



testo 342

Flue gas analyser

Instruction manual





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Testo worldwide	

Measuring instrument conforms
with EN 50 082-1 / EN 55 011 Group 1 Class A



System description

testo 342 was developed for domestic and heavy industrial applications. It enables the simple and precise measurement and control of flue gas temperature, ambient temperature, oxygen content, CO₂ and CO content (not testo 342-2), draught, excess air, Efficiency Gross/Net and NO content (not testo 342-1).

All measured data can be transferred to the optional printer via the integrated infrared interface, printed and thus recorded.

The **testo 342** is available in the following versions:

testo 342-1 with O₂ and CO measuring cells

testo 342-2 with O₂ and NO measuring cells

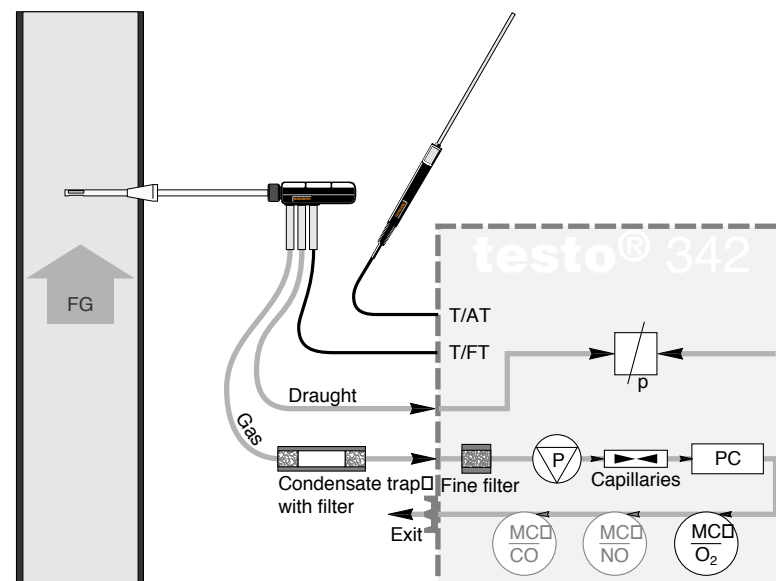
testo 342-3 with O₂, CO and NO measuring cells

These products are mainly aimed at service engineers, heating technicians and engineers with advanced knowledge and experience in everyday measuring technology.

We expect those trained in measuring technology to be able to recognise differences from the standard conditions and to be able to assess their effect on the measurement result. The following instructions should be of some help.

Description

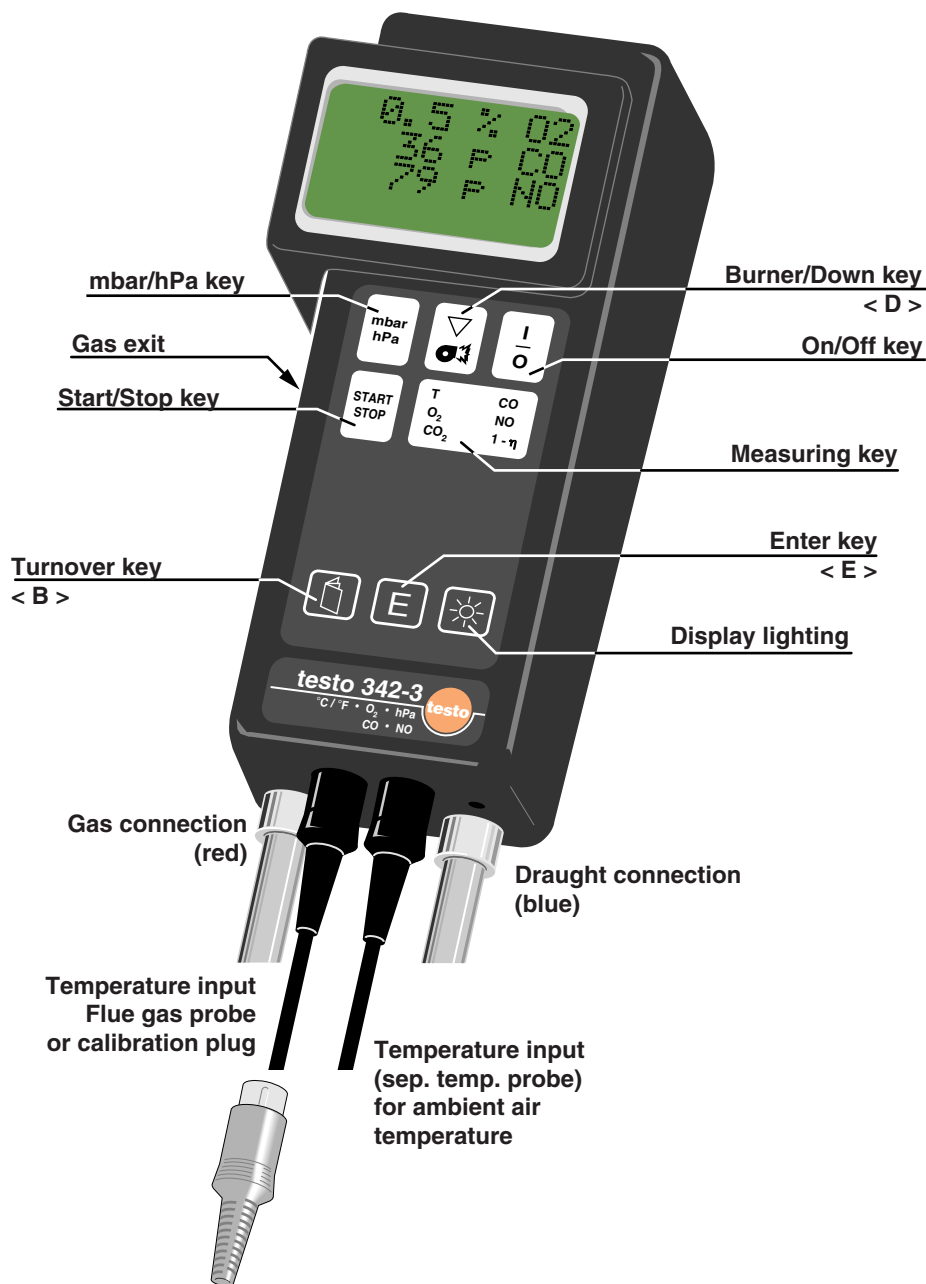
Gas path



FG = Flue gas
PC = Pre-combustion chamber
MC = Measuring chamber
T/AT = Ambient temperature
T/FT = Flue gas temperature



Instrument description



Operation instructions

Important remarks



Charge the built-in rechargeable battery fully before the first measurement or after a break of several days (see display of battery life during calibration phase). Should the instrument not be used for long periods, recharge the rechargeable battery every 4 weeks to avoid a complete drainage.

Operation via mains unit

Only use the original mains unit for operating the instrument.

Flue gas probes

Only flue gas probes with integrated condensate trap can be connected directly to the **testo 342**. Should a probe without integrated filter and condensate unit be connected, instrument failure will occur.

Tightness

Before a measurement is started, the complete measuring system (probe, condensate trap, tubes and screwings) must be tested for tightness. Should there be air leaks, the results of the measurement may be incorrect.

Gas exit

Ensure that the gas exit of the analyser is uncovered during measurement, so that the gas can escape unhindered. The results of the measurement may otherwise be incorrect.

Condensate trap

The condensate trap may only be emptied when the pump is switched off (the measuring cells are otherwise at risk)!

Measuring cells

Small amounts of concentrated acids are contained in the measuring cells (except for in the O₂ sensor → electrolyte) and should, thus, be treated as special waste (like commercial batteries).

Functions of the keyboard


The turnover key always enables the user to jump into or backwards within the menus. The Enter key confirms the option selected in the main menus, and in any function it enables you to jump to the next setting. The Burner/Down key moves the cursor down in the main menu and changes the figures in the function menus.



Operation instructions

Power supply

testo 342 can be operated via the built-in rechargeable battery or via the 0554.0085 mains unit.



As the NO measuring cell (if fitted) is permanently supplied with a bias voltage via the rech. battery within the instrument, the rech. battery must be regularly recharged via the mains unit.

Recharge the rech. battery for a max. of 24 hours - over-charging will damage the battery .

The built-in rechargeable battery in this instrument is subject to wear.

The service life depends mainly on the handling.

Note:

1. Discharge the rechargeable battery until the measuring instrument switches off. Only then recharge again. A "safety" recharge after only a few measurements significantly shortens the service life.
2. The maximum recharging is 24 hours. However recharging should be finished after 14 hours. Care should be taken recharging over the weekend.
3. Do not store the instrument with the discharged battery over a longer period. Recharge the battery once per month if possible.


The rech. battery voltage is displayed (in form of 4 segments) during the calibration phase. Information on the actual battery life cannot be given, as this depends on the condition of the rechargeable battery. With newly recharged batteries, a battery life of 3.5 hours can be expected. This time can, however, be considerably reduced by activating the display light.


Operation instructions

Power supply

Mains operation

When connecting the mains unit to the bottom of the instrument, ensure that the connecting plug is correctly positioned. A perfect connection is confirmed in the display during the calibration phase. The display "Line" and four segments represent a correct power supply.

Calibrate
18.8°C AT
Line: 
Time=19



It is normal for the mains unit to heat up. The instrument is protected from too high temperatures (e.g. due to an instrument error) by a heat protective switch.

Operation instructions

Connection of probes

Connecting the flue gas probe



Only flue gas probes with an independent, integrated condensate trap can be connected directly to the testo 342 flue gas analyser.

Insert the 8 pin DIN plug of the flue gas probe into the appropriate socket (flue gas probe symbol). Observe the coloured markings when attaching the gas and draught hoses.

Red: gas path (with condensate trap +filter)
Blue: draught path



Should the gas hoses be incorrectly connected, a complete instrument failure may occur, which could damage the measuring cells.

Connecting a separate ambient temperature probe

When an air probe is connected (temperature probe symbol), the ambient air temperature is continually measured by this probe (and displayed).

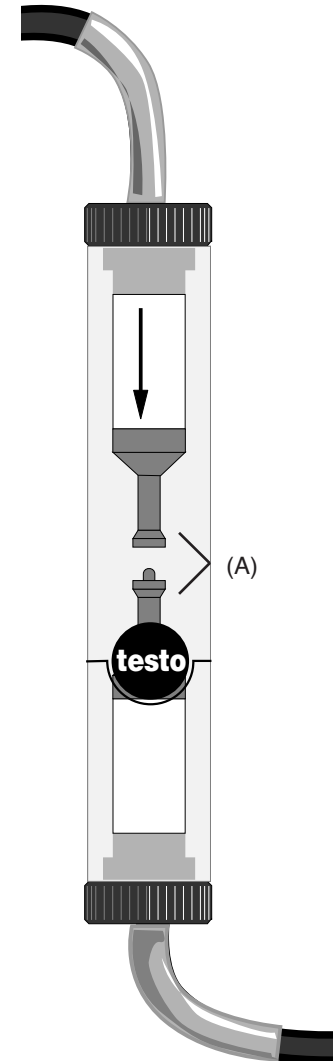


Observe the maximum operating temperature indicated in the ordering data.

Operation instructions

Condensate trap

from the flue gas probe



to meas. instrument

An independent condensate trap with 2 particle filters is fitted in the connecting lead of the 0600.9520/9521/9522/8720/8520 flue gas probes as well as in the multi-hole probe 0400.9332 .

To remove the condensate, pull off one of the end pieces of the trap and pour out the condensate.

Should you see that the filter is dirty, it must be replaced. Damp/wet filter material must be dried. Remove the filter in order to replace/dry the filter material. Order replacement material for the filter with part. no. 0554.0084.



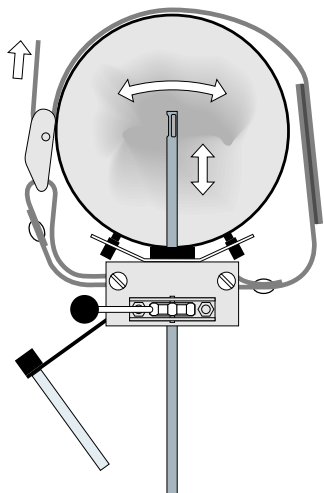
Only empty the condensate trap when the pump is switched off.

The construction of the condensate trap requires a certain flow direction. It is marked by arrows on the housing. If the gas flows in the opposite direction, the condensate separation will not function correctly; this may lead to instrument failure.

When fitting and assembling the condensate trap, take care not to damage the seal or mix-up the separating covers (A).

