

Instruction Manual MSI 150 Pro2-f



Dräger Safety MSI GmbH
Rohrstraße 32
D - 58093 Hagen

Tel.: 049-2331 / 9584 - 0
Fax: 049-2331 / 9584 - 29
e-mail: info@draeger-msi.de

D 893; Edition 2005-08-31

Contents

| | |
|------------------------------------|---------|
| 1. Warning | Page 3 |
| 2. The Instrument | Page 3 |
| 2.1 Front | |
| 2.2 Top | |
| 3. Measuring Step By Step | Page 4 |
| 3.1 Preparing The Instrument | |
| 3.2 Start Mode | |
| 3.3 Fuel Type Selection | |
| 3.4 Combustion Parameters | Page 5 |
| 3.5 Positioning The Probe | |
| 3.6 Gas Parameters | |
| 3.7 Pressure Measurement | Page 6 |
| 3.8 Input Menu | Page 7 |
| 3.9 Print Menu | |
| 3.10 Storing Data | Page 8 |
| 3.11 Terminating Measurement | Page 9 |
| 4. Functions | Page 10 |
| 4.1 O2-Reference Menu | |
| 4.2 Stack Leak Test | Page 11 |
| 4.2.1 CO-Ambient Air Measurement | |
| 4.2.2 Air Duct Measurement | Page 12 |
| 4.2.3 Stack Leak Print Menu | |
| 4.2.4 Stack Leak Storing Data Menu | |

Instruction Manual MSI 150 Pro2-f

Contents (Continue)

| | |
|--|---------|
| 4.3 Measurement of Qa Average Values | Page 15 |
| 4.3.1 Core Stream Detection | |
| 4.3.2 Qa Average Values | Page 16 |
| 4.3.3 Printout and Store Data | Page 17 |
| 4.4 Solid fuel measurement | |
| 4.4.1 Selection of the Solid Fuel | Page 18 |
| 4.4.2 Selection of the fuels humidity | |
| 4.4.3 Real Time Measurement | Page 19 |
| 4.4.4 Measurement of Average Values | |
| 4.4.5 Average Value Display | Page 20 |
| 4.4.6 Solid Fuel Print Menu | Page 21 |
| 4.4.7 Solid Fuel Storing Data Menu | |
| 4.5 Data Menu | Page 22 |
| 4.5.1 Show Data | |
| 4.5.2 Send Data | Page 24 |
| 4.5.3 Receive Data | Page 25 |
| 4.6 Info and Check Menu | Page 26 |
| 4.7 Adjustments | Page 28 |
| 4.7.1 Display Light Adjustment | Page 29 |
| 4.7.2 Date And Time Setting | |
| 4.7.3 Baud Rate | Page 30 |
| 4.7.4 mg* dimension unit | |
| 4.7.5 Efficiency Calculation of Condensing Boilers | Page 31 |
| 4.7.6 P-slow | Page 32 |
| 4.7.7 NOx-factor | |
| 4.8 Automatic Modes | Page 33 |
| 4.8.1 Measuring Ambient Temperature | |
| 4.8.2 Stand – by Mode | |
| 4.8.3 Shelter of the CO-Sensor | |
| 4.8.4 CO+ Sensor | Page 34 |

Contents (Continue)

| | |
|---|---------|
| 4.9 Special Features | Page 34 |
| 4.9.1 Online Data Transfer | |
| 4.9.2 Barcode Scanner | |
| 5. Warning Hints and Error Messages | Page 35 |
| 5.1 Warning Hints | |
| 5.1.1 Load Battery | |
| 5.1.2 TA-intern active | |
| 5.1.3 Stack Gas Temperature Sensor is missing | |
| 5.2 Error Messages | Page 36 |
| 5.2.1 Adjustment | |
| 5.2.2 Analogue System | |
| 5.2.3 Memory | |
| 5.2.4 Warning Hints and Error Messages for El.-Chem. Sensors | |
| 6. Technical Data | Page 37 |
| 7. Maintenance and Service | Page 38 |
| 7.1 Charger | |
| 7.2 Maintenance | |
| 7.3 Service | |
| 7.4 Consumables and Accessories | |

Instruction Manual MSI 150 Pro2-f

1. Warning

Any use of the MSI 150 Pro2-f requires a full understanding and strict adherence to these instructions and to national and international standards.

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

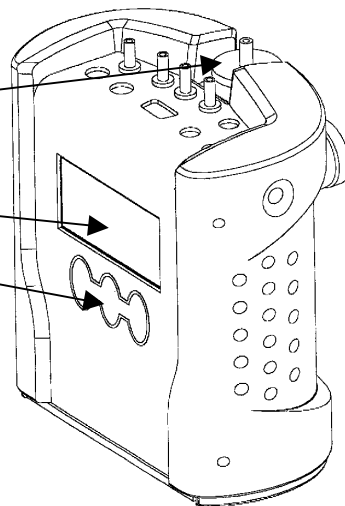
To maintain accuracy and correct function the MSI 150 Pro2-f should be checked and be calibrated by authorised service people once a year.

2. The Instrument

The MSI 150 Pro2-f is an electronic multiple channel measuring instrument, analysing the flue gas concentrations and combustion data of all kind of combustion for engineers, service, environmental protection, etc.

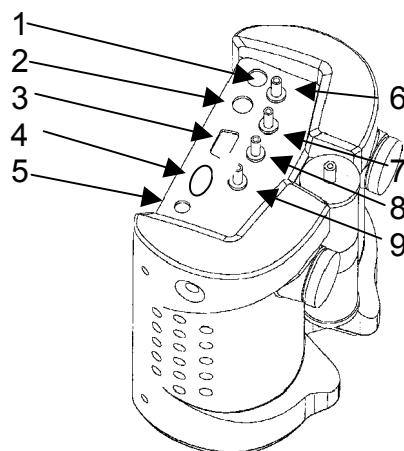
2.1 Front

Gas Conditioner
Display, 6 lines, illuminated
Function Keys " F , ▲ , !"



2.2 Top

1. Socket for Thermocouple
2. Socket for Room Temperature Sensor
3. PC RS 232 Socket
4. LED and Infra Red Transmitter
5. Socket for Charger
6. Gas Outlet at CO – Overflow
7. Gas Inlet
8. Pressure Inlet (-)
9. Pressure Inlet (+)



3. Measuring Step By Step

3.1 Preparing The Instrument

First connect the hose of the probe with the gas conditioner. Connect the gas conditioner with the gas inlet of the MSI 150 Pro2-f. Never forget to use the gas conditioner.

Make sure that the filter fleece and the filter disks are in good condition. The filters should not be visibly dirty, because particles and liquids may harm the pump and the sensors.

Connect the plug of the thermocouple (marked red) with the socket marked "TG" and switch on the instrument by pushing for a short while the buttons " F " and " ! " together. Verify that fresh air will be sucked through the probe before switching on.

