

Instruction Manual Dräger MSI EM200 + EM200-i



Dräger MSI GmbH
Rohrstraße 32
58093 Hagen

Tel.: +49-2331 / 9584 - 0
Fax: +49-2331 / 9584 - 29
e-mail: info@draeger-msi.de

5695019; Edition 2012-04-13

Content

1. Reference notes	Page 4
1.1 Approvals	
1.2 Information for use	
1.3 Service	
1.4 Specifications for disposal according WEEE	
2. The instrument	Page 5
3. Starting up and operation	Page 6
3.1 Preparing for use	
3.2 Push buttons	
3.3 Check of measuring gas duct	Page 7
3.4 Terminating measurement	
4. Selection of functions	Page 8
5. Flue gas measurements	Page 8
5.1 Select type of flue gas measurement	
5.2 Flue gas analysis	Page 9
5.3 Average measurements	Page 12
5.4 CO measurement	Page 13
5.5 Combustion air O ₂ measurement in air ducts	Page 14
5.6 Fresh air adjust	Page 15
6. Pressure measurements	Page 15
6.1 Selection of pressure measurement	
6.2 Medium pressure measurement	Page 16
6.3 Low pressure measurement	
6.4 Flow measurement (only MSI EM200-i)	Page 17

Instruction Manual Dräger MSI EM200 + EM200-i

Content (Page 2)

7. Gas pipe checks	Page 18
7.1 Selection of gas pipe checks	
7.2 Semiautomatic tightness test (DVGW TRGI 2008)	
7.3 Leak rate measurement (DVGW TRGI 2008)	Page 19
8. Special functions	Page 21
8.1 Ambient air CO measurement	
8.2 Measuring combustion air temperature	Page 22
8.3 Automatic switch off	
8.4 Shelter of the CO sensor	
8.5 Online data transfer	Page 23
9. Documentation menu	Page 23
10. Data processing	Page 24
10.1 Store data	
10.2 Data menu	
10.3 Info function of data menu	
10.4 Show stored data records	Page 25
10.5 Clear data files	
10.6 Selection of table type	
11. Info function	Page 26
12. Selection or input of customer ID	Page 26

Content (Page 3)

13. Settings	Page 27
13.1 General settings	Page 28
13.2 O2 reference	
13.3 NOx factor	Page 29
13.4 Selection of damping	
13.5 Date and time adjust	
13.6 Backlight adjust	
13.7 Key beep switch on / off	
13.8 Printer protocol selection	Page 30
13.9 Display contrast adjust	
13.10 Factory setting restore	
13.11 Display language selection	Page 31
13.12 Efficiency and stack loss	
14. Warning hints, error messages and operation references	Page 32
14.1 Warning hints	
14.2 Error messages	
14.3 Operation references	Page 34
15. Technical data	Page 35
15.1 General technical data	
15.2 Technical data of measured and calculated values	Page 36
16. Maintenance and service	Page 37
16.1 Storing	
16.2 Maintenance	
16.3 Service	
16.4 Consumables and accessories	

Instruction Manual Dräger MSI EM200 + EM200-i

1. Reference notes

1.1 Approvals

The flue gas analyser MSI EM200 is approved according the European Standards EN 50379 part 1, part 2 and part 3 and thus it is certified for official measurements.

1.2 Information for use

The MSI EM 200 is an electronic multiple channel measuring instrument for analysing the flue gas of combustions and industrial processes. The MSI EM200 is unlicensed as a gas detection alarm or personal security equipment.

Any use of the MSI EM200 requires a full understanding and strict adherence to these instructions and to national and international standards.

The instrument has only to be used for the purposes specified in here.

The display screens used in this instruction manual are only examples!

1.3 Service

To maintain accuracy and correct function the MSI EM200 should be checked and recalibrated by authorized service people once a year.

1.4 Specifications for disposal according WEEE

As from 2005 EC specifications for disposal of electric and electronic equipment are valid. These are regulated in the 2002/96/EC directive and respective national law.

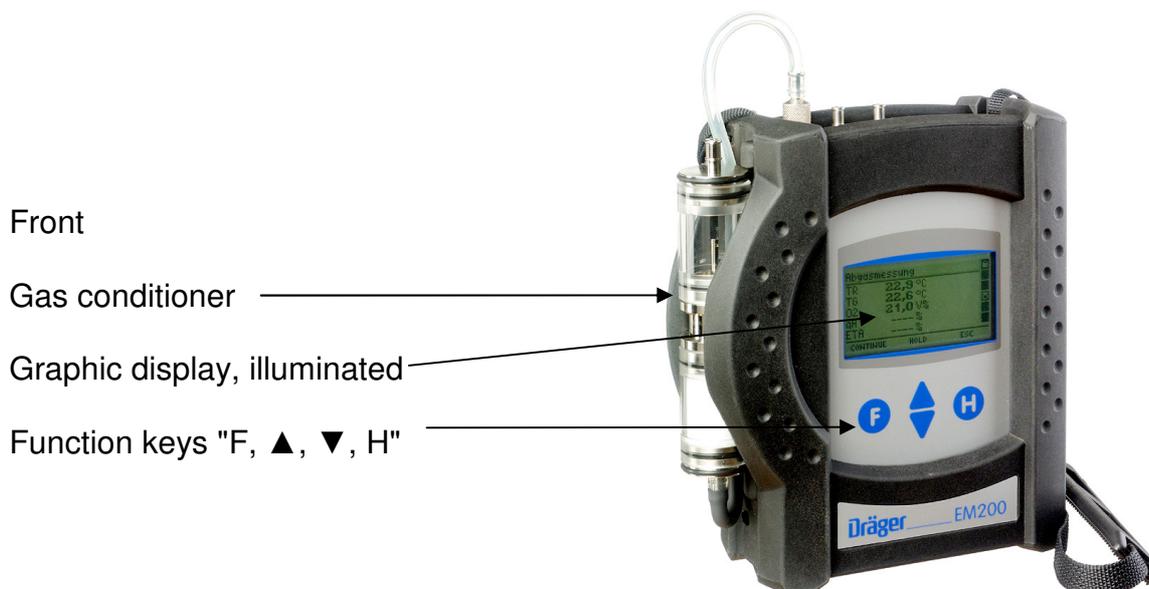
Essential content is the establishment of special collection and recycling facilities for private users. Since this device is not registered for private users, it is not allowed to dispose it in this way.

For disposal you can send it back to your local Dräger Safety organisation and if requested, get further information concerning this matter from Dräger MSI GmbH.

2. The instrument

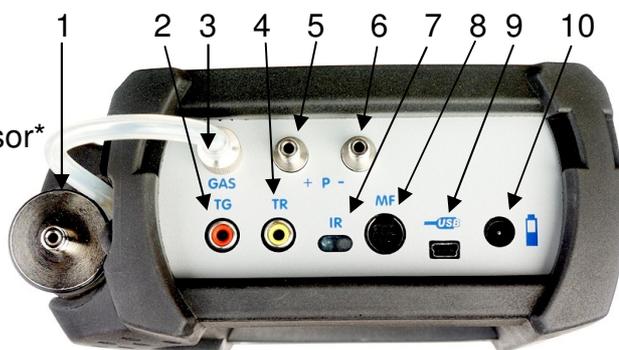
The MSI EM200 is an electronic multiple channel measuring instrument, analysing the flue gas concentrations and combustion data for engineers, service, environmental protection, etc..

All measurements and checks may be documented by printing or data storage.



Top

- 1 = Gas conditioner
- 2 = Socket for thermocouple (TG)
- 3 = Gas inlet
- 4 = Socket for combustion temperature sensor*
- 5 = Pressure inlet (+)
- 6 = Pressure inlet (-)
- 7 = LED and infrared transmitter
- 8 = Multiple function interface
- 9 = USB - interface
- 10 = Socket for charger



* Here you can connect different combustion air temperature probes.

Instruction Manual Dräger MSI EM200 + EM200-i

3. Starting up and operation

3.1 Preparing the instrument

Make sure that all components are in good condition e.g.:

- no condensate in the gas conditioner
- the filter fleece and the filter disks are clean
- the gas hoses are in good condition
- the probe is free from defects

Connect the gas conditioner with the gas inlet of the MSI EM200. Never forget to use the gas conditioner.

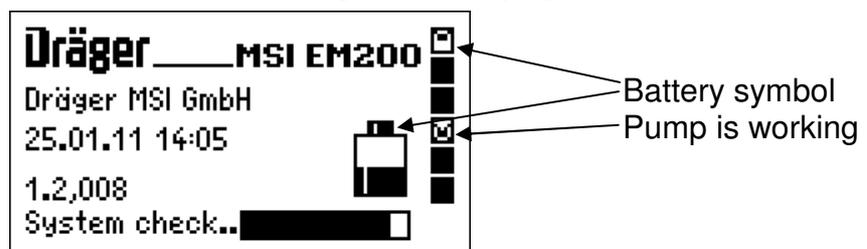
Verify that fresh air will be sucked through the gas conditioner before switching on, because the zero signals of the sensors are checked with fresh air.

