testo 350 · Flue gas analyzer

Instruction manual

1 Contents

2 Safety and the environment

2.1. About this document

This document describes the product testo 350 with the device setting **Country version** | **Great Britain**.

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.
Menu	Elements of the instrument, the instrument displays or the program interface.
[OK]	Control keys of the instrument or buttons of the program interface.
... | ...	Functions/paths within a menu.
"..."	Example entries

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.

> 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 objects to be measured or the measurement environment may also pose risks: Note the safety regulations valid in your area when performing the measurements.

Safety related symbols on the instrument

Representation	Explanation
	If the product is not used in strict compliance with this documentation, the intended protection may be impaired. > Operate the product only as described in this documentation. > Please consult your dealer or the manufacturer if in doubt.

> When carrying out any measurement, please observe the relevant lower explosion limit (LEL) of carbon monoxide, methane, propane, butane, etc.

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 in aeroplanes and hospitals, among others. For this reason the following points must be ensured before entering:

> Switch off the instrument (control unit and meas. box).

> Disconnect control unit and meas. box from all external power sources (mains cable, external rech. batts., ...).

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 350 is a portable flue gas analyser for professional flue gas analysis. The instrument consists of the Control Unit (control unit for displaying readings and controlling the meas. box) and the meas. box (measuring instrument). Plug-type contacts, databus cable or Bluetooth® (option) are used to connect the Control Unit to the meas. box.

The testo 350 has been designed for the following tasks / applications:

- Service / adjustment of industrial furnace systems (processing plants, power plants)
- Emission control and inspection of compliance with emission guidelines
- Service / commissioning of burners / boilers in industrial areas
- Measurements on gas turbines / stationary industrial engines

testo 350 must not be used:

- for continuous measurements
- as a safety (alarm) device
- to measure combustion gases (before the actual combustion process)

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

3.2. Technical data

3.2.1. Examinations and licenses

As declared in the certificate of conformity, this product complies with Directive 2004/108/EC.

This product is TÜV approved.

3.2.2. Bluetooth® module (option)

- Bluetooth® type: BlueGiga WT 11 / WT 11i-A (as of October 2013)
- Bluetooth® product note: WT 11
- Bluetooth® identification: B017401 (WT 11) / B017633 (WT11i-A)

- Bluetooth® company: 10274

Certification

EU countries

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

EFTA countries

Iceland, Liechtenstein, Norway, Switzerland

Other countries

USA, Canada, Turkey, Colombia, El Salvador, Ukraine, Venezuela, Ecuador, Japan, Australia, New Zealand, Mexico, Bolivia, Dominican Republic, Peru, Chile, Cuba, Costa Rica, Nicaragua, Korea

Information of the FCC (Federal Communications Commission)

Contains FCC ID: QOQWT11 / QOQWT11IA (as of October 2013)

- Section 15.19 Labelling requirements
- This device fulfils part 15 of the FCC-directives
- Commissioning is subject to the two following conditions:
  1 this instrument must not cause any dangerous interferences and
  2 this instrument must be able to cope with interferences, even if these have undesired effects on operation.

Changes

The FCC demands that the user is to be informed that with any changes and modifications to the device, which have not been explicitly approved by testo AG, the right of the user to use this device will become null and void.

3.2.3. Declaration of Conformity

EG-Konformitätserklärung / ***EC declaration of conformity***

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

Testo 350 Analysebox / *analyzer box*
Testo 350 Control Unit / *control unit*

Best. Nr.: / Order No.:
0632 3510 Analysebox / analyzer box
0632 3511 Control Unit / control unit

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

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

Zur Beurteilung der Erzeugnisse hinsichtlich elektromagnetischer Verträglichkeit wurden folgende Normen herangezogen:

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

Störaussendung / *Pertubing radiation*: EN 50270:2000-01 (Typ2)
Störfestigkeit: / *Pertubing resistance*: EN 50270:2000-01 (Typ2)

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

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

ISO 9001 TESTO QUALITY certified

Der Hersteller betreibt ein zertifiziertes Qualitätssicherungssystem nach DIN ISO 9001

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

abgegeben durch / *by:*

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

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

Lenzkirch, 06.04.2011
(Ort, Datum / *place, date*)

(Rechtsgültige Unterschrift / *Legally valid signature*)

3.2.4. Measurement ranges and resolution

Analysis box

Measurement parameter	Measurement range	Resolution
O_2	0…25vol.%	0.01vol.%
CO, H_2-comp.	0…10000ppm	1ppm
CO_{low}, H_2-comp.	0...500ppm	0.1ppm
NO	0...4000ppm	1ppm
NO_{low}	0...300ppm	0.1ppm
NO_2	0...500ppm	0.1ppm
SO_2	0...5000ppm	1ppm
H_2S	0...300ppm	0.1ppm
CO_2-(IR)	0...50vol.%	0.01Vol.% (0…25Vol.%) 0.1Vol.% (> 25Vol.%)
CxHy [1, 2]	Natural gas: 100…40000ppm Propane: 100…21000ppm Butane: 100…18000ppm	 10ppm 10ppm 10ppm
Differential pressure 1	-40…40hPa	0.01hPa
Differential pressure 2	-200…200hPa	0.1hPa
NTC (permanently installed)	-20 to 50°C	0.1°C
Abs. Press., optionally when IR sensor is installed	600…1150hPa	1hPa
Flow velocity	0…40m/s	0.1m/s
Type K (NiCr-Ni)	-200 to 1370°C	0.1°C
Type S (Pt10Rh-Pt)	0 to 1760°C	0,1°C

[1] Detection limit: 50ppm
[2] Strict compliance with the lower explosion limit is mandatory.

3.2.5. Accuracy and response time

Analysis box

Measurement parameter	Accuracy	Response time
O_2	±0.2Vol.%	< 20s (t95)
CO, H_2-comp.	±10ppm (0…199ppm) ±5% of reading (200…2000ppm) ±10% of reading (rest of range)	< 40s (t90)
CO_{low}, H_2-comp.	±2ppm (0…39.9ppm CO) ±5% of reading (rest of range)	< 40s (t90)
NO	±5ppm (0…99ppm) ±5% of reading (100…1999.9ppm) ±10% of reading (rest of range)	< 30s (t90)
NO_{low}	±2ppm (0…39.9ppm) ±5% of reading (rest of range)	< 30s (t90)
NO_2	±5ppm (0…99.9ppm) ±5% of reading (rest of range)	< 40s (t90)
SO_2	±5ppm (0…99ppm) ±5% of reading (100…1999ppm) ±10% of reading (rest of range)	< 30s (t90)
H_2S	±2ppm (0…39.9ppm) ±5% of reading (rest of range)	< 35s (t90)
CO_2-(IR)	±0.3Vol.% ±1% of reading (0…25Vol.%) ±0.5Vol.% ±1.5% of reading (rest of range)	< 10s (t90) heat-up time: < 15min
CxHy	±400ppm (100…4000ppm) ±10% of reading (rest of range)	< 40s (t90)
Differential pressure 1	±0.03hPa (-2.99…2.99hPa) ±1.5% of reading (rest of range)	-
Differential pressure 2	±0.5hPa (-49.9…49.9hPa) ±1.5% of reading (rest of range)	-
Absolute pressure	±10hPa	-

Measurement parameter	Accuracy	Response time
Type K (NiCr-Ni)	±0.4°C (-100 to 200°C) ±1°C (rest of range)	-
Type S (Pt10Rh-Pt)	±1°C (0 to 1760°C)	-
Combustion air (VT) via permanently installed NTC	±0.2°C (-10…50°C) ±3°C Offset	-

3.2.6. Measurement range extension for individual slot (option)

Measurement parameter	Max. measuring range with highest dilution factor 40	Accuracy [3]	Resolution
CO, H_2-comp.	0…400000ppm	±2% of reading	1 ppm
CO_{low}, H_2-comp.	0…20000ppm	±2% of reading	0.1ppm
SO_2	0…200000ppm	±2% of reading	1 ppm
NO_{low}	0…12000ppm	±2% of reading	0.1ppm
NO	0…160000ppm	±2% of reading	1 ppm
CxHy [4, 5]	Natural gas: 100…40000ppm Propane: 100…21000ppm Butane: 100…18000ppm	±2% of reading	 10 ppm 10 ppm 10 ppm

Dilution stages: x2, x5,x10, x20, x40

[3] The additional measuring inaccuracy, that needs to be added to the measuring inaccuracy without dilution, is specified.
[4] Detection limit: 50ppm
[5] Strict compliance with the lower explosion limit is mandatory.

3.2.7. Fresh air valve (option)

Dilution of all sensors, dilution factor 5

Measurement parameter	Measurement range	Accuracy [6, 7]
O_2	The reading does not appear in the display.	-
CO, H_2-comp.	2500…50000ppm	±5% of reading (-150…0hPa)
CO_{low}, H_2-comp.	500…2500ppm	±5% of reading (-100…0hPa)
NO_2	500…2500ppm	±5% of reading (-50…0hPa)
SO_2	500…25000ppm	±5% of reading (-100…0hPa)
NO_{low}	300…1500ppm	±5% of reading (-150…0hPa)
NO	1500…20000ppm	±5% of reading (-100…0hPa)
H_2S	200…1500ppm	±5% of reading (-100…0hPa)
CxHy [8, 9]	The reading does not appear in the display	-
CO_2-(IR)	The reading does not appear in the display.	-

[6] The additional measuring inaccuracy, that needs to be added to the measuring inaccuracy without dilution, is specified.
[7] Accuracy data are valid within the specified pressure range (pressure on probe tip).
[8] Detection limit: 50ppm
[9] Strict compliance with the lower explosion limit is mandatory.

3.2.8. Other instrument data

Flue gas analyser

Feature	Values
Ambient temperature	-5°C…45°C short-term (max. 5min.): up to 80°C by radiated heat (e.g. heat radiation from a hot exhaust channel)
Ambient pressure	600…1100mbar (abs.)
Ambient humidity	5…95%rF
Storage and transport temperature	-20 to 50°C
Degree of protection	IP40
Warranty	Flue gas analyser: 24 months (excluding wear parts) CO-, CO_{low}- ,NO_{low}-, SO_2, H_2S-, CxHy - sensor: 12 months O_2 sensor 18 months NO sensor: 12 months CO_2-(IR) sensor: 24 months Flue gas probe: 24 months Thermocouple: 12 months Rech. battery: 12 months
Terms of warranty	Terms of warranty: see website www.testo.com/warranty

Control unit

Feature	Values
Power supply	• Li-ion rech. batt. • Meas. box • Mains adapter
Battery charge time	7h (via mains adapter) 14h (via CAN interface)
Rech. batt. service life	approx. 5h (display switched on, Bluetooth® deactivated)
Memory	250,000 readings

Feature	Values
Housing material	PC, TPE
Weight	440g
Display	Graphic colour display, 240 x 320 pixels
Dimensions	88 x 38 x 220mm

Analysis box

Feature	Values
Power supply	via rech. batt. Li-ion rech. batt. via internal mains unit: 100V AC/0.45A - 240V AC/ 0.2A (50-60Hz) via DC-input (option) 11V…40V DC/ 1 - 4A
Battery charge time	<6h
Battery operation time	2.5h (with gas cooler and IR module) / 4.5h (without gas cooler and IR module)
Dimensions	330 x 128 x 438mm
Housing	ABS URL 94V0
Weight	4800g (completely assembled)
Memory	250000 readings
Flue gas overpressure	max 50hPa
Underpressure	max. 300hPa
Pump volumetric flow rate	1 l/min (controlled), standard litre ±0.1l/min
Hose length	max. 16.2m (corresponds to five probe hose extensions)
Diluting gas	Fresh air or nitrogen
Flue gas dust load	max. 20g/m³
Humidity load	max. 70°Ctd at measuring input
USB interface	USB 2.0
Trigger input	Voltage: 5...12V (falling or rising flank) Pulse width: >1 s Load: 5V/max. 5mA, 12V/max. 40mA
Bluetooth® option	Class1 module (reach <100m in open field)

4 Product description

4.1. Control Unit

4.1.1. Overview

1 IrDA interface
2 Switch On / Off

3 Magnetic holder (on rear)

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!

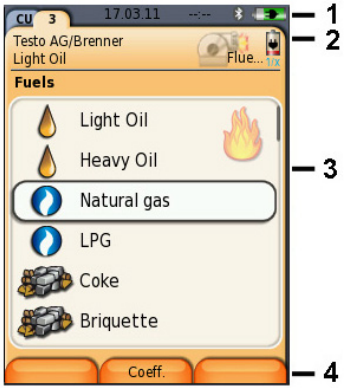
> Keep a safe distance away from products which could be damaged by the effects of magnetism (e.g. monitors, computers or credit cards).

