



Operating Instructions

ecom[®] • **EN** •

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Important hints



The ecom-EN meets the requirements of DIN EN 50379 part of 2.



The ecom-EN may not be used for continuous emission control!



Following minimum times must be kept, in order to receive correct measured values:
-1 min. to calibrate the sensors at fresh air
-2 min. for stable measured values



The following substances impair the working of the instrument:

- Cleaning agents
- Degreasers
- Wax polishes
- Adhesives
- Formaldehyde

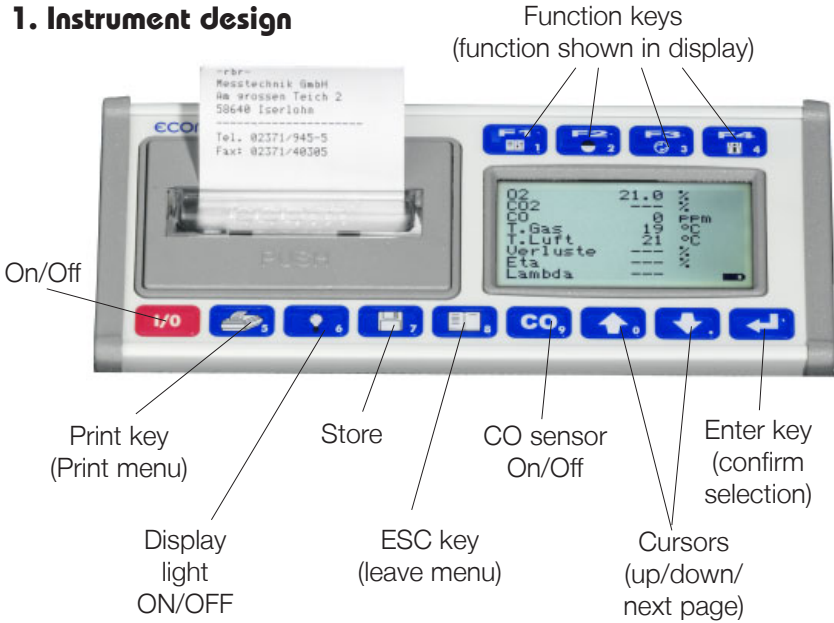


Adjustments at burners and boilers should be made only by specialists, who are familiar with those installations!



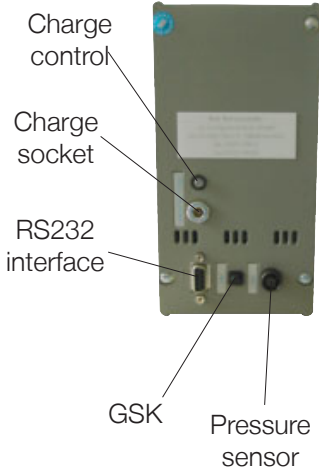
1. Charge the accumulator regularly (Charge not used instrument min. once a month)!
2. Never store the instrument with unloaded accumulator!

