Instruction Manual Dräger MSI EM200-s

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Content

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1. Reference notes

1.1 Approvals

The flue gas analyser MSI EM200-s is approved according the European Standard EN 50379 part 1 and part 3.

1.2 Information for use

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

Any use of the MSI EM200-s 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!
Only locked values can be printed and stored.

1.3 Service

To maintain accuracy and correct function the MSI EM200-s should be checked and re-calibrated 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-s 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.

Front

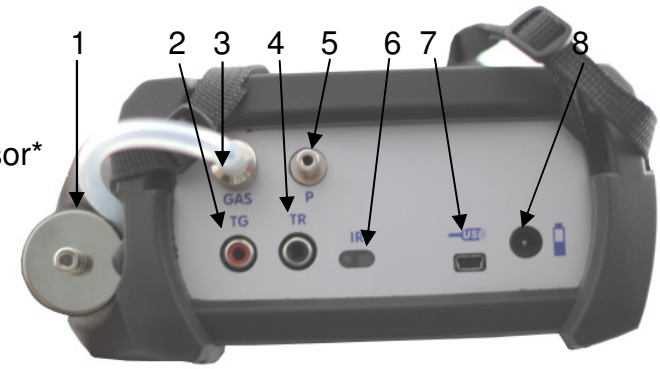
Gas conditioner

Graphic display, illuminated

Function keys "F, ▲, ▼, H"

Top

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



* Here you can connect different combustion air temperature probes.

3. Starting and operating keys

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-s. Never forget to use the gas conditioner.

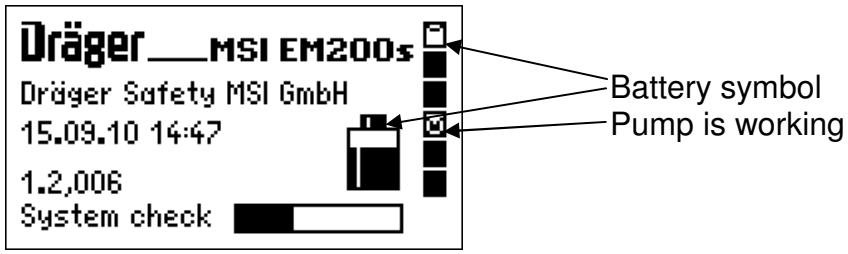
Verify that fresh air will be sucked through the gas conditioner before switching on, because the zero signals of the sensors are checked with fresh air.

3.2 Function keys

3.2.1 Switching on / off of the MSI EM200-s

Switch on the instrument by pushing for a second the buttons “F” and “H” together. If the annual service has do be done, a month earlier the MSI EM200-s displays a reminder.

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 system check lasts 30 seconds.
If errors have been detected, warning hints or error messages (see 13.) will be generated. Otherwise the menu “selection of functions” (see 4.) will be called.

Switch off the instrument 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 Function of the buttons

The function of the buttons is always shown in the last row of the display.

With “H” a measurement is stopped or it is skipped back a function level. In the function menu the function “Switch-off” is selected.

With “F” a selected function will be achieved or a set value will be taken over.

With “▲” or “▼” a function will be selected or a value will be set.

3.3 Check of measuring gas duct (tightness test)

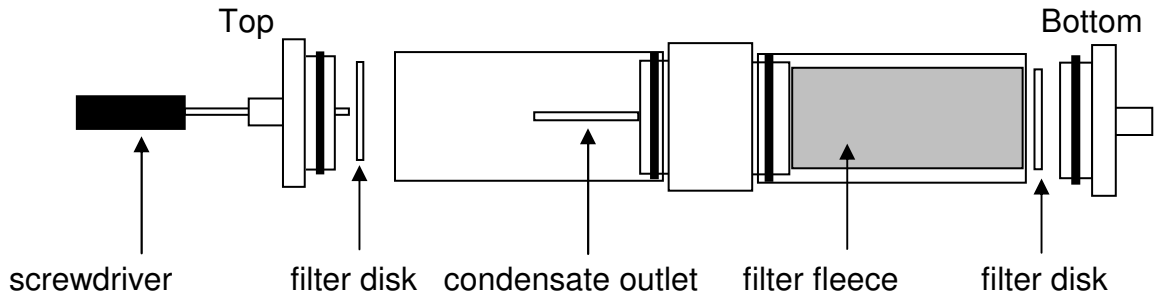
The test of the tightness of the measuring gas duct may only be done by an indirect method: Close the gas inlet of the probe, if the measuring gas duct is tight, the performance of the instruments pump will change and you may hear a change of the pump sound. If you do not hear a change of the pump sound, check the measuring gas duct with a flow meter.

3.4 Terminating measurement

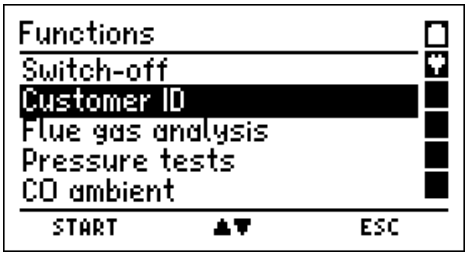
After the measurement remove the probe from the flue gas pipe and allow fresh ambient air to be sucked in for 1 to 2 minutes. After this, switch off the instrument by using the switch off function in the menu “selection of functions” (see 4.) or by pushing “F” until the display reads “Switch off” (ca. > 3 sec).

