testo 350 MARITIME V2 · Flue gas analyzer

0563 3503

Instruction manual

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2 Safety and the environment

2.1. About this document

This document describes the testo 350 MARITIME.

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
DANGER	Risk of death
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

Represen-tation	Explanation

ℹ	Note: Basic or further information.
1. ... 2. ...	Action: more steps, the sequence must be followed.
> ...	Action: a step or an optional step.
- ...	Result of an action.
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

⚠ DANGER

Always operate the product properly, for its intended purpose and within the parameters specified in the technical data. Do not use any force.

⚠ DANGER

Do not operate the instrument if there are any signs of damage on the housing, mains unit or supply lines.

⚠ DANGER

Do not replace the detachable mains cable with an inadequately sized cable. Using an inadequately sized cable can result in injury or death from electric shock.
The detachable mains cable supplied with the instrument may only be replaced with an equivalent mains cable.

⚠ CAUTION

If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be compromised!

Improper use of the instrument may compromise the protection provided by the product warranty.

> 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.

> Protect the instrument from rain and moisture.

> The measuring instrument should not be installed in locations with extremely high vibrations.

> Before use: Pay strict attention to the installation information for the flue gas probe.

> To prevent damage to the instrument, engine system or persons due to powerful vibration of the flue gas duct, the gas sampling probe must be attached in such a way that it is impossible for it to come loose. The probe must be positioned so that any parts that come loose cannot get into the machine system's moving components.

> Once measurement has been completed, remove the gas sampling probe from the flue gas duct and close the sampling point.

> 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.

> Do not operate the measuring instrument in the transport case.

⚠ DANGER

Risk of death!
The built-in battery can explode if it gets too hot.

- Do not expose the instrument to ambient temperatures of more than 50 °C.

CAUTION

Risk of burns from hot probes, probe shafts and sensor tips!

> Do not touch hot parts (> 45 °C/113 °F) with your bare hands immediately after a measurement.
- If you suffer a burn, immediately cool the affected area with cold water and consult a doctor if necessary.
- Allow probes, probe shafts and sensor tips to cool down.

CAUTION

Risk of poisoning!

- Make sure that there is no leak between the sampling point and the measuring instrument.
- In confined, enclosed spaces, discharge the flue gases from the gas outlet via a hose.

CAUTION

Risk of explosion!

- Make sure that there is no leak between the sampling point and the measuring instrument.
- During the measurement, do not smoke or use naked flames.

2.3. Hazard warnings

Description	Man	Hazard to system	Instrument
Power supply Disconnecting the protective conductor by any means inside or outside the device is prohibited! Using the identification plate, check that the type, line voltage and power correspond to the actual data.	X		X
Storing the measuring instrument Ensure that the permissible storage, transport end operating temperatures are observed.		X	

Description	Man	Hazard to system	Instrument
Rechargeable battery Fully charge the rechargeable battery before the first measurement and after several days of disuse. Recharge the rechargeable battery every 4 weeks during long periods of disuse. The testo battery block for the control unit must be inserted so that the marking is visible on the upper side. Otherwise, there is the risk of short circuit and reverse polarity if the insulating foil is damaged		X	
Service and maintenance The mains plug must always be pulled out before opening the housing. Danger of electric shock! Only authorised persons may carry out work inside the instrument!	X	X	X
Non-permissible measurements This instrument must NOT be used to measure explosive or flammable gas mixtures and gases that form flammable mixtures when exposed to atmospheric air!	X		
Test gas pressure A maximum of 50 mbar is permissible. Higher pressures run the risk of destroying the gas sensors! In addition, test gas must only be used in well ventilated rooms!	X		X
Cleaning the instruments Prevent the penetration of water into the instrument at all costs!			X
Differential pressure sensor When taking measurements, observe the permissible measuring ranges. Exceeding the measuring range will result in destruction of the sensor!			X

Description	Man	Hazard to system	Instrument
Condensation Avoid exposing the instrument and the instrument electronics to condensation.			X
Entire system Do not connect any part of the system to live parts for measurement. Danger of electric shock!	X		
Protect system against overvoltage.			X
CO measurement Ensure that there is adequate ventilation when measuring toxic gases (CO). Danger of poisoning!	X		
Power supply to the entire system Always ensure that the entire system is supplied with sufficient power (new or charged batteries, mains unit). Danger of the entire system becoming unstable.			X
EMC Increased electromagnetic interference can result in readings deviating from the standard specifications. Danger if the analog/switching outputs are connected. The mains plug must have a protective earth conductor connected. The temperature display with control unit and separate probe can jump by up to 2°C in the case of a thermocouple with earth contact in connection with a switched-mode power supply.	X	X	

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.
	IMPORTANT **Magnetic field** **Damage to other devices!** **Keep a safe distance away from products that could be damaged by the effects of magnetism (e.g. monitors, computers or credit cards).**
	DANGER **Magnetic field** **May be harmful to those with pacemakers.** **Keep a minimum distance of 20 cm between pacemaker and instrument.**

2.4. Product-specific safety instructions

CAUTION

Acid in the sensors

May cause chemical burns.

> Do not open the sensors.
Eye contact: Rinse the affected eye thoroughly under running water for 10 minutes, keeping the eyelids wide open and protecting the unaffected eye. Remove contact lenses wherever possible.
Skin contact: Remove the injured person's contaminated clothing, ensuring self-protection. Rinse affected skin areas under running water for at least 10 minutes.
Inhalation: Move to fresh air and make sure that breathing is unrestricted.
Ingestion: Rinse mouth out and spit out liquid. If conscious, drink 1 glass of water (approx. 200 ml). Do not induce vomiting.

> Always wear gloves when changing the sensor

CAUTION

Powder in the sensor filters

May cause irritation to the skin, eyes or respiratory tract.

> Do not open the sensor filters.
Eye contact: Rinse the affected eye thoroughly under running water for 10 minutes, keeping the eyelids wide open and protecting the unaffected eye. Remove contact lenses wherever possible.
Skin contact: Remove the injured person's contaminated clothing, ensuring self-protection. Rinse affected skin areas under running water for at least 10 minutes.
Inhalation: Move to fresh air and make sure that breathing is unrestricted.
Ingestion: Rinse mouth out and spit out liquid. If conscious, drink 1 glass of water (approx. 200 ml). Do not induce vomiting.

> Always wear gloves when changing the sensor

2.5. Protecting the environment

> Dispose of faulty rechargeable batteries/spent batteries in accordance with the valid legal specifications.

WEEE Reg. No. DE 75334352

> Used gas sensors must be disposed of as hazardous waste.

> 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

Do not use the testo 350 MARITIME for continuous flue gas measurements, i.e. the sensors must be regularly rinsed with fresh air. Recommended measurement periods and rinse phases, see Recommendation for emissions measurements over an extended period of time, page 95. The testo 350 MARITIME is a portable exhaust gas analyzer which, in accordance with MARPOL 73/78 Annex VI and NOx Technical Code 2008 (MEPC.177(58)), is used to measure exhaust gas emissions from ship diesel engines for simplified and mobile exhaust gas measurements or as a temporary measuring system Failure of the existing approved stationary emission measurement system on board can be used. The testo 350 Maritime is certified for checking renewal, annual and intermediate surveys in accordance with section 6.4 of the NTC 2008 as a measuring instrument to be left on board during the voyage.

The testo 350 MARITIME has been designed for the following applications:

- The testo 350 MARITIME can be used as a system component to measure the gaseous flue gas concentrations of O_2, CO, CO_2, NOx and SO_2 for the following procedures:
  - for periodical examinations and for intermediary examinations for direct measurement and monitoring on board
  - as a component for a simplified test and measuring method (HC must be measured separately
- testing the NOx limits specified in MARPOL Annex VI for official NOx monitoring measurements on board.
- NOx measurement as proof in regional special zones, e.g. as proof of NOx reduction for NOx tax in Norway
- Determination of the sulfur content in the fuel from the SO2 / CO2 ratio in the exhaust gas according to the limit values of 0.1-0.5% sulfur in the fuel specified by IMO MARPOL. Respectively after emission control systems; Determination of a value corresponding to the sulfur content in the fuel.

> To determine the SO2 / CO2 ratio corresponding to 0.1-0.5% sulfur in the fuel, the special SO2low gas sampling probe (0600 7562) is required.
>
> Attention, not included in the standard scope of delivery!

The flue gas analyser testo 350 MARITIME is certified by Class NK for measuring gaseous flue gas components as a system component (e.g. for the “direct measurement and monitoring” on board procedure, and for simplified measurement procedures).

Other system components required in accordance with NOx Technical Code for the “direct measurement and monitoring” on board procedure are not included in this certification!

Prior authorisation from the respective flag state is required in order to use a monitoring system and its measurement results.

The accuracy of the measuring instrument shall be determined in accordance with the calibration requirements laid down in Section 5 of Appendix 4 of the NOx Technical Code 2008. (The calibration curve shall be established by at least 6 calibration points (excluding zero) approximately equally spaced over the operating range from zero to the highest value expected during emissions testing.)

For direct on-board verification, this linearization should not be older than 3 months.

3.2. Technical data

3.2.1. Declaration of conformity

Testo SE & Co. KGaA hereby declares that the testo 350 - Maritime (0563 3503) comply with Directive 2014/53/EU.

The full text of the EU Declaration of Conformity can be found on the following website: https://www.testo.com/eu-conformity.

3.2.2. Measuring ranges and accuracies

Measuring box

Measurement parameter	Measurement range	Tolerance
°C, flue gas	-40 to +1000 °C	max. ± 5 K
O_2	0 to 25vol.%	according to Marpol, Annex VI or NOx
CO	0 to 3000 ppm	

Measurement parameter	Measurement range	Tolerance
NO	0 to 3000 ppm	Technical Code 2008
NO_2	0 to 500 ppm	
SO_2	0 to 3000 ppm	
CO_2 (IR)	0 to 40Vol.%	
P_{abs}	600 to 1150 hPa	± 5 hPa at 22 °C ± 10 hPa at -5 to +45 °C

Measurement parameter	Measurement range	Resolution
Differential pressure	-200 to 200 hPa	0.1 hPa
NTC (permanently installed)	-20 to 50°C	0.1°C
Absolute pressure	600 to 1150 hPa	1 hPa
Type K (NiCr-Ni)	-200 to 1370°C	0.1°C
Type S (Pt10Rh-Pt)	0 to 1760°C	1°C

Measurement parameter	Accuracy	Response time
Differential pressure	± 0.5 hPa (-49.9 to 49.9 hPa) ±1.5% of reading (rest of range)	-
Absolute pressure	±10 hPa	-
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)	-

3.2.3. Recommended test gas concentrations

Measurement parameter	Measurement range
CO	500 ppm (in N2)

Measurement parameter	Measurement range
CO_2	15% (in N2)
NO	1800 ppm (in N2)
NO2	100 ppm (in synthetic air)
SO2	1000 ppm (in N2)

3.2.4. Other instrument data

Control unit

Feature	Values
Power supply	• via Li-ion rechargeable battery • via measuring box • via mains adapter (6,3 V DC / 1,0 A)
Battery charge time	7h (via mains adapter) 14h (via CAN interface)
Rechargeable battery life	approx. 5 hrs (display switched on)
Memory	2 MB (approx. 250,000 readings)
Housing material	ABS_UL_94V0_black
Weight	440g
Display	Graphic colour display, 240 x 320 pixels
Dimensions	88 x 38 x 220mm

Measuring box

Feature	Values
Power supply	• via Li-ion rechargeable battery • Via internal power supply unit: 100 ... 240 V AC ± 10 % 0.8 ... 0.4 A 50 … 60 HZ
Battery charge time	<6h

Feature	Values
Ambient temperature for battery charging	+15 °C … +35 °C The testo 350 system's battery should always be charged at room temperature (+15 °C to +35 °C); in particular, at low temperatures (< 10 °C), the device may switch off prematurely, resulting in the battery not being fully charged.
Rechargeable battery life	2.5 hrs (with gas cooler and IR module)
Dimensions	330 x 128 x 438mm
Housing	ABS URL 94V0
Weight	4800 g (completely assembled)
Memory	2 MB (approx. 250,000 readings)
Flue gas overpressure	max 50 hPa
Underpressure	max. 300 hPa
Pump volumetric flow rate	1 l/min (controlled), standard litre ±0.1 l/min
Hose length	max. 5m
Diluting gas	Fresh air or nitrogen
Flue gas dust load	max. 20g/m^3
Humidity load	max. 70°Ctd at measuring input
USB interface	USB 2.0
Trigger input	Voltage: 5 to 12 V (falling or rising flank) Pulse width: >1 s Load: 5V/max. 5 mA, 12 V/max. 40mA
Feature	Values
Ambient temperature	-5°C to 45°C short-term (max. 5min.): up to 80°C by radiated heat (e.g. heat radiation from a hot flue gas duct)
Ambient pressure	600 to 1100mbar (abs.)
Ambient humidity	5 to 95%RH

Feature	Values
Storage and transport temperature	-20 to 50°C
Hight	Max. 2000 m
Protection class	IP40
Pollution degree	PD2

4 Product description

4.1. Scope of delivery

- testo 350 MARITIME control unit
- testo 350 MARITIME flue gas analyser, equipped with:
  - O_2, CO, CO_2 (IR), NO, NO_2 and SO_2 sensor incl. differential pressure sensor
  - Temperature probe input Type K NiCr-Ni and Type S Pt10Rh-Pt
  - Testo data bus connection
  - Rechargeable battery
  - Integrated combustion air probe (NTC)
  - Trigger input
  - Measurement data memory
  - USB interface
  - Gas processing
  - Measurement range extension for single slot (only for SO_2)
  - Fresh air valve
- Connecting cable (5m) between flue gas analyser and control unit
- Flue gas probe for industrial engines with probe shaft prefilter
  - 335mm immersion depth incl. probe stop and heat protection plate,
  - Tmax 1000°C,
  - Special hose for NO2/SO2 measurements, length 4m, incl. thermocouple for flue gas temperature measurement (NiCr-Ni, length 400mm, Tmax. +1000°C) with 4m connection cable and additional temperature protection
- Printer
- Mains cable
- Humidity measuring instrument testo 610

- CO2 calibration kit including service adapter for applying calibration gas
- Silicone hose, ø 4mm, length: 5m
- Hose connector
- Spare filter (optional)
- Thermal paper for printer
- Instruction manual
- Calibration report
- EC declaration of conformity
- Robust protective case with trolley function

4.2. Control unit

4.2.1. Overview

1 IrDA interface
2 Switch on / off
3 Magnetic holder (on rear)

CAUTION

Laser radiation!
IrDA Class 1 laser
- Do not look into the laser beam.

WARNING

Magnetic field
May be harmful to those with pacemakers.
> Keep a minimum distance of 15 cm between pacemaker and instrument.

ATTENTION

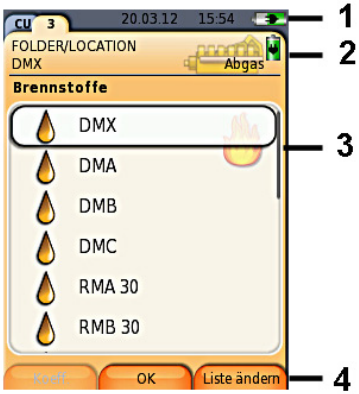
Magnetic field
Damage to other devices!
> Keep a safe distance away from products which could be damaged by the effects of magnetism (e.g. monitors, computers or credit cards).

4 Display
5 Keyboard
6 Contact strip for connection to the measuring box (on rear)
7 Interfaces: USB 2.0, charger, Testo data bus

4.2.2. Keyboard

Button	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**

4.2.3. Display



1 Status bar (dark grey background):

- Display of date and time (valid for control unit and measuring box).
- Display of status, power supply and remaining rechargeable battery capacity (valid for control unit):

Icon	Feature
	Battery operation Indication of remaining capacity of the rechargeable battery by colour and fill level of the battery icon (green = 20-100%, red = < 20%)
	Mains operation Indication of remaining capacity of rechargeable battery: see above

2 Tabs and tab info field:

- Tabs: Display of measuring system components (CU = control unit, 2, 3, etc. = measuring 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 measuring boxes): Indication of selected folder/location, selected fuel, selected application, status of power supply and remaining rechargeable battery capacity (valid for measuring box, symbols such as display for control unit, see above).

3 Selection field for functions (selected function appears against a white background, unavailable functions are identified by grey characters) or display of readings.

4 Function display for function keys.

4.2.4. Connections / interfaces

1 USB 2.0
2 Testo data bus
3 Connecting socket for mains unit 0554 1096
4 Guide groove for locking with the measuring box
5 Reset

Perform a reset

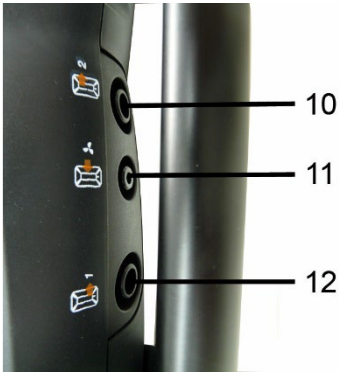
1. To perform a reset, have a thin, stiff object – such as a bent paper clip – ready.
2. The reset button of the control unit can be accessed in the horizontal orientation of the device approx. 5 mm behind the connection panel. A short press of the button triggers the reset process.
3. The control unit can be restarted.

4.2.5. Menu guide 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
	Language	Set instrument language
	Password protection	Change password
	Data bus	Display of bus address, enter bus rate
Instrument diagnosis	Error diagnosis	Display of errors present
	Device information	Display of device information
Search for boxes	-	Set up connection to measuring boxes

4.3. Measuring box

4.3.1. Overview



1 Condensate container
2 Locking/unlocking button for control unit
3 Measuring gas particle filter
4 Fresh air inlet filter
5 Contact bar for connection to control unit
6 Guide pins for locking with control unit
7 Dilution air filter
8 Status display
9 Full-visibility tab for labelling/marking
10 Gas outlet 1
11 Fresh air inlet
12 Gas outlet 2

⚠ CAUTION

Risk of poisoning!

When measuring flue gases, flue gas escapes from the exhaust outlet.

Flue gases can be toxic.

> Make sure there is good ventilation around the air outlet.

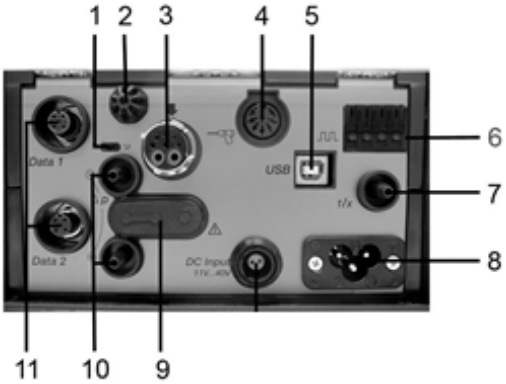
> If you are operating the instrument in an enclosed space, attach an extension to the exhaust outlet to remove the flue gases.

4.3.2. Status display

The status display shows the operating status of the measuring box:

Display	Status
green / permanent (measuring box switched on)	Mains operation or rechargeable battery operation / rechargeable battery fully charged
red / flashing (measuring box switched on)	• Rechargeable battery operation / residual rechargeable battery capacity < 20% • Other system failure
green / flashing (measuring box switched off)	Rechargeable battery or trickle charging
green / permanent (measuring box switched off)	Rechargeable battery fully charged,
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

4.3.3. Connections / interfaces



1 Data bus termination slide switch
2 Sensor for combustion air temperature (VT)

3 Flue gas probe
4 Sensor input
5 USB 2.0
6 Trigger input
7 Dilution air inlet for measurement range extension
8 Mains connection 100 to 240V AC, 50-60Hz
9 Gas channel access cover cap (only for servicing purposes)

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

10 Pressure ports p+ and p-
11 Testo data bus

4.3.4. Functions / instrument options

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

Imprint	Description
CO, NO, NO_2, SO_2, 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 (SO2 sensor)
GP	Gas preparation, by means of reduced and constant measuring gas dew point temperature for higher measuring accuracy

4.3.5. Menu guide for measuring box

Main menu	Menu	Description
Measurementoptions	-	Select measurement type • Flue gas • Differential pressure • EMDS • Prog. 1 • Prog. 2
Folder	-	Create and manage folders and locations
Fuels	-	Select and configure fuel

Main menu	Menu	Description
Measurement records	-	Display and manage measurement records
Device settings	Measurement view	Configure display, set measurement parameters and units
	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 during rechargeable battery operation
	Display brightness	Set display brightness
	Printer	Select printer, enter print text
	Language	Set instrument language
	Password protection	Change password
	Analog input	Configure analog input
	Data bus	Display of bus address, enter bus rate
Sensor settings	Sensor protection	Set safety cut-out
	Recalibration	Carry out calibration / adjustment:
	ppm counter	Consumption display for the sensors
	Calibration data	Calibration data display
	Negative values	Select negative values display
Programs	-	Configure and activate measuring programs
Instrument diagnosis	Error diagnosis	Display of errors present

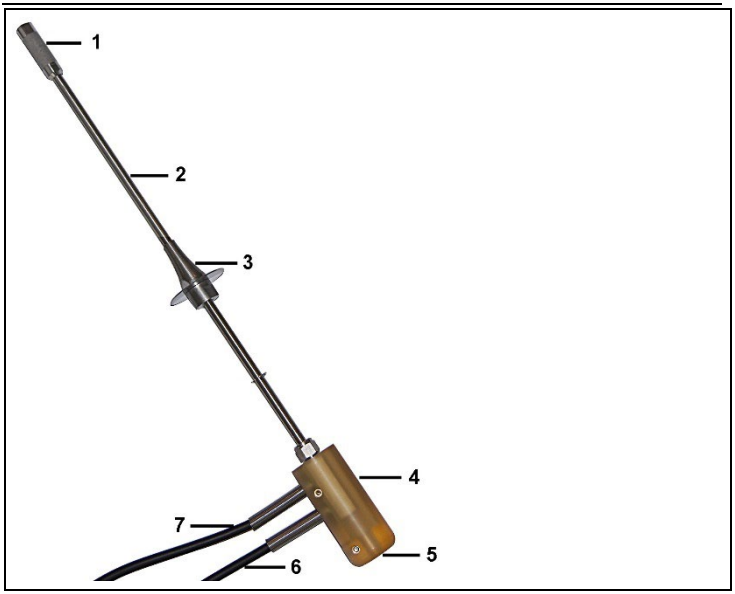
Main menu	Menu	Description
	Gas path check	Carry out tightness test
	Sensor diagnosis	Carry out sensor diagnosis
	Device information	Display of device information

4.4. Flue gas probe

4.4.1. Overview

Follow the safety instructions,

Before use: Pay strict attention to the installation information for the flue gas probe,



1 Prefilter
2 Probe shaft
3 Probe shaft stop
4 Probe handle with connections for probe shaft and gas tubes / thermocouple
5 Thermocouple
6 Gas tube

7 Overpressure outlet with locking clip

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 rechargeable battery fully before using the control unit.

Measuring box

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

> Charge the rechargeable battery fully before using the measuring box.

For longer measurements, we recommend using via the integrated mains unit.

In order to guarantee the security of the data connection, it is recommended to connect the control unit and the flue gas analyser using the connecting cable (item no. 0449 0076 included in the kit).

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. rechargeable battery empty) the settings for date / time will be lost.

If the power supply to the flue gas analyser is interrupted for a long time (empty rechargeable battery pack), it takes approx. 2 hours before an accurate NOx measurement can be carried out.

5.2.1.1. Recharging the rechargeable battery for the control unit

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

Charging via mains unit (item 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 status will be shown on the display.
- Once the rechargeable battery has been charged, the instrument will automatically change to trickle charge.

Charging via measuring box

✓ Control unit is locked to measuring box or is connected via the Testo data bus cable.

✓ The measuring box is supplied via the mains unit.

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

5.2.1.2. Charging the rechargeable battery for the measuring box

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

✓ The measuring box is switched off.

> Connect mains cable to measuring box and mains socket.

- Charging will start, the fan may come on automatically. The status LEDs lights green while the rechargeable battery is being charged.
- Once the rechargeable battery has been charged, the instrument will automatically change to trickle charge. The charging status of the measuring box is shown on the control unit display.

5.2.1.3. Battery care

> Do not fully exhaust rechargeable batteries.

> Store rechargeable batteries only in charged condition and at low temperatures, but not below 0°C.

> For longer breaks, you should discharge and recharge the batteries every 3-4 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 rechargeable battery 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.

Measuring box via internal mains unit

> Connect the mains cable to the measuring box and a mains socket.

- The measuring box is powered via the internal mains unit.
- If the measuring box is switched off, the rechargeable battery charging process will start automatically. Battery charging stops when the flue gas analyser is switched on via 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.

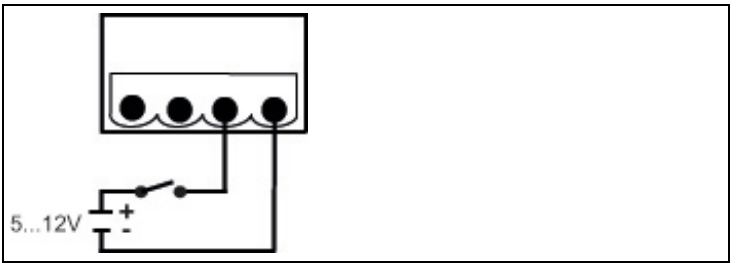
> Connect the supplied flue gas probe for industrial engines to the corresponding connection.

- Measurement of the flue gas temperature is carried out via the thermocouple at the tip of the flue gas probe inside the probe filter.

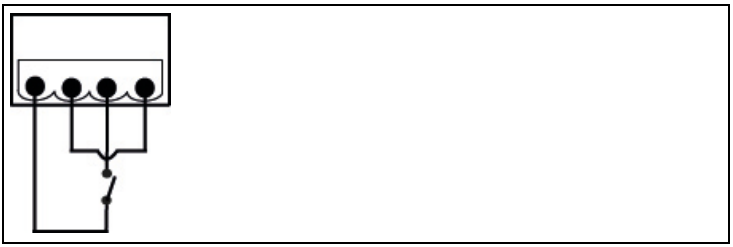
5.2.3. Occupying the trigger input

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 via contact strip

The control unit can be plugged onto the measuring box.

1. Insert the guide groove on the bottom of the control unit into the guide pins of the measuring box.
2. Press the control unit against the measuring box until the locking/unlocking button noticeably clicks into place **twice**.

> 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 measuring box.

5.2.4.2. Connection to a bus system via data bus cable (accessory)

The individual components (e.g. control unit to measuring box or measuring box to measuring box) can be connected to a bus system using the Testo data bus cable.

> Prior to commissioning a bus system, the bus address and the data rate of the connected components must be changed.

Before the components are joined up to a bus system, each component must be configured separately via the control unit.

Call up function:

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

Bus address

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

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

Data rate

Select the appropriate data rate, depending on the number of connected components in a system,

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

> Select **Data rate 500 kbit/s** or **50 kbit/s** : [ ], [ ], → **[Edit]** → [ ] or **[ESC]**.

If several measuring boxes are connected to the control unit, only the measurement data from one measuring box can be displayed at a time, or only one measuring box can be activated respectively. This is accomplished by selecting the measuring box, see Search for boxes, page **42.**

> 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 data bus cables.
- Do not route data bus cables anywhere near electric power cables.
- Ensure sufficient power supply by supplying each measuring box with line 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 disconnected under load.
- Data bus subscribers: max. 3 measuring boxes in one data bus system.
- Cable length: max. 100 m between control unit and measuring box, max. 800 m between all measuring 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 (measuring 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 measuring box is the furthest subscriber.

> Set the data bus terminating slide switch on the measuring box (see Connections / interfaces, page **29,** point 1) to switch position right ( ).

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 to the contact strip of the measuring box

or

- connected to a data bus cable

Switching on

> Press [⏻].

- The welcome screen is displayed (approx. 5s)
- The control unit display screen appears.
- The control unit searches for connected measuring boxes and shows these as independent tabs on the display.

Control unit and measuring box are not connected:
If the control unit has already been switched on, you must press [⏻] once again briefly to set up a connection to the measuring box.

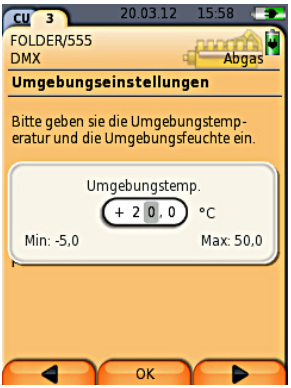
5.2.6. Calling up the function

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

5.2.7. Entering values

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

List field



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

Input editor

1. Select the value (character) to be changed: **[▲]**, **[▼]**, **[◄]**, **[►]**.
2. Accept value: **[OK]**.
   Options:
   > Toggle between letters and special characters:
   Select **|← ABC→&$/ →|** : **[▲]**, **[▼]** → **[ABC→&$/]**.
   > Position the cursor in the text:
   Select **|← ABC→&$/ →|** : **[▲]**, **[▼]** → **[|←]** or **[→|]**.
   > Delete character after the cursor:
   Select **|← ABC→&$/ →|** : **[←]** or **[→]**→**[▼]** → **[Del]**.
   > Delete character in front of the cursor:
   Select **|← ABC→&$/ →|** : **[←]** 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.

To assign 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.

> Readings from diluted sensors (with active measurement range extension enabled) are underlined on the printout.

5.2.9. Search for boxes

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

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

- Measuring boxes connected via Testo data bus: are displayed (tabs)

5.2.10. Confirming an error message

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

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

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

Error messages not yet resolved can be displayed in the menu **Error diagnosis**, See also Sensor diagnosis, page **47..**

5.2.11. Switching off

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

Rinsing phase

When switched off, the measuring 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 rinsing phase depends on the gas concentration in the sensors.

> Press **[ ]**.

- The rinsing phase starts.

- The flue gas analyser switches off. It is normal for the fan of the measuring box to run on for a while.

5.3. Folder

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

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

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

Call up function:

> **[ ]** → **Folders** → **[OK]** .

There are various options for opening folders.

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

> The initial letter is the determining factor when using the filter, and this can only be selected individually. The search function can also be used to find a series of several letters within the folder name!

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

Show all

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

- The location is activated.

> Open Measurement options menu: Press **[OK]** again.

Search

1. Edit search criteria: **[►]**→**[Edit]**.
2. Select search criteria: **[▲]**, **[▼]** → **[OK]**.

- The selected criteria is displayed.

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

> Enter search text → **[Finished]**

Filter

1. Edit search criteria: **[Edit]**.
2. Select search criteria: **[▲]**, **[▼]** → **[OK].**

- The selected criteria is displayed.

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

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

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
Fuel	Select fuel

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 in it.
- **Delete All Folders**: Delete all existing folders, including the locations created in them.

5.4. Measurement records

Measuring box

Measurement data is always saved in a measurement record in the measuring 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. However, measurement records saved in the measuring box can be copied to the control unit.

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

Call up function:

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

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

There are various options for opening records. see Folder, page **43**.

Display record:

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

Options

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

Measuring box options

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

> **[Options]** → **Copy Record**: Copy record into the record log of the control unit.

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

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

> **[Options]** → **Number of lines**: Change the number of readings shown 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.

Options for the control unit

> **[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 system failures not yet rectified are displayed.

Call up function:

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

or

> **[i]**.

5.5.1. Error diagnosis

> **Error diagnosis** → **[OK]**.

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

5.5.2. Gas path check

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

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

The gas sampling probe should not be connected to the flue gas analyser to carry out the leak-tightness test.

1. **Gas path check** → **[OK]**
2. Close the measurement input. The leak-tightness of the test gas path in the flue gas analyser testo 350 MARITIME can be tested.

- The pump flow is displayed.
- Volumetric flow rate less than or equal to 0.04 l/min: The gas paths are leak-tight (traffic light on the display lights up green).
- Volumetric flow rate higher than 0.04 l/min: The gas paths are leaky (traffic light on the display lights up red). Measuring box must be checked for leaks

5.5.3. Sensor diagnosis

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

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

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

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

5.5.4. Device information

> **Device information** → **[OK]**.

- Information is displayed.

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. Measurement view

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

The parameters / units and the display representation (number of readings displayed per display page) are preset and can be changed if required. Editing of the reading display is protected by a password, see Password protection, page **52.**

> ℹ 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 in such a way that the required parameters and units are activated,

> ℹ If the reading display is reconfigured in the graphical representation **[Show Graphic]** while a measurement is ongoing, readings previously displayed are no longer shown. The reading display should be configured before the Show Graphic menu is activated.

Complete overview of the selectable measurement parameters and units:

Display	Measurement parameter
NOxw	NOx displayed value corrected for CLD (chemiluminescence). This displayed value refers to ppm% wet flue gas.
NOxd	NOx displayed value corrected for CLD (chemiluminescence). This displayed value refers to ppm% dry flue gas.
SO2w	Sulphur dioxide wet
SO2d	Sulphur dioxide dry
NOd	Nitrogen monoxide dry
NO2d	Nitrogen dioxide dry
H2Oc	Flue gas humidity
O2d	Oxygen dry
COd	Carbon monoxide dry
H2d	Hydrogen dry (this is only an indicator value and is used to compensate the cross-sensitivity)
CO2d	Carbon dioxide IR dry active
pAin	Absolute pressure
hAin	Ambient humidity
°tAin	Intake air temperature
Pump	Pump flow
tEx	Flue gas temperature
tInstr	Instrument temperature
S-Fuel	Sulphur content of the fuel: The displayed sulphur content of the fuel (tolerance ±10%), based on complete combustion as per MEPC 184(59).

Call up function:

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

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

1. Select the line: **[▲]**, **[▼]** → **[Edit]**
2. Select the parameter: **[▲]**, **[▼]** → **[OK]**

3. Select the unit: **[▲]**, **[▼]** → **[OK]**
4. Save changes: **[OK]**

Options:

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

> **[Options]** → **Blank line**: Insert the blank line in front of the selected line.

> **[Options]** → **Delete line**: Delete the selected line.

> **[Options]** → **Factory setting**: Reset the readings display to the factory setting.

6.1.2.2. Units

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

Units for display variables used in configuration menus can be set.

Call up function:

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

Adjustable units

Parameter	Unit
Altitude	m, ft
Length	cm, inch, mm, ft
Area	cm^2, in^2, mm^2, ft^2

Setting the unit

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

6.1.2.3. 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]**.

6.1.2.4. 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]**

6.1.2.5. 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]**.

6.1.2.6. Printer

This function is available in both the measuring box and the control unit. Changes are accepted for the control unit and the measuring box.

The headers (lines 1-3) and the footer for the printout can be set. The printer that is used can be activated.

Call up function:

> **[ ]** → **Device settings** → **[OK]** → **Printer** → **[OK]**.

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

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

Configuring the print text:

1. **Print text** → **[OK]**.
2. Select function: **[▲]**, **[▼]** → **[Edit]**.

3. Enter values → **[Next]**.
4. Save the entry: **[Finished]**.

6.1.2.7. Language

This function is available in both the measuring box and the control unit. Changes are accepted for the control unit and for the measuring box.

The menu language can be set.

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

Activate the language:

> Select the language → **[OK]**.

6.1.2.8. 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]**.

6.1.2.9. 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]**.

6.1.2.10. Data bus

Bus address

*See Connection to a bus system via data bus cable (accessory), page **37.***

Data rate

*See also Connection to a bus system via data bus cable (accessory), page **37.***

6.1.3. Fuels

The following fuels can be selected:

Fuel	Designation
Distillate Fuel Oil (DM)	DMX
	DMA
	DMB
	DMC
Residual Fuel Oil (RM, RFO)	RMA 30

Fuel	Designation
	RMB 30
	RMD 80
	RME 180
	RMF 180
	RMG 380
	RMH 380
	RMK 380
	RMH 700
	RMK 700
Rapeseed Oil Methylester (RME)	RME (FAME)
Low-sulphur diesel (0.1% sulphur)	MDO 0.1 % S
Test gas	Test gas
Customised 1 to 5	Fuel 1 to 5

Call up function:

> **[ ]** → **Fuels** → **[OK]**.

View coefficients of configured fuels

> Select fuel: **[▲]**, **[▼]** → **[Coeff.]**.

- Coefficient information window opens and the factory setting for hydrogen, carbon and sulphur content of the selected fuel is displayed.

Set coefficients for customised fuels

In addition to the pre-configured fuels, 5 customer-specific fuels can be created.

> Select customer-specific fuel: **[▲]**, **[▼]** → **[Coeff.]**.

Possibly:

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

Configure fuel name / coefficients:

1. Edit fuel name: **[Edit]** → **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
2. Save change: **[Finished]**.
3. Select coefficient for hydrogen, carbon or sulphur content: **[▲]**, **[▼]** → **[Edit]**.

4. Set values: **[▲]**, **[▼]** and **[◄]**, **[►]** → **[OK]**.
   - H-content setting range: 0.1 to 99.9%
   - C-content setting range: 0.1 to 99.9%
   - S-content setting range: 0.0 to 5.0%

> The sum of the H, C and S-content should not be >100%.

5. Repeat steps 3 and 4 as required.
6. Save the entry: **[Finished]**.

6.1.4. Sensor settings

6.1.4.1. Sensor protection

Protection limits can be set to protect the sensors against overload. The sensor protection switch-off is available for the following sensors: NO, NO_2, 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 0 ppm.

Call up function:

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

Setting sensor protection thresholds:

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

6.1.4.2. Calibration / adjustment

CO, SO2, NO2, NO and O2 sensors can be tested (calibrated) and readjusted; the CO2 (IR) sensor can be readjusted. A readjustment of O2 only lasts until another zeroing is carried out or the testo 350 MARITIME is switched off. Calibration data is stored in the sensor, not in the instrument! The relevant calibration instructions of the standards/guidelines to be applied must be followed (e.g. calibration or adjustment of the gas sensors before and after a flue gas measurement).

If obviously unrealistic readings are displayed, the measuring cells should be checked and readjusted as required. To ensure that specific accuracies are retained, Testo recommends testing every 3 months and readjusting 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 thresholds set for the sensor protection.

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

- Use absorption-free hose material.
- Select **Test gas** 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 30 hPa (recommended: pressureless via bypass)
- Apply the test gas for at least 3 minutes

Call up function:

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

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

Possibly:

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

- Gas zeroing (30s).

Carry out calibration / adjustment of CO, SO_2, NO_2, NO, O_{2ref} 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. **[Edit]** → Enter the test gas concentration (nominal value).
3. Apply test gas to the sensor.
4. Start calibration: **[Start]**
5. Accept the nominal value once the actual value is stable (adjustment): **[Adjust]**
   -or-
   Cancel (no adjustment): **[esc]**
6. Save changes: **[Finished]**

Carry out calibration / adjustment of the CO_2 (IR) sensor

Check the CO_2 (IR) sensor with the aid of the absorption filter to obtain accurate readings. The CO_2 value displayed should be <0.03% CO_2 . If the value is higher, carry out 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 3352) is recommended, or apply test gas directly to the probe tip to avoid possible absorptions in the gas path.

1. Select **CO_2IR** sensor: **[▲]**, **[▼]** → **[OK]**
2. Connect absorption filter or apply test gas with 0% CO2.
3. **[◄]**, **[►]**, **[Yes]** → **[OK]**

- Stabilisation phase (120s)

4. Start measured value admission manually: **[Start]**
   or
   wait for stabilisation phase: Measured value admission is automatically started.

- Measured value admission ends automatically.

5. **[Next]**

6. Enter the nominal gradient value: **[Edit]** → **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
7. Start stabilisation phase: **[Start]**

- Stabilisation phase (120s)

8. Start measured value admission manually: **[Start]**
   or
   wait for stabilisation phase: Measured value admission is automatically started.

- Measured value admission ends automatically.

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

6.1.4.3. Calibration data

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

The condition of the sensor is checked with each sensor calibration / adjustment. The graphic representation shows the last 25 calibrations.

Call up function:

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

Options

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

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

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

6.1.4.4. Negative values

The display for negative values can be activated / deactivated.

Call up function:

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

Switching negative values on/off

1. **[Edit]**

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

6.1.5. Programs

Two flue gas measuring programs can be configured, saved and carried out.

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

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

Call up 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	• Flue gas
Readings per mean value	With mean value **Yes** only mean values will be saved.
Start	Determine the start criterion • The measuring program is started at any time (the function key automatically changes to the stop function). • External signal Trigger signal to control the start of measuring programs.

Parameter	Function
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 phase	Selection of gas phase cycle
Rinse phase	Enter the rinse phase (see Recommendation for emissions measurements over an extended period of time, page **95).** The measurement program always begins with a stabilisation phase (duration: 120s). Measuring phases (gas phase) and rinsing phases (rinse phase) alternate according to the programmed values.
Measuring rate	The measuring rate is the saving cycle for mean values. It is programmable in units of seconds and minutes.

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

6.2. Measuring

6.2.1. Preparing for measurement

The fresh air required for the zeroing phase is sucked in via the valve inlet. The flue gas probe can therefore already be inside the flue gas channel before or during the zeroing phase.

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.

The testo 350 MARITIME can be operated as follows:

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

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

Under ambient temperatures of <10°C the CO_2 (IR) sensor requires a shorter warm-up period 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 the zeroing phase

During the zeroing phase, the sensors of the analyzer unit are checked and 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 (CO, NO, etc.) during the zeroing phase!

Before the measurement

> Set the fuel for the engine to be measured.

> Activate the location to which the readings are to be assigned.

> Enter the ambient temperature (**tAin**) and ambient humidity (**hAin**) at the turbocharger inlet.

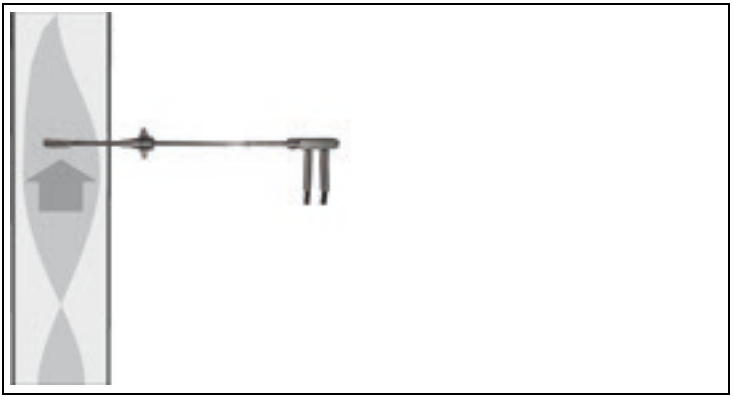
> If necessary, calibrate or readjust the sensors (observe country-specific regulations)

> Make sure that the gas outlets are free, so that the gas can escape without obstruction. Otherwise the measurement results may be corrupted.

> We recommend carrying out a gas path test once a day (see section 5.5).

6.2.2. Position flue gas probe

6.2.2.1. Flue gas flow with hot spot characteristics

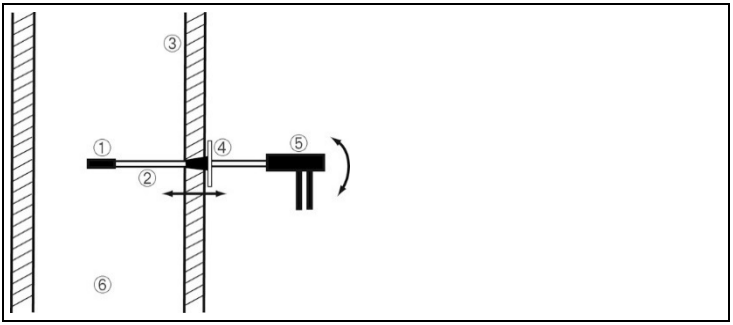


✓ The tip of the probe must be in the hot spot of the flue gas.

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

Do not measure within the marginal area. Measure min. 3x diameter of the flue gas boiler away from the last elbow.

6.2.2.2. Flue gas flow without hot spot characteristics



① Prefilter

② Probe shaft

③ Insulation

④ Probe stop

⑤ Handle

⑥ Flue gas duct

The immersion depth depends on the insulation thickness of the flue gas duct. If the flue gas is measured directly downstream of the flue gas turbocharger, the flue gas is very homogeneous in the flue gas duct due to good mixing, i.e. there is no hot spot. There is therefore no need to precisely position the probe shaft.

6.2.3. Attachment options for the flue gas probe

WARNING

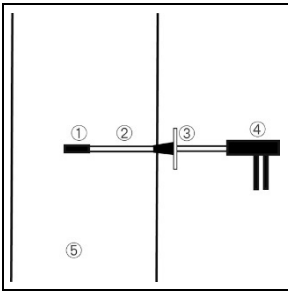
To prevent damage to the instrument, the engine system and personnel, special measures must be taken when attaching the flue gas probe if there is powerful vibration of the flue gas duct. If the probe stop is simply screwed in, the attachment will not remain durable or leaktight if there are strong vibrations.

> Position the probe so that no damage can be done to the engine system if the flue gas probe's attachments fall off or if the probe is broken.

> Only leave the flue gas probe in the flue gas duct for the duration of the measurement. Once the measurement has been completed, remove the probe from the flue gas duct.

> For the probe to be adequately attached, the free-floating end of the probe must also be suitably fixed in place / supported. Otherwise there is a risk that the probe will break.

6.2.3.1. Using the probe stop



① Prefilter

② Probe shaft

③ Probe stop

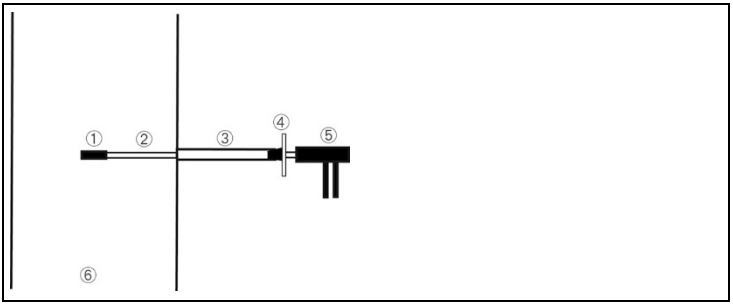
④ Handle

⑤ Flue gas duct

> Align the flue gas probe in the flue gas duct so that the tip is situated in the region of the highest flue gas temperature.

> Tighten probe stop.

6.2.3.2. Using the welded pipe



① Prefilter

② Probe shaft

③ Welded pipe

④ Probe stop

⑤ Handle

⑥ Flue gas duct

> Position flue gas probe in the flue gas duct.
> Tighten probe stop.

6.2.4. Vibrations

① Prefilter

② Probe shaft

③ Probe stop

④ Handle

⑤ Flue gas duct

> Affix and seal probe stop in the sampling point.
> Make sure that no attachments in the flue gas pipe fall off.

> Stabilise the free-floating end of the probe using appropriate means.

6.2.5. Flue gas measurement

Depending on the country-specific legal requirements, the flue gas analyser must be calibrated or readjusted before the measurement (max. 6-8 hours beforehand). Follow the calibration instructions prescribed in MARPOL Annex VI and NOx Technical Code 2008.

A selected load point (in accordance with NOx Technical Code 2008) must be kept stable for the measurement. Start the flue gas measurement once the load point is stable.

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

Measuring functions of the flue gas menu:

- The measurement type **Flue Gas** can be used to carry out a flue gas 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.

Call up function:

1. **[ ]** → **Flue Gas** → **[OK]**.

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

> To calculate the flue gas values correctly in accordance with NOx-TC and MEPC.103(49), the ambient humidity/temperature of the turbocharger's intake air must be taken into account. The following values are stored as the factory setting:
>
> - Ambient humidity: 50% RH
> - Ambient temperature: 25°C
>
> In order to take the relevant current ambient conditions into account for each measurement, we recommended use of the accompanying humidity/temperature measuring instrument testo 610 to determine the values. The relevant current ambient conditions can then be entered. The factory settings are overwritten until the next time the testo 350 MARITIME is switched on.

2. Enter ambient temperature and ambient humidity: **[Edit]** → **[▲]**, **[▼]**, **[◄]**, **[►]** → **[OK]**.
3. Save changes: **[Finished]**

Carrying out the measurement:

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

- Possibly: Gas zeroing (30s).
- The readings are displayed.

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

Options

> **[Options]** → **Save**: The readings are saved in a record.
> **[Options]** → **Print**: The readings from a record are printed.
> **[Options]** → **Fuels**: Select fuel
> **[Options]** → **Folders/Locations**: (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 readings shown 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 ( ).

6.2.6. Differential pressure measurement (determining the pressure in the flue gas duct)

Do not measure for longer than 5 min, as the drift of the pressure sensor means that the readings could be outside the tolerance limits. Do not switch between battery and mains operation during the differential pressure measurement (voltage fluctuations influence the measurement result)!

If you conduct the differential pressure measurement after a flue gas measurement, a head of pressure still exists in the hose after the pump has stopped, which must be dispelled.

This occurs within approx. 30 seconds. Remove any traces of condensation in the flue gas probe (shake out the probe with the tip towards the floor).

Call up function:

[ ] → **Differential pressure** → **[OK]**.

1. Silicone tubing (included) connect e.g. connect with a temperature-resistant metal tube to measure the differential pressure in the exhaust duct.
2. Connect the other end of the silicone hose to the measuring box port p+.
3. Start measurement: [ ].

- Depressurise pressure inlets (ambient pressure).
- The pressure sensor is zeroed.

4. Pressurise pressure inlets/insert.

- The readings are displayed.

5. Remove silicone hose.
6. End the measurement, record readings: [ ].

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.

6.2.7. EMDS measurement

Call up function:

1. [ ] → **EMDS** → **[OK]**.
2. Enter ambient temperature and ambient humidity: **[Edit]** → **[▲]**, **[▼]**, **[◀]**, **[▶]** → **[OK]**.
3. Save changes: **[Finished]**

Carrying out the measurement:

For EMDS measurement, the measurement parameters are factory set as follows and cannot be modified:

- Start condition: manual
- Stop condition: duration (1 cycle)
- Readings per mean value: no
- Gas phase: 10 min
- Gas phase measuring rate: 1s
- Stabilisation phase: 3min
- Rinse phase: 5min

1. Start measurement: [ ].

- Possibly: Gas zeroing (30s).
- The readings are displayed.

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

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 unit 0554 3149 (accessory) is suitable for the output of up to 6 measuring channels in the form of analog signals (4 to 20mA). The analog output unit is connected to the instrument via data bus, and the configuration can be carried out via the control unit.

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

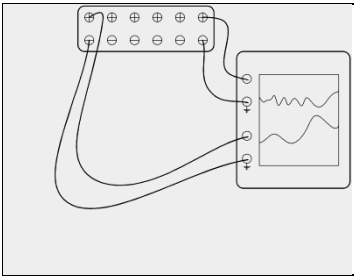
measurement range is fallen short of, the output will be up to 3.5 mA.

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

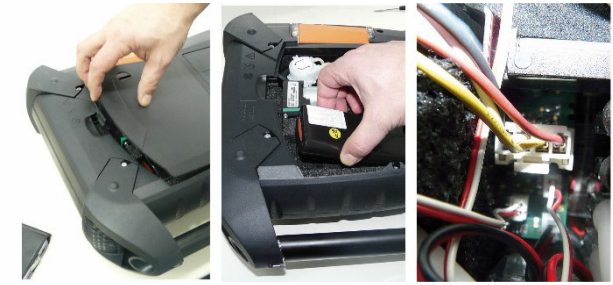
Control Unit

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 5039. 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

IMPORTANT

Leaking solvents and degreasers!
Damage to the instrument and sensors!
The following substances can damage the instrument or the sensors:

- Solvent-containing vapours such as those contained in cleaning agents, degreasers, wax polishes and adhesives
- Formaldehyde

Do not store cleaning cloths, solvents and degreasers in the case.

> 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

CAUTION

Acid in the sensors

May cause chemical burns.

> Do not open the sensors.
Eye contact: Rinse the affected eye thoroughly under running water for 10 minutes, keeping the eyelids wide open and protecting the unaffected eye. Remove contact lenses wherever possible.
Skin contact: Remove the injured person's contaminated clothing, ensuring self-protection. Rinse affected skin areas under running water for at least 10 minutes.
Inhalation: Move to fresh air and make sure that breathing is unrestricted.
Ingestion: Rinse mouth out and spit out liquid. If conscious, drink 1 glass of water (approx. 200 ml). Do not induce vomiting.

> Always wear gloves when changing the sensor

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!

ℹ	The CO_2 (IR) sensor can only be changed by a Testo service centre.

ℹ	When changing the sensor, the current switch-off threshold values are only preserved if the measuring box 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 measuring box must be disconnected from the mains and from the rechargeable battery.

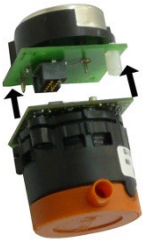
✓ The measuring box must be switched off and disconnected from the mains.

1. Place the measuring 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.

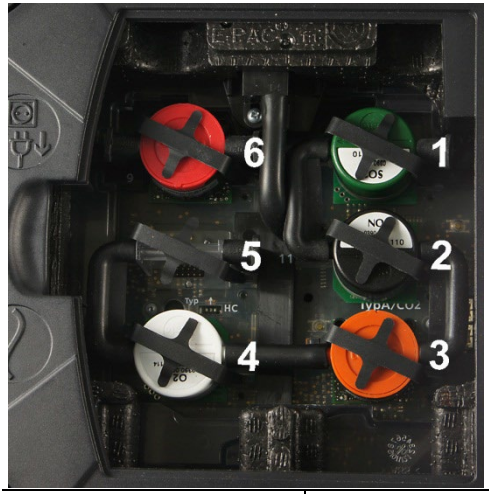
4. Take the sensor out of the bracket.
5. Pull the hose connections off the connecting nipples of the defective sensor / the bridge.
6. Remove the defective sensor /bridge from the slot.

> NO sensor: 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 15 min.

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



Slot	Sensors
1	NO_2
2	NO
3	CO_2 (IR)
4	O_2
5	CO
6	SO_2

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 O2 sensor, allow a 15-minute acclimatization time before using the instrument (establishing the supply voltage and initial stability time for new sensors).

7.4. Recalibrating sensors

See Calibration data, page **58.**

7.5. Cleaning the flue gas probe

✓ Disconnect the flue gas probe from the measuring instrument.

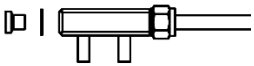
> Soot or particle deposits on the probe prefilter can be brushed off using a wire brush.

The probe prefilter cannot be changed. The screw above the probe prefilter is welded on for reasons of safety and therefore must not be removed.

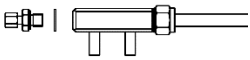
7.6. Changing the thermocouple

Only remove the thermocouple if it is defective.

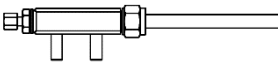
1. Unscrew the screw connection at the end of the handle with an Allen key (Ø 4mm).



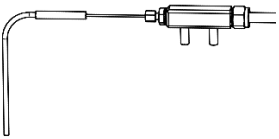
2. Screw in new screw connection with new seal and retighten.



3. Unscrew the union nut.



4. Insert thermocouple and tighten the union nut by hand.



5. Push heat shield over the handle.

6. Screw on heat shield.

7.7. Condensate container

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

Draining the condensate container

CAUTION

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 container while the flue gas pump is in operation.

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

2. Pull the condensate container horizontally off the measuring 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 container on the measuring box.

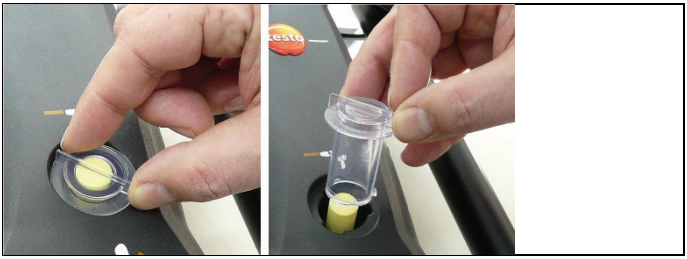
7.8. Checking / replacing the dirt filter

Checking the dirt filter:

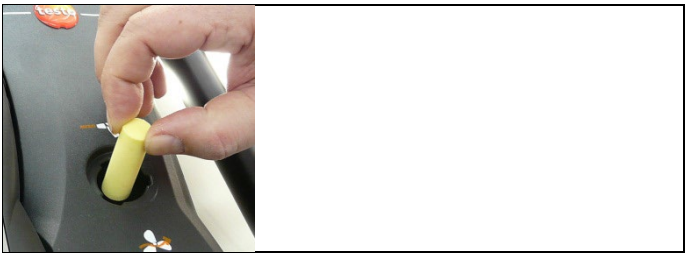
> Check the dirt filter of the meas. box periodically for contamination: Check visually by looking through the window of the filter chambers. In case of visible contamination: Change the dirt filter.

Replacing the dirt filter:

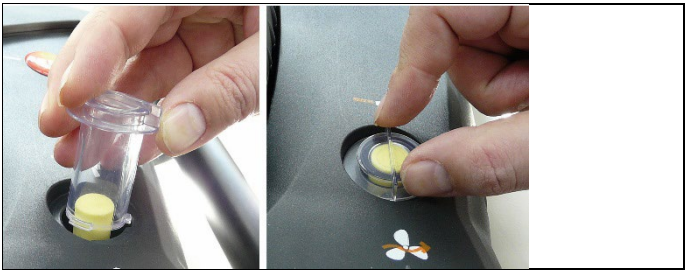
The filter chamber may contain condensate.



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).



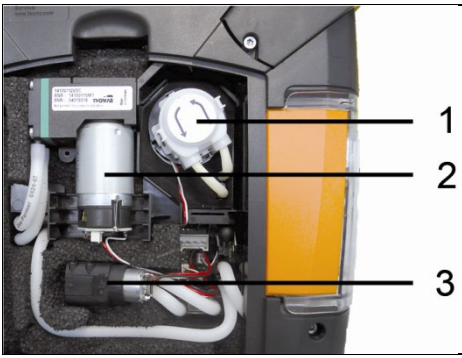
3. Attach the filter cover and lock by turning it clockwise. The rib on the filter cover must be parallel to the handle.

7.9. 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

7.9.1. 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.

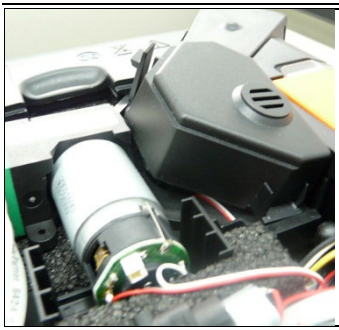
7.9.2. Changing the main gas pump

> 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.

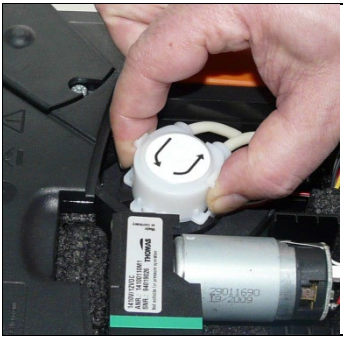
1. Pull the gas pump upwards out of the gas measuring block.
2. Pull the inlet and outlet hoses off the sockets on the pump head
3. Loosen the plug connector and remove the main gas pump.
4. Push the inlet and outlet hoses over the sockets on the pump head of the new main gas pump.
5. Connect the plug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

7.9.3. Changing the condensate pump

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



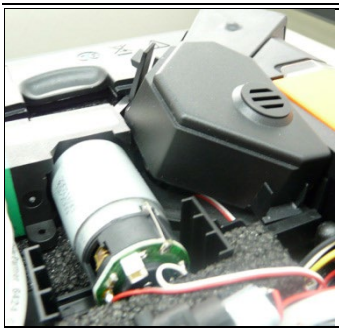
1. Unlock an remove the cover.



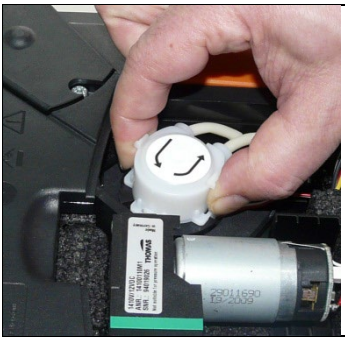
2. Unlock the two lateral clip locks of the condensate pump and pull off the pump head.
3. Pull the inlet and outlet hoses off the sockets on the meas. box.
4. Plug the inlet hose (length 25mm) and outlet hose (length 31mm) of the new pump onto the connecting sockets of the meas. box.
5. Push the pump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

7.9.4. 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).

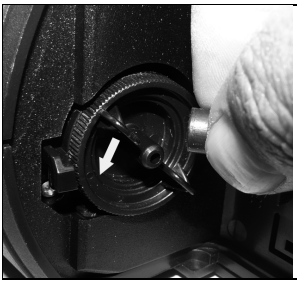
5. Take the motor of the condensate pump out of the bracket.
6. Loosen the plug connector, remove the motor.
7. Push on the plug connector of the new motor.
8. Place the motor of the condensate pump into the bracket.
9. Fasten the motor on the condensate pump (short clockwise turn).
10. Plug the inlet 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.

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

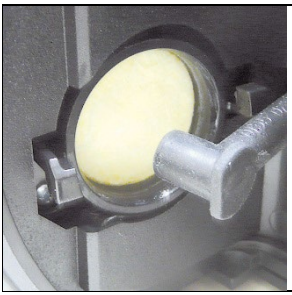
The filtration non-woven is included in the filter set 0554 3381

✓ 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.

7.11. Recommended maintenance cycles

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

8 Tips and assistance

8.1. Questions and answers

Question	Possible causes / solution
Rechargeable battery low	> Switch to mains operation.
Measuring box switches off automatically or flue gas analyser cannot be switched on	Batteries / rechargeable batteries empty. > Charge rechargeable battery 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. 2 h.
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 Testo customer service.
O2 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.
Pump volumetric flow rate	Too low gas flow (filter clogged) or too high gas flow (overpressure). > Check gas path / filter.

Question	Possible causes / solution
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.
Gas cooler fault	Condensate in gas cooler was not pumped off. > Check peristaltic pump Inlet and outlet hoses mixed up by mistake. Push the inlet and outlet hoses correctly over the sockets on the pump head.
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.

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

8.2. Accessories and spare parts

Printer

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

Filters

Description	Item no.
Particle filter for flue gas probe	0554 3385
Filter set for measuring box and gas cooler 20 pcs. dirt filters for measuring box and 10 pcs. filtration fleece for gas cooler	0554 3381

Flue gas probes, probe shafts and thermocouples

Description	Item no.
Engine probe with filter and hose, 4 m	0600 7556
Thermocouple, cable length: 4m	0600 8898
Replacement probe shaft with filter (length: 335mm)	0554 7455
SO2low flue gas probe, for SO2/CO2 ratio measurement corresponding to 0.1-0.5% sulfur in the fuel; 700 mm, Ø 8 mm incl. probe stop, Tmax. 220°C, hose length 2.2 m, NiCr-Ni thermo couple	0600 7562

Sensors (spare)

Description	Item no.
O_2	0393 0000
CO, H2 comp. (filter not replaceable)	0393 0104
NO incl. replacement filter	0393 0154
NO_2	0393 0200
SO_2	0393 0250
CO_2 (IR)	0393 0400

Spare parts

Description	Item no.
Tube cartridge (condensate pump)	0440 0013
Motor for condensate pump	0238 0001
Rinsing / feed pump for diluting gas	0239 0014
Pump diaphragm for rise and dilution pump	0193 0072
Main pump (standard)	0239 0031
Pump diaphragm for main pump	0193 0049
Special main gas pump for long-term measurement	0239 0032
Rechargeable battery pack for measuring box	0515 5039
Rechargeable battery pack for control unit	Testo Service

Other accessories

Description	Item no.
Service adapter	0554 3352 0554 1205
Mains unit for control unit	0554 1094 0554 1096
easy Emission (PC configuration software)	0554 3334
Transport case	0516 3503
Analog output box set	0554 3149
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

At www.testo.com/download-center you can download the current instrument software (Firmware) for the testo 350 MARITIME (registration required).

Control unit and measuring box must be disconnected in order to update the instrument software.

Before starting the firmware update, the rechargeable battery for the control unit must be fully charged. A rechargeable batter that is not fully charged will result in a faulty firmware update. If that happens, the flue gas analyser must be sent off to the Testo Service team.

Once the instrument software has been updated, it is possible that the descriptions in the instruction manual and the instrument functions no longer match up. You can find an up-to-date instruction manual at www.testo.com\download-center.

Control unit

> Unplug the mains unit and switch off the control unit.

1. Hold down **[▲]**.
2. Plug in the mains unit, continue holding down **[▲]**.

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

3. Release **[▲]**.
4. Plug the connecting cable (item 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 device.

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

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

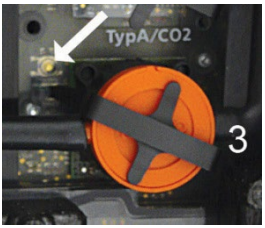
6. Disconnect the connecting cable from the device.

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

Measuring box

> Unplug the mains plug.

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



3. Keep the button at slot 3 carefully pressed down using a pointed tool.
4. Plug in the mains plug, continue holding down the button.
- The status display flashes alternately green and red.
5. Release the button.
6. Plug the connecting cable (item no. 0449 0073) into the USB port on the measuring box, then connect it to the PC.
- Your PC recognises the measuring box as a removable device.
7. Copy the new file (appboxdbg.bin) to the detected removable device.
- The status display flashes alternately green and red. This process may take a few minutes.
8. Remove the connecting cable from the measuring box 350.
- Once the instrument software (Firmware) has been updated, the measuring box will automatically reboot and is ready for use.

9 Appendix

9.1. 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[1]	0	0
$CO(H_2)$	---	0[2]	0[2]	0[2]	0
NO	0	---	0 (w)[3]	6%[1]	0
NO_2	0	0	<-2%	---	-20%[1]

Target gas	Cross-gas				
	H_2	**Cl_2**	**HCl**	**HCN**	**CO_2**
O_2	0	0	0[1]	0	see[4]
$CO(H_2)$	0[5]	0	0	0	0
NO	0	0	0	0	0
NO_2	0	100%	0	0	0
SO_2	<3%	-80%	0	30%	0

1 No influence up to a few 1000ppm; for cross-concentrations in the %-range 0.3% O2 per 1% SO2 / HCl.

2 With non-saturated filter

3 w = changeable filter

4 0.3% O2 per 1% CO2; is compensated

5 after H2 compensation

9.2. Recommendation for emissions measurements over an extended period of time

The following table shows rinse phase recommendations for measurements in high concentrations and calibration cycle recommendations for emissions measurements over an extended periods of time (via a measurement program):

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

Measurement parameter	Concentration [ppm]	Recommended testtime [min]	Recommended rinse phase [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	
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	
NO_2	10	90	5	3	-
	20	60	5	3	
	50	30	5	3	
	100	20	10	3	
	200	10	10	3	
	500	10	20	1	

Measurement parameter	Concentration [ppm]	Recommended testtime [min]	Recommended rinse phase [min]	Recommended calibration cycle in months	Filter service life
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
CO_2 (IR)	no rinse cycles required			1	-

9.3. Fuel parameters

Fuel	Designation]	Max. permissible S-content (%) (mass)]	Gc carbon content (%) (mass)	Gh hydrogen content (%) (mass)	α	Source
Distillate fuel oil, DM	DMX DMA DMB DMC	1.0 1.5 2 2	86.2	13.6	~1.88	Draft NTC 2008, ISO 8217-3: 2005
Residual fuel oil, RM	RMA 30 RMB 30 RMD 80 RME 180 RMF 180 RMG 380 RMH 380 RMK 380 RMH 700 RMK 700	3.5 3.5 4 4.5 4.5 4.5 4.5 4.5 4.5 4.5	86.1	10.9	~1.51	Draft NTC 2008, ISO 8217-3: 2005
Rapeseed oil methylester	RME	0	77.2	12.0	~1.85	ISO 8178-1: 2006
Low-sulphur diesel	MDO 0.1S	0.1	86.2	13.6	~1.88	none

Fuel	Desig-nation]	Max. permis-sible S-content (%) (mass)]	Gc carbon content (%) (mass)	Gh hydrogen content (%) (mass)	α	Source
Test gas	Test gas	0	0	0	0	none
5x customised fuel)	Input	Input	Input	Input	calculated	none

9.4. Certificates/Type Approvals

The testo 350 MARITIME has the following certificates:

DNV:

- Type Approval Certificate, Certificate No.: TAA00001KO, Revision No.: 4
- QS-Certificate of Assessment – EC (Module D), Certificate No.: MEDD00002FU
- EC-Type Examination Certificate (Module B), Certificate No.: MEDB0000328, Revision No.: 3

Nippon Kaiji Kyokai:

- Type Approval No.: 14DD001B

DNV

TYPE APPROVAL CERTIFICATE

Certificate No:
TAA00001K0
Revision No:
4

This is to certify:

That the Exhaust Gas Measuring Device for Exhaust Gas Emissions

with type designation(s)
testo 350 MARITIME_V2, Sensors

Issued to
Testo SE & Co. KGaA
Titisee-Neustadt, Germany

is found to comply with
DNV rules for classification – Ships

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Type	Temperature	Humidity	Vibration	EMC	Enclosure
testo 350 MARITIME_V2	A	A	A	A	A
Sensors	B	B	B	A	B

Issued at **Hamburg** on **2023-04-24**

This Certificate is valid until **2028-04-23**.
DNV local unit: **Augsburg**

Approval Engineer: **Didier Girardin**

for **DNV**

Digitally Signed By: Papanuskas, Joannis
Location: DNV GL SE Hamburg, Germany

Joannis Papanuskas
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

DNV

Job Id: **262.1-027763-3**
Certificate No: **TAA00001K0**
Revision No: **4**

Product description

testo 350 MARITIME_V2 including sensors as listed below, the analyzing unit, the control unit, sample probe and protective case.

Mobile exhaust gas measuring device for NOx (NO + NO2), CO, CO2, SO2 and O2.

Power Supply:	110...240V AC 50/60Hz
Sample pressure range:	-300hPa ... +50hPa
Ambient temperature:	-5°C ... +45°C

Component / Sensor Type / Measuring Range

- NO / TNFDi / 0-3000 vol.-ppm
- NO2 / TNDi / 0-500 vol.-ppm
- CO / TCHDi / 0-3000 vol.-ppm
- CO2 / TCO2 / 0-40 vol.-%
- O2 / TO2i / 0-25 vol.-%
- SO2 / TSFi / 100-3000 vol.-ppm

Software version:	Analyzing-Unit	1.27
	Control-Unit	1.26,
	MARITIME-Kernel	1.00

Application/Limitation

The measuring range is variable for each application, and is dependent on the test gas concentration selected.

The "testo 350-MARITIME_V2" is found to comply with the requirements of MARPOL Annex VI and the NOx Technical Code 2008, appendix 3, 4 and 8 and suitable as a component for chapter 6.3 and 6.4; "Simplified measurement method" and "Direct measurement and monitoring method.

The "testo 350-MARITIME_V2" is found to comply with the requirements of MARPOL Annex VI and the NOx Technical Code 2008, appendix 3, 4 and 8 and suitable as a component of a complete monitoring system. In order to completely fulfill the requirements of appendix 8 of MARPOL Annex VI and the NOx Technical Code 2008, "Implementing of the direct and measurement and monitoring method", additional equipment will have to be installed.

Equivalencies of the alternative sensors have been demonstrated under surveillance and to the satisfaction of GL in accordance with ISO 8178:2006 Part 1, Section 7 and Appendix D.

The "testo 350 MARITIME_V2" must be operated and calibrated in accordance with the requirements and intervals as specified in MARPOL Annex VI and NOx Technical Code 2008.

The "testo 350 MARITIME_V2" is not suitable for the measurement of SO2 exhaust gas concentrations equivalent to fuel sulfur concentractions below 0,5%.

CO, SO2, NO and NO2 testing

- Principle of detection (NOx Technical Code 2008 Appendix 3, 1.2): Equivalence tests have been carried out.
- Measurement precision (NOx Technical Code 2008 Appendix 3, 1.7)
- Noise (NOx Technical Code 2008 Appendix 3, 1.8)
- Zero- and span drift (NOx Technical Code 2008 Appendix 3, 1.9 and 1.10)
- Interference effects (NOx Technical Code 2008 Appendix 4, 9)
- Leakage test (NOx Technical Code 2008 Appendix 4, 4)
- Calibration curve (NOx Technical Code 2008 Appendix 4, 5.5)

Job Id:	**262.1-027763-3**
Certificate No:	**TAA00001K0**
Revision No:	**4**

CO2 and O2 testing

- Principle of detection (NOx Technical Code 2008 Appendix 3, 1.2)
- Measurement precision (NOx Technical Code 2008 Appendix 3, 1.7)
- Noise (NOx Technical Code 2008 Appendix 3, 1.8)
- Zero- and span drift (NOx Technical Code 2008 Appendix 3, 1.9 and 1.10)
- Leakage test (NOx Technical Code 2008 Appendix 4, 4)
- Calibration curve (NOx Technical Code 2008 Appendix 4, 5.5)

Type Approval documentation (Hidden)

Tests carried out

Applicable tests according to Class Guidelines DNV-CG-0339, Aug. 2021.

Marking of product

Manufacturer: Testo SE & Co. KGaA
Model name: As listed under Product description
Serial number: Unique for each delievered item

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.

The main elements of the assessment are:

- Ensure that type approved documentation is available
- Inspection of factory samples, selected at random from the production line (where practicable)
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used comply with type approved documents and/or referenced system, software, component and material specifications
- Review of possible changes in design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given
- Ensuring traceability between manufacturer's product type marking and the type approval certificate

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE

DNV

QS - CERTIFICATE OF ASSESSMENT - EC (MODULE D)

Certificate No:
MEDD00002FU

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED). This Certificate is issued by DNV GL SE based on the notification of the Federal Maritime and Hydrographic Agency of Germany.

This is to certify:

That the Quality System for the products

with type designation(s) as specified in the Appendix to this Certificate

Issued to

Testo SE & Co. KGaA
Titisee-Neustadt, Germany

is found to comply with the applicable requirements.
The quality system has been assessed with respect to the procedure of conformity assessment described in Annex II, Module D in the directive 2014/90/EU and regulation (EU) 2023/1667.

This Certificate is valid until **2028-12-19**.

Issued at **Hamburg** on **2023-12-20**

DNV local unit:
Essen

Approval Engineer:
Claus Kurok

Notified Body
No.: **0098**

for **DNV GL SE**

Digitally Signed By: Mydlak-Röder, Christine
Location: DNV GL SE, Hamburg, Germany

Mydlak-Röder, Christine
Head of Notified Body

0098/yyyy

0098: Notified Body number undertaking quality surveillance
yyyy: The year in which the mark is affixed

The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.
This certificate authorizes the manufacturer in conjunction with the valid EC Type Examination (Module B) Certificate(s) of the equipment listed before to affix the Mark of Conformity (wheelmark) to the product described herein.
This certificate loses its validity if the manufacturer makes any changes to the approved quality system, which have not been notified to, and agreed with the notified body named on this certificate. This certificate remains valid unless suspended, withdrawn, recalled or cancelled.
The Manufacturer has to apply for periodical audits to verify the maintenance and application of the quality system every 12 months.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

DNV

Job Id: **344.1-012977-1**
Certificate No: **MEDD00002FU**

APPENDIX

Item no. MED/2.8 NOx analyser permanently placed on board and for use on board as per NOx Technical Code 2008

Type designation	EC Type-Examination Certificate No.	Expiry date	Notified Body No.	USCG approval number
testo 350 MARITIME_V2[1]	MEDB0000328 Rev.3	2028-12-19	0098	N/A

Places of production

1.Testo SE & Co. KGaA, Celsiusstraße 2, Titisee-Neustadt, Germany

DNV

EC-TYPE EXAMINATION CERTIFICATE (MODULE B)

Certificate No:
MEDB0000328
Revision No:
3

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED). This Certificate is issued by DNV GL SE based on the notification of the Federal Maritime and Hydrographic Agency of Germany.

This is to certify:

That the NOx analyser permanently placed on board and for use on board as per NOx Technical Code 2008

with type designation(s)
testo 350 MARITIME_V2

Issued to
Testo SE & Co. KGaA
Titisee-Neustadt, **Germany**

is found to comply with the requirements in the following Regulations/Standards:
Regulation **(EU) 2023/1667,**
item No. MED/2.8. Marpol 73/78 as amended, Annex VI Regulation 13, IMO Res. MEPC.176(58) & 177(58) & 198(62)

Further details of the equipment and conditions for certification are given overleaf.

This Certificate is valid until **2028-12-19**.

Issued at **Hamburg** on **2023-12-20**

DNV local unit:
Essen

Approval Engineer:
Claus Kurok

Notified Body
No.: **0098**

for **DNV GL SE**

Digitally Signed By: Mydlak-Röder, Christine
Location: DNV GL SE, Hamburg, Germany

Mydlak-Röder, Christine
Head of Notified Body

The mark of conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production-surveillance module (D, E or F) of Annex B of the MED is fully complied with and controlled by a written inspection agreement with a Notified Body. The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.
This certificate is valid for equipment, which is conform to the approved type. The manufacturer shall inform DNV GL SE of any changes to the approved equipment.
This certificate remains valid unless suspended, withdrawn, recalled or cancelled.
Should the specified regulations or standards be amended during the validity of this certificate, the product is to be re-approved before being placed on board a vessel to which the amended regulations or standards apply.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

DNV

Job Id: **344.1-007295-3**
Certificate No: **MEDB0000328**
Revision No: **3**

Product description

Product Name: testo 350 MARITIME_V2
Exhaust gas measuring device.

Application/Limitation

The exhaust gas analyser testo 350 MARITIME_V2 is found to be suitable as a component of a continuous monitoring system of NO_X-emissions to comply with the requirements of Revised MARPOL Annex VI and NTC 2008.

The equivalence of the testo 350 MARITIME_V2 as an on board NO_X analyser have been demonstrated under surveillance and to the satisfaction of DNV in accordance with ISO 8178:2006 Part 1, Annex D.

The testo 350 MARITIME_V2 shall be installed, calibrated and operated in compliance with the manufacturer's instructions and in accordance with the requirements and intervals as specified in Revised MARPOL Annex VI and NTC 2008.

Type Examination documentation

Report no.: 42-967-50/0608; "Instrument for measuring and determining emission on ship engines in accordance with MEPC.103(49) and Marpol Annex VI"

Report no.: 16-750-15/1211-A Version V01b; "Measuring and determination of exhaust gas components NO_X, CO_2, CO, O_2 and SO_2 with the testo 350 MARITIME_V2 on a two stroke marine diesel engine to verify the used measurement technology with reference methods as required by MARPOL Annex VI and the NO_X Technical Code 2008"

Tests carried out

- Revised MARPOL 73/78 Annex VI and NO_X Technical Code 2008
  Appendix III: 1.6, 1.7, 1.8, 1.9, 1.10
  Appendix IV: 5.5.1, 9

- ISO 8178:2006 Part 1, Annex D.

Marking of product

For identification to this type examination certificate the products shall be marked with:

- Manufacturer's name or trade mark
- Type designation
- Mark of Conformity (see below)

Mark of Conformity

The manufacturer is allowed to affix the Mark of Conformity according to Article 10 in the Council Directive 2014/90/EU on Marine Equipment and shall issue a Declaration of Conformity, only when the module D or E or F of Annex II in the same directive is fully complied with.

Module D:	Conformity to type based on quality assurance of the production process
Module E:	Conformity to type based on product quality assurance
Module F:	Conformity to type based on product verification

NIPPON KAIJI KYOKAI

TYPE APPROVAL CERTIFICATE FOR EXHAUST GAS MEASUREMENT DEVICE

Certificate No. TA23536M

This is to certify that the undernoted product(s) has/have been approved in accordance with the requirements specified in Chapter 1, Part 7 of "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use" and the relevant Society's Rules.

This certificate is issued to

Manufacturer:	**Testo SE & Co. KGaA**
Place of Manufacturing:	**Celsiusstraße 2, 79822, Titisee-Neustadt, Germany**
Product description:	**Exhaust Gas Measurement Device**
Model:	**testo 350 MARITIME_V2**
Approval No.:	**14DD001B**
Valid until:	**22 January 2029**

The details are described in the attached sheet(s).

Issued at Tokyo on 28 November 2023.

S. Oishi
General Manager
Machinery Department

Note: The manufacturer, if desired, is requested to apply to the Society for renewal prior to the expiration date.

NIPPON KAIJI KYOKAI

Attached sheet-1/3 to the Certificate No. TA23536M

Product description

"testo 350 MARITIME_V2" is a portable measurement instrument for measuring exhaust gas emissions from combustion engines as a component for "Simplified Measurement Method" specified in Chapter 6.3 of NOx Technical Code 2008 and "Direct Measurement and Monitoring Method" specified in Chapter 6.4 of NOx Technical Code 2008.

- Hardware

  Portable exhaust gas analyzer for NOx, CO, CO_2, SO_2 and O_2

  Gas sampling probe with pre-filter

  Protective case

- Software

  Analyzer firmware Version 1.xx

  Control Unit firmware Version 1.xx

Technical specifications:

Power Supply: 110—230V AC 50/60Hz

Ambient Temperature: -5—+45℃

Sample Pressure Range: -300—+50hPa

Measurement Range:

Component	Measuring Principle	Range
O_2	ECS	0—25 vol.%
CO	ECS	0—3,000ppm
NO	ECS	0—3,000ppm
NO_2	ECS	0—500ppm
SO_2	ECS	0—3,000ppm
CO_2	NDIR	0—40 vol.%

- To be continued -

NIPPON KAIJI KYOKAI

Attached sheet-2/3 to the Certificate No. TA23536M

Examined documents

Report for applying of Type Approval (2012-06-01, Version V01j, 16-750-15/1211)
Report of Compliance Test (2012-05-22, Version V01b, 16-750-15/1211-A)
Equivalence Reports (June 2008, 42-967-50/0608)
Instruction Manual (0970 3509 en 01 V01.00 en_GB)
Instruction Manual (0970 3509 en 03 V01.00 ja_SMM)
EMC Test report (2021-0048-EMC-TR-23-0042-V01)

Environmental test items

(Applied testing items are marled with X.)

ENVIRONMENTAL TESTS (IACS UR E10 Rev.8 basis)		Mark
Electric power supply failure test		X
Power supply fluctuation test	Electric	X
	Pneumatic and Hydraulic	--
Insulation resistance test		X
High voltage test		X
Pressure test (Pneumatic and Hydraulic)		--
Dry heat test (Temperature 55℃×16hours)		X
Damp heat test		X
Vibration test (Acceleration probe: ±4g, system: ±0.7g)		X
Inclination test		X
Cold test (Temperature 5℃×2hours)		X
Salt mist test		X
Electrostatic discharge immunity test		X
Radiated radio frequency immunity test		X
Conducted low frequency immunity test		X
Conducted high frequency immunity test		X
Burst / Fast transient immunity test		X
Surge immunity test		X
Radiated emission test		X
Conducted emission test		X
Flame retardant test		X

- To be continued -

NIPPON KAIJI KYOKAI

Attached sheet-3/3 to the Certificate No. TA23536M

Application/Limitation

1. In case where the product is used as a component of a system for "Simplified Measurement Method", the overall system should completely fulfill the requirements of Chapter 6.3 of the NOx Technical Code 2008.

2. In case where the product is used as a component of a system for "Direct Measurement and Monitoring Method", the overall system should completely fulfill the requirements of Chapter 6.4 and Appendix VIII of the NOx Technical Code 2008.

3. The "testo 350 MARITIME_V2" must be installed, operated and calibrated in accordance with manufacturers' recommendations.

4. Amendments to MARPOL Annex VI and the NOx Technical Code 2008 may render this certificate invalid.

- The End -

NIPPON KAIJI KYOKAI

TYPE APPROVAL CERTIFICATE FOR EXHAUST GAS MEASUREMENT DEVICE

Certificate No.TA18598M

This is to certify that the undernoted product has been found to comply with the requirements specified in Chapter 1, Part7 of "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use" and the relevant Society's Rules.

This certificate is issued to

Manufacturer:	**Testo SE & Co. KGaA**
Product description:	**Exhaust Gas Measurement Device**
Model:	**testo 350 MARITIME_V2**
Approval No.:	**14DD001B**
Valid until:	**22 January 2024**

This certificate is subject to the conditions specified in the attached sheets.

Issued at Tokyo on 27 December 2018.

T. Shimada
General Manager
Machinery Department

NIPPON KAIJI KYOKAI

Attached sheet-1/3 to the Certificate No.TA18598M

Product description

"testo 350 MARITIME_V2" is a portable measurement instrument for measuring exhaust gas emissions from combustion engines as a component for "Simplified Measurement Method" specified in Chapter 6.3 of NOx Technical Code 2008 and "Direct Measurement and Monitoring Method" specified in Chapter 6.4 of NOx Technical Code 2008.

- Hardware

  Portable exhaust gas analyzer for NOx, CO, CO_2, SO_2 and O_2

  Gas sampling probe with pre-filter

  Protective case

- Software

  Analyzer firmware Version 1.07

  Control Unit firmware Version 1.07

Technical specifications:

Power Supply: 110－230V AC 50/60Hz

Ambient Temperature: -5－+45℃

Sample Pressure Range: -300－+50hPa

Measurement Range:

Component	Measuring Principle	Range
O_2	ECS	0－25 vol.%
CO	ECS	0－3,000ppm
NO	ECS	0－3,000ppm
NO_2	ECS	0－500ppm
SO_2	ECS	0－3,000ppm
CO_2	NDIR	0－40 vol.%

- To be continued -

NIPPON KAIJI KYOKAI

Attached sheet-3/3 to the Certificate No.TA18598M

Application/Limitation

1. In case where the product is used as a component of a system for "Simplified Measurement Method", the overall system should completely fulfill the requirements of Chapter 6.3 of the NOx Technical Code 2008.

2. In case where the product is used as a component of a system for "Direct Measurement and Monitoring Method", the overall system should completely fulfill the requirements of Chapter 6.4 and Appendix VIII of the NOx Technical Code 2008.

3. The "testo 350 MARITIME_V2" must be installed, operated and calibrated in accordance with manufacturers' recommendations.

4. Amendments to MARPOL Annex VI and the NOx Technical Code 2008 may render this certificate invalid.

- The End -

NIPPON KAIJI KYOKAI

Attached sheet-2/3 to the Certificate No.TA18598M

Examined documents

Report for applying of Type Approval (2012-06-01, Version V01j, 16-750-15/1211)
Report of Compliance Test (2012-05-22, Version V01b, 16-750-15/1211-A)
Equivalence Reports (June 2008, 42-967-50/0608)
Instruction Manual (0970 3509 en 01 V01.00 en_GB)
Instruction Manual (0970 3509 en 03 V01.00 ja_SMM)

Environmental test items

(Applied testing items are marled with X.)

ENVIRONMENTAL TESTS		Mark
Electric power supply failure test		X
Power supply fluctuation test	Electric	X
	Pneumatic and Hydraulic	--
Insulation resistance test		X
High voltage test		X
Pressure test (Pneumatic and Hydraulic)		--
Dry heat test (Temperature 55℃×16hours)		X
Damp heat test		X
Vibration test (Acceleration probe: ±4g, system: ±0.7g)		X
Inclination test		X
Cold test (Temperature 5℃×2hours)		X
Salt mist test		X
Electrostatic discharge immunity test		X
Radiated radio frequency immunity test		X
Conducted low frequency immunity test		X
Conducted high frequency immunity test		X
Burst / Fast transient immunity test		X
Surge immunity test		X
Radiated emission test		X
Conducted emission test		X
Flame retardant test		X

- To be continued -

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E-Mail: info@testo.de
Internet: www.testo.com

0970 3509 en 11 – 06.2026