

DESCRIPTION

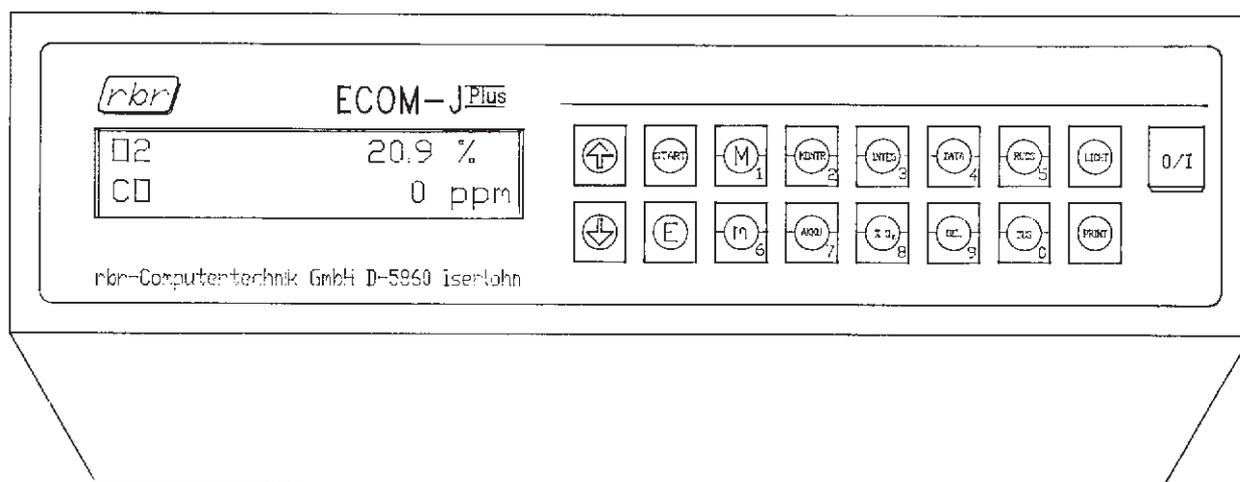
AND

OPERATING INSTRUCTIONS

FOR

THE COMBUSTION

GAS ANALYSIS COMPUTER



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1.0. PREFACE

To our Customer,

Congratulations on your decision to purchase this valuable rbr product. The ECOM-JPlus, like all rbr products, was produced by applying the most modern technical know-how in the fields of microprocessor technology and electrochemical sensor technology.

The ECOM-JPlus can quickly and easily measure the harmful substances found in the exhaust gas of furnaces.

According to your growing needs, the ECOM-JPlus' standard version can be equipped at any later time with the several offered options and guarantees you herewith a constantly up-to-date instrument.

On the following pages you will learn not only how the combustion gas analysis computer ECOM-JPlus operates, but also how you can use its versatility in the most effective way to suit your needs.

We wish for you much success in the use of rbr's combustion gas analysis computer ECOM-JPlus.

rbr Computertechnik GmbH proudly presents ...

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2.0. IMPORTANT ADVICES

The instrument is equipped with electrochemical cells that would be damaged by contact with condensate. As a consequence, please care for a regular evacuation of the condensate sampled in the water catchpot, if need be, during the measurement and, in any case, after the measurement. Damages due to condensate are not covered by the guarantee.

After having emptied the condensation trap, purify the unit during approximately 3 minutes with fresh air.

Hereby control the O₂ and CO concentrations indicated on the display. Consider the purification as successful when the O₂ concentration is approx. 20,7 % and the CO concentration less than 5 ppm.

If your instrument is equipped with the NO measurement module, a regular check of the battery voltage is of prior importance since the cell requires a constant bias voltage (also when the instrument is switched off) for a correct measurement value determination. In the control mode, check the voltage of the analyser's and sensor's batteries. The NO batteries must show an absolute value > 1300 mV and one should not differentiate from the other (otherwise disturbed function of one of the battery).