3.2 Start Mode

The display shows:

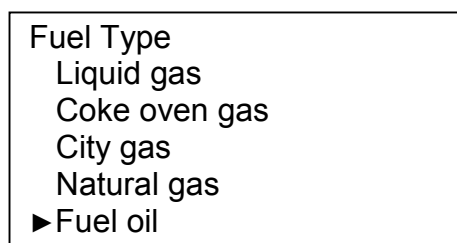


System check and zero point calibration last 20 sec (60 sec if the instrument is equipped with a CO+ Sensor). The count down to 0 is shown in the display.

In the next line each of 1-5 squares represent 20% of the battery's capacity. Below the line with date and time the bars represent the progress of the system check.

3.3 Fuel Type Selection

After calibration the instrument displays:



Pushing " ! " calls the Menu of Functions. Pushing " ▲ " marks the next fuel with " ▶ ". With " F " the marked fuel is chosen and the combustion parameters are called.

3.4 Combustion Parameters

All measured and calculated values necessary for calculation of the combustion efficiency are displayed:

| | | |
|---------------|----------|----------|
| display area | T-Gas | 22 °C |
| | T-Dew P. | ---- |
| | T-Amb | 22.4 °C |
| | Qa | ---- % |
| | Eta | ---- % |
| | O2 | 21.0 V % |
| not displayed | Press. | 0.00 hPa |

With "▲" you may scroll the display area, the first shown value disappears and a new value is shown at the bottom of the display.

The displayed bars mean, there are no measured values or the calculated values exceed the range or are illegal (division by zero).

With "!" all combustion parameters (except pressure) as well as the gas parameters will be locked. Rectangles indicate these "frozen" values. Pushing "!" again unlocks the values again.

Only locked values will be printed and stored.

With "F" you switch to gas parameters.

3.5 Positioning The Probe

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

3.6 Gas Parameters

| | | |
|--------|------|-----|
| O2 | 21.0 | V % |
| CO | 0 | ppm |
| CO-0% | ---- | ppm |
| CO2 | 0.0 | V % |
| Lambda | 9.99 | |

With " ! " all values can be locked or locked values may be unlocked (see 3.4).

By pushing " F " you see the Gas parameters in ppm and mg.

The Display reads:

| | ppm | mg | mg* |
|---------|-----|-----|------|
| CO | 0 | 0 | ---- |
| NO | 0 | 0 | ---- |
| SO2 | 0 | 0 | ---- |
| Ref. O2 | | 5 % | /MJ |

In the first row you find the gas type, (NO, SO2 only as option).

In the second row the measured values in ppm are shown.

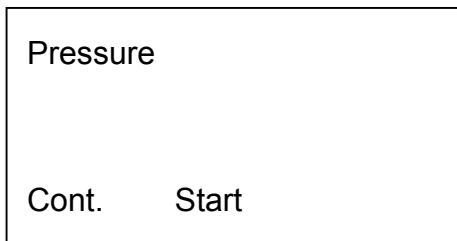
In the third row the measured values are displayed as mg/m³.

The fourth row shows the resulting reference values in mg/m³ or mg/MJ or mg/kWh using the O2-reference value and the dimension unit which are shown in the bottom line.

The O2-reference value may be adjusted in the O2-reference adjustment menu (see 4.1), the dimension unit may be chosen in the menu adjustments (see 4.7).

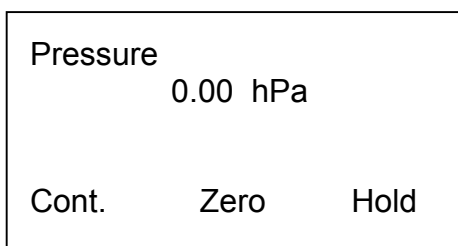
Pushing "F" leads to the pressure measurement.

3.7 Pressure Measurement



With " F " (Cont.) the instrument switches to the next function.

With " ▲ " (Start) the pressure measurement is started . The display shows then:



With " F " (Cont.) the instrument switches to the next function.

With " ▲ " (Zero) the actual shown pressure value is set to zero.

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.

For draft measurement with normal gas probe connect the tube of the gas conditioner from gas inlet to pressure inlet (+). After having finished the measurement, do not forget to connect the tube to the gas inlet again !

Draft measurement with MSI gas probe, including pressure measurement, can be done only, if the gas pump is not working. For this choose "Pump/pressure off" in the adjustment menu (see 4.6).

In case the value shall be printed or stored, press " !" (Hold) to lock it. The pressure value will be locked and unlocked independent from other values.

3.8 Input Menu

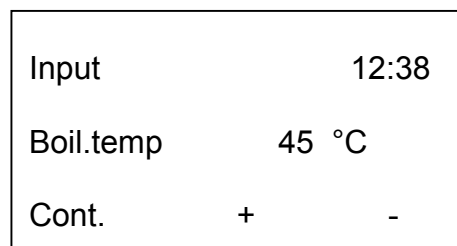


In the upper right corner the time is displayed.

With " F " (Cont.) the print menu is called, if one or more locked values exist. If not, the instrument switches to the fuel type selection.

Pushing " ▲ " (Start) allows you, to input 3 soot spots together with oil residues (only if the fuel type is oil) and the boiler temperature (for all fuel types).

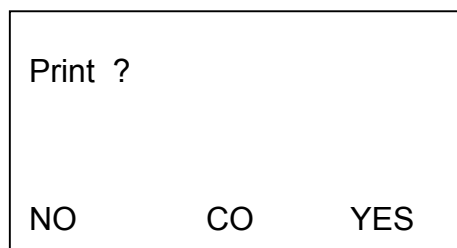
The Input works as follows:



With " ▲ " (+) or " ! " (-) you may vary the value, with " F " (Cont.) the value is accepted and the next input term, the print menu or the fuel type selection is called.

3.9 Print Menu

This display only appears when values have been locked:



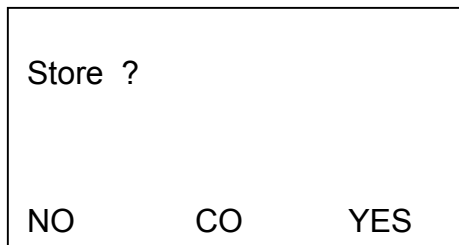
With pushing " ! " (YES) all locked and in given values may be printed.

With " ▲ " (CO) only the regarding values (O2, CO, CO-0%) are printed.

Pressing " F " (NO) leads to the storing data menu.

3.10 Storing Data

This display only appears when values have been locked:



With " F " (NO) you will switch to the menu fuel type selection.

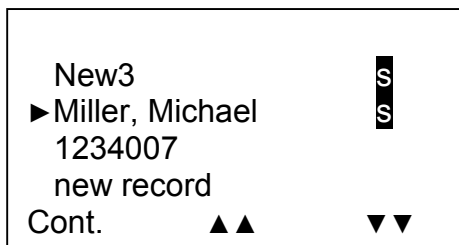
With pushing " !" (YES), you may store all locked and inputted values.

With " ▲ " (CO) you may store the regarding values (O₂, CO, CO-0%).

If the customer number and the customer name is stored, the MSI 150 Pro2-f displays the customers name.

Data regarding to not stored customers may be stored with new record, the customer name in this case is set to new1 new2 etc.

If you have pushed " !" or " ▲ " the Display reads (example):



For **S** marked customers a data record is already stored.