1. Instrument Design



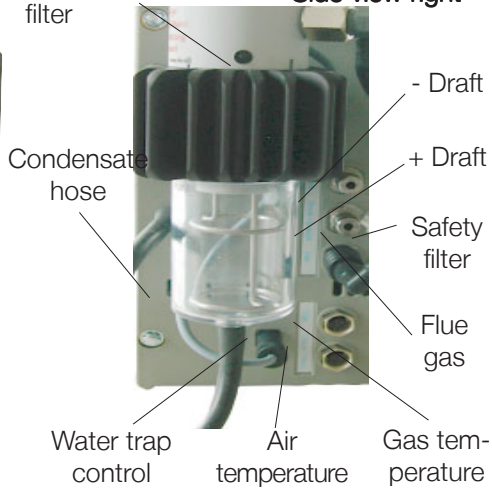
Keys are also used to input numbers

Side view left














Condensate trap with filter

Side view right



2. Accessories ecom-EN

<p>Transport bag with probe fixation Item no.: 30001104</p> 	<p>Transport case alu Item no.: 30001105</p> 
<p>Transport case leather (inkl. 30001104) Item no.: 30001106</p> 	<p>Soot pump kit Item no.: 50538</p> 
<p>T-Room sensor stick Item no.: 51446</p> 	<p>Data cable EN Item no.: 52694 <i>ohne Abbildung</i></p>
<p>Adaptor cable USB / RS 232 Item no.: 30000608 <i>ohne Abbildung</i></p>	<p>Gas leak detector GSK Item no.:  7001073 (mit ppm-Anzeige) 6005009 (mit Balkenanzeige)</p>
<p>Connection cable GSK / EN Item no.: 30000819 <i>ohne Abbildung</i></p>	<p>Gas pressure sensor Item no.: 30000504 (0-100 hPa) 30000505 (0-500 hPa)</p> 
<p>Filtering plate (Solid combustibles) Item no.: 10138</p> 	<p>Filtering case (Solid combustibles) Item no.: 55810</p> 
<p>CO-multi-hole probe Item no.: 54724</p> 	<p>O2-multi-hole probe Item no.: 30000503</p> 

3. Operation

Turn on the instrument (key I/O). The main menu will appear on the display, showing 7 submenus (scroll to access not displayed submenus).

The respective functions are as follows:

- Comb.measurēm.: Start gas analysis
- Draft/Pressure: Draft or pressure measurement performed
- Soot/Oil deriv: Input results of soot measurement
- Data processing: Assign measurement / Load or send data
- Adjustments: Change instrument's settings
- Control: Check operation condition of instrument
- Diagnostics: Read-out control units / delta T- measurement

Comb.measurēm.
Draft/Pressure
Soot/Oil deriv.
Data processing
Adjustments
Control
Diagnostics

When processing measurements, choose with cursor "**Comb.measurēm.**" and confirm with the <Enter> key. The instrument starts with a 1-minute calibration cycle and the fuel selection list is displayed. The following fuel types are available:

Fuel types acc. to BImSchV

Fuel oil
 Natural gas
 Town gas
 Coke gas
 Liquid gas

Fuel type
Natural gas
CO2max : 11.7
A1-Factor : 0.35
Select with ↑↓!

Select fuel type with arrow key and confirm with <Enter> key.

Select Yes or No for Data Processing. If you want the measured value in a certain order, then press the <F1> key for "Yes", and <F4> for "No".

Yes	No
Data processing	
Quit with ↵	

4. Select / Input plant number

To call up a specific plant already stored in the instrument or to create a new file, you may select one of the available search modes.

Select by:
Search word
Memory number
Select with ↑↓

Memory: For a new plant, a memory number can be allocated.

Choose **"Memory number"** and confirm with **<Enter>** key. Enter a memory number (0 - 4000).

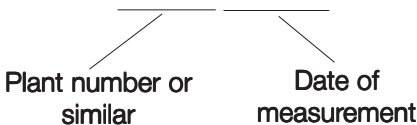
For example, enter **"0"**
for memory space 0.

Memory number
Input:
<input type="text" value="0"/>

After entering number, press **<Enter>** to take up this memory space. Pressing the **<F3>** key will seek out the next free space (starting by 0). After pressing the **<F4>** key, an identification number can be inputted for the new plant.

Tip: Since only numbers can be inputted (max. 16 characters), we recommend inputting the date, so the subsequent search can be performed by date (search acc. to date).

For example: 0000001.25.11.99



Number:
Input:
0000001.25.11.99

The memory space is activated by pressing **<Enter>** key when the input is finished. Then one can access the measurement mode. Press hereto twice on **<ESC>** to reach the main menu. Select **"Gas analysis"** and confirm with the **<Enter>** key.

Search word: If you know the identification number of the plant, the search mode will find the number if it is already in the memory.

Select "**Search word**" and confirm with **<Enter>**. Input 4 numbers to recognize the equipment.

Search word
Input:
25.11

For example: "**25.11**" for identification number **0000001.25.11.99**

After number input, press **<Enter>**. The programme will propose all stored numbers with this figures configuration. You can view each of them using the arrow key (use **<F1>** for the beginning and **<F2>** for selection end).

Once the correct data record is identified, it can be activated by pressing **<Enter>** and the stored measurement values can be viewed (choose "**Look at**" and confirm with **<Enter>**).

