust, organic compounds, etc.).

- Low-temperature and condensing boilers
- Gas water heaters

These systems can be adjusted using the flue gas analyzer and checked for compliance with the applicable limit values.

The following tasks can also be carried out with the flue gas analyzer:

- 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.
- Ambient CO measurement (only possible with additional ambient CO probe 0632 3331).
- Ambient CO measurement (only possible with additional ambient CO probe 0632 1240).
- Detection of CH4 (methane) and C3H8 (propane) (only possible with additional gas leak probe 0632 3370).

The Bluetooth® option may only be operated in countries in which it is type approved.

3.2. Technical data

3.2.1. Examinations

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

This product is TÜV-tested in compliance with 1. BImSchV. The sensors 0393 0105 (CO, H2-compensated), 0393 0003 (O2),

temperature and pressure are TÜV-tested in accordance with EN 50379 part 2.

The measuring cell 0393 0053 (CO, not H2-compensated) is TÜV-tested as per EN 50379 part 3.

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

For official measurements in accordance with 1. BImSchV (chimney sweeps), the measuring instrument must be checked every six months by a technical testing body of the Guild of Master Chimney Sweeps or another testing body recognised by the authorities.

3.2.2. Bluetooth® module (option)

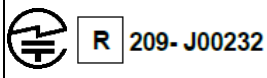
The use of the wireless module is subject to the regulations and stipulations of the respective country of use, and the module may only be used in countries for which a country certification has been granted. The user and every owner has the obligation to adhere to these regulations and prerequisites for use, and acknowledges that the re-sale, export, import etc. in particular in countries without wireless permits, is his responsibility.

3.2.3. Licenses

Product	Testo 320
Mat.-No.	0632 3220
Date	23.02.2018

Country	Comments
Canada	contains IC 5123A-WT11U IC Warnings
Europa + EFTA (Länderliste einfügen)	CE The EU Declaration of Conformity can be found on the testo **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),

<table>
<tr><td></td><td>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), Republic of Cyprus (CY).

EFTA countries:
Iceland, Liechtenstein, Norway, Switzerland</td></tr>
<tr><td>Japan</td><td> 
Japan Information</td></tr>
<tr><td>Turkey</td><td>Authorized</td></tr>
<tr><td>USA</td><td> 
contains FCC ID: QOQWT11U

FCC Warnings</td></tr>
<tr><td>Radio module</td><td><table>
<tr><th>Feature</th><th>Values</th></tr>
<tr><td>Bluetooth Range</td><td><10 m (free field)</td></tr>
<tr><td>Bluetooth type</td><td>Bluegiga WTT11u Bluetooth Module</td></tr>
<tr><td>Qualified Design ID</td><td>22298</td></tr>
<tr><td>Declaration ID</td><td>B016141</td></tr>
<tr><td>Bluetooth radio class</td><td>Class 1</td></tr>
<tr><td>Bluetooth company</td><td>Silicon Laboratories Inc.</td></tr>
<tr><td>RF Band</td><td>2402 - 2480 MHz</td></tr>
<tr><td>Nominal output power</td><td>17 dBm</td></tr>
</table></td></tr>
</table>

IC Warnings

RSS-Gen & RSS-247 statement:

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

(1) this device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.
L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Caution: Radio Frequency Radiation Exposure
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets the IC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person´s body in normal use position.

Co-Location:
This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

Attention : exposition au rayonnement de radiofréquences
Cet équipement est conforme aux limites d'exposition aux radiofréquences IC fixées pour un environnement non contrôlé et aux Lignes directrices relatives à l'exposition aux radiofréquences (RF). Cet équipement devrait être installé et utilisé à une distance d'au moins 20 cm d'un radiateur ou à une distance plus grande du corps humain en position normale d'utilisation.

Co-location
Ce transmetteur ne peut pas être installé en colocation ou être utilisé avec une autre antenne ou transmetteur, quel qu'en soit le type.

FCC Warnings

Information from the FCC (Federal Communications Commission)

For your own safety
Shielded cables should be used for a composite interface. This is to ensure continued protection against radio frequency interference.

FCC warning statement
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful

interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Shielded interface cable must be used in order to comply with the emission limits.

Warning

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.

Caution: Radio Frequency Radiation Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person´s body in normal use position.

Japan Information

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。

3.2.4. Declaration of Conformity

You can find the EU declaration of conformity on th

3.2.5. Measurement ranges and resolution

Measurement parameter	Measuring range	Resolution
O_2	0 to 21 Vol.%	0.1 vol.%
CO	0...4000 ppm	1 ppm
CO, H_2-comp.	0 to 8000 ppm	1 ppm
COlow, H_2-comp.	0 to 500 ppm	0.1 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[1] (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 %

3.2.6. 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

[1] Depending on the country version

Measurement parameter	Accuracy	Response time (t_{90})
CO, H_2-comp.	±10 ppm or ±10% of meas. val.[2] (0 to 200 ppm) ±20 ppm or ±5% of meas. val.[2] (201 to 2000 ppm) ±10% of meas. val. (2001 to 8000 ppm)	< 40 s
COlow, H_2-comp.	±2 ppm (0 to 39.9 ppm) ±5% of meas. val. (rest of range)	< 40 s
Draught[1]	±0.02 ppm or ±5% of meas. val.[2] (-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)	-
Fine draught[1]	±0.02 ppm or ±5% of meas. val.[2] (-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)	
ΔP (only with gas pressure set 0554 1203)	± 0.5 hPa (0.0 to 50.0 hPa) ±1% of meas. val. (50.1 to 100.0 hPa) ±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) ±1% of meas. val. (50.1 to 100.0 hPa) ±1.5% of meas. val. (rest of range)	
temperature	± 0.5°C (0.0 to 100.0°C) ±0.5% of meas. val. (rest of range)	depending on the probe
Efficiency	-	-
Flue gas loss	-	-

[2] higher value is valid

3.2.7. 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	500 measured values
Display	Graphic colour display, 240 x 320 pixels
Gas leak testing probe	visual indication (LED) audible indication by buzzer
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, Bluetooth® (option)
Bluetooth® (option)	Range < 10 m

4 Product description

4.1. Case 0516 3300 (accessory)

Recommended for stowing away the measuring instrument and accessories (example)

4.1.1. Bottom level view

1 Sealing clip
2 Flue gas analyser testo 320
3 Repository for printer accessories
- Spare batteries for IRDA printer
- 1 roll of spare thermal paper (0554 0568)