With " ▲ " (▲▲) or " !" (▼▼) you may place the mark " ► " to the wanted customer.

If you are using a scanner, you may read now the barcode label by pushing the scanners key. A beep and the lighting of the LED quit the scanners correct function. The assigned customer name (if stored) will be displayed marked by " ► ".

With pushing " F " (Cont.) the marked customer is accepted and the display reads:

| | | |
|-----------------|--------|---------------|
| 0002 | | |
| Miller, Michael | | |
| Boiler Nr. | 1 | S BCDF |
| Back | Cancel | Store |

The first line shows the customer number, the second the customer name. The third line contents the number of the boiler.

If for this customer a data record is stored, this is shown by **S** and the type of data record B, C, D, F. If C follows only data regarding CO measurement are stored, if B follows all data of locked and inputted values are stored. If D is shown a data record regarding leakage detection, if F is shown a data record regarding solid fuel measurement is stored.

Pushing " F " (Back) leads back to the selection of customer.

With " ▲ " (Cancel) the storing is cancelled and the fuel type selection menu is shown.

With pushing " ! " (Store) the data are stored and the fuel type selection menu is shown.

Is the type of data record already stored the display reads:

| | |
|-----------------------------------|-----|
| Data record filled overwrite ? | |
| NO | YES |

With " F " (NO) the fuel type selection menu is called again without data storing.

With pushing " ! " (YES), the existing data record is overwritten and the fuel type selection menu is shown.

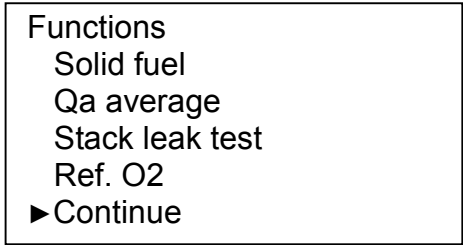
3.11 Terminating Measurement

After measurement remove probe from flue gas pipe and allow fresh ambient air to be sucked in for 1 to 2 minutes. After this, switch off the instrument by pushing " F " for longer than 3 sec. and empty and clean the gas conditioner.

Instruction Manual MSI 150 Pro2-f

4. Functions

If the MSI 150 Pro2-f shows the fuel type selection menu, you may call the menu of functions by pushing " ! ". The display reads:



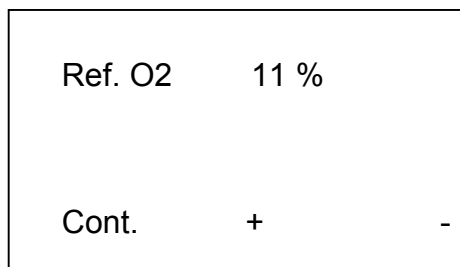
With pushing " ▲ " you mark the next function with " ▶ ".
With " F " you start the marked function.

Functions you can choose are:

| | |
|-----------------|--|
| Continue | = continues with fuel type selection |
| Ref. O2 | = calls "O2-reference menu" (see 4.1) |
| Stack leak test | = calls menu " Stack Leak Test " (see 4.2) |
| Qa average | = calls menu " Measurement of Qa Average Values (see 4.3) |
| Solid fuel | = starts solid fuel measurement (see 4.4) |
| Reset | = unlocks all locked and input values |
| CO purge | = starts and stops fresh air flushing pump (see 4.8.3 too) |
| Data menu | = calls "Data Transfer Menu" (see 4.5) |
| Info | = calls "Info and Check Menu" (see 4.6) |
| Adjustments | = calls menu "Adjustments" (see 4.7) |

4.1 O2-Reference Value

If you have chosen Ref. O2 the Display reads:



Pushing " ▲ " (+) gives a higher O2-Reference value, with " ! " (-) you get a lower one.

With " F " (Cont.) the shown value is accepted and the menu "Functions" is called.
Reference values are calculated by the following formula:

$$CO_{reference} = CO_{measured} * (21-O2_{reference}) / (21-O2_{measured})$$

4.2 Stack Leak Test

4.2.1 CO-Ambient Air Measurement

Call the menu of functions by pushing " ! " in the fuel selection menu. Now choose Stack leak test with " ▲ " and quit with pushing " F ", now the display shows:

| | | |
|-----------------|------|-------|
| Stack leak test | | |
| CO-Amb. | | 0 ppm |
| Cont. | Zero | Hold |

Pressing " F " (Cont.) calls the function air duct measurement.

If you want to print or to store the current value you can lock it with " ! " (Hold) , locked values are marked by rectangles.

With " ▲ " (Zero) you go on to the zero point calibration of the CO-ambient air measurement.

Then the display shows now:

| | |
|---------------------|-----|
| Stack leak test | |
| Zero point adjust ? | |
| No | Yes |

If you are in fresh air with definitely no CO and the displayed value differs from 0 ppm, pull off the gas tube from the gas port and press " ! " (Yes) and the new zero point is set, if it does not differ press " F " (No) and the stored zero point remains in the memory.

The zero point for the CO-ambient air measurement is not the same, as the zero point of the CO measurement of the combustion process. In any case the instrument switches to the previous Display.

!! Do not forget to connect the gas tube with the gas port again !!

4.2.2 Air Duct Measurement

Having pressed " F " (Cont.) in the menu air duct measurement, the display shows:

| | | |
|----------------------|------|------|
| Stack leak test | | |
| O2-air duct 21.0 V % | | |
| Cont. | Zero | Hold |

With " ▲ " (Zero) you select fresh air calibration of the O2 air duct value ($O_2 = 21\%$) .
With " ! " (Hold) the current value is frozen, indicated by a rectangle.
With " F " (Cont.) you either go back to the selection menu or to leakage print menu.

4.2.3 Stack Leak test Print Menu

In case a value has been frozen the display shows:

| | |
|-----------------|-----|
| Stack leak test | |
| Print ? | |
| NO | YES |

With " ! " (YES) the values of the CO-ambient air measurement and/or air duct measurement are printed. Only locked values are printed. Pressing " F " (NO) calls the Leakage Storing Data Menu.

4.2.4 Stack Leak test Storing Data Menu

The display shows:

| | |
|-----------------|-----|
| Stack leak test | |
| Store ? | |
| NO | YES |

With " ! " (YES) the values of the CO-ambient air measurement and/or air duct measurement will be stored like it is written in chapter 3.10.

Pressing " F " (NO) calls the menu of functions.

4.3 Measurement of Qa Average Values

The different response time of the temperature and the 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 accurate results of the stack loss.

With pushing the button "▲" in the menu "Functions" you may mark "Qa average" and with " F " you start the Menu "Core Stream Detection" (4.3.1).

4.3.1 Core Stream Detection

After calling "Core Stream Detection" menu the Display reads:

| Actual values | | |
|------------------|--------|---------|
| | curr. | max. |
| O ₂ | 20.9 | 20.9 V% |
| T _{Gas} | 70 | 72 °C |
| Start | Cancel | Reset |

In the 1. row the measuring channels (O₂ and T_{Gas}) are listed, in the 2. row you found the current measured values and in the 3. row you see the max. values.