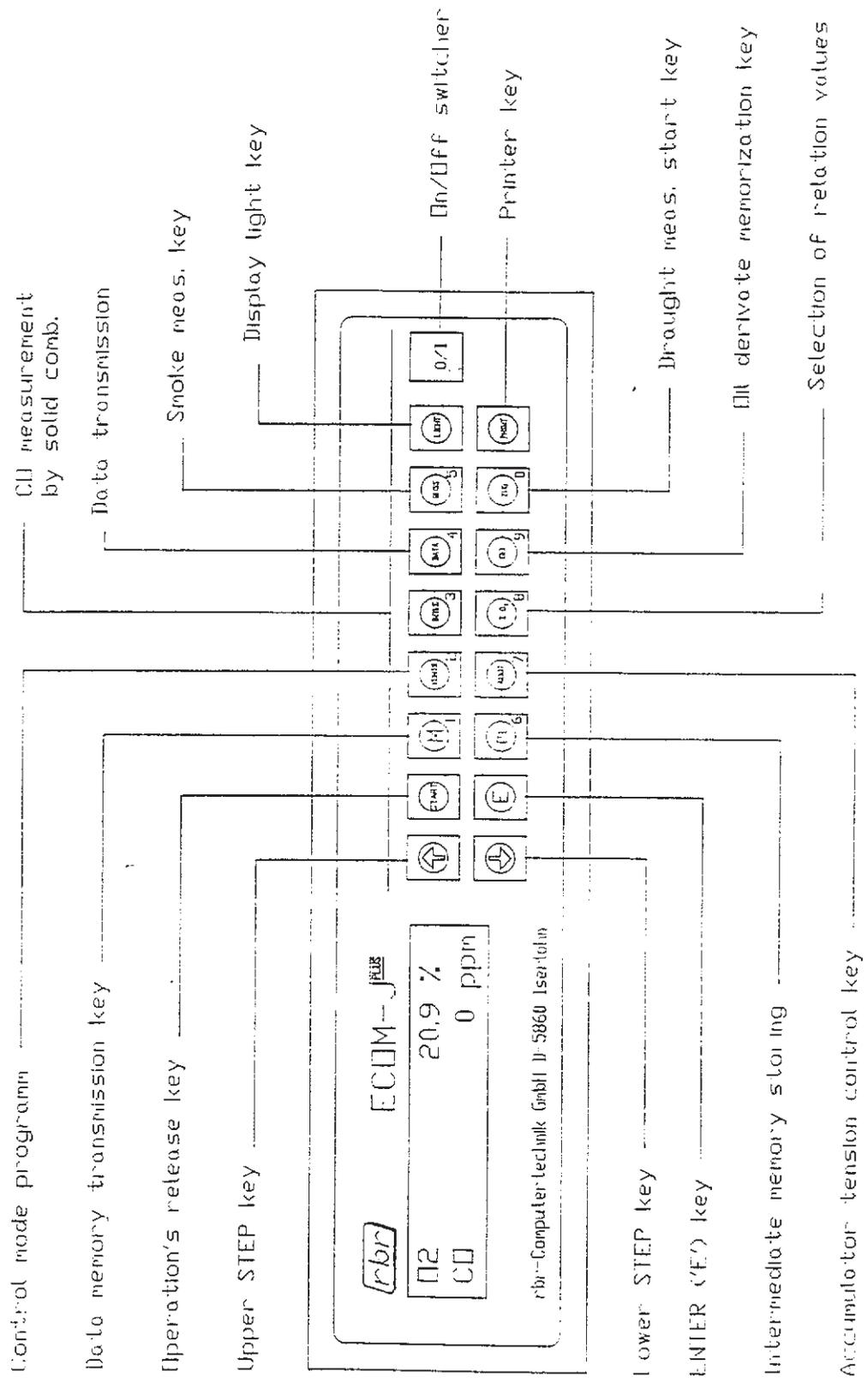
Re-load regularly the batteries while simply plugging the instrument to mains power without switching it on (see 14.0).

Further a regular observation of the condition of the filters is important. As soon as the white filtering wool of the gas filter becomes grey and the SO₂/Nox filter red granulate white, the replacement of them will be indispensable.

These advices will ease your work with the instrument and guarantee for a longer life span of the sensors.

For an easier and a purposeful utilisation of this manual, you will find the important indications characterized as follows :

Adjust draught measurement	: display indication for operation
"START"	: key to be pressed to operate function



3.0. MEASURED AND CALCULATED QUANTITIES

The ECOM-JPlus is a portable, light-weight combustion gas analysis computer that not only monitors exhaust gas values, but also determines the efficiency of the furnace. The ECOM-JPlus measures the :

**room temperature,
exhaust gas temperature,
residual oxygen in exhaust gas,
carbon monoxide content in exhaust gas,
nitrogen oxide content in exhaust gas, *
and the draught in the chimney.**

It is also possible to perform a smoke test with this unit. In addition, the following values are calculated (based on the above mentioned measurements) :

**carbon dioxide content of exhaust gas,
efficiency (Eta),
losses,
excess air (Lambda).**

In a separate operation mode, the ECOM-JPlus indicates the following :

**the absolute potential of the O2 sensor,
the relative potential of the CO sensor,
the relative potential of the NO sensor,(*)
the relative potential of the draught sensor,
the battery potential,
the NO accumulators voltage,(*)
the CO2max value resulting from the adjusted
fuel type or rather, the previously selected
CO2max value,
the parameters resulting from the fuel type,
the phone number of the next service office.**

The standard unit can be optionally equipped with :

**an integral printer and data processing unit,
a NO module.**

* by units equipped with NO measurement module

4.0. MEASURING PRINCIPLES

In the new ECOM-JPlus, all the measurement values are no more absolutely measured but as relative figures which will be calculated by consideration of the pre-programmed calibration values (in the EEprom).