F1:Begin	F3:Empty
F2: End	
0000001.25.11.99	
Memory number	8 M

Measured values available

Using the cursor key, you can call up -one after the other- 3 display pages covering all measured and calculated values.

Date	Time
25.11.99	10:35:56
0000001.25.11.99	
Memory number	8

O2	3.2	%
CO2	13.1	%
CO	12	ppm
NO	52	ppm
T.Gas	184	°C
T.Air	20	°C
Losses	7.5	%
Eff.	92.5	%

<u>Soot/Oil trace</u>	
Draught	-0.08 hPa
T.Boiler	65 °C
1.Soot-meas.	0.5
2.Soot-meas.	0.3
3.Soot-meas.	0.7
Oil trace	No

CO-measure.		
O2	17.5	%
CO	0.0%	738 ppm
CO		123 ppm
Excess air	7.00	
BlmSchV : keys ↑↓		

Press twice **<ESC>**, "**Comb.measur.**" and then **<Enter>** to enable the recording of the current measurement values.

5. Gas analysis

5.1. Measurement preparation



Always use a filtering system as per our recommendation for combustion plants firing solid combustibles!

Prepare the instrument for operation in that you perform all connections (T-Room sensor and T-Gas, GAS and DRA of the 3-chamber hose). Make sure that:

- the condensate trap contains no humidity
- the fine dust filter and the safety filter are not soiled darker than number 3 on the soot scale.

5.2. Gas analysis



Always position the probe in the exhaust pipe once the calibration phase is over!



To obtain accurate measurement values, re-calibrate the instrument after each measurement (at the latest after one hour)!

Once the 1-minute calibration phase is over, the instrument enters the measurement mode. The values are viewable on 4 screen pages (3 x gas analysis; 1 x CO measurement; use the cursor keys to scroll the pages):

O2	4.0 %	O2	4.0 %	O2	4.0	%
CO2	12.5 %	CO2	12.5 %	CO2	12.5	%
T. Air	20 °C	CO	30 ppm	CO	30	ppm
T. Gas	212 °C	Lambda	1.23	NO	45	ppm
				T. Gas	166	°C
				T. Air	20	°C
				Losses	7.0	%
				Efficiency	93.0	%

In case of measuring interruption the instrument can be switched standby with <F3> (pump out). Pressing <F3> again terminates standby. The position of the measured and calculated values (gas analysis measurement) is free selectable. To change the succession, process as follows:

- press <F1> to activate the first line on the display,
- select with arrow keys the measured or calculated value,
- press <F1> to activate the next line and so on and so on...

CO₂, Efficiency, Losses, Excess air and dew point are calculated values. They are calculated only when realistic values for temperature and O₂ are available. It means that:

$$O_2 < 20.5\% \quad T.Gas - T.Air > +5^\circ C$$

The dew point can only be calculated correctly, if in the menu “**Adjustments / Air pressure**” the current barometric air pressure has been entered. The analyser cannot determine the air pressure.

If the gas temperature falls below the dew point (between 25 and 65 °C), ETA will be calculated with condensation. In the display (C) appears behind ETA.

Correct values are displayed after a short time (1 to 1 ½ minute), necessitated by the gas transport to the sensors and once a stable electrochemical reaction is given at the sensors. Wait for the values to get stable before storing, printing and evaluating them. If the gas values still fluctuate more than 2 ppm, there may be unstable draft conditions in the gas channel.

Once the measured values are stable and the results can be printed, press <Store> to transfer the values in a temporary memory (note: store separately gas analysis and CO measurements). The data is stored in this temporary memory for a later printout or for a final data storage (you can view the values in the intermediate memory by pressing <F4>).

Measurement is stored in temporary memory

O ₂	4.0	%	m
CO ₂	12.5	%	
CO	30	ppm	
NO	45	ppm	
T.Gas	166	°C	
T.Air	20	°C	
Losses	7.0	%	
Eta	93.0	%	

5.3. CO measurement (Flue gas channel check)

The flue gas channel check, also called CO measurement, is the specific control of gas-fired plants, performed under safety aspects.