Now you may look for the core stream and fix the probe after detection.

By pushing "!" (Reset) the current measured values become new maximum values.

With "▲" (Cancel) you may call the menu Functions (see 4.).

With " F " (Start.) you start the measuring of Qa Average Values (see 4.3.2).

4.3.2 Qa Average Values

After starting the measuring of Qa average values the display reads:

| | | |
|----------|------|---------|
| 1: curr. | A.V. | |
| O2 | 3.9 | 3.9 V% |
| TGas | 70 | 72 °C |
| TAmb | 22.1 | 22.1 °C |
| 11 sec | ▲▲ | Cancel |

The measuring of Qa Average Values lasts 30 seconds and may be done three times. The first number (1:) shows which of the three possible average measurements is running.

In the 1. row the measuring channels (O₂ and T_{Gas}) are listed, in the 2. row you found the current measured values and in the 3. row you see the mean values calculated so far.

With "▲" (▲▲) you may scroll the displayed measuring channels.

By pushing the button "!" (Cancel) you may cancel the complete measuring and call the menu Functions (see 4.).

After a average measurement the display reads:

| | | |
|---------------|------|-----|
| Average value | [1] | |
| O2 | 9.7 | V% |
| TGas | 119 | °C |
| TAmb | 20.8 | °C |
| Qa | 6.6 | % |
| OK | ▲▲ | END |

With "▲" (▲▲) you may scroll the display area, the first shown value disappears and a new value is shown at the bottom of the display.

Pushing "!" (END) finishes measuring of Qa average values and calls the menu Printout and Store Data (See 4.3.3).

With "F" (OK) you may start the next measuring of mean values and call the menu "Core Stream Detection" (see 4.3.1) again.

After the third measuring of mean values, pushing "F" (OK) finishes measuring of Qa average values and calls the menu Printout and Store Data (See 4.3.3).

4.3.3 Printout and Store Data

After finishing of the average measurement the Display reads:

| | |
|------------|-----|
| Qa average | |
| Print ? | |
| NO | YES |

If a printer is switched on you may get the documentation of the Qa average measurement by pushing " !" (YES). With pushing " F " (NO) or after the printout is finished the display reads:

| | |
|------------|-----|
| Qa average | |
| Store ? | |
| NO | YES |

By pushing the button " !" (YES) you may start the data storing of the Qa average measurement. Customer selection and storing is done like it is written in chapter 3.10.

Pressing " F " (NO) calls the menu of functions (see 4.).

4.4 Solid Fuel Measurement

During the combustion of solid fuels the glow is changing remarkable, so the stack gas temperature and the concentration of the different gas components is changing too.

To get reproducible measurements you have to measure average values. For a measurement of stack gases of solid fuels usual 15 minutes average values are measured.

If you have chosen "Solid fuel" in the menu of functions (4.) and there are still no average values locked, you will skip to the menu "Selection of The Solid Fuel" (4.4.1). Are already average values locked, you skip to the menu "Measurement of Average Values" (4.4.4).

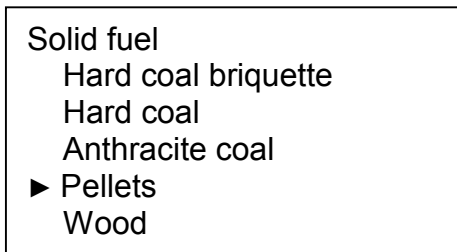
The average values are locked automatically by the end of the 15 minutes measurement time or by cancelling of the measurement. It is possible to display or print the results at any time, until the MSI 150 Pro2-f is switched off.

For changing the solid fuel or its humidity you have to cancel the locked average values first. This can be done by calling "Reset" in the menu "Functions" (see 4.). Attention: all other locked data will be unlocked too .

Instruction Manual MSI 150 Pro2-f

4.4.1 Selection of the Solid Fuel

If you activate "Solid fuel" in the menu "Functions" (see 4.) the display reads:



With " F " you select the marked fuel and skip to "Selection of the Fuels Humidity" (4.4.2).

By pushing " ▲ " you mark the wanted solid fuel. Selectable solid fuels are:

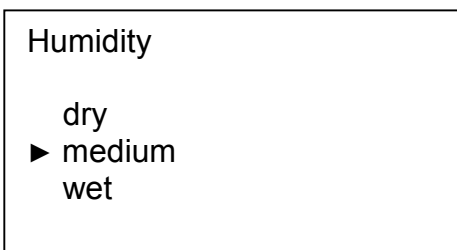
| Fuel | CO2 max | Reference O2 |
|---------------------|---------|--------------|
| Wood | 20.3 % | 11 % |
| Pellets | 20.3 % | 11 % |
| Anthracite coal | 19.2 % | 7 % |
| Hard coal | 18.7 % | 7 % |
| Hard coal briquette | 18.6 % | 7 % |
| Hard coal coke | 19.8 % | 7 % |
| Brown coal | 19.8 % | 7 % |

The fuel type list can be modified by MSI.

4.4.2 Selection of the Fuels Humidity

The efficiency of a combustion depends of the fuels humidity too. Therefore the instrument needs for the ETA calculation of solid fuel combustion a simple classification of the fuels humidity.

After the selection of the solid fuel type the Display shows:



By pushing " ▲ " you mark the wanted humidity.

With " F " you select the marked humidity and skip to "Real Time Measurement " (4.4.3).

4.4.3 Real Time Measurement

Before you start the average value measurement, the real time measurement allows to see the state of the combustion and to fix the tip of the probe in the core stream.

Now the Display reads:

| Instantaneous values | | | |
|----------------------|-------|------|-------|
| | curr. | max. | |
| O2 | 21.0 | 21.0 | V% |
| CO | 100 | 1500 | ppm |
| TGas | 150 | 155 | °C |
| Cont. | | | Reset |

In the first row the measured quantity is listed, in the 2. (curr.) the current measured values are shown, in the next row (max) you find the maximum values during this measurement and in the last row you see the units.

By pushing "!" (Reset) the current measured values become new maximum values.

With " F " (Cont.) you call "Measurement of Average Values" (4.4.4).

4.4.4 Measurement of Average Values

The Display reads:

| | |
|---------|-------|
| Avarage | |
| Cont. | Start |

By pushing " F " (Cont.) the MSI Pro2-f continues with the menu "Functions" (see 4.).

With "▲" (Start) the measuring of average values is started.

Instruction Manual MSI 150 Pro2-f

After choosing "Start" the display reads:

| | curr. | AV. | |
|-------|-------|------|--------|
| O2 | 3.0 | 2.9 | V% |
| CO | 15 | 20 | ppm |
| TAmb | 21.3 | 21.1 | °C |
| TGas | 125 | 120 | °C |
| 00:27 | ▲▲ | | Cancel |

In the first row the measured quantity is listed, in the 2. (curr.) the current measured values are shown, in the next row (AV.) you find the average values and in the last row you see the units.

In the left of the last line the duration until now of the average measurement is shown.

With "▲" (▲▲) you scroll to the next quantities CO₂ and pressure.

By pushing "!" (Cancel) you may stop the average measurement.