This kind of memorization of the measurement values has the great advantage that the unit can be very easily calibrated and this without intervention in the Hardware. By the calibration, the unit's software will be adjusted to the concentration of the calibration gas (span gas bottle) or other calibration values. The unit records these concentration values together with the programmed values. By the later measurement, these fixed values as well as the zero point values recorded after the calibration, are essential for the calculation of the real measurement values.

4.1. Gas temperature measurement

The exhaust gas temperature is measured by a temperature compensating NiCrNi thermocouple. The temperature measurement range is 0-600°C. The signal is linearized in the unit. This guarantees for an indication accuracy of +/- 1°C. The temperature compensator of the NiCrNi sensor is situated directly at the thermocouple's junction thermocouple/copper. The temperature at this point is measured by a separate temperature sensor and taken into account, in the program, for the temperature measurement.

4.2. Room temperature measurement

The room temperature is measured from a separate temperature sensor with an approximately 3 m long line. This sensor is encapsulated in a small metal capsule which is equipped with a magnet for the fastening of the sensor on the boiler.

The processing of the measurement signal happens in the program "Room temperature measurement".

Both signals -T_{Gas} and T_{Room}- are measured relatively from the unit and calculated absolutely with the correction values of the EEprom. Because of this fact -similar by all measurements- the user can make at any time a very precise re-calibration.

4.3. Draught measurement

The draught is measured by a differential pressure sensor which is not temperature compensated. This measurement should be considered as short time measurement (5 minutes). By continuous measurement, the zero point of the sensor would shift under the influence of the temperature. A re-calibration of the zero point happens by pressing on the key "ZUG".

4.4. Soot dot measurement

During the soot measurement the electronically regulated sampling pump sucks the required 1,63 liter within 40 seconds approximately.

A volume measurement unit monitors the sucked flue gas volume. Should there be any discrepancy in the sucking capacity of the pump (too high or too low) during the soot measurement, the unit will report it as error.

Soot probe:

In order to avoid the formation of condensate on the soot filter during the measurement, the soot probe is heated by a PTC resistor to approximately 80°C.

4.5 Oxygen measurement

The analysis of the oxygen concentration is effectuated by an electrochemical cell (combustible cell). After the calibration (to fresh air), the current sensor's tension of the O₂ cell will be recorded and memorized from the unit. By the later measurement of the O₂ content in exhaust gas, this tension will be adjusted to 20,9 % O₂.

The signal of the O₂ sensor is not linear. This non-linearity will also be corrected in the programm through a mathematical operation.

A re-calibration of the O₂ sensor is then superfluous regarding of the above mentioned measurement principle.

The life span of the sensor is according our experience, approx. 1-2 years. A new cell has a tension of approx. 2000 mV by 20,9 % O₂, a weared out one of approx. 780 mV by 20,9 % O₂.

The minimal tension is continuously checked in the self-checking programm of the unit and if need be, reported as error.

4.6. Carbon monoxide measurement

The carbon monoxide measurement is also performed by a temperature compensated, electrochemical cell without H₂ cross-sensitivity thanks a switching circuit installed on the sensor (4 electrodes sensor). The output signal of the sensor is recorded from the unit and divided thanks a Matrix calculation in net values for CO and for H₂. On the display of the ECOM-JPlus, only the CO content will appear. Further, the temperature of the cell is separately measured and used for the temperature compensation calculation.

An alignment of this sensor (conc. the cross-sensitivity and the temperature) can happen only in our factory, since a special climatic cabinet as well as a special software are required for this procedure. Nevertheless the absolute calibration of the CO value can be made by an external service office.

4.7. Nitrogen oxide measurement

Is also performed by an electrochemical cell (3 electrodes sensor). The sensor's signal is also here compensated through the measured sensor temperature.

Additionally the sensor is equipped with a proper power supply board (accumulators) required to avoid any sensor drift.

Sensor's alignment

After the calibration phase, the natural zero point of the above mentioned electrochemical sensors will be defined from the unit and memorized. By the later measurement, this value will be called on for the correction of the measurement's signal.

The sensors have a linear signal. A further mathematical processing of the linear signal is herewith superfluous.

5.0. POWER SUPPLY

The following possibilities of power supply enable a large field of application of the ECOM-JPlus and, for the user, a liberty as great as possible by measurements on the spot.

5.1. Accumulator power supply

The ECOM-JPlus is standardly equipped with a 12V/1,2 Ah accumulator with a deep discharge's protection. The capacity of this accumulator is sufficient for a continuous measurement of 3 hours at a maximum.

The use of the heatable probe is here impossible (only by mains power supply !).

By a battery voltage of ca. 10,8 V the red LED blinks, by ca. 10,5 V the unit automatically switches off.

By connection of the unit to 220V mains power supply, the accumulator will automatically be loaded, no matter if the unit is switched on or not. An overcharging of the accumulator is also prevented. The loading of a fully empty accumulator lasts approx. 14 hours (at best during one night, when current supply is not so expensive !).

5.2. Mains power supply

By longer measurements and in labors, the ECOM-JPlus should be connected directly through the connection hose to 220 V mains power supply and operated. This is in general valid also for short time measurements, because by mains power supply, the accumulator will in any case reach a longer life span.

6.0. SAMPLING

The ECOM-JPlus is standardly equipped with a heated coaxial gas sampling probe and a support cone. The latest enables a free adjustment of the sampling probe in the stack's channel with borehole dimensions of 11 till 16 mm. The thermocouple at the top of the sampling probe is made for the measurement of the exhaust temperature (gross temperature).“

Reliable and reflective values can only be determined with help of a defined measurement point in the exhaust's stream. The most common method is the definition of the gas stream's core in the exhaust. After having loosened a little bit the screw of the support cone, the sampling probe will be inserted slowly through the exhaust channel and simultaneously, the exhaust temperature indicated on the display of the ECOM-JPlus will be observed. The sampling point has been determined when the highest exhaust temperature value has also been found out. After adjustment of the sampling probe (screw on the support cone), the user can start all measurements : gas measurement, smoke measurement and draught measurement in the desired order. The energetic measurement should be started at first.

7.0. MEASUREMENT IN GENERAL

During the measurement, the sampling probe must be inserted in the exhaust stack. The room temperature sensor should be fastened near the sucking opening of burner. The unit measures then all the following parameters quite simultaneously :

- . room temperature
- . exhaust gas temperature
- . oxygen content in exhaust gas
- . carbon monoxide (in ppm)
- . carbon monoxide (in mg/m³)
- . nitrogen oxide (in ppm)
- . nitrogen oxide (in mg/m³)

Simultaneously the following values will be calculated :

- . theoretical CO₂ content
- . CO content related to 0% rest oxygen
- . NO content related to 0% rest oxygen
- . efficiency (Eta)
- . exhaust losses
- . excess air (Lambda)

The display (range and memorization) of the CO and NO_x values in mg or ppm will be selected with the key "0% 02" as described below.

7.1. Selection of relation values

Herewith the user has not only the possibility to change the reading of the CO and NO concentrations from ppm in mg (conversion), but also to find out which would be the real CO and NO concentration in the theoretical case that no oxygen supply would happen by the combustion (0% rest O₂).

Corresponding regulations based on calculations foresee that the rest oxygen should be 3% by oil and gas and 7% by solid combustibles. Nevertheless, this percentage is free programmable for the user.

In the normal measurement mode it is possible -without interrupting the measurement- to modify the display of the CO and NO_x values.

After having pressed on "0% 02" appears on the display :

<ppm>	mg
0%-ppm	0%-mg

The required range can now be chosen by pressing one of the "**STEP**" keys until the desired range is marked with the two arrows. By indication 0%-ppm or 0%-mg, the corresponding rest oxygen will be programmed thanks to the numerical keyboard. Consign with "**E**". By the output of measurement values higher than 10000 ppm under consideration of the 0% oxygen rest, only lines will be displayed at the corresponding place.

The indication would not be valid since the oxygen rest in the exhaust would be still too high.

7.2. Corrections in the data memory

The ECOM-JPlus recording system includes two different memories.

- The first one called "**intermediate memory**" is used :

. by instruments without data management set : for the simple "freezing" of the data. Since this instrument's version do not include a printer (and an interface), the user will then have the possibility to read and to note the values (manual recording of the values),

. by instruments equipped with the data management set, like the name already says : for the intermediate recording of all values. At this stage, all values can always be corrected separately in case of error, before being transmitted to the data memory.

- The second one called "**data memory**", included only by models equipped with the data management set is used for the definitive memorizing of the values that will be directly transmitted to the PC.

As you will see, the possibility of correction at this stage also exists !

Should during a measurement the situation happen, that wrong data have been memorized in the data memory through pressing the key "**M**", this is no tragedy !

By pressing the key "**KONTR**" in the control mode, the data can be copied back from the data memory in the intermediate memory. After having called the data to be modified on the display, press "**m**" the values will be cancelled ("m" disappears).

Now the user has the possibility to record new measurements in the intermediate memory by pressing "**m**" and, further, pressing "**M**" in the data mamory. You will find exact explanations of the control mode on the following pages.

The built in LC-display is lightened. With help of the key "**LICHT**", the light can be indefinitely switched on and off.

Within the normal measurement mode (energetic measurement), the tension of the accumulator can always be checked through pressing the key "**ACCU**". By pressing the same key again, the user returns in the measurement mode.

