

ASSEMBLAD S.r.l.
Costruzioni Elettroniche

Sampling SMOKE METER Model OPA-391 and OPA-391/HF Model OPA-391/HD and OPA-391/HDF



Model OPA-391 and OPA-391/HF



Model OPA-391/HD and OPA-391/HDF

USER MANUAL

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ASSEMBLAD – Engineering Departement – Automotive division



Note:

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1 INTRODUCTION

The OPA-391/HF and its derivatives are equipments for measuring the opacity of the smoke emitted by Diesel engines.

Please read carefully this manual before operating on the equipment and follow the instructions when doing any action on it, in particular when doing maintenance procedures.

Open the equipment only when explicitly indicated and after switching off its powering. Then, at the end of operations, close it restoring its original conditions, in particular the casing and the flap door, before powering it again.

Be careful of the right hose connections and don't inhale the smoke leaving it flowing outside in free air.

The manufacturer disclaims any responsibility for any kind of event deriving from a improper use of the equipment or from a procedure not explicitly written on this manual. In any case, the responsibility is limited to the repair of the instrument.

For more detailed informations please read the chapter "Warranty".

The smoke meter does its smoke measurements through the "sampling" method and the measuring chamber is of the specular reflection type.

The equipment performs measures in conformity with the Italian Ministerial Decree of law n. 628 of 23/10/1996 and following modifications as Circular n. 88/95 of 6/9/1999 (mode L1) and measures in conformity with the Directive 1999/52/CE take in with D.M. of 7/8/2000 and Circular 6902/604 of 4/8/2000 (mode L2).

The smokemeter is able to use the communication protocol defined in the technical specification MCTCNET revision 1.0 of 23/06/1999.

The smokemeter meets CUNA NC-005/11 standards

This manual contains procedures to be performed by both the final user and the technician which is doing service on the equipment.

Procedures labeled with (###) Must not be undertaken by the final user.

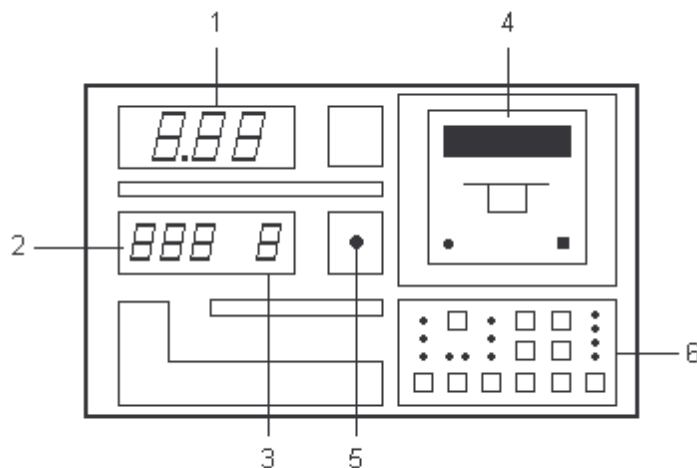
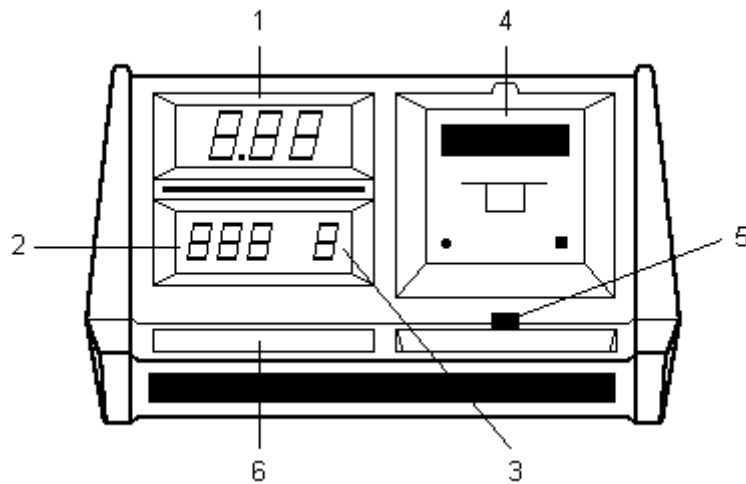
Note: (§§) This simbol means that feature or operation which refers to is activated only in OPA-391/HF and OPA-391 / HDF but not on other Models of the Smoke-meter.

1.1 SMOKE METER FRONT PANEL

- 1) Smoke value display, shows the SMOKE values of the vehicle exhaust gases expressed as percentage from 00.0 to 99.9% and in K from 0.00 to 9.99 (m-1).
- 2) Temperature/rpm display, show the temperature of gas incoming measuring chamber, number of engine rpms, chamber's temperature (§§), oil temperature (§§).
- 3) Display of test number being performed/that can be performed.
- 4) 24 column pin printer
- 5) Infrared remote control receiver
- 6) Control keypad and function lights

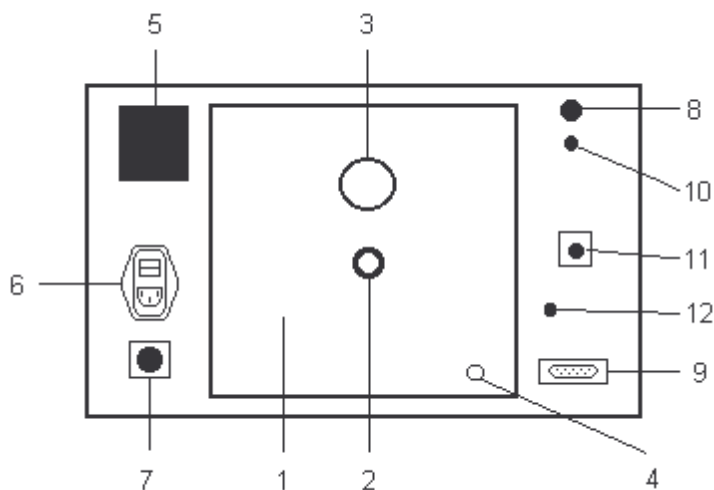
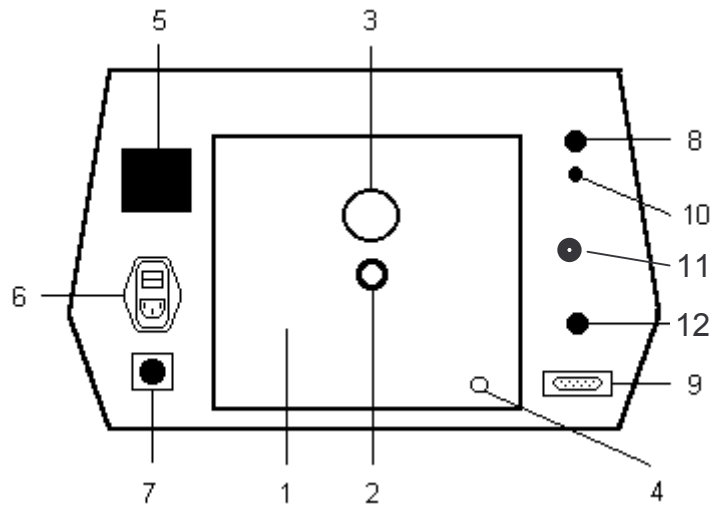
Keys: ON/OFF, %K, MODE, COUNT ADV, ZERO, PRINT, PAPER ADV, F1, F2, F3, RPM/TEM.