After 15 minutes average time or after cancelling the MSI Pro2-f continues with the menu "Average Value Display".

4.4.5 Average Value Display

The display shows:

| Average | | |
|---------|------|-------|
| O2 | 2.9 | V% |
| CO | 19 | ppm |
| TAmb | 21.1 | °C |
| TGas | 121 | °C |
| Cont. | ▲▲ | Start |

With "F" (Cont.) you may call the Solid Fuel Print Menu (4.4.6).

The Function Start and the according hint in the last line exist only if the average measurement has been done earlier and not yet. By pushing "!" (Start) a new average measurement may be started (see 4.4.4). This will overwrite the existing values.

By pushing "▲" (▲▲) the last line of the average values will show a new quantity, while the first quantity vanishes.

Additional average values are:

| | | |
|----------|------|-----|
| CO2 | 10.1 | V% |
| QA | 9.1 | % |
| Eta | 90.9 | % |
| CO | 24 | mg |
| CO | 29 | mg* |
| Pressure | 3.0 | V% |
| Ref. O2 | 11.0 | V% |

The CO average value of the 4. line is calculated to mg/m³ with 1ppm = 1.25mg/m³
 The CO average value of the 5. line is calculated regarding the Reference O₂ value, which depends on the chosen solid fuel type, and the chosen measuring unit see (3.6).

4.4.6 Solid Fuel Print Menu

The Display shows:

Print ?

NO YES

With " F " (NO) you call Solid Fuel Storing Data Menu.

Pushing " !" (Yes) starts the printout of the "Average Value Display" (4.3.5), together with the time and the duration of the average measurement . After the printout the Pro2-f continues with the "Solid Fuel Storing Data Menu".

4.4.7 Solid Fuel Storing Data Menu

The display reads:

Store ?

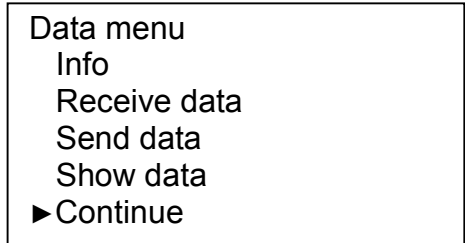
NO YES

With " !" (Yes) you start storing. The selection of the wanted customer and the storing procedure is like the description in Chapter 3.10.

By pushing " F " (NO) you continue with menu "Functions".

4.5 Data Menu

After choosing Data menu in the menu of functions the display reads:



With pushing the button "▲" you mark the next function.

With " F " you start the marked function.

You can choose between following functions:

- Continue = continues with Functions (see 4.)
- Show data = calls menu "Show Data" (see 4.5.1)
- Send data = calls menu "Send Data" (see 4.5.2)
- Receive data = calls menu "Receive Data" (see 4.5.3)
- Info = Info about number of stored data records
- Clear = cancels all stored data records

4.5.1 Show Data

If you have chosen the menu Show Data the customer selection has to be done, the display reads for example:



For **S** marked customers a data record is stored.

With "▲" (▲▲) or "!" (▼▼) you may place the mark "▶" to the wanted customer.

If you are using a bar code scanner, you may read now the barcode label by pushing the scanners key. A beep and the lighting of the LED quit the scanners correct function. The assigned customer name (if stored) will be displayed marked by "▶".

With pushing " F " (Cont.) the marked customer is accepted and the display reads:

| | | | | |
|------|-----------------|--------------|----------|------|
| 2 | Miller, Michael | Boiler Nr. 1 | S | BCDF |
| Back | Cancel | Show | | |

The first line shows the customer number, the second the customer name. The third line contents the number of the boiler.

If for this customer a data record is stored, this is shown by **S** and the type of data record B, C, D, F. If C follows only data regarding CO measurement are stored, if B follows all data of locked and inputted values are stored. If D is shown a data record regarding leakage detection, if F is shown a data record regarding solid fuel measurement is stored.

Pushing " F " (back) leads back to the selection of customer.

With "▲" (cancel) the Data menu is called.

With pushing " !" (Show) the first stored data record of the chosen customer is shown.

The display now reads:

| | | |
|----------|------------|-------|
| B | 2004-11-24 | 13:48 |
| T-Amb | 23.2 | °C |
| T-Gas | 163 | °C |
| T-Boiler | 57 | °C |
| O2 | 9.7 | V% |
| CO | 89 | ppm |

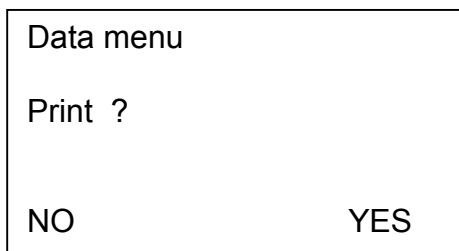
In the first line, date and time of the measurement is shown. The letter informs you about the type of stored data, B in this example means all data of locked and in putted values are stored.

With "▲" the shown values are scrolled, only the first line remains.

By pushing " F " you will get the next type of stored data for the same customer.

Instruction Manual MSI 150 Pro2-f

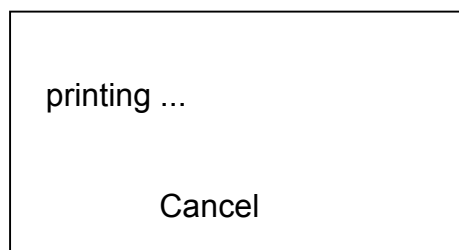
Pushing " F " during the last data record of this customer is shown, then the display reads:



Pushing " F " (NO) leads back to the selection of customer.

Pushing " ! " (YES) starts printing of all stored data.

During printing the display reads:



Pushing " ! " (Cancel) stops printing.

After printing is finished or cancelled the MSI Pro2-f switches back to customer selection.

4.5.2 Send Data

Now the display reads:

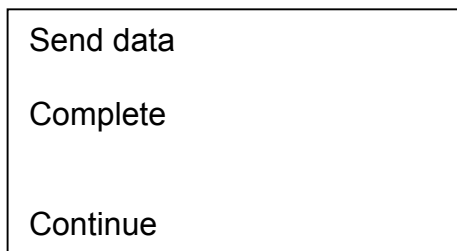


Connect the MSI 150 Pro2-f to the serial Interface of your PC by means of the MSI-PC cable and start transmission program of the PC.

When the PC program is ready to receive data, push " ▲ " (start). Whilst the MSI 150 Pro2-f sends data, the display shows " Record xx ", xx is the number of the data record.

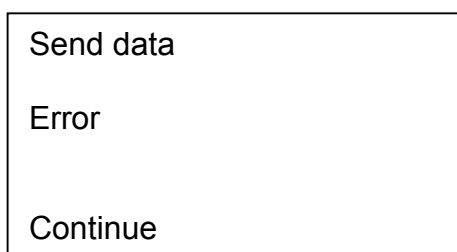
With " ! " (Cancel) you may cancel the data transfer at any time.

After the data records have been sent to the PC, the instrument displays:



Pushing " F " (Continue) calls the Data Transfer Menu again.