4 Repository for printer
- IRDA printer (0554 0549)
- • Bluetooth®/IRDA printer (0554 0620)

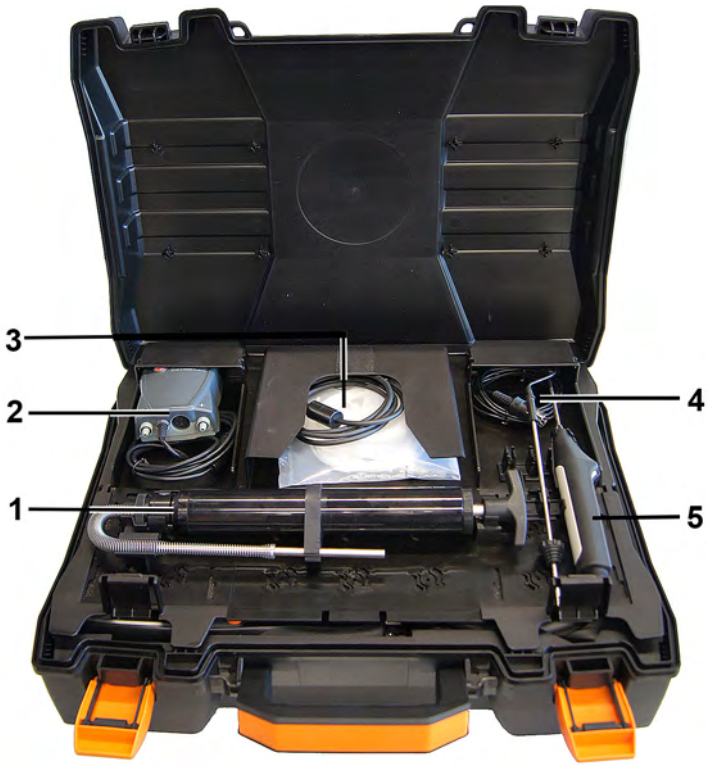
5. Instruction manual
6 Lock testo 320
7 Probes

- Flue gas probe (e.g. 0600 9741)
- Pitot tube for heating check (0635 2050)

8 Large storage compartment
- Mains unit fortesto 320 (0554 1105)
- Differential temperature set (0554 1208)
- Spare dirt filter (0554 0040)

9 Round storage compartment
- Hose connection set with pressure adapter (0554 1203)

4.1.2. Top level view



1 Soot pump set (0554 0307)
2 Storage compartment
- Fine pressure probe (0638 0330)

3 Storage compartment
- Capillary hose set for fine pressure probe (0554 1215)
- Connecting cable for surface probe (0430 0143)

4 Combustion air temperature probe (0600 9787)
5. Surface temperature probe Type K (0604 0994)

4.2. Case 0516 3301 (accessory)

Recommended for stowing away the measuring instrument and accessories (example)

4.2.1. Bottom level view

1 Fine pressure probe (0638 0330)
2 testo 308 smoke tester (0632 0308)

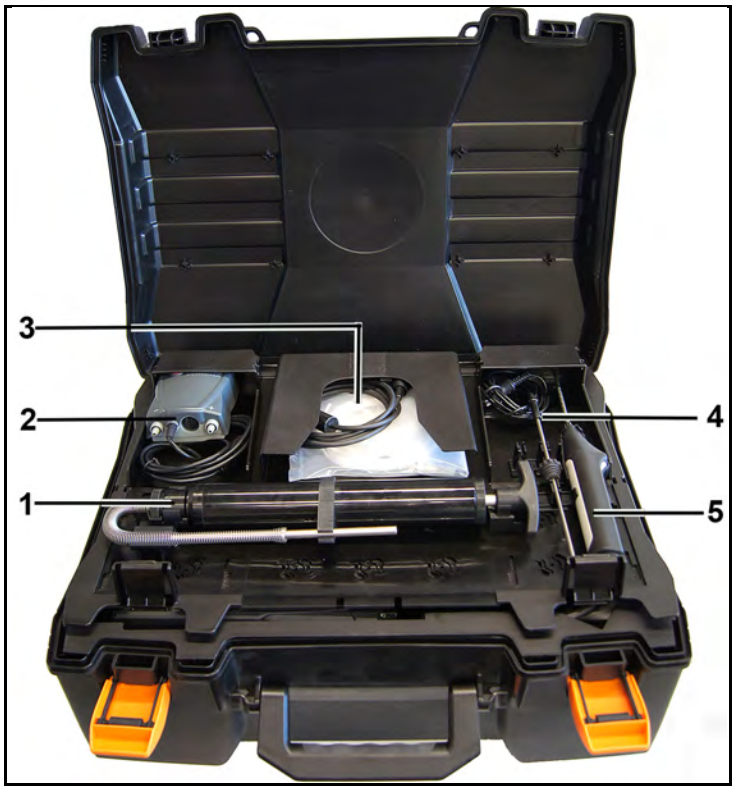
4.2.2. Middle level view

1 Sealing clip
2 testo 330-1 /-2 LL flue gas analyzer
3 Repository for printer accessories
   - Spare batteries for IRDA printer
   - 1 roll of spare thermal paper (0554 0568)
4 Repository for printer
   - IRDA printer (0554 0549)
   - Bluetooth®/IRDA printer (0554 0620)
5. Instruction manual
6 Lock
7 Probes
   - Flue gas probe (e.g. 0600 9741)
   - Pitot tube for heating check (0635 2050)
8 Large storage compartment

- Mains unit for testo 330-1 /-2 LL (0554 1096)
- Differential temperature set (0554 1208)
- Spare dirt filter (0554 0040)

9 Round storage compartment
- Hose connection set with pressure adapter (0554 1203)

4.2.3. Top level view



1 Soot pump set (0554 0307)
2 Storage compartment
- Fine pressure probe (0638 0330)

3 Storage compartment
- Capillary hose set for fine pressure probe (0554 1215)
- Connecting cable for surface probe (0430 1215)

4 Combustion air temperature probe (0600 9787)
5. Surface temperature probe Type K (0604 0994)

4.3. Measuring instrument

4.3.1. Front view

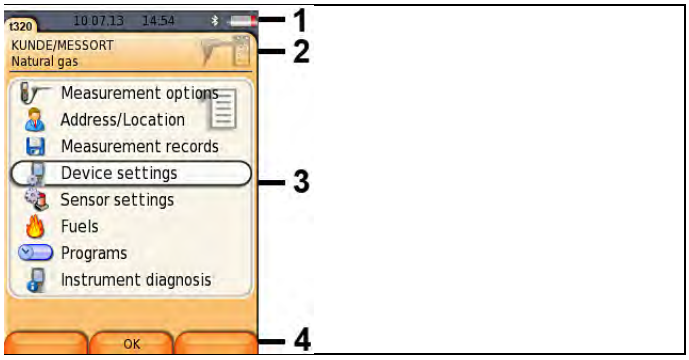
1 Display
2 Function keys
3 Keypad

4.3.2. Keypad

Button	Functions
[⏻]	Switch measuring instrument on / off

Button	Functions
[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.