4 Display
5 Keyboard
6 Contact bar for meas. box (on rear)
7 Interfaces: USB 2.0, charger, Testo Data bus

4.1.2. Keyboard

Key	Functions
[⏻]	Switch measuring instrument on / off
[OK] Example	Function key (orange, 3x), relevant function is shown on the display
[▲]	Scroll up, increase value
[▼]	Scroll down, reduce value
[esc]	Back, cancel function
[📋]	Open main menu
[i]	Open menu **Instrument diagnosis**

4.1.3. Display



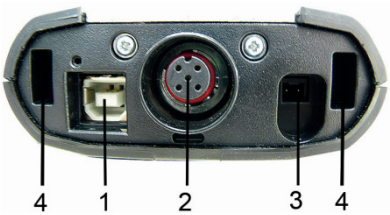
1 Status bar (dark grey background):

- Display of date and time (valid for control unit and meas. box).
- Display of Bluetooth® status, power supply and remaining rech. batt. capacity (valid for control unit):

Icon	Feature
	- Blue background / white symbol = Bluetooth® on, no Bluetooth® connection to the analyzer unit. - Grey background / white symbol = Bluetooth® off - Blue background / green symbol = Bluetooth® connection to meas. box up and running
	Battery operation Indication of remaining capacity of the rech. batt. by colour and filling degree of the battery symbol (green = 20-100%, red = < 20%)
	Mains operation Indication of remaining capacity of rech. batt: see above

2 Tabs and tab info field:
   - Tabs: Display of measuring system components (CU = Control Unit, 2, 3, ... = meas. boxes, analog output box) connected to the Control Unit.
     The tabs provide access to the individual components.
     Warning symbol: ⚠
     - Red frame, red symbol / white background:
       Display of instrument errors in the instrument diagnosis menu, otherwise: Instrument designation.
     - Black frame, black symbol / yellow background:
       Information message (symbol is displayed alternately with the instrument designation).
     - Yellow frame, yellow symbol / red background:
       Warning (symbol is displayed alternately with the instrument designation).
   - Information field on tab (only in the tabs of meas. boxes):
     Indication of selected folder/location, selected fuel, chosen application, status of power supply and remaining rech. batt. capacity (valid for meas. box, symbols like for display of Control Unit, see above), set dilution factor.
3 Selection field for functions (chosen function appears against a white background, unavailable functions are identified by grey characters) or display of measuring values.
4 Function display for function keys.

4.1.4. Connections / interfaces



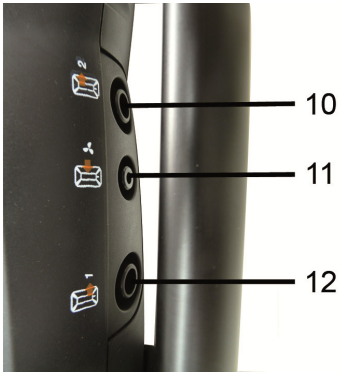
1 USB 2.0
2 Testo Data bus
3 Connecting socket for mains unit 0554 1096
4 Guide groove for locking with meas. box

4.1.5. Menu guidance for control unit

Main menu	Menu	Description
Measurement records	-	Display of saved measurement records
Device settings	**Date/Time**	Set date, time, time format:
	Power Options	Automatic instrument shut-down on / off Display backlight in battery operation on / off
	Display brightness	Set display brightness
	Printer	Select printer, enter print text
	Bluetooth® (option)	Bluetooth® on / off
	Language	Set instrument language
	Country version	Set country version
	Password protection	Change password
	Data bus	Display of bus address, enter bus rate
Instrument diagnosis	**Error diagnosis**	Display of present errors
	Device information	Display of device information
Search for boxes	-	Set up connection to meas. boxes

4.2. Meas. box

4.2.1. Overview



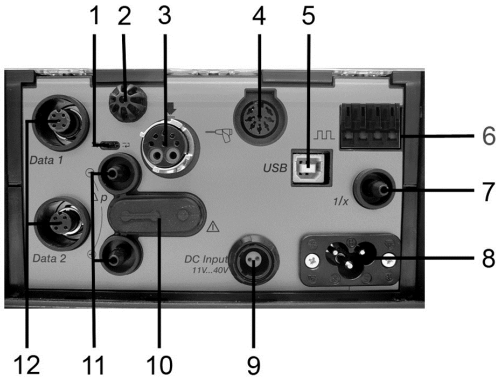
1 Condensate trap and condensate container,
2 Locking/unlocking button for Control Unit
3 Measuring gas particle filter
4 Filter fresh air inlet (option: fresh air valve / measurement range extension overall (5x))
5 Contact bar for connection to Control Unit
6 Guide pins for locking with Control Unit
7 Diluting gas filter
8 Status display
9 Full-view slider for marking/identification
10 Gas outlet 1
11 Fresh air inlet
12 Gas outlet 2

4.2.2. Status display

The status display shows the operating status of the meas. box:

Display	Status
green / permanent (meas. box switched on)	Operating status
red / flashing (meas. box switched on)	• Rech. batt. operation / residual rech. batt. capacity < 20% • other device error
green / flashing (meas. box switched off)	Rechargeable battery charging or trickle charging
green, red / alternately flashing	Update mode active
green, yellow alternately flashing (green is on longer)	Instrument is in the switch-on phase
yellow, green alternately flashing (yellow is on longer)	Instrument is in the switch-off phase

4.2.3. Connections / interfaces



1 Data bus termination slide switch
2 Sensor for combustion air temperature
3 Flue gas probe
4 Sensor input
5 USB 2.0
6 Trigger input
7 Dilution gas inlet for measurement range extension
8 Mains connection 100...240V AC, 50-60Hz
9 DC-voltage input 11…40V DC (option)
10 Covering cap gas channel access (only for servicing purposes)

Plugged in covering cap: Position (●—● ●) must not be changed!

11 Pressure ports p+ and p-
12 Testo Data bus

4.2.4. Functions / instrument options

Some functions are available as optional extras. The functions your meas. box is equipped with (condition as delivered) can be read on the identification plate on the bottom side of the meas. box.

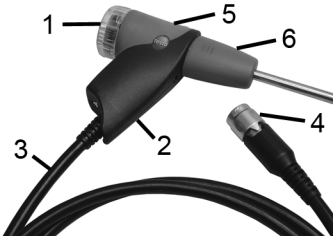
Imprint	Description
CO, NO, NO_2, SO_2, NO_{low}, CO_{low}, CxHy, H_2S, O_2, CO_2-(IR)	The sensor of the specified type is plugged in
SG	Special main gas pump for long-term measurement
1/x	Measurement range extension (individual dilution with selectable dilution factors)
DC	DC-voltage input (11…40V DC)
Δp-0	Automatic pressure zeroing for flow measurement
GP	Gas preparation, by means of reduced and constant measuring gas dew point temperature for higher measuring accuracy
	Fresh air valve for overall dilution (x5) to measure high flue gas values.
Contains Bluetooth® FCC ID: QOQWT11 / QOQWT11IA (of as October 2013) IC ID: 4620A-1 / 5123A-BGTWT11IA (of as October 2013)	Bluetooth® module

4.2.5. Menu guidance meas. box

Main menu	Menu	Description
Applications	-	Select an application in accordance with the measuring task to be performed
Folders	-	Create and manage folders and locations
Fuels	-	Select and configure fuels
Measurement records	-	Display and manage measurement records
Device settings	**Dilution**	Set the dilution factor
	Measurement view	Configure the display, set measurement parameters and units for selected application and measurement type
	Units	Set units for display variables
	Date / time	Set date, time, time format:
	Power Options	Set automatic instrument shut-down and switch off display backlight in rech. batt. operation
	Display brightness	Set display brightness
	Printer	Select printer, enter print text
	Bluetooth®	Bluetooth® on / off
	Language	Set instrument language
	Country version	Set country version (fuels, display variables, calculation formulas)
	Password protection	Change password
	Analog input	Configure analog input
	Databus	Display of bus address, enter bus rate

Main menu	Menu	Description
Sensor settings	-	Make sensor settings, perform calibration / adjustment
Programs	-	Configure and activate measuring programs
Instrument diagnosis	**Error diagnosis**	Display of present errors
	Gas path check	Perform tightness test
	Sensor diagnosis	Perform sensor diagnosis
	Device information	Display of device information

4.2.6. Modular flue gas probe



1 Removable filter chamber with window and particle filter
2 Probe handle
3 Connecting cable
4 Connector plug for measuring instrument
5 Probe module lock release
6 Probe module

5 First steps

5.1. Commissioning

Control Unit

The Control Unit has a permanently installed rechargeable battery.

> Remove the protective film from the display.

> Charge the rech. batt. fully before using the Control Unit.

Meas. box

The meas. box is supplied with a rech. batt. already fitted.

> Charge the rech. batt. fully before using the meas. box.

5.2. Getting to know the product

5.2.1. Mains unit, batteries/rechargeable batteries

In case of longer interruption of the power supply to the Control Unit (e.g. rech. batt. empty) the settings for date / time will be lost.

5.2.1.1. Recharging the rech. batt. of the Control Unit

The rech. batt. can only be charged at an ambient temperature of ±0...+35°C. If the rech. batt. had been completely discharged, the charging time at room temperature will take about 7h (charging with mains adapter) or approx. 14h (charging via Testo Data bus).

In the case of Testo data bus cables >90 m, the rechargeable battery for the control unit can no longer be charged via the Testo data bus cables when the control unit is switched off. In this case the external mains unit 0554 1096 is required in order to charge the battery.

The CU can be used without an external mains unit during operation, even with Testo data bus cables >90 m.

Charging via mains unit (Art.-No. 0554 1096)

✓ The Control Unit is switched off.

1. Connect the plug of the mains unit to the mains unit socket on the Control Unit.
2. Connect the mains plug of the mains unit to a mains socket.

- The charging process starts. The charge condition will be shown on the display.
- Once the rech. batt. has been charged the instrument will automatically change to trickle charge.

Charging via meas. box

✓ Control Unit is locked to meas. box or is connected via the Testo Data bus cable.

✓ The meas. box is supplied via the mains unit.

During operation with low charge power or in switched off state.

5.2.1.2. Charging the rech. batt. of the meas. box

The rech. batt. pack can only be charged at an ambient temperature of ±0...+35°C. If the rech. batt. has been discharged completely, the charging time at room temperature is approx. 6h.

✓ The meas. box is switched off.

> Connect mains cable to meas. box and mains socket.

- Charging will start, the fan may come on automatically. The status LEDs lights green while the rech. batt. is being charged.

5.2.1.3. Battery care

> Do not fully exhaust rechargeable batteries.

> Sore rech. batts. only in charged condition and at low temperatures, but not below 0°C.

> For longer breaks you should discharge and recharge the batteries every 3- months. Trickle charging should not exceed 2 days.

5.2.1.4. Mains operation

In case of danger the instrument must be disconnected from the electric power supply by simply pulling out the mains cable.

> Always position the instrument so that the power supply plug can be easily reached.

Control Unit

1. Connect the plug of the mains unit to the mains unit socket on the Control Unit.
2. Connect the mains plug of the mains unit to a mains socket.

- The Control Unit is powered by the mains unit.
- If the Control Unit is switched off the rech. batt. charging process will start automatically. Switching the Control Unit on has the effect of stopping battery charging and the Control Unit being powered via the mains unit.

Meas. box via internal mains unit

> Connect the mains cable to meas. box and mains socket.

- The meas. box is powered via the internal mains unit.
- If the meas. box is switched off the rech. batt. charging process will start automatically. Battery charging stops when the flue gas analyser is switched on by the Control Unit.

Meas. box via DC-voltage input DC

✓ Cable with battery terminals and adapter for connection to meas. box required (0554 1337, accessory).

- If the meas. box is switched off the rech. batt. charging process will start automatically. Battery charging stops when the flue gas analyser is switched on by the Control Unit.

5.2.2. Connecting probes / sensors

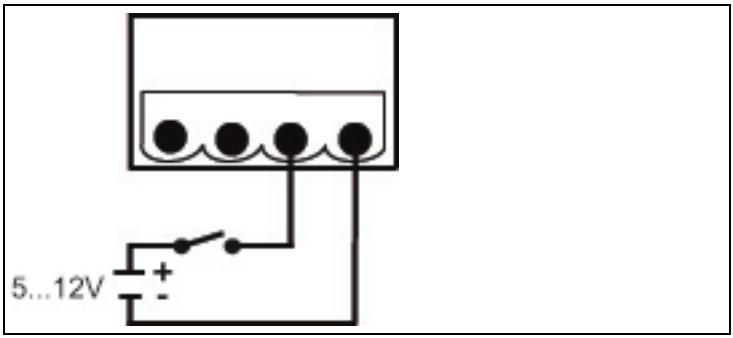
Sensor detection takes place during the activation process: Sensors that are required must always be connected before the flue gas analyser is switched on, or the flue gas analyser must be switched off and then on again after a sensor change, so that the correct sensor data can be read.

> Connect the required probes / sensors to the corresponding ports.

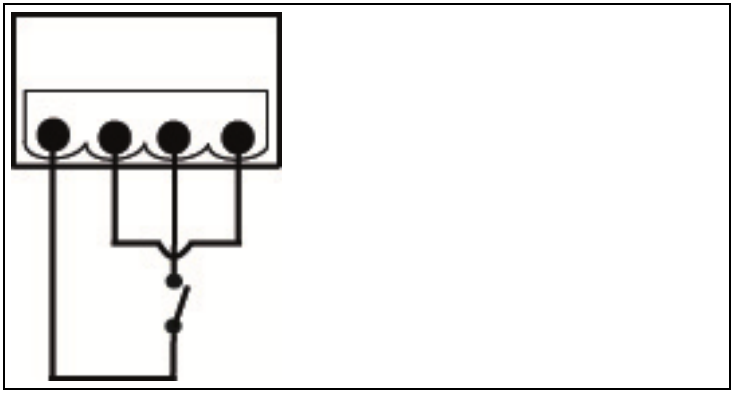
5.2.3. Occupying the trigger input

The trigger input can be used as a criterion to either start or stop (ascending or descending flank) measuring programs.

> Occupying the trigger input, with external voltage supply (5...12 V):



> Occupying the trigger input, with supply via instrument voltage (12 V):



In case of supply via instrument voltage the flue gas analyser can only be started via the trigger input from switched off state when the mains plug is plugged in.

5.2.4. Connecting system components

5.2.4.1. Connection using contact strip

The Control Unit can be plugged onto the meas. box.

1. Place the guide groove in the bottom side of the Control Unit over the guide pins of the meas. box.
2. Press the Control Unit against the meas. box until the locking/ unlocking buttons noticeably clicks into place **two times**.

To protect the display (e.g. during transport) the Control Unit can also be inserted with the back facing up, however, in this case there is no connection to the meas. box.

5.2.4.2. Connection using a Data bus cable (accessory part to a bus system)

Before connecting to a bus system, all analyzer units must first be equipped with the identical country version and firmware version.

If testo easyEmission software is connected via a control unit to measuring boxes, the number of measuring boxes must not be changed. To add new measuring boxes, end the testo easyEmission software, connect the new measuring box and restart the testo easyEmission software.

or

or

The individual components (e.g. Control Unit with meas. box or meas. box with meas. box) can be connected to a bus system using the Testo Data bus cable.

Prior to commissioning a bus system, the bus address, bus rate, application and measuring location must be configured separately in each analyzer unit.

For this, before the components are connected to a bus system, each component must be configured separately either with the control unit or the notebook/PC.

Calling up the function:

[ ] → **Device settings** → **[OK]** → **Data bus** → **[OK]**.

Bus address

The bus address of each component connected to the Testo data bus must be unambiguous. The bus address of the connected component can be changed, if necessary.

1. **Bus Address** → **[Edit]**.
2. Setting a new bus address: [▲], [▼], [◄], [►].
3. Confirm the entry: **[OK]**.

Bus rate

The relevant data rate must be selected depending on the number of connected components in a system.

- Control unit with one measuring box: **500 kbit/s**
- All other systems: **50 kbit/s**

> Select **bus rate 500 kbit/s** or **50 kbit/s**: [▲], [▼], → **[Edit]** → [📋] or **[ESC]**.

If several meas. boxes are connected with the Control Unit, only the measurement data from one meas. box can be displayed at a time, or only one meas. box can be activated respectively. This is accomplished by selecting the meas. box, see **Search for meas. boxes**, page 41.

If several meas. boxes are connected to a notebook/PC, the meas. boxers can be activated and opened parallel to each other, e.g. to display measuring channels of different meas. boxes parallel to one another.

If a notebook/PC or data bus controller (0554 0588) has several connected and enabled measuring boxes, the minimum measuring rate changes, depending on the number of measuring boxes, as follows:

Measuring boxes	Minimum measuring rate
1 to 2	1 s
3 to 4	2 s
5 to 8	3 s
9 to 16	5 s

> Connect the Data bus cable to the Data bus interfaces.

Please observe the following points when setting up a connection via Data bus cable:

- Use only Testo databis cables
- Do not route Data bus cables in the vicinity of electric power cables.
- Ensure sufficient power supply by supplying each meas. box with mains voltage.
- The cables should ideally be plugged in before the system is switched on. Connecting during operation (hot plugging) is possible, however, depending on the combination the system may need to be switched off and on again.

- The connection cannot be separated under load.
- Data bus subscribers: max. 16 meas. boxes in one Data bus system.
- Cable length: max. 100 m between Control Unit and meas. box, max. 800 m between all meas. boxes in the Data bus system.
- The bus system must have a defined electrical termination, see below.

Electrical termination of the bus system

The Data bus system is linear in structure. The Control Unit or the Testo Data bus controller with USB connection represents the beginning of the line.
The end is represented by the last components connected in the system (meas. box or analog output box). This component must have a defined electrical termination.

An analog output box is the furthest subscriber.

> Plug the Data bus termination plug into the Data bus socket on the analog output box.

A meas. box is the furthest subscriber.

> Set the Data bus terminating slide switch on the meas. box (see Connections / interfaces page 26, point 1) to switch position right ( ).

5.2.4.3. Connection via Bluetooth® (option)

or

or

Via Bluetooth® the Control Unit can be connected to a meas. box or a PC/Notebook, as long as both components are equipped with this function, see **Bluetooth®**, page 54.

5.2.5. Switching on

Before switching on

> Connect all system components.
> Connect all required probes / sensors.
> Connect all system components to the electric power supply.

When switching on the Control Unit

- should be plugged on the contact strip of the meas. box

or

- connected with a Data bus cable

or

- plugged to the mains cable of the meas. box, so that starting via Bluetooth® is enabled.

Switching on

> press [⏻].

- The Welcome Screen is displayed (approx. 5s)
- The Control Unit display screen appears.
- The Control Unit searches for connected meas. boxes and shows these as independent tabs in the display.

ℹ Control Unit and meas. box are not connected:
If the Control Unit has already been switched on, you must press [⏻] once again for a short moment to set up a connection to the meas. box.

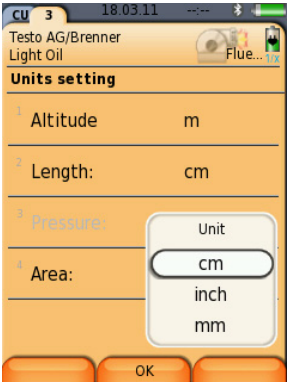
5.2.6. Calling up a function

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

5.2.7. Entering values

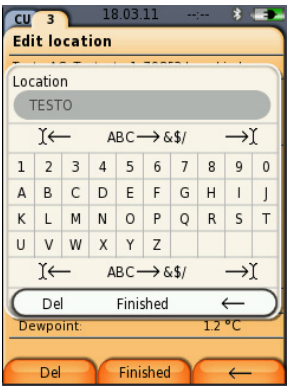
Some functions require values (numbers, units, characters) to be entered. Depending on the function that is chosen, the values are entered via either a list field or an input editor.

List field



1. Select the value to be changed (numerical value, unit): [▲], [▼], [◄], [►] (depending on the selected function).
2. Press [Change].
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 to be changed (character): **[▲]**, **[▼]**, **[◄]**, **[►]**.
2. Accept value: **[OK]**.
   Options:
   > Toggle between characters and special characters:
   Select **I⟵ ABC⟶&$/ ⟶I**: **[▲]**, **[▼]** → **[ABC⟶&$/]**.
   > Position the cursor in the text:
   Select **I⟵ ABC⟶&$/ ⟶I**: **[▲]**, **[▼]** → **[I⟵]** or **[⟶I]**.
   > Delete character after the cursor:
   Select **I⟵ ABC⟶&$/ ⟶I**: **[⟵]** or **[⟶]**→**[▼]** → **[Del]**.
   > Delete character in front of cursor:
   Select **I⟵ ABC⟶&$/ ⟶I**: **[⟵]** or **[⟶]**→**[▼]** → **[⟵]**.
3. Repeat steps 1 and 2 as required.
4. Save the entry: Select **⟵ Finished ⟶**: **[▲]**, **[▼]** → **[Finished]**.

5.2.8. Printing / saving data

Printing and saving is accomplished via the menu **Options**, which is accessed via the left function key and is available in many different menus.

Assignment of the right function key with the function **Save** or **Print**, see Assigning the right hand function key page 48.

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

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

Measure values of diluted sensors (with enabled measurement range extension) underlined on the printout.

5.2.9. Search for meas. boxes

(only available via **Control Unit** tab)

> **[ ]** → **Search for boxes** → **[OK]**.

- Meas. boxes connected via Testo Data bus: are displayed (tabs)
- Meas. boxes connected via Bluetooth®:
  - Meas. box found:
    Meas. box and Control Unit are connected automatically
  - several meas. boxes found:
    The available meas. boxes are displayed for selection

An existing Bluetooth® connection is disconnected by selecting a new meas. box from the selection field.

5.2.10. Confirming an error message

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

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

Errors which have occurred and have not yet been rectified are indicated by a warning symbol in the status bar.

Not yet rectified error messages can be displayed in the menu **Error diagnosis**, see Sensor diagnosis, page 47.

5.2.11. Switching off

Unsaved readings will be lost when the flue gas analyser is switched off.

Rinse phase

When switched off, the meas. box checks whether flue gases are still in the sensors. The sensors are rinsed with fresh air, if this should be necessary. The duration of the rinse phase depends on the gas concentration in the sensors.

> press [⏻].
- The rinse phase starts.
- The flue gas analyser switches off. It is normal for the fan of the meas. box to run on for a while.

5.3. Folders / Locations

(only available via **Meas. Box** tab)

All readings can be saved under the currently active location. Readings not yet saved are lost when the measuring instrument is switched off.

Folders and locations can be created, edited, copied and activated. Folders and locations (incl. protocols) can be deleted.

Calling up the function:

> [📁] → **Folders** → **[OK]**.

Adapting the display**:**

> Toggle between overview (display of number of locations per folder) and detailed view (display of all locations per folder): **[Overview]** or **[Details]**.

Activating a location:

> Select the location → **[OK]**.
- The location is activated and the menu **Measurement Type** is opened.

Creating a new location**:**

A location is always created in a folder.

1. Select the folder in which the location is to be created.
2. **[Options]** → **New location**→ **[OK]**.
3. Enter values or make settings.

The following inputs/settings are possible:

Parameter	Description
Location	Enter name
Application	Select application
Fuel	Select fuel
Profile	Enter diameter, length, width, height and area. For correct measurement of the volume flow you must set the profile and area. A volumetric flow rate is calculated from the geometries entered here together with the measured velocity.
Pitot Tube Factor	The parameter "Pitot tube factor" influences the measurement of flow speed, volume flow rate and mass flow. The Pitot factor depends on the type of Pitot tube used: Straight Pitot tubes: Factor = 0.67 Prandt'l Pitor tubes (bent): Factor = 1
Humidity	The parameter "Humidity" (combustion air humidity) influences the calculation of qA (flue gas loss) and flue gas dew point. The factory setting is 80.0% humidity. To achieve a higher accuracy, the values can be adjusted to the actual ambient conditions.
Pressure absolute	The absolute pressure influences the calculation of flow speed, volume flow, mass flow and flue gas dew point. The factory setting is 980mbar. To achieve a higher accuracy, the values can be adjusted to the actual ambient conditions. If a CO_2-(IR) module is installed, the absolute pressure value measured there will automatically be used.

Parameter	Description
Barometric pressure	The input of the barometric pressure and the height above sea level is only required when no absolute pressure is available (no CO_2 IR module present). The barometric pressure influences the calculation of flow speed, volume flow, mass flow and flue gas dew point. To achieve a higher accuracy, the values can be adjusted to the actual ambient conditions. This is 1013mbar as an annual average, regardless of the altitude. Depending on the current weather, this pressure can fluctuate by ±20mbar around the annual average.
Altitude	The height above sea level influences the calculation of flow speed, volume flow, mass flow and flue gas dew point. To achieve a higher accuracy, the value can be adjusted to the actual ambient conditions.
Dewpoint	The parameter "Dewpoint" (combustion air dewpoint) influences the calculation of qA (flue gas loss) and flue gas dew point. The factory setting for the dewpoint is 1.5°C. To achieve a higher accuracy, the values can be adjusted to the actual ambient conditions.

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 folder.

> **[Options]** → **Delete location**: Delete an existing location.

Create a new folder:

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

Other folder options:

- **Edit Folder**: Make changes to an existing folder.
- **Copy Folder**: Make a copy of an existing folder.
- **Delete Folder**: Delete an existing folder, including the locations created therein.
- **Delete All Folders**: Delete all existing folders, including the locations created therein.

5.4. Measurement records

Meas. box

Measurement data are always saved in a measurement record in the meas. box with which the measurement data were measured.

An overview with all created folders and locations is displayed. The measurement records saved for the corresponding locations are displayed. Measurement records can be displayed, printed, deleted and copied to the Control Unit.

Control Unit

Locations cannot be saved in the Control Unit. Measurement records saved in the meas. box can be copied to the Control Unit, e.g. to be able to transport these for evaluation by PC software, while the meas. box remains at the location.

For easy assignment the measurement records are saved under the serial number of the meas. box. The data (folders, locations, readings) contained in these records are displayed like in the meas. box.

Calling up the function:

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

> only with Control Unit tab: Choose the serial number of the meas. box → **[OK]**.

Adapting the display:

> Toggle between overview (display of number of locations per folder) and detailed view (display of all locations per folder): **[Overview]** or **[Details]**.

Display record:

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

Options

> **[Options]** → **[Delete All Records]**: The readings of all locations will be deleted.

> **[Options]** → **[Copy All Records]**: The readings of all locations will be copied.

Meas. box options

> **[Options]** → **Print Data**: Transmit data of the chosen record to a record printer.

> **[Options]** → **Copy Record**: Copy record into the record log of the Control Unit.

> **[Options]** → **Delete Record**: Delete the chosen record.

> **[Options]** → **Show Graphic**: Display saved record data as graphic.

> **[Options]** → **Number of lines**: Change the number of measuring values per display page.

> **[Options]** → **Delete All Records**: Delete all saved records for a location.

> **[Options]** → **Copy All Records**: Copy all records of a location into the record log of the Control Unit.

Control Unit options

> **[Options]** → **Delete All Records**: Delete all saved records for a location.

5.5. Instrument diagnosis

Important operating values and instrument data are displayed. A gas path check can be carried out. The status of the sensors and any device errors not yet rectified are displayed.

Calling up the function:

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

or

> **[i]**.

5.5.1. Error diagnosis

> **Error diagnosis** → **[OK]**.

- Unrectified errors, warnings and notes are displayed.
  > View next / previous error: **[▲]**, **[▼]**.

5.5.2. Gas path check

(only available via **Meas. Box** tab)

Check the flue gas analyser regularly for leaks, to ensure accurate measurements.

The leak test requires a plastic cap 0193 0039, comes with the flue gas probe).

1. **Gas path check** → **[OK]**
2. Place the plastic cap on the tip of the flue gas probe so that the openings are completely covered.

- The pump flow is displayed.
- Volumetric flow rate less than or equal to 0.04l/min: The gas paths are leak tight (traffic light in display lights green).
- Volumetric flow rate higher than 0.04l/min: The gas paths are leaking (traffic light in display lights red). Probe and meas. box must be checked for leaks.

5.5.3. Sensor diagnosis

(only available via **Meas. Box** tab)

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

- The status of the sensor is indicated by a lamp.

A sensor is able to recover. It is therefore possible that the sensor status indication changes from yellow to green or from red to yellow.

5.5.4. Instrument information

> **Device information** → **[OK]**.

- Information is displayed.

The fill level of the condensate trap is only displayed if the condensate trap is plugged onto the analyzer unit.

6 Using the product

6.1. Performing settings

6.1.1. Assigning the right hand 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, various functions are available.

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

6.1.2. Instrument settings

6.1.2.1. Dilution

(only available via tab **Meas. Box** and with the measurement range extension option)

Option dilution (for single slot with selectable dilution factors

With active dilution the measuring gas for the sensor in slot 6 is diluted with ambient air (other possibility: nitrogen gas) in a controlled manner. For this purpose, the diluting gas is drawn through a separate gas inlet by a pump and a valve operating on the principle of pulse width modulation. A filter is installed to protect the gas path against dust.

If the measurement range extension is active this is indicated by a clearly noticeable clicking of the valve. In addition the symbol 1/x appears at the right hand top of the display (in the header) and the selected dilution factor appears at the corresponding parameter (the complete line of the diluted parameter appears against a blue background).

The following dilution factors can be manually set:

Factor	Ratio of diluting gas: Measuring gas
x 1	no dilution
x 2	1 : 1
x 5	4 : 1
x 10	9 : 1
x 20	19 : 1
x 40	39 : 1
Auto dilution	4 : 1

If the dilution stage **auto-dilution** is selected, dilution (5x) is activated automatically when the set switch-off threshold of the sensor in slot 6 is reached.

- If the surrounding air contains interfering gases, push the hose onto the dilution inlet and place in a clean atmosphere.
- If gas from a gas cylinder is used, observe a max. pressure of 30hPa
- Diluting also changes the resolution of the reading display, e.g.:
  Undiluted resolution 1ppm, with factor 10 resolution 10ppm.

Calling up the function:

> [📋] → **Device settings** → **[OK]** → **Dilution** → **[OK]**

1. **Single slot** → **[Change]**
2. Set the dilution factor: [▲], [▼].
3. Confirm the entry: **[OK]**.

Option:

> Without dilution: Press **[Without]**.

Measurement range extension with fixed dilution factor (x5) for all sensors (fresh air valve option)

The selection of **to dilute all** (x5) results in the dilution of all sensors (x5). The measuring channels O_2, CO_2-(IR), CO_2, qA, Lambda, Eta and all measuring channels for flow measurements are faded out in case of dilution **to dilute all**. 1x deactivates the dilution (extension of measuring range).

It is possible to calibrate / adjust with test gas when dilution is switched on to eliminate any measuring errors caused by dilution (see Calibration / adjustment page 60).

Calling up the function:

> [ ] → **Device settings** → **[OK]** → **Dilution** → **[OK]**

1. Select **to dilute all (x5)**: [ ] → **[Change]**.
2. Select setting: **[On] / [Off]**.
3. Confirm the entry: **[OK]**.

6.1.2.2. Measurement view

(only available via **Meas. Box** tab)

The parameters / units and the display representation (number of readings displayed per display page) can be set.

The settings are only valid for the currently chosen combination of application and measurement type, which is indicated by the symbol (application) and the text (measurement type) in the info field.

Only those parameters and units that are activated in the reading display appear in the reading display, in the saved measurement records and on the record printouts. Readings not listed in the reading display are not recorded or stored either. Before carrying out measurements, set up the reading display so that the required measurement parameters and units are enabled.

Total overview of selectable parameters and units (available selection depends on the chosen application / measurement type):

Display	Measurement parameter
FT	Flue gas temperature
AT	Combustion air temperature
HCT	Heat carrier temperature
Δp	Differential pressure
Δp1	Differential pressure 1 (flue gas + m/s)
Δp2	Differential pressure 2 (flue gas + ΔP)
Draught	Flue draught
Pabs	Absolute pressure
Pump	Pumping capacity
O2	Oxygen
CO2	Carbon dioxide
CO2max	maximal carbon dioxide content

Display	Measurement parameter
Effn	Efficiency
Effg	Efficiency under due consideration of the heat value range
CO	Carbon monoxide
uCO	Carbon monoxide undiluted
AmbCO	Ambient carbon monoxide
NO	Nitrogen monoxide
NO2	Nitrogen dioxide
NOx	Nitrogen oxide
SO2	Sulphur dioxide
H2S	Hydrogen sulphide
HC	Hydrocarbon
H2	Hydrogen (this is only an indicator value and is used to compensate the cross-sensitivity)
λ	Air ratio
Smoke numberØ	Mean smoke number
Oil deposits	Oil deposits yes/no
Ratio	Poison index
Vel	Flow velocity
Volume flow	Volume flow
Dew Pt	Flue gas dew point temperature
MCO	Mass flow CO
MNOx	Mass flow NOx
MSO2	Mass flow SO_2
MH2S	Mass flow H_2S
CO2IR	Carbon dioxide IR active
MCO2IR	Mass flow CO_2-IR
AmCO2	Ambient carbon dioxide
%rH ambient	Humidity measuring value external sensor
Ul ext	external voltage
Itemp	Instrument temperature

Calling up the function:

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

Change parameter / unit in a line**:**

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

Options:

> **[Options]** → **Number of lines**: Change the number of measuring values per display page.
> **[Options]** → **Blank line**: Insert the empty line before the selected line.
> **[Options]** → **Delete line**: Delete the selected line.
> **[Options]** → **Factory setting**: Reset the readings display to factory setting.

6.1.2.3. Units

(only available via **Meas. Box** tab)

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

Calling up the function:

> [📋] → **Device settings** → **[OK]** → **Units** → **[OK]**

Adjustable units

Parameter	Unit
Altitude	m, ft
Length	cm, inch, mm
Pressure	mbar, psi, inHG, inW, hPa
Area	mm², in²
Volume	m³, l
Volume flow	m³/h, l/min
Time	sec, min

Setting the unit

1. Select the line: **[▲]**, **[▼]** → **[Change]**.
2. Select the unit: **[▲]**, **[▼]** → **[OK]**.
3. Confirm the entry: **[Finished]**

6.1.2.4. Date / time

This function is available in both the meas. box and the Control Unit. Changes are accepted for the Control unit and for the meas. box.

Date, time mode and time can be set.

Calling up the function:

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

Set date/time

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

6.1.2.5. Power options

This function is available in both the meas. box and the Control Unit. Changes are accepted by the Control Unit and the meas. box.

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

Calling up the function:

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

Making settings:

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

6.1.2.6. Display brightness

This function is available in both the meas. box and the Control Unit. Changes are accepted for the Control unit and for the meas. box.

The intensity of the display illumination can be set.

Calling up the function:

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

Performing settings

> Set parameter: **[◄]**, **[►]**→ **[OK]**.

6.1.2.7. Printer

This function is available in both the meas. box and the Control Unit. This function is available for both the Control Unit and the meas. box.

The headers (lines 1-3) and the footer 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 54.

1. **Select Printer** → **[OK]**.
2. Select the printer: **[▲]**, **[▼]** → **[OK]**.

- The printer is activated and the menu **Printer** is opened.

Setting the print text:

1. **Print text** → **[OK]**.
2. Select function: **[▲]**, **[▼]** → **[Edit]**.
3. Enter values → **[Next]**.
4. Save the entry: **[Finished]**.

6.1.2.8. Bluetooth®

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

This function is available in both the meas. box and the Control Unit. Settings only apply for the device activated at the time.

To set up a connection between Control Unit and meas. box, see Connection via Bluetooth® (option), page 37.

To set up a connection between Control Unit and Notebook/PC: Follow the operating instructions for the software and Notebook/PC used.

Calling up the function:

> [ ] → **Device settings** → **[OK]** → **Bluetooth®** → **[OK]**.

Switching Bluetooth® on / off

1. **[Change]**.
2. Select setting: [ ], [ ] → **[OK]**.
3. Confirm the entry: **[Finished]**.

6.1.2.9. Language

This function is available in both the meas. box and the Control Unit. Changes are accepted for the Control Unit and for the meas. box.

The menu language can be set. The number of available languages depends on the activated country version, see Country version, page 55.

Calling up the function:

> [ ] → **Device settings** → **[OK]** → **Language** → **[OK]**

Activate the language:

> Select the language → **[OK]**.

6.1.2.10. Country version

This function is available in both the meas. box and the Control Unit. Changes are accepted for the Control Unit and for the meas. box.

The country version can be set. The selection of the country version influences the menu languages that can be activated. Please make sure that the correct country version has been set.

By changing the country version the bases of calculation and thus the displayed measurement parameters, fuels, fuel parameters and calculation formulas may change.

Information concerning assignment table, basis of calculation and country version see www.testo.com/download-center

If several components with different country versions are connected, the components will automatically change to the country version of the Control Unit when the Control Unit is connected.

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 Password protection, page 56.

Possibly:

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

Setting the country version:

1. Select the country version: **[▲]**, **[▼]** → **[OK]**.
2. Confirm confirmation request: **Yes** → **[OK]**

- The system is restarted.

If the control unit is connected via Bluetooth to the measuring box, when the measuring box is restarted, the control unit should be used to search again for the measuring box (see **Search for meas. boxes**, page 41.)

6.1.2.11. Password protection

This function is available in both the meas. box and the Control Unit. Changes are accepted for the Control unit and for the meas. box.

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]**.

6.1.2.12. Analog input

(Only available via **Meas. Box** tab)

Power cable 0554 0007 (accessory) is required.

An analog signal is read in by an external instrument. The signal is scaled and assigned to a physical parameter. The calculated value is displayed.

> Before the flue gas analyser is started, insert power cable 0554 0007 at the measuring box probe input port.

1. Select analog signal (±1 V, ±10 V, 0…20 mA) at power cable 0554 0007.

Calling up the function:

> **[ ]** → **Device settings** → **[OK]** → **Analog input** → **[OK]**.

Configuring the analog input:

1. **Measurement parameter** → **[Edit]**.
2. Enter or set values: **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
3. Save the entry: **[Finished]**.
4. Entry of min. and max. measure value limit (**Min0V** or **Min0mA**) → **[Edit]**.
5. Enter or set values: **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
6. **[Finished]**.

6.1.2.13. Data bus

Bus address

*See Connecting system components, page **34**.*

Bus rate

*See Connecting system components, page **34**.*

6.1.3. Fuels

The fuel can be selected. Fuel-specific coefficients (such as $O_{2\ ref}$, $CO_{2\ max}$ and $SO_{2\ max}$) can be set.

Besides the already pre-configured fuels, up to 5 more fuels can be configured in a customized way (e.g. with the **testo easyEmission** software). Fuel parameter, see www.testo.com/download-center (registration required).

> In order to maintain the measuring accuracy of the instrument one must choose or configure the correct fuel.

Calling up the 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: **[Change]**.

Possibly:

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

3. Set values → **[OK]**.
4. Save changes: **[Finished]**.

6.1.4. Sensor settings

An NO_2 addition and shut-down thresholds to protect the sensors can be set.

Recommended test gas concentrations and compositions can be found in the Testo Test Gas Manual (order no. 0980 2313 version D) or in the Download Centre.

Calling up the function:

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

6.1.4.1. NO_2 addition

The NO_2 addition value can be set.

The setting of the NO_2 addition value can be password protected, see Password protection, page 56.

Calling up the function:

> [ ] → **Sensor settings** → **[OK]** → **NO2 addition** → **[Change]**.

Possibly:

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

Setting the NO_2 addition:

> Set parameter → **[OK]**.

6.1.4.2. CxHy-Sensor

The CxHy-Sensor can be activated / deactivated.

> The **CxHy-Sensor** menu under **Sensor settings** is only displayed if an CxHy sensor is connected.

This sensor is a Pellistor which always requires a certain amount of O_2 to operate (approx. 2% O_2). This sensor would be destroyed at lower values. The sensor therefore switches off at inadequate O_2 values. If it is known from the beginning that values below 2% do exist, the sensor can also be switched off manually. CxHy-Sensor **On** starts the flue gas analyser with a zeroing phase (30s).

> For proper functioning the sensor is heated up to approx. 500°C, duration: approx. 10min. This means that the sensor needs to be zeroed again 10min after the device has been switched on, in order to prevent drifting (into the "minus" range).

Calling up the function:

> **[ ] → Sensor settings → [OK] → HC-Sensor**

Switching the CxHy sensor on/off

1. **[Change]**.
2. Select setting: **[▲]**, **[▼]**
3. Confirm the entry: **[OK]**

6.1.4.3. Sensor protection

Protection limits can be set to protect the sensors against overload. The sensor protection switch-off is available for the following sensors: H_2S, NO, NO_2, CO_2-(IR), CxHy, CO, SO_2.

The sensor protection is activated if the threshold is exceeded, the measuring gas is diluted. If the threshold is exceeded again, the system will be shut down.

To deactivate sensor protection the thresholds must be set to 0ppm.

Calling up the function:

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

Setting sensor protection thresholds:

1. Select parameter: **[Edit]**
2. Set parameter → **[OK]**

   optional

   > Reset value to the factory setting: **[Default]**
3. Save changes: **[Finished]**

6.1.4.4. Calibration / adjustment

CO, SO_2, NO_2, NO, O_2, H_2S, CxHy and CO_2 (IR) sensors can be tested (calibrated) and adjusted using test gas.

Calibration/adjustment of the O_2 sensor (O_2 reference) is basically carried out in the same way as the calibration/adjustment of toxic sensors. The O_2 nominal value entered is only temporary, i.e. the nominal value will be overwritten with the ambient oxygen content (21 Vol.%) the next time the instrument is switched off/on or when another zeroing process is carried out. The same applies when a measuring program passes through a zeroing phase. The O_2 test gas must also be applied to the measurement gas inlet (as with the toxic sensors).

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

The calibration/adjustment can be carried out by the user or by a qualified service centre approved by Testo.

To ensure that specific accuracies are retained, Testo recommends testing every six months and recalibration when required.

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

The sensor protection (shut-down function) is not deactivated. The test gas concentration should therefore be lower than the set thresholds for the sensor protection.

The function of **to dilute all** (x5) is automatically deactivated.

If the instrument is fitted with an CxHy sensor, it should be switched off before test gas is applied.

If a CxHy-Sensor is fitted, switch this off before measuring test gases with O_2 contents <2%. If you forget to do this, the sensor will switch off automatically during the measuring process, but will still be strained unnecessarily.

The following boundary conditions must be met when calibrating / adjusting:

- Use absorption-free hose material.
- Select **Testgas** as fuel
- Switch on the flue gas analyser at least 20 minutes before calibration / adjustment (to warm up)
- Use clean air for gas zeroing
- Maximum overpressure of the test gas 30hPa (recommended: pressureless via bypass)
- Apply the test gas for at least 3 minutes

Recommended test gas concentrations and compositions can be found in the Test Gas Manual (Order-No. 0981 2313) or in the Download Centre.

Calling up the function:

Make sure that the ambient air us free of interfering gases (e.g. CO, NO, etc.) during zeroing!

> **[ ]** → **Sensor settings** → **[OK]** → **Calibration /Adjust** → **[OK]**.

Possibly:

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

- Gas zeroing (30s).

Perform calibration / adjustment of CO-, SO_2-, NO_2-, NO-, O_2-, H_2S-, CxHy-sensors:

WARNING

Dangerous gases

Danger of poisoning!

> Observe safety regulations / accident prevention regulations when handling test gas.

> Use test gases in well ventilated rooms only.

Application of test gas via service adapter (0554 1205) is recommended, or apply test gas directly to the probe tip to avoid possible absorptions in the gas path.

1. Select the parameter: **[▲]**, **[▼]** → **[OK]**
2. **[Change]** → Enter the test gas concentration (nominal value).
3. Apply test gas to the sensor.
4. Start calibration: **[Start]**

5. Once the actual value is stable, apply the nominal value (i.e. adjust the sensor to the nominal value) via **[Adjust]**. The values are stored in the record.

   - or -

   Carry out a comparison (calibration) between nominal and actual value via **[Calibr.]** without adjusting the sensor, and the values are stored in the record.

   - or -

   Cancel (no adjustment/calibration): **[esc]**
6. Save changes: **[Finished]**

Perform calibration / adjustment of the CO_2-(IR) sensor

Check the CO_2-(IR)-sensor with the absorption filter to obtain accurate readings. The displayed CO_2-value should be <0.03%CO_2. If the value is higher, perform calibration and gradient 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.

Application of test gas via service adapter (0554 1205) is recommended, or apply test gas directly to the probe tip to avoid possible absorptions in the gas path.

1. Select the **CO_2IR-sensor: [▲], [▼] → [OK]**
2. Connect Absorptionsfilter or apply Testgas CO2 with 0%.
3. **[◄], [►], [Yes] → [OK]**

- Stability time (300s)

4. Start meas. val. admis. manually: **[Start]**
   or
   wait for stability time: Meas.val. admis. is automatically started.

- Meas. val. admis. ends automatically.

5. **[Next]**

6. Enter the nominal gradient value: **[Change]** → **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
7. Start stability time: **[Start]**

- Stability time (300s)

8. Start meas. val. admis. manually: **[Start]**
   or
   wait for stability time: Meas.val. admis. is automatically started.

- Meas. val. admis. ends automatically.

9. Perform adjustment: **[Finished]**
   -or-
   Cancel (no adjustment): **[esc]**

6.1.4.5. ppmh counter

The current ppm/h value can be displayed for the CO, COlow, NO, NOlow sensors.

The hour meter can be reset for the NO sensor, which uses a replaceable filter for neutralizing transverse gases.

Calling up the function:

> **[]** → **Sensor settings** → **[OK]** → **ppmh counter** → **[OK]**.

- The display shows maximum, current and remaining filter lifetime.

Reset hour meter (NO sensor only)

1. **[Reset].**
2. Confirm confirmation request: **Yes** → **[OK]**

6.1.4.6. Calibration data

Use this function to display the current calibration data (comparison of nominal value and actual value without sensor adjustment).

Calling up the function:

> **[]** → **Sensor settings** → **[OK]** → **Calibration data** → **[OK]**.

Options

> **[Options]** → **[Print]**: The current calibration data of all sensors are printed out.

6.1.4.7. Adjustment data

Use this function to display the current adjustment data and the sensor status of the individual sensors.

The condition of the sensor is checked every time the sensor is adjusted. The graph view shows the last 25 adjustments.

Call up function:

> [ ] → **Sensor settings** → **[OK]** → **Adjustment data** → **[OK]**

Options

> **[Options]** → **[Print]**: the current adjustment data for all sensors is printed out.

> **[Options]** → **[Graphic]**: the status of the selected sensor is graphically displayed.

Threshold	Explanation
100%	Full capacity
70%	Reduced sensor sensitivity. Recommendation: Acquire a replacement sensor
50%	Replace sensor

6.1.4.8. Negative value

The display for negative values can be activated / deactivated.

Calling up the function:

> [ ] → **Sensor settings** → **[OK]** → **Negative values**

Switching negative values on/off

1. **[Change]**
2. Select setting: **[▲]**, **[▼]**
3. Confirm the entry: **[OK]**

6.1.5. Programs

Five flue gas measuring programs can be set, saved and executed.

The **Trigger** function (trigger signal as start/stop criterion) is only available for devices with the trigger input option.

Instrument settings cannot be changed if a program is active or running.

The program **Flue Gas (before + after cat)** checks whether the meas. box is equipped with a fresh air valve. If not, a measuring program with normal flue gas measurement will be added, instead of the program **Flue Gas (before + after cat)**. A program **Flue Gas (before + after cat)** without fresh air valve does not show any sensible measuring results.

Calling up the function:

>**[**  **]** → **Programs** → **[OK]**.

Activating / deactivating a program:

> Select the program: **[▲]**, **[▼]** → **[Enable]** or **[Disable]**.

- When activating a program: The program is activated and the measurement type matching the program is opened.

Editing the measuring program:

Adjustable parameters:

Parameter	Function
Measurement program	Edit program name
Measurement type	Select flue gas menu: • Flue gas • Flue gas + m/s • Flue gas ΔP • Flue gas (before and after catalyst) • Solid fuel

Parameter	Function
Reading per mean value	Mean value **Yes**: the measurement system saves one reading per second (measurement rate cannot be changed). At the end of the gas phase, a mean value is calculated from the individual values saved thus far and stored. Mean value **No**: when the end of the gas phase is reached, the values measured at this time are stored.
Start	Determine the start criterion •  The measuring program is started at any time (the function key automatically changes to the stop function). • Time Start of measurement at a pre-programmed time. • External signal Trigger signal to control the start of measuring programs.
Stop	Determining the stop criterion •  The measuring program is stopped at any time (the function key automatically changes to the start function) • Time The recoding of readings stops at a desired time. • External signal Trigger signal to control the stop of measuring programs. • Duration Setting cycles to save readings. • Memory full Saving readings ends when the memory is full.
Gas time	Selection of gas time cycle

Parameter	Function
Rinse time	Enter the rinse time (see **Recommendation for emission measurements over an extended** period of time, page 104). The measurement program always begins with a rinse phase (duration: 6min). Measuring phases (gas time) and rinsing phases (rinsing time) alternate according to the programmed values.
Meas. rate	The meas. rate is the saving cycle for mean values It is programmed in units of seconds, minutes, whereby the smallest possible meas. rate depends on the number and type of connected probes.

1. Select the program: [▲], [▼] → **[OK]**.
2. Press **[Change]**.
3. Press **[Change]**.
4. Edit program name: [▲], [▼], **[◄]**, **[►]**.
5. Confirm the entry: **[OK]**.
6. Repeat steps 4 and 5 as required.
7. Press **[Next]**.
8. Perform steps 4 and 7 for further criteria accordingly.
9. Press **[Finished]**.

6.2. Measuring

6.2.1. Preparing for measurement

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

The combustion air temperature (VT) is continuously measured by the temperature sensor installed in the meas. box. The fresh air required for the zeroing phase is drawn in through the exhaust if no fresh air valve (option) is installed and through the valve inlet if a fresh air valve is installed. The flue gas probe can thus already be inside the flue gas channel before or during the zeroing phase.

Exception: when using an analyzer unit with no fresh air valve and overpressure in the flue gas duct, the flue gas probe must be removed from the flue gas duct for zeroing.

The testo 350 can be operated as follows:

- lying down
- hanging horizontally down by its handle
- plugged vertically to the wall bracket by the handle

To prevent measuring errors the position of the testo 350 must not be changed during a measurement.

Under ambient temperatures of <10°C the CO_2-(IR) sensor requires a shorter heat-up time to reach full measuring accuracy. At -5°C this typically is 15min.

Before switching on

> Check whether:

- All system components are properly connected.
- All required probes / sensors are connected.
- The power supply of all system components is guaranteed.

During then zeroing phase

During the zeroing phase the sensors of the flue gas analyser are zeroed. Zero point and drift of the sensors are checked. The O_2 value is set to 21% O_2.

> Make sure that the ambient air is free of interfering gases (e.g. CO, NO) during the zeroing phase!

Before the measurement

> Set the fuel for the furnace system to be measured.
> Assign the required measurement parameters and units to a display field in the measurement view.
> Activate the location to which the readings are to be assigned.
> Make sure that the gas outlets are free, so that the gas can escape without obstruction. Otherwise the measurement results may be corrupted.

Measurements with the CxHy sensor

WARNING

Dangerous mixture of gases

Danger of explosions.

> Perform measurements only in flue gas ducts.
> Only measure gases which do not form a combustible mixture in the ambient air.

There must always be sufficient oxygen in the flue gas to prevent the CxHy sensor from being destroyed. With an O_2 content of less than 2% the CxHy sensor switches off automatically (protective function). Higher concentrations of silicones, H_2S and sulphurous hydrocarbons can also lead to the destruction of the CxHy sensor.

Zeroing takes place automatically when the CxHy sensor is activated. To ensure that accurate CxHy readings are obtained, you should then wait about 10min (with the instrument switched on) before starting another zeroing process manually.

To prevent the CxHy sensor from drifting during lengthy measurement operations, zeroing should be carried out from time to time.

6.2.2. Using the flue gas probe

Checking the thermocouple

> Make sure that the thermocouple of the flue gas probe does not touch the probe basket. Bend the thermocouple back if necessary.

Aligning the flue gas probe

> Turn the probe to align the thermocouple so that it is freely exposed to the flue gas flow.

> Align the flue gas probe in the flue gas duct so that the tip is in the hot spot (area of the highest flue gas temperature).

6.2.3. Applications

You can choose from fixed saved and a user defined application (application defined on the basis of the measuring object).

The memory contains suitable device settings for the meas. box and typical fuels and calculations for these applications. These quickly provides you with optimized device configurations for the respective measuring task and the device will automatically inform you about important application specific peculiarities (information in the display).

burner

- Fuels: **Natural gas**, **Coke oven gas**, **Town gas**, **Propane**, **Light oil**, **Diesel**, **Heavy oil**, **Briquette**, **Lignite**, **Wood Pellets**, **Coke**, **Bois**, **Wood 30%M**, **Bark 45%H**, **Bark 60%H**, **G20**, **G25**, **G30**, **Test Gas**
- Available measuring programs: **Flue Gas**, **Flue Gas + m/s**, **Flue Gas + ΔP**, **Program for all analyzer boxes**

turbine

- Fuels: **Natural gas**, **Coke oven gas**, **Town gas**, **Propane**, **Light oil**, **Diesel**, **G20**, **G25**, **G30**, **Test Gas**
- Available measuring programs: **Flue Gas**, **Flue Gas + m/s**, **Flue Gas + Δp**, **Flue gas before + after catalyst**, **Program for all analyzer boxes**

Engine λ >1 and engine λ<1

- Fuels: **Natural gas**, **Coke oven gas**, **Town gas**, **Propane**, **Light oil**, **Diesel**, **Heavy oil**, **G20**, **G25**, **G30**, **Test Gas**
- Available measuring programs: **Flue Gas**, **Flue Gas + m/s**, **Flue Gas + Δp**, **Program for all analyzer boxes**, **Flue Gas before + after catalyst**
- Measurement program **Flue gas before + after catalyst**: Two analyzer units are required. For this measurement type, both analyzer units must have a fresh air valve.
  If one of the two meas. boxes is equipped with a measurement range extension (individual dilution), the test 350 will automatically recommend this meas. box to be used for **Before cat**.
  If the meas. box used for measurement **Before cat** is not equipped with the option measurement range extension, the device will recommend to install this option.
  If the meas. box used for the measurement **Before cat** is equipped with the dilution option and the CO sensor is plugged into the dilution slot, 5x will automatically be used for dilution. I a higher dilution factor has already been activated, this setting will be maintained.
  If the meas. box used for the measurement **Before cat** is equipped with the dilution option and the CO sensor is not plugged into the dilution slot, the device will recommend to replug the sensor accordingly.

User-defined

- Fuels: **Natural gas**, **Coke oven gas**, **Town gas**, **Propane**, **Light oil**, **Diesel**, **Heavy oil**, **Briquette**, **Lignite**, **Wood Pellets**, **Coke**, **Bois**, **Wood 30%M**, **Bark 45%H**, **Bark 60%H**, **G20**, **G25**, **G30**, **Test Gas**

Calling up the function:

1. **[ ]** → **Applications** → **[OK]**.

Press the function key **Options** to open configuration menus.

2. Selecting an application: **[ ]**, **[ ]** → **[OK]**.
3. Selecting fuel: **[ ]**, **[ ]** → **[OK]**.

6.2.3.1. Flue Gas, Flue Gas + m/s, Flue Gas + Δp, Program for all meas. boxes, Flue Gas before + after catalyst

The flue gas menus (**Measurement Type**) are the central measuring menus, which – in addition to the readings measured with this function – contain the readings of all measurements performed (if selected in the menu **Measurement view**). All readings can also be saved in or printed out from these menus.

The flue gas menus can always be selected, irrespective of the plugged in sensors.

Measuring functions of the flue gas menu:

- The measurement type **Flue Gas** can be used to perform a flue gas measurement.
- The measurement type **Program for all analyzer boxes** can be used for e.g. a bus system, in which several flue gas analysers are interconnected. A measuring program can thereby be defined and transferred to all meas. boxes.
- The measurement type **Flue Gas before + after cat** enables synchronous measuring of flue gas concentration before and after the catalyst. For this flue gas menu two measuring boxes are required, which are linked via the Test Data bus. The readings of both meas. boxes are displayed parallel in the display of the Control Unit to provide a quick overview over the condition of the catalyst.
- With measurement type **Flue Gas + m/s** a flue gas measurement can be performed in parallel to a flow measurement (+ volume / mass flow calculation) via a Pitot tube (the connecting cable for the thermocouple of the straight Pitot tube must thereby not be connected to the sensor socket of the instrument).
- The measurement type **Flue Gas + ΔP** can be used to perform a flue gas measurement with parallel differential pressure measurement.

After measurements with high concentrations and after longer measurements the instrument should be rinsed with fresh air, so that the sensors can be regenerated again.

Flow measurement: Before the measurement make the location settings (Pitot tube factor and correction factor), see Folders / Locations, page 42.

Do not measure for longer than 5min, as the drift of the pressure sensor could have the effect that the readings are outside the tolerance limits.

Calling up the function:

✓ Application selected.

> Choose the measurement type: [▲], [▼] → **[OK]**.

Options

> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Fuels**: Select fuel
> **[Options]** → **Dilution**: Select the dilution factor.
> **[Options]** → **Measurement view**: (This function is not available during a measurement): The configure measurement view menu is opened.
> **[Options]** → **Folders**: (This function is not available during a measurement): - The folder Folders/Locations is opened.
> **[Options]** → **Programs**: The programs menu is opened.
> **[Options]** → **Recalibrate**: (This function is not available during a measurement): The gas sensors are zeroed.
> **[Options]** → **Number of lines**: Change the number of measuring values per display page.
> **[Options]** → **Show Graphic**: The readings are displayed in form of a line graph.
> **[Options]** → **Configure Graphic**: The measurement parameters to be represented (max. 4) can be displayed (⊕) or hidden (⊗).

- Possibly: Gas zeroing (30s).

> Depressurize the pressure sensor and perform pressure zeroing.

Performing the measurement:

1. Start measurement: **[▶]**.

Undiluted CO reading

If a separate measurement of CO undiluted has not yet been carried out, this value is calculated using the readings of the flue gas probe and is updated continuously.

If CO undiluted has already been measured separately, the value obtained is adopted.

- The readings are displayed.

2. End the measurement, record readings: **[■]**.

6.2.3.2. Draught-Measurement

No flue gas probes with preliminary filter may be used for draught measurements.

✓ A flue gas probe must be connected.

✓ The pressure socket of the instrument must be free (depressurized, not closed).

Do not measure for longer than 5 min, as the drift of the pressure sensor could have the effect that the readings are outside the tolerance limits.

The **automatic pressure zeroing** (retrofit by Testo Service) automatically zeroes the pressure sensor at regular intervals (60s), to prevent the typical drift of the pressure sensor.

> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Measurement view**: (This function is not available during a measurement): The configure measurement view menu is opened.
> **[Options]** → **Folders**: The folder **Folders** is opened.
> **[Options]** → **Show Graphic**: The readings are displayed in form of a line graph.
> **[Options]** → **Configure Graphic**: The measurement parameters to be represented (max. 4) can be displayed ( ) or hidden ( ).

Calling up the function:

> **Measurement type** → **Draught-Measurement** → **[OK]**.

Performing the measurement:

1. Start measurement: **[ ]**
- Draught zeroing (7s).
- Rinse (approx. 10s).
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 (FT) helps when positioning the probe.
- The reading is displayed.
3. Quit measurement **[ ]**.
- The reading is maintained.

Options:

> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Show Graphic**: The readings are displayed in form of a line graph.
> **[Options]** → **Configure Graphic**: The measurement parameters to be represented (max. 4) can be displayed () or hidden ().

6.2.3.3. Smoke number/HCT

Calling up the function:

> **Measurement Type** → **Smoke number/HCT** → **[OK]**.

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

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

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

Enter the heat carrier temperature (HCT):

> **Heat carrier** → **[Change]** → Enter value → **[OK]**.

Options

> **[Options]** → **Reset values**: The entered values are deleted.
> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Print**: The readings from a record are printed.

6.2.3.4. Gas rating

The function **Gas rating** is only available if the activated fuel is a gas.

Calling up the function:

> **Measurement Type** → **Gas rating** → **[OK]**.

Performing the measurement:

1. Start measurement: **[**  **]**.

- The measuring duration is displayed.

2. When the adjusted gas flow is reached: **[**  **]**.

- The calculated gas flow and the gas burner capacity (in kW) are displayed.

Options:

> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Enter Gas Flow**: Set the gas flow value.
> **[Options]** → **Change unit**: The unit for the gas flow can be changed (**m3 > l** or **l > m3**).

6.2.3.5. Oil flow rate

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

Calling up the function:

> **[** **]** → **Measurement Options** → **[OK]** → **Oil Flow** → **[OK]**.

Performing the measurement:

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

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

Options:

> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Change unit**: The unit for the oil flow can be changed (**kg/h > gal/h** or **gal/h > kg/h**).

6.3. Analog outputs

(only available via tab **Analog output box**)

The analog output box is displayed like the meas. box. The tab contains the databus number.

The analog output box 0554 0845 (accessory) is suitable for the output of up to 6 measuring channels in form of analog signals (4 to 20 mA). The analog output box is connected to the instrument via databus, the configuration can be made via Control Unit or the PC software easyEmission (with Testo Databus Controller).

Power supply

Power is supplied to the analog output box via the measuring box.

The LED of the analogue output unit lights green when the power supply is correct.

Each individual output channel is thereby assigned to a measuring channel, the range of the respective measurement channel is entered and then corresponds to the 4 t 20 mA output of the output box connected to this channel. If the measurement range is

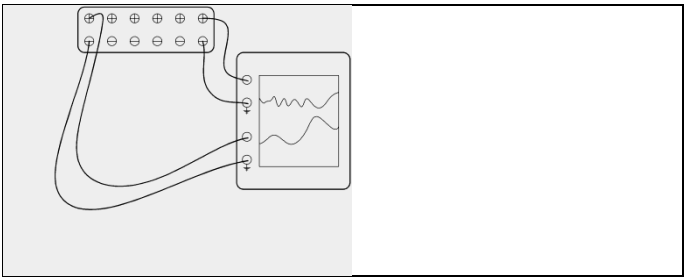
exceeded 21-22 mA is still output, depending on load. If the measurement range is fallen short of, the output will be up to 3.5 mA.

The current value is set to 3.5 mA as start value for a non-adjusted analog output box and for cases of faults.

Connections

The channels are electrically isolated towards the Testo databus. However, the individual channels are not electrically isolated among each other.

When connecting you must make sure that there are no undesired ground loops!



In both channels the positive output is connected to the ground connection of the recorder. The interfaces work correctly.

Calling up the function:

> [☰] → **Analog outputs** → **[OK]**.

Configuration of analog outputs

1. Press **[Edit]**.
2. Assign channel to box: [▲], [▼] → **[OK]**.
3. Press **[►]**.
4. Press **[Edit]**.
5. Select parameter: [▲], [▼] → **[OK]**.
6. Press **[Edit]**.
7. Set min. measurement limit: [▲], [▼], **[◄]**, **[►]**→ **[OK]**.
8. Set max. measurement limit: [▲], [▼], **[◄]**, **[►]**→ **[OK]**.
9. Select next channel: [▼].

> Repeat steps 1 to 9.

10. Confirm the entry: **[Finished]**.

7 Maintaining the product

7.1. Changing the rechargeable battery

Control Unit

The rech. batt. pack can only be changed by the Testo service.

Meas. box

✓ The meas. box must not be connected to a mains socket.

✓ The meas. box must be switched off.

1. Open the cover of the service compartment (locking clip) on the back of the meas. box.
2. Take the rech. batt. pack out of the battery compartment and loosen the plug connection from the slot.

Use only Testo rech. batt. pack 0515 0039. When inserting the rech. batt. pack, make sure that the leads do not get kinked or squeezed.

3. Connect the connector of the new rech. batt. pack to the slot and lay the rech. batt. pack into the battery compartment.
4. Close the service compartment cover.

7.2. Cleaning the flue gas analyser

> In case of contamination clean the housings of Control Unit and meas. box with a damp cloth. Do not use any aggressive cleaning agents or solvents! Mild household cleaning agents and soap suds may be used.

> Clean ventilation slots, gas outlets, fresh air inlets, pressure connections and dilution air inlet with a vacuum cleaner. Do not blow out with compressed air.

7.3. Changing / retrofitting sensors

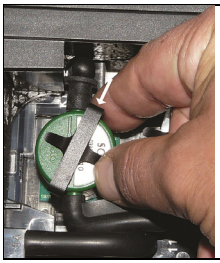
A slot bridge (0192 1552) must be inserted in slots which are not equipped with a sensor. Used sensors must be disposed of as hazardous waste!

The CO_2-(IR) sensor can only be changed / retrofitted by the Testo Service.

When changing the sensor, the current switch-off threshold values are only preserved if the analyzer unit is not disconnected from the rechargeable battery. If the switch-off thresholds need to be reset to the factory setting when changing the sensor, the analyzer unit must be disconnected from the mains and from the rechargeable battery.

✓ The analyzer unit must be switched off and disconnected from the mains.

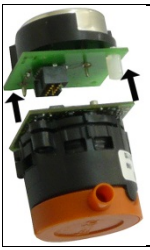
1. Place the meas. box on its front.
2. Open the cover of the sensor compartment (locking clip) and take it off.



3. Loosen the bow from the sensor.

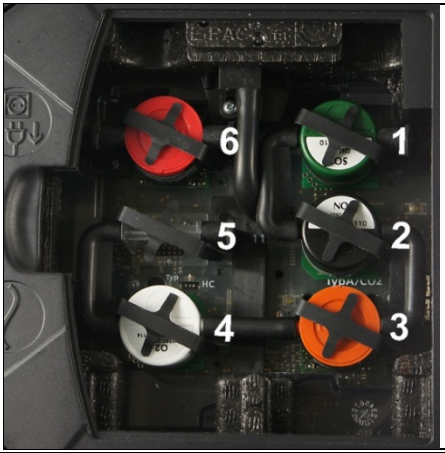
4. Take the sensor out of the bracket.
5. Pull the hose connections off the connecting nipples of the defective sensor / the bridge.
6. Remove the defective sensor /bridge from the slot.

> NO- / NO_{low} sensors: Remove the auxiliary circuit board.



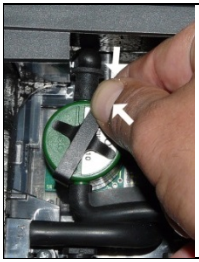
Remove the additional circuit boards of the new sensors just before the installation. Do not allow sensors to lay around without additional circuit board for longer than 15min.

Sensors must be connected to the dedicated and correspondingly marked slots:



Slot	Sensors
1	NO_2, H_2S, CO, CO_{low}, NO, NO_{low}, SO_2
2	NO_2, H_2S, CO, COI_{low}, NO, NO_{low}, SO_2
3	CO_2-(IR), NO_2, H_2S, CO, CO_{low}, NO, NO_{low}, SO_2
4	O_2
5	CO, CO_{low}, NO, NO_{low}, SO_2, CxHy
6	CO, CO_{low}, NO, NO_{low}, SO_2, CxHy

7. Install new sensor / new bridge in the slot.
8. Plug the hose connectors on the sensor / bridge.



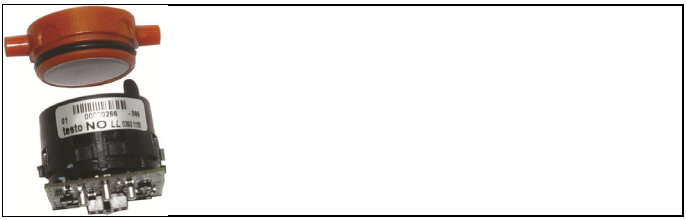
9. Insert the bow into the bracket.
10. Attach the sensor compartment cover and close it (the clip must click into place).

After replacing an O_2-sensor allow a adaptation time of 60min before you use the device.

7.4. Replacing the filter for NO sensors

✓ The measuring instrument must be switched off and isolated from the mains supply.

1. Place the measuring instrument on its front.
2. Open the cover of the sensor compartment (locking clip) and take it off.
3. Loosen the bow from the sensor and take it out of the bracket, see Changing / retrofitting sensors, page 80.
4. Pull the hose connectors off the sensor.
5. Remove the sensor from the slot.
6. Remove the used filter from the sensor.



7. Plug the new filter on the sensor.

Avoid touching the sensor. Follow the marking on filter and sensor.

8. Insert the sensor in the slot.
9. Press the hose connectors on the sensor.
10. Insert the bow into the bracket, see Changing / retrofitting sensors, page 80.
11. Attach the service cover and close it (the clip must click into place).
12. Reset the ppm-hour meter, see ppmh counter, page 63.

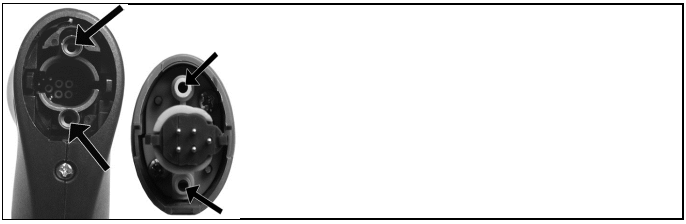
7.5. Recalibrating sensors

See **Calibration data**, page 63.

7.6. Cleaning the modular flue gas probe

✓ Disconnect the flue gas probe from the measuring instrument prior to cleaning.

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 probe handle and engage it in place.

7.7. Replacing probe pre-filter

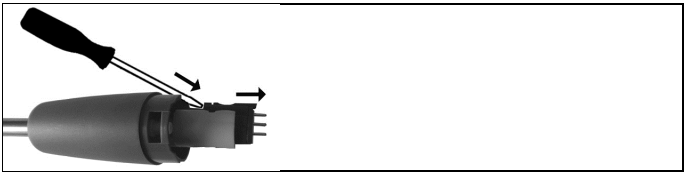
On probe modules with pre-filter the pre-filter can be replaced.

Due to heavy dust loads, the probe preliminary filter should be checked regularly for contamination. Clean or replace the preliminary filter if the flow rate is too low (error message at a flow rate of < 0.6l).

> Unscrew the pre-filter from the probe shaft and screw on a new filter.

7.8. Changing 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.

7.9. Condensate trap / condensate container

With the gas preparation option fitted, the condensate is separated from the measuring gas and is led into a condensate container that is isolated from the gas path. In the case of longer measurements with moist flue gas, the condensate can be led off using a tube without any external air being carried along.

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

Emptying the condensate trap / 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.

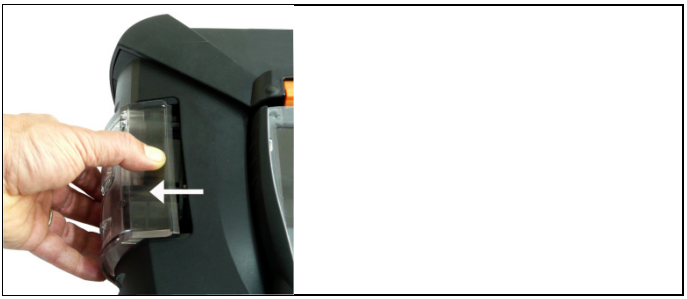
CAUTION

Condensate entering the gas path.

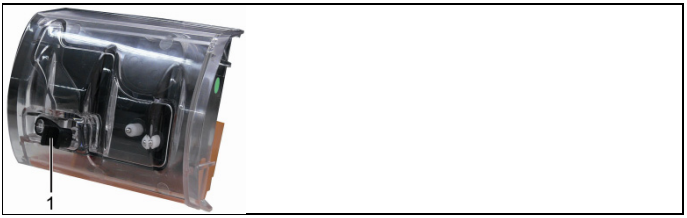
Damage to sensors and flue gas pump!

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

1. Unlock the condensate trap / condensate container by the orange handle on the underside.



2. Unlock the condensate trap / condensate container and pull it vertically off the meas. box.



3. Open the drain plug (1) and let the condensate run out into a sink.
4. Wipe off any drops still on the condensate outlet with a cloth and close the condensate outlet.
5. Plug the condensate trap / condensate container on the meas. box.

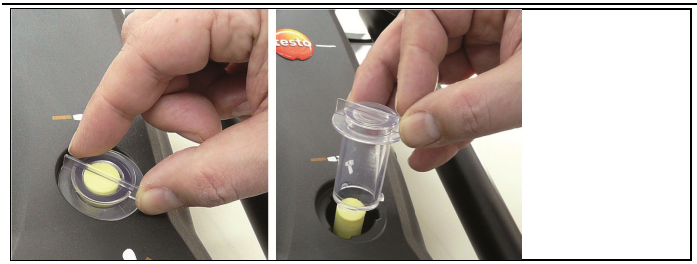
7.10. Checking / replacing the dirt filter

Checking the dirt filter:

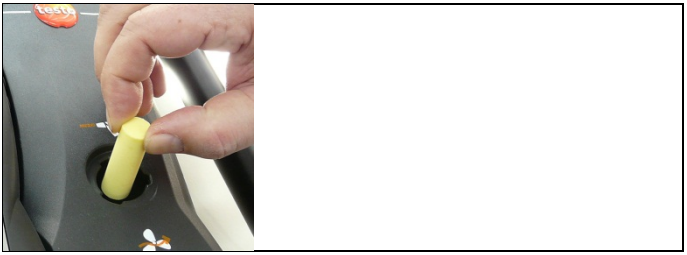
> Check the dirt filter of the meas. box periodically for contamination: Check visually by looking through the window of the filter chambers. In case of visible contamination: Change the dirt filter.

Replacing the dirt filter:

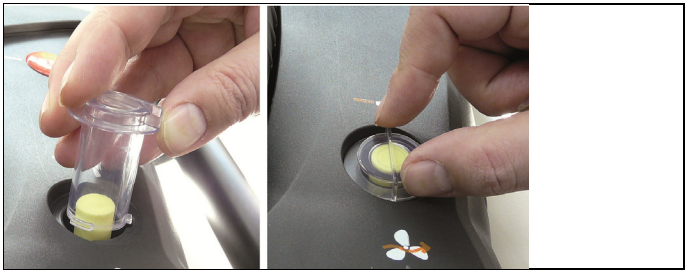
The filter chamber may contain condensate.



1. Open the filter chamber: Turn the filter cover anti-clockwise and take it off.



2. Remove the dirt filter and replace it with a new one 0554 3381).

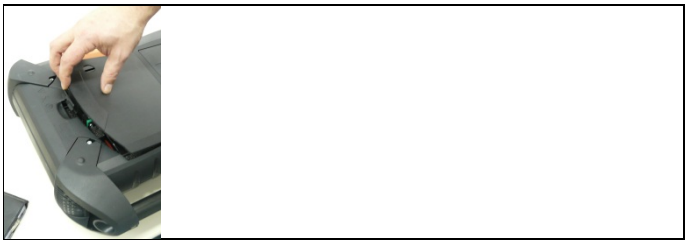


3. Attach the filter cover and lock by turning it clockwise. The rib on the filter cover must be parallel to the handle.

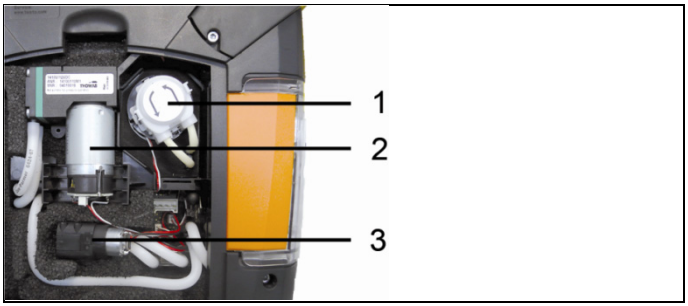
7.11. Cleaning / replacing the pump

✓ The meas. box must be switched off and isolated from the mains supply.

1. Empty the condensate container.
2. Place the meas. box on its front.



3. Open the cover of the service compartment (locking clip) on the back of the meas. box.



1 Condensate pump
2 Main gas pump
3 Rinsing / feed pump for diluting gas

7.11.1. Cleaning the main gas pump

1. Pull the gas pump upwards out of the gas measuring block.
2. Pull the inlet and outlet hoses off the sockets on the pump head
3. Loosen the plug connectors and remove the main gas pump.

4. Loosen the 4 fastening screws (Torx spanner T 9) on the pump head of the main gas pump.
5. Pull off the pump head.
6. Remove the two circlips from the depressions of the pump head (front and rear).
7. Remove and clan the pump diaphragm (e.g. white spirit).

> If necessary, blow the inlet and outlet sockets out with compressed air.

8. Reattach the pump diaphragms with the circlips.
9. Place the pump head on the main gas pump and fasten with the screws (Torx spanner T 9).
10. Push the inlet and outlet hoses over the sockets on the pump head.
11. Connect the plug connectors and insert the main gas pump into the gas measurement block.

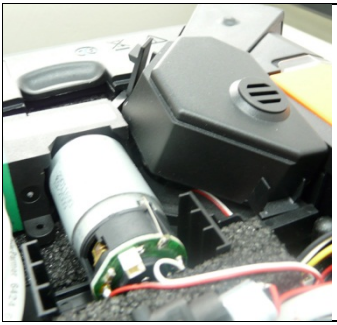
7.11.2. Changing the main gas pump

When the main gas pump is changed by the user, the operating hour meter is not reset. The difference between the current operating hour reading and the operating hours from the last pump change serve as an indicator for the next pump change.

1. Pull the gas pump upwards out of the gas measuring block.
2. Pull the inlet and outlet hoses off the sockets on the pump head
3. Loosen the plug connector and remove the main gas pump.
4. Push the inlet and outlet hoses over the sockets on the pump head of the new main gas pump.
5. Connect the plug connectors and insert the main gas pump into the gas measurement block.

7.11.3. Changing the condensate pump

The condensate pump is only available in instruments with the gas preparation (GP) option.

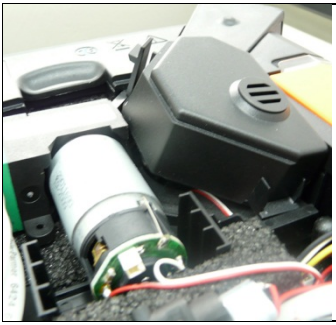


1. Unlock an remove the cover.

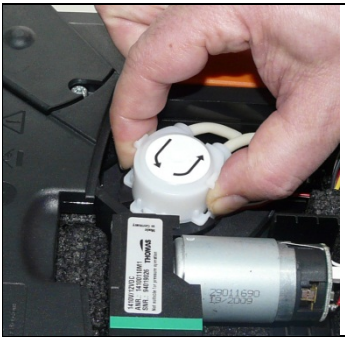
2. Unlock the two lateral clip locks of the condensate pump and pull off the pump head.
3. Pull the inlet and outlet hoses off the sockets on the meas. box.
4. Plug the inlet hose (length 25mm) and outlet hose (length 31mm) of the new pump onto the connecting sockets of the meas. box.
5. Push the pump onto the motor shaft until the clip locks engage. Make sure that the tubes are not pinched or constrained.
6. Attach cover.

7.11.4. Replacing the motor of the condensate pump

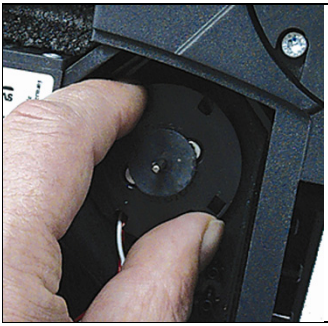
The condensate pump is only available in instruments with the gas preparation (GP) option.



1. Unlock and remove the cover.



2. Unlock the two lateral clip locks of the condensate pump and pull off the pump head.
3. Pull the inlet and outlet hoses off the sockets on the meas. box.



4. Loosen the motor on the condensate pump (short anti-clockwise turn).

5. Take the motor of the condensate pump out of the bracket.
6. Loosen the plug connector, remove the motor.
7. Push on the plug connector of the new motor.
8. Place the motor of the condensate pump into the bracket.
9. Fasten the motor on the condensate pump (short clockwise turn).
10. Plug the inlet hose (length 25mm) and outlet hose (length 31mm) of the pump onto the connecting sockets of the meas. box.
11. Push the pump onto the motor shaft until the clip locks engage. Make sure that the hoses are not pinched or constrained.
12. Attach cover.

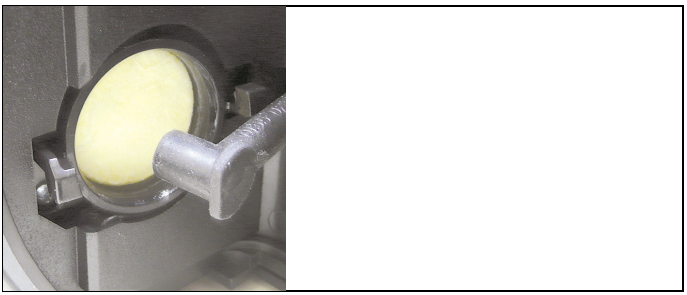
7.12. Replacing the filtration non-woven in the gas cooler

The filtration non-woven is included in the filter set 0554 3381

✓ The meas. box must be switched off and isolated from the mains supply.

1. Unlock the condensate trap and pull it vertically off the measuring box.

2. Pull off the hose.
3. Open the cover of the filtration non-woven in anti-clockwise direction.



4. Replace the exhausted filter with a new filtration non-woven.
5. Close the cover.
6. Plug on the hose.
7. Plug the condensate container on the measuring box.

7.13. Recommended maintenance cycles

Component	Service life	Remedy
Main gas pump	2500h	Renew the pump
Special main gas pump for long-term measurement	10000h	Renew the pump
Rinsing/delivery pump	2500h	Renew the pump
Condensate pump	2500h	Renew pump head with hose
(gas cooler option)	5000h	Renew the pump
Fleece in gas cooler (gas cooler option)	1200h	Clean housing, renew fleece
Condensate trap/ condensate container	25ml condensate	Empty the condensate trap/condensate container at regular intervals

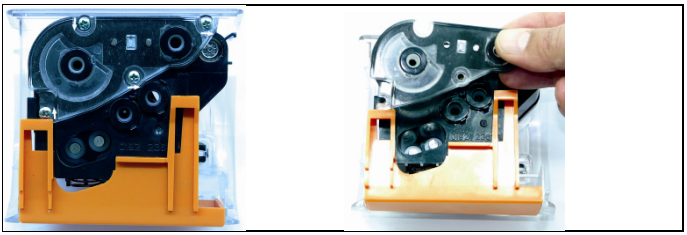
7.14. Condensate watchdog (option)

The condensate watchdog serves the purpose of protecting the infrared CO_2 sensor. It prevents the penetration of condensate into the infrared sensor. If the message **Condensate watchdog** appears in the display of the Control Unit, the condensate watchdog needs to be dried. If the message appears repetitively, the flue gas analyser must be returned to the Testo Service.

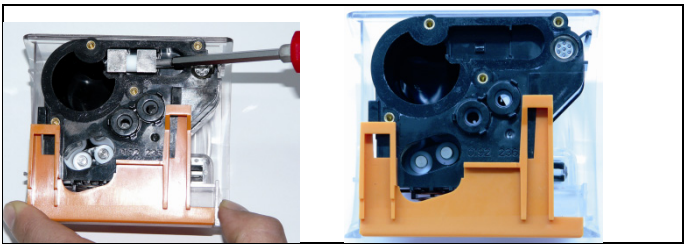
Drying the condensate watchdog

✓ The meas. box must be switched off and isolated from the mains supply.

1. Unlock the condensate trap and pull it vertically off the measuring box.



2. Unscrew the 4 screws from the cover and open the cover.



3. Remove the measuring electrodes and clean them with a dry cloth.

The housing may still contain condensate residues.

4. Clean out all condensate and wipe the housing with a dry cloth.
5. Reinsert the cleaned measuring electrodes.
6. Attach the cover and fasten it with the screws.
7. Plug the condensate trap / condensate container on the meas. box.

8 Tips and assistance

8.1. Questions and answers

Question	Possible causes / solution
Rechargeable battery low	> Switch to mains operation.
Meas. box switches automatically off or meas. box cannot be switch on	Batteries / rechargeable batteries empty. > Charge rechargeable batteries or switch to mains operation.
NO value drifts	Auxiliary voltage for NO sensor was interrupted, e.g. by a sensor change. > Wait until sensor has regenerated. Stable NO measurement only possible after approx. 2h.
Double module	A sensor of the same type has already been plugged in.
Dilution	Gas flow rate in dilution path too high / too low > Please contact your local dealer or the Testo Customer Service.
O_2 sensor exhausted	> Replace the O_2 sensor
... Signal too high	Signal of indicated sensor is too high. > Wait until regenerated (additional zeroing starts automatically). > Ensure fresh air supply
... Signal not stable	Signal of indicated sensor is drifts excessively (defect). > Change sensor. > Wait until regenerated (additional zeroing starts automatically). > Ensure fresh air supply
... Switch-off	Reading of indicated sensor is higher than the set switch-off threshold.
Instrument temperature	Instrument temperature is beyond the operating temperature.

Question	Possible causes / solution
Pump volumetric flow rate	Too low gas flow (filter clogged) or too high gas flow (overpressure). > Check gas path / filter.
Gas cooling system	Gas cooler not working (faulty). > Please contact your local dealer or the Testo Customer Service.
Sensor temperature too high	O_2 sensor temperature beyond the specification.
Condensate in gas cooler was not pumped off.	Filter fleece is not absorbing condensate > Replace filter fleece. Condensate pump is not working > Check hose connections. > Replace condensate pump.
Low pump power	Inlet and outlet hoses mixed up by mistake. > Push the inlet and outlet hoses correctly over the sockets on the pump head.
Slow to establish a connection or slow data transfer between PC/notebook and testo 350 via Bluetooth	Control unit is plugged into measuring box or is connected via data bus cable. > To achieve a high data speed, we recommend setting up a Bluetooth connection directly via the measuring box.

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

8.2. Accessories and spare parts

Printer

Description	Article no.
Infrared high-speed printer	0554 0549
Bluetooth® printer, incl. rechargeable battery and charging adapter	0554 0553

Filter

Description	Article no.
Particle filter for probe handle	0554 3385
Filter set for measuring box and gas cooler 20 pcs. dirt filters for measuring box and 10 pcs. filtration non-woven for gas cooler	0554 3381
Replacement sintered filter for probe	0554 3372
Spare filter for NO-sensor	0554 4150

Flue gas probes, probe shafts and thermocouples

Description	Article no.
Flue gas probe, 335mm incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 500 °C, 2.2m tube	0600 9766
Flue gas probe, 700mm incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 500 °C, 2.2m tube	0600 9767
Flue gas probe, 335mm incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 1000°C, 2.2m tube	0600 8764
Flue gas probe, 700mm incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 1000°C, 2.2m tube	0600 8765
Flue gas probe, 335mm with pre-filter, incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 1000°C, 2.2m tube	0600 8766
Flue gas probe, 700mm with pre-filter, incl. probe stop, thermocouple NiCr-Ni (TI), Tmax 1000°C, 2.2m tube	0600 8767
Engine probe with pre-filter, 335mm	0600 7552
Engine probe without pre-filter, 335mm	0600 7553

Description	Article no.
Tube extension 2.8m	0554 1202
Probe shaft with pre-filter, 335mm, Tmax 1000°C	0554 8766
Probe shaft with pre-filter, 700mm, Tmax 1000°C	0554 8767
Probe shaft, 700mm, Tmax 500°C TI	0554 9767
Probe shaft, 335mm, Tmax 1000°C TI	0554 8764
Probe shaft, 700mm, Tmax 500°C TI	0554 8765

Pitot tubes

Description	Article no.
Pitot tube 350mm	0635 2145
Pitot tube 1000mm	0635 2345
Pitot tube 750mm, including temperature measurement and heat protection plate	0635 2042

Sensors (spare)

Description	Article no.
O_2	0393 0000
CO, H2-comp. filter cannot be changed	0393 0104
NO, filter not replaceable	0393 0150
NO_2	0393 0200
SO_2	0393 0250
SO_{2low}	0393 0251
NO_{low}	0393 0152
CO_{low}-H2-comp.	0393 0102
CO_2-(IR)	Testo-Sevice
H_2S	0393 0350
CxHy	0393 0300

Retrofits

CO, H2-comp. sensor	0554 2104
NO sensor	0554 2150
NO_2 sensor	0554 2200
SO_2 sensor	0554 2250
NO_{low} sensor	0554 2152
CO_{low}-H2-comp. sensor	0554 2102
CO_2-(IR) sensor	Testo-Sevice
H_2S sensor	0554 2350
CxHy-sensor	0554 2300
Bluetooth® module for Control Unit and meas. box	Testo-Sevice
Gas cooler / gas preparation	Testo-Sevice
Fresh air valve	Testo-Sevice
Measurement range extension for individual slot	Testo-Sevice
DC voltage input	Testo-Sevice
Automatic pressure zeroing	Testo-Sevice

Spare parts

Description	**Article no.**
Tube cartridge (condensate pump)	0440 0013
Motor for condensate pump	0238 0001
Rinsing / feed pump for diluting gas	0239 0014
Main pump (standard)	0239 0031
Special main gas pump for long-term measurement	0239 0032
Rech. batt. pack for meas. box	0515 0039
Rech. batt. pack for Control Unit	Testo-Sevice

Other accessories

Description	Article no.
Service adapter	0440 1205
Mains unit for Control Unit	0554 1096
easy Emission (PC configuration software)	0554 3334
Transport case	0516 3510
Carrying strap	0554 0434
Analog output box set	0554 3149
Cable with battery terminals and adapter for connection to meas. box	0554 1337
Hose set for flue gas discharge	0554 0451
Wall bracket for flue gas analyser	0554 0203
USB cable to connect the PC to the flue gas analyser	0449 0073
Data bus line 2m	0449 0075
Data bus line 5m	0449 0076
Data bus line 20m	0449 0077
ISO calibration certificate	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 350 (registration required).

Control Unit and meas. box must be separated for updating the instrument software.

Before the firmware update is started, the control unit's rechargeable battery must be fully charged. If the battery is not fully charged, this will affect the firmware update. The flue gas analyser must then be sent in to Testo Service.

Once the instrument software has been updated, the descriptions in the operating instructions will no longer match the instrument functions. For the latest version of the operating instructions, visit www.testo.com\download-center.

Control unit

> Unplug the mains unit and switch off the Control Unit.

1. Hold **[▲]** depressed.
2. Plug in the mains unit, keep **[▲]** depressed.

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

3. Release **[▲]** .
4. Plug the connecting cable (Art.-No. 0449 0073) into the USB-port on the Control Unit, then connect it to the PC.

- Your PC recognises the Control Unit as a removable medium.

5. Copy the new file (appcurel.bin) to the detected removable medium.

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

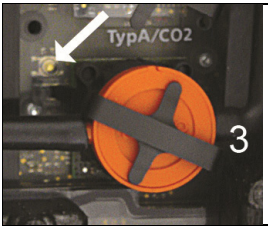
6. Disconnect the connecting cable from the device.

- After updating of the instrument software (Firmware) has been completed the Control Unit will automatically reboot and is ready for use.

Meas. box

> Disconnect mains plug

1. Place the meas. box on its front.
2. Open the cover of the sensor compartment (locking clip) and take it off.



3. Hold the button at slot 3 carefully depressed with a pointed tool.
4. Plug in the mains plug, keep the button depressed.

- The status display flashes alternately green and red.

5. Release the button.
6. Plug the connecting cable (Art.-No. 0449 0073) into the USB-port on the meas. box, then connect it to the PC.

- Your PC recognises the meas. box as a removable medium.

7. Copy the new file (appboxdbg.bin) to the detected removable medium.

- The status display flashes alternately green and red. This process may take a few minutes.

8. Remove the connecting cable from the meas. box 350.

- After updating of the instrument software (Firmware) has been completed the meas. box will automatically reboot and is ready for use.

9 Appendix

Recommendation for emission measurements over an extended period of time

The following table shows recommendations for rinse times for measurements with high concentrations and recommendations for calibration cycles for emission measurements over an extended period (via a measuring program):

> Rinse the instrument: Expose the probe to fresh air and start flue gas measurement.

Measurement parameter	Concentration [ppm]	Recommended measurement period [min]	Recommended rinse time [min]	Recommended calibration cycle in months	Filter service life
COH_2	50	90	5	3	approx. 300.000ppmh
	100	60	5	3	
	200	30	10	3	
	500	15	10	3	
	1000	10	10	3	
	2000	10	15	3	
	4000	5	30	1	
	8000	5	45	1	
	10000	5	60	1	
COH_{2low}	10	90	5	3	approx. 80.000ppmh
	20	60	5	3	
	50	30	10	3	
	100	15	10	3	
	200	10	15	3	
	500	10	20	3	
NO	50	90	5	3	approx. 120.000ppmh (filter exchangeable)
	100	60	5	3	
	200	30	5	3	
	500	20	10	3	
	1000	10	10	3	
	2000	10	20	1	
	3000	5	30	1	
	4000	5	30	1	

Measurement parameter	Concentration [ppm]	Recommended measurement period [min]	Recommended rinse time [min]	Recommended calibration cycle in months	Filter service life
NO_{low}	10 20 50 100 200 300	90 60 30 20 10 10	5 5 5 10 10 20	3 3 3 3 3 3	approx. 40.000ppmh
NO_2	10 20 50 100 200 500	90 60 30 20 10 10	5 5 5 10 10 20	3 3 3 3 3 1	-
SO_2	50 100 200 500 1000 2000 5000	90 60 30 15 10 10 5	5 5 10 10 10 20 40	3 3 3 3 3 1 1	approx. 200.000ppmh
H_2S	10 20 50 100 200 300	40 30 20 10 5 5	5 5 10 10 10 20	2 2 2 2 2 2	-
CxHy Pellistor	no rinsing cycles required, as long as the flue gas contains a sufficient amount of O_2 (O_2 shut-down...)			2	approx. 70.000ppmh
CO_2-(IR)	no rinse cycles required			1	-

If the testo 350 is not used for measurements over an extended period, but rather, for example, for random measurements during start-up, servicing and adjustment of industrial combustion systems, process systems, power plants, gas turbines or stationary industrial motors, an annual check of the testo 350 by Testo Service is recommended.

Cross-sensitivities

This table is valid for new sensors with possibly unused filters, and for cross-gas concentrations in the ppm-range (down to less than 1000ppm).

The value "0" means: <1% cross-sensitivity.

Target gas	Cross-gas				
	CO	**NO**	**SO_2**	**NO_2**	**H_2S**
O_2	0	0	0[13]	0	0
$CO(H_2)$	---	0[10]	0[10]	0[10]	0
$CO(H_2)_{low}$	---	0[10]	0[10]	0[10]	0
NO	0	---	0[10](w)[11]	6%[12]	0
NO_{low}	0	---	0[10]	<5%[12]	0
NO_2	0	0	<-2%	---	-20%[12]
SO_2	<5%[12]	0	---	-110%[12]	0[10]
SO_{low}	<5%[12]	0	---	-110%[12]	0[10]
CxHy	35%[10]	0[10]	0[10]	0[10]	0
H_2S	<2%[12]	<15%[12]	<20%[12]	-20%[12]	---

Target gas	Cross-gas				
	H_2	**Cl_2**	**HCl**	**HCN**	**CO_2**
O_2	0	0	0[13]	0	see[14]
$CO(H_2)$	0[15]	0	0	0	0
$CO(H_2)_{low}$	0[15]	0	0	0	0
NO	0	0	0	0	0
NO_{low}	0	0	0	0	0

[10] With non-saturated filter.
[11] w = changeable filter
[12] Is compensated, if the cross-gas in the instrument is also measured (i.e. if the instrument is equipped with the corresponding sensors).
[13] No influence up to a few 1000ppm; for cross-concentrations in the %-range 0.3% O_2 per 1% SO_2 / HCl.
[14] 0.3% O_2 per 1% CO_2; is compensated
[15] after H_2-compensation

Target gas	Cross-gas				
	H_2	**Cl_2**	**HCl**	**HCN**	**CO_2**
NO_2	0	100%	0	0	0
SO_2	<3%	-80%	0[10]	30%	0
SO_{low}	<3%	-80%	0[10]	30%	0
CxHy	130%[16]	no data	no data	no data	0
H_2S	0	<10%	0	0	0

[16] Is compensated with indication H_2 from the CO(H_2) sensor