If an error occurs or the transfer is cancelled and the display reads:

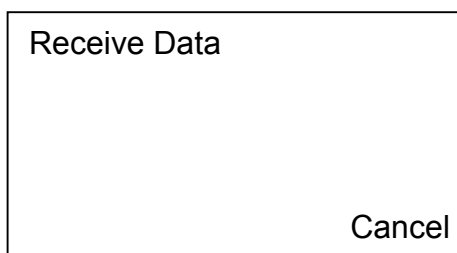


With " F " (Continue) you call the Data Menu (see 4.5).

4.5.3 Receive Data

Connect the MSI 150 Pro2-f to the serial Interface of your PC by means of the MSI-PC cable and start the transmission program of the PC.

After choosing "Receive data" in the Data menu the display reads:



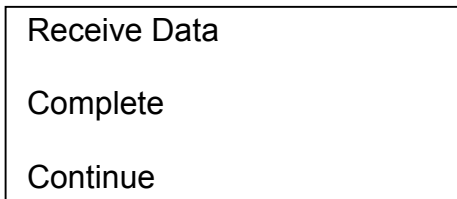
With " ! " (Cancel) you may stop the data transfer.

The MSI Pro2-f waits to receive data (e.g. client number, client name) from PC. Start the transmission of data from PC.

While the PC is sending, the display shows " Data Record xx". xx is the number of the data record.

Instruction Manual MSI 150 Pro2-f

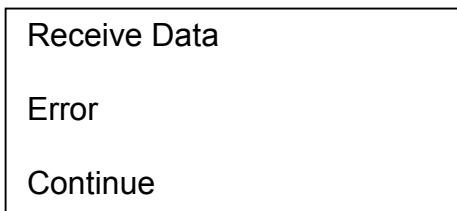
After the data are stored in the instrument the display shows:



```
Receive Data
Complete
Continue
```

Pushing " F " (Continue) calls the Data Menu.

If an error occurs or the transfer has been cancelled the display reads:

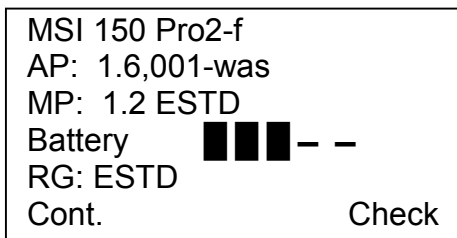


```
Receive Data
Error
Continue
```

Pushing " F " (Continue) calls the Data Menu and you may start the data transfer again.

4.6 Info and Check Menu

After choosing " Info " in the function menu, the display will read:



```
MSI 150 Pro2-f
AP: 1.6,001-was
MP: 1.2 ESTD
Battery █ █ █ - -
RG: ESTD
Cont. Check
```

In the 1. line the name of the Instrument is shown, in the 2. line behind "AP:" you find the version number of the used software.

In the 3. line behind "MP:" the version of the approved measuring software tool is stated.

In the 4. line the battery's state of charge is shown, every rectangle represents 20% of maximum capacity.

Pushing " F " (Cont.) calls the function menu again (see 4.).

With "!" (Check) you may start the check function.

Now the display may read:

Next service

02/2007

Cont.

The Display informs about the month and the year of the next service, the MSI Pro2 shall be serviced once a year. This information has been inputted by your authorized dealer at the last service.

If this information is missing, or after you pushed " F " (Cont.) the display will read:

SYSTEMCHECK

TR-Sensor
Check

Please wait

You are informed, that the check function is working and which function is actually tested (in this case ambient air temperature measurement).

The dots behind Check show the progress of the actual check.

If the check of a function is finished the result is shown. Results may be: Check OK or Warning or Error.

Following functions are tested:

- ambient air temperature measurement
- stack gas temperature measurement
- battery
- electronics
- internal temperature
- thermo couple compensation temperature
- O2 - sensor
- CO - sensor
- pressure sensor
- gas pump*

* = with repeated stop and restart the function and power of the gas pump is tested.

If the system check is finished the display may read (example):

Warning:
TR-sensor miss.

Cont.

You are informed if all functions have been error free or which warnings (missing temperature sensors) or errors have been detected.

With " F " (Cont.) you may skip to the listing of errors or to the menu of functions (see 4.).

4.7 Adjustments

If you have chosen "Adjustments" in the menu "Functions" the display reads:

Adjustments
Standby
Baud rate
Set Clock
Backlight
▶ Continue

With "▲" you mark the next function.

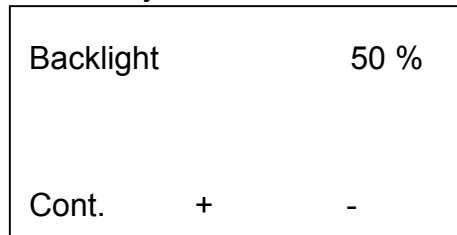
With " F " you start the marked function or call the marked menu.

You can choose between following functions:

- | | |
|--------------------|--|
| Continue | = continues with "Functions" (see 4.) |
| Back Light | = adjust the display light (see 4.7.1) |
| Set Clock | = adjust date and time (see 4.7.2) |
| Baud rate | = choose of the baud rate (see 4.7.3) |
| Standby | = switch on or off of the standby function |
| mg* dimension unit | = adjust the dimension unit for reference values (see 4.7.4) |
| Key beep | = switch on or off the beep at pushing keys |
| Pump/Press | = switch on or off the pump during pressure measurement |
| Condens. Boil. | = activate efficiency calculation of condensing boilers (see 4.7.5) |
| P-slow | = adjust pressure measurement-delay (see 4.7.6) |
| Printer | = set printing speed (use fast only with MSI IR3 printer) |
| NOx-factor | = adjust NOx calculation (only if equipped with NO-Sensor see 4.7.7) |

4.7.1 Display Light Adjustment

Having chosen " Back Light " in the adjustment menu then the display reads:



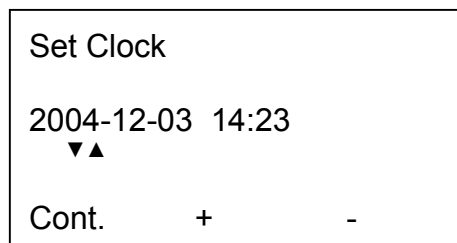
With pushing " F " (Cont.) the menu Adjustments is called.

With " ▲ " (+) or " ! " (-) you may adjust the intensity of the display light. Possible intensity adjustments are: 0 % (shut off), 25 %, 50 %, 75 %, 100 % and Auto (Automatic).

Automatic means, the intensity of the display light depends on the light of the ambient. So in the dark the illumination is bright, in a full lighted ambient the display light is shut off, to save energy.

4.7.2 Date and Time Setting

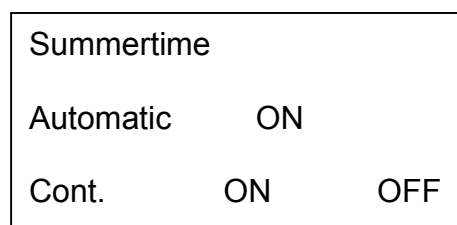
After having chosen " Set Clock " in the menu Adjustments the display reads:



Pressing " F " (Cont.) changes to month, day, hour and minute.