4.3.3. Display



1 Status bar (dark grey background):

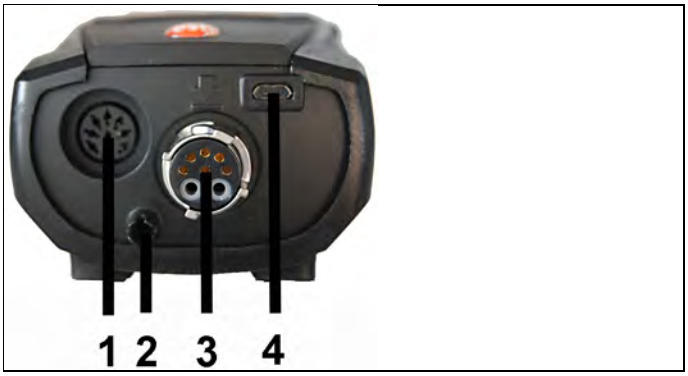
- Warning symbol ⚠ (only if there is an instrument error, display of error in instrument diagnosis menu), otherwise: Instrument designation.
- Symbol (only if data is stored in the temporary memory).
- Display of date and time.
- Indication of Bluetooth® status, power supply and remaining rechargeable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

Icon	Feature
	blue symbol = Bluetooth® on, grey symbol = Bluetooth®off
	Battery operation Display of remaining rechargeable battery capacity by colour and fill level of the battery icon (green = 5-100%, red = < 5%)

Icon	Feature
	Mains operation Display of remaining rechargeable battery capacity: see above

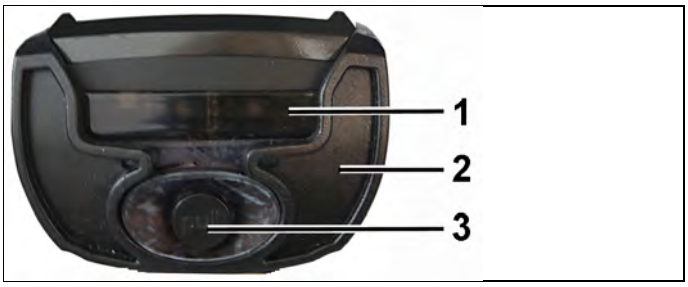
2 Info field of register tabs: Indication of selected address/location, chosen fuel, chosen measurement type.
3 Selection field for functions (selected function appears against a white background, unavailable functions are identified by grey font) or display of measured values.
4 Function display for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

4.3.4. Instrument connections



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

4.3.5. Condensate outlet and interfaces



1 Infrared interface (IrDA)
2 Bluetooth interface (option)
3 Condensate outlet

4.3.6. 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

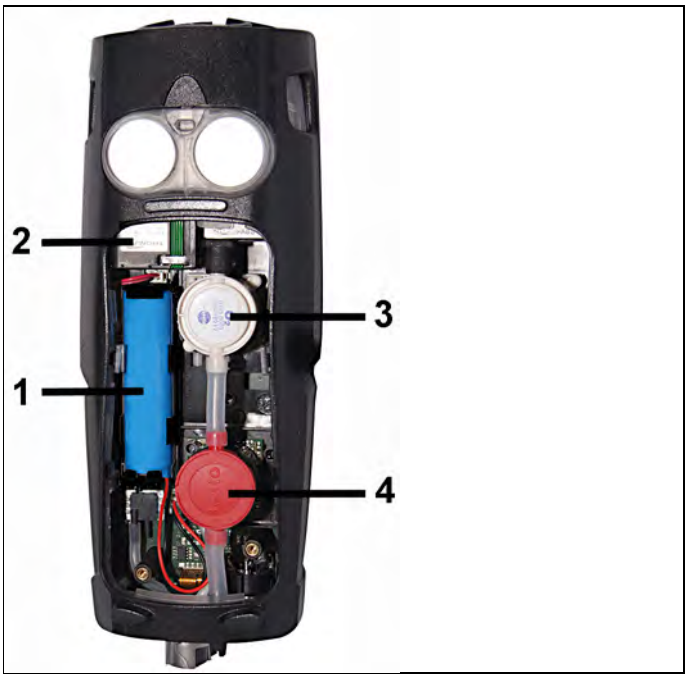
Magnetic field

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

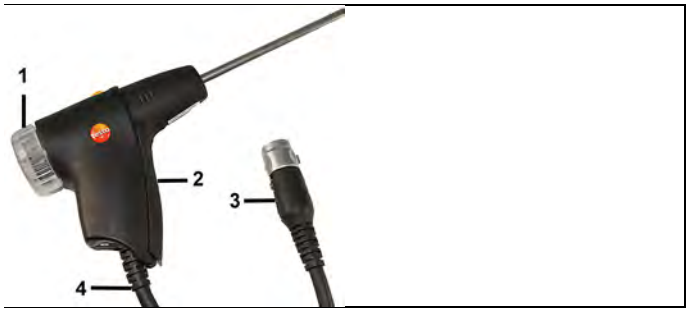
4.3.7. Components



1 Rechargeable battery

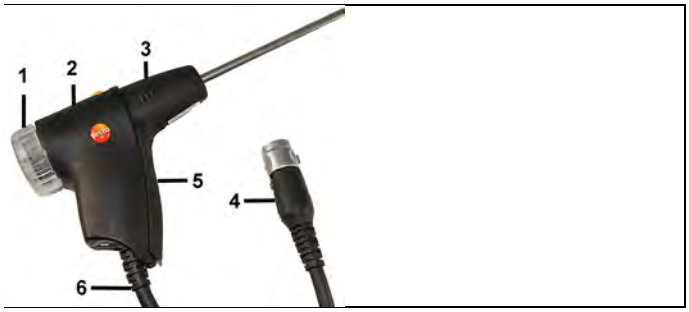
2 Measured gas pump
3 Slot for O2 sensor
4 Slot for CO sensor, COlow sensor or CO, H2-compensated sensor

4.4. 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

4.5. Modular flue gas probe



1 Removable filter chamber with window and particle filter
2 Lock release
3 Probe module
4 Connector plug for measuring instrument
5 Probe handle
6 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 **61.**

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.

During mains operation the battery is charged automatically.

5.2.2. Connecting probes

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

Connect a probe to the probe socket before switching on the measuring instrument or start sensor detection manually after changing the probe: **[Options]** → **Sensor detection**.

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).

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 flue gas analyzer 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 **36,**

Only readings assigned a display field in the measurement view will be saved / printed out.

ℹ	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 or Bluetooth interface, the printer used must be enabled, see Printer, page **40**.

ℹ	Graph charts can be printed out using the Bluetooth® / IRDA printer 0554 0620.

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 **35.**

5.2.9. Switching off

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. Address/Location

All measuring values can be saved under the currently active location. Measuring values that have not been saved are lost when the measuring instrument is switched off!

Addresses and locations can be created, edited, copied and enabled. Addresses and locations (incl. protocols) can be deleted.

Call up function:

> [📋] → **Address/Location** → [OK].

There are various options for opening address.

1. Edit search setting: [Edit].
2. Select search setting: [▲], [▼] → [OK].
   Possible settings:
   - **Show all**: All address/location are displayed.
   - **Search**: A search text only brings up address/location that contain characteristics of the search text.
   - **Filter**: Individual letters or numbers can be selected. All data beginning with the relevant letter/number is displayed.

The initial letter is the determining factor for the **filter** function, and this can only be selected individually. The **search** function can also be used to find a series of several letters within the address!

3. Carry out search according to search setting: [Search]

Show all

1. Select address: **[▲], [▼].**
2. Show details: **[Details]**.
3. Enable a location: select the location → **[OK].**

- The location is activated.

> Open measurements menu: press **[OK]** again.

Search

1. Edit search criteria**: [►]** → **[Edit]**.
2. Select search criteria**: [▲], [▼]** → **[OK]**.
   Possible options:
   - **Contact person**
   - **Address**
   - **Town/city**
   - **Postcode**
   - **Street**

- The selected criterion is displayed.

3. Call up entry field for search text: **[►] or [▼]**

> Enter search text → **[Finished]**

Do not use the special character * as a placeholder.

Filter

1. Edit search criteria: **[Edit]**.
2. Select search criteria: **[▲], [▼]** → **[OK].**
   Possible options:
   - **Contact person**
   - **Address**
   - **Town/city**
   - **Postcode**
   - **Street**

- The selected criterion is displayed.

3. Enable tab: **[▼]**
4. Select the required tab: **[▲], [▼]** and sometimes **[◄], [►]**→ **[Filter]**.

- The search result for the relevant letter or number is displayed.

Create a new measuring location**:**

A location is always created under an address.

1. Select the address in which the location is to be created.

2. **[Options]** → **New/Location** → **[OK]**.
3. Enter values or make settings.
4. Finalise the entry: **[Finished]**.

Other location options:

> **[Options]** → **Edit location**: make changes to an existing location.
> **[Options]** → **Copy location**: make a copy of an existing location in the same address.
> **[Options]** → **Delete location**: delete an existing location.

Create new address**:**

1. **[Options]** → **New address** → **[OK]**.
2. Enter values or make settings.
3. Finalise the entry: **[Finished]**.

Other address options:

- **Edit address**: make changes to an existing folder.
- **Copy address**: make a copy of an existing folder.
- **Delete address**: delete an existing folder, including the locations created therein.
- **Delete All addresses**: delete all existing folders, including the locations created in them.

5.4. Measurement records

Call up function:

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

There are various options for opening records. see Address/Location, page **32.**

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.

5.5. 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.

ℹ	A sensor is able to recover. The sensor status indication may therefore change from yellow to green or from red to yellow.

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 opened 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 28) are known.

Calling up a function:

> **[ ]** → **Device Settings**.

see First steps, page **28**

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

Display	Measurement parameter
O2	Oxygen
CO2	Carbon dioxide
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
CO2um	Ambient carbon dioxide
O2ref	Oxygen reference
Draught	Draught measurement
ΔP	Differential pressure measurement
E draught	External draught (external micro pressure probe)
E-ΔP	External differential pressure (external micro pressure probe)
cCO	Carbon dioxide reduction
ExAir	Air surplus
qA	Flue gas loss without due consideration of the calorific value range
η	Efficiency without consideration of the heat value range
Dew Pt	Flue gas dew point temperature
Nett	Differential temperature
GI	Toxin index
ET	qA+ - qA

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:

> [ ] → Instrument 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. Units

The units used for parameters in configuration menus can be set.

Call up function:

> [ ] → Device settings → [OK] → Units → [OK].

Adjustable units

Parameter	Unit
Altitude	m, ft

Parameter	Unit
Pressure	mbar, hPa

1. Select the line: [▲], [▼]→ [Edit].
2. Select the unit to be changed: [▲], [▼] → [OK].
3. Confirm the entry: [Finished].

6.1.2.4. Date / time

Date, time mode and time can be set.

Calling up the function:

> [📋] → Instrument Settings → [OK] → Date/Time → [OK]

Setting date/time:

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

6.1.2.5. Energy management

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

Calling up the function:

> [📋] → Instrument Settings → [OK] → Energy Management → [OK]

Making settings:

1. Select function or parameter: [▲], [▼] → [Edit].
2. Set parameter: [▲], [▼] and partly [◄], [►] → [OK].
3. Save changes: [Finished].

6.1.2.6. Display brightness

The intensity of the display illumination can be set.

Calling up the function:

> [📋] → Instrument Settings → [OK] → Display Brightness → [OK]

Performing settings

> Set parameter: [◄], [►] → [OK].

6.1.2.1. Choose measurement type

Individual measurement types can be shown or hidden. These are displayed or hidden accordingly under Measurement options.

Call up function:

> [ ] → Device settings → [OK] → Choose measurement type → [OK].

Show or hide measurement types:

1. Select measurement type: [▲], [▼]
2. Enable / disable measurement type: [ ] (enabled), [ ] (disabled)
3. Save selection: [Finished].

6.1.2.2. 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:

> [ ] → Instrument Settings → [OK] → Printer → [OK]

Activating the printer:

The printer 0554 0543 can only be selected after the Bluetooth®-interface has been activated, see Bluetooth®, page 40.

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].

see Bluetooth®, page 40

6.1.2.3. Bluetooth®

This menu is only available if the instrument is equipped with Bluetooth. The Bluetooth module can be switched on / off.The relay can now be tested.

Calling up the function:

> [ ] → Instrument Settings → [OK] → Bluetooth → [Edit].

Making settings:

> Set parameter → [OK].

6.1.2.4. Language

The menu language can be set. The number of available languages depends on the activated country version, see Country version, page 41.

Calling up the function:

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

Activating the language:

> Select the language → **[OK]**.

see Country version, page **41**

6.1.2.5. 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.

Calling up the function:

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

This action can be password protected. A password is specified in the menu **Password Protection**, see Password protection, page 42.

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.

see Password protection, page **42**

6.1.2.6. 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:

> **[ ] → Instrument 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. O_2 reference

The O2 reference value can be set.

The O2 reference value setting may be password protected, see Password protection, page **42.**

Call up function:

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

Possibly:

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

Setting the O_2 reference:

> Set value → **[OK]**.

6.1.3.2. Sensor protection

Protection limits can be set to protect the sensors against overload. Sensor protection switch-off is available for the CO sensor.

Sensor protection is activated if the threshold is exceeded.

To disable sensor protection, the threshold values must be set to 0 ppm.

Call up function:

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

Setting sensor protection thresholds:

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

6.1.3.3. 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.

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

ℹ	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 **28**) 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.

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.

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

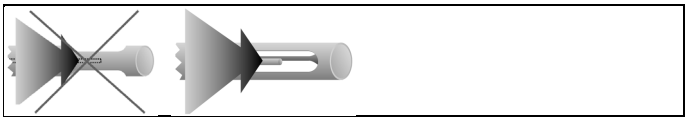
6.2.1.3. Using flue gas probe

Checking the thermocouple

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

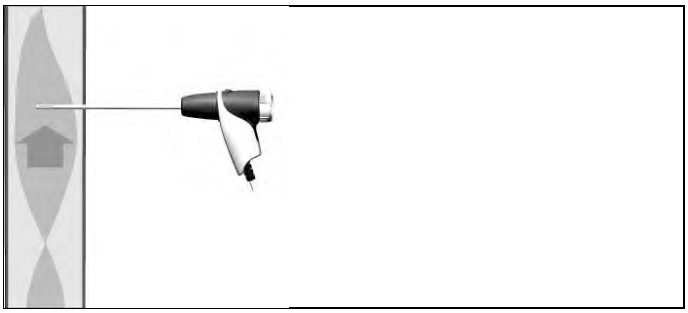
> Check before use. Bend the thermocouple back if necessary.

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 measurement parameters and -units that are enabled in the reading display appear in the reading display, in the saved measurement records and on 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 **36.**

6.2.1.5. Setting the location and fuel

Before carrying out measurements, the location and fuel must be correctly selected, see Address/Location, page **32** and see Fuels, page **44.**

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 separate measurement of CO undiluted has not yet been carried out, this value is calculated using the measured values of the flue gas probe and is updated continuously.
>
> If CO undiluted and/or 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]** → **Fluegas matrix**: the measured values are displayed as a flue gas matrix, see below.
> **[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.

Showing the flue gas matrix

This function is only available if the measurement parameter **CO** has been activated in the measured value display.

Call up function:

✓ The flue gas function is open.

> **[Options]** → **Fluegas matrix**.

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]** → **Show numeric value**: data is displayed as numerical values.

> **[Options]** → **System type**: (This function is not available during a measurement) Set the system type to be able to configure the ideal zone (green) of the flue gas matrix, using the limits pre-configured for each system type.

> **[Options]** → **Reset graphic**: the displayed graphical values are deleted.

> **[Options]** → **Thresholds**: (This function is not available during a measurement) Enter limits to be able to configure the ideal zone (green) of the flue gas matrix.

> **[Options]** → **CO + O2** or **CO + CO2**: choose which parameter should be assigned to the x-axis of the display matrix (O2 or CO2).

> **[Options]** → **Measurement view**: (This function is not available during a measurement) Open the measured value display menu.

6.2.3. Draught measurement

Call up function:

✓ A flue gas probe must be connected.

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

Carrying out the measurement:

ℹ	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. External micro pressure probe

The following measurements can be performed using the external micro pressure probe (0638 0330):

- **Ext-Draught**
- **Ext-Delta-P Single meas.**
- **Ext-Delta Program**
- **Ext 4Pa-Measurement** (only available if Germany country version is selected)
- **Heating Check** (only available if Germany country version is selected)

See instruction manual for external micro pressure probe.

6.2.5. Average

This function is only available when the **Italy** country version is selected.

Call up function:

✓ A flue gas probe or a multi-hole probe (0554 5762) is connected.

> [📋] → **Measurement options** → **[OK]** → **Average** → **[OK]**.

Options:

> **[Options]** → **Recalibrate**: the gas sensors are set to zero.
> **[Options]** → **Addresse/Location**: the Address/Location folder is opened.
> **[Options]** → **Fuels**: select fuel.
> **[Options]** → **Sensor detection**: once the probe has been changed, start sensor detection manually.

To calculate the average, a series of 3 measurements are carried out.

Averaging:

1. Position the flue gas probe in the centre of flow (area of the highest flue gas temperature).
2. Start measurements

> First measurement: [▶].
> Second and third measurement: **[OK]**

- The set measurement parameters, measurement period and measured values are displayed.
- A signal is sounded after 2 min (recommended measurement period)

3. End measurements: [■].

- Once the series of measurements has been carried out, the record for averaging is displayed.

> If necessary, scroll through the record: **[◄]**, **[►]**

4. **[Next]**
5. Enter checks:
   > Select criterion: **[▲]**, **[▼]**.
   > Change value: **[Edit]** → **[▲]**, **[▼]** → **[OK]**.
6. End check: **[Close]**

- The record is saved.

6.2.6. BImSchV

This function is only available when the **Germany** country version is selected.

A qA average value measurement can be carried out. For this purpose the average is determined continuously over a period of 30 s, the measuring cycle takes 1 s. The average values actually valid at the corresponding time of recording are displayed.

Call up function:

✓ A flue gas probe and a combustion air temperature probe must be connected.

> [ ] → **Measurement options** → **[OK]** → **BImSchV** → **[OK]**.
> Select the fuel → **[OK]**.

Carrying out the measurement:

1. Start the measurement series: [ ]

Wait for the balancing time, until O_2 shows a value below 20%.

2. **[Next]**.

- The qA measured values (O_2, AT, VT) are determined (30 s).
- The measurement stops automatically.
- The measured values are displayed and saved automatically in a record.

3. End measurement: **[Close]**
   or
   End measurement and call up draught measurement function: **[Draught - Measuring]**.

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]** → **Address/Location**: the Address/Location folder is opened.

6.2.7. CO undiluted

Call up function:

✓ A multi-hole probe (0554 5762) should be connected.

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

Carrying out the measurement:

1. Start measurement: [ ]

- The measured value is 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.

6.2.8. Smoke number/HCT

Calling up the function:

> **[ ]** → **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 → **[Edit]**.
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 (Data lights up).
> **[Options]** → **t308**.
- The values recorded by the smoke tester are transferred to the testo 320.

Entering the heat carrier temperature:

> **Heat carrier.** → **[Edit]** → 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.

6.2.9. 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.

6.2.10. 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.

6.2.11. O2 air

✓ An O2 dual wall clearance probe (0632 1260) must be connected.

Call up function:

> **[ ]** → **Measurement options** → **[OK]** → **O2air** → **[OK]**.

Carrying out the measurement:

1. Start measurement: **[ ]**.
- The measured value is 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.

6.2.12. Gas flow rate

The function is only available if the chosen fuel is a gas.

Call up function:

> **[ ]** → **Measurement options** → **[OK]** → **Flowrate** → **[OK]**.

Carrying out the measurement:

1. Make a note of the gas meter value.
2. Start measurement: **[ ]**.
3. When the adjusted gas flow is reached: **[ ]**.
- The calculated gas flow rate and the gas burner capacity (in kW) are displayed.

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]** → **Enter Gas Flow**: set the gas flow value.
> **[Options]** → **Enter heating value**: heating value can be set.
> **[Options]** → **Units setting**: the unit for gas flow, heating value, duration and GasPgr can be changed.

6.2.13. Oil flow

The function is only available if the chosen fuel is an oil.

Calling up the function:

> [ ] → **Measurements** → **[OK]** → **Oil Flow** → **[OK]**.

Performing the measurement:

1. Select the parameters **Oil Flow** (of the oil nozzle) and **Oil Pressure** (no effect on calculation): **[▲]**, **[▼]** → **[Edit]**.
2. Enter values. **[▲]**, **[▼]** and partly **[◄]**, **[►]**→ **[OK]**.

- The calculated oil burner capacity (in kW) is displayed.

Options:

> **[Options]** → **Clipboard**: Data are saved to the clipboard
> **[Options]** → **Delete clipboard**: Any data saved to the clipboard is deleted.
> **[Options]** → **Save**: The readings are saved in a protocol.
> **[Options]** → **Unit settings**: The unit for the oil flow can be changed (**kg/h > gal/h** or **gal/h > kg/h**).

6.2.14. Ambient CO

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

✓ A flue gas probe must be connected.

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

6.2.15. CO2 ambient

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

✓ An ambient CO2 probe (0632 1240) must be connected.

In order to obtain correct measured values, it is imperative to enter the prevailing absolute pressure. This can be entered directly (**Pressure absolute**), or it is automatically calculated when entering **Altitude** and barometric pressure (**Barometric pressure**).

Call up function:

> [ ] → **Measurement options** → **[OK]** → **AmbCO2** → **[OK]**.

Carrying out the measurement:

1. Select parameter → **[Edit]**.

2. Enter values. [▲], [▼] and in some cases [◄], [►] → [OK].
3. Start measurement: [ ].
4. End measurement: [ ].

- The ambient CO2 value is displayed.

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] → Alarm limit: the alarm limits menu is opened.
> [Options] → Edit: values for adjustable parameters can be edited.
> [Options] → Measurement view: (This function is not available during a measurement) The measured value display menu is opened.

6.2.16. Leak detection

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

During gas leak detection, no measurement is carried out, but gas detection is performed.

✓ A gas leak probe (0632 3330) must be connected.

You must also refer to the documentation that comes with the gas leak probe.

Call up function:

> [ ] → Measurement options → [OK] → Gas leak detection → [OK].

Carrying out detection:

> Set the gas type to be detected and perform gas leak testing by following the instructions described in the documentation of the gas leak probe.

1. Start detection: [ ].

- The gas concentration is displayed, and if it exceeds the limit, an alarm signal will sound.

Options:

> [Options] → Save: the readings are saved in a record.
> [Options] → Alarm limit: (this function is not available during a measurement) Adjusting alarm limits.

> **[Options]** → **Alarm signal**: (this function is not available during a measurement) Disable/enable alarm signal.
> **[Options]** → **Zeroing probe**: perform zeroing.
> **[Options]** → **Sensor detection**: newly inserted sensor is detected.

2. End detection: **[ ]**.

6.3. Transferring data

6.3.1. Report printer

To be able to transmit data via infrared or Bluetooth interface to a Testo report printer, the printer to be used must have been activated, see Printer, page 40.

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

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 / Pocket PC

Data transfer to a PC can take place via USB, IrDA or Bluetooth®.

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.

Use distilled water, or alternatively mild solvents such as isopropanol to clean the flue gas analyzer. If using isopropanol, please refer to the instruction leaflet for the product. Isopropanol fumes have a slight narcotic effect, and typically cause irritation of the eyes and sensitive mucous membranes. When using it, please ensure that there is adequate ventilation.

Do not store any objects that have come into contact with solvents and/or degreasers (e.g. isopropanol) in the case. Evaporating or leaking solvents and/or degreasers may cause damage to the instrument and to the sensors.

The use of strong or harsh alcohol or brake cleaner can result in damage to the instrument.

7.2. Replacing the rechargeable battery

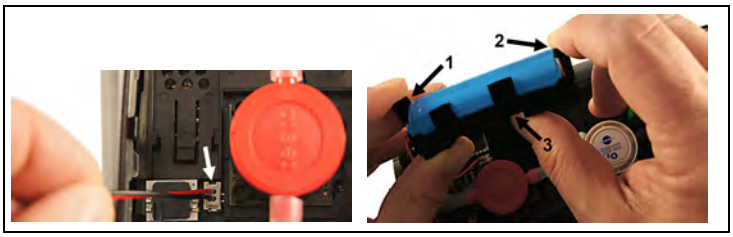
✓ The measuring instrument must not be connected to a mains socket via the mains unit. The instrument must be switched off.

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°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°C, recharge completely before use).

7.4. Replacing sensors

✓ The measuring instrument must be switched off.

✓ No power supply unit must be plugged in.

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.
8. Switch on the measuring instrument.

After replacing an O2 sensor, wait for an equalisation period of 15 min to elapse before using the instrument again. (Production of the supply voltage and initial stabilization phase for new sensors.)

When retrofitting a sensor, the associated measurement parameter and unit must be enabled, see Sensor settings, page **42.**

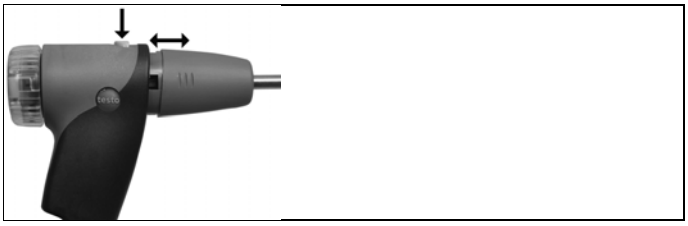
7.5. Recalibrating/adjusting sensors

See Recalibration/adjustment, page **43.**

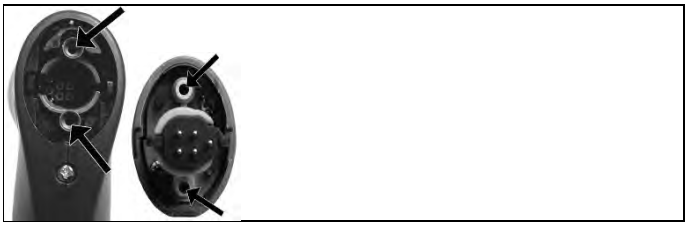
7.6. Modular flue gas probe

7.6.1. Cleaning the flue gas ducts

✓ Disconnect the flue gas probe from the measuring instrument.



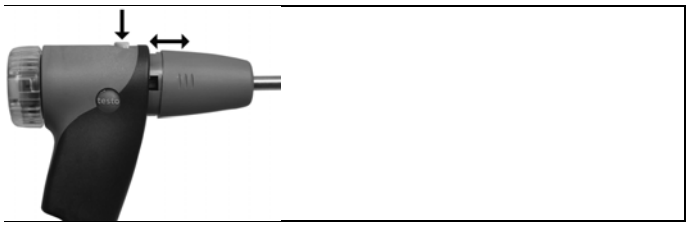
1. Release the probe catch by pressing the key on the probe handle and remove the probe module.



2. Blow compressed air through the flue gas ducts in probe module and probe handle (see illustration). Do not use a brush!
3. Fit a new probe module on the handle and engage in place.

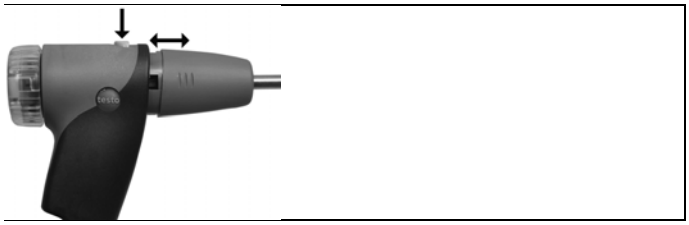
7.6.2. Replacing the probe module

✓ Disconnect the flue gas probe from the measuring instrument.

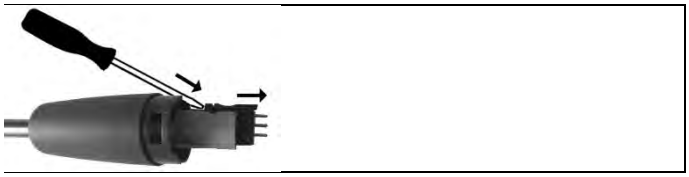


1. Press the key on the top of the probe handle and remove the probe module.
2. Plug in the new probe module and engage it in place.

7.6.3. Replacing the thermocouple



1. Release the probe catch by pressing the key on the probe handle and remove the probe module.



2. Remove the thermocouple plug-in head from the socket using a screwdriver and pull the thermocouple out of the probe shaft.
3. Keep inserting the new thermocouple into the probe shaft until the connection head clicks into place.
4. Fit a new probe module on the handle and engage in place.

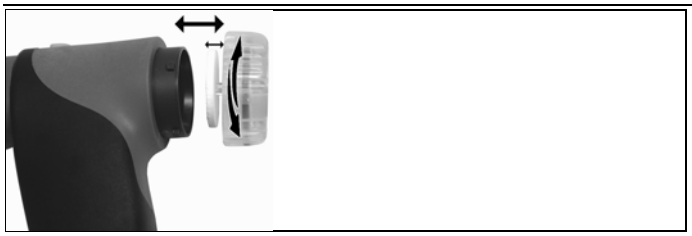
7.6.4. Checking the particle filter

> Check the particle filter of the modular flue gas probe regularly for contamination: check visually by looking through the window of the filter chamber.

  Replace the filter if there are signs of contamination.

7.6.5. Replacing the particle filter:

The filter chamber may contain condensate.

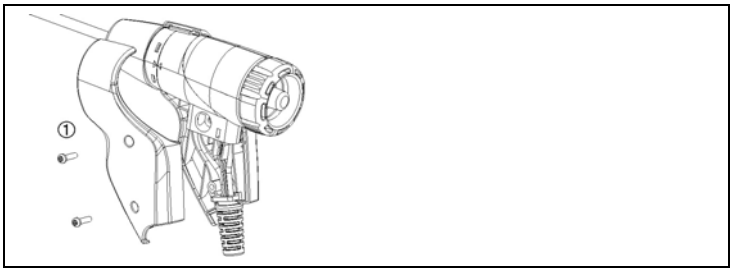


1. Open the filter chamber: turn slightly anti-clockwise.
2. Remove the filter cartridge and replace it with a new one (0554 3385).
3. Attach the filter chamber and lock it: turn slightly clockwise.

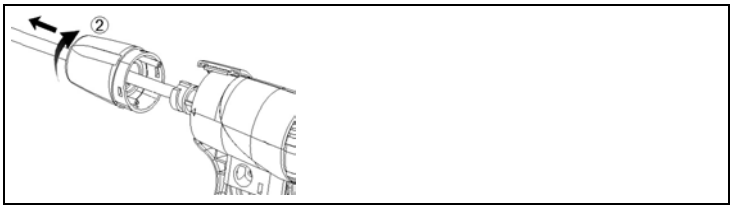
7.7. Compact flue gas probe

7.7.1. Cleaning the probe shaft

✓ Disconnect the flue gas probe from the measuring instrument.



1. Loosen and remove halfshell handles (1).

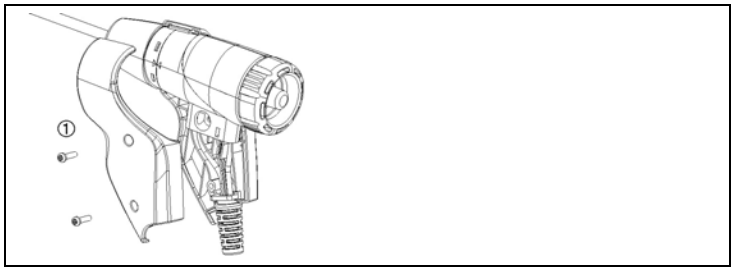


2. Turn the sealing cap (2) clockwise as far as it will go and remove probe shaft.
3. Blow compressed air through the probe shaft.

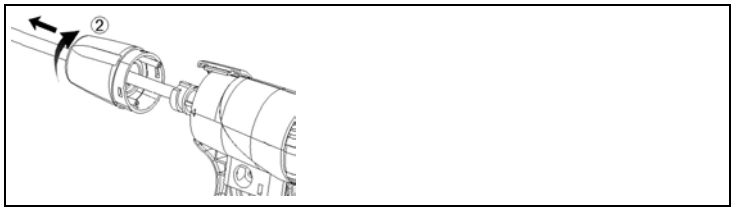
4. Replace the probe shaft and lock the sealing cap (2) by tightening it anti-clockwise (as far as it will go, observe markings).
5. Replace halfshell handles and secure with screws.

7.7.2. Replacing the thermocouple

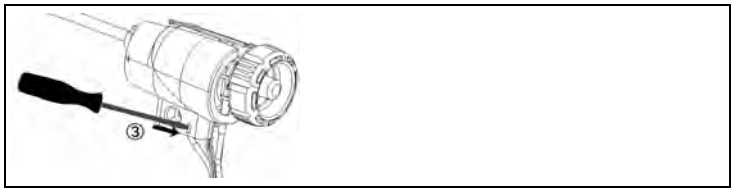
✓ Disconnect the flue gas probe from the measuring instrument.



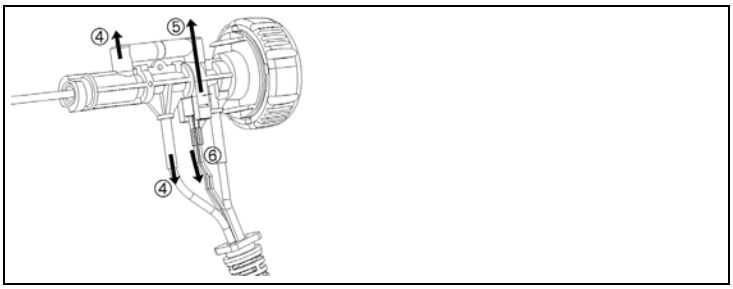
1. Loosen and remove halfshell handles (1).



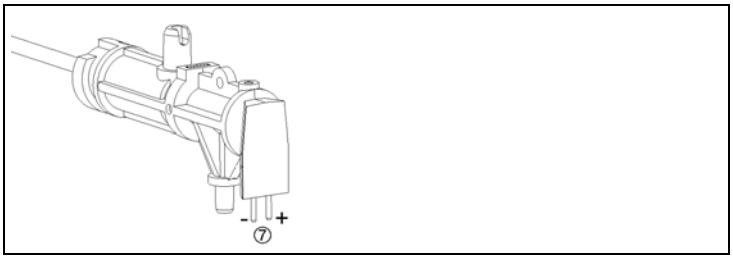
2. Turn the sealing cap (2) clockwise as far as it will go and remove probe shaft.



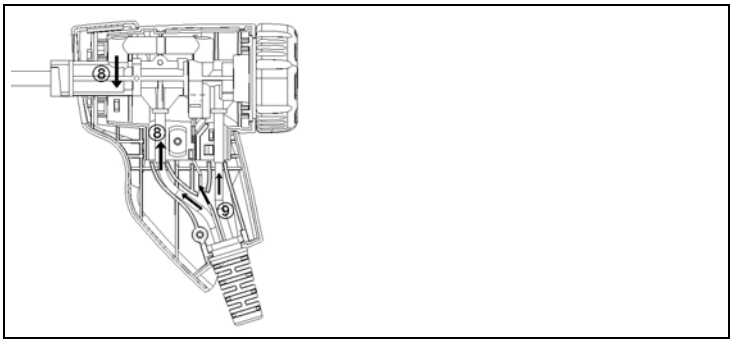
3. Release halfshell elements (3) and remove.



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



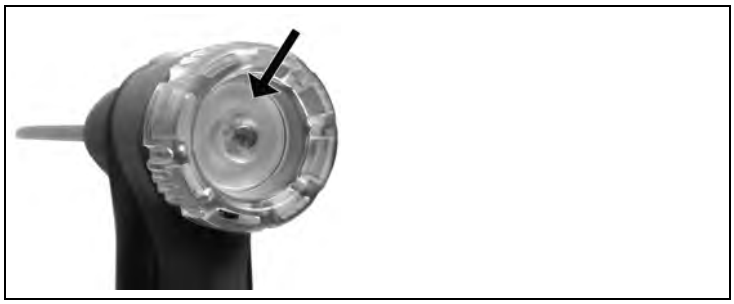
5. Connect cables to the new thermocouple (white -, green +) (7) and push the thermocouple back into the holder.



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.

7.7.3. Checking the particle filter

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

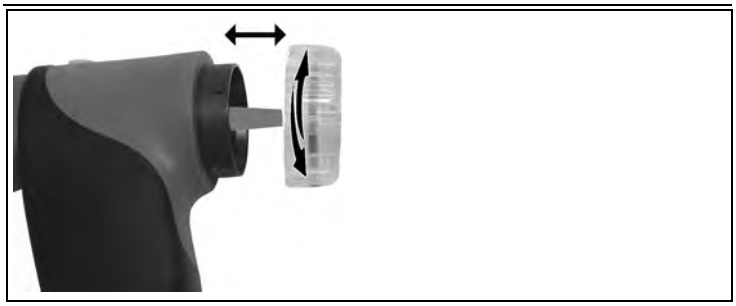


> Carry out a visual inspection through the window in the filter chamber.

- Replace the filter if there are any signs of contamination.

7.7.4. 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.

7.8. Condensate container

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

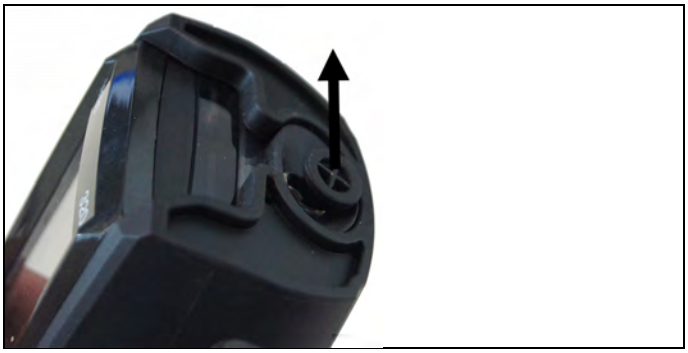
Draining the condensate container

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**	• With printer 0554 0543: Bluetooth interface not enabled. • Wrong printer enabled. • Printer switched off. • Printer outside wireless transmission range. > Enable Bluetooth interface, see Bluetooth®, page **40.** > Enable printer to be used. > Switch on printer. > Move printer into wireless transmission range.

8.2. Accessories and spare parts

Printer

Description	Article no.
Infrared high-speed printer	0554 0549

Description	Article no.
Bluetooth® /IRDA printer, incl. Mains unit 5 V / 1.0 A with micro USB cable	0554 0620
Mains unit 5 V / 1.0 A with micro USB cable	0554 1105
Spare thermal paper for printer (6 rolls)	0554 0568

Modular flue gas probes

Description	Article no.
Modular flue gas probe 180mm, 500 °C, thermocouple 0.5 mm, probe shaft diameter: 8 mm	0600 9760
Modular flue gas probe 300 mm, 500 °C, thermocouple 0.5 mm, probe shaft diameter: 8 mm	0600 9761
Modular flue gas probe 180mm, 500 °C, thermocouple 0.5 mm, probe shaft diameter: 6 mm	0600 9762
Modular flue gas probe 300 mm, 500 °C, thermocouple 0.5 mm, probe shaft diameter: 6 mm	0600 9763
Flexible modular 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 9770

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

Probe modules/accessories for modular flue gas probes

Description	Article no.
Probe shaft module 180mm, 500°C, thermocouple 0.5mm, probe shaft diameter: 8 mm	0554 9760
Probe shaft module 300mm, 500°C, thermocouple 0.5mm, probe shaft diameter: 8 mm	0554 9761
Probe shaft module 180mm, 500°C, thermocouple 0.5mm, probe shaft diameter: 6 mm	0554 9762
Probe shaft module 300mm, 500°C, thermocouple 0.5mm, probe shaft diameter: 6 mm	0554 9763
Probe shaft module 300 mm, 1000°C, thermocouple 1.0 mm, probe shaft diameter: 6 mm	0554 8764
Probe shaft module 700mm, 1000°C, thermocouple 1.0 mm, probe shaft diameter: 6 mm	0554 8765
Spare thermocouple for module 0554 9760, 0554 9762	0430 9760
Spare thermocouple for module 0554 9761, 0554 9763	0430 9761
Spare thermocouple for module 0554 8764	0430 8764
Spare thermocouple for module 0554 8765	0430 8765
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
Particle filter for modular flue gas probe, 10 pieces	0554 3385

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, 300mm	0600 9791
Combustion air temperature probe, 190mm	0600 9787
Combustion air temperature probe, 60mm	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 leak probe	0632 3330
Ambient CO probe	0632 3331
CO2 ambient probe (without connecting cable)	0632 1240
Connecting cable for CO2 ambient probe, 1.5 m	0430 0143
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
CO sensor H2-compensated	0393 0105
COlow sensor	0393 0103

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
Readout adapter for automatic furnaces	0554 1206
Connecting cable instrument / PC	0449 0047
Easyheat (PC configuration software)	0554 3332
Draught set	0554 3150
External micro pressure probe	0638 0330
Set of capillary hoses	0554 1215
Solid fuel measurement module with adapter and probe shaft with sintered filter	0600 9765
Sintered filter for solid fuel measurement probe shaft	0133 0035
Filter material for condensate trap on solid fuel measurement adapter	0133 0012
Adhesive kits (x50) for printouts, paper barcode labels etc.	0554 0116
Straight Pitot tube	0635 2050
ISO Calibration Certificate Flue Gas	0520 0003

8.3. Updating the instrument software

(registration required).

> Unplug the micro USB cable and switch off the flue gas analyzer.

1. Hold down **[▲]**.
2. Reconnect the micro USB mains cable to the flue gas analyzer, continue holding down **[▲]**.

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

3. Release **[▲]**.

- Your PC recognises the flue gas analyzer as a removable medium.

4. Copy the new file (ap320rel.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 flue gas analyzer.