8.0. MEASUREMENT WITHOUT MEMORY

After having switched on the unit, the following indication appears on the display :

Gas measurement <E> Special keys <DATA>
--

8.1. Energetic measurement

After having pressed "E" (Enter), the programm starts the normal gas measurement. The unit will now check if :

- . **the condensation trap is well adjusted,**
- . **the CO switcher is well switched on,**
- . **the TRoom sensor is well connected,**
- . **the TGas sensor is well connected.**

As long as one of the corresponding instructions is displayed, the sucking pump remains off. First after all above mentioned operations have been made, the pump starts again and the unit enters the calibration phase.

After the calibration phase (3 minutes), it appears on the display :

Data management ? Yes <E> No <Start>

The unit is now waiting for the decision of the user if he wants to work with or without data management. The owner of a model without data management set will automatically choose No ("START"). It appears then on the display :

Boiler temp. - < °C

“With help of the numerical keyboard, the user can dial the boiler temperature indicated on the machine (0-999°C). By error, the correction will be effectuated by dialing 0 and then the correct temperature : the wrong number will be automatically superscribed.
Press on "E" to store the boiler temperature (intermediate memory).

Further appears on the display :

Fuel type : Light fuel oil

With help of the step keys, the burnt combustible type can be called on the display and will be confirmed by pressing "E". The real measurement begins :

02	20,9%
CO	0 ppm

With the step keys all measured and calculated values can be called on the display one after another. With the upper one the values in the upper part of the display will be turned over and with the lower one the ones of the lower part.

Two same channels can't be displayed simultaneously.

When the measured values look like stable, the whole energetic measurement will be stored in the intermediate memory by pressing "m". On the lower right part of the display appears "m". From now on, these values are "frozen" and the measurement is finished. By pressing "m" again, the user will cancel the indication and herewith the stored values and can continue the measurement.

8.2. Draught measurement

Press "ZUG" to enter the draught measurement mode. On the display appears :

Press <START> !

The pump switches off. The sensor is calibrating to 0.00 hPa. Press "START", the measured draught appears on the display :

Draught 0,00 hPa

After the indication gets stable, the value should be stored in the intermediate memory with "m". By pressing "E", the pump runs on again and the user returns to the normal measurement mode back.

8.3. Soot dot measurement

Background :

The new BimSchV (= BundesimmissionsSchutzVerordnung : the German regulation concerning control and monitoring of small combustion plants) prescribes 3 consecutive smoke measurements as well as -by oil burners- a test on eventual oil derivate (oil trace on soot filter paper).

Despite its "national look", this prescription should be of interest and of concern all over the world because :

- . **the 3 measurements enable the calculation of a mid-value and herewith a very reliable statement on the soot content,**
- . **the oil derivate test enables to recognize if the burner is well adjusted or not.**

Press on "**RUB**", the pump switches off and it appears on the display :

**Soot measurement:
Insert smoke filter**

After having pressed "**START**", the pump runs on again and sucks exactly 1,63 l flue gas within approx. 50 seconds through the soot filter paper (the sucked volume will be exactly measured and integrated within the soot measurement).

During the soot measurement, it appears on the display, for instance :

**1. soot measurement :
Rest volume 0,82 l**

As soon as the required exhaust volume is sucked, the pump switches off again and it appears on the display :

**1. soot measurement :
Soot dot: 0**

Thanks to the numerical keyboard, the user can dial the number he read after having compared the soot dot with the soot comparison scale, or when available with our ECOM-D.

After having pressed "**START**" again, the second soot measurement will be started (same procedure as above described), as well as the third one.

After the 3 soot measurements have been conducted and having pressed once again "**START**", it appears on the display :

**Oil trace :
Yes/No**

With "**OEL**", the user will choose between Yes and No : press "**OEL**" one time for yes, twice for no.

This measurement can also be stored in the intermediate memory by pressing "**m**" (on the lower right part of the display appears "**m**").

By pressing "**E**" one returns in the normal measurement mode.

Nota : the soot measurement procedure can already be interrupted after the first or the second measurement : when the soot number is questioned in the display, press "**E**" and you return in the normal measurement mode.

8.4. Correction of the soot dot measurement

By memorization of erratic soot values in the intermediate memory, begin a new soot measurement by pressing "**RUB**". It appears again on the display :

<p style="text-align: center;">Soot measurement : Insert filter "m"</p>
--

The recorded results can then be called on the display with help of the step keys. Press "**m**" ("**m**" will disappear) and the soot measurement that appears on the display can be performed again once you have pressed on "**START**". Press "m" again and the corrected value will be memorized in the intermediate memory. As above described, press "**E**" to return in the normal measurement.

8.5. Conclusion of the measurement without memory

By pressing "**PRINT**", all in the intermediate memory with "**m**" recorded values will be printed on the measurement certificate (printer paper) and the measurement without memory is finished.