Operation instructions

Option: Holding fixture



- **Attach the fixing device with direction-finder and magnets (holding fixture) at the extraction point (feed the direction-finder into the drilled hole).**
- Secure the holding device for the flue gas probe by means of the holding belt.
- Withdraw the direction-finder and insert the flue gas probe in such a way that the protective frame at the tip of the flue gas probe is situated across the direction of the gas flow. When the locking lever is open, the flue gas probe can be moved in the gas pipe. If the flue gas probe is situated in the core flow, it should be fixed with the locking lever.
- When fixing the flue gas probe, make sure that the tip of the probe is on the same level or a little higher than the handle of the flue gas probe. You can, thus, avoid getting moisture on the thermocouple, which would lead to incorrect measuring results.

User instructions

Temperature, O₂/CO₂/CO and NO measurement e.g. for the setting of burners



Calibrate
18.8 °C AT
Accu:
Time=19

Switch on the measuring instrument (the flue gas probe is in fresh air).

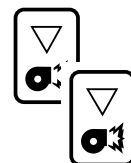
The instrument jumps to the calibration phase (duration: approx. 70 seconds).

O₂ cell
calibrate
adjust
O₂=21.0 %

The O₂ cell must be adjusted to read 21.0%. By pressing the burner key, the flashing digit can be adjusted. Activate the next digit by pressing Enter and adjust with the burner key.

Natur. gas
Light oil
Heavy oil
Coal

The instrument jumps to the sub-menu "fuel selection".



Natur. gas
Light oil
Heavy oil
Coal

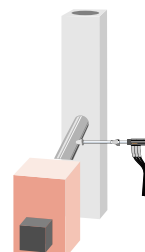
You can select the required fuel with the burner key. The cursor indicates which fuel is selected.

T	CO
O ₂	NO
CO ₂	1-η

Press the measuring key in order to jump to the measurement.

Natur. gas
25.0 °C FT
21.0 % O₂

Insert the flue gas probe into the flue.

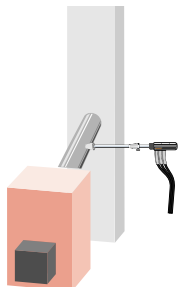




User instructions

Temperature, O₂/CO₂/CO and NO measurement e.g. for the setting of burners

START
STOP



Turn the pump on and position the flue gas probe into the core flow (flue gas temperature FT max.).

219.6 C FT
6.9 % O₂
36 p CO
Pump

You can call up

the individual values

with the measuring key.

When the measured values no longer change

T CO
O₂ NO
CO₂ 1-η

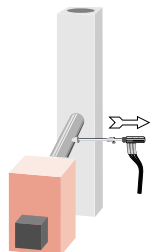
10.4 %CO₂
87.7 %EffG
96.7%EffN
Pump

0.00 mbar
54 puCO
17.8 °C AT
Pump

stop the pump.

Pull the flue gas probe out into fresh air.

START
STOP



After every measurement rinse the measuring cells with fresh air (start/stop pump), until the O₂ content is > 20.0% and the CO content or the NO content is < 50 ppm.

User instructions

Draught measurement

The measuring unit consists of testo 342 and flue gas probe.

You can choose when to effect a draught measurement (before or after gas analysis).

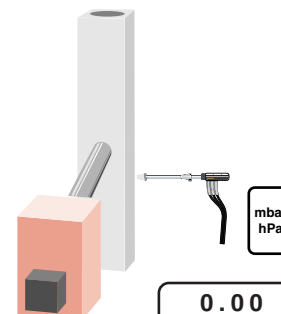


Draught measurement can only be made when the pump is switched off.

Do not switch between the rechargeable battery and mains unit during draught measurement (fluctuations in voltage can influence the measured result)!

If the draught measurement is effected after gas analysis, there is dynamic pressure in the tube once the pump has stopped, which must be reduced.

This is done within approx. 30 seconds. Possible condensate residues must also be removed from the flue gas probe (shake out).



0.00 hPa

Drghcal

Start the draught measurement by pressing the mbar/hPa key to set the zero point with the flue gas probe outside the flue gas pipe. Do not alter the position of the instrument after having set the zero point.



approx.
2 - 3 sec.

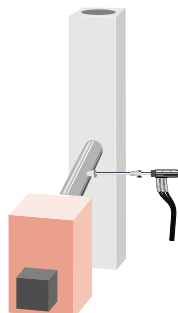
0.00 hPa

Measure



User instructions

Draught measurement



Insert the flue gas probe into the gas pipe.

0.15 hPa
Measure mbar hPa

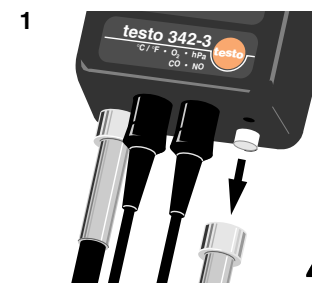
When the measured values have stabilised, end the draught measurement.

0.15 hPa
Finishd

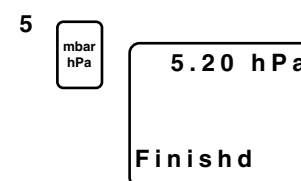
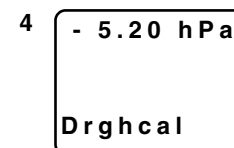
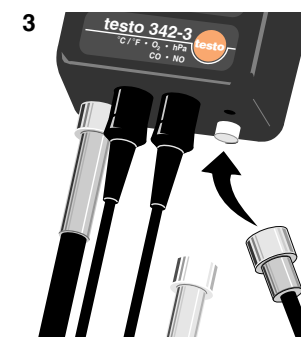
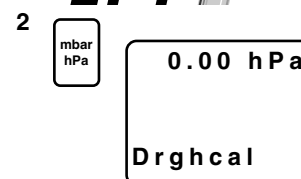
The value is now saved and can be reset to zero by repeatedly pressing the mbar/hPa key.

User instructions

Gas pressure measurement



When adjusting gas installations the testo 342 can be used for gas pressure measurement. Attach a piece of hose pipe between the gas pipe and the hand-held instrument testo 342. Use the input marked with a blue point. For a pressure tight connection to the hand-held instrument a nipple can be screwed on (order no. 0400.9023).



Do not use in the main connection.

Ensure that the path between the sampling point and the measuring instrument is tightly sealed (escaping gas and oxygen could form an explosive mixture)

Do not smoke when measuring. Use of naked flame should be avoided.

Observe the nominal pressure at the connection! It must not exceed 40 hPa!

Gas cannot get into the measuring instrument because an air cushion is formed between the sensor and the gas inlet. For this reason the measuring device is not explosion-proof.

- 1) Remove the (draught) hose pipe of the flue gas probe from the instrument.
- 2) Reset to zero by pressing the mbar key.
- 3) Connect the hose for the gas pressure measurement.
- 4) Pressure measurement is running (- = excess pressure)

When the measured values have stabilised, end the draught measurement.

Do not measure for longer than 5 minutes, then start again from Point 2 (reset to zero). Otherwise the measured values could be outside the tolerance level on account of drift.

- 5) The value is now saved and can only be reset to zero by repeatedly pressing the mbar/hPa key.



User instructions

Temperature measurement

If you only want to take a temperature measurement, connect 2 temperature probes and press the start/stop key to start (or to stop) the measurement.

The FT temperature value corresponds to temperature probe 1, AT corresponds to temperature probe 2.




Temp. probe 1
→ FT

Temp. probe 2
→ AT

User instructions

Illuminating the LCD/Switching off the instrument

The display can be illuminated by pressing the  key. As the light consumes a lot of power, it switches off automatically after 3 minutes, so as to protect the rechargeable batteries. It can be switched back on by pressing the key again.

Switching off the instrument

When the on/off key is pressed, "Instrument will switch off soon" is displayed. In the 5 seconds that follow, you can press any key (apart from ON/OFF to return to the last menu).

If no key is pressed, the instrument switches itself off.

If the instrument detects too high concentrations of gas in the cells, it will ask you to rinse them with fresh air. Place the flue gas probe in fresh air and start the pump with ENTER.

Should you avoid this rinsing phase (by pressing the on/off key again), the measuring instrument will repeat the calibration phase several times when it is switched back on.

The concentrations of gas are displayed in the rinsing mode. If the concentrations of gas have reduced to the limit values, the instrument automatically switches itself off.

Instrument
will
switch off
soon

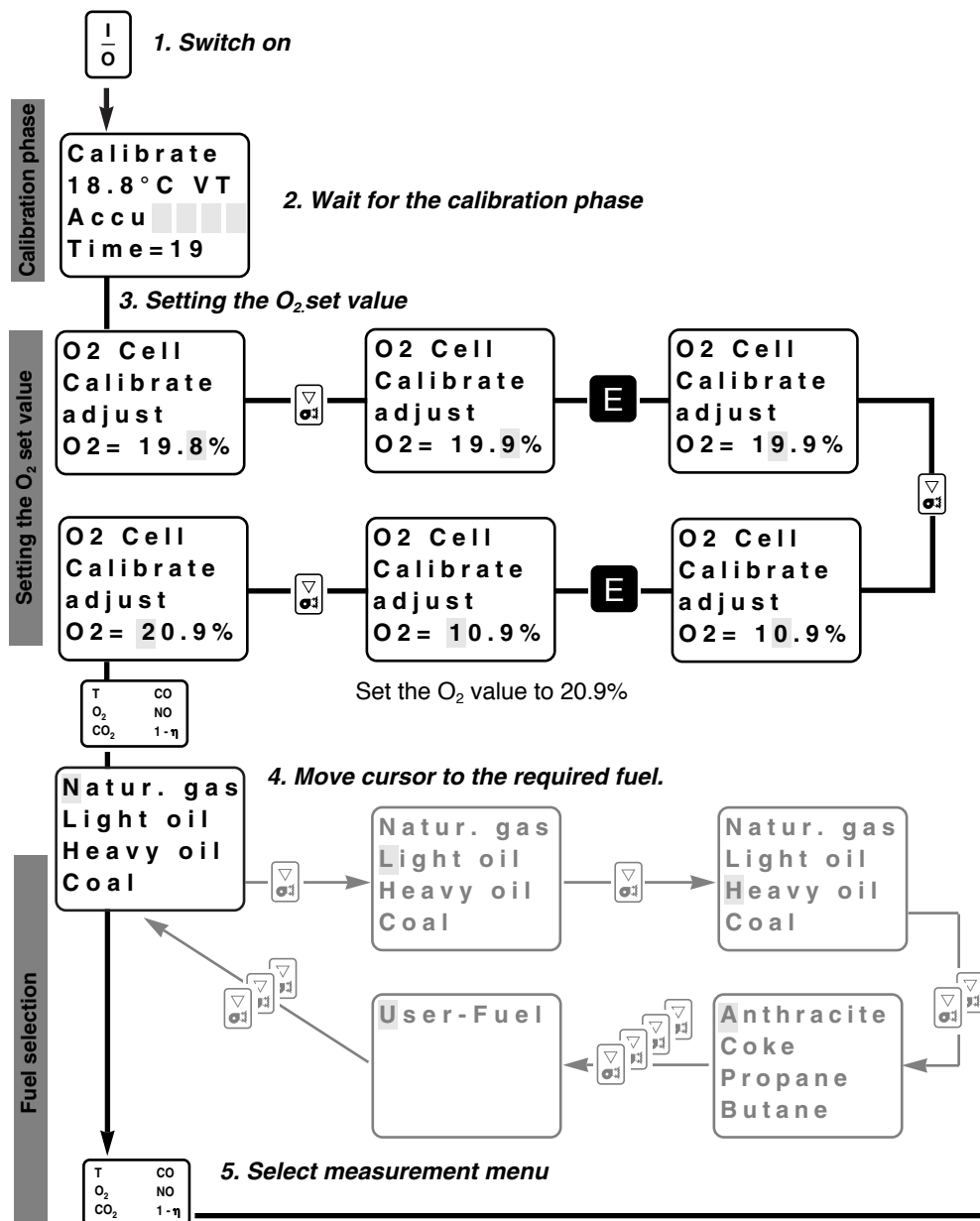
Rinse
before
switching
off

Start
rinsing
with
< E > key

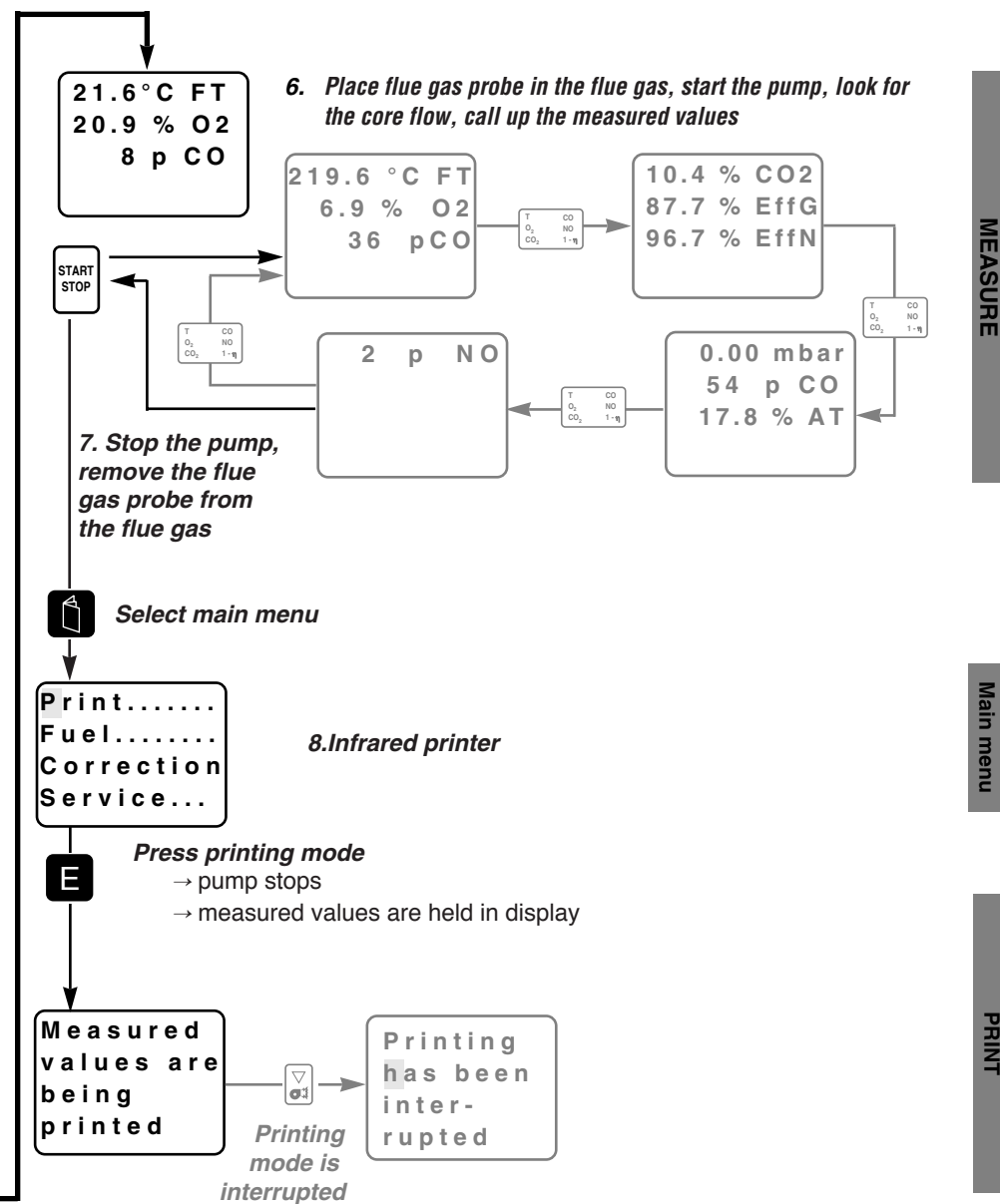
Rinsing
21.0 % O2
78 p CO
63 p NO



Short guide to “MEASURING” and “Printing”

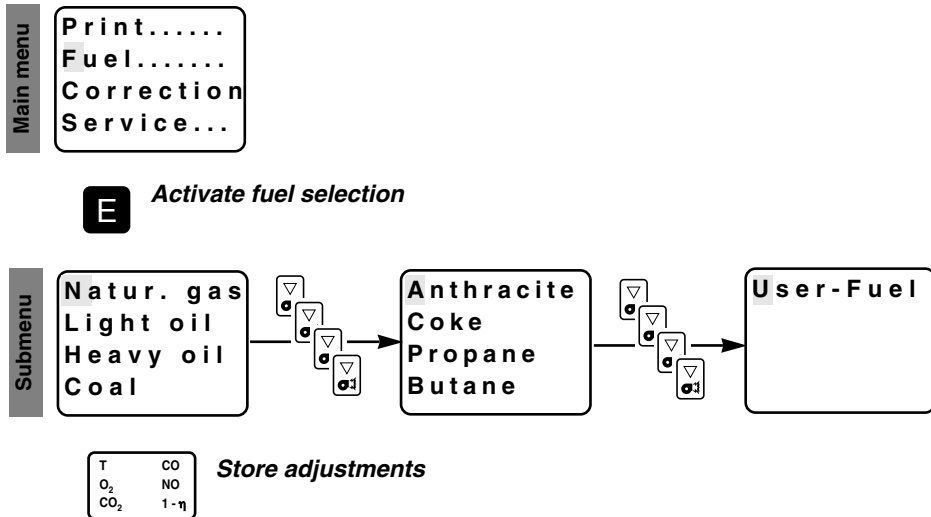


Short guide to “MEASURING” and “Printing”





Fuel selection



The most common fuels are stored with their characteristic values:

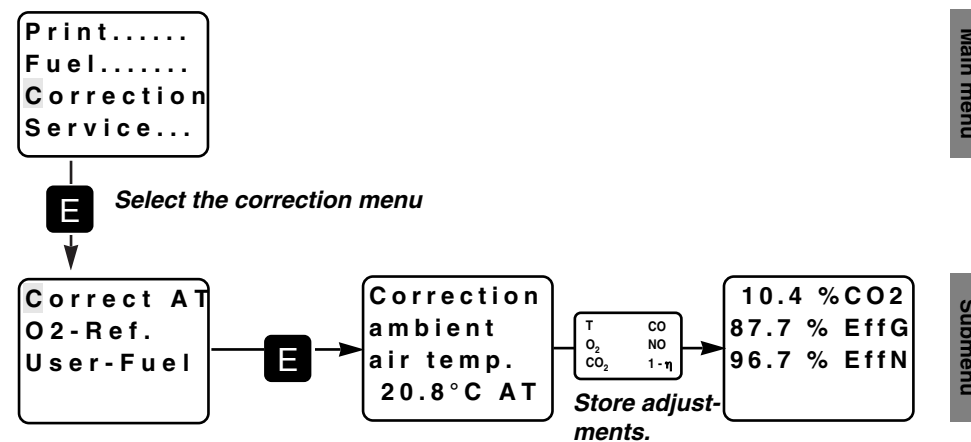
Fuel	CO _{2max} %	K _{gr} ----	K _{net} ----	K _i ----	O _{2bz} %	Hydrogen Content of Fuel H %	Moisture Content of Fuel MH ₂ O %	Q _{gr} mJ/kg	Q _{net} mJ/kg
Natural gas	11.9	0.35	0.39	40	3	24.4	0.0	53.42	48.16
Light oil	15.5	0.48	0.51	53	3	13.0	0.0	45.60	42.80
Heavy oil	15.8	0.51	0.54	54	3	11.5	0.2	42.90	40.50
Coal	18.4	0.62	0.65	63	7	4.0	13.0	26.75	25.50
Anthracite	19.1	0.67	0.69	65	3	3.0	12.0	29.65	28.95
Coke	20.6	0.75	0.76	70	7	0.4	10.0	27.90	27.45
Propane	13.8	0.42	0.45	48	3	18.2	0.0	50.00	46.30
Butane	14.1	0.43	0.46	48	3	17.2	0.0	49.30	45.80
User-fuel*	11.9	0.35	0.39	40	3	24.2	0.0	53.42	48.16

The last acknowledged fuel remains stored even after switching off the instrument.

* default-values may be changed by user

CORRECTION menu

Correcting the ambient air temperature



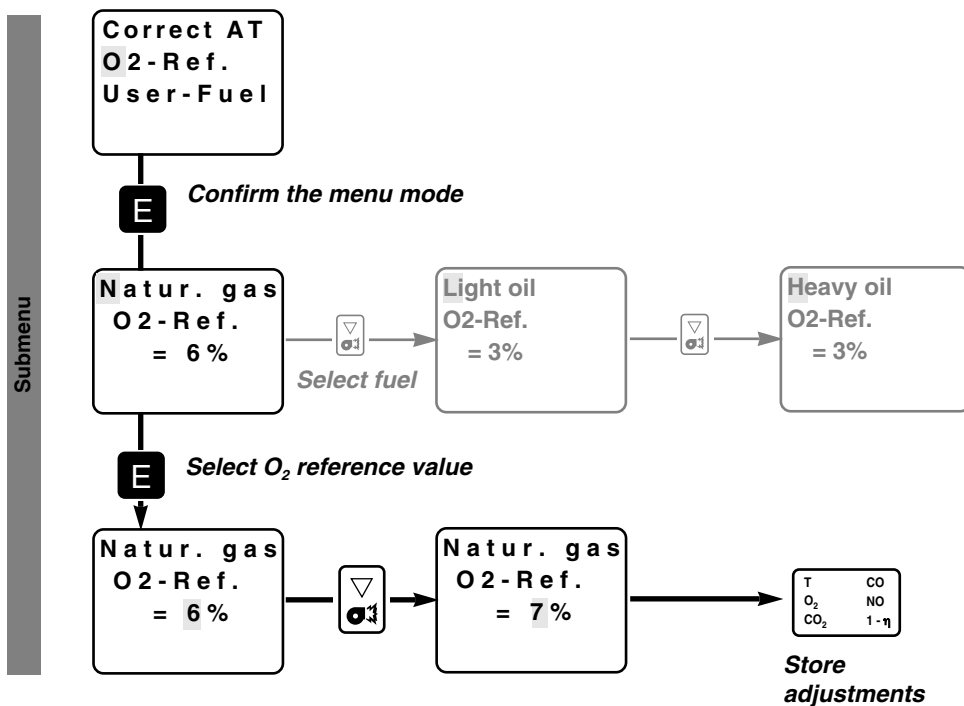
If a separate temperature probe is used e.g. 0610.9713, the ambient temperature AT is continuously measured by this temperature probe as soon as it is plugged-in and the efficiency is continuously calculated. The values last displayed remain stored after the probe has been unplugged.

When using the flue gas probe for measuring the ambient air temperature, switch the pump off and let the flue gas probe cool down before measuring the temperature in the burner air intake.



CORRECTION menu

Setting an O₂ reference value



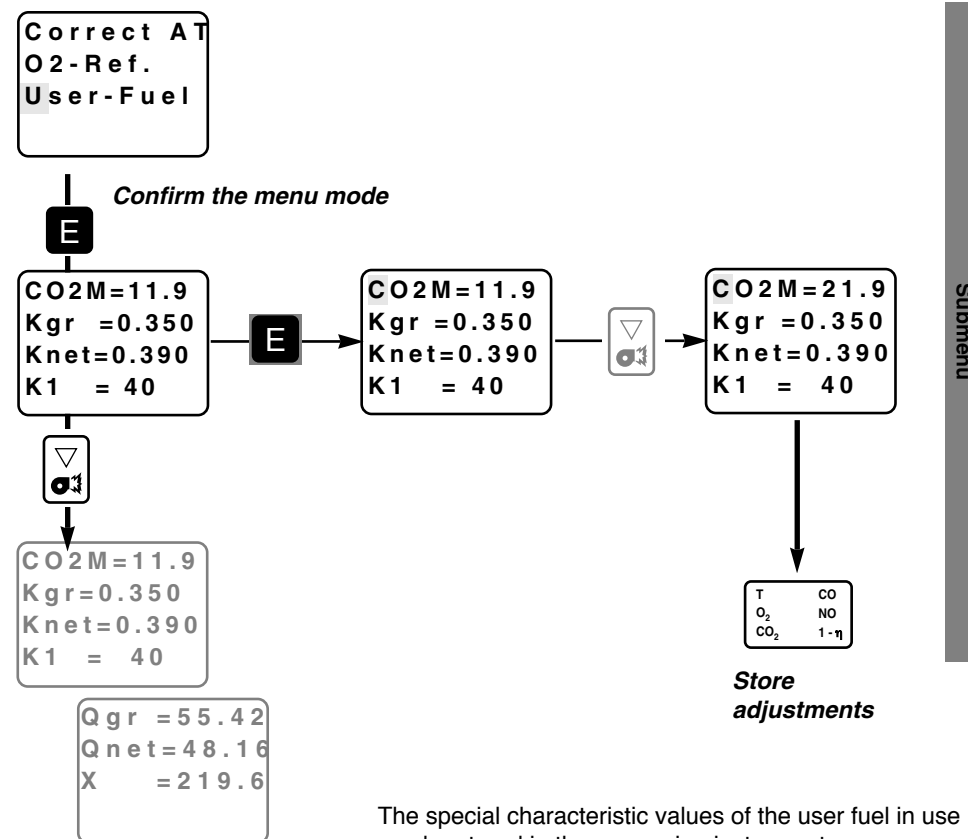
The O₂ reference value is required for the conversion of the ppm values to mg/m³. This can be individually selected and stored for each fuel. The O₂ reference value is displayed with the mg/m³ display. It is freely adjustable in the range 0 to 21%.

The figure can be changed with the Down key.

Your alterations are stored with the measuring key. You will automatically find yourself in the measurement menu.

CORRECTION menu

User fuel



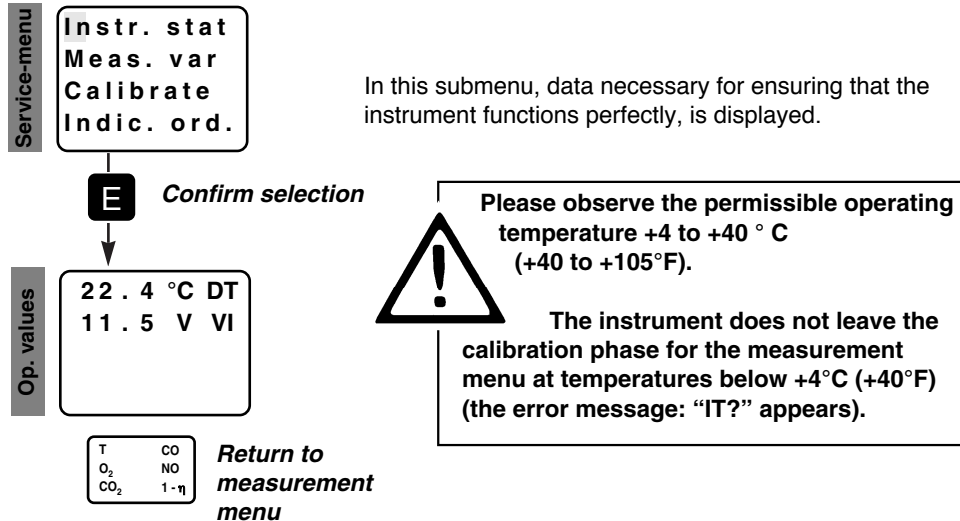
The special characteristic values of the user fuel in use can be stored in the measuring instrument.

A maximum value of 255 is valid for CO_{2max} and K1.



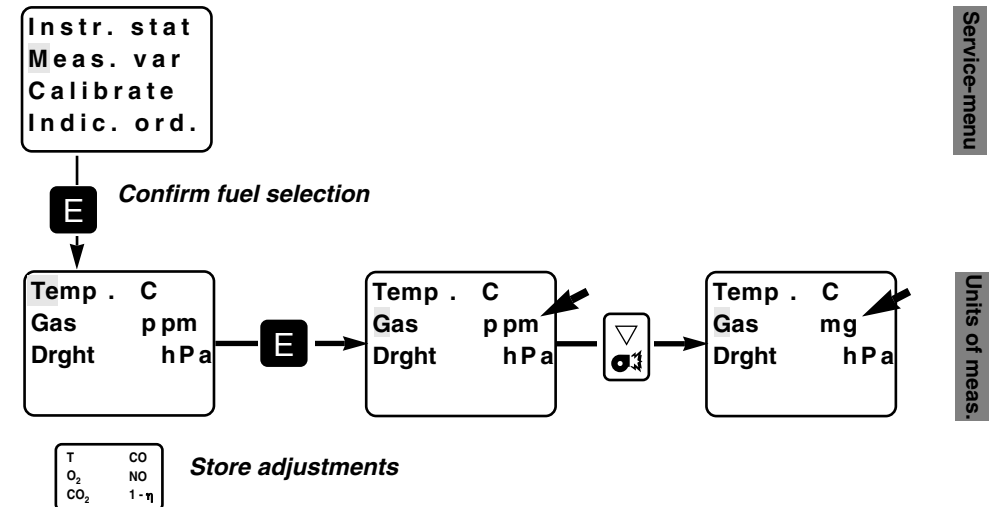
"Service" menu

Operational values



"Service" menu

Units of measurement



It is possible to choose between two measuring units for a measured variable:

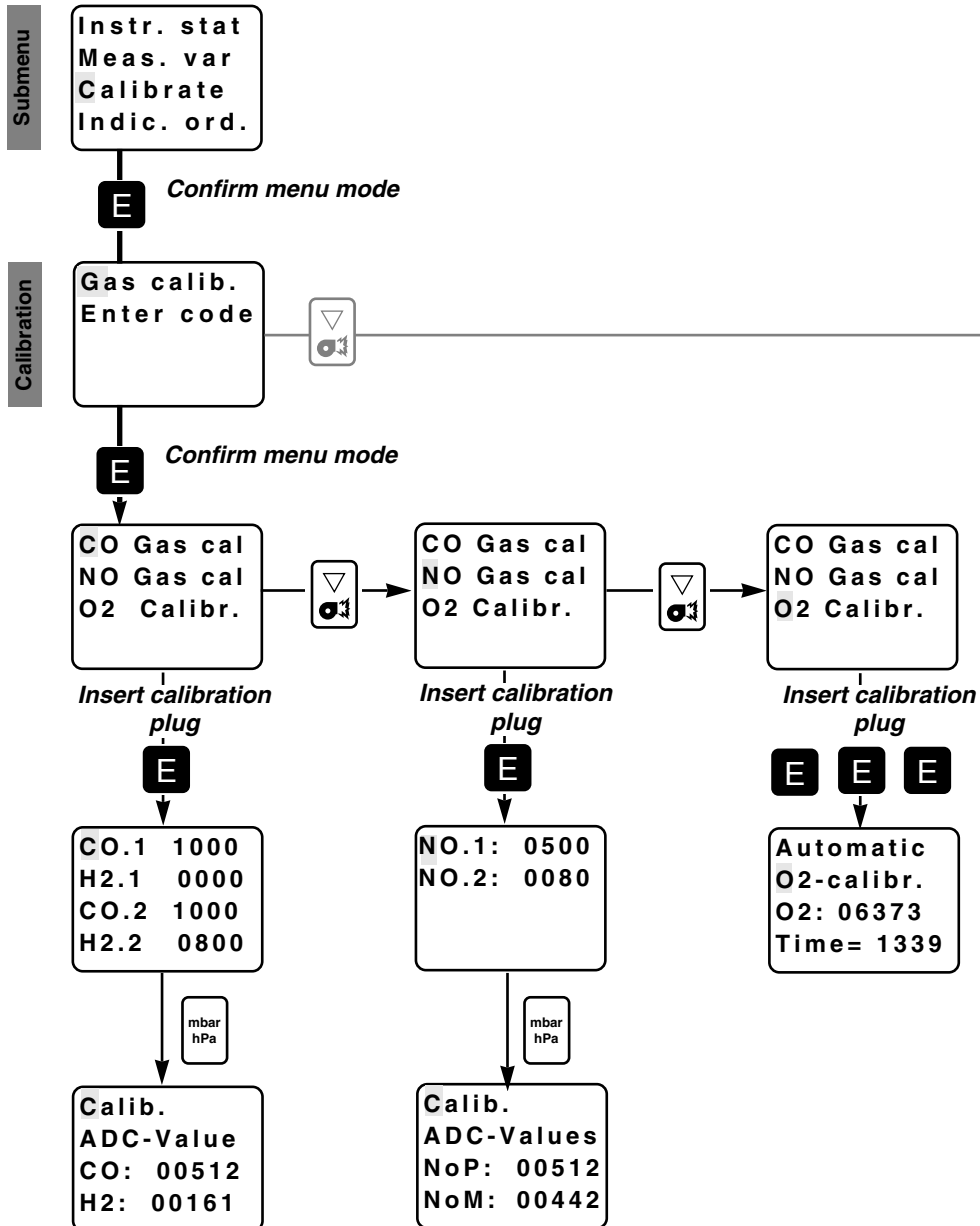
°C	↔	°F
ppm	↔	mg/m ³
		(The indication mg/m ³ refers to dry gas in normal state: 0 °C, 1013 mbar air pressure).
hPa	↔	mbar

The cursor jumps to the next row with the Enter key and you can alter the unit of measurement with the Down key.

The adjustments are stored by pressing the measuring key. You will automatically find yourself in the measurement menu.



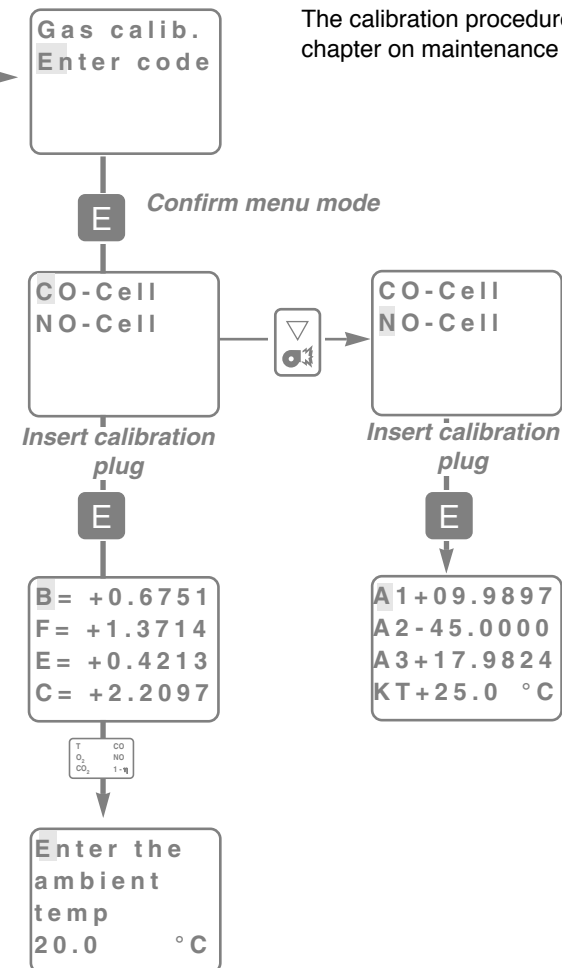
"Service" menu Calibration



"Service" menu Calibration

The CO measuring cells can be calibrated with test gas or via the cell coefficients. The cell coefficients are specific for each measuring cell. If they are calibrated with test gas, the measuring instrument will itself determine the new cell coefficient. For calibration without test gas, you will find a sheet with the standard delivery of the cell, on which the cell coefficients are indicated.

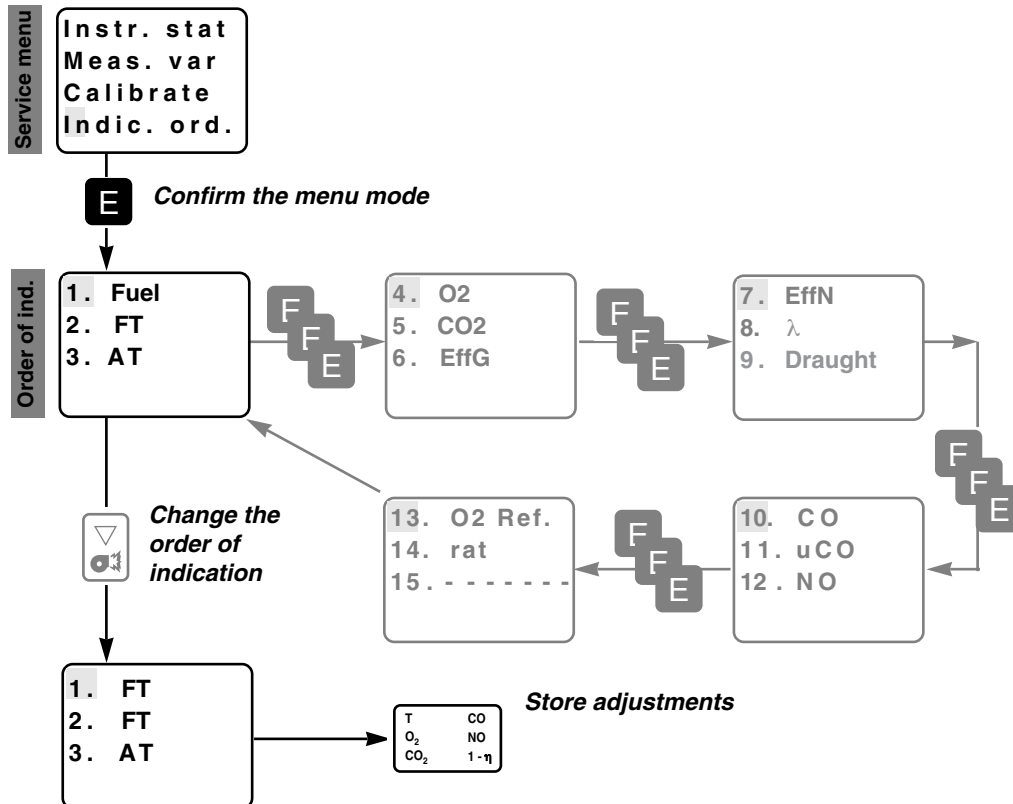
The calibration procedure is described in detail in the chapter on maintenance (see page 39).





"Service" menu

Order of indication



"Service" menu

Order of indication

You can adjust the order of indication within a block of measured values according to your needs.

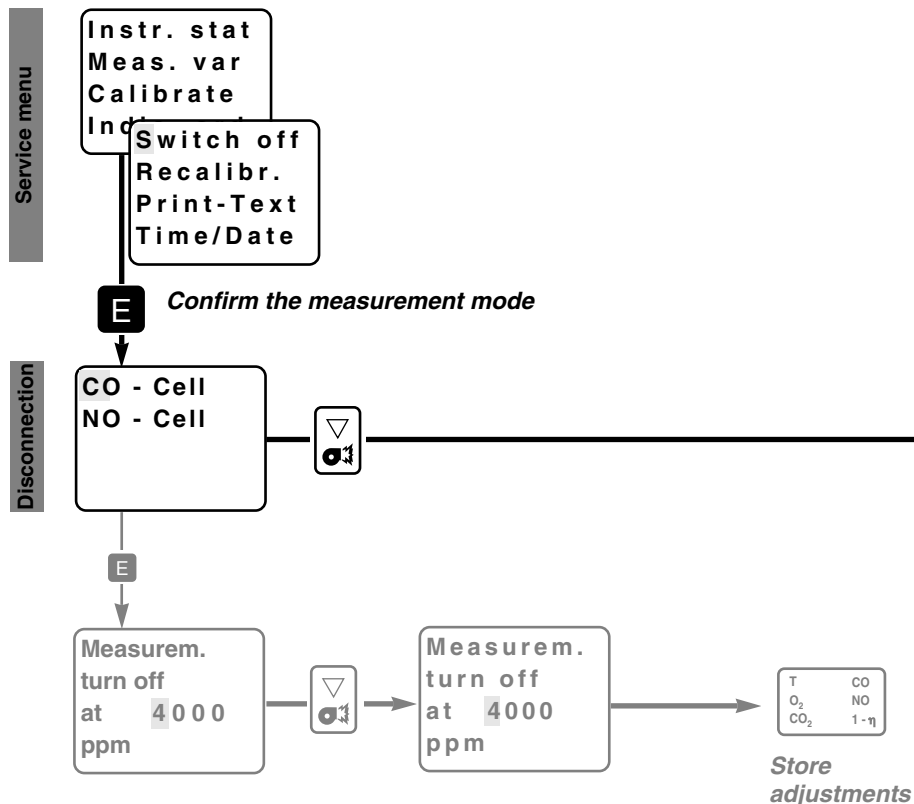
Each block of measured values contains the following variables:

- selected fuel
- flue gas temperature FT
- ambient temperature
- O₂ content
- CO₂ content
- Efficiency Gross
- Efficiency Net
- excess air
- draught
- CO content
- uCO
- NO content
- O₂ reference
- Ratio (rat)
- You can also produce empty lines

The adjustments can be stored by pressing the measuring key (and remain stored even after the measuring instrument has been switched off).



"Service" menu Disconnection



The pump automatically switches itself off at high concentrations of CO in order to protect the CO measuring cell.

The meas. instrument has been adjusted by the manufacturer in such a way that the pump automatically stops when measurements are performed in concentrations of more than 4000 ppm. This limit value can be adjusted over the range 2.000 to 7.000 ppm (in steps of 1000).

Even when this protection is switched off (by setting a limit value of 0000 ppm), a certain protective function remains. The pump switches itself off in CO concentrations of ≥ 8100 ppm.

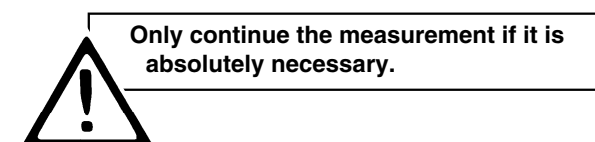
"Service" menu Disconnection

In order to protect the NO measuring cells, the pump switches off at concentrations of above 3000 ppm. This is a factory setting.

The limit value setting is freely selectable within the range 1000 to 3900 ppm (in steps of 100).

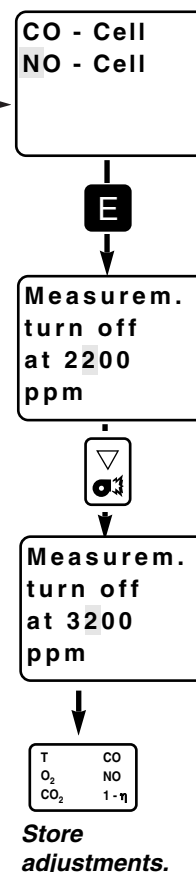
Even when a limit value of 0000 ppm is set, the protective function remains. The pump will switch off in NO concentrations of ≥ 4000 ppm.

If the pump has switched itself off ("Rinsing" appears in the display), remove the flue gas probe from the flue gas and rinse the measuring cells with fresh air.



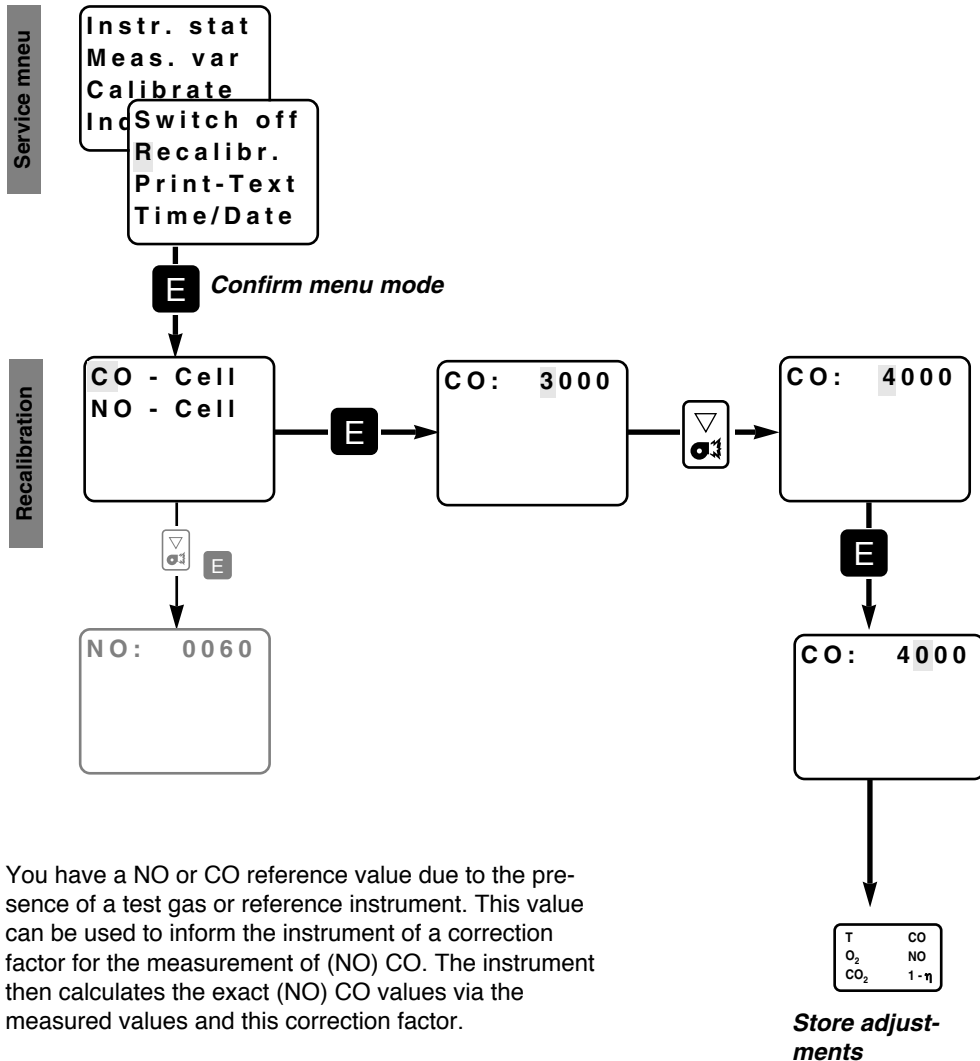
Only continue the measurement if it is absolutely necessary.

Each time the pump switches off automatically, we recommend that you rinse the measuring cells with fresh air until the CO value or NO value drops below 50 ppm CO (or 50 ppm NO).

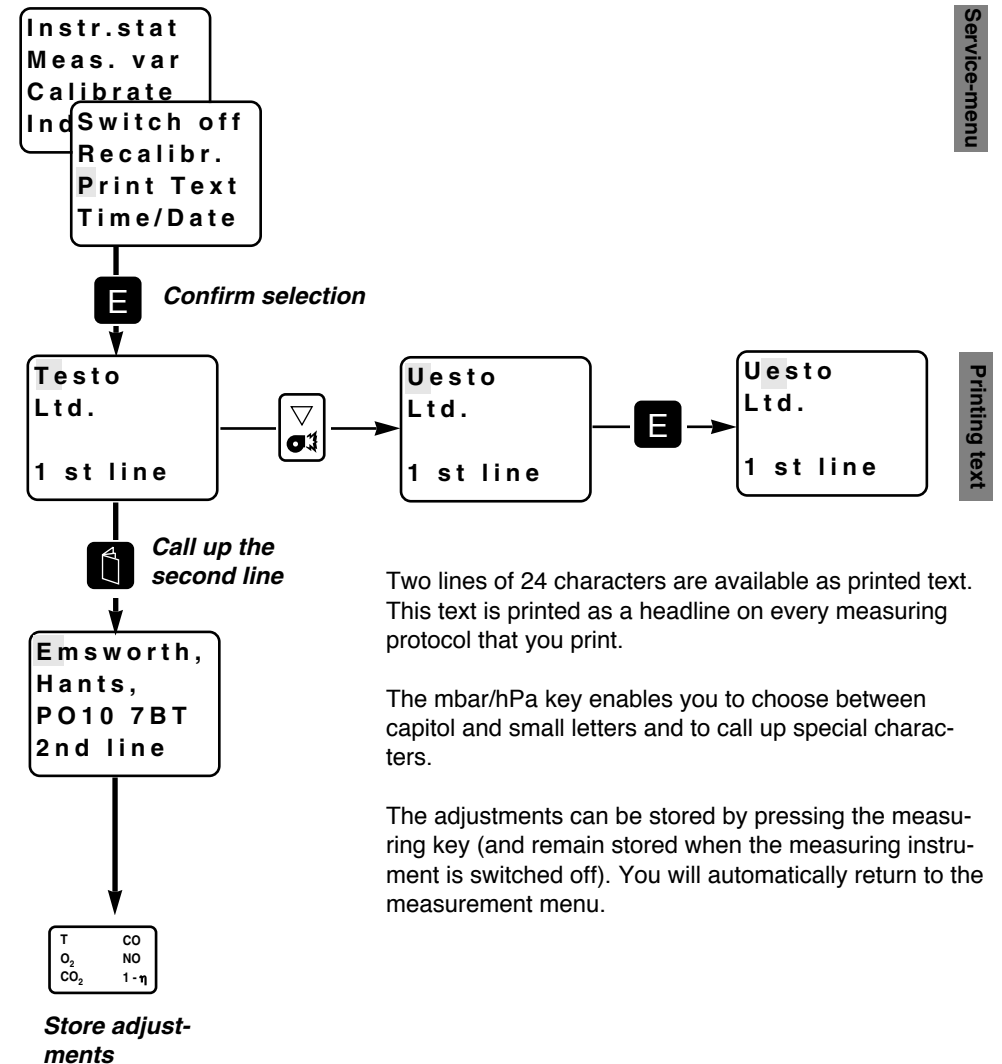




"Service" menu Recalibration

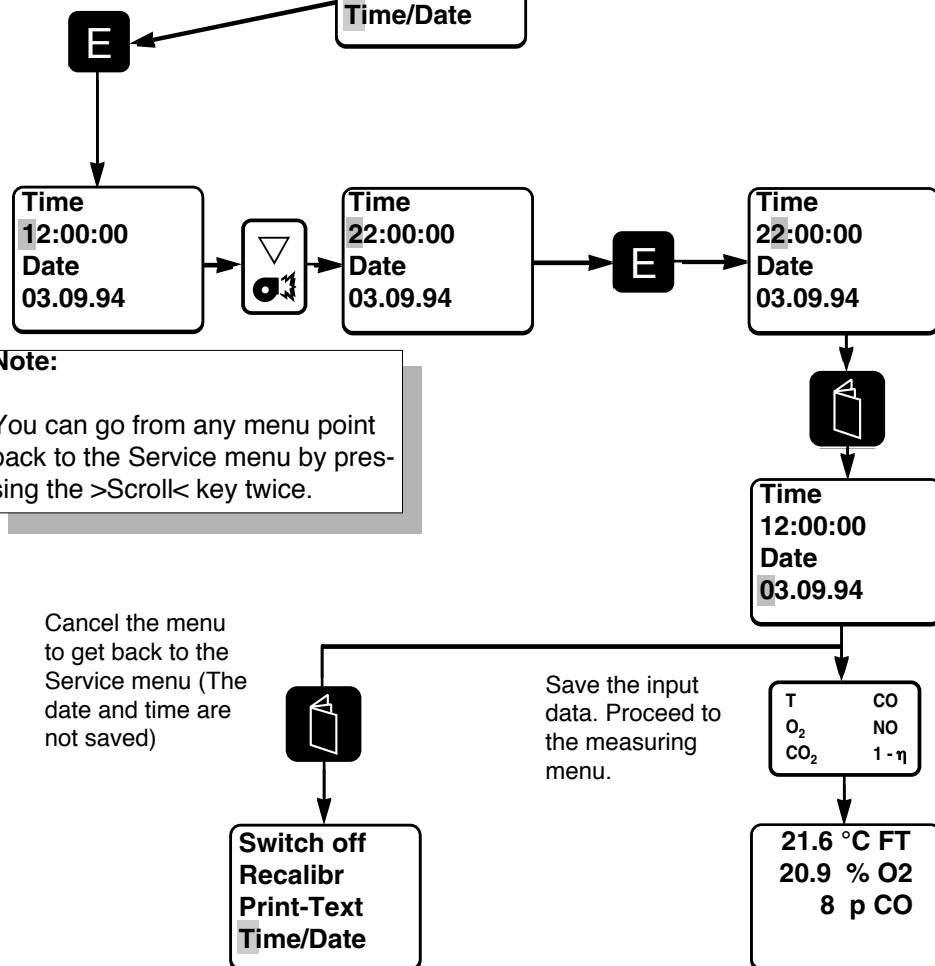


Print text menu Setting/changing the printing text



Instr. stat
Meas. var
Calibrate
Indi

Switch off
Recalibr
Print-Text
Time/Date



Note:

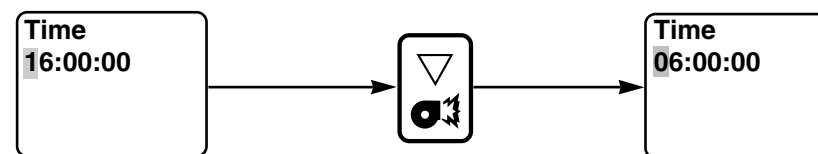
You can go from any menu point back to the Service menu by pressing the >Scroll< key twice.

Cancel the menu
to get back to the
Service menu (The
date and time are
not saved)

Date and time

To avoid errors certain number combinations are not permitted.

For example the setting from 16.00 to 24.00



The figure 1 can only be changed if the second figure lies between 0 and 4.

Printout on infrared printer

The printout on the infrared printer includes the following:

1st line	freely definable text
2nd line	freely definable text
3rd line	Space
4th line	Day Month Year Hour Minute Second DD - MM - YY - HH - MM - SS



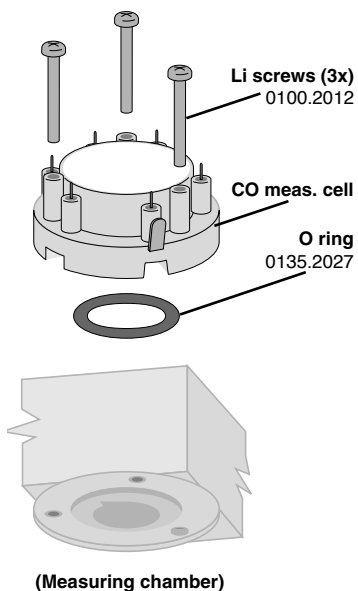
Maintenance

Replacing CO measuring cell

In order to replace the measuring cell, loosen the screw or the spring lock at the back of the instrument and remove the cover.

Please observe the following:

- When inserting the cell avoid putting any pressure (e.g. thumb pressure) on the sensor (especially on the bottom).
- The opening for the gas input at the front of the sensor should not be touched or jolted.
- The connecting clamps must not be turned or moved, as this may interrupt the electrical connections in the instrument or reduce tightness.
- The sensor must be screwed in such a way that maximum tightness is ensured. The tension of the screws should, therefore, not be too great.
- The sensors should never be glued as dissolving glue vapours may cause cracks in the plastic housing and destroy the electrodes.



Please observe the following instructions when replacing the cell

- Loosen the screws of the measuring cell and remove the measuring cell. Take out the O ring.
- Remove the connecting cable from the measuring cell (plug-in connection).
- Place the O ring in the centre
- Connect the cables.
- Insert the measuring cell.

Once the cell has been inserted, calibration must be effected, e.g. with the cell coefficients enclosed with the cell (→ calibration of CO measuring cell with cell coefficients, page 42).

Maintenance

Calibration of CO measuring cell with test gas

- only possible if an H₂ content exists in test gas -

The cell coefficients are subject to programming protection. In order to change these parameters, the flue gas probe thermocouple connector must be replaced by the calibration plug, which is enclosed with the standard delivery, for the duration of the calibration.

Should you not have a test gas with H₂ components, you can only perform calibration via CO recalibration (→ CO recalibration, page 41).

Select the submenu gas calibration (service menu → calibration → gas calibration → CO gas calibration).

Change the numerical values in lines 1 and 2 according to the test certificate of test gas 1, the same in lines 3 and 4 for test gas 2. The down key changes the figure, Enter activates the next figure.

CO.1	1000
H2.1	0000
CO.2	1000
H2.2	0000



mbar
hPa

Calib.	
ADC-Value	
CO:	00031
H2:	00037



Calib.	
ADC-Value	
CO:	00031
H2:	00037



Press the mbar/hPa key to enter the CO/H₂ calibration mode.

Start the pump.

Wait until the ADC values have stabilised and press the Enter key to set the zero point of the measuring cell.

Rinse the measuring cells with fresh air.



Calibration

Calibration of CO measuring cell with test gas - only possible if an H₂ content exists in test gas -

Calib.
ADC-Value
CO: 00527
H 2: 00161



Admit test gas 1 to the measuring cells. Apply the gas without pressure (max. 30 mbar) - for duration of approx. 3-4 minutes.

Once the ADC values have stabilised (after approx. 3-4 minutes) press the turnover key in order to set the gradient for test gas 1.

Calib.
ADC-Value
CO: 00527
H 2: 00161



Admit test gas to the measuring cells. Apply the gas without pressure (max. 30 mbar) - for duration of approx. 3-4 minutes.

Once the ADC values have stabilised (after approx. 3-4 minutes) press the light in order to set the gradient for test gas 2.

T	CO
O ₂	NO
CO ₂	1-η

The measuring instrument performs cell calibration with the measuring key, stores the values and jumps automatically to the calibration phase.

Maintenance

CO recalibration

- for test gases without H₂ -

The cell coefficients are subject to programming protection. In order to change these parameters, the flue gas probe thermocouple connector must be replaced by the calibration plug, which is enclosed with the standard delivery, for the duration of the calibration.

Select the submenu recalibration of CO cell (service-menu → recalibration → CO cell).
Effect a measurement of the test gas (same procedure as measurement on page 14). Should the measured value lie outside the tolerance, enter the corresponding nominal CO value.

The Down keys enable the figures to be altered in a numerical order.

Press Enter to jump to the next figure.

You can store this value by pressing the measuring key, the measuring instrument calculates the correcting factor. You will automatically find yourself in the measurement menu.



**Should you unintentionally find yourself in this mode, always leave the menu via the turnover key.
Please switch off the instrument and then switch on again.**

CO: 3000



CO: 4000



CO: 4000

T	CO
O ₂	NO
CO ₂	1-η

Calibration of CO measuring cell with cell coefficients

The cell coefficients are subject to programming protection. In order to change these parameters, the flue gas probe thermocouple connector must be replaced by the calibration plug, which is enclosed with the standard delivery, for the duration of the calibration.

B= +0.6751
F= +1.3670
F= +0.4284
C= +2.2097

E

Select the submenu CO cell (service menu → calibration → enter → CO cell).

B= +0.6751
F= +1.3670
F= +0.4284
C= +2.2097

After factory cell calibration with test gases, the spare measuring cell is given 4 cell coefficients. These coefficients are printed on a sheet which is enclosed with the measuring cell. Enter these coefficients by means of the Enter and Down keys.

As soon as you have entered all cell coefficients, keep the cursor on a number and press the measuring key to store the cell coefficients.

The basic calibration temperature is asked for. The correct temperature is indicated on the sheet enclosed with the measuring cell. Press the measuring key, once you have entered the temperature. The measuring instrument jumps to the calibration phase.

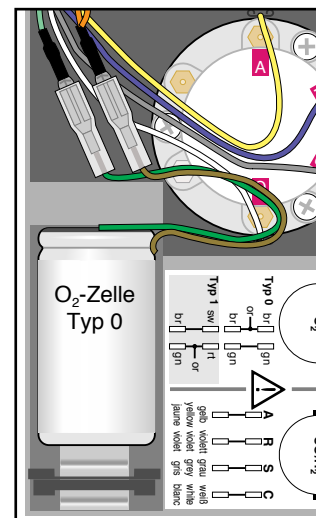
T	CO
O ₂	NO
CO ₂	1-η

Input
Enter the
ambient temp.
20.0°C

E

T	CO
O ₂	NO
CO ₂	1-η

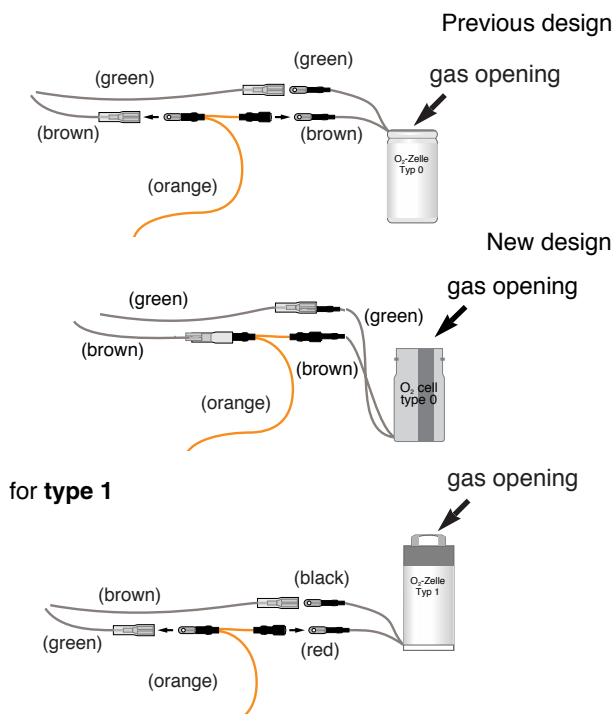
Calibrate
18.8°C AT
Accu :
Time=19



Replacing an O₂ measuring cell

In order to replace the measuring cell, loosen the screw on the back of the instrument and remove the cover.

- Pull the measuring cell out on the textile band
- Remove the connection cable from the measuring cell (plug-in connection).
- When connecting the O₂ measuring cell, the following is valid for **type 0**



- Insert the measuring cell with the gas opening facing upwards.
- Insert the cable in the slot provided.

Once the measuring cell has been inserted, calibration must be effected (→ Calibration of a new O₂ measuring cell, page 44).



Maintenance

Calibration of a new O₂ measuring cell

The cell coefficients are subject to programming protection. In order to change these parameters, the flue gas probe thermocouple connector must be replaced by the calibration plug, which is enclosed with the standard delivery, for the duration of the calibration. We recommend the use of the mains unit to guarantee an adequate power supply.

Select the submenu gas calibration of a O₂ measuring cell (service menu → calibration → gas calibration → O₂ calibration).

The display questions the type of O₂ sensor used (see label on the measuring cell). You can confirm that the setting is correct by pressing the Enter key.

(Should the O₂ sensor type displayed be incorrect, press the turnover key and then use the burner key to correct the sensor type displayed. Confirm with the measuring key).

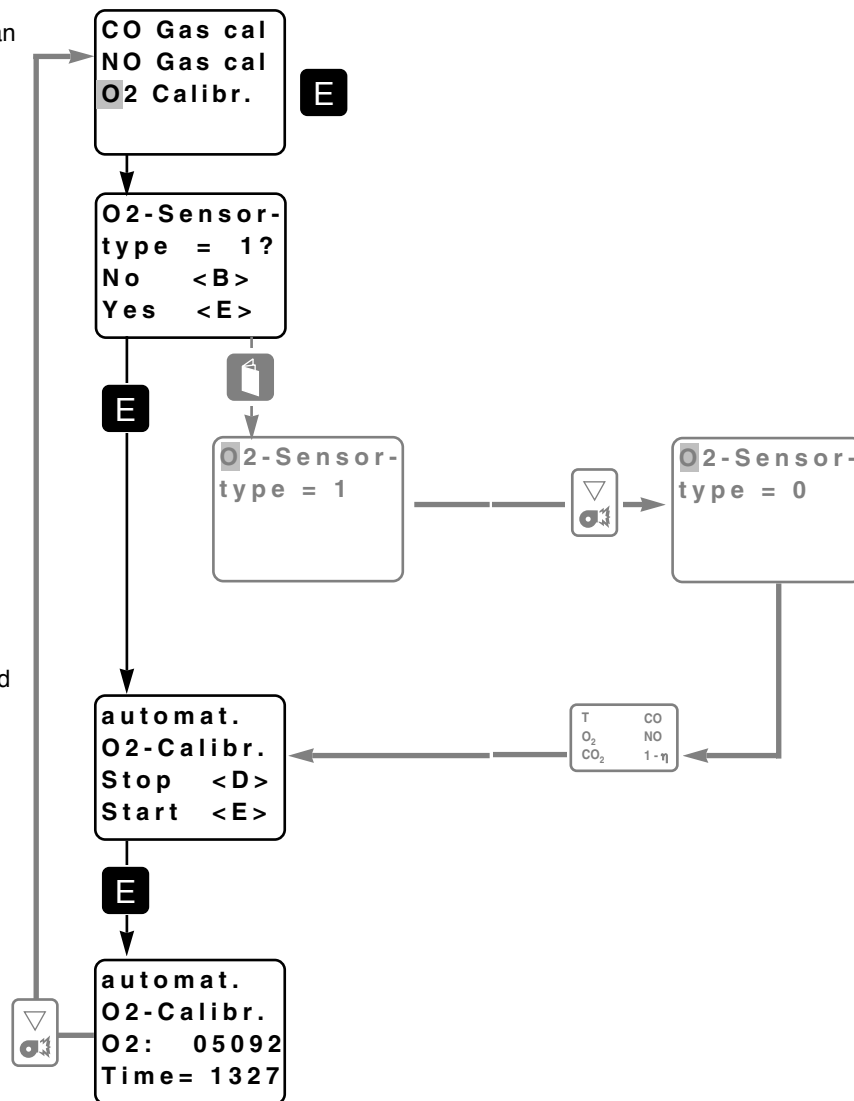
Start O₂ cell calibration with the Enter key. You can stop or interrupt this mode via the turnover key.

Calibration and storage of the ADC values is effected automatically. The measuring cell (type 0) requires approx. 70 minutes, type 1 requires roughly 25 minutes.

Remove the calibration plug when the instrument asks. The instrument jumps to a calibration phase and is then operational.

Note:

The calibration of the O₂ cell in rooms with a low O₂ contents (no fresh air) leads to error messages or incorrect measurements



Maintenance

Calibration of a new O₂ measuring cell

Use the arrow key to jump directly to the menu which enables the entry to be changed. Save the alteration with the measuring key. You will then automatically find yourself in the O₂ cell calibration phase.

Note:

Keeping the measuring instruments in rooms where solvents are stored leads to the damage of the measuring cells.

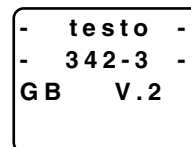


Maintenance

Replacing a NO measuring cell

The **testo 342** NO measuring cell cannot be replaced by the user himself, as it is situated inside the instrument and a time-consuming calibration is necessary due to the high accuracy requirements. The instrument should be returned to the factory or to an authorised dealer for the replacement of the NO measuring cell.

The corresponding menu NO cell in gas calibration menu (service menu) is only for authorised service departments.



Maintenance

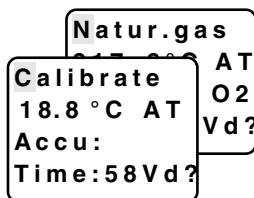
Determining the instrument version

Press the turnover key during the calibration phase. The instrument type appears which gives information on the fitted cells.

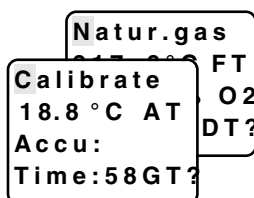
342-1: O₂/CO
343-2: O₂/NO
342-3: O₂/CO/NO



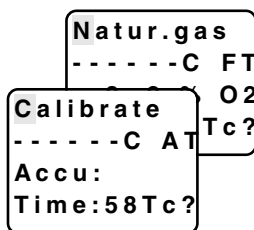
Error messages



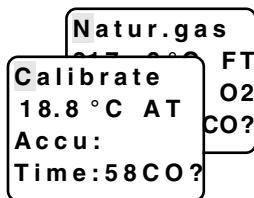
Cause: Insufficient power supply of the instrument.
Result: If the battery voltage drops below 5.5V, automatic disconnection follows.
Remedy: Connect the mains unit and recharge the battery.



Cause: The instrument temperature is below +4 °C.
Result: The instrument is not operational and remains in the calibration phase.
Remedy: Increase ambient temperature.

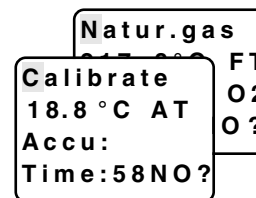


Cause: 1. Thermocouple connection of the flue gas probe is not connected.
2. The temperature part of your flue gas probe is faulty.
Result: Measurement continues, but FT will not be measured.
Remedy: Check the thermocouple connection or insert new thermocouple.

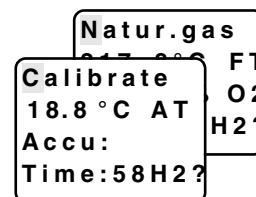


Cause: There is CO in the instrument.
Result: The calibration time of the measuring cell is considerably longer (when the instrument is next switched back on), if long-term measurements are effected in this high concentration. This has no effect on the measuring cell.
Remedy: Only continue measurements when urgent and rinse the measuring cells with fresh air.

Error messages



Cause: There is NO in the instrument.
Result: The calibration time of the measuring cell is considerably longer (when the instrument is next switched back on), if long-term measurements are effected in this high concentration.
This has no effect on the measuring cell.
Remedy: Only continue measurements when urgent and rinse the measuring cells with fresh air.



Cause: Instrument has detected too high a level of H₂ in the CO cell.
Result: The calibration time is longer.
Remedy: If the instrument does not leave the calibration phase the CO cell must be changed.



Cause: The calibration plug was not connected for calibration.
Result: The programming protection for the parameters could not be reserved.
Remedy: Insert the calibration plug (left connection socket = temperature input for the flue gas probe).



Cause: The calibration plug was not removed after calibration.
Result: The programming protection for the parameters could not be activated.
Remedy: Remove the calibration plug (left connection socket = temperature input for the flue gas probe).



Error messages

O₂ cell : ! ? !
217.8 °C FT
4 Calibrate
18.8 °C AT
Accu: ■ ■ ■ ■
Time=1902?

10.4 % CO₂
11 % qA
1.50 λ
Rinsing

NO - Cell
is not
switched
on
Please use
the <E>
key to
switch
Measurem.
NO is not
possible
for 2 hrs.

Self-test
fault.
Service is
required

Cause: O₂ cell is used up.
Result: The measurement will continue, the accuracy indicated in the data sheet can no longer be observed.

Remedy: Replace the O₂ cell.

Cause: The NO or CO concentrations exceed the upper limit during the measurement (disconnection according to setting in instrument).

Result: Measuring instrument not operational.

Remedy: Remove flue gas probe from flue gas and rinse in fresh air.

Cause: 1. The voltage of the internal rech. battery has dropped below the 3.5 limit.
2. Malfunction of the NO measuring switch.

Result: The NO measuring cell is inactive.

Remedy: 1. Press Enter and recharge the battery (for at least 2 hours). Should the display not change to calibration phase in the 10 seconds after the Enter key has been pressed, an error has occurred which must/can be repaired by an authorised service department.

Cause: Instrument error

Result: Measuring instrument is not operational.

Remedy: Return instrument for repair.

Calculation information

Information on the calculation of CO₂-value, flue gas loss and excess air value

The following equations are used for calculating the listed values:

$$\text{CO}_2\text{-value: } \text{CO}_2 = \text{CO}_{2\text{max}} \times \frac{\text{O}_{2\text{set.}} - \text{O}_2}{\text{O}_{2\text{set.}}}$$

CO_{2max} : fuel specific
max. CO₂-value

O_{2set} : set O₂-value

O₂ : measured oxygen content

$$\text{Excess air } \lambda: \lambda = \left(\frac{\text{O}_{2\text{set.}}}{\text{O}_{2\text{set.}} - \text{O}_2} - 1 \right) \times 100$$

Resolution 0.1 %

Interruption of calculation at 19 % O₂

Gross Efficiency

$$\text{EffG: } 100 - \left(\frac{K_{\text{gr}} * (\text{FT} - \text{AT})}{\text{CO}_2} \right) - \left(\frac{X * (2488 + 2.1 * \text{FT} - 4.2 * \text{AT})}{Q_{\text{gr}} \times 1000} \right) - \left(\frac{K1 * \text{CO}}{\text{CO}_2 + \text{CO}} \right)$$

Net Efficiency

$$\text{EffN: } 100 - \left(\frac{K_{\text{net}} * (\text{FT} - \text{AT})}{\text{CO}_2} \right) - \left(\frac{X * (210 + 2.1 * \text{FT} - 4.2 * \text{AT})}{Q_{\text{net}} \times 1000} \right) - \left(\frac{K1 * Q_{\text{gr}} * \text{CO}}{Q_{\text{net}} * (\text{CO}_2 + \text{CO})} \right)$$

K_{gr} : fuel specific value

FT : flue gas temperature

AT : ambient temperature

K1 : fuel specific value

CO : measured CO value in %

CO₂ : measured CO₂ value in %

Q_{gr} : fuel specific value

Q_{net} : fuel specific value

X : fuel specific value
(MH₂O + 9 * H)

- for fuel specific values see page 22 -



Calculation information

Information on the calculation of CO₂-value,
flue gas loss and excess air value

Conversion ppm to mg/m³ in relation to O₂ reference (Freely selectable according to fuel)

$$\text{CO (mg/m}^3\text{)} \quad \text{CO} = \frac{O_{2\text{set}} - O_{2\text{bz}}}{O_{2\text{set}} - O_2} \times \text{CO (ppm)} \times 1.25$$

$O_{2\text{set}}$: O₂ set
 $O_{2\text{bz}}$: O₂ reference value
 O_2 : measured oxygen content

$$\text{NO (mg/m}^3\text{)} \quad \text{NO} = \frac{O_{2\text{set}} - O_{2\text{bz}}}{O_{2\text{set}} - O_2} \times \text{NO (ppm)} \times 2.05$$

$O_{2\text{set}}$: O₂ set
 $O_{2\text{bz}}$: O₂ reference value
 O_2 : measured oxygen content

Measurement menu

12.0% CO₂
1000 p CO
0.8 rat

Ratio calculation

$$\text{rat} = \frac{\text{CO [ppm]}}{\text{CO}_2 [\%] \cdot 100}$$

O₂set = 20.9

10.0% O₂
1000 p CO
1917 puCO

uCO calculation

$$\text{uCO [ppm]} = \text{CO [ppm]} \cdot \frac{O_2 \text{ set}}{O_2 \text{ set} - O_2}$$

uCO [mg/m³] does not exist

Technical data/Warranty

Temperature measurement:

NiCr-Ni(Al):

Meas. range: -40 to +1200 °C
 (-40 to +2190 °F)
 Max. tolerance: ±0.5 °C/°F (0 to 100 °C)
 (+32 to +210 °F)
 ±0.5 % of m.v. (from +100°C/+210 °F)
 Resolution: 0.1 °C / 1 °C (from +1000 °C/+1830 °F)
 Sensor: Thermocouple type K
 (NiCr-NiAl according to
 DIN IEC 584, part 2, class 1)

NTC:

Meas. range: -10 to +100 °C (+15 to +210 °F)
 Max. tolerance: ±0.5 °C/°F
 Resolution: 0.1 °C/°F

Draught:

Meas. range: ±50 mbar
 Resolution: 0.01 mbar
 Max. tolerance: ±0.03 hPa absolute (up to 3.00 mbar)
 ±2 % of m.v. (up to 50 mbar)

O₂ measurement:

Meas. range: 0 to 21 vol.%
 Max. tolerance: ±0.2 vol.% absolute
 Resolution: 0.1 vol.%
 Meas. procedure: electrochemical meas. cells
 Response time t₉₀: approx. 40 sec.

CO₂ measurement:

Meas. range: 0 to CO_{2max}
 Max. tolerance: ±0.2 vol.%
 Resolution: 0.1 vol.%
 Meas. procedure: digital calculation from O₂
 Response time t₉₀: approx. 60 sec.



Technical data/Warranty

CO Measurement (with H₂ compensation)

(testo 342-1 and testo 342-3):

Meas. range:	0 to 4000 ppm
Max. tolerance:	±20 ppm (up to 400 ppm) ±5 % v. Mw. (up to 2000 ppm)
Response time t_{90} :	approx. 60 sec.

NO measurement

(testo 342-2 and 342-3):

Meas. range:	0 to 3000 ppm
Max. tolerance:	±5 ppm (up to 100 ppm) ±5 % of m.v. (up to 2000 ppm) ±10 % of m.v. (up to 3000 ppm)
Resolution:	1 ppm
Measuring procedure:	electrochemical meas. cells
Response time t_{90} :	approx. 40 sec.

General data:

Dimensions:	210 x 95 x 60 mm
Weight:	0.6 kg
Display:	4 lines of 10 characters (5 x 7 dot matrix) alphanumeric display illuminated display
Perm. operating temp.:	+4 to +40 °C (-40 to 105 °F)
Perm. storage and transport temperature:	-20 to +50 °C (-4 to 120 °F)
Power supply:	via mains unit or integrated block of rech batteries

Warranty:

Measuring instrument (except measuring cells)	24 months
Flue gas probes, Temperature probes, CO/NO measuring cells	6 months
O ₂ measuring cells	18 months

Ordering data

	Description	Part.no.
Meas. instrument	Flue gas analyser testo 342-1 with 2 temperature probe inputs, O ₂ , CO ₂ , CO (H ₂ compensated), CO undiluted, effg/effn and hPa (incl. mains unit and service plug)	0563.3421
	Flue gas analyser testo 342-2 with 2 temperature probe inputs, O ₂ , NO (H ₂ compensated), effg/effn and hPa (incl. mains unit and service plug)	0563.3431
	Flue gas analyser testo 342-3 with 2 temperature probe inputs, O ₂ , CO ₂ , CO (H ₂ compensated), CO undiluted, NO and hPa (incl. mains unit and service plug)	0563.3421

Options	Infrared printer for cableless printing of measured values (thermal printer) with 4 miniature batteries and 1 roll of thermopaper	0554.0345
	Spare thermopaper (6 rolls)	0554.0115

Flue gas probes	Standard probe L = 185 mm, 2.20 hose, T _{max} = +500 °C (+930 °F), with integrated independent condensate trap	0600.9521
	Standard probe L = 335 mm, 2.20 hose, T _{max} = +500 °C (+930 °F), with integrated independent condensate trap	0600.9522
	Heavy duty industrial probe L = 335 mm, 2.20 hose, T _{max} = +1000 °C (+1830 °F), with integrated independent condensate trap	0600.8720
	Heavy duty industrial probe L = 715 mm, 2.20 hose, T _{max} = +1000 °C (+1830 °F), with integrated independent condensate trap	0600.8520



Ordering data

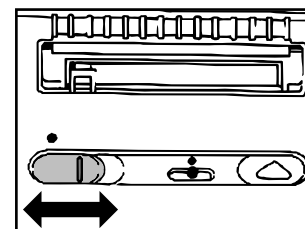
Description		Part.no.
Temperature	Air probe (NTC) for separate measurement of ambient air temperature, $T_{max.} = +100\text{ °C (+210 °F)}$, L = 300 mm, with cone	0600.9791
	Magnetic holding for air probe 0600.9791	0554.0431
	Air probe (NTC) Shaft end probe for separate measurement of ambient temp. $T_{max.} = +80\text{ °C (+175 °F)}$, L = total of 60 mm	0600.3691
	Temperature probe (NiCr-NiAl) for surface measurement, very quick, meas. range -200 to +500 °C (-60 to +265 °F)	0600.4593
	Temperature pipe wrap probe (NiCr-NiAl) for pipes with diameter of 5 to 63 mm, meas. range -50 to +130 °C (-60 to +265 °F)	0600.4593
Accessories	Holding fixture for flue gas probe	0554.0094
	Carrying case for testo 342 with magnetic disk and carrying strap	0516.0014
	System case for testo 342 flue gas probe and printer	0516.0134
	Service case (leather) for testo 342 flue gas probe, printer and other tool	0516.0100
Spare parts	Spare set of O ₂ meas. cell	0390.9000
	Spare meas. cell CO (H ₂ compensated)	0390.0019
	Spare filter material for flue gas probe filter unit	0554.0084
	Spare thermocouple for flue gas probe (l. 335 mm)	0430.0050
	Spare thermocouple for flue gas probe (l. 185 mm)	0430.0055

Option: Infrared printer

General features

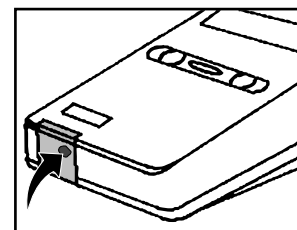
For your protection, the printer has been tested to different national and international safety standards. The tests include electrical/mechanical safety, radio interference, ergonomics, acoustics and hazardous materials. Where required, approvals obtained from independent test institutes are shown on the bottom of the product.

The printer was tested in a typical system configuration and corresponded with the FTZ 1046/84. The instrument was, thus, issued with the VDE radio trade mark, with the 0871-B/P index for peripheral equipment.



Switching on the infra-red printer

Push the switch to "I". The control lamp lights up when the printer is in operation.

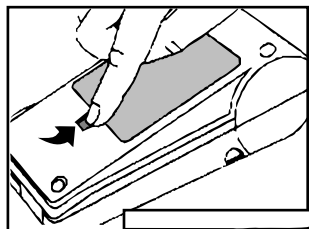




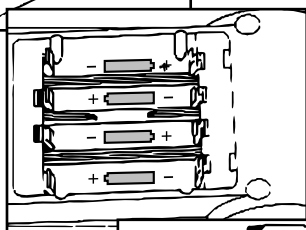
Option: Infrared printer

Batteries

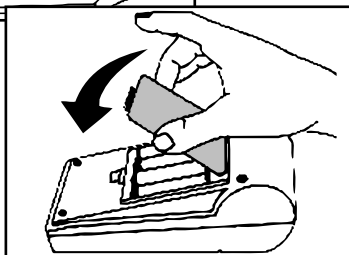
Use 4 x 1.5 V alkaline AA batteries.



Remove the battery compartment cover.



Insert the new batteries as shown.



Replace the battery compartment cover.

After approx. 10 minutes of inactivity, the printer will switch to a low-power mode in order to conserve the batteries. Press the paper feed key to reactivate the printer.

In order to prolong the battery life, set the contrast to the lowest acceptable setting and switch the printer off after use.

Option: Infrared printer

Batteries

Insert new batteries, if the following occurs:

- The print contrast is too weak, even at the highest setting.
- Printing takes longer as printing head moves at a much slower speed.
- If a large amount of information - over 200 characters - is transmitted by the meas. instrument, printing slows because the printer pauses momentarily before printing each new line. However, the printing head moves across the paper at normal speed. This is not a sign of low batteries.
- Printing stops before all the information has been printed on one line.
- The battery capacity (printed at the end of the selftest) lies between 0.1 (weak) and 4.5 (high).

If you are not intending to use the printer in the near future, you should remove the batteries before storing the printer.

You can also use rechargeable batteries; they must, however, be charged outside the printer with a commercial charger (see ordering data on p. 53). The battery life of the rech. batteries between each charge is less than that of alkaline batteries.

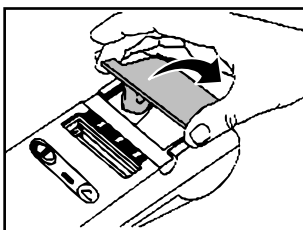


Option: Infrared printer

Changing the paper

Never use the printer without paper. For best results, use black-printing thermopaper.

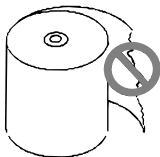
Always use the arrow key (paper feed) to move the paper. Do not pull the paper backwards through the printer.



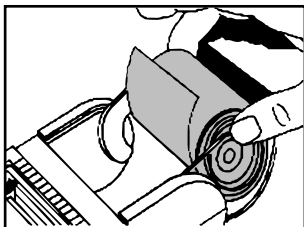
Replace the paper before it runs out completely.

Open the door to the paper compartment.

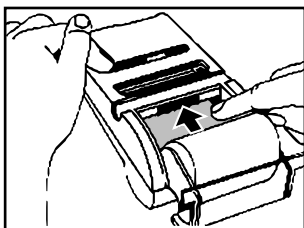
If the paper is stuck to the empty paper roll, loosen the paper with scissors and remove the remaining paper with the arrow key.



Insert a new roll of paper. Do not use paper with folds or uneven edges. Avoid obstructions within the printing mechanism.



Position the paper as shown.



Hold the arrow key down (until the paper appears), while you insert the paper into the slot. If the paper jams, pull it back very slowly.

Insert the roll of paper and close the door to the paper compartment.

Option: Infrared printer


Self-test

If you think that the printer is not operating properly, you can run a self-test.


Switch the instrument off. Hold the arrow key down while turning the printer on.

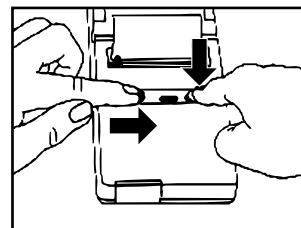
If the printer files the self-test, rerun the test to verify the results, before sending it back for repair.

Incorrect or missing information

If the symbol  is printed, it means that the printer has detected faulty data due to interference in the incoming infrared signals.

This is usually caused by unsuitable positioning of the printer and measuring instrument (i.e. distance between the objects and angle of transmission), interference in the transmission link (infrared signal), flashes of light or interference from other infrared-controlled instruments.

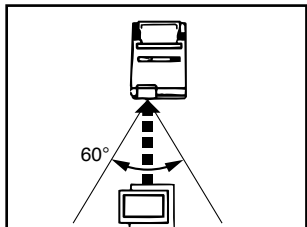
The symbol  is printed when information is lost, as the printer cannot print quickly enough to keep up with the incoming data. This is usual when the batteries are low. This can be rectified by inserting new batteries or a block of rechargeable batteries.



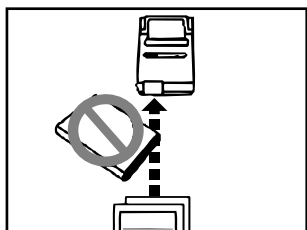


Option: Infrared printer

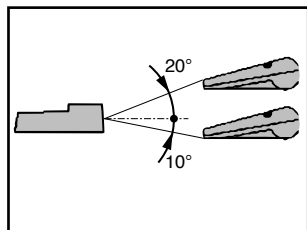
Transferring measured data



In order to transfer the measuring protocol from the measuring instrument to the infrared printer, point the top of measuring instrument (IR transmitting diode) towards the infrared printer (i.e. the window on the right-hand side of the instrument). The distance between the hand instrument and the printer should not be more than 2.0 m.



The transmission link between the two instruments must be straight and may not be broken by any objects.



When transferring data, both instruments must be held steady. It is possible to lay the instrument and printer on the same (horizontal) level, e.g. on an opened system case.

Option: Charger

The charger is suitable for charging 4 cylindrical cells as well as a 9 V E block.

Starting the charge

Connect the charger to a 220/50 Hz socket. The charger is activated when one or several rech. batteries are inserted. The red LED lights up. Observe polarity when inserting the rech. batteries!

Recharging time

The integrated control of the charging time is activated when the charger begins recharging the batteries. After a charging time of 7 hours, the charger automatically switches to compensating charge. This then guarantees that the rech. batteries will not be overloaded (provided that the rech. batteries were empty when inserted) and that they will remain ready for operation in the charger. The green LED lights up during the compensating charge phase.

Important notes

Please note that if the Charge is interrupted by disconnection from the mains unit or by the removal of the rech. batteries, the control of the loading time is deactivated. When the charge is restarted, the charger will effect a complete reload. Therefore, the charger should always remain connected to the mains unit when charging and no other rech. batteries should be added, as these will only be charged for the remaining duration of the initial (i.e. the rech. batteries which are added later will not be fully charged).

Ending the charge

We recommend that you leave the rech. batteries in the charger until you need them. The charge is interrupted by disconnection from the mains unit or by the removal of the rech. batteries. The red or green LED switches off.



Option: **Charger**

As the charger cannot recognise the capacity of the inserted rech. batteries, only empty batteries should be inserted, in order to avoid overloading. We, therefore, recommend that you buy a second set of rech. batteries so that one set is always in the charger and one in the instrument.