3.2 Push buttons

3.2.1 Switching on / off the MSI EM200

Switch on the instrument by pushing for a second the buttons "F" and "H" together. If the annual service has do be done the MSI EM200 starts a month earlier to remind you to the service due date.

After pushing "F" (CONTINUE), or direct after switching on the display will read:



The time and the software version is shown and the battery symbols show the batteries capacity. The bar represents the progress of the run in of the el.-chem. sensors and the progress of the check function. The time of the system check is dependent on the stabilisation time of the O₂ sensor. Depending on the switch-off length and time the stabilisation time will be at least 30 seconds, possibly it can last more than 10 minutes.

The instrument is switched off by using the switch off function in the menu "selection of functions" (see 4.) or by pushing "F" until the display reads "Switch off" (ca. > 3 sec).

3.2.2 Functions of the push buttons

The functions of the push buttons are always shown in the last row of the display.

With “H” the function “switch off” will be marked, a measurement will be aborted or the instrument skips back one function level.

With “F” a marked function will be achieved or an adjusted value will be adopted.

With “▲ or ▼” (▲▼) a function will be marked or a value will be adjusted.

3.3 Check of measuring gas duct

Instruments with integrated gas duct control monitor the gas duct continuously. If the gas flow is too small an error message is generated and displayed. The tightness of the complete measuring gas duct may be proved by closing the gas inlet of the probe. After a short while the error message “gas duct low” will be shown if the measuring gas duct is tight.

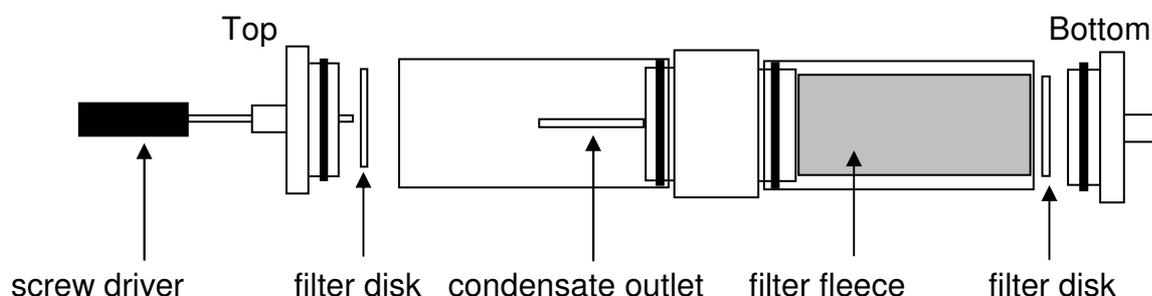
Instruments without gas duct control may only be tested by an indirect method. Close the gas inlet of the probe, if the measuring gas duct is tight, the performance of the instrument’s pump will change and a change of the pump sound may be heard. If a change of the pump sound will not be heard, the measuring gas duct has to be checked with a flow meter.

3.4 Terminating measurement

After the measurement remove the probe from the flue gas pipe and allow fresh ambient air to be sucked in for 1 to 2 minutes, only now switch off the instrument.

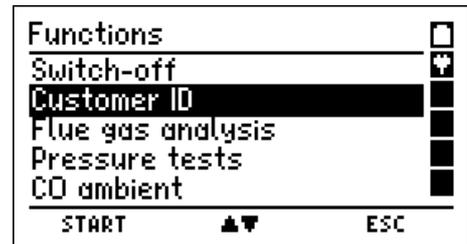
Empty and clean the gas conditioner. Check the filter fleece and the filter disks and replace them if they are visibly dirty. For pushing out the filter disks use a small screw driver or a paper clip.

Gas conditioner:



4. Selection of functions

Selectable functions are:

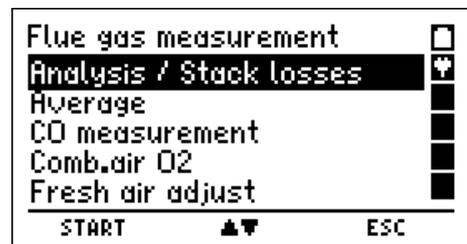


- Switch-off = Switches off the MSI EM200
- Customer ID = Calls function “selection or input of customer ID” (see 12.)
- Flue gas analysis = Calls menu “select type of flue gas measurement” (see 5.1)
- Pressure tests = Calls menu “selection of pressure measurements” (see 6.1)
- CO ambient = Calls menu “ambient air CO measurement” (see 8.1)
- Gas pipe checks = Calls menu “selection of gas pipe checks” (see 7.1)
- BCI diagnostic = Start of the reading out of digital burner controllers of Siemens (Landis & Staefa) and Honeywell (Satronic) using Dual-BCI-S or Smart-BCI (see manuals D896 or D910)
- Memory = Calls “data menu” (see 10.2)
- Info = Calls “info function” (see 11.)
- Settings = Calls menu “settings” (see 13.)

5. Flue gas measurements

5.1 Select type of flue gas measurement

Selectable flue gas measurements are:



- Analysis / stack losses = Starts flue gas analysis incl. temperature, gas concentrations (in ppm, mg/m³, mg/kWh), pressure, efficiency etc. (see 5.2)
- Average = Starts measurement of average values (see 5.3)
- CO measurement = Starts O₂ and CO measurement (see 5.4)
- Comb.air O₂ = starts O₂ measurement of combustion air in ducts (see 5.5)
- Fresh air adjust = zero point calibration with fresh ambient air (see 5.6)

5.1.1 Preparing for measurement

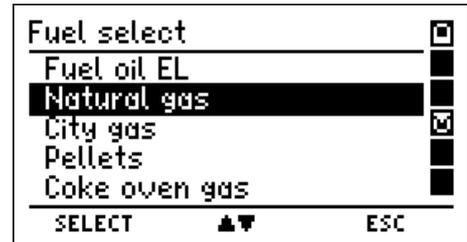
First connect the hose of the probe with the gas conditioner and then the plug of the thermocouple (marked red) with the socket marked “TG”. The combustion temperature sensor is plugged into the socket “TR”.

Is “flue gas analysis” been chosen the fuel type selection is called.

After starting the burner please wait until the combustion is steady going. Direct after start burner may emit high concentrations of toxic gases and soot and this would needlessly pollute the instruments sensors.

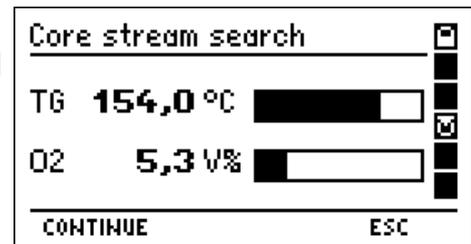
5.1.2 Fuel type selection

With (SELECT) the marked fuel type will be accepted.



5.1.3 Core stream detection

In the flue gas stream exist some regions, where only parts are filled with exhaust gas. Therefore it is important to take the gas out of the core stream. The core stream is characterised by maximum temperature and minimum O2 concentration. This program helps to fix the probe in the core stream.

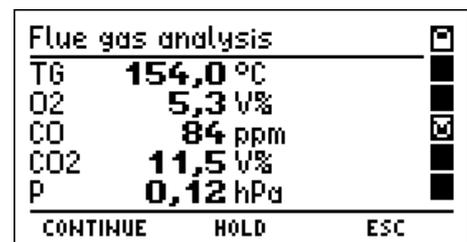


Insert probe into flue gas pipe, move probe position until the probe tip is situated in the core stream (highest temperature) and secure this probe position with the fixing cone.

5.2 Analysis / stack losses

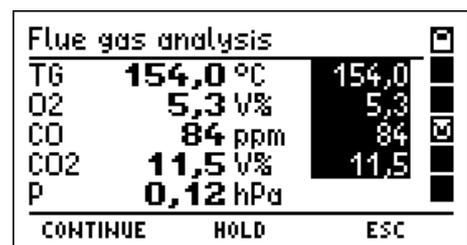
5.2.1 Display of main analysis values

If dashes are displayed this means there exist no value or the value is too big (exceeds measuring range) or the calculation is forbidden (e.g. division by zero).



Only locked values can be printed and stored.

The display shows the actual and the locked (inverted) values. The pressure values are only locked if the additional pressure measurement is deactivated (see 13.1).



Instruction Manual Dräger MSI EM200 + EM200-i

The display shows the actual and the locked (inverted) values. The pressure values are only locked if the additional pressure measurement is deactivated (see 13.1).

Flue gas analysis		<input type="checkbox"/>
TCA	21,2 °C	<input type="checkbox"/>
TG	154,0 °C	<input type="checkbox"/>
O2	5,3 V%	<input checked="" type="checkbox"/>
qA	6,7 %	<input type="checkbox"/>
Eta	93,3 %	<input type="checkbox"/>
CONTINUE		HOLD
		ESC

Are additional sensors like NO, NO2 or SO2 integrated, the measured concentrations will be shown in an additional display screen.

The calculation of flue gas loss for condensing boilers can be activated (see 13.1 and 13.12).

Is the calculation of flue gas loss for condensing boilers deactivated or (CONTINUE) is pushed; the display screen in table form is called (see 5.2.2).

Flue gas analysis		<input type="checkbox"/>
O2	4,3 V%	<input type="checkbox"/>
T dew	46 °C	<input type="checkbox"/>
qA-B	-3,2 %	<input checked="" type="checkbox"/>
Eta-B	103,2 %	<input type="checkbox"/>
CONTINUE		HOLD
		ESC

The used abbreviations for the measuring channels mean:

TCA	= combustion air temperature
TG	= flue gas temperature
T dew	= dew point temperature
qA	= flue gas loss
qA-B	= flue gas loss for condensing boilers
Eta	= efficiency
Eta-B	= efficiency for condensing boilers

5.2.2 Display screen in table form

Is the calculation of gas concentrations in mg/m³ deactivated (see 13.1), this display screen is not shown, continue with chapter 5.2.3.

	ppm	mg/m ³	mg/m ³ !	<input type="checkbox"/>
CO	84	105	120	<input type="checkbox"/>
O2 ref.	3 V%	mg/Nm ³		<input type="checkbox"/>
CONTINUE		HOLD	ESC	

In the first column the measuring channel is displayed. NO, NO2 or SO2 may be displayed too (depending of the instrument version).

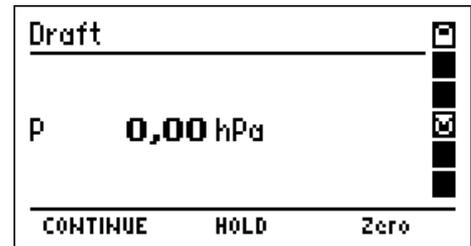
In the second column the measured values in ppm are shown and in the third column the measured values are displayed calculated in mg/m³.

The fourth column shows the resulting reference values in mg/m³ or mg/MJ or mg/kWh using the O2-reference value (here 3 %) and the dimension unit (here mg/Nm³), which are shown in the bottom line. The O2-reference value and the dimension unit may be modified in the menu "settings" (see 13.1 and 13.2).

Only locked values can be printed and stored.

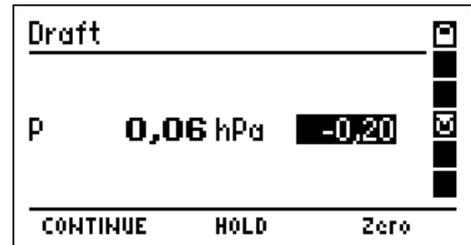
5.2.3 Separate measurement of flue gas draft

For measurement of the draft with a standard probe the function “separate draft measurement” has to be activated (see 13.1), in case of use of a probe with integrated pressure measurement (tube-in-tube) the function may be disabled. Is the function “separate draft measurement” (see 13.1) disabled, this function is missed out.



For measurement with a standard probe, plug the hose of the gas conditioner from the gas inlet onto the (+) pressure inlet.

With (HOLD) the actual shown reading may be locked. The pressure value in this case will be locked and unlocked independent from the other values.

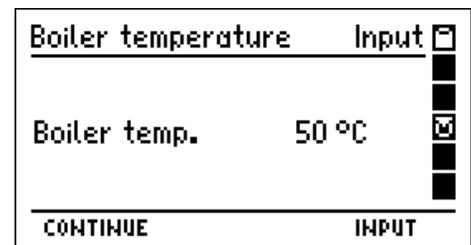


The display shows the actual and the locked (inverted) pressure reading.

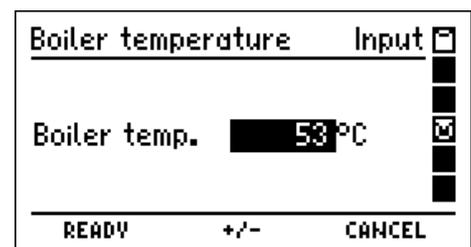
After the measurement is finished, do not forget to connect the tube to the gas inlet again!

5.2.4 Input of boiler temperature

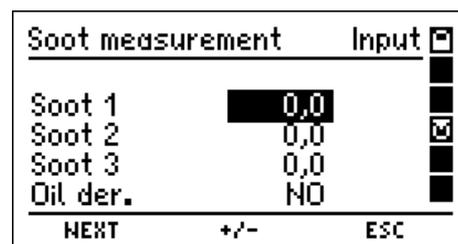
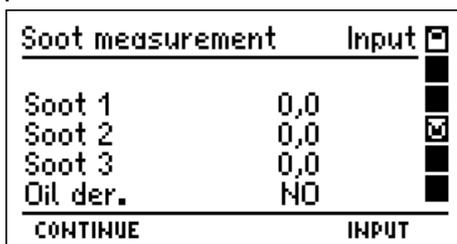
Is the function “input” (see 13.1) deactivated and no values are locked, this function is missed out.



With (INPUT) the value of the boiler temperature may be adjusted.



5.2.5 Input of soot numbers



With (INPUT) the inverted shown value may be adjusted.

If all inputs have been done, it will be skipped to “result of flue gas analysis”.

Soot measurement		Input
Soot 1	1,0	<input type="checkbox"/>
Soot 2	2,0	<input checked="" type="checkbox"/>
Soot 3	1,0	<input type="checkbox"/>
Oil der.	NO	<input type="checkbox"/>
NEXT	+/-	ESC

5.2.6 Result of flue gas analysis

In the first two lines of the main display area the customer number (if selected) and the fuel type is shown. In the following lines in the first row the measuring channels are displayed and in the second row the values together with their units.

Result	25.11.08 16:51	<input type="checkbox"/>
Cust.No.	3DGB3	<input type="checkbox"/>
Fuel	Fuel oil EL	<input type="checkbox"/>
TG	154,0 °C	<input checked="" type="checkbox"/>
TCA	21,2 °C	<input type="checkbox"/>
O2	5,3 V%	<input type="checkbox"/>
CONTINUE	▲▼	

With (▲▼) the reading may be scrolled and thus all measured and calculated values can be shown. With (CONTINUE) the “documentation menu” is called (see 9.).

5.3 Average measurements

In many cases average values are measured, to get repeatable results at time varying combustions. For this a defined time for averaging is required.

So at bigger combustions a half hour mean value is demanded, on the other hand for with solid fuels fired combustions the averaging for 15 minutes is required.

For measuring the efficiency in Germany a regulation exists to measure the efficiency for 30 seconds, because the different response time of temperature and O2 concentration measurement may lead to an incorrect stack loss calculation, especially when the core stream varies. The measurement of average values avoids this and makes it possible to get more accurate results of the stack loss.

The average time may be selected in the function “settings” (see 13.1).

5.3.1 Display of main analysis values

In the first column the measuring channels are displayed (TG = flue gas temperature), in the second column the values and in the third the dimensions. If dashes are displayed, this means there exists no value or the value is too big (exceeds measuring range) or the calculation is forbidden (e.g. division by zero).

Flue gas average		<input type="checkbox"/>
TG	154,0 °C	<input type="checkbox"/>
O2	5,3 V%	<input type="checkbox"/>
CO	84 ppm	<input checked="" type="checkbox"/>
CO2	11,5 V%	<input type="checkbox"/>
P	0,12 hPa	<input type="checkbox"/>
CONTINUE	START	ESC

With (START) the average measurement will run for the selected average time.

Average	0:16	☐
TG	154,0 °C	■
O2	5,3 V%	■
CO	84 ppm	☑
CO2	11,5 V%	■
P	0,12 hPa	■
CONTINUE	ESC	

The current and the mean measurement values (inverse) are displayed. As described in the chapters 5.2.2 to 5.2.5 the display screen in table form of the average values of the gas concentrations, the separate measurement of flue gas draft, the input of boiler temperature and the input of soot numbers may be called.

Flue gas average	60 s	☐
TG	154,0 °C	154,0
O2	5,3 V%	5,3
CO	84 ppm	84
CO2	11,5 V%	11,5
P	0,12 hPa	
CONTINUE	ESC	

After the average measurement is finished “result of average measurement” is called.

5.3.2 Result of average measurement

With (CONTINUE) the “documentation menu” is called (see 9.).

Result	25.11.08 16:58	☐
Cust.No.	30GB3	■
Average	60 s	■
Fuel	City gas	☑
TG	154,0 °C	■
TCA	21,2 °C	■
CONTINUE	▲▼	

5.4 CO measurement

In some cases, requested by regional rules, the concentration of O₂, CO and CO undiluted in the stack gas is of interest.

CO measurement		☐
O2	5,3 V%	■
CO	84 ppm	☑
CO-0	112 ppm	■
HOLD	CANCEL	

The current and the mean measurement values (inverse) are displayed.

CO measurement		☐
O2	5,3 V%	5,3
CO	84 ppm	84
CO-0	112 ppm	112
CONTINUE	HOLD	CANCEL

With (CONTINUE) the result of the CO measurement is displayed.

With (CONTINUE) the “documentation menu” is called (see 9.).

Result	24.11.08 14:28	<input type="checkbox"/>
Cust.No.	34H9	<input type="checkbox"/>
O2	5,3 V%	<input type="checkbox"/>
CO	8 ppm	<input checked="" type="checkbox"/>
CO-0	4 ppm	<input type="checkbox"/>
<hr/>		
CONTINUE		

5.5 Combustion air O₂ measurement in air ducts

At room-air independent combustions the tightness of the combined combustion-air duct and flue exhaust system may be checked by measuring the O₂-concentration in the air duct with a special multi hole probe.

First connect the hose of the probe with the gas conditioner.

Is in fresh air the value of the O₂ concentration 21 Vol. %. the flue exhaust pipe is not tight, the O₂ concentration will decrease, because flue gas is mixed with the combustion air.

Combustion O2		<input type="checkbox"/>
O2-CA	21,0 V%	<input type="checkbox"/>
O2-Dif	0,0 V%	<input checked="" type="checkbox"/>
CO-CA	1 ppm	<input type="checkbox"/>
<hr/>		
CONTINUE	HOLD	ESC

Displayed are the O₂ value in the air duct (O₂-CA), the difference to 21 % and the CO value in the air duct (CO-CA).

With (HOLD) the display shows the actual and the locked (inverted) values.

Combustion O2		<input type="checkbox"/>
O2-CA	17,6 V%	18,0
O2-Dif	3,4 V%	3,0
CO-CA	3 ppm	3
<hr/>		
CONTINUE	HOLD	ESC

With (CONTINUE) the pressure measurement in the air duct is called.

Combustion O2		<input type="checkbox"/>
P-CA	-0,24 hPa	<input checked="" type="checkbox"/>
<hr/>		
CONTINUE	HOLD	Zero

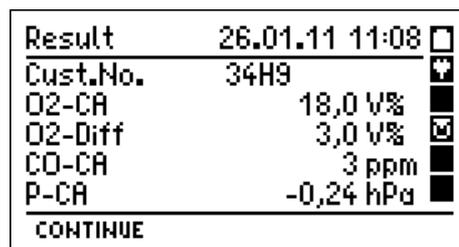
For pressure measurement in the air duct plug the hose of the gas conditioner from the gas inlet onto the +) pressure inlet.

The display shows the actual and the locked (inverted) pressure reading.

Combustion O2		<input type="checkbox"/>
P-CA	-0,24 hPa	-0,24
<hr/>		
CONTINUE	HOLD	Zero

With (CONTINUE) the result of the combustion air O2 measurement is called.

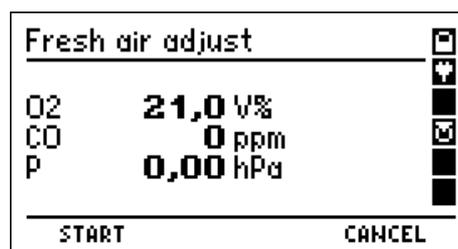
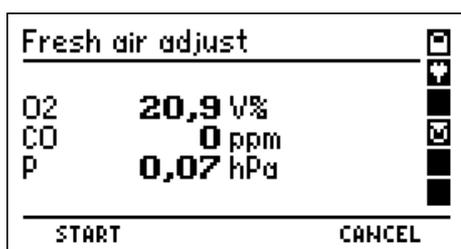
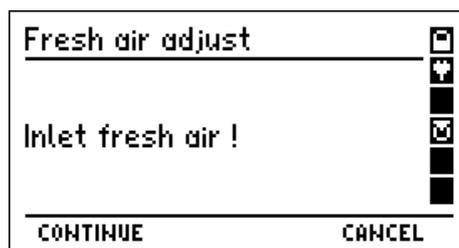
With (CONTINUE) the “documentation menu” is called (see 9.).



5.6 Fresh air adjust

This function allows a zero point calibration of all el.-chem. sensors and of the pressure sensor, before starting a flue gas analysis.

The display asks to care that fresh air may be sucked through the gas conditioner. There should no tube be connected to the pressure inlets.



With (START) all zero points will be recalibrated.

6. Pressure measurements

6.1 Selection of pressure measurements

Selectable pressure measurements are:



- Medium press. = pressure measurement in the range up to 100 mbar (see 6.2)
- Micro press. = pressure measurement in the range up to 100 Pascal (see 6.3)
- Flow measurement = flow measurement (see 6.4; only MSI EM200-i)

Instruction Manual Dräger MSI EM200 + EM200-i

6.2 Medium pressure measurement

For pressure measurement (gas or nozzle pressure) connect pressure inlet (+) via pressure probe with the measuring point. For differential pressure measurement connect the pressure inlet (+) to the measuring point with the higher pressure.

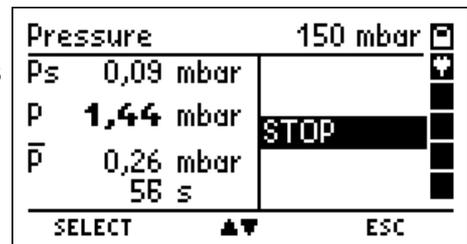
On the left of the display screen the pressure value together with its dimension unit is displayed and on the right the selectable functions.



Selectable functions are:

- Zero = The shown value is set to zero
- Damping = Calls adjusting the damping value (see 13.4)
- Start = Start of pressure measurement

In the top line the actual type of pressure measurement is shown. On the left of the display screen the first value is the pressure at the beginning of this measurement, the second value is the actual pressure value, the third is the mean value of the running measurement. The fourth value informs how long the pressure measurement is running.



With (SELECT) the measurement may be finished.

The start-, the stop- and 10 until 20 measurement values between them have been stored in a buffer. These buffered values may be stored and transferred to a PC. With help of the software "EM Tools" a measurement report including a diagram of the time depending pressure measurement may be printed.



- Zero = The shown value is set to zero
- Damping = Calls function for adjusting the damping value (see 13.4)
- Start = Start of a new pressure measurement, the actual values are released
- Print = Transfer of mean value, time of measurement, date and time to an IR printer
- Store = Calls the function "storing of pressure measurements" (see 10.1)

6.3 Low pressure measurement

For initial operation of gas fired heaters you need often to measure very low differential pressures. So e.g. the company "Buderus" requires in their installation manual for Logamax plus GB 162-80/100, to adjust the differential pressure ($p_{\text{gas}} - p_{\text{air}}$) at -5 Pa.

The MSI EM200 therefore measures the pressure in the range of -100 to + 100 Pascal (100 Pa = 1 hPa) with a resolution of 0.1 Pascal.

The damping default in this case is “high”. The damping setting of “low pressure measurement” does not affect the damping setting of other pressure measurements. The further function is like it is written in “medium pressure measurement” (see 6.2).

6.4 Flow measurement (only MSI EM200-i)

The gas velocity in the stack differs often in different points of a cross section; therefore several measurements have to be done to get a correct mean value.

The gas velocity can be averaged out of 60 individual measurements.

If “flow measurement” has been selected, the fuel type selection is called.

6.4.1 Fuel type selection

The measured differential pressure depends from the gas velocity but the gas type (mass of the gas) and the stack gas temperature will also matter. The gases in the stack are calculated from the fuel type.

After selection of the fuel type the flue gas temperature is called.

6.4.2 Flue gas temperature

The temperature dependence can not be neglected regarding stack gas opposite to measurement of gases with ambient air temperature. For this the stack gas temperature has to be measured and its influence has to be corrected.

The measurement of the stack gas temperature is done with a gas probe with integrated thermocouple. Connect the plug of the thermocouple with the bushing (marked TG) of the MSI EM200-i and insert the probe into the stack.

With (CONTINUE) the displayed stack temperature is accepted and “start of flow measurement” is called (see 6.4.3).

6.4.3 Start of flow measurement

The measurement of gas velocity is done with a pitot tube by measuring the differential pressure between total pressure and static pressure. To do this, the tubes outlet of total pressure has to be connected with the + pressure inlet and the outlet of the static pressure with the – pressure inlet of the MSI EM200-i.

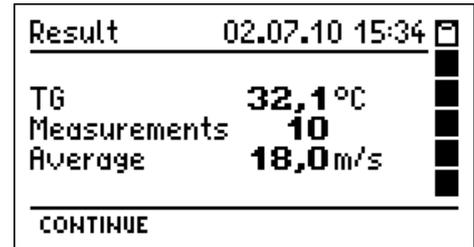
Displayed are the active flow, the result of the last measurement, the calculated average value of the temporary stored measurements and the number of all temporary stored measurements. With (ZERO) the active flow may be set to zero (zero point adjustment). With (MEASURE) the active flow will be temporary stored and the value is shown as last. The number of the temporary stored measurements will increase.

Flow measurement		☐
Flow actual	0,9m/s	■
Last value	20,4m/s	■
Average	18,0m/s	■
Measurements	10	■

MEASURE	ZERO	READY

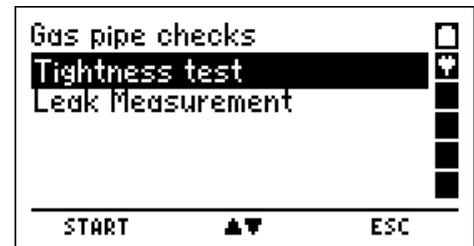
With (READY) the result of the flow measurement will be displayed.

With (CONTINUE) the documentation menu will be called (see 9.).



7. Gas pipe checks

7.1 Selection of gas pipe checks

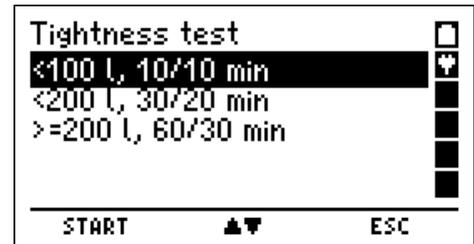


Selectable functions are:

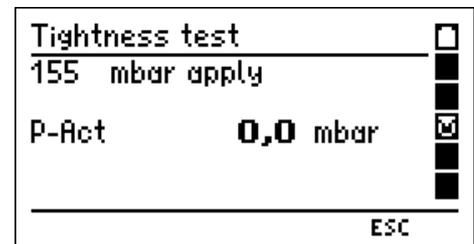
- Tightness test = Starts "semiautomatic tightness test" (see 7.2)
- Leak measurement = Starts "leak rate measurement" (see 7.3)

7.2 Semiautomatic tightness test (DVGW-TRGI 2008) (not MSI EM200-i)

The regulated stabilization and measuring time for the different volumes of the gas pipes are displayed.

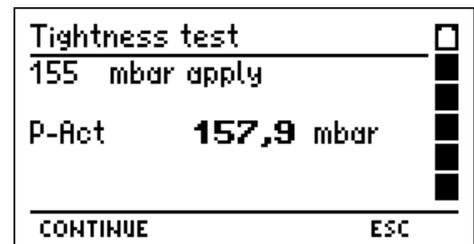


With (START) the stabilization and measuring time of the marked volume will be adopted. Connect the gas pipe with the pressure inlet (+) of the instrument.



Connect a hand pump and a valve with the gas pipe and increase the pressure to a little bit more than 155 mbar.

The instrument recognizes the pressure and with (CONTINUE) it asks to close the valve.



Is the volume of the gas pipe unknown, the volume can be calculated with the diameter and the length of the gas pipe.

Pipe volume		☐
Inputs	3	■
Total	14,2 l	■
Section	'VOL'	■
Frac volume	3,5 l	■
STORE +/-		READY

Selectable diameters are: 'VOL', 35 mm, 28 mm, 22 mm, 15 mm, 2", 1½", 1¼", 1", ¾" and ½". With (CONTINUE) may be changed to "Length" and the length of the gas pipe fraction with the marked diameter may be putted in. With (STORE) the fraction will be adopted.

Pipe volume		☐
Inputs	5	■
Total	20,5 l	■
Section	35 mm	■
Length	3,5 m	■
STORE +/-		READY

With (READY) the calculated gas pipe volume will be adopted and all fractions may be printed.

With (CONTINUE) may be changed to the start of the leak measurement.

Pipe volume		☐
Inputs	5	■
Total	20,5 l	■
CONTINUE PRINT		ESC

7.3.2 Start of leak measurement

Selectable operational pressures are 23 mbar, 50 mbar and 100 mbar. The test pressures are 50 mbar, 55 mbar and 110 mbar (DVGW TRGI 2008).

Connect the instrument with the gas pipe and (CONTINUE).

Leak measurement		☐
P-Test	50 mbar	■
P-Nom.	23 mbar	■
CONTINUE +/-		ESC

Observe national and international regulations concerning the handling of explosive gases!

Close the gas supply (e.g. main valve behind the gas meter). Connect hand pump and valve with the gas pipe and increase the pressure to a little bit more than the test pressure.

Leak measurement		☐
Apply	50 mbar test pressure	■
P-Act	51,5 mbar	■
CONTINUE		ESC

After (CONTINUE) closed the valve of the pump and start measurement.

After a stabilization time of 30 seconds the measurement will start automatically.

Leak measurement		☐
Stabilisation		■
P-Act	51,1 mbar	■
Time	0:14 min	■
		ESC

The currently calculated leak rate, the pressure at the beginning of the measurement, the actual pressure value and the time how long the measurement is running are displayed.

Leak measurement		☐
Measurement		■
Leak rate	0,9 l/h	■
P-Start	51,1 mbar	■
P-Act	49,0 mbar	■
Time	0:36 min	■
ESC		

After 1 minute the measurement will be finished and the calculated volume, the duration of the measurement, the pressure at the beginning of the measurement, the measured pressure difference and the leak rate in l/h calculated for the operational pressure will be displayed.

Result	26.01.11 16:15	☐
Volume	20,5 l	■
M.duration	1 min	■
P-Start	51,1 mbar	■
ΔP	4,1 mbar	■
Leak rate	2,1 l/h	■
CONTINUE		

With (CONTINUE) the “documentation menu” will be called (see 9.).

8. Special functions

8.1 Ambient air CO measurement

In some countries (e.g. Spain) exists a regulation, to measure ambient air CO at the site of a combustion to prove their tightness. For this the MSI EM200 needs no external sensor.

CO ambient		☐
CO-Amb	0 ppm	■
CONTINUE		Zero
		ESC

At a place with fresh air, without CO content, the value has to be 0 ppm.

Is the reading not 0 ppm, pull the hose off of the gas inlet of the gas conditioner and wait for a while. Push (ZERO). The displayed value will become zero, this zero point is independent from the CO zero point of normal flue gas measurements.

Slip the hose on the gas inlet again!

After pushing (CONTINUE) the display reads the actual CO value of the ambient air.

CO ambient		☐
CO-Amb	0 ppm	■
CONTINUE		HOLD
		ESC

By pushing (HOLD) the actual value may be locked.

Only locked values can be printed and stored.

With (CONTINUE) the result of the ambient air CO measurement is displayed:

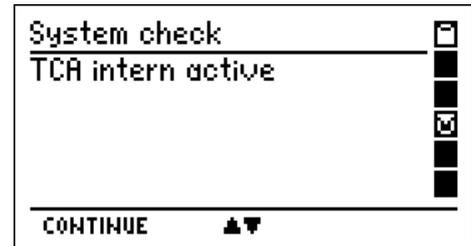
Result	26.11.08 11:43	☐
Cust.No.	BHA2	■
CO-Amb	1 ppm	■
CONTINUE		

With (CONTINUE) the “documentation menu” is called (see 9.).

Instruction Manual Dräger MSI EM200 + EM200-i

8.2 Measuring combustion air temperature

The MSI EM200 is equipped with a built-in temperature sensor, which is able to measure in first approximation the temperature of the ambient (room temperature) and where applicable the temperature of the combustion air. Is no external sensor plugged in the instrument tells after the check function.



In order to enhance the accuracy of the measurement and according to the requirements of EN 50379 part 1-3, it is recommended to use an external temperature probe. The instrument recognises if an external probe is connected and takes automatically the results measured by the adapted probe.

8.3 Automatic switch off

In order to increase the battery life time the instrument is provided with a standby mode. In case no key has been touched for 30 minutes and the instrument is not in a measuring mode (flue gas, pressure, CO-air measurement) the display back light will be switched off. If any key will be touched the MSI EM200 switches automatically on again. The information "standby" is shown in the display. After 30 minutes of standby time the instrument will be switched off completely.

8.4 Shelter of the CO sensor

The instrument is equipped with a special function protecting the sensors from getting harmed by too high CO concentrations.

Already during the first contact with the flue gas the MSI EM200 realises how fast the concentration rises and recognises if the measuring range (8,000 ppm) will be exceeded.

8.4.1 MSI EM200 without extension of CO measuring range

In EM200 without extension of the CO measuring range the pump is switched off and the display demands to draw in fresh air.

With pushing a button the pump may be started again. Has the concentration been very high, it is possible that the concentration at the sensor is still > 8,000 ppm. In this case bars are displayed as the CO value.

Don't start measuring until the concentration is < 1,000 ppm.

8.4.2 MSI EM200 with extension of CO measuring range

The instrument will start the flushing pump to protect the CO sensor and activate the extension of CO measuring range. CO may now be measured up to 3.000 %. The O2 sensor remains active.

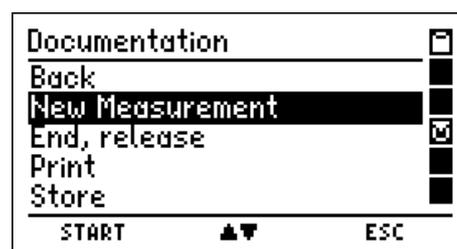
If the CO concentration becomes less than 0.600 % the flushing pump is switched off and the instrument will display the CO measurement values in ppm again.

8.5 Online data transfer

The MSI EM200 possesses an online data transfer feature. During normal measurement all measured data are transferred to the USB interface.

With the PC program DERAS from MSI all measured values may be shown online (numeric or graphic) on a PC's monitor. The PC program allows additional storing of the values in a chosen interval. The stored data may be printed in numeric or graphic charts.

9. Documentation Menu



Selectable functions are:

- Back = Calls the last display screen of actual measurement
- New Measurement = Start of a new measurement of the same type, the results of the actual measurement will be overwritten.
- End, release = End of measurement, the results are released and the menu, from which the measurement has been started, is called again.
- Print = The result is printed on an IR-printer. For this there has to be an intervisibility between printer and IR-transmitter of MSI EM200.
- Store = Calls menu "store data" (see 10.1)

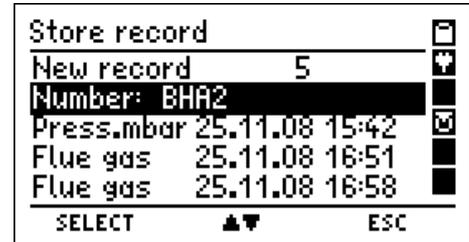
Instruction Manual Dräger MSI EM200 + EM200-i

10. Data processing

10.1 Store data

With (▲▼) mark "Number" (customer ID).

With (SELECT) call "selection and input of customer number" (see 12.). This function makes it possible, to alter the displayed customer ID, to select another existing number or to create a new customer number.



With (▲▼) mark the wanted data record (a new or an existing one).

The records may be displayed with date or customer ID (see 10.6).

With (STORE) all values may be stored together with date and time.

Is an existing data record selected it could be overwritten.



10.2 Data menu

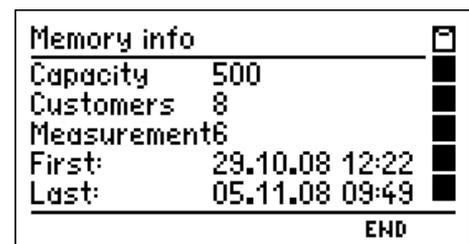
Selectable functions are:



- Info = Calls info function of the data menu (see 10.3)
- Show, pos at last = Show last stored data record (see 10.4)
- Show, pos at first = Show first stored data record (see 10.4)
- Clear data file = Delete all stored data records (see 10.5)
- Table settings = Selection of table type (see 10.6)

10.3 Info function of data menu

The display informs about the number of possible data records, the number of stored customer and measurement records and the date and time of the first and the last storing.

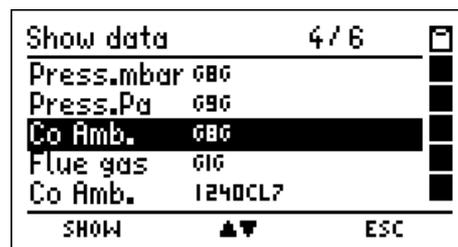


10.4 Show stored data records

If “Show, pos at first or at last” has been called, the stored data records are displayed. In the first case the first data record is marked, in other case the last one is marked.

The head line informs about the number of the marked record and the number of stored records. The table informs about the type of measurement and the customer number or date and time of storing (see 10.6).

With (SHOW) the result screen of this measurement may be displayed.

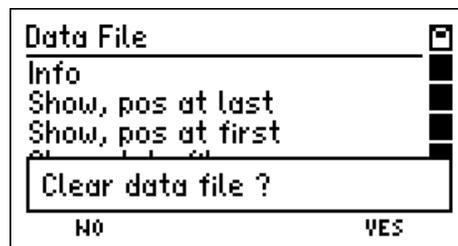


Following types of measurement may be shown:

- CO measurement = CO measurement (see 5.4)
- Comb.air O2 = Combustion air O2 concentration in air ducts (see 5.5)
- CO Amb. = CO concentration in ambient air (see 8.1)
- Flue gas = Flue gas analysis and average (see 5.2.6 and 5.3.2)
- Press. Pa = Pressure measurement in the range up to 100 Pa (see 6.3)
- Press. mbar = Pressure measurements in the range up to 100 mbar (see 6.2)

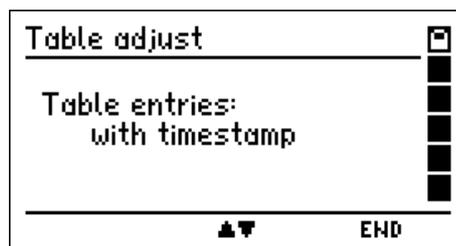
10.5 Clear Data Files

With (YES) all stored data records are deleted.



10.6 Selection of table type

With this function the table of data records (see 10.1 and 10.4) containing date and time or customer ID may be selected.



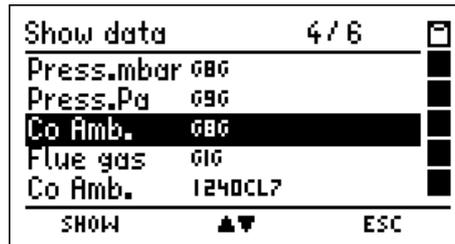
With (▲▼) can be changed between date and time or customer IDs.

With (END) this table type is accepted.

Instruction Manual Dräger MSI EM200 + EM200-i



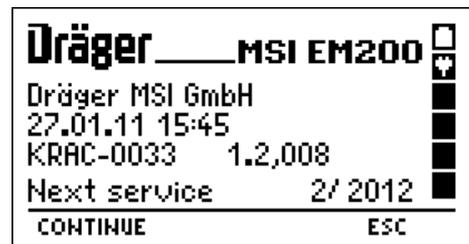
Display with date and time.



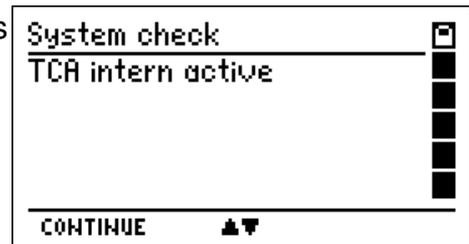
Display with customer IDs.

11. Info function

The display informs about the analyser (MSI EM200), the manufacturer (Dräger MSI GmbH), the date and time when info function was called, the serial number of the analyser, the version of the firmware (1.2,008) and the due date of next service.

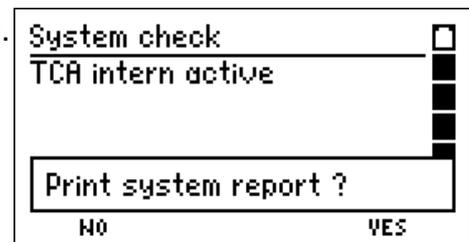


With (CONTINUE) all existing warnings and error messages will be displayed (see 14.).



With (CONTINUE) a complete system report can be printed.

All active warning and error messages together with all actual settings of the instrument will be printed. By means of this report, skilled service technician are able to find out easier, if malfunctions of the MSI EM200 are existent.

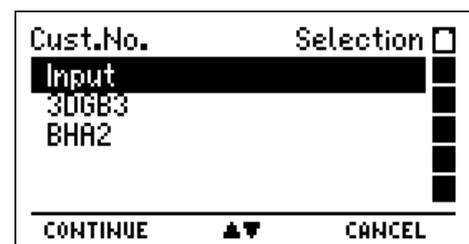


12. Selection or input of customer ID

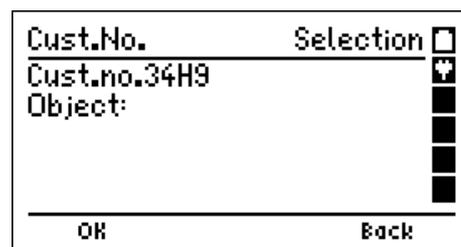
With the PC program PC200P it is possible to compile a list with customer number and name and send all or parts of it to the MSI EM200.

If customer numbers are stored, a customer number could be selected or changed with this function.

If no customer number is stored, it could be created with this function.

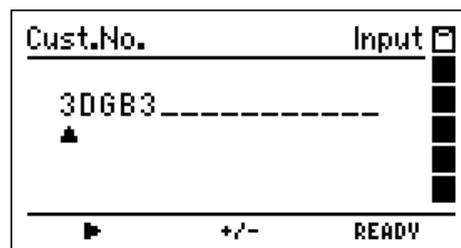


With (CONTINUE) the marked customer number and (if existing) object number and customer name will be displayed.



With (OK) the customer is selected and you skip back to the function from where "selection or input of customer ID" has been called.

Has "input of customer ID" been called, with (+ / -) the character which is marked by "▲" can be modified.



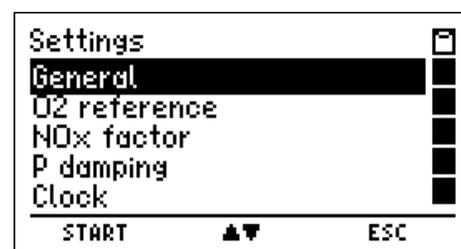
Selectable characters are letters (A-Z), numbers (0 - 9) and 4 additional characters (_ . - /). The sign "_" means no character.

With (▶) the next position on the right is marked with "▲".

With (READY) the shown customer number is stored, selected and you skip back to the function, from where "selection or input of customer ID" has been called.

The selected customer number is used for all measurements, until the instrument is switched off or a new customer number is selected.

13. Settings



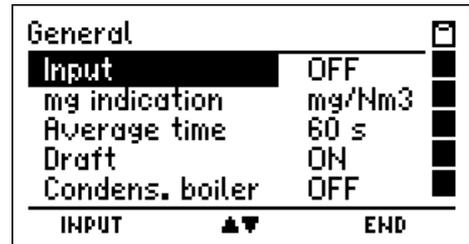
Selectable functions are:

- General = Call the menu for general settings (see 13.1)
- O2 reference = Adjustment of the O2-reference value (see 13.2)
- NOx-factor = Adjustment of NOx factor (see 13.3)
- P-damping = Select the damping (see 13.4)
- Clock = Adjust date and time (see 13.5)
- Backlight = Adjust backlight (see 13.6)
- Key beep = Switch on / off the key beep (see 13.7)
- Printer = Select HP or MSI printer protocol (see 13.8)
- Contrast = Adjust display contrast (see 13.9)
- Factory settings = Restore factory setting (see 13.10)
- Language = Select language of display text (see 13.11)

Instruction Manual Dräger MSI EM200 + EM200-i

13.1 General settings

With (INPUT) the marked setting may be modified.

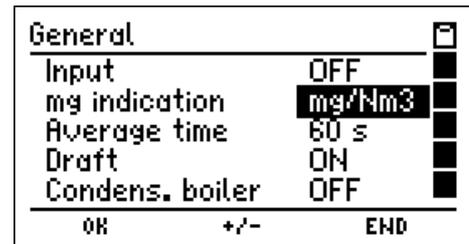


The changeable setting is displayed inverted.

With (+/- or ON/OFF) the setting may be modified.

With (OK) the inverted displayed setting is activated.

With (END) all general settings may be accepted.



Selectable general settings are:

setting	choices	function
Input	ON / OFF	enables / disables: input of vessel temperature input of soot numbers
mg-indication	OFF mg/Nm3 mg/MJ mg/kWh	mg indication disabled indication in ppm and mg/m ³ indication in ppm and mg/MJ (Mega-Joule) indication in ppm and mg/kWh
Average time	30 s 60 s 15 min 30 min	30 seconds average time 1 minute average time average time needed for solid fuel combustions 1/2 hour average time
Draft	ON / OFF	additional measurement of chimney draft
Condens. boiler	ON / OFF	stack loss calculation for condensing boilers

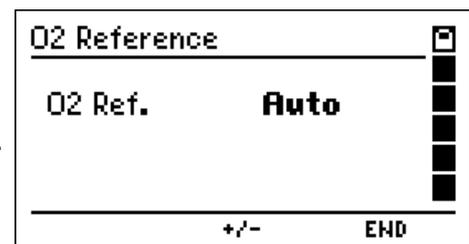
13.2 O2 Reference

With (+/-) the O₂ reference value may be modified.

Selectable settings are Auto and O₂ reference values from 0 % until 20 %. Auto means, the O₂ reference value depends of the fuel type (liquid and gaseous fuels = 3 %).

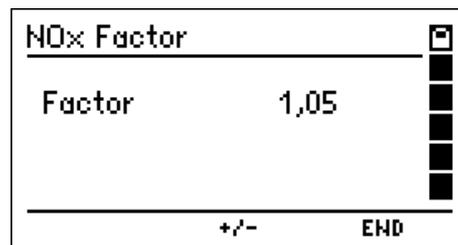
Concentrations regarding to the reference O₂ are calculated as follows:

$$CO_{\text{Reference}} = CO_{\text{measured}} * (21 - O2_{\text{Reference}}) / (21 - O2_{\text{measured}})$$



13.3 NOx factor (only at MSI EM200 with NO sensor)

This function calculates NOx, if the part of NO₂ from NO is known. Is e.g. from a measurement known, that the NO₂ part is 5 % from the NO concentration, the NO measurement value has to be multiplied with 1.05, to get NOx. For this adjust the NOx factor to 1.05.

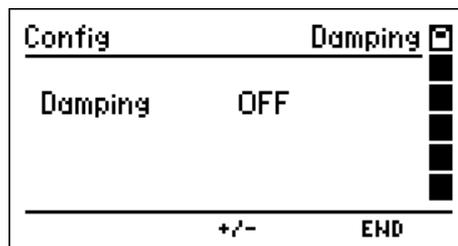


13.4 Selection of damping

Selectable damping settings are:

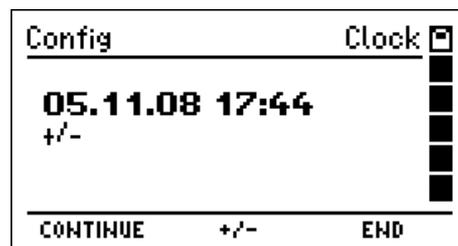
- OFF = no damping
- MEDIUM = medium damping
- HIGH = strong damping

The selected damping remains held even after switch off.



13.5 Date and time adjust

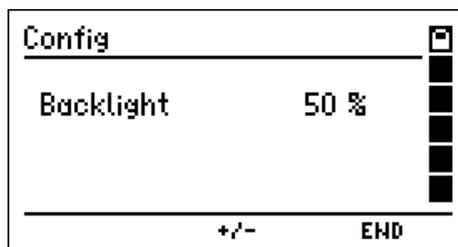
With (+/-) the position marked with +/- may be modified.
 With (CONTINUE) the next position may be marked.
 With (END) the displayed date and time are accepted.



13.6 Backlight adjust

Selectable intensity levels are: 0 %, 25 %, 50 %, 75 % and 100 %.

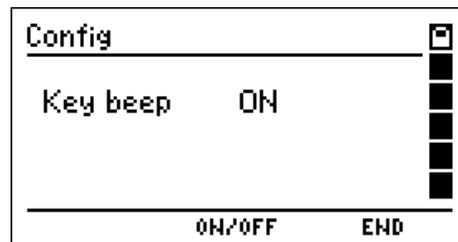
The selected intensity level remains held even after switch off.



13.7 Key beep switch on / off

With (ON / OFF) "key beep ON" or "key beep OFF" may be selected.

The selected function remains held even after switch off.



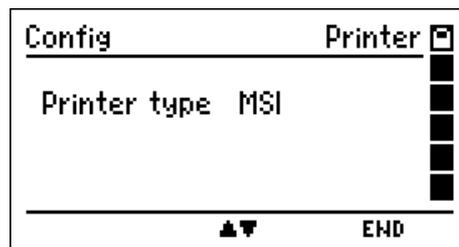
Instruction Manual Dräger MSI EM200 + EM200-i

13.8 Printer protocol selection

With (▲▼) the printer MSI IR3 or HP may be selected.

Printer MSI IR3: Data transfer and printing is much quicker than with HP compatible printers.

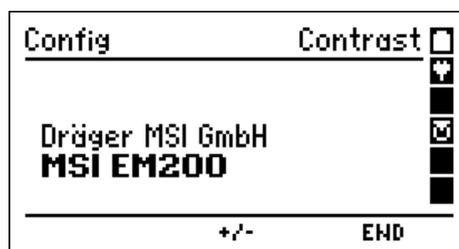
Printer HP: Data transfer is conforming to the HP protocol and fits to all HP compatible printers, of course for MSI IR3 too.



The selected function remains held, even after switch off.

13.9 Display contrast adjust

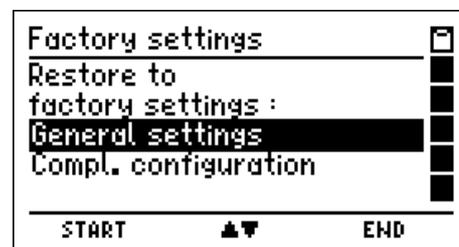
With (+/-) the contrast of the display may be changed. The selected contrast remains held, even after switch off.



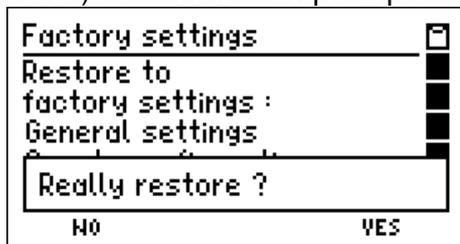
13.10 Factory setting restore

With this function all modified settings could be cancelled and the factory settings could be restored.

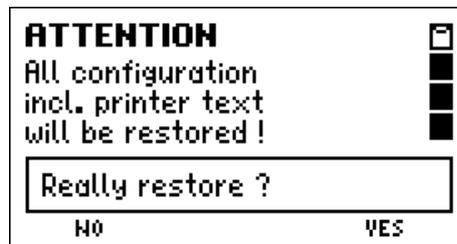
The function "general settings" restores all settings, which are described in chapter 13. with the factory settings. The function "complete configuration" restores additionally all configurations which are made with the software "MSI EM-Tools" as for example modified printer text or modified display screens.



With (START) a confirmation prompt occurs.



or

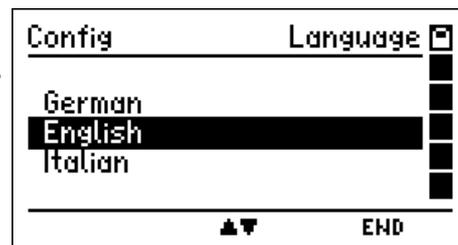


With (Yes) all modified settings are cancelled and the factory settings are restored and if "complete configuration" has been selected, all configurations which have been made with the software MSI EM-Tools.

After that the previous display screen is called.

13.11 Display language selection

With (▲/▼) the wanted language may be marked.
The selected language remains held even after switch off.



13.12 Efficiency and stack loss

The stack loss of normal boilers is calculated as follows:

$$qA = (TG - TCA) * [(A2 / (21 - O2)) + B]$$

With:

- TG = flue gas temperature
- TCA = combustion air temperature
- O2 = oxygen concentration of flue gas in Vol. %
- A2, B = fuel type dependent constants

This stack loss is always calculated and displayed as qA and can be printed and stored.
The efficiency is calculated from the stack loss as follows: $\text{Eta} = 100 - qA$.

Is the calculation for condensing boilers enabled (see 13.1) the energy has to be considered, which became free when the flue gas condensates. Now the calculation of the stack loss for condensing boilers is:

$$qA_B = qA - qA_{\text{Cond}}$$

At this qA_{Cond} is a function, which depends from the fuel type, the flue gas temperature, and the difference "Tdew – TG". The value of this function is zero or negative. Tdew means "dew point temperature".

The stack loss for condensing boilers is displayed additionally as qA-CB, and may be printed and stored. The efficiency for condensing boilers is calculated from the stack loss qA-CB as follows: $\text{Eta-CB} = 100 - qA\text{-CB}$.

Instruction Manual Dräger MSI EM200 + EM200-i

14. Warning hints, error messages and operation references

Already after being switched on, as well as during the measurement process, the MSI EM200 checks the function of all measuring channels. Warning hints and error messages are shown before the selection of functions or during normal function.

14.1 Warning hints

14.1.1 TCA intern active

This warning hint (TCA = **T**emperature sensor for **C**ombustion **A**ir) is displayed if no external sensor is plugged in or if the instrument can not recognise it. The MSI EM200 switches to an internal temperature sensor, so that the stack loss and the efficiency may be measured without an external temperature sensor. The internal temperature sensor has not the accuracy and the response time of an external sensor and does not meet the demands of the European Standard.

14.1.2 TG missing / fault

This warning hint (TG = **T**emperature sensor for **F**lue **G**as) is displayed, if the thermocouple of the probe can not be detected, because it is missing (probe has no thermocouple) or because the thermocouple or the plug is faulty. All values, which need this temperature, are displayed as "- - -".

14.2 Error messages

14.2.1 Error messages regarding sensors

Error message	Error cause	Remedy
O2 sensor	probe has been in flue sensor defect	calibrate again with fresh air service
CO sensor	probe has been in flue sensor defect	calibrate again with fresh air service
NO sensor	NO sensor has been without current others like CO sensor	check function see CO sensor
NO2 sensor	probe has been in flue sensor defect	calibrate again with fresh air service
SO2 sensor	probe has been in flue sensor defect	calibrate again with fresh air service
pressure sensor	sensor with pressure during calibration sensor defect	calibrate again without pressure service

14.2.2 General error messages

Error message	Error reason; remedy
system temperature	operating temperature range exceeded; vary temperature, service
junction temperature	operating temperature range exceeded; vary temperature, service
battery temperature	operating temperature range exceeded; vary temperature, service
battery voltage	voltage not between 4.4 V and 6.5 V; replace battery (service)
battery current	battery current for charging or operating too high; service
battery error	battery manager data error; charge battery
set clock	clock lost data; charge battery, set clock
gas flow	gas flow out of operating range; check gas duct, service
options	data record options error; factory service
settings	wrong settings; check and change settings
calibration data	error in calibration data record; service
data memory	error in memory data record; service
next service	next service data error; service
fuel table	fuel table error; reload fuel table with PC program "EM-Tools"
display table	display table error; reload display table with PC program "EM-Tools"
printer table	printer table error; reload printer table with PC program "EM-Tools"
system configuration	system configuration error, service

Instruction Manual Dräger MSI EM200 + EM200-i

14.3 Operation references

14.3.1 Operation references - symbols

On the display in the right column symbols may indicate following activated functions:

Symbol 1		charge of battery
Symbol 2		battery is charging
Symbol 3		error
Symbol 4		internal pump is working
Symbol 5		internal valve is switched

14.3.2 Electric power supply

The instrument possesses a rechargeable nickel metal hydride battery. In principle only the provided charger may be used for charging the MSI EM200. The sensors of the instrument need continuous power supply (as well if the instrument is switched off). Please charge the instrument timely. Charge the measuring device after every use.

The charge condition of the battery is checked by the instrument and displayed. Becomes the voltage and the capacity of the battery too low, this is indicated by red flashing of a LED. The battery should be charged immediately.

The charging lasts 1 to 4 hours, depending on the charge condition. During charging the LED on top of the instrument is lighted red. At the beginning of the charging a green flashing of the LED indicates that battery and charging system are checked. After finishing of the charging the red light of the LED changes to green. That means the battery gets only conservation charge.

If the charging circuit has an error detected, the LED will flash green and red together.

Please note, that the measuring instrument may be charged only at ambient temperatures between + 5 °C and + 35 °C. Do not charge or store the instrument in the sun.

Change battery only with an original MSI spare part.

If the charging has been forgotten, the instrument will be shut off automatically. If it is impossible to switch on the MSI EM200, because of low voltage, plug in the charger and switch on the instrument again !!

15. Technical data

15.1 General technical data

general technical data	
humidity	10 - 90 % RH not condensing
barometric pressure	800 ... 1,100 hPa
operating temperature	+5 °C ... + 40 °C
storage temperature	-20 °C ... + 50 °C
dimensions	ca. 165 mm x 195 mm x 75 mm
weight	ca. 1,100 g
approvals	EN 50379 Part 1-3
charger	wall power supply prim. 100 - 240 V; sec. 12 V; 0.8 A
battery	internal NiMH battery, 4.8 V 2,000 mAh
gas sampling	membrane pumps for gas sampling and for cleansing of the sensor with fresh air in case of CO measuring range change-over (Option)
gas conditioning	integrated, position independent, gas conditioning cartridge with condensate trap and particle filter
interfaces	USB as PC interface infrared for printer and PDA multiple function interface for accessory devices
display	graphic display, adjustable illumination

Instruction Manual Dräger MSI EM200 + EM200-i

15.2 Technical data of measured and calculated values

Measurement	Principle	Range	Resolution	Accuracy
temperature combustion air	PTC	-10...+100 °C	0.1 °C	< ± 1 °C
temperature flue gas	thermocouple	-10...1000 °C EM200-i: ...1,200 °C	0.1 °C	< ± 2 °C or < ± 1.5% of mv
O ₂ , oxygen	el.-chem. sensor	0 ... 25 Vol. %	0.1 Vol. %	< ± 0.3 Vol. %
CO, carbon monoxide	el.-chem. sensor, H ₂ -compensated	0 ... 8,000 ppm	1 ppm	0... 4,000 ppm: < ± 20 ppm or < ± 5 % of mv
CO+ *, carbon monoxide	measuring range change-over	0.600..3.000 Vol. %	0.001 Vol. %	< ± 10 % of mv
NO *, nitrogen monoxide	el.-chem. sensor	0 ... 2,000 ppm	1 ppm	± 5 ppm or < 5 % of mv
NO ₂ *, nitrogen dioxide	el.-chem. sensor	0 ... 200 ppm	1 ppm	± 5 ppm or < 5 % of mv
SO ₂ *, sulphur dioxide	el.-chem. sensor	0 ... 3,000 ppm	1 ppm	± 10 ppm or < 5 % of mv
low pressure	piezo-resistance	-100 ... +100 Pa	0.1 Pa	< ± 2 Pa or < ± 5 % of mv
draft	piezo-resistance	-10 ... +100 hPa	0.01 hPa	< ± 0.5 hPa or < ± 1% of mv
pressure (difference)	piezo-resistance	-10 ... +100 mbar	0.01 mbar	< ± 0.5 mbar or < ± 1% of mv
Calculated values				
CO, undiluted	calculated	0 ... 9,999 ppm	1 ppm	
CO ₂	calculated	0 ... 20 Vol. %	0.1 Vol. %	
stack loss	calculated	-20 ... +100 %	0.1 %	
excess air	calculated	1.00 ... +9.99 %	0.01 %	
CO, NO, NO ₂ , SO ₂	calculation in	mg/ Nm ³ , mg/ kWh or mg/MJ		

mv = Measuring value, * = depends on EM200 version

16. Maintenance and service

16.1 Storing

El.-chem. gas sensors react to gases in the ambient, even if the instrument is switched off. Make sure, that the instrument is stored in a place with room temperature without contamination with solvents, exhaust gases or combustibles and that it becomes recharged periodically.

16.2 Maintenance

The gas conditioning cartridge should be cleaned after been in use. In addition to that, the cartridge should be checked due to tightness (O-ring seal). The filter discs and fleece have to be changed if dirty (see 3.4 too).

The housing of the instrument can be cleaned with a damp cloth. Take care that the gas outlet at the bottom of the instrument will not get blocked.

16.3 Service

In order to assure accurate measurement and the reliability of the functions the MSI EM200 should be checked according to requirement of EN 50379 and if applicable be calibrated by an authorised service point every 12 month.

16.4 Consumables and accessories

Printer with infra-red data transmission 5600401

Paper for IR-Printer 5690151

Consumable set 2 5600411
consisting of:

10 x disc filter

20 x filter fleece ø 26