10.0. DATA PROCESSING

IMPORTANT : before reading the following pages, please note that we do not offer a software programm monitoring the later management of the stored data.

In his country, our customer will without any problem find firms offering software programms for all purposes.

Generalities:

The ECOM-JPlus enables the recording of up to 250 data blocks. Every data block is 64 Byte long. 40 Byte (2 display lines) are at the disposal of the user for the recording of, for instance, customer's name, customer's number, etc. to which the measurement values will be later attached to.

The residual 24 Byte are reserved for the memorizing of all measurement values (as above described).

10.1. Data transmission from the ECOM-JPlus to the PC

After the unit has been switched on, the programm asks the user :

Gas measurement ? <E>
Special keys <DATA>

In this mode, press on "**DATA**". The unit should have been first connected to the PC via the RS 232 interface and the connection cable. On the display, it appears now :

Data output ? <E>
Only BImSchV <START>

Should the measured data now be transmitted to the computer, so press on "**E**". The unit transmits now the whole memory inclusive the 250 x 40 Byte for the free programming. The termination of the data transmission is signaled by an acoustical signal and it appears on the display :

Data transmission finished

10.2. Data transmission from the PC to the ECOM-JPlus

After the unit has been switched on, the programm asks :

Gas measurement <E>
Special keys <DATA>

In this mode press "**DATA**" and it appears on the display :

Data output ? <E>
Only BImSchV <START>

By pressing the lower "**STEP**" key, it's now possible to load the unit with data :

Load data ?

At the latest now, the unit should be connected via the RS 232 interface to the computer. Is the computer ready for the transmission, so press on "**E**" and it appears on the display :

**Data transmission
is running !**

Simultaneously, the unit counts the number of the transmitted customers on the lower right part of the display. Has the counter come to a standstill, so the data are transmitted and the user can interrupt the junction PC/unit. Subsequently, the instrument will be brought in its transport position.

10.3. Cancellation of old data

After the unit has been switched on and the programm entered until

Data output <E>
Only BImSchV <START>

press twice the lower "**STEP**" key, it appears on the display :

Cancel old data ?

Press "**E**" and it appears on the display :

Are you sure ?
Yes <E> No <START>

Confirm with "**E**" and the old data will irrevocably be cancelled. The display indication returns to :

Cancel old data ?

Attention : we advise the user to let print by every measurement the recorded data. Indeed, the printer has not only a function as measurement's certificate but also as data protecting system. By eventual operator's error, the data would so not be irrevocably cancelled.

11.0. MEASUREMENT WITH MEMORY AND DATA MANAGEMENT

After the unit has been switched on, it appears on the display :

Gas measurement ? <E>
Special key <DATA>

11.1. Energetic measurement

After having pressed "E" (Enter), the programm enters the normal gas measurement mode. The unit is now checking if :

- . **the condensation trap is well adjusted,**
- . **the TRoom sensor is well connected,**
- . **the TGas sensor is well connected.**

As long as one of the corresponding instructions is displayed, the sucking pump remains off. First after all above mentioned operations have been made, the pump starts again and the unit enters the calibration phase.

After the calibration phase (3 minutes), it appears on the display

Data processing ?
Yes <E> No <DATA>

The unit is now waiting for the decision of the user if he wants to work with or without data management. With "E", the measurement will be conducted with data management. On the display, the number of the next free memory block will appear, for instance :

Memory case
no. 38

Press one time "START" and the corresponding -previously memorized- text will appear, for instance :

Martin Smith
London Rd 142

Press twice "START" and the corresponding -previously transmitted- 16-digit customer's number will appear, for instance :

16-digit number :
1234567891234578

This number will appear later on the printed paper. The user can freely choose to programm a name or a real estate instead of a customer number.

USEFUL TO KNOW : by measurements by a customer whose data (name, address, etc.) have not been programmed before, the user can also dial via the numerical keyboard a 16-digit number under which the values will be memorized and herewith will have the possibility to find and to sort out the memorized measurements results afterwards. Of course the programming of name, address is impossible since, as said, the unit's keyboard is only numerical.

With help of **"START"**, the user can always choose to memorize under one of these 3 criteria (memory block, name/address or customer's number).

After the criterion has been chosen, press **"E"** and the programm will now ask :

Boiler temp. °C

With help of the numerical keyboard (1-0), the temperature read on the boiler (0-999°C) can now be dialed. Hereby "°C" is blinking so as to show the activation of the numerical keyboard. By error, the wrong number can be corrected by dialing 0 and it will be superscribed with the correct value. Press **"E"** to confirm (intermediate memory).

Next indication on the display will be :

Fuel type : Light fuel oil

With the **"STEP"** keys, the required combustible can be called on the display. Confirm with **"E"** and the measurement begins :

02 20,9%
CO ppm

With the **"STEP"** keys, all measured and calculated values will be called on the display. With the upper **"STEP"** key, the values will be turned over on the upper part of the display, with the lower one, the ones of the lower part.

Two same channels can't be displayed simultaneously.

When the indicated values look like stable, the whole energetic measurement will be stored in the intermediate memory by pressing **"m"**. On the lower right part of the display, it appears **"m"**. It means that from now on, the values are "frozen" and the measurement is finished. By pressing **"m"** again, the intermediate memory can be cancelled and continue the measurement.

By a CO concentration higher than 4000 ppm, a magnetic valve will automatically cut the CO sensor from the gas channel and the fresh air pump will purge the sensor with fresh air. The CO sensor will be re-activated first when the CO concentration is less than 1500 ppm.

11.2. CO measurement

From the energetical measurement mode the user can enter the CO measurement. Hereto press on "KONTR" and then the upper "STEP" key.

It appears on the display :

**BImSchV measure.
Change : <START>**

Press on "START" to modify the measurement mode. Press on "E" to enter the CO measurement which displays the following 4 parameters :

**CO
CO %O2
O2
Lambda**

The measurement results can be recorded by pressing "m" and printed out.

11.3. Draught measurement

After having pressed "ZUG", one enters the draught measurement mode and it appears on the display :

Press <START> !

The pump switches off. The draught sensor is calibrating to 0.00 hPa. Press "START", the measured draught appears on the display, for instance :

Draught : 0,00 hPa

After the indication has become stable, the value will be transmitted in the intermediate memory by pressing "m". After having pressed "E", the pump runs on again and one returns in the normal measurement mode.

11.4. Soot dot measurement

Background :

The new BimSchV (= Bundesimissionschutzverordnung : the German regulation concerning control and monitoring of small combustion plants) prescribes 3 consecutive soot measurements as well as -by oil burners- a test on eventual oil derivate (oil trace on the soot filter paper).

Despite its "national look", this prescription should be of interest and of concern all over the world because :

- . the 3 measurements enable the calculation of a mid-value and herewith a very reliable statement on the soot content,
- . the oil trace test enables to recognize if the oil burner is well adjusted or not.

Press on "**RUB**", the pump switches off and it appears on the display :

Soot measurement
Insert soot filter

After having pressed "**START**", the pump runs on again and sucks exactly 1,63 l exhaust gas within approx. 50 seconds through the soot filter paper (the sucked volume will be exactly measured and integrated within the soot measurement).

During the soot measurement, it appears on the display, for instance :

1. soot measurement
Rest volume 0,82 l

As soon as the required exhaust volume is sucked, the pump switches off again and it appears on the display :

1. soot measurement
Soot dot : 0

Thanks to the numerical keyboard, the user can dial the number he read after having compared the soot dot with the soot comparison scale, or when available with our ECOM-D.

After having pressed "**START**" again, the second soot measurement will be started (same procedure as above described), as well as the third one.

After the 3 soot measurements have been conducted and having pressed once again "**START**", it appears on the display :

Oil trace:
Yes/No

With "OEL", the user will choose between Yes and No : press "**OEL**" one time for yes, twice for no (in the case he found oil on the filter paper or not).

This measurement can also be stored in the intermediate memory by pressing "**m**" (on the lower right part of the display appears "**m**").

By pressing "**E**" one returns in the normal measurement mode.

Nota : the soot measurement procedure can already be interrupted after the first or the second measurement : when the soot number is questioned on the display, press "**E**" and you return in the normal measurement mode.

11.5. Correction of the soot dot measurement

By memorization of erratic soot numbers in the intermediate memory begin a new soot measurement by pressing "**RUB**". It appears on the display :

<p style="text-align: center;">Soot measurement Insert filter m</p>

The recorded results can then be called on the display with help of the "**STEP**" keys. Press "**m**" ("**m**" will disappear) and the soot measurement that appears on the display can be performed again after having pressed "**START**". Press "**m**" again and the corrected value will be stored in the intermediate memory. As above described, press "**E**" to return in the normal measurement.

11.6. Conclusion of the measurement with memory and data management

After all measurements (energetical, draught and soot measurement) have been performed and stored in the intermediate memory with "**m**", press "**M**" to run the transmission intermediate memory to data memory : on the display "m" has been replaced through "**M**" : the data have been transferred into the main memory.

As already mentionned, we advise to let print one time the results through the printer before pressing "**M**" (data security).

12.0. CO MEASUREMENT BY SOLID COMBUSTIBLES

Key "**INTEG**".

Only in connection with a filtering system like ECOM-GPlus (operation see hereto ECOM-GPlus manual).

13.0. DISTANT READING MONITOR

Only the measurement results stored in the intermediate memory are usually printed from the printer. This is not valid by activation of the printer through the distant reading monitor.

The distant reading monitor shows all measurement results that are usually also shown from the unit's display.

When the user leaves the normal measurement mode to enter for instance, the soot or draught measurement mode, the activation of the printer through the distant reading monitor is blocked. Should the printer (in normal measurement mode) be activated through the distant reading monitor, so the present measurement values are displayed -the same as on the unit's display.

If the printer is activated through the key "**PRINT**" (on the unit), only the values memorized in the intermediate memory are printed.

14.0. CONTROL PROGRAMM

From the normal measurement mode, press "**KONTR**" to enter the control programm. Several indications are displayed. With help of the "**STEP**" keys, the required text can be called upon the display. Press "**E**" to return to the normal measurement mode.

Control step 1

Switch off CO ?
<START> : No

Pressing "**START**" releases the CO sensor from the gas channel (by too high concentration).

Control step 2

BImSchV measure.
Change : <START>

The measurement mode can hereby be modified into CO measurement and reverse.

Control step 3

Paper feeding ?
<START> :

In this mode by changing of the printer paper roll, the printer will be activated through pressing "**START**" so that the paper is automatically drawn in. The printer runs as long as the key "**START**" is pressed.

Control step 4

Boiler temp. 60°C m

Hereby the boiler temperature can be corrected. Press "**m**" : "**m**" will disappear. Press on "**START**" and input the new temperature. Press "**E**" to record in the intermediate memory.

Control step 5

**Fuel type :
Light fuel oil**

If needed the fuel type can be modified. Hereto press "START" and select with the "STEP" keys the required fuel type. Press "E" to memorize.

Control step 6

**A1 = 0,50 A2 = 0,68
B = 0,007 CO2 = 15,4**

The above parameters are fuel type specific factors according the BImSchV.

Control step 7

**O2 = 2262 mV CO = 0 mV
NO = 0 mV Drau. = 29 mV**

The above are the alignment values of each sensor (NO optional).

If your instrument is equipped with the NO module, the next control step will be dedicated to the voltage of the NiCd accumulators.

Control step 8

**NO + 2,15 V NO -2,24 V
NO-ref. 198 mV**

For optimal operation, the NO sensor has a proper, constant power supply system. The bias voltage should not drop under 1,3 V (absolute) and one battery's absolute value should not differentiate substantially from the other's.

Control step 9

**Work hours :
10,23 hours**

This indication has to be interpreted in hours and minutes. The addition of the operation time is made integrally in full minutes.

Control step 10

**Service :
02371/44029**

This is the phone number of the next service office where your ECOM analyser can be maintained and if need be, repaired.

Control step 11

**rbr 01:01:93
Unit-no.: 12345**

Information about last calibration of the unit in our premises as well serial number.

Press on "AKKU" to check the loading state of the batteries. The display shows :

**Batt. voltage
11,57**

When operating on mains power supply, the display shows :

Batt. is loading

Control step 12

**Date Time
06.01.93 12.44**

This indication serves to the control of date and time.

Should it be necessary to adjust the internal clock, so press on "START". The day indication (06) blinks. Dial with help of the numerical keyboard the right day date and confirm with "E". Then the month indication (01) blinks : proceed as above. Same procedure also for time indication. Confirm the last alteration with "E".

TECHNICAL SPECIFICATIONS

Ranges	oxygen	O ₂	0-21.0 % volume
	carbon monoxide	CO	0-4000 ppm *
	nitrogen oxide	NO	0-2000 ppm
	carbon dioxide	CO ₂	0-99.9 % (calc.)
	gas temperature		0-500 deg. C
	surrounding temp.		0-99 deg C
	fuel efficiency	(Eta)	0-99.9 % (calc.)
	loss		0-99.9 % (calc.)
	excess air	(Lambda)	1 - ∞
	draught measurement		+/- 20.00 hPa
	smoke measurement		Bacharach scale (0 - 9)
Display	two lined, 20 positions LC-Display		
Calibration	sensors automatically calibrated after initiation (reference gas: fresh air)		
Power supply	mains power 220 V, 50 Hz ; battery 12 V/1,2 Ah		
Check programme	indication of all unit's specific data, called upon display		
Sensor type	O ₂ , CO, NO (electrochemical cell) combustion gas temp. (NiCrNi thermocouple) surrounding temp. (separate sensor encapsulated in metal housing) draught measurement (DMS measuring bridge)		
Operating temp.	15 °C - 45 °C		
Sampling probe	standard length 300 mm **, insertion length 250 mm		
Gas hose	combi hose silicon, 3 m length **		
Accessories	water catchpot, sampling probe		
Weight	approximately 10 kg		
Dimensions	410 x 250 x 120 mm (W x L x H)		

Technical modifications according technical development are not excluded.
D-58640 Iserlohn/West-Germany - August 1993

* by integral measurement using ECOM-GPlus : 0-10000 ppm

** other lengths on request