With " ▲ " (+) or " ! " (-) the corresponding values are altered.

After pushing " F " (Cont.), while the minute value is marked, the Display reads:

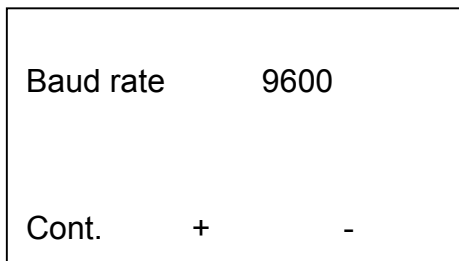


Pushing " ▲ " (ON) chooses the automatic change from summertime (day light saving time) to wintertime and vice versa. With " ! " (OFF) this function is switched off.

With " F " (Continue) the chosen function "Automatic ON" or "Automatic OFF" becomes activated and the menu "Adjustments" will be shown.

4.7.3 Baud Rate

Is "Baud rate" called in the menu Adjustments, the display reads:



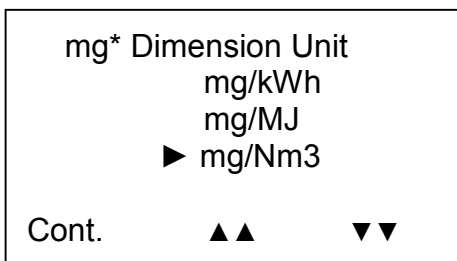
With "▲" (+) you choose a higher baud rate, with "▼" (-) you get a lower one.

You may choose: 2,400; 9,600; 38,400; 57,600 and 115,200 baud.

If you push " F " (Cont.), the menu "Adjustments" is called.

4.7.4 Adjustment of the mg* Dimension Unit

Is mg* Dimension Unit chosen the display shows:

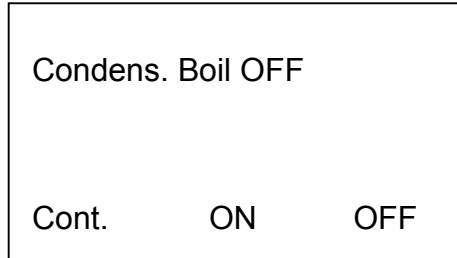


With "▲" (▲▲) or "▼" (▼▼) you may place the mark "▶" to the needed unit.

By pushing F (cont.) the marked unit is chosen and the menu Adjustments is called.

4.7.5 Efficiency Calculation of Condensing Boilers

If "Condens. Boil." is selected the display reads:



With "▲" the efficiency calculation of condensing boilers is chosen, with "!" the normal efficiency calculation will be done. Behind Condens. Boil you can read the actual selection.

"F" (Cont.) activates the selected calculation and calls the menu Adjustments (see 4.7).

The normal efficiency is: $ETA = 100 - qA_N$ with the stack loss qA_N

$$qA_N = (T-Gas - T-Amb) * [(A2 / (21 - O2)) + B]$$

If the efficiency calculation of condensing boilers is activated and if the stack gas temperature (T-Gas) is lower than the dew point (T-Dew), then the stack loss is:

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

qA_{Cond} is a function, depending of " T-Dew - TGas " and represents the energy you win during condensing. This type of stack loss and efficiency is always signed with a star.

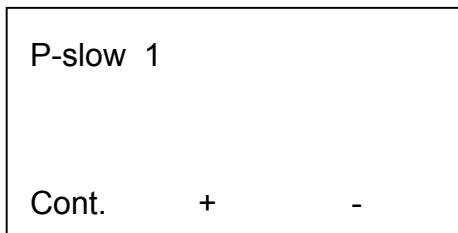
Instruction Manual MSI 150 Pro2-f

4.7.6 P-slow

The pressure measurement of the MSI 150 Pro2-f is very quick. Some applications (e.g. chimney draft) do not have stable conditions and thus the displayed value is changing too fast.

In order to get a stable pressure value displayed, a delay can be activated.

Having chosen the "P-slow" in the menu Adjustments the display shows:



With "▲" (+) you may activate the delay or make it stronger, with "!" the delay will be switched off or weakened.

The delays you may choose are: 0 = no delay; 1=soft delay; 2= strong delay.

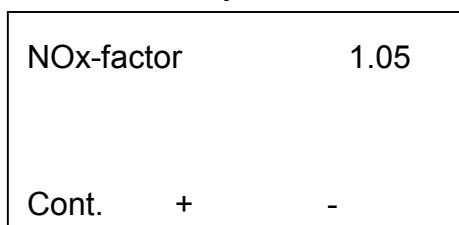
The displayed adjustment will be activated by pressing "F" (Cont.) and the instrument switches back to the menu Adjustments (see 4.7).

4.7.7 NOx-Factor

In case the MSI 150 Pro2-f is equipped with a NO-channel, the instrument is also able to calculate NOx by taking the NO₂ share of the NOx into account.

If, for example, a measurement has proven, that the NO₂ share is 5 % of the total NOx value, then the measured NO value has to be multiplied with the factor 1.05 in order to get the NOx value. To do so, the NOx-factor has to be set to 1.05.

Having chosen "NOx-factor" in the menu "Adjustments" the display shows:



With "▲" (+) the NOx-factor can be increased, with "!" the value can be decreased.

With "F" (Cont.) the indicated factor will be accepted and the instrument switches back to the menu "Adjustments" (see 4.7).

4.8 Automatic Modes

4.8.1 Measuring Ambient Temperature

The MSI 150 Pro2-f is equipped with a built-in temperature sensor. In order to enhance the accuracy of the measurement, it is recommended to use an external temperature probe. If not, a warning is shown (see chapter 5.).

The instrument recognises if an external probe is connected and takes automatically the results measured by the adapted probe.

4.8.2 Standby Mode

In order to increase the battery capacity the instrument is provided with a Standby Mode.

In case no key has been touched for 30 seconds and the probe is not placed in the flue gas, the display back light and the gas pump will be switched off.

If any key will be touched the Pro2-f switches automatically back to the measuring process.

Standby Mode is shown in the display. After 30 minutes of standby time the instrument will be switched off.

For being able to use online data transfer even during the time, while the boilers are not working, the standby function can be switched off (See chapter 4.7).

4.8.3 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 the instrument realises how fast the gas concentration rises and recognises if the measuring range will be exceeded. Having recognized this, the instrument will activate the flushing pump to protect the CO- and if installed the NO-sensor with fresh air being sucked in. The missing of real measured concentrations caused hereby, is now shown in the display by -**- instead of values for CO and NO.

Whilst this happens the O₂-sensor is still active and thus allows to do the necessary adjustments (increasing excess air) of the burner.

After having taken the probe out of the flue or having disconnected the tube from the condensate trap the oxygen content will rise above 19.5 % and the instrument offers all functions again.

Instruction Manual MSI 150 Pro2-f

4.8.4 CO+ Sensor

The MSI Pro2-f may be equipped with an CO+ Sensor which is able to measure concentrations up to 2.000 % (= 20,000 ppm).