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

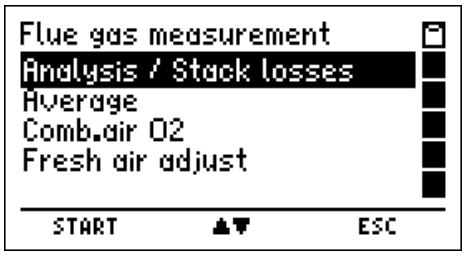


Selectable functions are:

Switch-off	= Switches off the instrument
Customer ID	= Calls function “selection or input of customer ID” (see 11.)
Flue gas analysis	= Calls menu “select type of flue gas measurement” (see 5.1)
Pressure tests	= Calls menu “pressure measurements” (see 6.)
CO ambient	= Calls menu “ambient air CO measurement” (see. 7.1)
Memory	= Calls “data menu” (see 9.2)
Info	= Calls “info function” (see 10.)
Settings	= Calls menu “settings” (see 12.)

5. Flue gas measurements

5.1 Select type of flue gas measurement



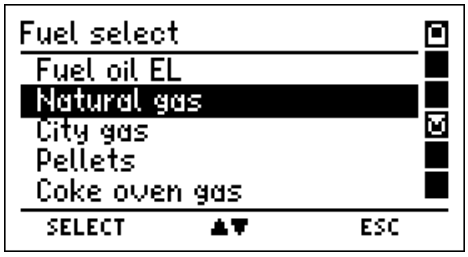
Selectable flue gas measurements are:

Analysis / stack losses	= Starts flue gas analysis (see 5.2)
Average	= Starts measurement of average values (see 5.3)
Comb.air O2	= starts O_2 measurement of combustion air in ducts (see 5.4)
Fresh air adjust	= zero point calibration with fresh ambient air (see 5.5)

5.1.1 Preparing for flue gas analyses and measurement of average values

Connect the hose of the probe with the gas conditioner and then the plug of the thermo-couple (marked red) with the socket marked “TG”. The combustion temperature sensor is plugged into the socket “TR”.
After starting the burner wait until the combustion is steady going. Direct after start the burner may emit high concentrations of toxic gases and soot and this would needlessly pollute the instruments sensors.
After start of the measurement the fuel type selection (see 5.1.2) is called.

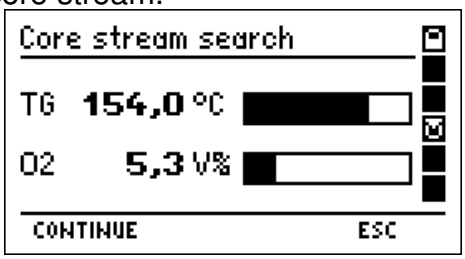
5.1.2 Fuel type selection



Set the fuel type with (SELECT).

5.1.3 Core stream detection

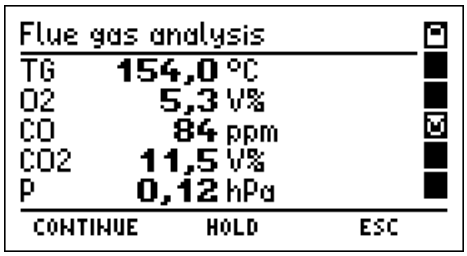
In the flue gas stream exist some regions, where only parts are filled with exhaust gas. Therefore it is importend to take the gas out of the core stream. The core stream is characterised by maximum temperature and minimum O2 concentration. This program helps to fix the probe in the core stream.



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 Flue gas analysis

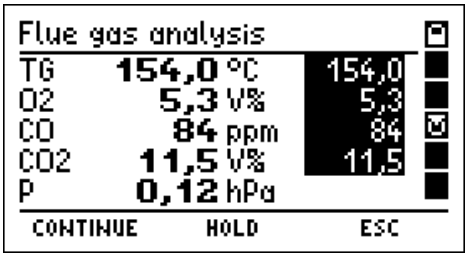
5.2.1 Display of main analysis values



In the first column the measuring channels are displayed, in the second column its value and in the third the dimension.

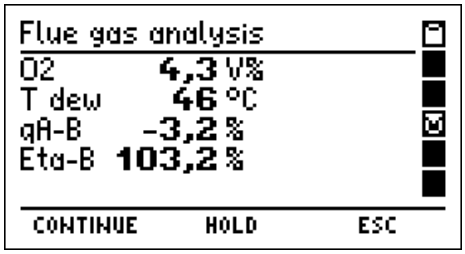
If dashes are displayed this means there exist no value or the value is too big (exceeds measuring range) or the calculation is forbidden (e.g. division by zero).

Only locked values can be printed and stored.



The display shows the actual and the locked (inverted) values.

The calculation of flue gas loss for condensing boilers may be activated (see 12.1).



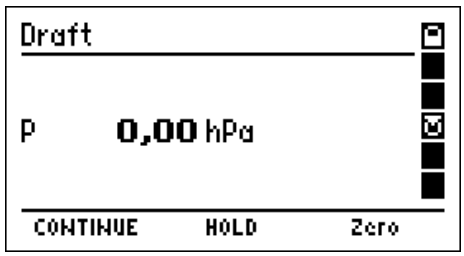
The used abbreviations for the measuring channels mean:

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

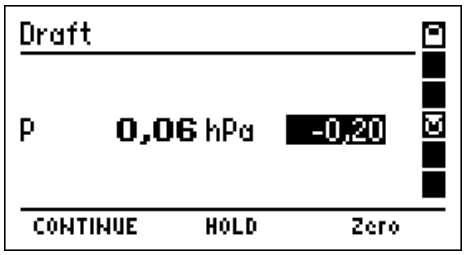
5.2.2 Separate measurement of flue gas draft

For measurement of the draft with a standard probe the function “separate draft measurement” has to be activated (see 12.1), 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 12.1) disabled, this function is missed out.



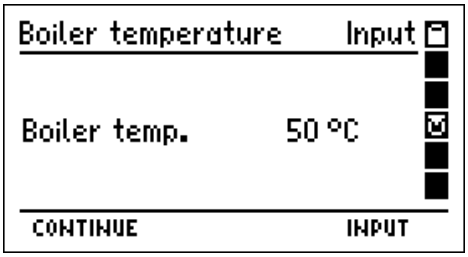
For measurement with a standard probe, plug the hose of the gas conditioner from the gas inlet onto the (+) pressure inlet.
With (HOLD) the actual shown reading will be locked. The pressure value in this case will be locked and unlocked independent from the other values.



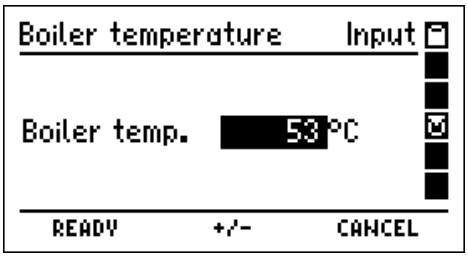
The display shows the actual and the locked (inverted) pressure reading.
After the measurement is finished, do not forget to connect the tube to the gas inlet again!

5.2.3 Input of boiler temperature

Is the function “input” (see 12.1) deactivated and no values are locked, this function is missed out.

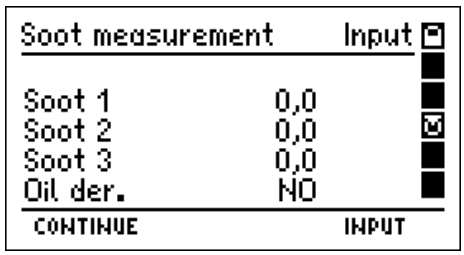


With (INPUT) the boiler temperature is displayed inverted and may be set.

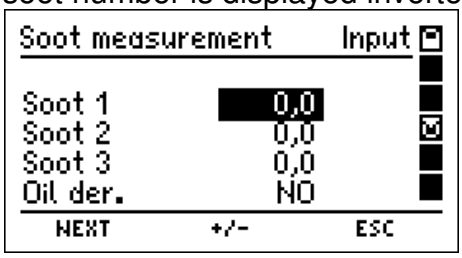


Pressing the button for a longer time accelerates the changing of the value.

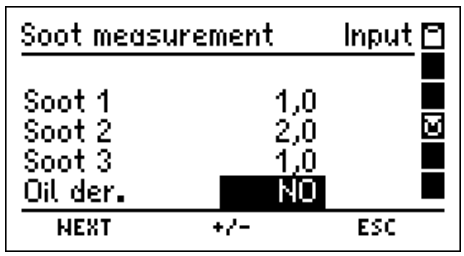
5.2.4 Input of soot numbers



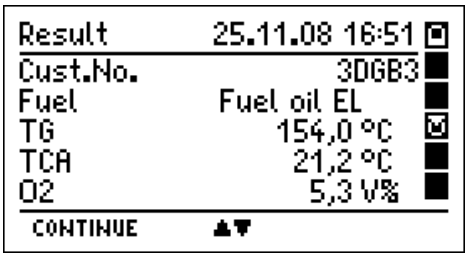
With (INPUT) the value of the soot number is displayed inverted and may be set.



If all inputs have been done, with (NEXT) you may skip to “result of flue gas analysis”.



5.2.5 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 column the measuring channel is displayed and in the second the values together with their units.
With (▲▼) you may scroll the reading and thus all measured and calculated values can be shown.
With (CONTINUE) you may skip to the “documentation menu” (see 8.).

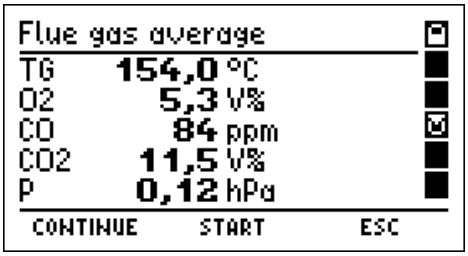
5.3 Average measurements

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.

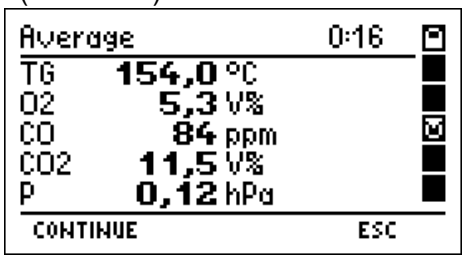
The average time, which should be used by the MSI EM200-s, may be selected in the configuration function (see 12.1).

5.3.1 Display of main analysis values

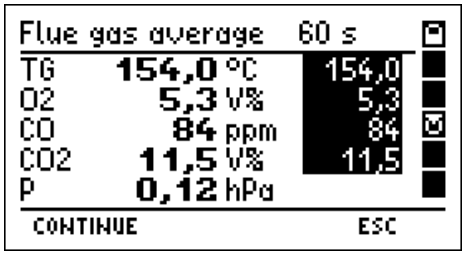


In the first column the measuring channels are displayed, in the second the values and in the third the dimensions.

After (START) the chosen time (see 12.1) runs.



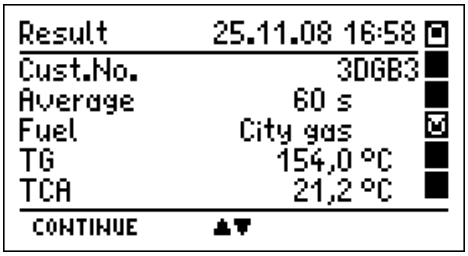
After the average period the current and the mean measurement values (inverse) are displayed.



As described in the chapters 5.2.2 to 5.2.4 the separate measurement of flue gas draft, the input of boiler temperature and the input of soot numbers may be called.

After the average measurement is finished "result of average measurement" (see.5.3.2) is called.

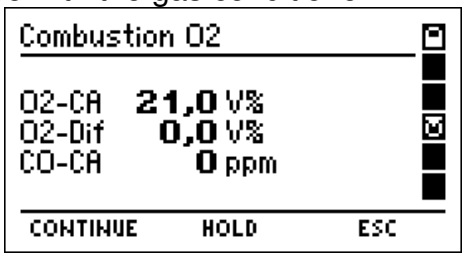
5.3.2 Result of average measurement



With (CONTINUE) the “documentation menu” (see 8.) is called.

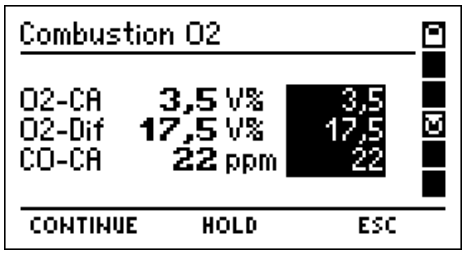
5.4 Combustion air measurement in air ducts

At room-air independent combustions, you may check the tightness of the combined combustion-air duct and flue exhaust system, by measuring the O_2-concentration in the air duct with a special multi hole probe.
Connect the hose of the probe with the gas conditioner.

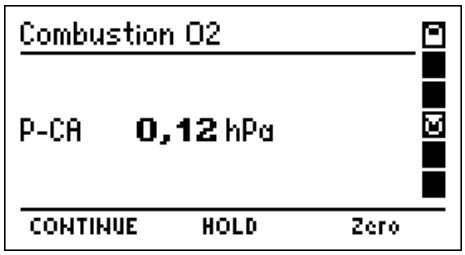


In fresh air the value of the O_2 concentration is 21 Vol. %. Is the flue exhaust pipe not tight, the O2 concentration will decrease. Displayed are the value of O2 (O2-CA), the O2 difference to 21,0 Vol. % (O2-Dif) and the value of CO (CO-CA).

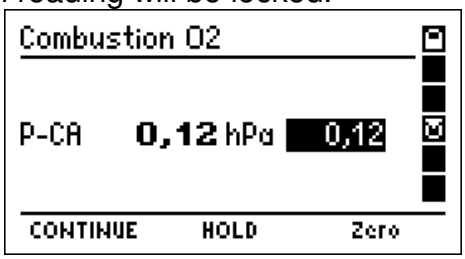
Displayed are the actual and the locked values.



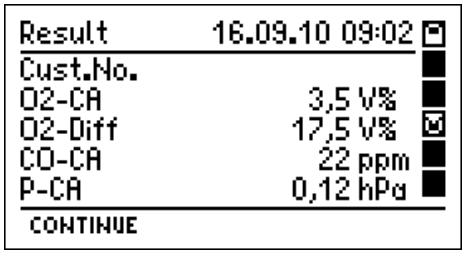
With (CONTINUE) the pressure measurement in the combustion air duct is called. For measurement with a standard probe, plug the hose of the gas conditioner from the gas inlet onto the (+) pressure inlet.



With (HOLD) the actual shown reading will be locked.



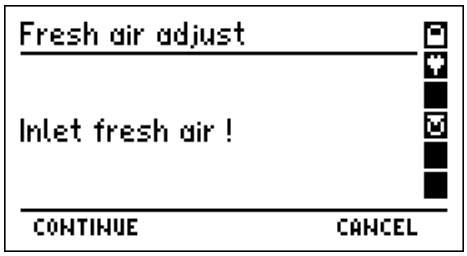
With (CONTINUE) the result of the combustion air measurement is called.



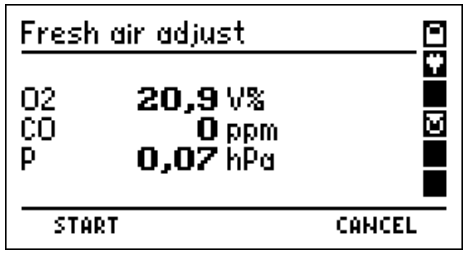
With (CONTINUE) “documentation menu” is called (see 8.).

5.5 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.

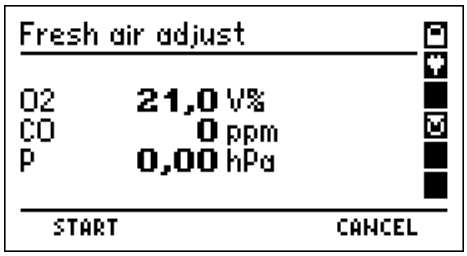


The MSI EM200-s asks to care that fresh air may be sucked through the gas conditioner. There should no tube be connected to the pressure inlet.



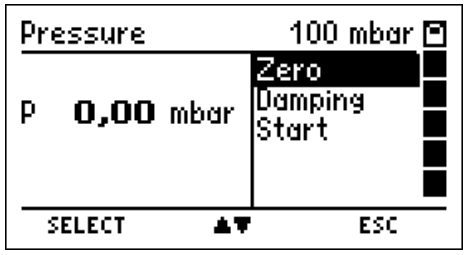
With (CONTINUE) the actual values of all el.-chem. sensors and of the pressure sensor are displayed.

With (START) all zero points are recalibrated.



6. Pressure measurement

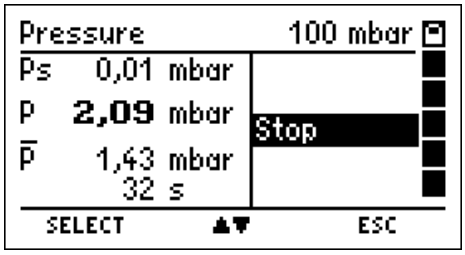
For pressure measurement (gas or nozzle pressure) connect pressure inlet via pressure probe with the measuring point.



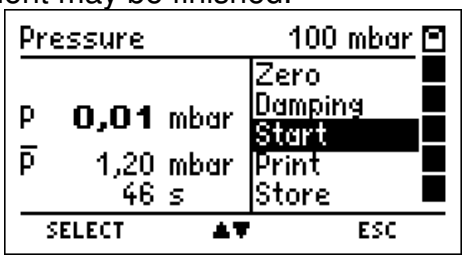
On the left of the display screen the pressure value together with its dimension unit and on the right the selectable functions are displayed.

Selectable functions are:

Zero = The shown value is set to zero
Damping = Calls adjusting the damping value (see 12.3)
Start = Start of pressure measurement



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 first value is the actual pressure; the second value is the average of the last measurement. The start-, the stop- and 10 until 20 measurement values between them and the elapsed time 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.

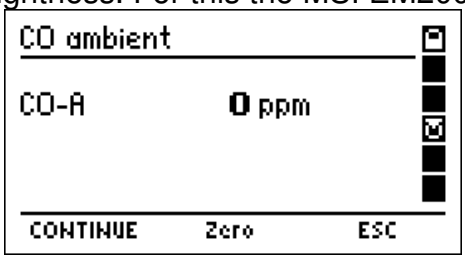
Selectable functions are:

Zero = The shown value is set to zero
Damping = Calls function for adjusting the damping value (see 12.3)
Start = Start of a new pressure measurement, the actual values are released.
Print = Transfer of measurement data to an IR printer
Store = Calls the function “storing of pressure measurements” (see 9.1)

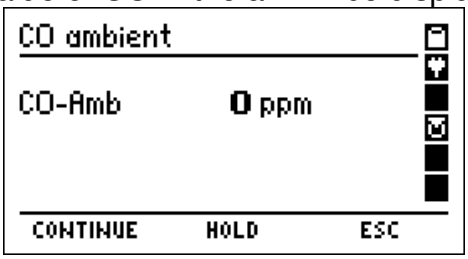
7. Special functions

7.1 Ambient air CO measurement

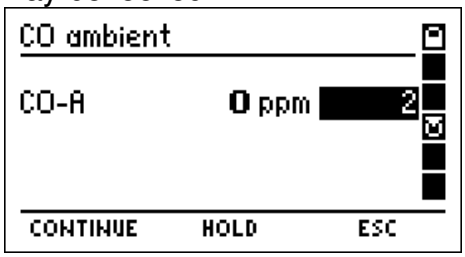
In some countries (e.g. Spain) exists a regulation, to measure ambient air CO at the site of a combustion to prove their tightness. For this the MSI EM200-s needs no external sensor.



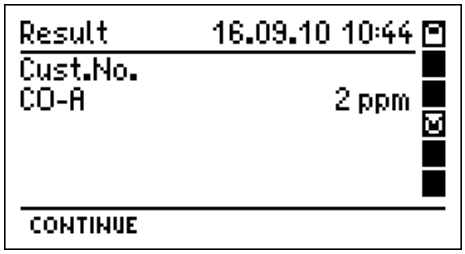
At a place with fresh air without CO content, the reading has to be 0 ppm.
Is the reading not 0 ppm, pull the hose off of the gas inlet of the gas conditioner and wait for a while and push (ZERO). The displayed value will become zero, this zero point is independent from the CO zero point of normal flue gas measurements.
Slip the hose on the gas inlet again!
With (CONTINUE) the actual value of CO in the air will be displayed.



Go to the site of the combustion. The MSI EM200-s sucks ambient air in through the normal probe and displays the CO concentration of the ambient air.
With (HOLD) the actual value may be locked.



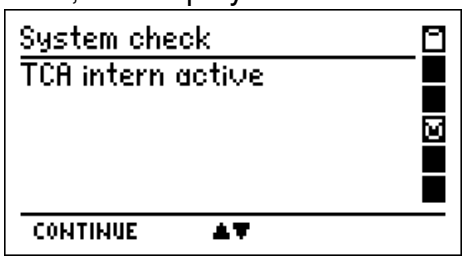
With (CONTINUE) the result of the ambient air CO measurement is displayed:



With (CONTINUE) the “documentation menu” may be called (see 8.).

7.2 Measuring Combustion Air Temperature

The MSI EM200-s 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.
If no external sensor is plugged in, it is displayed after the check function.



In order to enhance the accuracy of the measurement and according to the requirements of EN 50379 part 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.

7.3 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 and the gas pump will be switched off. If any key will be touched the MSI EM200-s automatically switches on again. The information "standby" is shown in the display. After 30 minutes of standby time the instrument will be switched off completely.

7.4 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-s realises how fast the concentration rises and recognises if the measuring range (8,000 ppm) will be exceeded.

The pump is switched off and the display demands to draw in fresh air.

By pushing a button the pump starts 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.

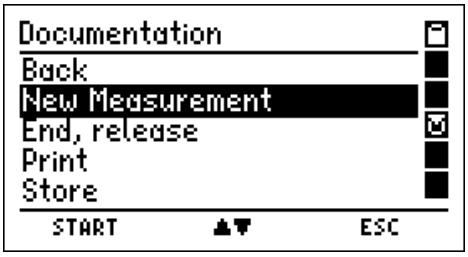
Wait until the concentration is < 1,000 ppm before starting measuring again.

7.5 Online data transfer

The MSI EM200-s 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 PCs 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.

8. Documentation Menu



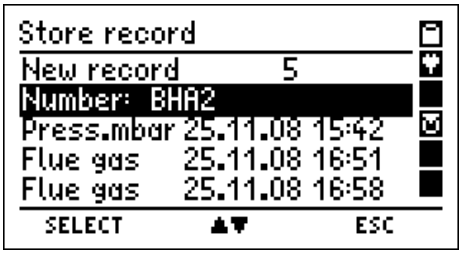
Selectable functions are:

Back	= Skip back to the last display screen of actual measurement
New Measurement	= Start of a new measurement of the same type, the results of the actual measurement are not available.
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.
Store	= Calls menu “store data” (see 9.1)

9. Data processing

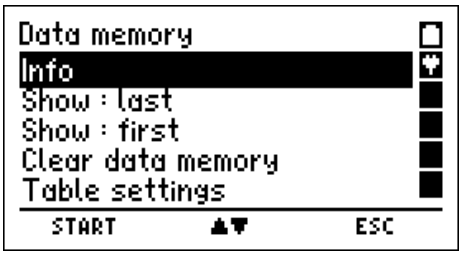
9.1 Store data

Has no customer ID been selected before measurement, with (STORE) all values may be stored together with date and time. Has a customer ID been selected before measurement (see 11), with (STORE) “New record” all values may be stored under the displayed customer ID.
With (▲▼) mark “Number” (customer ID).
With (SELECT) “selection and input of customer ID” (see 11.) may be called. This function makes it possible, to alter the displayed customer ID, to select another existing number or to create a new customer ID.



Is an existing data record selected, this data record may be overwritten. The records may be displayed with date or customer ID (see 9.6).

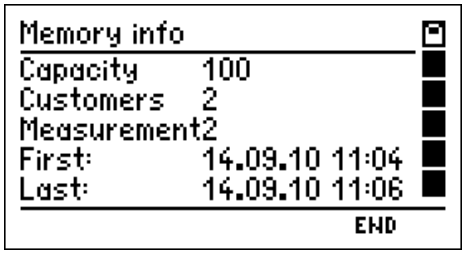
9. 2 Data menu



Selectable functions are:

Info	= Calls info function of the data menu (see 9.3)
Show, pos at last	= Show last stored data record (see 9.4)
Show, pos at first	= Show first stored data record (see 9.4)
Clear data file	= Delete all stored data records (see 9.5)
Table settings	= Selection of table type (see 9.6)

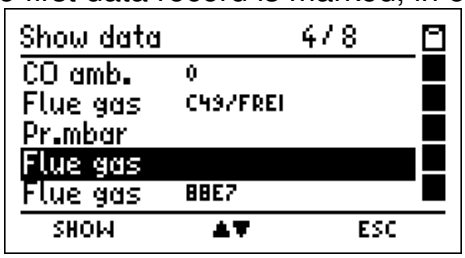
9.3 Info function of data menu



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.

9.4 Show stored data records

If "Show, pos at first" or "Show, pos 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.

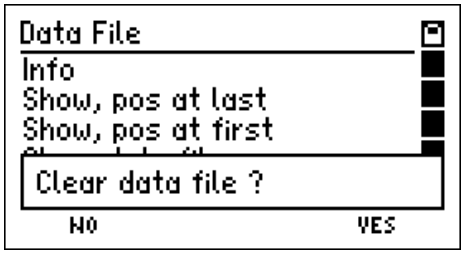


The head line informs about the number of the marked record and the number of stored records. The table informs about the type of measurement and the customer ID or date and time of storing (see 9.6).
With (SHOW) the result screen of this measurement may be displayed.

Following types of measurement may be shown:

Comb.air O2	= Combustion air O2 concentration in air duct (see 5.4)
CO Amb.	= CO concentration in ambient air (see 7.1)
Flue gas	= Flue gas analysis and average (see 5.2.5 and 5.3.2)
Press. mbar	= Pressure measurements (see 6)

9.5 Clear Data Files



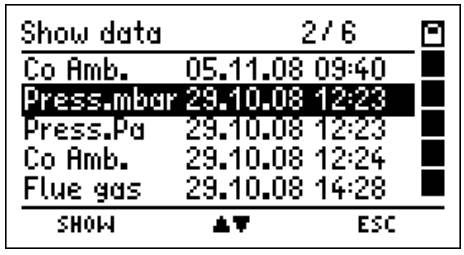
With (YES) all stored data records will be deleted.

9.6 Selection of table type

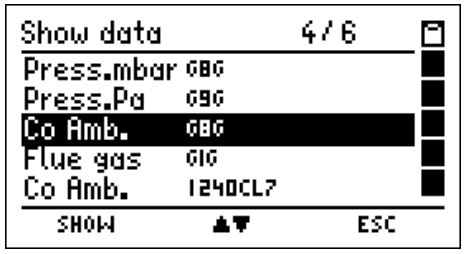
With this function the description of the table of data records (see 9.1 and 9.4) may be selected, either date and time or customer IDs.

With (▲▼) may be changed between the description, date and time or customer IDs.
With (END) the table type is accepted.

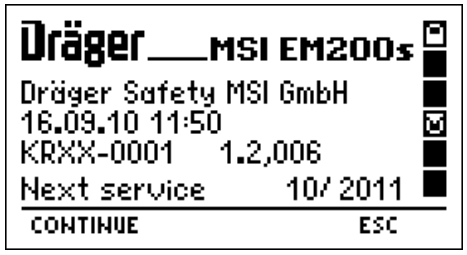
Description with date and time:



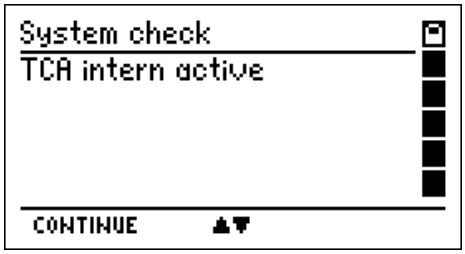
Description with customer numbers:



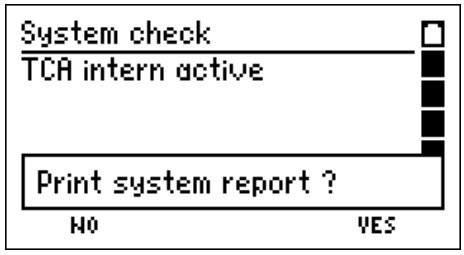
10. Info function



The display informs about the analyser (MSI EM200-s), the manufacturer (Dräger MSI GmbH), the date and time when info function was called, the version of the firmware (e.g. 1.2,006) and the serial number of the analyser.
With (CONTINUE) you get informed about all existing warnings and error messages (see 13.).



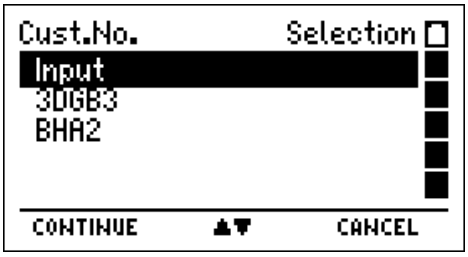
With (CONTINUE) a complete system report may be printed.



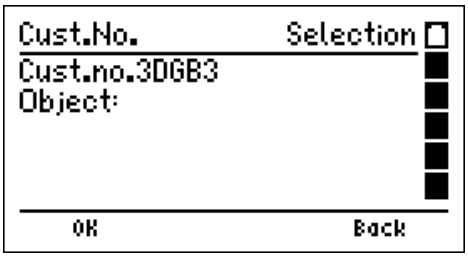
By means of this report, skilled service technician are able to find out easier, if malfunctions of the MSI EM200-s are existent.

11. Selection or input of customer ID

With the PC program “EM Tools” it is possible to compile a list with customer number and name and send all or parts of it to the MSI EM200-s.
With this function you may create new customer numbers, or if numbers are stored in the MSI EM200-s you may select one of them or alter it.



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

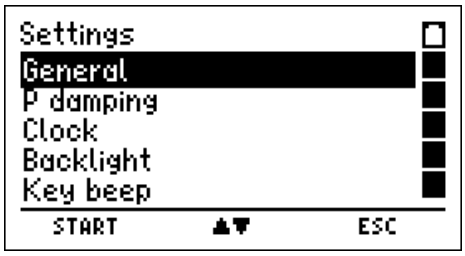


Has “Input” been called, the character which is marked by “▲” may be modified or a new customer ID may be created.

Selectable characters are letters (A-Z), numbers (0 - 9) and 4 additional signs (_ . - /). 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.

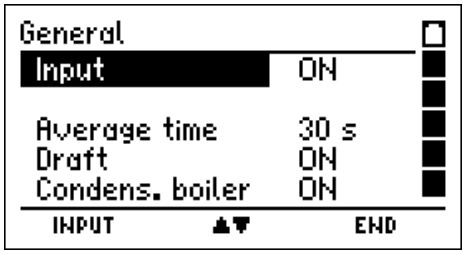
12. Settings



Selectable functions are:

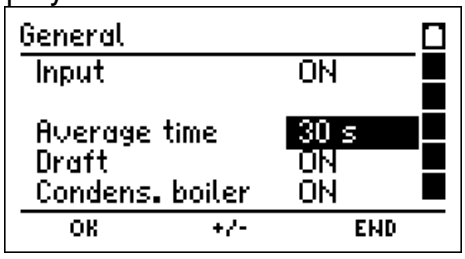
General	= Call the menu for general settings (see 12.1)
P-damping	= Select the damping (see12.2)
Clock	= Adjust date and time (see 12.3)
Backlight	= Adjust backlight (see 12.4)
Key beep	= Switch on / off the key beep (see 12.5)
Printer	= Select HP or MSI printer protocol (see 12.6)
Contrast	= Adjust display contrast (see 12.7)
Factory settings	= Restore factory setting (see 12.8)
Language	= Select language of display text (see 12.9)

12.1 General settings



With (INPUT) the marked setting may be changed.

The changeable setting is displayed inverted.

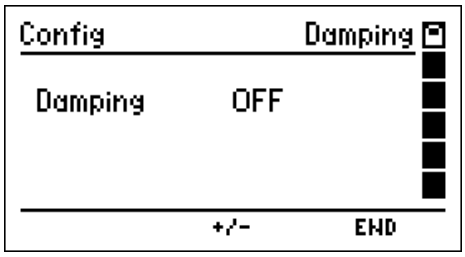


With pushing (+/-) or (ON/OFF) the setting may be modified.
With (OK) the inverted displayed setting is activated.
With (END) all general settings may be accepted.

Selectable general settings are:

setting	choices	function
Input	ON / OFF	enables / disables: input of vessel temperature (see 5.2 / 5.3) input of soot numbers (see 5.2 / 5.3)
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 (see 5.2.2)
Condens. boiler	ON / OFF	stack loss calculation for condensing boilers (see 12.10)

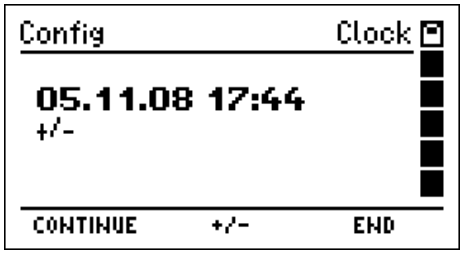
12.2 Selection of damping



Selectable damping settings are:
OFF = no damping
MEDIUM = medium damping
HIGH = strong damping

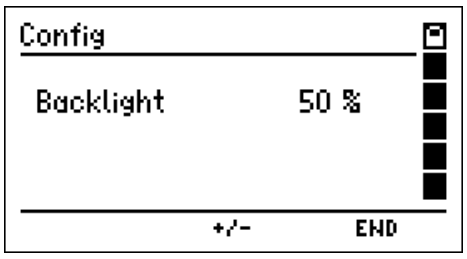
The selected damping remains held even after switch off.

12.3 Date and time adjust



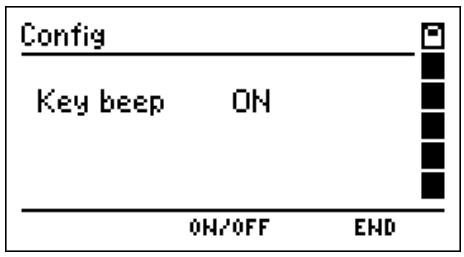
With pushing (**+/-**) the position marked with **+/-** may be modified.
With (CONTINUE) the next position may be marked.
With (END) the displayed date and time are accepted.

12.4 Backlight adjust



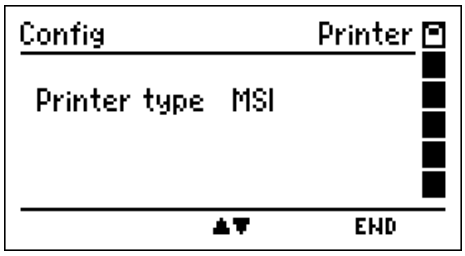
Selectable intensity levels are: 0 %, 25 %, 50 %, 75 % and 100 %.
The selected intensity level remains held even after switch off.

12.5 Key beep switch on / off



With (ON / OFF) will be changed between “Key beep ON” and “Key beep OFF”.
The selected function remains held even after switch off.

12.6 Printer Protocol Selection



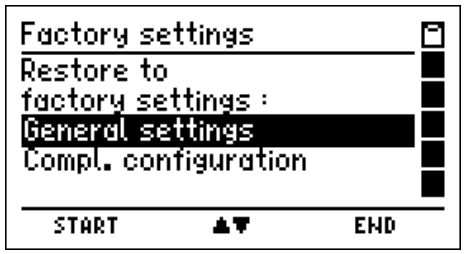
With (▲▼) the printer MSI IR3 or the printer HP may be selected.
Printer MSI IR3: Data transfer and printing is much quicker than with HP compatible printers.
Printer HP: Data transfer is conforming to the HP protocol and fits to all HP compatible printers, of course for MSI IR3 too.
The selected function remains held, even after switch off.

12.7 Display contrast adjust

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

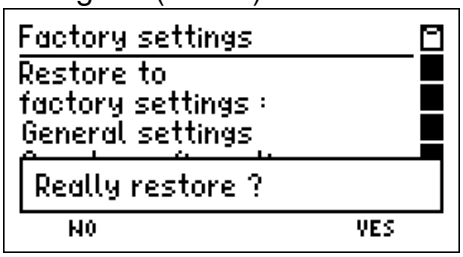
12.8 Factory setting restore

With this function all modified settings (see 12. and 12.1) may be cancelled and the factory settings may be restored.

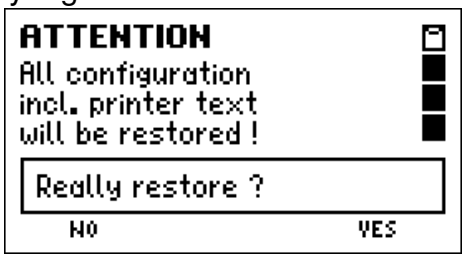


The function “General settings” restores all settings, which are described in chapter 12. with the factory settings.
The function “Complete configuration” does this too and restores additionally all configurations which are made with the software “MSI EM-Tools” as for example modified printer text or modified display screens.

After pushing "F" (START) the MSI EM200 will display e.g.:

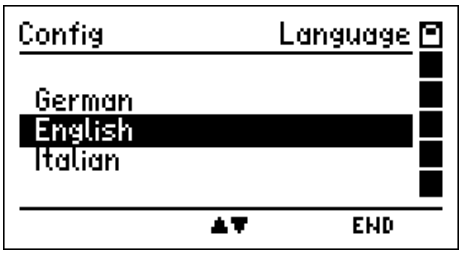


or



With (Yes) all modified settings may be cancelled and the factory settings may be restored and if “Complete configuration” has been selected, all configurations which have been made with the software MSI EM-Tools.

12.9 Display language selection



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

12.10 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: Eta = 100 - qA.

Is the calculation for condensing boilers activated (see12.1) 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:

$$qA_{B} = qA - qA_{Cond}$$

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-B, and may be printed and stored. The efficiency for condensing boilers is calculated from the stack loss qA-B as follows: Eta-B =100 - qA-B.

13. Warning hints, error messages and operation references

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

13.1 Warning hints

13.1.1 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-s 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.

13.1.2 TG missing / fault

This warning hint (TG = **T**emperature sensor for Flue **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 are faulty. All values, which need this temperature, are displayed as "- - -".

13.2 Error messages

13.2.1 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
pressure sensor	sensor with pressure during calibration sensor defect	calibrate again without pressure service

13.2.2 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
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

13.3 Operation references

13.3.1 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

13.3.2 Electric power supply

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

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

14. Technical data

14.1 General technical data

general technical data	
humidity	10 - 90 % RH not condensing
barometric pressure	800 … 1100 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. 1100 g
approvals	EN 50379 part 1 and part 3
charger	plug-in charger prim. 100 – 240 V, 50 – 60 Hz; sec. 12 V; 0.8 A
battery	internal NiMH battery, 4.8 V 2000 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
display	graphic display, adjustable illumination

14.2 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	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	0 ... 8,000 ppm	1 ppm	0.... 4,000 ppm: < ± 20 ppm or < ± 5 % of mv
draft	piezo-resistance	-10 ... 100 hPa	0.01 hPa	< ± 0.5 hPa or < ± 1% of mv
Calculated values				
CO, undiluted	calculated	0 ... 9999 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 %	

mv = Measuring value

15. Maintenance and service

15.1 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 (once a month).**

15.2 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.

15.3 Service

In order to assure accurate measurement and the reliability of the functions the MSI EM200-s should be checked according to requirements of EN 50379 and if applicable be calibrated by an authorised service point once a year.

15.4 Consumables and accessories

Printer with infra-red data transmission	5600401
Paper for IR-Printer	5690151
Consumable set 2 consisting of: 10 x disc filter 20 x filter fleece ø 26	5600411