The CO content is measured in the flue gas channel after the gas has been enriched with surrounding air and is converted in an undiluted value (residual oxygen content in combustion gas = 0%). As the gas behaviour after air addition is no longer homogenous due to secondary air, and the main stream core determination can be erratic, this gas analysis is performed across the whole diameter of the exhaust pipe.

A multi-hole probe (optional accessory) is the ideal sampling tool hereto. The calculated CO value shown by “**CO 0.0%**” corresponds to the measured CO content, supposing that in the same gas volume the O₂ content is 0%. This is consequently the undiluted CO content in the flue gas. Once the measured value is stable, press **<Store>** in order to transfer the value in temporary storage.

Measurement is stored
in temporary
storage

CO-measur.		m
O ₂		17.5 %
CO	0.0%	738 ppm
CO		123 ppm
Excess air		7.00
BlmSchV: keys ↑↓!		

5.4. Draft / Pressure measurement

Besides the draught respectively differential pressure measurement performed by the internal draught sensor, the **ecom-EN** offers a connection possibility for an external pressure sensor (0 - 100 mbar or 0 -500 mbar) for the determination of pressure conditions in the surrounding field of combustion places (e.g. gas nozzle pressure).

5.4.1. Draft measurement

The gas measurement mode already provide with a trend indication of the draught value. As the differential pressure sensor is very sensitive and tends to drift, the value will not be recorded by pressing **<Store>**. It is consequently advisable to recalibrate this sensor prior to the practical measurement and results printing. Enter the measurement mode by selecting „Draft/Pressure“.

Select the internal pressure sensor (use arrow keys and then **<Enter>**).

Draft/Pressure	
Internal	0..20.00 hPa
External	0..100.0 hPa
External	0..500.0 hPa

The current value is displayed as well as the advice to zero the sensor. Remove the draft hose from the instrument and press **<Enter>**. The sensor is then reset to zero.

Set zero point	
Draft	0.12 hPa
Stored value:	
Draft	-- hPa

Reconnect the draught hose. The exact value is then displayed. Press **<Store>** to store it together with the gas mesurement results in the temporary memory.

Set zero point	
Draft	0.12 hPa
Stored value:	
Draft	0.12 hPa

Press **<ESC>** to escape the pressure measurement.

5.4.2. Pressure measurement with external sensor

Connect the external pressure sensor to the instrument where labeled (Aux). Initialise the pressure measurement by selecting „Draft/Pressure“. Select external sensor (Cursor to; <Enter>) and re-zero (<F1>). Place the sensor at the measurement point. Once the measurement value is stable, it can be stored in the temporary memory for later printout.

Draft/Pressure	
Internal	0..20.00 hPa
External	0..100.0 hPa
External	0..500.0 hPa

5.5. Soot / Oil derivative

The measured values for boiler temperature, soot number and oil trace can be entered in the sub-menu „Soot/Oil deriv.“. Select the appropriate line on the display and press <Enter>. The input for boiler temperature, soot number 1 - 3 can be keyed in respectively. After pressing <Enter> the data is recorded. The result of the oil trace check is to be documented as follows:

- place cursor on line „Oil deriv.“
- press <Enter> to register („No“; „Yes“ or „---“)

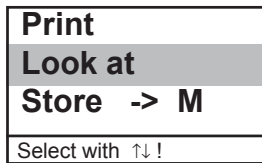
Soot/Oil deriv.	
T.Boiler	--- °C
1. Soot-meas.	---
2. Soot meas.	---
3. Soot-meas.	---
Oil trace	---

Press <ESC> to quit this menu when all required inputs have been made. The measurement is now complete.

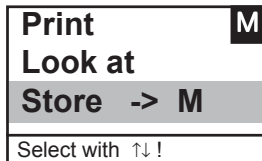
5.6. Store/Print measurements

Important: The values stored in the temporary memory must be transferred in the internal memory of the instrument, otherwise they will be lost when the instrument turns off !

Press key **<Print>** (printer symbol) to access the print menu. The values can be checked one more time („**Look at**“; **<Enter>** and scroll with cursor).



Select „**Store -> M**“ and press **<Enter>** to store into the internal memory. Once the data is successfully stored, then a „**M**“ appears in the right hand corner of the display and the data can now be printed („**Print**“ and **<Enter>**).