If the measuring range of the normal CO sensor (4,000 ppm) will be exceeded, the instrument will activate the flushing pump, to protect the CO- and if installed the NO-sensor with fresh air being sucked in. Whilst this happens, the O2 and the CO+ sensors are still active and continue with measuring. The displayed CO concentration changes from ppm into %.

Becomes the CO concentration less than 0.300 % (3,000 ppm), the flushing pump is switched off and after a short while the displayed CO concentration changes back to ppm.

4.9 Special Features

4.9.1 Online Data Transfer

The Pro2-f possesses an online data transfer feature. During normal measurement all measured data are transferred to the RS 232 interface of the Pro2-f.

With the MSI program **DERAS** all measured values may be shown online (numeric or graphic) on a PCs monitor.

The PC program **DERAS** allows additional storing of the values in a chosen interval. The stored data may be printed in numeric or graphic charts.

4.9.2 Barcode Scanner

Connect the scanner to the RS 232 interface of the MSI 150 Pro2-f. If the instrument is or becomes switched on a double beep and the lighting of the LED show, that the scanner is initialised.

To read a barcode you have to choose Store and push the scanners key (see also 3.10). The lighting of the LED and a beep quit the reading.

5. Warning Hints and Error Messages

Already after being switched on, as well as during the measurement process, the MSI 150 Pro2-f checks the function of all measuring channels.

Warning and Error Messages are shown direct after the system check or before the fuel type selection or during normal function.

5.1 Warning Hints

5.1.1 Load Battery

In case the MSI 150 Pro2-f is running and the battery becomes lower than 5.7 V, the Display shows " Load Battery ! " in change with the normal reading.

If the battery power becomes lower than 5.3 V the instrument is shut off automatically.

The red flashing LED reminds you, that the battery has to be reloaded.

5.1.2 TA-intern active

The warning hint " TA-intern active " is shown before fuel type selection, if no external sensor is plugged in or if the instrument cant recognize it.

With pushing key " F ", you call fuel type selection menu. The MSI 150 Pro2-f now measures with an internal temperature sensor.

The internal temperature sensor is not so quick in response time and its accuracy is not so good like that one of the external sensor. For this MSI recommends to use the external temperature sensor.

5.1.3 Stack Gas Temperature Sensor is missing

The warning hint " Missing TG Sensor " is shown before fuel type selection, if no sensor is plugged in or if the instrument cant recognize it.

With pushing the key " F ", you call the fuel type selection menu.

The MSI 150 Pro2-f now measures without stack gas temperature, all values who need this temperature are displayed as " --- ".

Instruction Manual MSI 150 Pro2-f

5.2 Error Messages

5.2.1 Adjustment

If the MSI 150 Pro2-f recognizes an illegal adjustment, this warning is displayed direct after the system check.

With " F " you may call the fuel type selection. After calling the adjustment menu you should call every function, change the settings and shut off the instrument. If the error message occurs again after the next start, the Pro2-f must be serviced.

5.2.2 Analogue System

If the MSI 150 Pro2-f recognizes an error in the analogue system, this warning is displayed direct after the system check.

Because measuring values may be wrong the instrument has to be serviced.

5.2.3 Memory

If the MSI 150 Pro2-f recognizes an not initialised memory, this warning is displayed direct after the system check.

With " F " you may call the fuel type selection. After calling the menu of functions, call cancel stored data in the data menu (see 4.5). The memory is now reinitialised and ready.

5.2.4 Warning Hints and Error Messages for El.–Chem. Sensors

Before the fuel type selection following warning hints may be displayed:

| Warning Hint | 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 CO concentration too high Flushing pump defect Sensor defect | Calibrate again with fresh air Wait until CO-protection works Service Service |
| NO-Sensor | NO-Sensor had no current others like CO-sensor | check function see CO-sensor |

6. Technical Data

| | |
|------------------------|---|
| Approvals: | Approved according German regulation, TÜV ByRgG 215 CO Approval according ZIV regulation, M-KC 1001-00/03 |
| Display: | LC-display; 6-lines, 20 characters each; alphanumerical, manual and automatic controlled illumination |
| Interface: | serial, 2,400 up to 115,200 baud |
| Operating temperature: | + 5 °C ... +40 °C |
| Storage temperature: | -20 °C ... +50 °C |
| Power supply: | maintenance-free, sealed lead accumulator, 6 V / 1.2 Ah, capacity up to 8 h, battery monitoring with charge status, charger |
| Gas sampling: | Membrane pumps for gas sampling and for cleansing of the sensors with fresh air in case of off-range values |
| Gas conditioning: | integrated gas conditioning cartridge with condensate trap and particle filters |
| Dimensions: | 205x180x105 mm (LxWxH) |
| Weight: | 2050 g |

| Display | Principle | Range | Resolution | Accuracy |
|-----------------------------------|---|---------------------------------|------------|--|
| T-ambient | PTC | -20... +100 °C | 0.1 °C | ≤ 1 °C |
| T-gas | Thermocouple | 0 ... 1000 °C caution: probe | 1 °C | 0...250 °C: ≤ 2°C 250...400 °C: ≤ 4°C |
| 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 .. 4,000 ppm | 1 ppm | 0 - 2,000 ppm: ± 20 ppm or < 5 % of MV |
| CO+, (Option) Carbon monoxide | El.-chem. Sensor | 0 .. 2.000 % | 0.001 % | ± 0.01 % or < 5 % of MV |
| NO, (Option) Nitrogen monoxide | El. chem. Sensor | 0 .. 2,000 ppm | 1 ppm | ± 5 ppm or < 5 % of MV |
| CO, undiluted | Calculated | 0 .. 9,999 ppm | 1 ppm | |
| CO ₂ , | Calculated | | 0.1 Vol. % | |
| Draft | Semiconductor | -10 ... +5 hPa | 0.01 hPa | |
| Gas pressure | Semiconductor | +5...+120 mbar | 0.01 mbar | |
| Efficiency | Calculated | 0 ... 199.9 % | 0.1 % | |
| Stack loss | Calculated | - 20... +100 % | 0.1 % | |
| Excess Air | Calculated | 1.00... 9.99 % | 0.01 % | |

MV = Measuring Value

Instruction Manual MSI 150 Pro2-f

7. Maintenance and Service

7.1 Charger

The integrated lead battery offers a mains independent operation and shows no memory effect.

With the supplied charger the battery can be fully charged within ca. 8 hours. The red signal light on the charger demonstrates the charging process.

After the instrument is fully charged the instrument switches to holding capacity (signal light switches off). The battery can not be overcharged.

If the instrument will not be used for a longer period, connect it to the mains.

7.2 Maintenance

The gas conditioning cartridge should be cleaned after having been in use. In addition to that. The filter disc and fleece has to be changed if dirty.

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.

7.3 Service

In order to assure accurate measurements and the reliability of the functions the MSI 150 Pro2-f should be checked and if requested be calibrated by an authorized service point once a year.

In case the integrated O₂ sensor should be used up (approx. 2 years), the display indicates an error message. If so, the instrument has to be sent to an authorized service point.

7.4 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

10 x Filter fleece

Remarks: