OPTIMA 7
NDIR

USER MANUAL

62876GB-NDIR

Program 1

CO [%]	0.745
HC [ppm]	612
CO2 [%]	11.21
Lambda	1.160
O2 [%]	3.8
PEF	0.470

stop | store | zero draft

optima7

MRU AIRfair®

MRU® since 1984
AIRfair
EMISSION MONITORING SYSTEMS

Operation Manual –

Please carefully read and follow all instructions before operating the analyser.

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1 TABLE OF CONTENTS

Inspect Shipment for Damage

Carefully inspect the entire shipment for damage in the presence of the shipper's agent, removing packaging material if necessary. Note any damage to packaging and/or goods on Packing List and have it signed by the shipper's agent prior to accepting the shipment. Submit damage claim to MRU immediately.

NOTE: Damage claims not received by MRU within 3 days of receipt of shipment will not be accepted.

Important notice!

This high quality electronic analyser utilizes batteries that discharge even when the analyser is not in use. Therefore it is very important to charge the batteries every 4 – 6 weeks, *even if the analyser is not in use.* When it is fully charged*,* the analyser should be switched on and allowed to zero itself before being switched off again. (see chap. 11.8)

Failing to properly charge the batteries will void your warranty!

Save the original box and the packing material for use if the analyser must be shipped in the future.

The products described in this manual are subject to continuous development and improvement and it is therefore acknowledged that this manual may contain errors or omissions. MRU encourages customer feedback and welcomes any comments or suggestions relating to the product or documentation.

Please forward all comments or suggestions to the Customer Feedback Department at the following address:

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Fon (+49) 71 32 99 62 0 (Reception)

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This manual is intended solely as a guide to the use of the product.

MRU shall not be liable for any loss or damage whatsoever arising from content errors or misinterpretation of information's from this manual or any mis-use resulting from the use of this manual.

Electrochemical sensors are by their operating principle not only sensitive to the gas they are intended for, but for other gases as well.

This cross sensitivity is compensated by MRU for the typical application of flue gas analysis.

However, unusual high concentration levels of single gas components might lead to

- *a reduced measurement accuracy of other gas components*
- *and to a temporary change of the sensitivity of sensors, which may require several hours recovery time.*

Especially concentration levels as high as several % for single gas components may affect the measurement of other gas components at ppm level. Those applications need to be discussed with MRU in detail.

2 INTRODUCTION

2.1 The OPTIMA 7 - NDIR

The OPTIMA 7 - NDIR flue gas analyser is used for: total measurement of up to 5 car exhaust gas components:

CO / CO_2 /HC infrared (ndir) measurement
O_2 and NOx electrochemical measurement

Simultaneous measurement of:
HC as (n-Hex) 0 - 20.000ppm
CO_2 0 - 20,00 %
CO   0 - 16,000 %
O_2 0 - 21,00 %
NO   0 - 5.000 ppm

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2.2 The company MRU GmbH

Your analyser is produced by the MRU GmbH in Neckarsulm Germany (founded in 1984), a medium sized company that specializes in developing, producing and marketing high quality emission monitoring analysers. MRU GmbH produces a wide range of instruments, from standard analysers up to tailor made industrial analysers. MRU GmbH contact details are listed on one of the previous page.

Factory 1 (service department,sales department, development division, administration)

Factory 2 (Product division)

2.3 Important general information (EN 50379) and VDI 4206

This analyser is not designed to be used for continuous measurements.

Before using the analyser verify the condition of the various parts of the analyser, such as the probe, the ambient air conditions, the condensate separator, star filter and the connectors for damage and/or blockages.

When starting up the analyser it will take between 1 – 3 minutes to set to zero depending on the condition of the sensors and of ambient.

The minimum zeroing time of the analyser to achieve correct measurement values can be expected by 1.5 minutes!

Caution: Exposure to acids; aggressive gases such as sulphur; vapours such as thinners, gasoline, alcohol and paint, etc. can damage, reduce the life of, or destroy the sensors.

The life of the sensors depends on how they are used, maintained and treated. Typical average life expectations are: O_2 - 2 years and NO - 3 years.

The use of the analyser for regulatory purposes is subject to special regulations (for example a periodical examination of the analyser). Please obtain the appropriate regulations from your local responsible authority.

2.4 Important information about the users/operation manual

The users/operation manual is an important part of this delivery. It will explain how to use this analyser properly and sets forth safety and environmentally friendly procedues.

It is the responsibility of all users to read and familiarize themselves with this manual, paying particular attention to the safety instructions.

The most important safety details are listed in chapter 3 (Safety Information). Additional safety details in other chapters are clearly marked with an *attention* sign.

3 SAFETY INFORMATION

The following safety procedures must to be followed at all times. They are a significant and essential part of this manual. Failure to follow safety procedures can result in the loss of your warranty claims.

3.1 Safety regulations

1. The OPTIMA 7 - NDIR analyser may only be used as indicated in this manual.

2. Our analysers are checked according to the following regulations:
    VDE 0411 (EN61010) and **DIN VDE 0701** before they leave the MRU GmbH factory.

3. MRU technical products are designed and manufactured according to **DIN 31000/ VDE 1000** and **UVV = VBG 4** of the professional guilds for fine mechanics and electrical engineering.

4. MRU GmbH assures that the analyser complies to the essential requirements of the legal regulations of the member states of the electro-magnetic compatibility **(89/336/EWG)** and to the low-voltage regulations **(3/23/EWG)**.

3.2 Specific safety regulations

1. Use only the battery charger supplied with the analyser for this instrument

2. No part of the analyser, including the metal probe tube and all other metal parts & accessories are to be used as electric conductors.

3. The analyser is not to be used in or under water.

4. The analyser is not to be placed near or directly exposed to open fire or heat.

5. The specified probe temperature range is not to be exceeded, as the probe, temperature sensory mechanism and sensor could be damaged or destroyed.

6. The analyser shall void dropping.

7. Caution: Moisture, being pumped out of the condensates trap can be slightly acidic.
   In case of skin contact IMMEDIATELY: clean affected parts of the body.
   Avoid getting liquid in eyes.
   Please carefully clean all parts that come into contact with the condensates.

8. After measurement, vent the analyser with ambient air and allow the probe to cool. A hot probe could cause burns or ignite flammable material.

9. The fumes from certain materials (for. example, cleaners, petrol, spirit, varnish) may damage the sensors of the analyser. Do not store or use these or other similar fluids near the analyser.

3.3 Guideline for Li-Ion Batteries

- The battery pack is not accessibly for end users

- Li-Ion rechargeable battery pack for OPTIMA 7 - NDIR Combustion Analyser

- Do not heat or throw the battery pack of in fire.
  Do not charge and leave the battery pack at the high temperature.

- Do not deform, short-circuit, disassemble or modify the battery pack

- Do not allow the battery to be immersed in or wetted with water or sea water

- Do not subject the battery pack to a strong impact or throw it

- Do not cut, squeeze, tear at the cables of the battery pack

- Do not carry or store the battery pack together with material which have sharp edges or is electrical conductive in the same custody

- Not letting (+) terminal come in contact with (-) terminal or metal

  The above items may cause heat, fire and explosion

Your quality management MRU GmbH

4 RETURNED GOODS

Packing regulation of 12.07.1991

If your local waste facility does not except MRU packing materials for disposal, you may return it to MRU or our local sales representative. Packing materials returned to MRU must be returned prepaid.

4.1 Return of hazardous waste

- Waste Disposal/Returns/Warranty -

MRU GmbH is required to accept the return of hazardous waste such as electro-chemical sensors that cannot be disposed of locally. Hazardous waste must be returned to MRU prepaid.

Return of analyser according to ElektroG:

MRU GmbH is required to accept the return, for proper disposal, of all analysers delivered after 13th of August 2005. Analysers must be returned to MRU prepaid.

5 MEASUREMENT PRINCIPAL

The analyser draws a sample of the exhauist gas from the duct using a built-in gas pump through the probe is cleaned and dried using condensate separator with built-in filter and analyzes the extracted gas with NDIR and electrochemical sensors.

5.1 Gas flow diagram
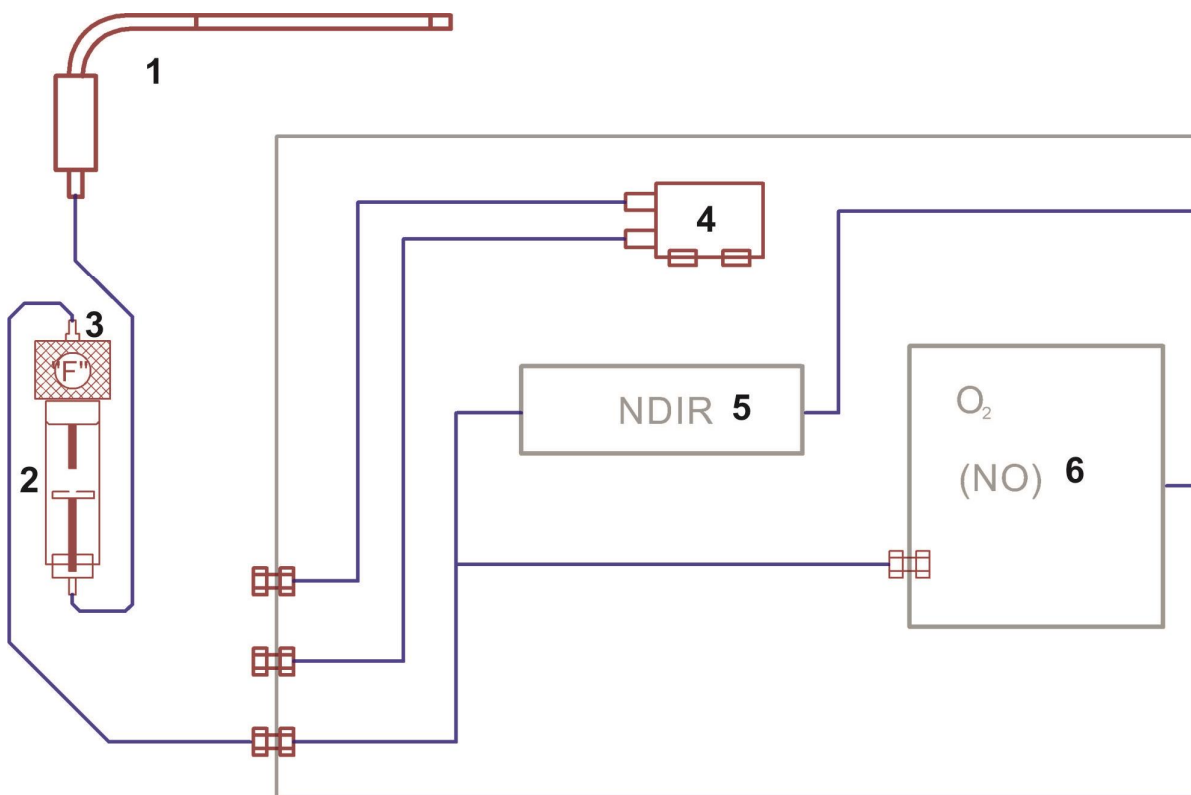
Position	Description
1	Sampling probe
2	Condensate separator
3	Star filter
4	Pressure sensor
5	NDIR sensor
6	Electrochemical sensor (s)

5.2 Electrochemical measured principle

The oxygen content of the sample gas is measured with a 2 electrode electrochemical sensor.

Toxic gases like carbon monoxide (CO), nitrogen oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and hydrogen sulphide (H_2S) are measured with 3 electrode sensors.

The electrochemical sensors are based on gas diffusion technology.

The advantage of this technology is that the signal generated is direct proportionally and linear to the volume concentration (% or ppm) of the analysis gas components.

The 3 electrodes are: S (sensing electrode), C (counter electrode) and R (reference electrode).
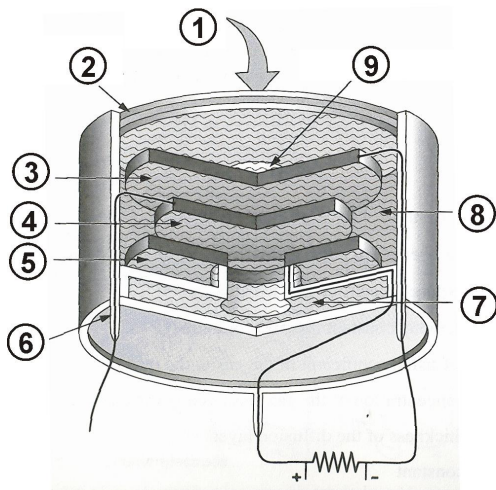
Pos.	
1	Sample gas
2	Particle filter
3	Sensing Electrode
4	Reference Electrode
5	Counter Electrode
6	Connection pin
7	Electrolyte reservoir
8	Electrolyte
9	Capillary diffusion barrier

When the gas being measured contacts the sensing electrode, it reacts on the electrode surface either through oxidation (for example CO, SO_2, NO) or reduction (like NO_2, and Cl_2).

Example: CO sensor:

CO reacts at the sensing electrode as follows:

$$CO + H_2O \ -> \ CO_2 + 2H+ + 2e-$$

and at the counter electrode, oxygen from air will be re-oxidized to water:

$$\tfrac{1}{2} O_2 + 2H+ + 2e- \ -> H_2O$$
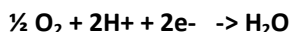
The sensor supplies a constant current signal (μA-range) that is monitored and analyzed. The current intensity is dependant upon the volume concentration of the sample gas, while other parameters like temperature and cross sensitivity are calculated by the analyser.

5.3 Principle of the IR-bench

A regulated infrared source (IR) provides light in the range of 2 to 8 microns (μm). The infrared light is directed through the sample cell to the optical detector. The source is electronically modulated with no chopper wheels and no moving parts.

The residual infrared energy, not absorbed by the sample gas, is guided to the optical detector. It passes an optical narrow band pass.

Infrared light passed through the filter is collected by a pyro-electric detectors. It produce a voltage that is proportional to light intensity.
Unlike electrochemical sensors, the NDIR measurement shows no ageing due the gas concentration measured.
It's lifetime is only limited by the lifetime of the IR source.

6   ANALYSER DESCRIPTION

6.1   Analyser front

1	Display
2	Condensate separator
3	Key pad

6.2   Analyser Connectors - bottom side
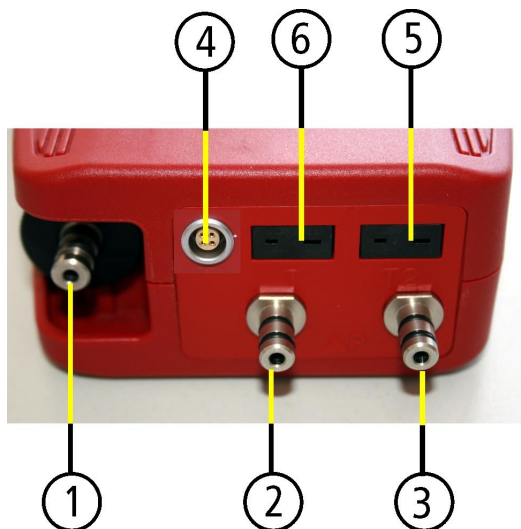
1	Sampling probe connection Condensate separator
2	Pressure connection 1 (Draft)
3	Pressure connection 2 (Differential pressure)
4	Connector AUX (optional)
5	Temperature connection 1 / T-Ambient air (combustion air)
6	Temperature connection 2 / T-gas

Note:
If during zeroing T air (5) is disconnected, then value of T gas at the end of zeroing will be used. In this case, the measuring value will be displayed green coloured.
If T air (5) will be connected during the measurement, then true T air measurement will occur and the display color changes from green to black.

6.3 Analyser Connectors - top
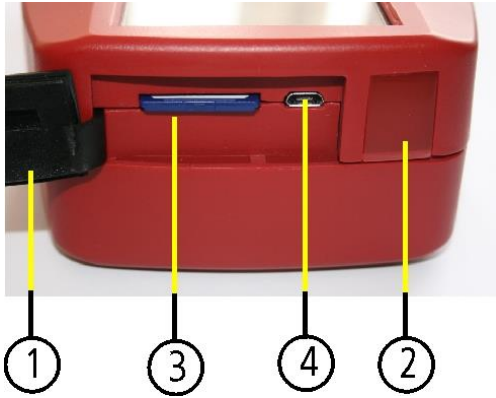
1	Cover
2	IR-interface
3	SD-card reader (only by using a MRU-SD-CARD we can assure the compatibility of all analyser functions)
4	USB-port and charging port

6.4 Analyser Back

1	Fixing magnets
2	Gas outlet
3	Handle strip
4	Analyser feet

Important!

During measurement the gas outlet must not be covered

6.5   Condensate separator
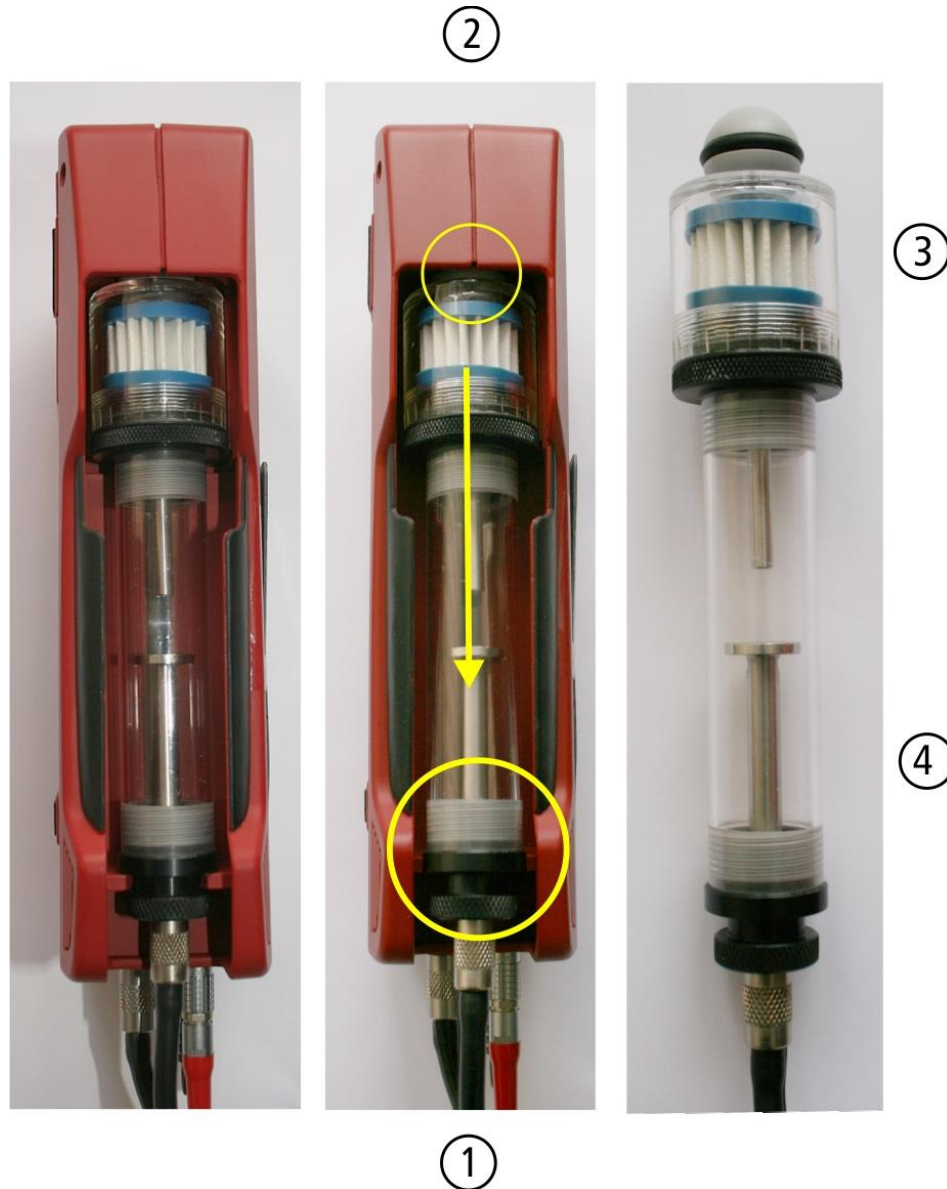
Remove the condensate separator by pulling it towards you (1) out of the groove of the OPTIMA 7 - NDIR housing, then pull it downwards (2).

The condensate show glass is screwed into the plug. The complete condensate separator can easily be taken apart for cleaning or for exchanging the star filter. (Condensate separator details are included in the service manual)

After cleaning a leaknes check (see chap. 14.4) must be done!

7 ACCESSORIES

7.1 Exhaust gas sampling probe

The OPTIMA 7 - NDIR is available with an exhaust gas sampling probe, flexible, 400 mm, with 2,5 m Viton sampling line and benzine on-line filter
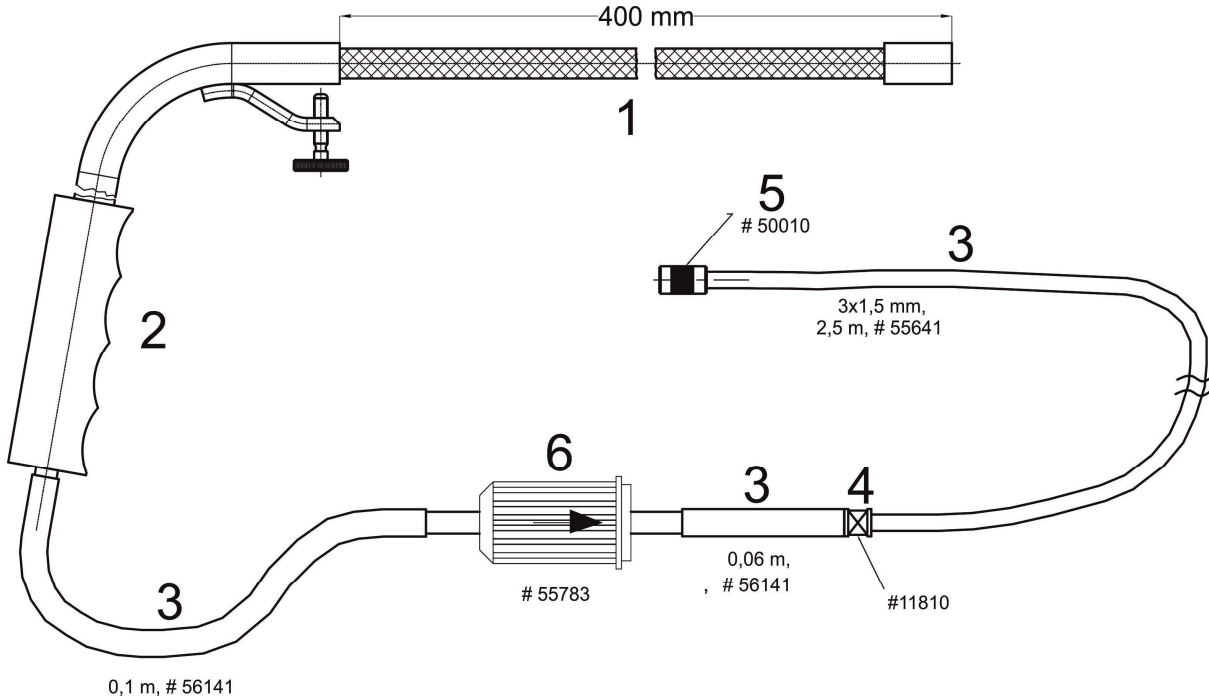
1	Probe hose
2	Probe
3	Viton hose
4	Hose connector
5	Hose bush
6	Benzine filter

8 OPERATING THE ANALYSER

8.1 The Display

All information required to operate the analyser is displayed as shown below.
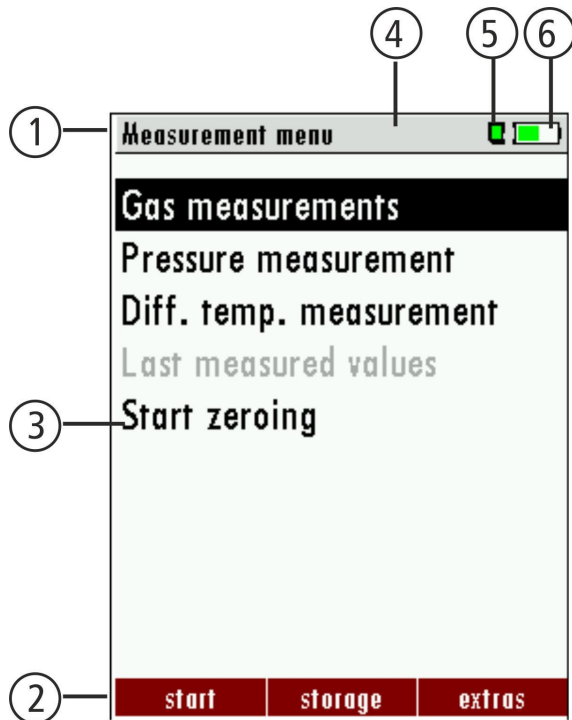
1	Menu bar
2	Function key bar
3	Display panel - Menu - Measurement value - …
4	Zeroing active

5	SD-Card in the slot
	 - Indication green
	   Read- and write access
	 - Indication yellow
	   only Read access
	   (SD-Card write protected)

6	Battery charge condition

8.2 The Keypad

Description and function of the keys:

ON/OFF		Press to start the analyser without delay. The power off function will be delayed to protect the sensors. If there is not enough ambient air the analyser will recommend the purging of the sensors.
Function Keys	F1 F2 F3	Activates the functions seen on the display (2 function key bar)
Menu Key		Will show all available functions in the window that is currently in use – also those which have an individual key on the key pad like the printer and the three function keys.
ESC Key	ESC	Abort or return to the menu above
Arrow Keys		Jump in between lines, change values
OK Key	OK	Confirmation key, select a marked menu point
Printer Key		Activates the printer function in the measurement and service window.

8.3 Menu configuration

The OPTIMA 7 - NDIR organizes all available actions in three main menus:

- Menu Measurement   → all tasks for the measurement programs of the analyser. Here you can select all installed and available measurement programs.

- Menu Memory   → all tasks for the management of the data memory available.

- Menu Extras   → all the other available tasks – for management and customizing your analyser.

OPTIMA 7 - NDIR

Measurement menu	Storage menu	Extras menu
Gas measurements	**Sites administration**	**Settings**
Pressure measurement	Delete all sites	Date & time
Diff. temp. measurement	Sites from SD card	Service menu
Last measured values	Sites onto SD card	Option reset
Start zeroing	View measurements	Service values
	Delete measurements	Leak proof test
	Measurements to SD card	Contents SD card
	Memory info	Device info
start storage extras	measure sites extras	measure storage settings

The topic „Gas measure-ments"are a standard feature in every analyser and is explained in chapter 12. Other menu points are optional and will be explained either in this manual or in an additional manual or flyer.

Please read chapter 13 for details.

Please read chapter 14 for details.

You can jump in between the 3 main menus with the 3 function keys (according to the displayed name on the screen).

9 FIRST USE OF THE INSTRUMENT

After the analyser has been inspected and is ready for start up it can be switched on and personalized settings can be entered. These settings can be changed at any time.

9.1 Analyser ready for operation

- Unpack the analyser, read the complete manual

- The analyser was shipped completely assembled, in working condition and ready for operation. It is recommended that the analyser is thoroughly inspected for completeness and damage.

- Recommendation: charge the batteries for 8 hours prior to use.

- Check/Change date and time

9.2 Analyser settings

The "Settings" menu allows configuring some instrument specific paramteres.

In the main menu "EXTRAS" = "F3 key" - scroll down to "Settings" then press the "OK" key, By selecting a line the parameter value can be changed by the arrow keys.

Extras menu	Settings	Settings	Settings
Settings	LCD brightness (%) 55	LCD brightness (%) 55	
Date & time	Country England/intern.	**Country England/intern.**	**ATTENTION !**
Service menu	Language English	Language English	
Option reset	LED condensate trap 75	LED condensate trap 75	Changing the country causes the loss of some individual settings!
Service values	Helping hints ON	Helping hints ON	
Leak proof test	Switch-ON protection OFF	Switch-ON protection OFF	
Contents SD card	Keyboard beep ON	Keyboard beep ON	
Device info	Power-on logo ON	Power-on logo ON	**abort** / continue
measure storage settings **OK**	print-out measurem.	print-out measurem.	print-out measurem.

LCD brightness	5 – 100 %	Display-brightness, depending on temperature and also on the personal judgement of the user, at 20°C a value of ca. 50% is normal
Language	option	Select device languages
Country	option	Enables some country specific parameters like fuel types, calculated values etc.
LED condensate trap	0 … 150	Change the brightness of the condensate separator LED
Helping hints	ON / OFF	Helpful hints activated or deactivated (explanation below)
Switch-ON protection	ON / OFF	If activated and if ON key is pressed (possibly inadvertently), then the message „3 seconds OK key press " displays
Keyboard beeper	ON / OFF	Keyboard beeper activated or deactivated
Power-on logo	ON / OFF	Logo will be show during power-ON of the analyser

Settings measurement:
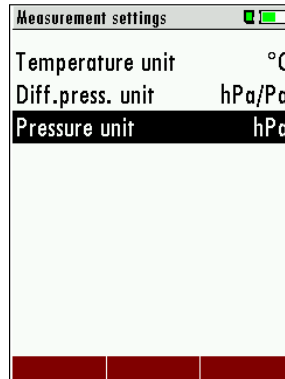
Temperature Unit	°C, °F	Change the unit for temperature in all screens
Diff. Pressure Unit	Pa, hPa/Pa, hPa, kPa/Pa, kPa, mbar, mmH2O, cmH2O, inH2O, mmHg, inHg, PSI,	Change the unit for pressure in all screens. The meaning of hPa/Pa and kPa/Pa is that the instrument performs a dynamic change of unit depending on the absolute value of pressure.
Pressure Unit	Pa, hPa/Pa, hPa, kPa/Pa, kPa, mbar, mmH2O, cmH2O, inH2O, mmHg, inHg, PSI,	Change the unit for pressure in all screens. The meaning of hPa/Pa and kPa/Pa is that the instrument performs a dynamic change of unit depending on the absolute value of pressure.

Explanation for "Helping hints":

Some helpful hints which are very useful for an inexperienced user but are not needed by experienced users, can be activated or deactivated. The following hints will be affected:

"Zeroing finished, Sensors are ready. Analyser ready for measurement."
"Reminder! Charge batteries at regular intervals!"
"Measurement stopped/started."

9.2.1 Switch-ON protection

If activated and if ON key is pressed (possibly inadvertently), then the message:„3 seconds OK key press "
displays

9.2.2 Setting printer type and print-out
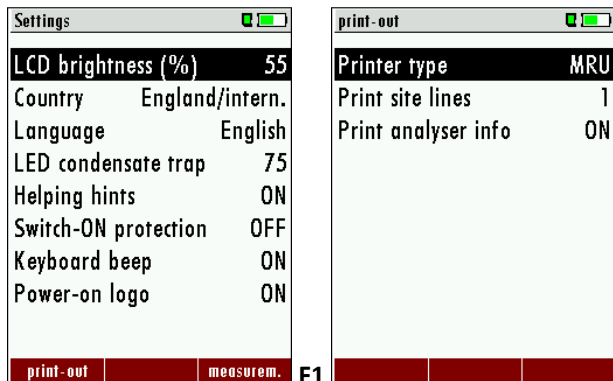
Printer type	Select printertype MRU / HP
Print site lines 0 … 9	Line 1 (Site no.) is necessary, further lines (freetext) printable if necessary

| Print analyser info | To measuring print out can be shorter designed, while the device info will be left out. In some print outs (adjustment, service ...) the info will be printed forever. |

9.2.3 Bluetooth settings

 F2
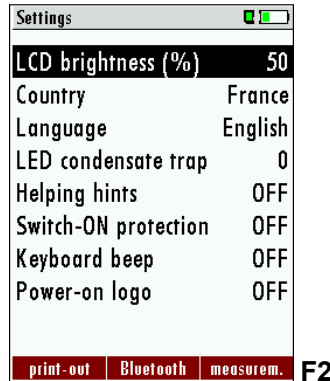
The following MRU software can be used:

MRU4u (Bluetooth) Available in the Apple App Store and Google Play

For iOS communication with PC, tablet or smartphone is additionally the Low power module # 66173 required

SMARTdata (Bluetooth)   (SMARTdata Version 1.2.0 or newer)
MRU-Win (USB)   (MRUwin Version 2.7.4.0 or newer)
ONLINEview (USB/Bluetooth)   (ONLINEview Version 2.9.5 or newer)

The Bluetooth passkey is: 1234
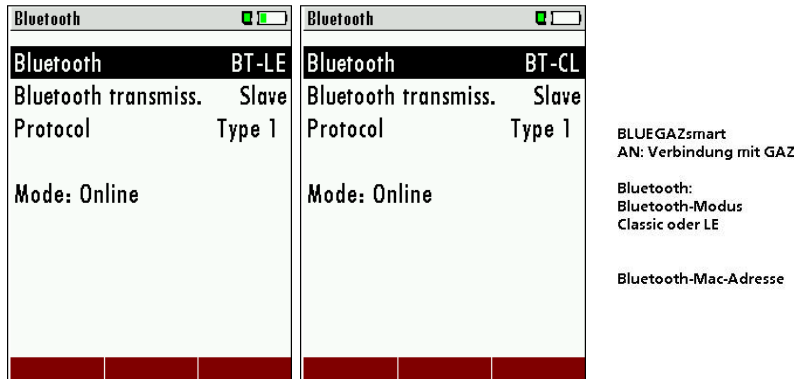
Devices as of firmware version 1.66.00 with dual Bluetooth module:

The Bluetooth mode can be selected under EXTRAS / SETTINGS.

For Android devices, select the mode: Bluetooth-Classic   BT-CL
For Apple- devices, select the mode   :   Bluetooth Low-Energie   BT-LE

Always set the BLUEGAZsmart setting to OFF!
ONLINEview must be operated in master mode - please select "Master" under Setup.
Please select "Master" under SETUP.
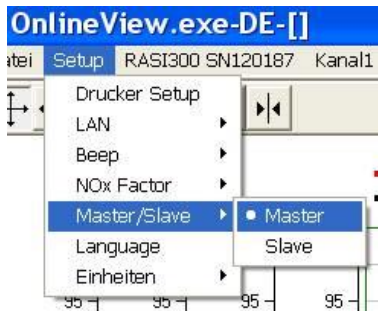
For further information please refer to the corresponding documentation for the respective software program.

9.3 Setting time and date
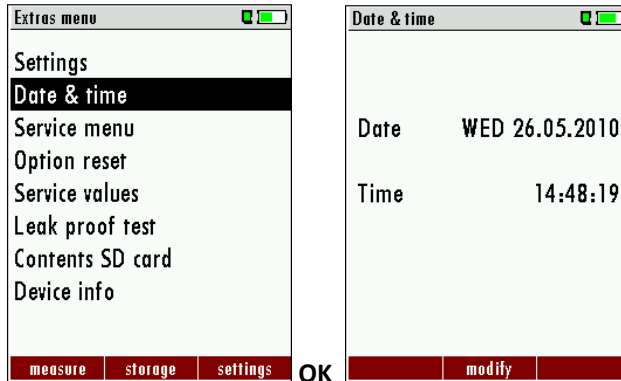
F2	Edit
▲, ▼	Change the marked number
◄►	Move the cursor to the next position
ESC	Return to *Extra-Menu*

9.4 Configuration of measurement program

(Flue gas measurements) Select one of the 4 configurable measurement programs.

For each of the programs the following parameters can be configured:

- Measurement windows: configuration of what and where will be displayed in the 3 measurement value windows.
- Zoom – window: select what will be displayed in the zoom - window
- Program name

The following programs have a pre configured:

- "Test Program" indented for use at instrument maintenance and calibration

9.4.1 Configuration of the measurement window (display content)

Start the measuring program – once you are inside the measuring window press the menu- key.
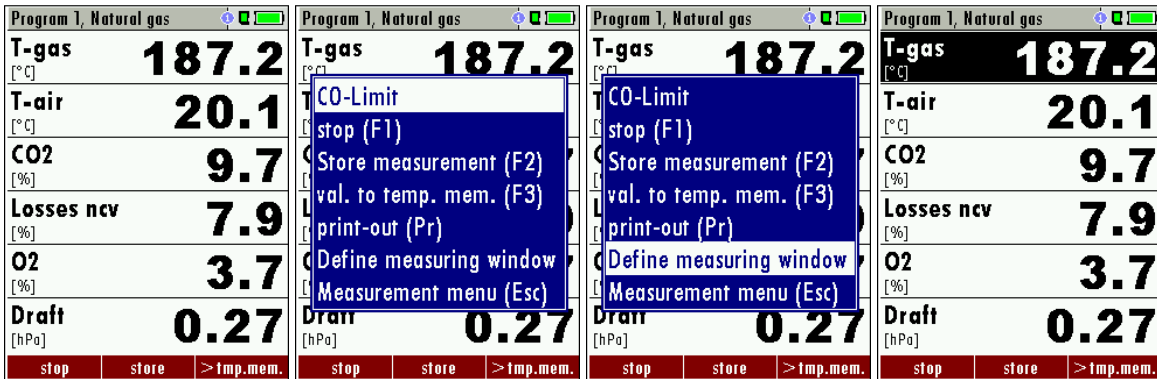
Now you select "define measuring window" and press the OK key. The top value will now be marked black – this black bar can be moved up and down. Move it to the postion that you would like to change or to the position where you want to add a measuring value. Once you have reached the position you van uses the arrow left and right keys to change the measuring value.

When all your changes have been made, you press again the **menu** key. Now you select "Save measuring window". All your changes will be saved and all saved values will be printed when using the printer function.

Start the measuring program – once you are inside the measuring window press the **menu** key.

9.4.2 Configuration of the zoom function

For each measurement program you have 3 zoom windows with two selectable values for each window.

 Menu-key
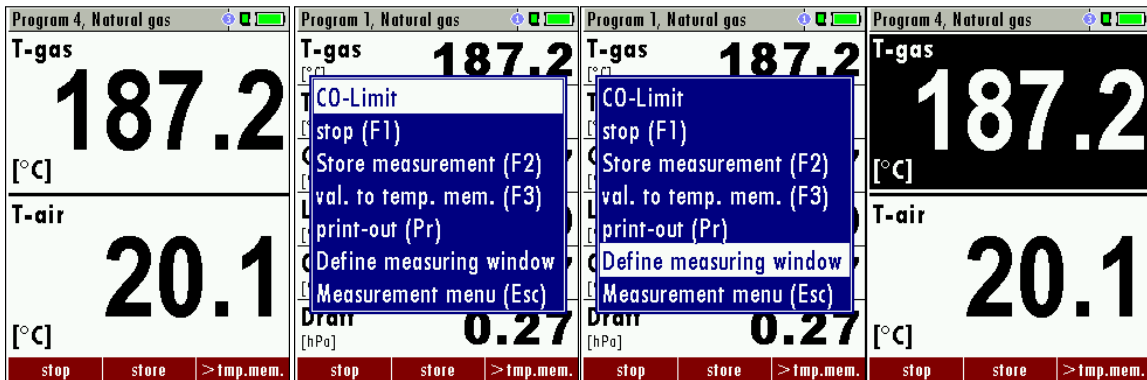
▲▼	Change Zoom window 1..3
◄►	Change measuring values
🗁,🗁	Save measuring window and save configuration

9.4.3 Change measurement program names

In the "Fuel type selection" window you can edit the marked program name with the F3 key and then change the program name.

10 MAINTENANCE

The OPTIMA 7 - NDIR needs to the long value preservation only one very low maintenance need:

- now and then: Cleaning of the probe and the probe tube
- after every measurement: remove gas sampling tube from the OPTIMA 7 - NDIR, so that the hose can dry
- after longer disuse load battery first and afterwards approx. all 4 weeks

11 PREPARATION FOR EACH MEASUREMENT

11.1 Power supply

The analyser can be used with:

1. with the internal MRU battery (provided)
2. with the MRU battery charger (provided)

External equipment may only be connected while the analyser is switched off!

11.2 Auto Off

The instrument is automatically switched off after 60 minutes. During a measurement or a battery charging cycle the auto off is deactivated.

11.3 Measurement with battery charger/battery charging

When ever you connect the analyser with external battery charger (90..260 V / 50/60Hz) the battery will be charged.
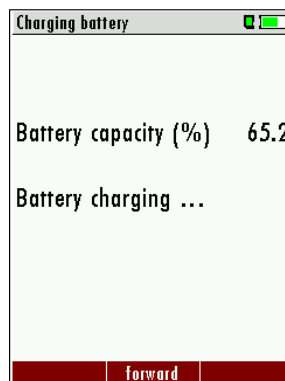
Once the battery is fully charged the analyser will switch to trickle charge mode.
At the moment, if the battery is fully charged and the trickle charge mode begins, an acoustic feedback will be played.

    ......

11.4 Measurement with battery (Battery monitoring)

The battery symbol in the top right corner displays the current battery charge condition.

Approximately 15 minutes (depending on the analyser configuration) before the battery is drained, the battery symbol will start to blink red (about once per second).

When the battery is almost drained and the analyser is not connected to the battery charger within one minute, then the analyser will switch off automatically to prevent deep discharge of the battery.

11.5 Operation temperature

If the analyser has been stored at low temperatures, it will require some time to equilibrate to the ambient temperature before being switched on. If it does not equilibrate, condensation will occur inside the analyser!
If the temperature is out of its operation range (see chap. 15), you will see the following messages on the display.

 or
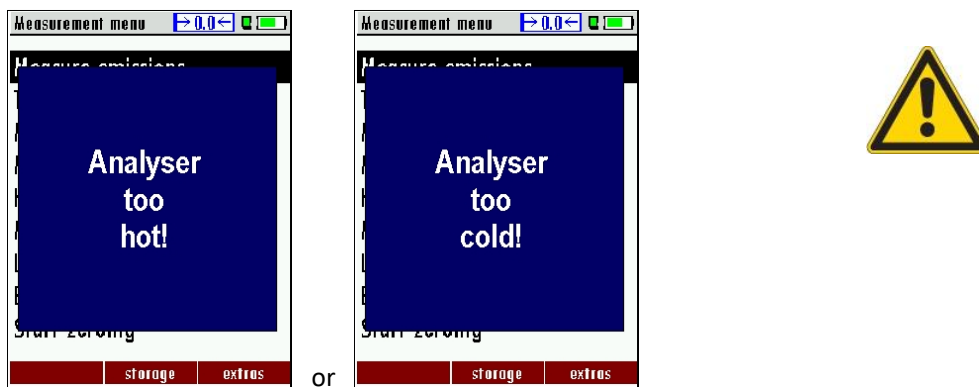
Once one of these messages appears you will not be able to use the analyser, it will give an acoustic signal until it has reached the specified operation temperature between +5°C and +45°C.

11.6 Condensate separator

The condensate separator must be checked before and after each measurement!

Please check if the condensate separator must be **emptied a**nd if the star filter is still **white**.

White = good for measurement   dark = replace

11.7 Connectors and leak tightness

- Check all push on connectors for proper fit.

- Check all hoses, hose connectors and the condensate separator.

- Start separate instrument tightness test (see chap. 14.4)

11.8 Power ON and zeroing

Press the ON key. The analyser will start zeroing without any further action from the user.

The probe shall **NOT** be installed in the stack during zeroing!

While the analyser is zeroing you will see a blinking →0.0← symbol in the task bar indicating the progress of zeroing.
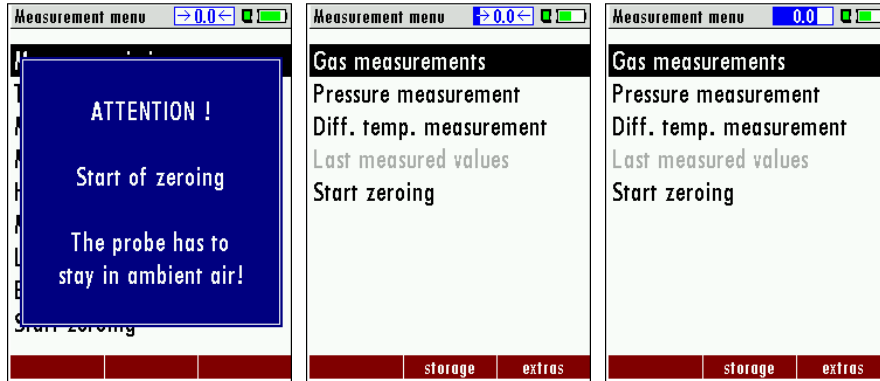
Once the zeroing cycle is finished the analyser is ready for measurement.

If any defective sensors will be detected during the zeroing cycle you will get an error message on the display.

Repeating the zeroing

The zeroing can be repeated at any time as long as the probe is not inside the stack. In the main menu you select "Zeroing", and after the displayed message press the OK key.

OK
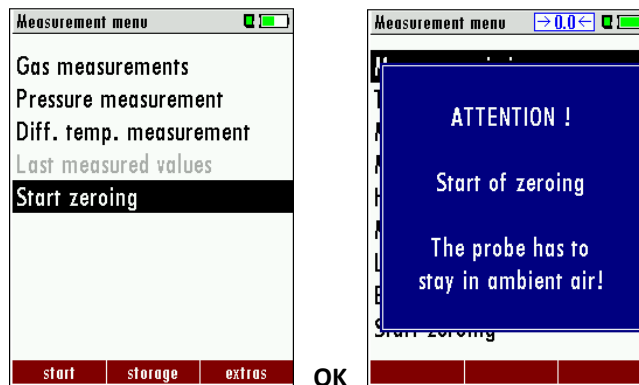
▲, ▼	Zeroing
OK	Start zeroing

12 HOW TO TAKE A MEASUREMENT

Every OPTIMA 7 - NDIR is capable of making a complete flue gas measurement. How to perform this is described below.

The description of other optional available measurement programs can be read in the appendix or in additional flyers.

12.1 Selection of the measurement program

In the measurement menu select "Flue gas measurements" then select one of the available programs.

If you press the F1 key "Start" in the measurement menu, you will be directed directly into the measurement screen, using the parameters that have been selected last time the analyser was used.

▲▼	change between the lines
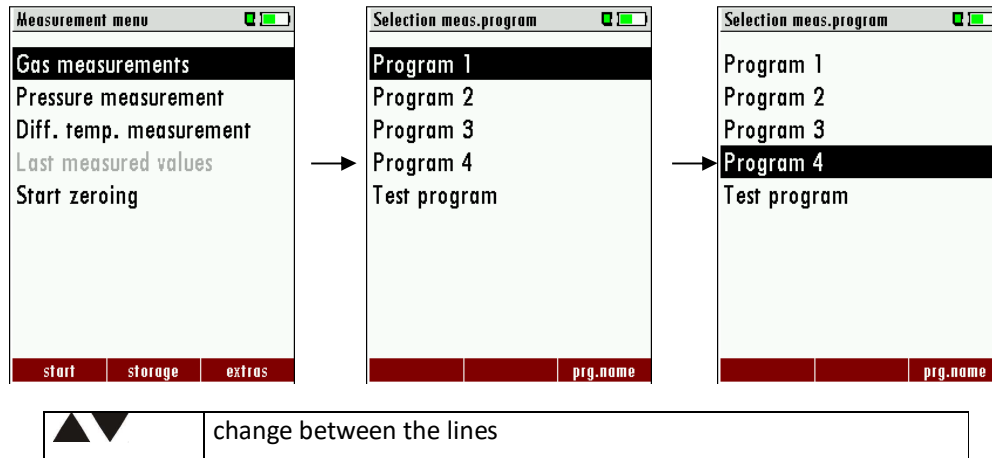
12.2 Measured Value Display

Measurement values can be organized on three pages, each page displaying 6 measurement values.

The order of the display is operator settable.
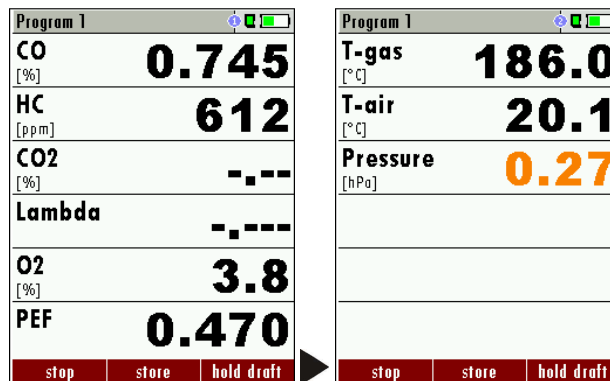
There are direct measured values available such as CO and Temperature as well as P.E.F facor and

Values that cannot be displayed are indicated with dashes. Possible reasons for value not being displayed are:

- Electro chemical sensor was detected as defective during zeroing.

- External temperature sensors are not connected.

The measurement value T-Gas is usually read at the connector "T-Gas/AUX" (depending on configuration) or if not available from the connector "T1". (see chapter 6)

There are three measurement windows available, with the arrow keys left and right moving between them.

Zoom function, each with two values, is activated by moving the arrow keys up and down. Moving arrow keys left and right pages between the two zoom windows.
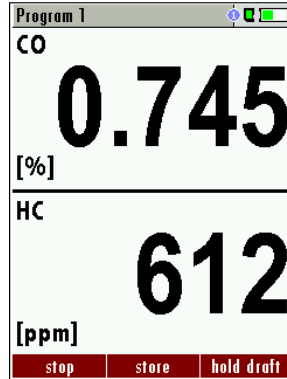
12.3 Test program

This test program is made for testing facilities that will test these analysers with test gases and don't need to make any modifications.

In this program you will only see measured values and no calculated values at all.

Now you can change the current values and the values of the temporary buffer with the key F3. This change of the actual values with the values of the temporary buffer memory can be executed several times one after the other

Now it is possible to print and save as usual one of both measurements.

12.4 Storage the measuring results

If in the function key bar "store" is indicated, you can store with the accompanying function key F2 or F3 the measurement in the data memory. The function of the data memory is explained in chapter 13.

12.5 Printing the measurement results

While in the measurement window pressing the printer key will send the information to the IR printer.

The speed printer (IR desktop printer) Art. No. 62693 must be aligned in addition as follows:
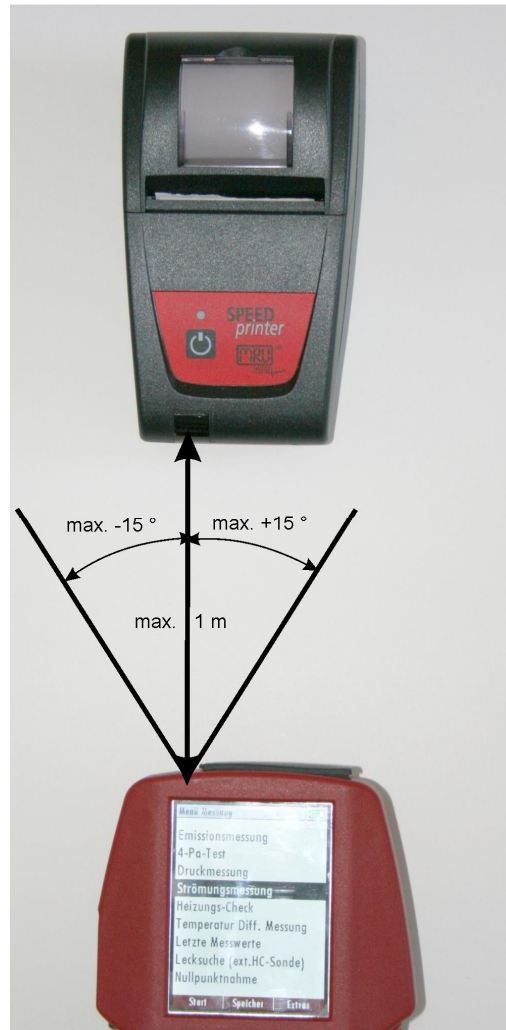
All values that can be seen in the measurement window on all three pages will be printed, double measurement values will only be printed once.

Further technical specifications as well as battery and paper rolls changes please see separate printer manual.

12.6 End of measurement

A current emission measurement can be stopped at any time with the F1 key. The display will change its colour and the measurement will be frozen. At the time you stop the measurement all measured values are still available and can be viewed at a later time (see chap. 12.7).

Return to the measurement menu by pressing the ESC key.

12.7 Last measurement results

The analyser allows the viewing of the last measurement after a measurement is completed.

In the main menu "Measurement" select the point "last meas. values".
The last values can be viewed, printed and/or saved.

Measurement menu	Program 1
Gas measurements	CO [%] **0.000**
Pressure measurement	HC [ppm] **1**
Diff. temp. measurement	CO2 [%] **0.02**
Last measured values	Lambda **-.---**
Start zeroing	O2 [%] **20.9**
	PEF **0.587**
start · storage · extras **OK**	**F1** start · store
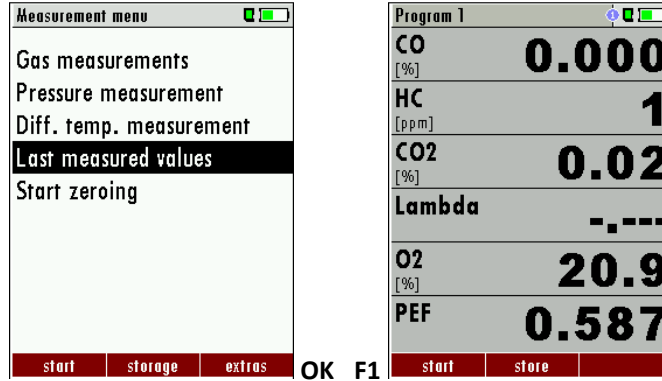
Above the F1 key "Start"instead of "Stop" is displayed. Pressing this key will continue the measurement.

12.8 Pressure measurement

Pressure (4 values) is measured and saved to the selected measurement name. The actual measured value is displayed in the middle of the display. The 4 measurement names can be changed as desired.

The hose on the draft + connector must be connected for draft measurements.

The second hose on the Delta P- connector must be connected for differential measurement.

Measurement menu	Pressure measurement
Gas measurements	hPa
Pressure measurement	Differ.pressure 0.00
Diff. temp. measurement	Gas flow press. 0.00
Last measured values	Pressure 3 0.00
Start zeroing	Pressure 4 0.00
	pressure peak 0.00
	[Pa] **0.3**
start · storage · extras **OK**	accept · zero point · store
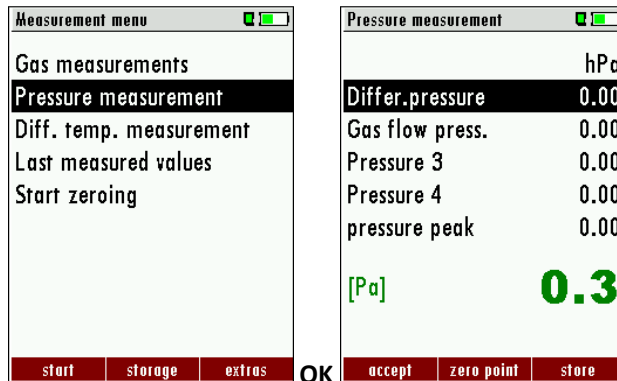
▲, ▼	Select the measurement name 1-4
F1	Save the measured value to one of the measurement name
F2	Zeroing the pressure sensor
F3	Change the name of the measurement category
ESC	Return to the measurement menu

12.9 Differential temperature measurement

In the differential temperature measurement menu two temperatures can be measured simultaneously by using the T1 and T2 connectors. Both measured temperatures and the difference between the temperatures will be displayed.
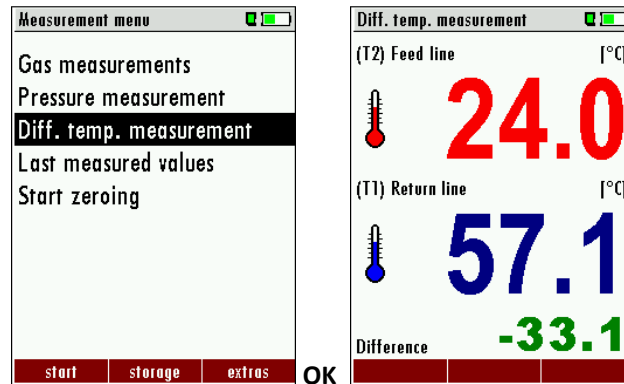
Note:

The accuracy of the difference temperature measurement is guaranteed only on use of the MRU temperature sensors.

13 DATA STORAGE

13.1 Organisation of the data memory

Basis of the data memory of the OPTIMA 7 - NDIR is a set of sites stored in the device. Every site exists of an unique site number and 8 freely usable text lines which can have, e.g., the address, customer name etc.

The device can store up to 4000 different sites.

Sites can be created in the device and be changed, or could be imported from a PC program. Attention: sites created in the device and site data changed in the device will not be updated towards the PC. The device does only transmit to the PC the measurement values, but no information about site data.

Measurements are stored by assigning them to a site. Measurements can be, on this occasion, singles flue gas measurements or other measuring programmes available in the device.

13.2 Information about the data memory

In the menu item "storage" you select „memory info" to get information about the actual memory volume. The part of free memory, the total number of the stored sites and the number of the measurements stored all together, split in the kind of the measurement is listed.

OK
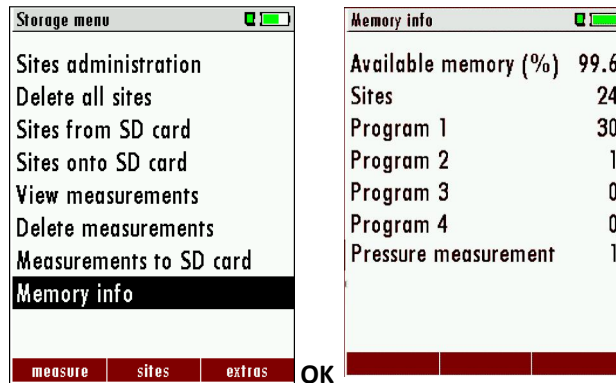
13.3 Site administration

In the menu item "Sites administration" you are able

- view all data of the stored sites

- create new sites

- change date of existing sites

- delete sites

Attention:
In the device new created sites and changes in the data of a site will not transmit to the PC back.

13.3.1 View and search sites

If the menu item "Site administration" will be selected for every stored site will be displayed with:

- of the unequivocal site number in the first line which is set down because of this meaning colorful-ly,

- the other 8 free text lines.

With the arrow keys on the left / on the right you scroll by all sites.
In this menu item, as well as in the menus for viewing the measurements, you can filter straight after sites by using a search mask.

- Select with the menu key "Search a site"
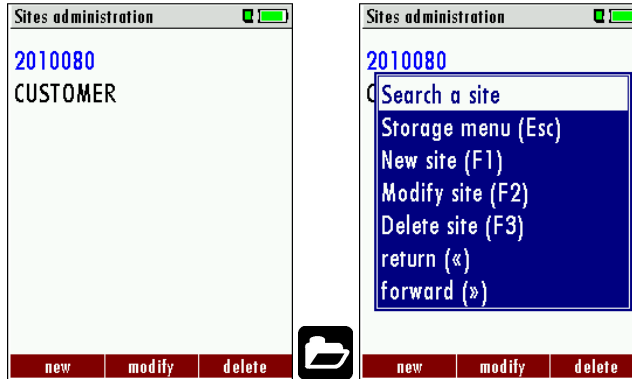
- Now you can enter the text to be searched for the first line, i.e. the site number, or for the second line, or for the rest of the text lines.
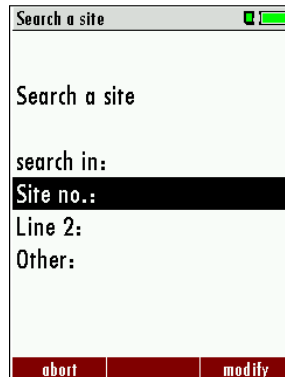
- Select the line for searching (site no. No., line 2, or rests) and select F3 "modify"

- Now in the indicated text input field you can enter a combination of letter, character and figures for whose occurence is searched in the selected text field. Press then "OK".

- Select after input of the search text F2 = "start"
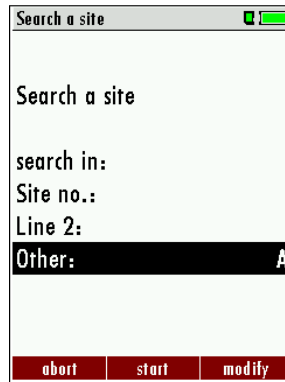
- If only one site is found as a result of the search, this is displayed. If became several sites the total number is found in the header viewed and you can scroll by this found standing with the arrow keys.

◄►	Page through the sites

📁	Menu key: Search site
	
	▲, ▼: Selection of the input field
	
	F3: Input mask, see chap. 16.1
	
	F2: Start search
	
	◄►: According to the search criteria found sites page through. If no
	
	      saved site with the search criteria agrees occurred the Me-dung:
	
	      „Search unsuccessfully"

ESC	Back to storage menu

13.3.2 New entry and change of sites

In the menu item "Sites administration" you can new entry sites and change data of existing sites.

Select F1 = "new" for a new site. Besides, it is displayed:

- The first line which must contain an unequivocal site number to the identification of the site. With the function F2 = „auto no. "can assign the device automatically a free site number.

- All further free text lines which can contain, e.g., name and address.
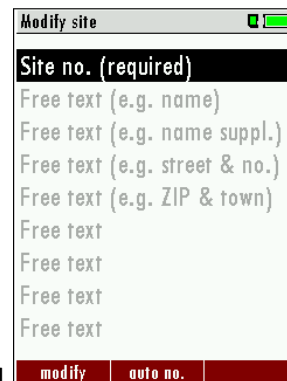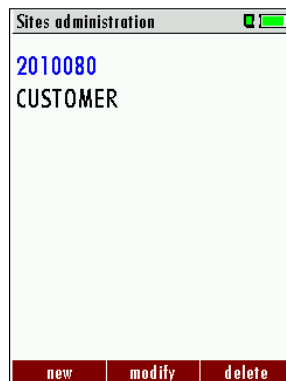
In the new site or an existing site you can change the data while you select the too change line, F1 = "modify" select and use the text input field for editing of the text. Conclude the text input field with "OK" and store the
updates with F3 = "store".
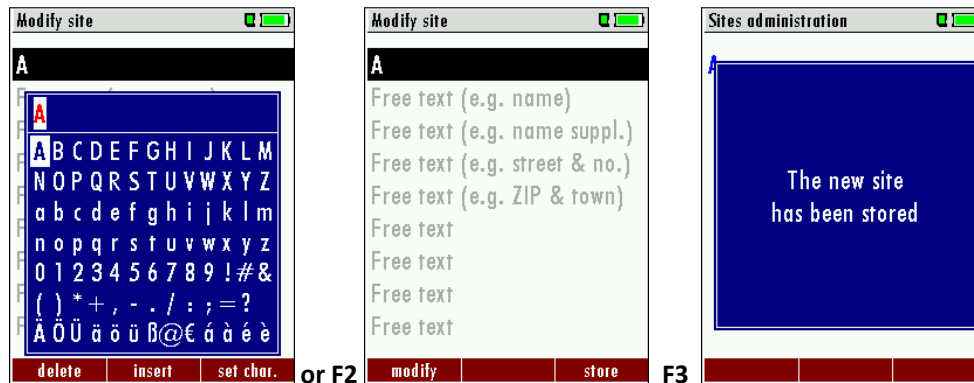
13.3.3 Delete sites

You are able to

- delete the displayed sites only by selecting the menu entry "F3" = "delete

- or delete all sites at the same time
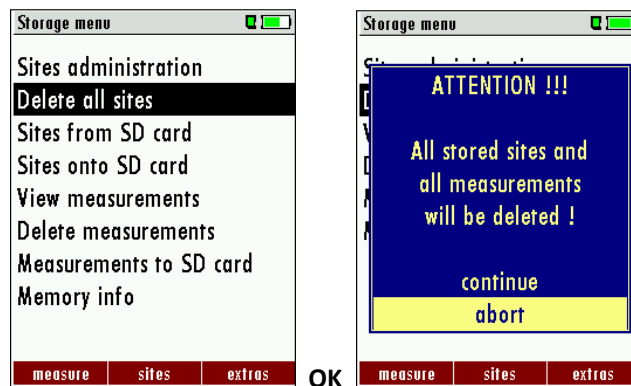
This user's decision must be confirmed. (see chap. 16.2).

13.4 Data transfer via SD Card (Option)

The data exchange format is CSV. A character-separated values (CSV) file is a simple text format for a database table. Each record in the table is one line of the text file. Each field value of a record is separated from the next by a character. OPTIMA 7 - NDIR uses a semi-colon ';' as value separator (other implementations use sometimes a comma). Implementations of CSV can often handle field values with embedded line breaks or separator characters by using quotation marks or escape sequences. CSV is a simple file format that is widely supported, so it is often used to move tabular data between different computer programs, for example Microsoft Excel™ or Access™, that support the format. Also other computer programs offer this type of interface because it is widely spread and easy to use.

The following functions are available from Software Version 1.11 and higher:

- Import of Sites
- Export of Sites
- Export of Flue Gas Measurements
- Export of Differential Pressure Measurements

13.4.1 Import of Sites

Storage menu 🔋▯	Sites from SD card 🔋▯
Sites administration	Sites from SD card
Delete all sites	
Sites from SD card	No sites file found
Sites onto SD card	
View measurements	Found sites 0
Delete measurements	Imported sites 0
Measurements to SD card	Max. importable 3998
Memory info	
measure sites extras	

OK
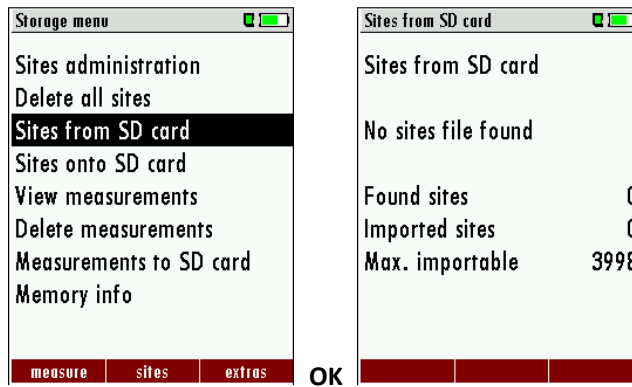
With this function you can Import Sites which have been created on a computer or another Analyser.

The File name must have the name "anlagen.csv" (anlagen = german for sites) . The file has no column heading that means that the first line already has user data. Each line has a minimum of 9 columns (with 8 semi-colons) and the first field in the line will be the site number. All data will be imported as long a site number is available. Per field a maximum of 24 characters will be imported, too long words will be cut off.

Example file with 8 valid sites (4 with 9 lines and 4 with less lines):

A1-Z1;A1-Z2;A1-Z3;A1-Z4;A1-Z5;A1-Z6;A1-Z7;A1-Z8;A1-Z9

A2-Z1;A2-Z2;A2-Z3;A2-Z4;A2-Z5;A2-Z6;A2-Z7;A2-Z8;A2-Z9

A3-Z1;A3-Z2;A3-Z3;A3-Z4;A3-Z5;A3-Z6;A3-Z7;A3-Z8;A3-Z9

A4-Z1;A4-Z2;A4-Z3;A4-Z4;A4-Z5;A4-Z6;A4-Z7;A4-Z8;A4-Z9

A5-Z1;A5-Z2;A5-Z3;A5-Z4;;;;;

A6-Z1;A6-Z2;;A6-Z4;;;;;

A7-Z1;;;A7-Z4;;;;;

A8-Z1;;;;;;;;;

Example file with 2 invalid sites (1 with not enough fields and 1 with missing site number):

A1-Z1;A1-Z2

;A1-Z2;A1-Z3;A1-Z4;A1-Z5;A1-Z6;A1-Z7;A1-Z8;A1-Z9

Important:

Whilst importing data from the SD Card to the analyser there is no check for double site numbers (Line 1), neither inside of the file that is imported nor between the file and the sites already inside the analyser. The analyser can easily handle double site numbers but you could face problems with double site numbers when exporting them again to a computer program (see also Export of Measurements).

However the analyser marks the files that have been imported successfully. If you try to import a file with the same analyser that is already in the analyser you will get a red information screen.

13.4.2 Export of Sites
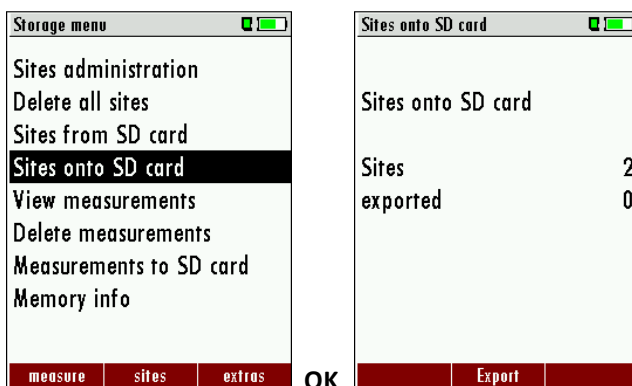
This function can be used for an analyser back up or if you wish to supply the analyser information to a computer program or another analyser. This is very handy if you have made some modifications inside the analyser (site) for example if you have modified the phone number of a customer and this modification needs to be updated in the computer software, or if a second analyser needs to have the same site information.

The File format ist the same as described above„Import of Sites".

Only the file name is different, the file name will be ‚ANLxxxxx.csv', in which the xxxxx are continuing 5 digit numbers with leading zeros. If the file must be imported into another analyser, the file must first be renamed into "anlagen.csv".

13.4.3 Export of Gas Measurements

This function is used to export the measurements from the analyser to a computer program.

Attention! This function is not suitable for back up or for the transfer to another analyser because the exported file can not be imported again!

The created file has the name ‚EMIxxxxx.csv', in which the xxxxx are continuing 5 digit numbers with leading zeros.

The created file has a column header with the following information: Site number, Date/Time, Measuring program name, Fuel type, CO2max, O2reference, and all measured values that the analyser can measure as well as the soot numbers, Derivate and T-Boiler.

Example:

	A	B	C	D	E	F	G	H	I	J	K
1	Site no.	Date & time	meas.progra	fuel type	CO2max [%]	O2ref [%]	T-gas [°F]	T-air [°F]	Dewpoint [°l	O2 [%]	CO2 [%]
2	BOILER	THU 30.09.2(	Program 1	Natural gas	11.7	3.0	--.-	73.5	--.-	21.0	--.-
3	BOILER	THU 30.09.2(	Program 1	Natural gas	11.7	3.0	--.-	73.0	--.-	21.0	--.-
4	BOILER	THU 30.09.2(	Program 1	Natural gas	11.7	3.0	--.-	73.0	--.-	21.0	--.-
5	BOILER	THU 30.09.2(	Program 1	Natural gas	11.7	3.0	--.-	72.5	--.-	21.0	--.-
6	BOILER	FRI 01.10.20	Program 1	Natural gas	11.7	3.0	--.-	72.5	--.-	21.0	--.-
7	A FURNACE	TUE 05.10.2(	Program 1	Natural gas	11.7	3.0	81.0	--.-	113.0	11.7	5.2
8	A FURNACE	TUE 05.10.2(	Program 1	Natural gas	11.7	3.0	81.0	--.-	113.0	11.7	5.2
9	A FURNACE	TUE 05.10.2(	Program 1	Natural gas	11.7	3.0	82.5	--.-	112.5	11.7	5.1
10	A FURNACE	TUE 12.10.2(	Program 1	Natural gas	11.7	3.0	84.5	--.-	132.5	2.7	10.2

13.4.4 Export of Differential Pressure Measurements

The same function as under 13.4.3(Export of Flue Gas Measurements) only the file name is different.

The created file has the file name "DDMxxxxx.csv", in which the xxxxx are continuing 5 digit numbers with leading zeros.

The created file has a column header with the following information: Site number, Date/Time, as well as 4 saved pressure measurements.

13.5 Measurements in the data memory

13.5.1 View measurements

In the menu item „View measurements"you can inspect the stored measurements. After selection of this item you receive first an overview of the number of the stored measurements according to measuring type.
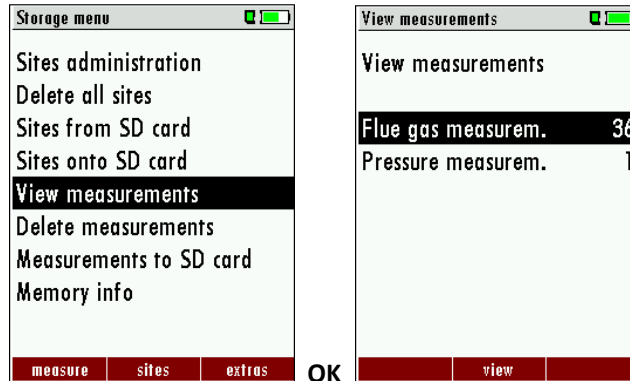
- Select flue gas measurement or another measuring type.

- Then you receive first a page with context information to the stored measurement. Scroll with the arrow keys by the context information of the stored measurements.
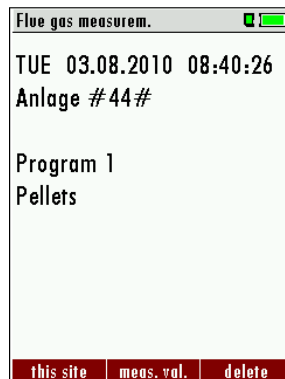
- With F2 = "measured value" are displayed the measured data of the stored measurement in detail, available in 3 measuring value pages, as they are defined in the measuring value window.
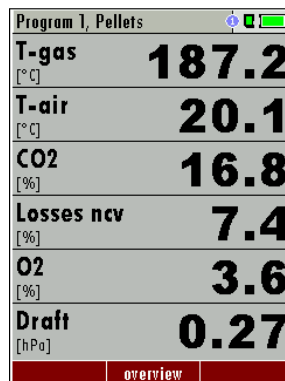
- With ESC you return to the context information of the measurement.

You have the possibility to display only those data that are assigned to a single site:.

- either F1 = „this site" , while a measurement of the desired site is displayed.
  With F1 = „all sites" you cancel this filter again.

- or while you select with the menu key the function "search a site" and execute, as described in the chapter site administration.

13.5.2 Delete measurements

You are able to

- delete single measurements, while they are displayed – press the key F3 = "delete" .

- or delete all measurements of a measuring type.

Storage menu	Delete measurements	Delete measurements
Sites administration	Delete measurements	
Delete all sites		ATTENTION !!!
Sites from SD card	All measurement types 51	
Sites onto SD card	Flue gas measurem. 36	All selected measurements will be deleted !
View measurements	Pressure measurem. 1	
Delete measurements		
Measurements to SD card		continue
Memory info		abort
measure sites extras **OK**	delete **F2**	delete

13.5.3 Export measurements to a SD card (optional)

The OPTIMA 7 - NDIR offers the possibility to export all stored measurements to a SD card.

Storage menu	Measurements to SD card
Sites administration	Measurements to SD card
Delete all sites	
Sites from SD card	Flue gas measurem. 36
Sites onto SD card	Pressure measurem. 1
View measurements	
Delete measurements	
Measurements to SD card	
Memory info	
measure sites extras **OK**	Export **F2**
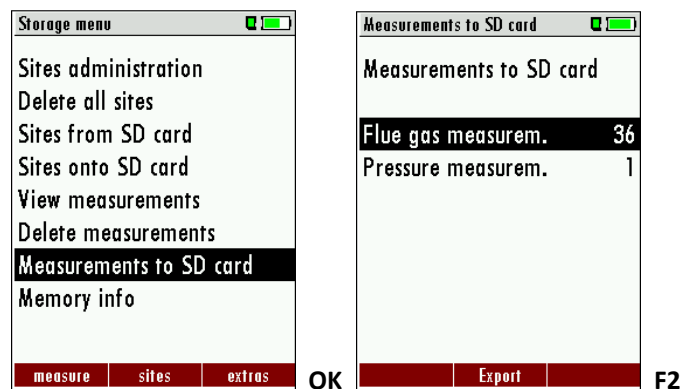
By confirming with the F2 key the data transmission / export on the SD card is started.

During the data export the display reads „please wait". A write error to SD card is reported by the instrument. Make sure that the SD card is not write protected.

The data are stored as a csv-file (e.g., EMI01032.csv) on the SD card. The filename exists of a sequential number which fixes the device.

This file is editable on your Notebook/PC with a program like e.g. Microsoft® EXCEL or OpenOffice® Calc. With possible problems with the using of your computer programs please read your software documentations or ask your software dealer.

14 EXTRAS / ADJUSTMENTS

The OPTIMA 7 - NDIR is delivered in a standard software configuration which should cover most needs. However, there are many ways to tailor the settings to your individual needs if required. The possibilities are highly flexible and individual adaptable.

Use the variable possibilities to adapt your analyser to your own needs and customize the measurement menu, the measurement window, the printer out put and many other features. Usually this is something you will do once you receive the analyser, once you have adapted your analyser you will most probably don't make much changes in future, but you can when ever you need and want to do so.

After you have made any changes in the configuration, you should switch off the analyser to save all the changes that have been made. Next time that you start up the analyser, all changes will have been made.

14.1 Maintenance adjustment menu

The Maintenance adjustment menu is secured with a Pin Code to protect it against unauthorized users.
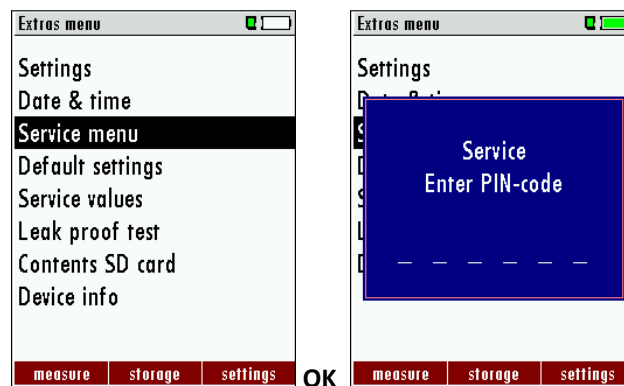
If you enter a wrong pin code you will be exited into the "Extra Menu" again.

Please contact MRU GmbH if you need the Pin Code for your analyser.

Press the Enter key if you should have landed in this menu by accident and you will be exited into the "Extra Menu" again.

14.2 Manufacturer default settings
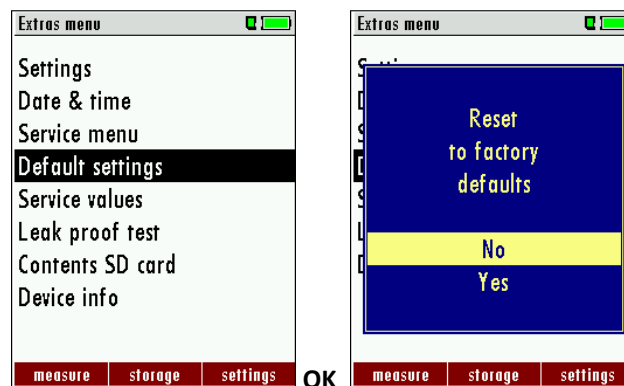
The analyser will be reset to original delivery settings.

Be aware that your configurations will be deleted, such as:

Measurement window selection and others.

14.3 Service values

Should your analyser display an error message after zeroing (for example: „O2-Sensor not OK"), then you can use the Service value menu to get detailed information about possible defects. In this menu you will see all service values of the sensors and also other parameters.

In case of a defect contact the MRU service department. The MRU service technician will ask you about these values or he will ask you to send them by fax or email.

Extras menu			Service values	
Settings			O2 [mV]	9.745
Date & time			CO [mV]	0.007
Service menu			CO/H2 [mV]	0.003
Default settings			TC-AIR [mV]	-0.075
Service values			TC-GAS [mV]	-0.051
Leak proof test			PT-REF-I [kR]	1.105
Contents SD card			TC-LEMO [mV]	585.000
Device info			PT-REF-L [kR]	1951.056
			U-Batt [V]	3.972
measure	storage	settings **OK**	Gas pump	Purge pump
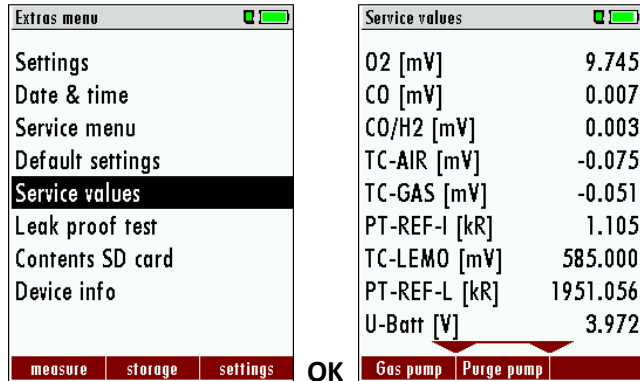
▲, ▼	Jump between the lines
F1	Function test gas pump (on / off)
F2	Function test purge pump (on / off)
ESC	return

14.4 Leak proof test

With the leak proof test the system is checked by the device (incl. the condensate separator) up to the probe spike on undensity. The internal gas pump generates in addition a subpressure which is measured over the built-in draft sensor and is observed for a period of 10 seconds. Based on the decrease of pressure the leakness of the system will be determined.

Operation:

to connector pressure 1   to probe tip
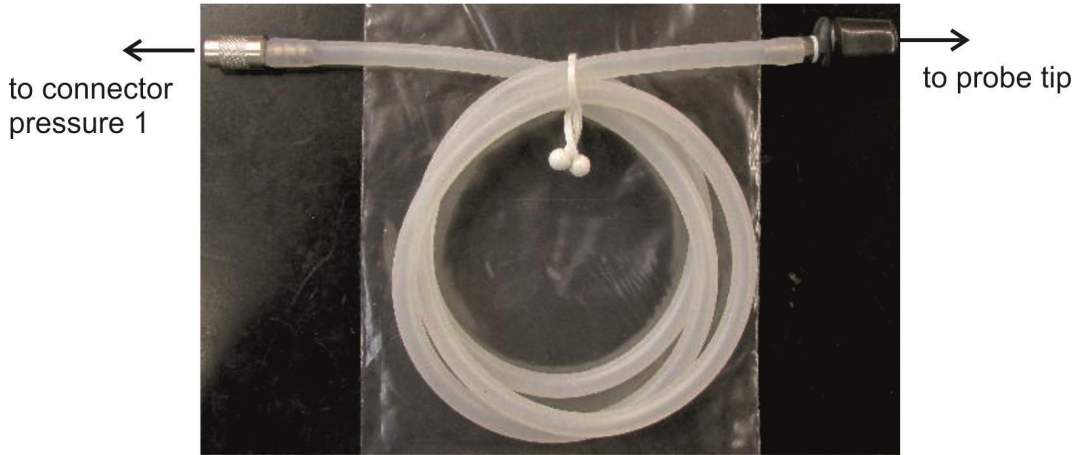
- Hose set for leak proof set

ATTENTION: The probe spike before the density test clean! (With depositions on the tube the cap does not seal.)

- Launch under "extras" the leak proof test on which the following window will pop up:
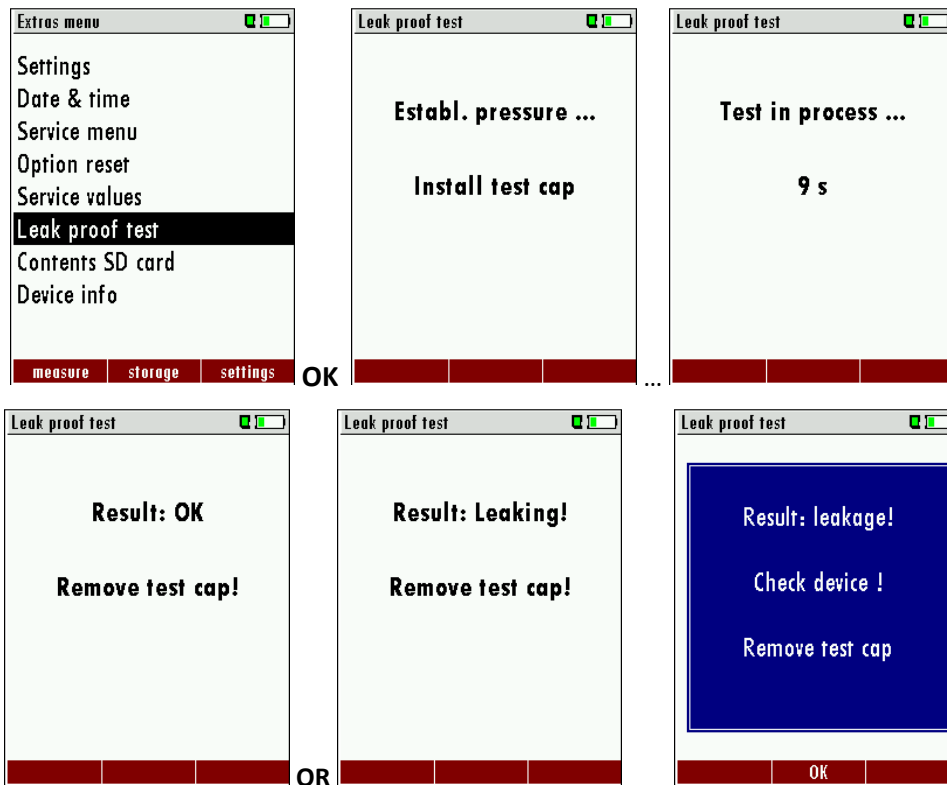
If of the leak proof test is not passed the probe must be checked including the hosing as well as the condensate separator.

If no undensity is ascertained in these external parts the OPTIMA 7 - NDIR Combustion Analyser has to be checked in a service department
(worldwide service departments see www.mru.eu).

14.5 Contents SD card

Extras menu	Inhalt SD-Karte	
Settings	**ANL00000.CSV**	
Date & time	ANL00001.CSV	
Service menu	ANL00002.CSV	
Default settings	ANLAGEN.CSV	
Service values	ANLAGEN.ZIV	
Leak proof test	ANLAGEN0.LCD	
Contents SD card	ANLAGEN1.LCD	The contents of the SD card will be dis-
Device info	ANLAGE~1.BMP	played. With F3 the selected file can be
	ANLAGE~2.BMP	opened.
measure storage settings	löschen aktualisieren öffnen	

OK

14.6 Analyser info

Here you will find information about the analyser and the installed options.

Extras menu	Device info
Settings	Firmware version 1.09.13
Date & time	Meas kernel version 1.03
Service menu	Bootloader version 0.92
Default settings	
Service values	Serial number 312321
Leak proof test	Manuf. date 02.08.2010
Contents SD card	
Device info	Operating hours 307.4
	Adjustment date 12.04.2010
measure storage settings	options
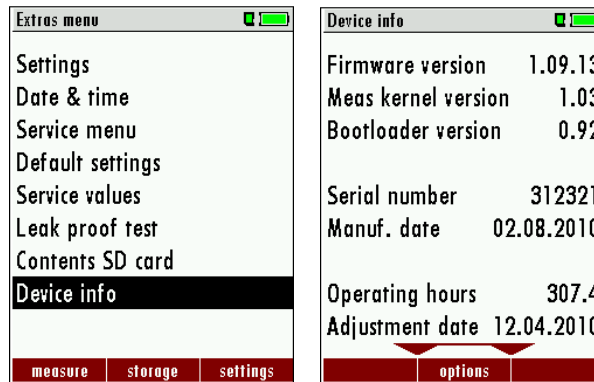
Press the F2-key to see the installed options.

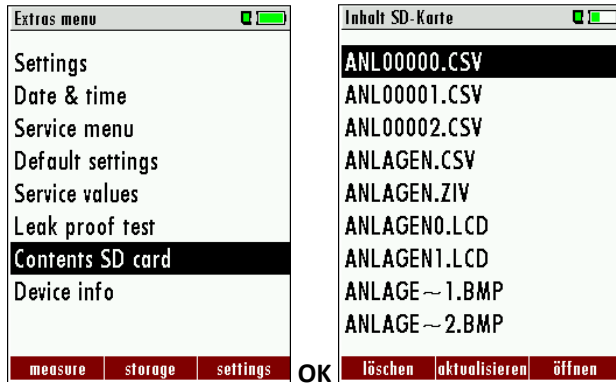| Options list	Options list
O2 sensor	Li-Ion battery
CO sensor	CO purge pump
Draft sensor (type 2)	Due for service active
Li-Ion battery	SD-Card
CO purge pump	Diff.temp. measurement
Due for service active	Diff.press. measurement
SD-Card	Flow measurement
Diff.temp. measurement	Ext. HC-detector
Diff.press. measurement	Instrument leak test
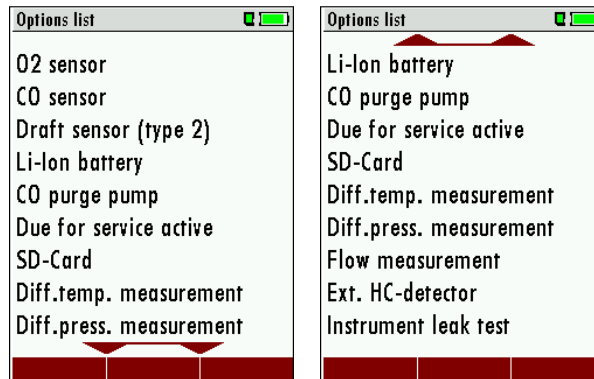
With the F1-key you get information about the date of the last 7 service procedures

Service history	
Service counter	471.7
24.03.2010	
- - - -	
- - - -	
- - - -	
- - - -	
- - - -	
- - - -	
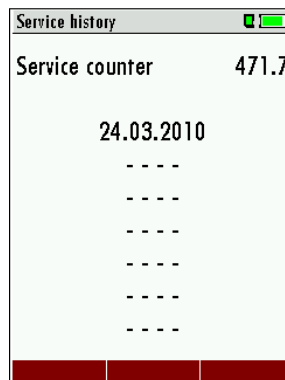
15 TECHNICAL SPECIFICATIONS

Measured values	OPTIMA 7 - NDIR
CO2 NDIR	
Measurement range	0 - 20 Vol-%
Accuracy	± 0,4 % abs. or** 4 % of the measured value
Reaction time T90*	< 40 s
CO	
Measurement range	0 – 10 Vol-%
Accuracy	± 0,03 % abs. or** 3 % of the measured value
Reaction time T90*	< 40 s
HC as n-Hexan	
Measurement range	0 – 20.000 ppm
Accuracy	± 10 ppm or ** 5 % reading
Reaction time T90*	< 40 s
O_2	
Measurement range	0 - 21,0 Vol-%
Accuracy	± 0,2 Vol-% abs.
Reaction time T90*	< 20 sec
NO	
Measurement range	0 - 1.000 ppm, overload up to 5.000 ppm***
Accuracy	± 5 ppm or** 5 % of the measured value up to 1.000 ppm
	or** 10 % of the measured value up to 5.000 ppm
Reaction time T90*	m30 sec
Gas temperature T_A	
Measurement range	0 - 800 °C with high grade steel probe pipe
Measurement range	0 - 1.100 °C with Inconel probe pipe
Accuracy	± 2 °C m200 °C
	1 % of the measured value > 200 °C
Ambient air temperature T_L	
Measurement range	0 - 100 °C
Accuracy	± 1 °C

Draft	
Measurement range	± 200 hPa
Accuracy	± 0,02 hPa or** 1% of the measured value
Differential pressure	
Measurement range	± 100 hPa
Accuracy	± 0,02 hPa or** 1% of the measured value
Max suction range gas pump	150 hPa
Typical gas flow	60 l/h
Calculated values	Lambda (Brettschneider formula), PEF (propane equivalency factor)
General specification	
Operating temperature	+ 5 - + 45 °C / +41 … + 113° F, max. 95 % RH, not condensing
Storing temperature	- 20 - + 50 °C / - 4 … + 122° F
Power supply	Internal: NiMH battery pack 3,6 V/ 2.100 mAh, 6 h operation time
	Internal: LI-Ion battery pack 3,7 V/ 5.800 mAh (optional), 15 h operation time
	External:wall-plug grid power supply, 100 - 240 V AC / 5,0 Vdc / 1200 mA / 50 … 60 Hz
Weight	ca. 750 g / approx. 1.65 lbs (with 2 sensors)
Sizes	244 x 113 x 54 mm / 4.3" x 8.8" x 2.04"
	* = typical sensor value, ** which ever is larger, ***only for SHORT-TERM measurement
Technical changes possible at any time!	Rev date: 20170213

15.1 Lambda (Brettschneider formula)

The emission analyser OPTIMA7-NDIR is a multi-component analyser, **which measures continuously:**

CO (carbon monoxide)   [%] O_2 (oxygen)   [%]

CO_2 (carbon dioxide)   [%]   NO (nitrogen monoxide)   [ppm]

HC (hydrocarbons)   [ppm]

Simplified Excess Air calculation according to Brettschneider :

$$Lambda = \frac{[CO_2] + [CO]/2 + [O_2] + \left(\frac{1,7261}{4} \cdot \frac{3,5}{3,5 + [CO]/[CO_2]} - 0,0088\right) \cdot ([CO_2] + [CO])}{\left(1 + \frac{1,7261}{4} - 0,0088\right) \cdot ([CO_2] + [CO] + K1 \cdot [HC])}$$

15.2 P.E.F. factor

The P.E.F factor Propane-Hexane is the conversion factor and is used because the OPTIMA7-NDIR is calibrated with propane (C_3H_8), but it has to display n-Hexane.

n-Hexane = P.E.F. * propane

This factor is determined for this in the factory and used in the calculation, display and printout. This determines value is displayed in the service-menu and after the adjustment.
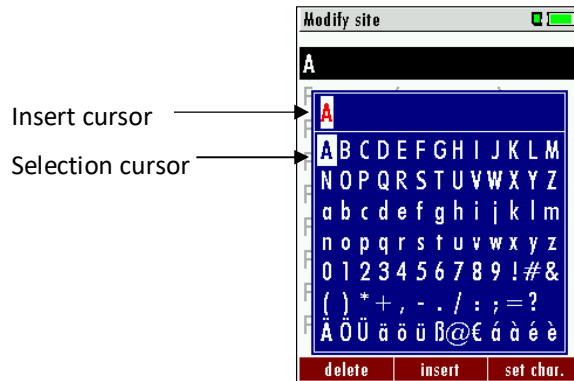
16 APPENDIX

16.1 Text input

A numbers of texts and names can be changed to your own needs.
(for example: the names of the user defined fuel types, site names, the names of the measurement programs)

When you select the text input, the following window will pop up:

Insert cursor
Selection cursor

▲, ▼, ◄, ►	Select a letter, number or sign
F1 – delete	The letter left of the cursor will be deleted
F2 – insert	Selected letter or number will be inserted
F3 – over write	Selected letter or number will over write the current letter or number
ESC	Abort the window, changes will NOT be saved

16.2 Asking the user for a decision (pop up window)

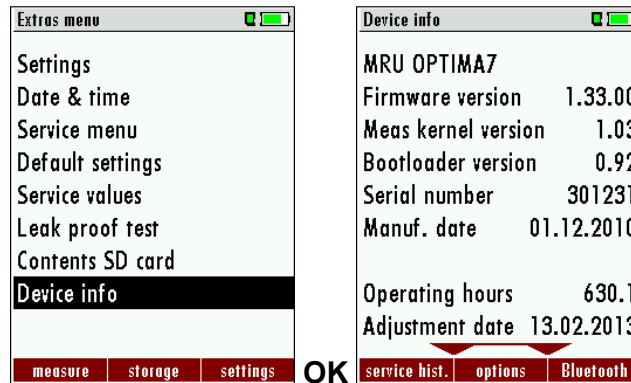The OPTIMA 7 - NDIR will ask you now and then to confirm the action that will be taken.
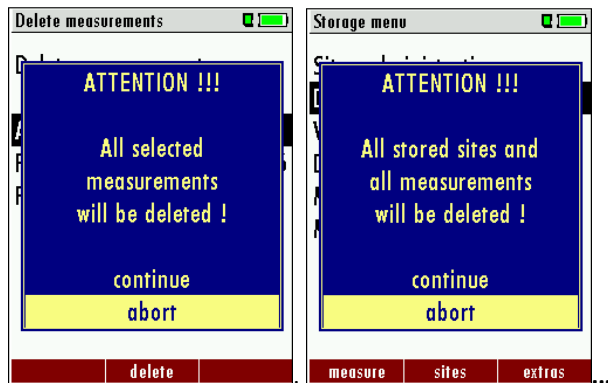
▲, ▼	Select a line
OK	Confirm the action
ESC	Abort the window, changes will NOT be saved

16.3 Firmwareupdate

Switch ON the device.
Select F3 settings/Device info

Extras menu	Device info
Settings	MRU OPTIMA7
Date & time	Firmware version 1.33.00
Service menu	Meas kernel version 1.03
Default settings	Bootloader version 0.92
Service values	Serial number 301231
Leak proof test	Manuf. date 01.12.2010
Contents SD card	
Device info	Operating hours 630.1
	Adjustment date 13.02.2013
measure	storage	settings	**OK**	service hist.	options	Bluetooth

The first line shows e.g.: Firmware-Version 1.33.00

For the case that there should be problems by the update we need some information of you.
Please write down your Firmware-Version **(e.g. 1.33.00)**_____

Please write down your serial number   **(e.g. 301231)**_____

You need the latest file 'All_1083.fwb'. In case you get it in a zip archive you have to extract it before usage. This file contains all firmware types and the analyser will extract the correct type out of this file automatically.

Please follow these steps in order to update the analyser:

- copy the file 'All_1083.fwb' to a SD card in the root directory (that means in no directory)

- switch on the analyser

- insert the SD card into the analyser

- in most cases a message 'Searching firmware, please wait...' will be displayed for some seconds

- you will be asked: 'Firmware found. Install now?'

- acknowledge with 'install'

- for about 30 seconds the display will be dark, then the analyser will reboot with the new firmware

- Finished

Attention:
Don't press during the update any key and remove the SD card first after a restart of the base unit from the device!

16.4 Using the USB-Port

This port is used for data transfer from your analyser to your PC / Laptop using the MRU Online View (Version 2.XX). The first time you want to use your analyser for data transfer to your PC or laptop, you have to "mate" the OPTIMA 7 - NDIR and your PC / Laptop. (Requires operating system Windows XP or Windows 7).

Your PC / Laptop will recognize the OPTIMA 7 - NDIR as USB- HID (Human Interface Device).

Check list:

1. Switch on the OPTIMA 7 - NDIR

2. Connect the USB cable to the OPTIMA 7 - NDIR

3. Connect the USB cable into a free USB port at your PC/Laptop

4. The PC/Laptop must be powered on

5. The above seen information „New hardware found" will be displayed above the USB-Icon of your PC/Laptop


If this is not the case, then you have a problem with your USB-Connection of your PC/Laptop.

Check in your Device Manager if the analyser is ready for operation.
The OPTIMA 7 - NDIR is as HID-conform unit registrated.

Windows XP: Press the START button – then select the CONTROL PANEL – select SYSTEM – select HARDWARE – select DEVICE MANAGER

Windows 7: for Windows 7 there are several possibilities, please read your Windows 7 manual for details.
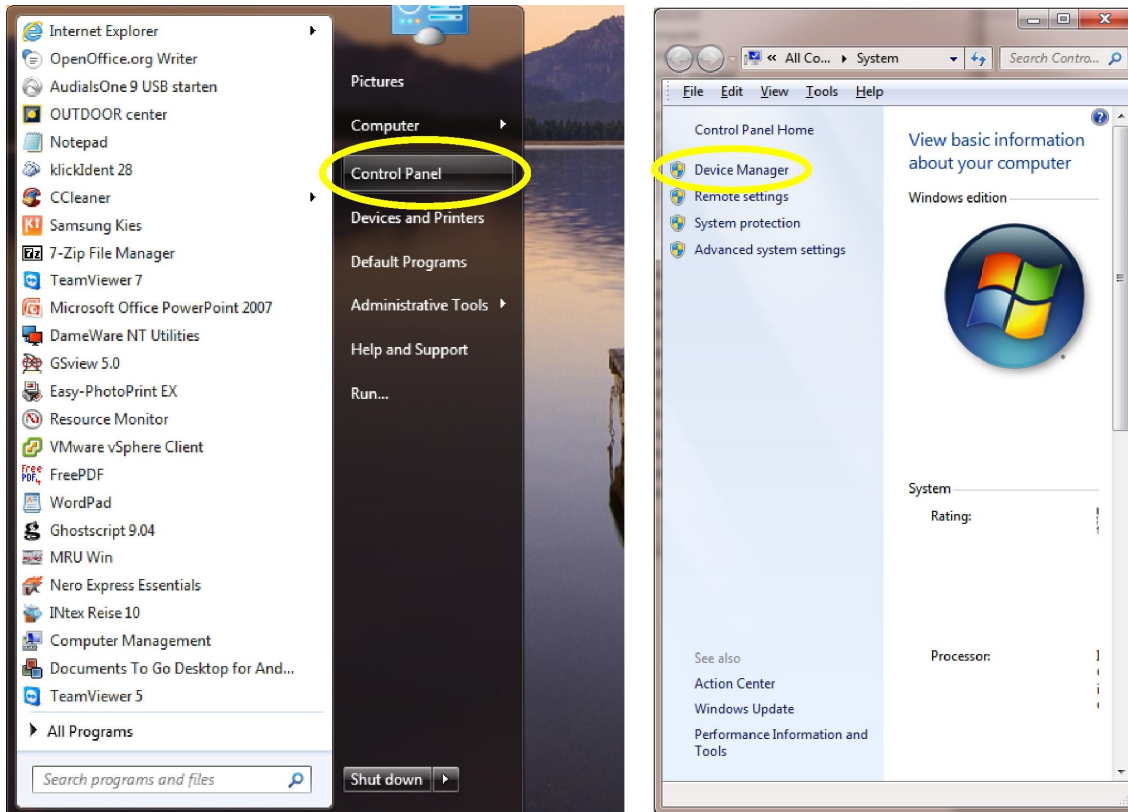
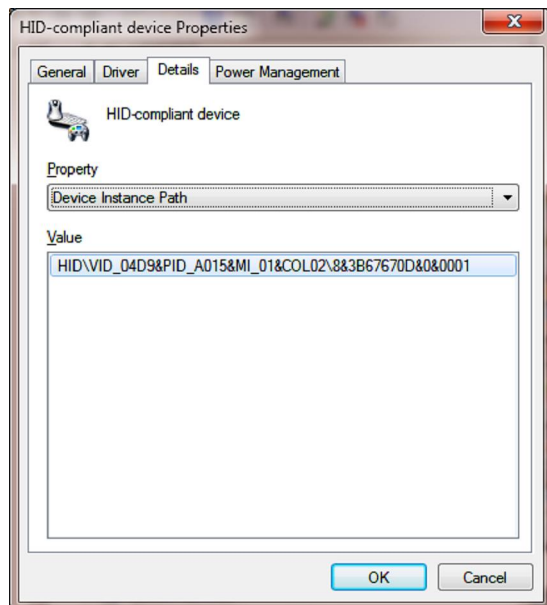(The grafics may look different on your PC/Laptop as shown in this manual!)
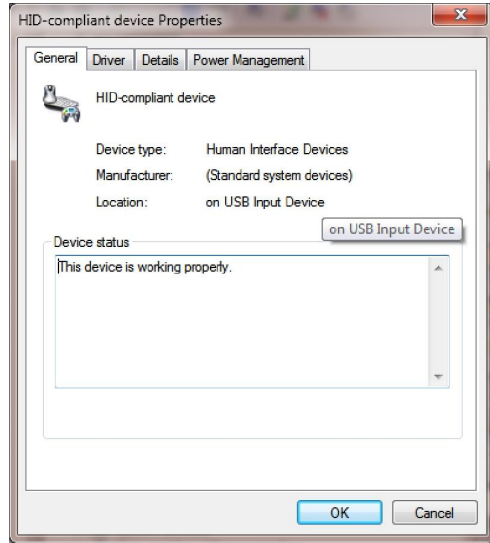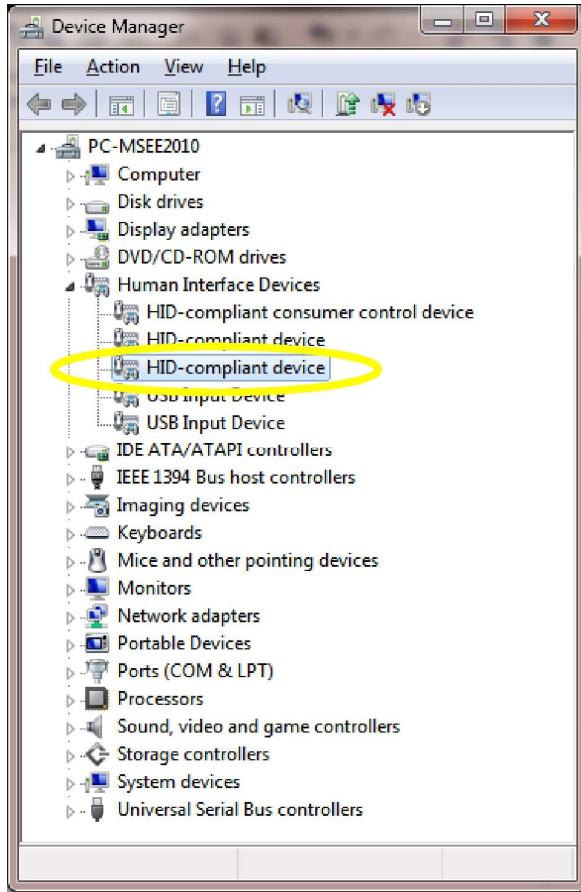
The OPTIMA 7 - NDIR is registrated as HID-conform unit.   In the General folder you can see if the unit is ready for

operation.

In case the analyser id not ready for operation, choose a different USB instrument to check the USB port on your computer, and/or connect the OPTIMA 7 - NDIR to a different computer to locate the error.

16.5 Analysis and calculations

Measured values	Unit
O_2	[%]
CO	[ppm]
CO2	[%]
HC as n-Hexan	[ppm]
NO	[ppm]
Temp. Ambient air (Thermo-Element)	[°C] [°F]
Temp. Flue gas (Thermo-Element)	[°C] [°F]
Draft	[hPa]/cf. Chapter 9.2

Available conversions of CO	CO	NO
[ppm] related to. on 0% rest O_2 (undiluted)	X	X
[ppm] related to. on fuel type dependent O_2 reference value	X	X
[mg/m^3]	X	X
[mg/kWh]	X	X
[mg/MJ]	X	X
[mg/m^3] on fuel type dependent O_2 reference value	X	X

Continously caculated values	Unit
Lambda	-

For further information please contact MRU GmbH. (www.mru.eu)

16.6 Errors

16.6.1 Error diagnosis regarding the measuring device

1. Effect	2. Error indication	3. Cause	4. Solution
Device cannot be switched off by pressing the OFF key.	LED behind the condensate separator is on and the LCD display is dark	Device does not react on any key.	Press ESC and ON simultaneously! EMERGENCY OFF After this, the date and time have to set new.
Inside of the device is too cold, device not ready for operation.	Display indication: "Device too cold" or audible sound every 5 sec..	e.g. device was stored in a cold place during winter.	Put the device to a warm room and wait
Measuring values are not correct		Sensors already get in tough with the gas during calibration.	Vent device with fresh air and re-start!
No measurement possible		Device cannot be switched on or does not react after being switched on. Battery discharge	Connect the device to the line power in order to charge the battery.
Measurement without exact temperature values.	Temperature indication: - - - , - °C	Thermo element defective, balancing network interrupted or not connected.	Call our after-sales service. Remove probe from the gas duct and condensate from the probe tube.
Wrong measuring values	Measuring range exceeded: Value O_2 too high Values CO and CO_2 to low	Connection probe – device not correct. Leakage at probe / tube / condensate separator, pump does not suck correctly	Effect tightness test! By visual control of probes, tubes condensate separator, leaking parts could be found.
Wrong measuring values	Gas temperature is too hot or alternates	Probe is not plugged in correctly, defective cable in the probe line, formation of condensate at the probe tip.	Check probe plug respectively probe line regarding damages (loose connection), remove condensate from the probe tip.

16.6.2 Error diagnosis regarding the condensate separator

1. Effect	2. Cause	3. Solution
Dirt and / or humidity inside the device No filter effect Sensor failure Pump failure	Fine filters are wet and / or dirty.	Check filters more often Renew them if necessary (white = OK) Brown-black = renewal
Wrong measuring values	Cover, intermediary unit, plexiglass tube and locking pieces are not tightly fixed respectively screwed	Check tightness with every filter change.

16.7 EG-Declaration of conformity

EG-Konformitätserklärung
Declaration of conformity
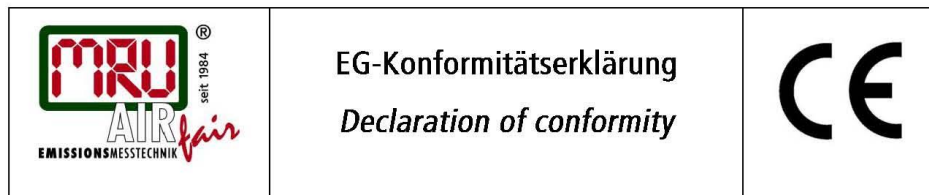
MRU Messgeräte für Rauchgase und Umweltschutz GmbH

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Bevollmächtigte Person, für die Zusammenstellung der technischen Unterlagen
Person authorized to compile the technical documents

Name / *name:*	Dierk Ahrends
Funktion / *function:*	QM-Beauftragter / *QM- Representative*
Firmenname / *company:*	Messgeräte für Rauchgase und Umweltschutz GmbH
Straße / *street:*	Fuchshalde 8 + 12
Ort / *city:*	74172 Neckarsulm
Land / *country:*	Deutschland / *Germany*

Produkt/Product

Bezeichnung /*designation:*	Gasanalysator
	Gas analyser
Produktname / *name:*	OPTIMA 7
Funktion / *function:*	Gasanalyse / g*as analysis*

Hiermit erklären wir, dass das oben beschriebene Produkt allen einschlägigen Bestimmungen entspricht, es erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We declare the conformity of the product with the applicable regulations listed below:

- EMV-Richtlinie / *EMV-directive* 2014/30/EU
- Niederspannungsrichtlinie / *low voltage directive* 2014/35/EU
- RoHS-Richtlinie / *RoHS directive* 2011/65/EU (RoHS II)

Neckarsulm, 01.07.2016

Erwin Hintz, Geschäftsführer / *Managing Director*

Technical data change w/o notice!   Date of issue: 20170217