Press **<ESC>** to escape to main menu.

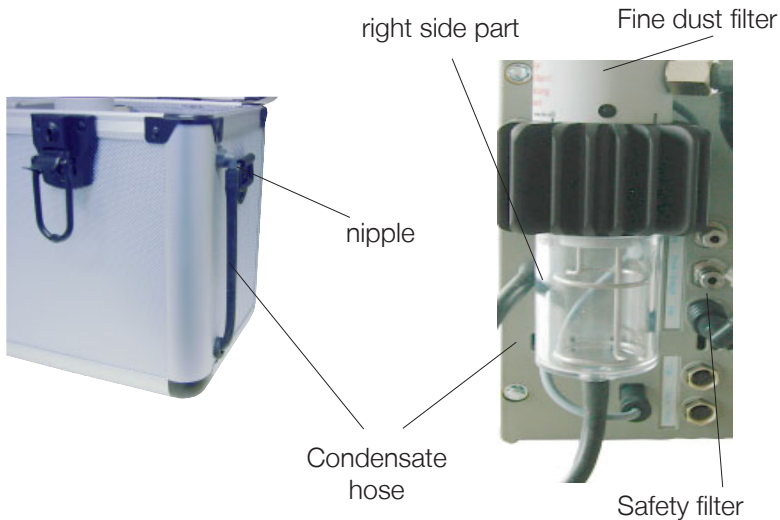
5.7. After measurement



Make sure that condensate never enters the instrument (otherwise sensors will get defective)!

Empty condensate trap:

The condensate collects the humidity of the sampled gas. Check regularly how much liquid has been gathered. Empty the trap in time and avoid humidity to enter the instrument. Remove condensate hose from nipple and let the condensate out. **Note:** The condensate hose must be attached to the nipple during the measurement!



Change fine dust filter / safety filter:

Screw off the cover. Release the filter and check the soiling state of the filter. Change it once it has a grey colour in the gas flow area (ca. number 3 on soot comparison scale). The safety filter should also be replaced when the soiling degree corresponds to number 3 of said comparison scale.

6. Adjustments

In addition to the functions already described, various adjustments can be performed in this instrument. From the main menu, select „Adjustments“ and confirm by pressing <Enter>. You will find a selection of other parameters which can be adjusted for each application. Place the cursor on the requested line and press <Enter> to call up or change the adjustment.

Unit	
O2-reference	
Air pressure	
Set clock	
Fuel type	
Internal	
Paper feed	
GSK	ON/OFF

Explanations:

Unit (change with <F1> - <F3>):

- Calculation of gas concentration in:

- ppm = volume concentration (parts per million)
- mg/m³ = mass concentration unit
- mg/kWh = mass concentration unit

ppm	mg/m ³
	mg/kWh
undiluted	
CO	9999ppm

Undiluted (change with <F4>):

- Conversion of gas concentration for a given content of reference O2
- Formula for conversion:

$$E_{ref} = E_{meas} * \frac{21 - O_{2ref}}{21 - O_{2meas}}$$

Reference O2 (press <Enter> then input):

- Input reference O2 (O_{2ref})

Air pressure (press <Enter> then input):

- Input barometric pressure for calculation of dew point

Set clock (press <Enter> then input):

- Correct inner clock by overwriting new numbers

Fuel type (press **<Enter>** and then select):

-Change the type of fuel (e.g. by measurements at combi plants)

Paper feed (press **<Enter>**):

-paper feed line by line

Internal (access menu with **<Enter>**):

-further instrument's adjustments

Keyboard beep
Printer contrast
Baud rate
Handshake

Keyboard beep (press **<F1>** for Yes / **<F4>** for No):

-Acoustic signal when keyboard is pressed

Printer contrast (0..9) (press **<Enter>** then select):

-Set printer contrast

Baud rate (adjustment with **Cursor keys**):

-Data transfer speed via RS 232 (1200 -19200 Baud)

Handshake (key **<F1>** for Yes / **<F4>** for No):

-Adjustment of data transfer option

7. Control

The electrochemical sensors used for the gas analysis are submitted to a wearing process and consequently do age. Along the operation period, they alter their output values depending on the gas concentration, flow duration and soiling degree of the measured gases. The programme controls the sensors and corrects drifts. If drifts and the correlated measurement errors increase, an error message is displayed. In this case the corresponding sensor must be changed by an authorised service centre.

The control menu informs about the current status values for the sensors and on 2 further pages (scroll display page via cursor key) about:

- the accu voltage (charging state);
also in other menus as symbol:

Accu full Accu 1/2 full Accu empty



- the phone number of the next service centre
- the serial number
- the software version
- the operation hours
- the date of the last service
- the number of CO switch offs
- the number of errors occurred

O2	1034 mV
CO	-10 mV
NO	5 mV
Accu	6.42 Volt
SV.Tel. 02371/945-5	
Ser.nr.EN 2750 V2.8	
Further info with ↑↓	

Oper. hours	7.39
Service date	23.06.04
CO switch offs	0
Error counter	00
SV.Tel. 02371/945-5	
Ser.nr. EN 2750 V2.8	
Further info with ↑↓	

8. Data processing

The menu „Data processing“ offers the following functions:

Select:

Identify or create a combustion plant's data file for allocation of measurement data (see § 4).

Look at:

Look at recorded values of the selected combustion plant (see § 4).

Select
Look at
Load data
Transfer data
Format memory

Load data:

Import data from PC programmes (pay attention to the transfer options of your software and adjust them, if need be, on the instrument, see § 6).

Proceed as follows:

1. Connect **ecom EN** and PC via a current RS 232 cable.
2. Select „**Load data**“ and confirm with <Enter>.
3. Answer safety question with Yes.
4. Decide whether stored values should be erased (<F1> for Yes, <F4> for No).
5. Start data transfer at your PC.

Send data:

Transfer data records containing measurement values to the PC programme (proceed like described under „**Load data**“).

Format memory:

This function is usually needed only at our factory to initialise the instrument (preparing the internal memory for data receipt).

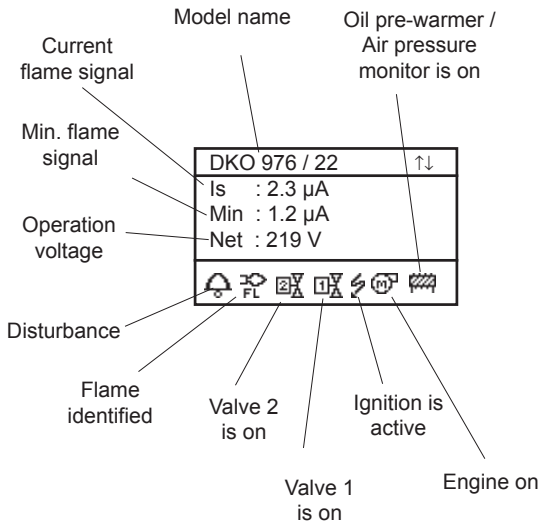
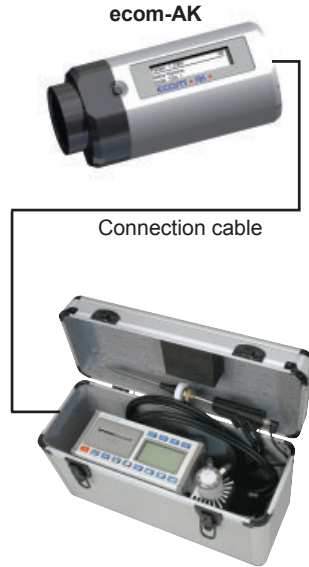
Caution: all stored data are erased !

9. Diagnostics

9.1. Trouble diagnostic

The ecom-EN is able to receive and to process information sent via cable by the ecom-AK (read-out head for digital firing automats).

In the main menu select the sub-menu **"Fault diagnosis"** and confirm with **<OK>**. The ecom-EN tries to get into contact with the ecom-AK (message: „Searching“) Once the connection is realized, the current operation stand of the burner is shown graphically on the display.



Use the <Up/Dn> keys to call up further data of the firing automat.
 The next display pages lists information about the disturbance history (type and volume of information depending on firing automat).

Current error	Last 2 errors (Satronic) Last 5 errors (Siemens)								
<table border="1"> <tr><td>Current error</td></tr> <tr><td>No error</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Current error	No error	Further info with ↑↓	<table border="1"> <tr><td>Error history 1</td></tr> <tr><td>Extraneous light during vent. time !</td></tr> <tr><td>2.2µA 220V 12sek</td></tr> <tr><td>Start-ups 005</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Error history 1	Extraneous light during vent. time !	2.2µA 220V 12sek	Start-ups 005	Further info with ↑↓
Current error									
No error									
Further info with ↑↓									
Error history 1									
Extraneous light during vent. time !									
2.2µA 220V 12sek									
Start-ups 005									
Further info with ↑↓									
	<table border="1"> <tr><td>Error history 2</td></tr> <tr><td>No flame</td></tr> <tr><td>END of TSA !</td></tr> <tr><td>0.0µA 222V 22sek</td></tr> <tr><td>Start-ups 001</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Error history 2	No flame	END of TSA !	0.0µA 222V 22sek	Start-ups 001	Further info with ↑↓		
Error history 2									
No flame									
END of TSA !									
0.0µA 222V 22sek									
Start-ups 001									
Further info with ↑↓									

Error statistics (errors number)																			
<table border="1"> <tr><td>Number errors :</td><td></td></tr> <tr><td>Total</td><td>11</td></tr> <tr><td>Straylight</td><td>1</td></tr> <tr><td>Safty time</td><td>4</td></tr> <tr><td>Loss of flame</td><td>6</td></tr> <tr><td>FT/LW</td><td>0</td></tr> </table>	Number errors :		Total	11	Straylight	1	Safty time	4	Loss of flame	6	FT/LW	0	<table border="1"> <tr><td>Statistik</td></tr> <tr><td>Start-ups</td><td>928</td></tr> <tr><td>SV cnt cur.</td><td>017</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Statistik	Start-ups	928	SV cnt cur.	017	Further info with ↑↓
Number errors :																			
Total	11																		
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FT/LW	0																		
Statistik																			
Start-ups	928																		
SV cnt cur.	017																		
Further info with ↑↓																			

Number of burner starts at a total resp. since reset of firing automat

The next display pages lists information about the monitoring times (type and volume of information depending on firing automat).

<table border="1"> <tr><td>Timing values</td></tr> <tr><td>Safty time TSA</td></tr> <tr><td>4.9sec</td></tr> <tr><td>Delay time BV2</td></tr> <tr><td>40.0sec</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Timing values	Safty time TSA	4.9sec	Delay time BV2	40.0sec	Further info with ↑↓	<table border="1"> <tr><td>Pre-ignition time</td></tr> <tr><td>17.0sec</td></tr> <tr><td>Post-ignition time</td></tr> <tr><td>20.0sec</td></tr> <tr><td>Delay strayl. superv.</td></tr> <tr><td>11.5sec</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Pre-ignition time	17.0sec	Post-ignition time	20.0sec	Delay strayl. superv.	11.5sec	Further info with ↑↓	<table border="1"> <tr><td>Straylight supervis.</td></tr> <tr><td>5.0sec</td></tr> <tr><td>Further info with ↑↓</td></tr> </table>	Straylight supervis.	5.0sec	Further info with ↑↓
Timing values																		
Safty time TSA																		
4.9sec																		
Delay time BV2																		
40.0sec																		
Further info with ↑↓																		
Pre-ignition time																		
17.0sec																		
Post-ignition time																		
20.0sec																		
Delay strayl. superv.																		
11.5sec																		
Further info with ↑↓																		
Straylight supervis.																		
5.0sec																		
Further info with ↑↓																		

Monitoring times of firing automat

9.2. delta-T measurement

With the ecom-EN a difference temperature measurement is easy to make. For the measurement at hoses (e.g. in and out of heating systems) special temperature sensors are needed. The sensors can be ordered from your responsible rbr distributor. Select from the point of main menue "**Diagnostics**" the submenu "**delta-T measurement**" and confirm with **<Enter>**. The instrument shows the temperature T1 (sensor at connection „gas temperature“), the temperature T2 (sensor at connection „air temperature“) and the difference of both temperatures (T1 - T2). With the key **<store>** the result of the measurement can be stored and the data can be printed (key **<Print>**).

delta-T measurement	
T1	70.4 °C
T2	56.3 °C
dT(m)	14.1 °C
--- °C	

delta-T measurement	
T1	70.4 °C
T2	56.3 °C
dT(m)	14.1 °C
14.1 °C	

Measurement is stored in temporary memory

10. Maintenance tips

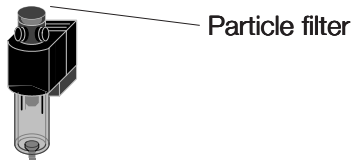
Your instrument should be serviced by an authorised service center once a year, respectively after 250 operating hours at a maximum, in order to check the sensors and clean the internal tubing.

Do not use sensors/parts which are not provided by our factory, and be aware that service done by unauthorised service centers, will cancel any warranty.

The following tips for the daily care of accessible parts and components should be helpful:

Dust filter on top of the water trap

Unscrew the top cap of the water trap and check the condition of the particle filter. When the filter becomes grey, it should be changed (soot number approx. 2-3).



Sensors

Each time the instrument is turned on, the sensors are calibrated with fresh air. The instrument permanently monitors the condition of the sensors. New sensors wear out from use in time due to reagent (O₂ sensor) and due to soiled gases respectively gases in concentrations beyond the nominal range (toxic sensors). The output values of the sensor are (menu „Control“):

O ₂	approx. 1000 mV
CO	0 mV (+/- 70)
NO	0 mV (+/- 30)

If an error message is displayed during calibration and does not disappear after repeated calibrations, then the instrument should be sent to a service center. The O₂ sensor should show > 200 mV, otherwise it should be changed.

The internal program applies a limit value for each sensor. By exceeding, a magnetic switch flows fresh air to the sensor (respectively to all sensors). The CO sensor limit is set at 4000 ppm and corresponds for other toxic sensors (if available in the instrument) to their respective measurement range end value.

Mains Power

The battery makes mains power independent operation possible. The battery is automatically charged when the instrument is connected to mains power. It should be expressly re-charged when the voltage displayed (menu „**Control**“) is lower than 5.8 V. The instrument will indeed stop working by 5.5 V.

Sampling probe and hose

Depending on the frequency of use, Probe and hose must be cleaned regularly, thus in order to prevent particles from lodging and early wear due to corrosion.

The hose can be released from the probe and instrument and cleaned (use warm water and then blow out to dry).

Replace paper roll

Press slightly on the paper roll drawer to release the lock. Pull out the paper drawer and eject -if need be- residual paper from the printer („**Adjustments**“, „**Paper feed**“ and then **<Enter>**).

Extract the paper shaft and put a new printer roll on the shaft. Re-position the printer shaft in the fixation. Insert the paper roll end through the slot. Press „**Adjustments**“, „**Paper feed**“ and then **<Enter>** to pull out approx. 10 cm paper. Push the drawer back in the compartment. Push carefully the paper drawer until it locks.

11. Technical data

Parameter	Range	Measurement principle
O ₂	0 ... 21 % vol	electrochemical
CO	0 ... 4000 ppm	electrochemical
CO% (Option)	0 ... 63000 ppm	electrochemical
NO (Option)	0 ... 5000 ppm	electrochemical
CO ₂	0 ... CO _{2max}	calculated
T-G	0 ... 500 °C	NiCr/Ni
T-A	0 ... 99 °C	semiconductor
Pressure	0 ... +/- 20 hPa	DMS-bridge
Efficiency	0 ... 120 %	calculated
Losses	0 ... 99,9 %	calculated
Lambda	1 ... ∞	calculated
CO-undiluted	(ref. O ₂ adjustable)	calculated
Dew point of combustion gas		calculated

Power supply	230 V / 50~; battery 6 V / 3,2 Ah
Printer	Integrated; 58mm paper width
Display	Graphic display; backlight
Size	190 mm x 160 mm x 75 mm
Weight	approx. 3500g complete with sampling system

Subject to technical changes
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