LEDS: ON, +15%, -15%, %, K, CONT, L1, L2, °C, RPM, F4, F5.



1.2 SMOKE METER BACK PANEL

- 1) Measuring Chamber
- 2) Fitting for exhaust gas input
- 3) Exhaust gas vent
- 4) Fitting for releasing condensate formed in the measuring chamber
- 5) Metal label-plate
- 6) Switch filter complete with: prestart filter, fuses, mains outlet
- 7) Connector for vehicle-battery power supply (13.8 VDC)
- 8) Connector for motor oil temperature probe (§§)
- 9) RS232 Serial port
- 10) RPM probe connector
- 11) RPM fuse holder
- 12) Calibration Filter



2 TECHNICAL FEATURES

2.1 PHOTODETECTOR TECHNICAL FEATURES

Ricetransmitter	- Reflection type
Transmitter	- 6V 10W halogen lamp
Color temperature	- 3000°K
Average lamp life	- 2000 hours
Receiver	- BPW21 photodiode
Response corrector filter	- L.I.S.S. passband
Periodic settings	- Neutral density filter supplied

2.2 MEASURING CHAMBER TECHNICAL FEATURES

Chamber ventilation	- Controlled
Measuring cell length	- 198 mm
Measuring cell, inside diameter	- 36 mm
Length of an exhaust gasspecimen	- 400 mm
Exhaust gas input	- Balanced
Clean air input	- Balanced
Exhaust gas intercept	- 1/2 inch solenoid valve
Clean air intercept	- 1/8 inch solenoid valve
Gas discharge	- By ventilation
Pressure/depression sensor	- Differential, solid state
Measuring chamber	- Interchangeable
Condensate drainage	- At the base of the chamber
Chamber thermostating (§§)	- Over 70°C, by microprocessor-controlled heaters

2.3 ELECTRONIC STRUCTURAL FEATURES

Setting	- Automatic when switched on
Measurement processing	- Microprocessor controlled
Printer	- Impact, 24 columns
Smoke display	- 3, 7-segment red colour 20 mm high
Temp/Rpm display	- 3, 7-segment green colour 20 mm high
Test N° Display	- 1, 7-segment green colour 14 mm high
Measurements displayed	- Smoke: from 00.0 to 99.9% Smoke K (m-1) from 0.00 to 9.99 Gas temp: from 0 to 180°C Oil temp: from 0 to 180°C (§§) Chamber temp: from 45 to 180°C (§§) RPMs from 0 to 6000 rpm
Start-up and self-test time	- 1 min, normal
Time for operating rates	- 15 min, normal (at 25°C)
Operating temperature	- +5° to +40°C
Humidity range	- 45%-90%
Clearing measurement device	- Automatic, press ZERO key

2.4 POWER SUPPLY

From mains	- Single phase 220V ($\pm 10\%$) 50 Hz ($\pm 2\%$)
From battery	- 13.8 VDC ($\pm 10\%$)
Absorbed power	- 200VA max for 391/HF and 391/HDF - 80 VA max for 391 and 391/HD

2.5 SUPPLEMENTARY FUNCTIONS

Remote control	- Infrared
Serial output	- RS-232 for connection to remote unit (PC)
Calendar/clock	- For dated printouts

2.6 OTHER FEATURES

Dimensions, weight (Std)-	- 480 x 300 x 630 mm, 29 kg approx.
Dimensions weight (HD)	- 475 x 280 x 480 mm, 28 kg approx.
Exhaust pipe probe	- 3 different sizes, inside diameters of 10, 17 and 27 mm, to be connected to the hose of probe.
Ballast	- 2 kg approx; to connect to the hose of probe

2.7 FITTINGS SUPPLIED

Standard accessories:

- N° 1 Rubber sampling hose
- N° 3 Exhaust pipe connectors
- N° 1 Ballast bag
- N° 1 220 VAC mains lead
- N° 1 Battery mains lead
- N° 1 Calibration filter (preinstalled).
- N° 1 Infrared remote control device (without battery)
- N° 1 RPM probe
- N° 1 This manual

Optional Accessories:

- Oil temperature probe

3 KEYPAD AND LEDS

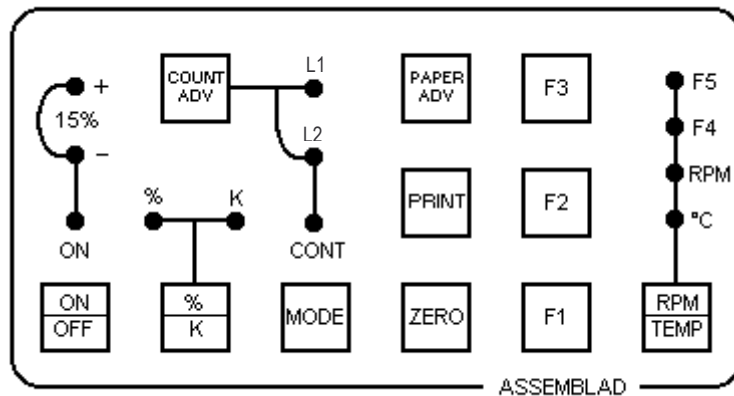


Figure 5

Description:

ON/OFF

This key switches the smoke meter on and off. It only functions if the ON led is lit. The key is timed at about 0.5 seconds to prevent inadvertent switching. Each time the instrument is turned on, the smoke meter automatically goes through a self-test and setting procedure (the messages concerning instrument status are either printed or shown on the display).

%/K

Use this key to display smoke values, that is in terms of percentage on a 00.0% to 99.9% scale, or with the K (m-1) factor. The form you select is confirmed by the % and K LEDs. The machine is automatically in the % mode when it is switched on.

MODE

Use this key to set the desired measuring mode. You can select from: CONT, L1 or L2. Your selection will be shown on the respective led CONT, L1, L2. When measuring in the L1 or L2 modes, the MODE key is inhibited by the program; it will only be released if you give a clear or PRINT command when measuring is completed. The machine is automatically in the CONT mode when it is switched on.

COUNT ADV

Use this key to increment measurements in the L1 or L2 modes. The measuring increment is timed for 5 seconds to prevent program skips if you do not press the key properly.

ZERO

Use this key to clear the measurement in progress and recover the initial drift after the pre-heating phase. Press this key each time you start a new measuring procedure. During this phase the smoke meter will clean out gases from the chamber and recheck the settings.

PRINT	Press this key to if you want a print-out of the results of a measurement. If the machine is in the CONT mode you can print at any time. If it is in the L1 or L2 mode it will only print after having completed the number of measurements required for the test. After printing, press the ZERO key for proceed with the next measurement.
PAPER ADV	Use this key to advance the printer paper. If you keep the key depressed as you press the ON/OFF key (switching on the smoke meter) you will obtain a function TEST of the printer.
RPM/TEMP	Use this key to select the function for display temperatures or RPM counter. When the machine is turned on it goes to chamber temperature mode. To calculate engine RPMs, multiply the value shown on the display by ten (RPM x 10).
F1 / F2 / F3	Function key for settings

Settings Using Combinations of Function Keys:

Here are the key combinations to use for certain settings. A plus sign (+) between key designators means that you have to press both keys at the same time.

In any event, after pressing the desired combination of keys, press the F2 key to decrease the current displayed value set (that you can see on the TEMP/RPM display) or F3 to increase it. Then press F1 to confirm the current setting.

You can only access these settings when the machine is in the CONT mode.

F1	UNIT OF MEASUREMENT (0=%, 1=K) You can change the display during measurement by pressing the %/K key, but the printout and final display will be consistent with this setting (unless the selected type of measurement requires a specific unit of measurement).
F1+F2	Modem status 0 = Inhibited, 1 = Active
F2+F3	SHOP MESSAGE (0=from EPROM, 1= from EEPROM) The message from eprom is fixed, while the one from eeprom can be defined by a personal computer that is connected to the instrument via the serial port.
F1+F3	CLOCK SETTING See the appropriate section of this manual.
F2+PRINT (###)	Display of the chamber's internal differential pressure
%/K + COUNT ADV	Entering the maximum allowed limit for the opacity.

This value is printed in the test report and it is used by the smoke-meter in order to evaluate if the vehicle's test is passed. The value is expressed in K x 100 and its admitted range is from 000 to 490 (K from 0 to 4.9) in step of 10 units (0.1 K). If the value 000 is entered, the printout will leave the user free for handwriting the value.

The following settings should be used by authorized personnel only and only when the instrument give manifest wrong values for temperatures.

ZERO + F1 + COUNT ADV Chamber Temperature Calibration **(###)**
In case of wrong values shown it's possible to recalibrate the sensor by entering the current true value (in °C) measured by means of a reference thermometer placed inside the chamber.

ZERO + F2 + COUNT ADV Oil Temperature Calibration **(###)**
In case of wrong values shown it's possible to recalibrate the sensor by entering the current true value (in °C) measured by means of a reference thermometer placed near the probe.

ZERO + F3 + COUNT ADV Smoke's Temperature Calibration **(###)**
In case of wrong values shown it's possible to recalibrate the sensor by entering the current true value (in °C) measured by means of a reference thermometer placed near smoke inlet.

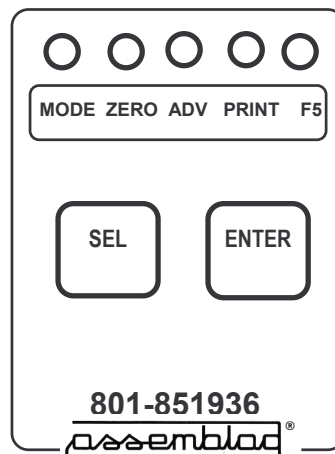
The LEADS:

ON		When this LED is lit the smoke meter is connected to the vehicle's battery or the 220VAC mains power supply. If the device is connected to the mains, the switch on the back has to be set to ON, the smoke meter is ready to be switched on.
+15%		The power supply to the smoke meter is above the rated value, if it is not corrected this can damage the smoke meter or impact the results of the measurements.
-15%		The power supply to the smoke meter is below the rated value, if it is not corrected this can alter results of the measurements or yield a printout with a pre-depression error signal.
%		The smoke measurements on the display are expressed in percentage terms.
K		The smoke measurements on the display are expressed according to the $K(m-1)$ factor.
CONT		The CONTINUOUS mode has been selected for measuring smoke values.
L1		The smoke values will be measured in accordance with L1 mode.
L2		The smoke values will be measured in accordance with L2 mode.
C°	(§§)	The green TEMP/RPM display shows the temperature in the measuring chamber. (This temperature on OPA-391 is not significant because the chamber is without heating in this equipment).
RPM		The green TEMP/RPM display shows the number of engine revolutions. Make sure that the sensor is corrected connected to the diesel fuel delivery tube on a cylinder and that the plug is fitted into the appropriate connector on the back of the device. To calculate the number of engine revolutions multiply the number on the display by 10 (RPMx10).
F4	(§§)	The green TEMP/RPM display shows the temperature of the gas entering the measuring chamber.
F5	(§§)	The green TEMP/RPM display shows the motor oil temperature. Make sure that the oil probe is properly connected inside the oil-checking rod (dip-stick), and that plug is fitted into the appropriate connector on the back of the device.

4 INFRARED REMOTE CONTROL

The ASSEMBLAD cod. 801-851936 remote control is a microprocessor based device and it is designed to operate in conjunction with the Smoke meters of both '189' and '391' series. It is biased by a 9 Volts alkaline battery installed in the rear side, behind the small slide cover.

Direction of the I.R. emission
↑↑↑↑



Keys and lamps of remote control

Operating notes

- 1- Press the key 'SEL'. One of the five functional LEDs will be lightened, in particular the last one selected.
- 2- If the requested function is different from the selected one, press again the key 'SEL' until the needed function LED is lightened.
- 3- Press the key 'ENTER' being careful to direct the Infrared emission spot towards the receiver installed in the front of the instrument.
- 4- After few seconds with no key entered, the remote control will switch off itself in sleep mode keeping in its memory the last function used.

If the device is not used for a long time, it is advisable to remove the battery in order to avoid damages to the device due to chemical components flowing out from the battery.

5 STARTING THE SMOKE METER

5.1 POWER SUPPLY CONNECTIONS

Select the power supply for the smoke meter. Usually 220 VAC mains power is used. If it is not available, connect the smoke meter to the battery of the vehicle being tested, or to a fully-charged shop battery.

MAINS POWER SUPPLY

Connect the smoke meter to a 220 VAC outlet using the cable supplied with the device; set the switch on the back to ON. The ON LED on the keypad will light up (if you set the switch to OFF, the LED will go out very slowly).

BATTERY POWER SUPPLY

Connect the smoke meter to a 12V battery using the cable that is supplied with the device. Make sure that the cable is properly inserted and screwed into the round connector on the back of the device before connecting the battery. Check polarity as you connect to the battery: Red clip = Positive, Black clip = Negative. The smoke meter is protected against inversions, but be careful when making these connections. As soon as the battery cable is connected the ON LED will light up, irrespectively of the back switch position.

5.2 START-UP

When the ON LED is lit, press the ON/OFF key. The smoke meter will now switch on, and go through a series of selftest and setting procedures automatically. The self-test series consists of several steps; you can see the following ones:

- a) All the displays will read 8
All the LEDs are lit.
- b) The displays will all read zero, except for N° TEST that will read 1.
The ON, %, CONT, C° LEDS will remain lit, the printer will start a message.
- c) The N° TEST display will read 2.
The two other displays will blink on zero, the printer will stop.
- d) All the displays will read zero.
The printer will complete its message.
- e) The display will show the chamber temperature (if below 45°). The smoke display will show a value around zero, oscillating by a few units. (The initial oscillation is due to the intrinsic stabilization of the filament, and will continue for a few minutes after the device is turned on).

Select the unit of measure (%/K key).

Select the measurement mode using the MODE key (CONT is the default).

Press the ZERO key to clear the smoke values from the display. The display will blink during the automatic clearing phase. Clearing may not work the first time, therefore, repeat the procedure until you get zero (the value should not be higher than 00.5%).

Set the RPM/TEMP key to display one of three (§§) available temperature readings (chamber, gas, oil), or engine revolutions (RPMs).

NOTE: If any problems occur during this initialisation procedure such as inadequate settings, defects inside the machine, etc., the smoke meter will go into the alarm mode and will send messages via the printer specifying the type of problem and, whenever, possible how to solve it. If the problem is more difficult, all the displays and leds will blink at the same time (see error section).

5.3 PREPARATION FOR MEASUREMENTS

Bring the engine to its normal operating temperature.

Fit the hose into the 19 mm fitting on the back of the measuring chamber. Connect the other end of the hose onto the vehicle's exhaust pipe using one of the three metal fittings supplied with the instrument (small probe with the conical fitting for pipes with diameters up to 35 mm; medium probe for pipes with diameters of 35 to 80 mm, big probe for exhaust pipes with diameters exceeding 80 mm).

Use the ballast to prevent engine's vibrations from shaking the hose loose during testing.

5.4 MESSAGES AT START-UP

When you turn on the instrument the printer will issue a message like this:

```
SMOKE METER
ASSEMBLAD OPA-391/HF
S/N ABXXXXXX
ver. x.xx
SELF CALIBRATION AND
TESTING IN PROGRESS
```

Which means that self-testing and self-setting are in progress.

After this first message, the machine will complete all the internal tests as required by the program. Then, if everything is in proper order, the printer will continue with:

```
SELFTEST = OK
SELFCALIBRATION = OK
DATE xx/xx/xx TIME xx:xx
```

If any errors or other malfunctions are found, the printer will send a message specifying the problem and, if possible, how to solve it.

6 SMOKE MEASUREMENTS

6.1 CONTINUOUS SMOKE MEASUREMENT

When the smoke meter is switched on it is automatically ready to work in this mode.

Measurements are continuous in the sense that the smoke values of the gases are shown continuously, the value on the display is the direct opacity of smoke.

This type of measurement is particularly useful in bench tests, since it shows the smoke values as they rise and fall.

The print-outs of these results do not have any legal value since the reading is an absolute result and not the results of an average of readings taken according to specific standards.

6.2 MEASURE OF OPACITY WITH L1 PROCEDURE.

This method makes it possible to work in accordance with the requirements of the DM 628. To take measurements follow the procedure described below:

Set the CONT Mode and select the limit value K applicable to the vehicle under test, then set the L1 Mode.

Make the setup, settings and measures as described for L2 procedures (next paragraph) from point b) to k).

When you have reached the stabilized average press the PRINT key, the printer will give the data on smoke levels obtained during the measurements performed, expressed in the K unit of measure, along with the max and the min number of RPMs for each acceleration, exhaust gas temperature, oil temperature, chamber temperature, chamber pressure, and finally the mean smoke value calculated.

The test is favourable when the values of last 4 measures has a maximum difference of 0.25 m^{-1} and the average has a value lower than the limit value settled, or if the last 4 measures have values lower then limit value.

The maximum number of tests is 16, after you can push only the PRINT key to have the values of measure without average.

6.3 MEASURE OF OPACITY WITH L2 PROCEDURE

This method allows to operate in accordance with the prescriptions of Directive 1999/52/CE, the procedure for carrying out the measure is the following:

- a) Set the CONT Mode and select the limit value K applicable to the vehicle under test, then set the L2 Mode.
- b) Verify that the silencer is airtight. Introduce the oil temperature probe.
- c) The gears has to be neutral, engaged for the manual or semiautomatic transmission vehicles, with the lever in neutral position for the automatic transmission vehicles or according to the manufacturer instructions.
- d) Disconnect all parts that can influence the engine rotation at minimum regime, except when expressly prohibited by the manufacturer or by regulatory prescriptions.
- e) Engine has to be at normal operation temperature (oil temperature must be equal to or greater than 80°C).
- f) Introduce the probe into exhaust pipe up to 300 mms, if it is not possible opportunely prolong the exhaust pipe verifying the airtight of the connection.
- g) Press the ZERO key and wait for the zero resetting cycle to be finished.
- h) Press the COUNT ADV key (display will show N. 1). Perform a fast full power run by pushing the pedal down in 0,4 sec. and maintain it for 2 sec. (+1,-0), then release, maintaining the minimum regime for 3 sec. (+1,-0). The opacity display will show the maximum value reached by the opacity in such phase.
- i) Press the COUNT ADV key (display will show N. 2). Perform a fast full power run as described at point (h).
- j) Repeat instructions at points h) and i) until pressing the COUNT ADV key you will ear a prolonged sound that means that a favourable test has been reached, the average value will be showed on the opacity display.
- k) When the test is positive press the PRINT key. The printer output will give the result of the calculated average in accordance with the selected normative.
- l) Press ZERO key and wait for the zero resetting cycle.

The test is favourable when the average of the last 3 measures has a value lower than the limit value settled, if the average value is higher than the limit value the test is not considered negative.

The maximum number of tests is 8. However for the measures procedure and the elaboration of the data please refer to the actual normative.

If the average of the first 3 measures is greater than 50% of the limit settled the test will be stopped and the negative result will be showed.

If the Cell Test temperature result lower than 70°C the measure will be interrupted, a zero resetting will be performed and the anomaly pointed out.

A report with the smokemeter data, RPM, all measures, calculated average, result, environmental data and vehicle data will be printed.

6.4 REVOLUTION COUNTER

Introduction:

Detection of diesel engine rpm is a difficult operation because of the physical nature of the problem without any electrical signal to measure.

Generally the rpm circuits use a piezoelectric sensor to convert pressure variation on adduction diesel pipe into an electrical signal.

This system does not guarantee a good performance in all cases for the following reason:

- Impossible to connect the sensor cause inaccessible diesel pipe and position sensor problem.
- Excessive engine vibration that does not permit to detect correctly the signal.
- No standard engine injection pump.

Operating mode :

The RPM value is visualized on RPM/TEMP display.

- Verify the correct grounding connection of the electrical power supply connected to smoke meter.
- Push RPM/TEMP button until RPM led is on.
- Assure that adduction pipe diameter is equal to the piezo sensor one.
- Positioning the sensor on a straight part of pipe after a accurate cleaning, as close as possible to the injection pump, tighten strongly the sensor fixing screw.
- Connect the cable fast-on connector to the sensor, connect the cable crocodile to car battery pole ground connected, connect the cable DIN connector to the rpm socket on the back cover of smoke meter.
- Maintain the engine idle, verify reading on green display, the displayed value is rpm divided by 10.
- Accelerate verifying the correct value of rpm displayed.
- Proceed to measure according with the selected modality.

Troubleshooting:

If displayed rpm remain constantly zero:

- Verify rpm fuse on the back panel of the smoke meter;
- Verify perfect coincidence of the sensor diameter with diesel pipe diameter.
- Move the crocodile connector from car battery to diesel pipe, near sensor, or to several other ground connections.
- Slack lightly sensor fixing screw.

If displayed rpm remain constantly at 600:

- Verify electrical connection of rpm cable;
- Verify the correct grounding of the smoke meter.

If displayed rpm became instable during the acceleration:

- Verify that sensor is positioned on a straight part of pipe with low engine vibrations.
- Tighten strongly the sensor fixing screw.

6.5 TEMPERATURE READINGS

The TEMP/RPM display can show 3 different temperatures (§§): the exhaust gases, the measuring chamber (§§) and the motor oil (§§).

Select the temperature you want to see on the display by pressing the RPM/TEMP key, until the appropriate LED (°C- Chamber temp., F4- Gas Temp., F5-Oil Temp.) lights up.

The gas temperature sensor is an integrated circuit mounted on the inlet duct. You can inspect it by removing the two screws that hold the fastening plate in position.

The chamber temperature sensor (§§) is located inside the chamber insulation.

The oil temperature sensor (§§) is part of the probe that has to be put into the oil rod housing and be connected to the device with the fitting on the back of the unit.

6.6 PRESSURE/DEPRESSION MEASUREMENTS

The pressure sensor is of the differential type. It detects the difference in pressure between the measuring chamber and the outside environment.

It is mounted directly on the chamber output pipe so that vibrations affecting the chamber are damped.

The pressure sensor does not require any maintenance at all. NEVER use compressed air to clean it; pressures of only 0.3 Bar can damage the sensor.

Pressure or depression in the chamber at the time of measurement is printed on the test results. Pressure or depression values exceeding 75 mm H₂O are not allowed during the tests; if this occurs, the control device stops the smoke meter and transmits an error message on the printer.

7 INFRAPLUS Software

InfraPlus is a program designed for DOS that allows to display on the PC's screen all the data regarding the test procedures in progress on the smoke meter.

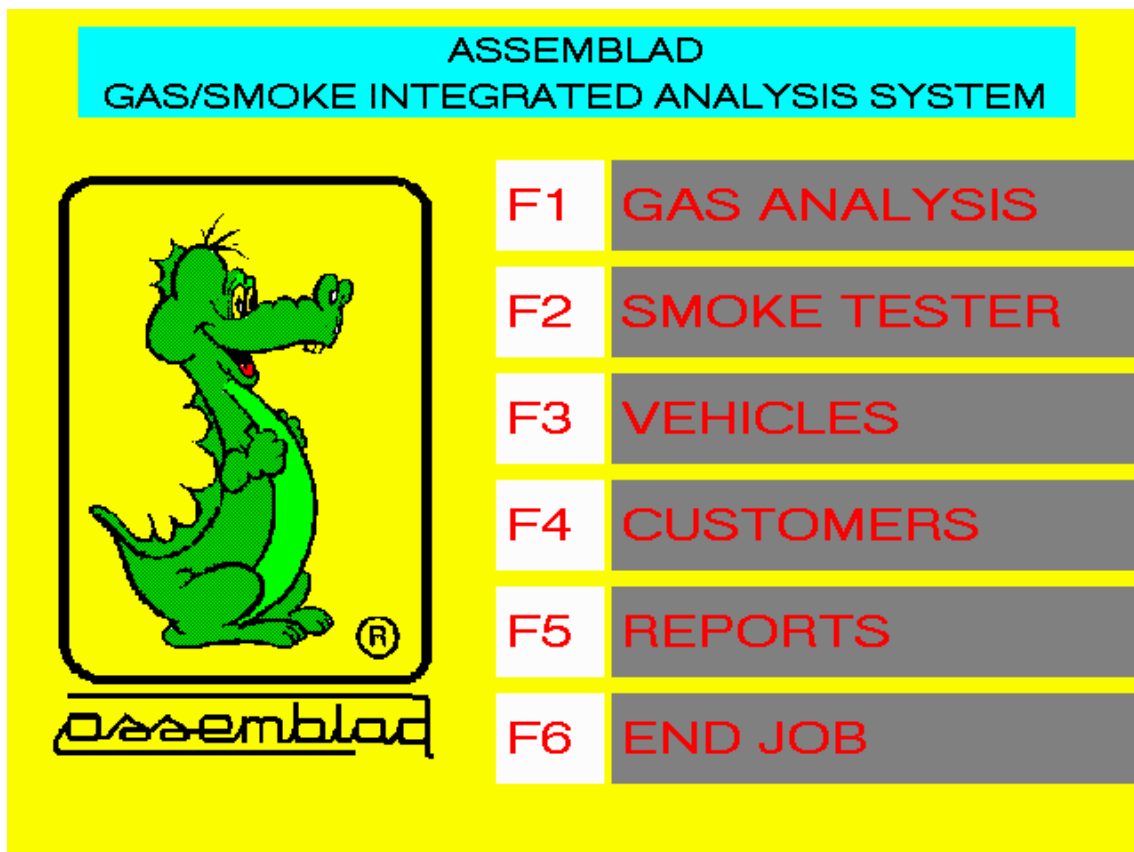
In order to use it, a RS232 connection with the smokemeter using a standard serial cable must be provided.

7.1 SOFTWARE INSTALLATION

In order to install InfraPlus on your computer running DOS (not use a DOS shell under Windows) please insert the diskette into drive A: then type **"A:install<ente**

The software will be copied on your hard disk in the directory named **"INFPLUS"**.

To run the program type **"INFPLUS<enter>"** at the DOS prompt or click to the Icon named InfraPlus.



7.2 RUNNING THE PROGRAM

Before running InfraPlus check the connection between the PC's RS232 COMx port and the smoke meter.

Check also if there is installed the mouse software driver for the same serial port that you assign to the smokemeter. If so, you have to remove the installation of the mouse software driver in your PC or alternatively you could place the mouse in a different port in order to avoid conflicts with the smoke meter.

When running InfraPlus a main menu with 4 items and the ASSEMBLAD logo will appear. Don't worry if after few minutes the screen will change, it is just for saving the screen.

InfraPlus is shipped as default with these communication settings:

Port : **COM1**
Speed : **9600**
Word : **8 bits**
Stop : **1 bit**
Parity: **None**

If the default port (COM1) doesn't match with your PC's port, you have to switch the configured port to another available serial port using the **<F5>** key.

WARNING!: Don't change at all the other parameters, please change only the COMx port if required.


After that you can go to the smoke meter section striking the **<F2>** key.

If an error message will appear, or the system respond very slowly, please check again the wire connection as well as the communication parameters in use.

7.3 SMOKE METER SECTION

This section shows:

- the smoke meter's status
- all measurements made by the smoke meters in real time
- report of all subsequent intermediate measures performed according to the official directives
- the final official value of opacity computed according to the directives
- a menu describing the hot keys availables
- two header rows describing the vehicle under test

		ASSEMBLAD		GASOLIN 4S		MEAS	
Infragas 196		PEF=0.538					
CO	3.34	%	RPM	1005	rpm		
CO Corr	3.3	%	Manufacturer data				
CO2	12.6	%	CO				
HC	1336	ppm	CO Acc				
O2	1.44	%	CO2				
T.OIL	97	°C	HC				
Lambda	0.92		O2				
			T.OIL				
			Lambda				
		F1 VEHICLE TYPE		F5 MEAS			
		F2 VEHICLE DATA		F6 LAMBDA P.			
		F3 2S/4S		F7 PRINTOUT			
		F4 FEEDING		F8 END JOB			

a. Smoke meter's status

The measuring mode is shown as continuous, L1 and L2 as selected by the smoke meter's keyboard.

In the case of L1 and L2 mode, the progressive number of the test under execution it is also shown.

b. Real time measuring

The instant values of opacity, both in % and in K units, is shown as well as the RPM and three internal temperatures in degrees, the oil, camera and fumes temperatures.

c. Intermediate results

In case of measuring according to the L1 and L2 mode all intermediate values of opacity for each test are shown in the same unit selected by the instrument keyboard.

d. Official value

The official value computed according to which of the selected mode (L1 or L2) is shown after the end of the procedure.

e. Hot keys

<F1> VEHICLE TYPE

Make selection of the vehicle's type. The selection is made from the registered vehicles. You can register new vehicles, as well as new manufacturers, using the <F3> key labeled DATA BANK on the first menu. A form requesting some data will appear. You can select first the manufacturer using the <space bar> or typing the first letter. Then you will be prompted for selecting the vehicle. You can select it by the <space bar>. Type the <ESC> key for leaving without confirming.

<F2> VEHICLE DATA

Get data concerning the vehicle under test. These data, if present, will be printed on the report.

<F7> PRINT

Printing is enabled only when the smoke meter has finished the measuring procedure. A standard international form will be printed containing also, if inserted, other information concerning the vehicle.

<F8> END

Leaving the program.

f. Header

If vehicle data are present, the vehicle's type and plate will be shown here. If not, a default string of the smoke meter's manufacturer and the model will appear.

7.4 USING THE DATA BANK

This function is useful for adding new vehicle's manufacturers and/or models to InfraPlus internal database. Vehicle's manufacturer and model are printed, when chosen, in the top of the display as well as in the printed report.

A form requesting the manufacturer's name and the model will appear. Through this function you will be able to insert new vehicles or modification or deleting data of the existing ones.

In this form you can use the:
<ESC> key for leaving without modifying
<F6> key for deleting an item
<F10> key for saving modified values.

The model form contains some data which are specific for gasoline vehicles. You can ignore them when using InfraPlus with the smoke meter.

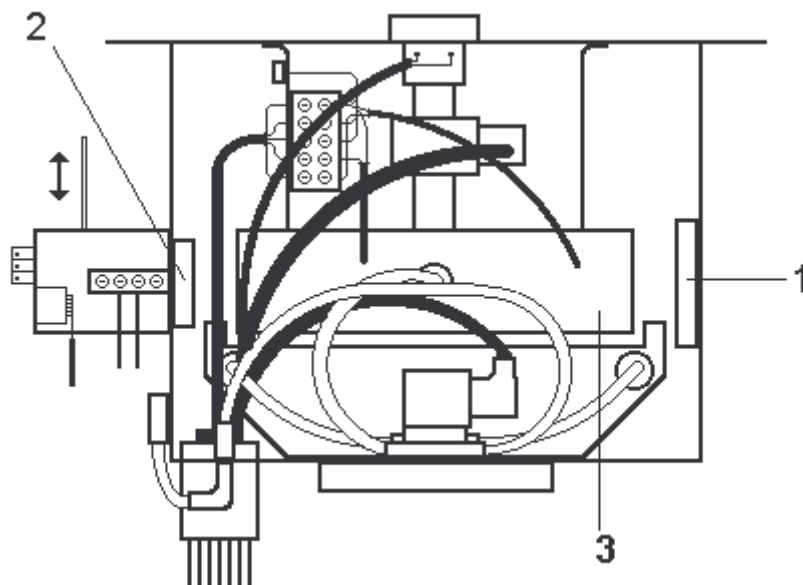
8 MAINTENANCE

8.1 CLEANING THE MEASURING CHAMBER

To clean the measuring chamber, proceed as follows:

- 1 Switch off the smoke meter and disconnect it from all power supplies.
- 2 Open the hinged cover on top of the smoke meter.
- 3 Remove the cover from the measuring chamber.
- 4 Moisten a piece of cotton with denatured alcohol and clean the mirror (1) and the two glass plates (2) on the photoelectric cell.
- 5 We do not recommend using compressed air to clean the chamber. However, sometimes it may be necessary to blow some air to remove soot. Pressure, leaving the gun should never exceed 2/3 bar.

HIGHER PRESSURES CAN CAUSE PERMANENT DAMAGE
TO THE DIFFERENTIAL PRESSURE SENSOR.



8.2 **PRINTER**

The printer provides the initial Autotest and Autosetting message, results of the tests and a series of error messages for the entire system.

PRINT and printer TEST functions can be obtained via the keypad.

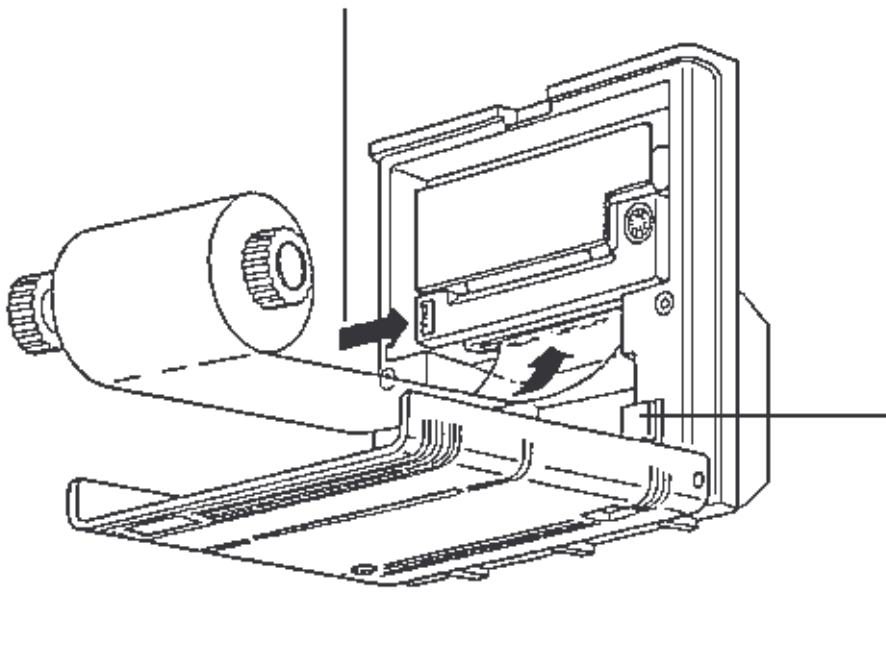
To test the printer proceed as follows:

with the smoke meter switched off, press the PAPER ADV key, while keeping it pressed, switch on the smoke meter using the ON/OFF key. The printer will send a message showing the series of available characters; when this message is completed it can resume normal operations.

To replace the ink cartridge and paper, see the drawing below.

(Ink cartridge = EPSON ERC 09; Paper = w 56 mm; diam. 50 mm)

PRESS "PUSH" TO REMOVE USED CARTRIDGE



PRESS THE BUTTON UNTIL THE PAPER COMES OUT OF THE PRINTING MECHANISM

8.3 CALENDAR-CLOCK

The calendar setting will remain stable over long periods even if the smoke meter is not powered. This is because the calendar-clock device kept in the stand-by mode by an accumulator.

If smoke-meters still several days turned off, the accumulator may discharge, if so turn on the instrument, set the clock and let the smoke meter powered.

Setting/correcting date and time settings:

Press F1 and F3 contemporaneously to enter the set/correct mode, then use keys F1 and F2 for all the functions.

F1 Selects and confirms the date setting and lets you go on to the next setting. The settings are shown on the N°TEST display:

TEST: 0 = Wait
 TEST: 1 = Year
 TEST: 2 = Month
 TEST: 3 = Day
 TEST: 4 = Hour
 TEST: 5 = Minutes

F2 Moves the set value ahead one digit at a time (for fast advance, keep the key pressed down).
 The value is displayed on TEMP/RPM.

Example:

- Press F1+F3: All displays read zero
- Press F1: Display N°TEST = 1 (year)
- Press F2: Display TEMP = from 00 to 99 (year)
- Press F1: Confirm preceding step and start next phase.
Display N°TEST = 2(month)
- Press F2: Display TEMP = from 01 to 12 (month)
- Press F1: Confirm.....
.....
.....
- Press F1: Confirm everything and return to normal functions

8.4 REPLACING FUSES

The smoke meter is equipped with two types of fuses: 0.5A/250 (5x20) for protections towards the 220VAC mains, and 2A/250 (5x20) to protect the halogen lamp circuit. The 0.5A/250 fuse is located in the filter/power switch unit. To replace it:

- disconnect the smoke meter from the 220V AC power supply.
- use your finger or a small screwdriver to remove the fusecarrier housing located above the power plug.
- pull out the fuse and replace it with a new one.
- replace the fuse carrier.
- close the snap on cover.

The 2A/250 fuse is located on the power supply card (situated horizontally at the back of the smoke meter); to replace it:

- switch off the smoke meter and disconnect it from the power supply.
- raise the hinged door on the cover.
- raise the protective cover.
- removed the blown fuse and replace it with a new one.
- replace the cover.

8.5 REPLACING THE HALOGEN LAMP

To replace the lamp on the photoelectric cell, proceed as follows:

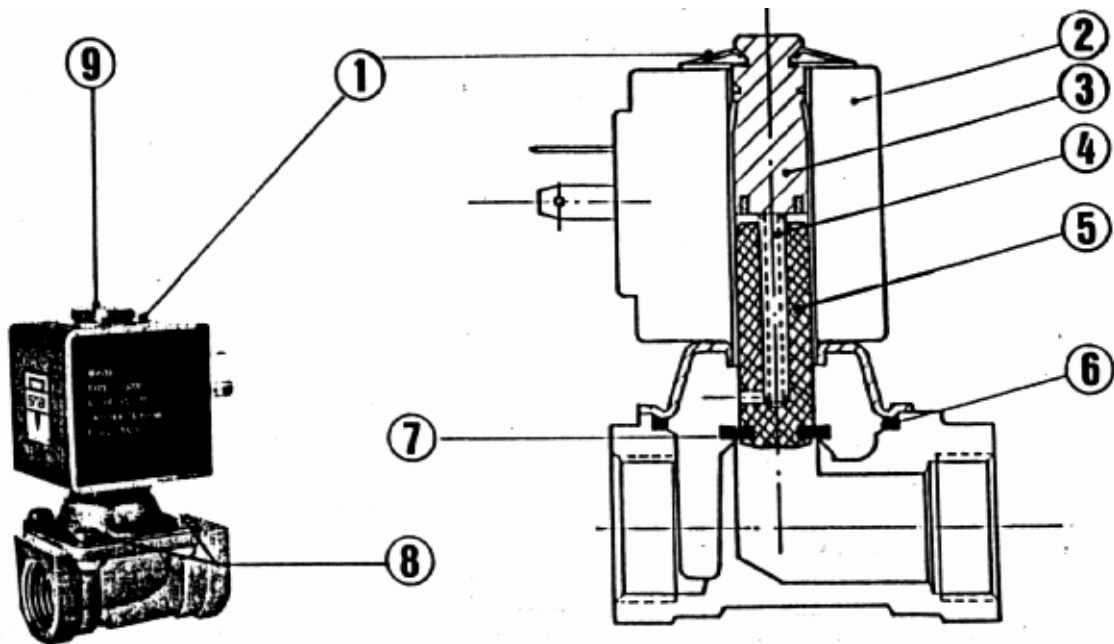
- 1 Switch off the smoke meter.
- 2 Open the hinged door on top of the smoke meter.
- 3 Use the 3 mm Allen key supplied with the device to loosen the two screws (7) that support the lamp holder's fastening plate.
- 4 Replace the lamp with another 6V 10W halogen lamp; we recommend OSRAM HALO STAR N.64410 or (S).
- 5 Insert the lamp into the shoe as centrally as possible.
- 6 Clean the lamp with denatured alcohol before you put it into the photoelectric cell (dirt or grease will drastically reduce the service life of all halogen lamps).
- 7 Put the fastening plate back onto the photoelectric cell; make sure that the lampholder is properly guided and fastened into position by the two pointed screws (their length is preset in the factory and must not be adjusted).
- 8 Replace the two Allen screws and tighten securely.
- 9 Switch on the smoke meter.
- 10 Recalibrate the instrument.

8.6 SMOKE-INTERCEPT SOLENOID VALVE MAINTENANCE

If the smoke meter is not used for long periods, and especially after heavy work cycles, the solenoid valve may not open. This is due to the fact that, after the deposited gases have dried, they hold back the seals restraining the core (7). In this case the smoke meter can give an error signal or the display will read zero throughout the various tests.

A firm tap on the fitting for exhaust gas input (see Fig.2, item 2), on the head (9) or on the brass body is usually sufficient to start the solenoid valve working again. If this does not work, or each time you want to clean the solenoid valve circuits, proceed as follows:

- a) disconnect the smoke meter from the mains or battery power supply.
- b) open the measuring chamber.
- c) loosen the 4 screws (8), to access each one, rotate the coil (2) on its own axis. (The coil can only be removed if you first release the cup spring (1), but this is usually not necessary).
- d) raise the coil/pin unit.
- e) clean all the internal parts with a brush and compressed air at medium pressure (1-2 Atm).
- f) reassemble.



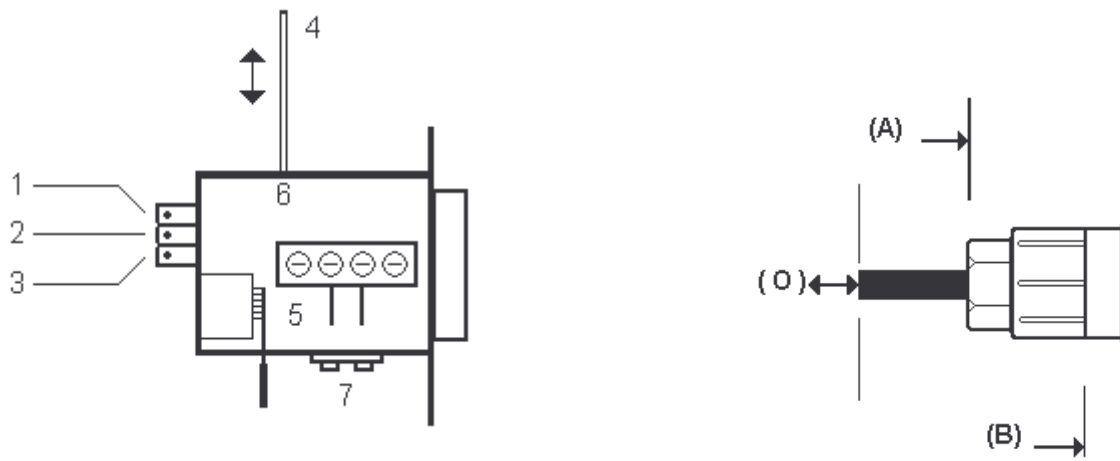
- | | |
|---------------|-----------------------|
| 1) Cup spring | 2) Coil |
| 3) Guide unit | 4) Core return spring |
| 5) Core | 6) OR Gasket |
| 7) Seal | 8) Screws M4x10 |

8.7 HOW TO CHECK THE CALIBRATION OF THE SMOKEMETER

Along with the smoke-meter an embedded optical filter with a well known absorption factor is supplied. In order to check the proper operation of the equipment proceed as follows:

- Clean all optical parts with care
- Switch on the equipment. After that the following indicators must be lightened : ON, %, CONT, °C.
- Wait for the end of the initial drift for about 15 minutes
- Do a zeroing using the ZERO key
- Insert the embedded filter till the position referred as “(B)”
- Look at the opacity display and verify this value against the nominal value of the filter as written in the calibration certificate issued along with the manual. The maximum allowed deviation is of the $\pm 1,0\%$.
- If a bigger deviation is found the Technical Service must be invoked as the recalibration with three sample filters is required.
- Introducing the embedded filter till the position referred as “(A)” should generate an opacity value of 99.9%.

IMPORTANT: never clear the smoke meter with the filter inserted.



- (1) - Full light regulation
- (2) - Dark level regulation
- (3) - Mean level regulation
- (4) - Embedded optical filter
- (5) - Light sensor device
- (6) - Filter housing
- (7) - Lamp holder

8.8 HOW TO RECALIBRATE WITH SAMPLE FILTERS (###)

The following operations are needed in order to recalibrate the equipment (fig. 4.2).

- Remove the top panel of the smokemeter then the top panel of the measuring chamber and proceed with cleaning all the optical parts.
- Switch on the smokemeter. Be careful when operating inside the instrument as there are inside some dangerous voltages.
- Do the dark level tuning then the full light tuning according to their relative paragraphs.
- Wait for the end of the initial drift for about 15 minutes
- Do an autozeroing using the ZERO key then set the measuring unit as in K.
- Insert in sequence the three sample filters and look at the value shown for the opacity. They should indicate the same values written on the filters with a tolerance of ± 0.1 K then press the key PRINT for getting the calibration report after each insertion.
- In case of a not accurate reading recalibrate the smokemeter through the trimmer (3), then when the match is done remove the filter and do an autozeroing through the key ZERO waiting for its completion.
- Repeat the same procedure until all the three readings are included in the allowed range.
- Do not make in any case an autozeroing when there's a filter inserted
- Close the chamber with its panel and set the top cover of the instrument.

8.9 DARK LEVEL REGULATION (###)

In order to check the right voltage level proceed as follows (fig. 4.2):

- Remove the top panel of the smokemeter then the top panel of the measuring chamber proceed being careful when operating inside the instrument as there are inside some dangerous voltages.
- Connect the + terminal of a multimeter to the test point TP2 of the measuring board then the - terminal to the ground test point TP7 with the multimeter set as for DC Voltages.
- Switch on the smokemeter. The LEDs ON, %, CONT and °C should be lit.
- Wait for the end of the initial drift for about 15 minutes
- Do an autozeroing using the ZERO key and wait for its completion
- Insert the embedded optical filter (4) in the apposite slot (6) as shown in fig. 4.1 mentioned as "Verifica a".
- Look at the opacity display. It should indicate 99.9 % (or 9.99 1/m)
- If the reading of the multimeter is lower than 50 mV or greater than 200 mV regulate the trimmer (2) in such a way to get 100 mV, then let the filter return back in its idle position.
- Do an autozeroing using the ZERO key and wait for its completion, then check again the indication of the multimeter
- Do not make in any case an autozeroing when there's a filter inserted
- Close the chamber with its panel and set the top cover of the instrument.

8.10 FULL LIGHT REGULATION (###)

In order to check the right voltage level proceed as follows (fig. 4.2):

- Remove the top panel of the smokemeter then the top panel of the measuring chamber proceed being careful when operating inside the instrument as there are inside some dangerous voltages.
- Connect the + terminal of a multimeter to the test point TP2 of the measuring board then the - terminal to the ground test point TP7 with the multimeter set as for DC Voltages.
- Switch on the smokemeter. The LEDs ON, %, CONT and °C should be lit.
- Wait for the end of the initial drift for about 15 minutes
- Do an autozeroing using the ZERO key and wait for its completion
- Look at the opacity display. It should indicate 00.0 % (or 0.00 1/m)
- If the reading of the multimeter is different from 4.3 regulate the trimmer (1) in such a way to get 4.3 Volts.
- Do an autozeroing using the ZERO key and wait for its completion, then check again the indication of the multimeter
- Do not make in any case an autozeroing when there's a filter inserted
- Close the chamber with its panel and set the top cover of the instrument.

8.11 PROGRAM FOR PERIODIC MAINTENANCE UTILITY

The serial port meets the RS-232 standards and permits dialogue between the device and a Personal Computer.

Some operations are uniquely achievable by Personal Computer running the "Periodic Maintenance Utility", which is a DOS program.

In order to install the "Periodic Maintenance Utility" on your computer please make a new directory named "A391" then copy there all the contents of the enclosed diskette.

Alternatively, run the installation batch typing

```
A:\install<ENTER>
```

After the installation, run the program typing A391<ENTER> from the DOS prompt.

The menu below described will appear. The menu contains all operation you can do on the smoke meter.

At the top rightmost side the current PC's date and time is displayed.

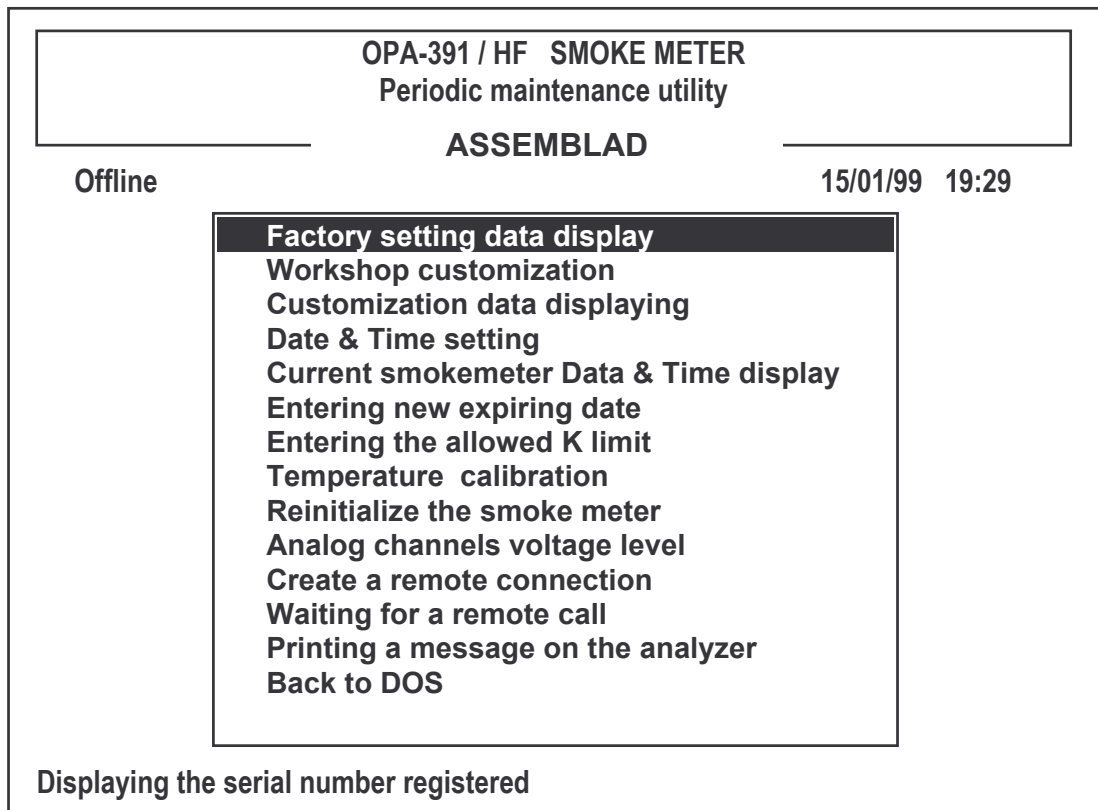
Through the up/down arrows choose the operation you need to do then press the ENTER key. In the last row of the screen you could see a brief description of the currently selected operation. The operation displayed in reverse will be undertaken.

Before starting with any operation with the smoke-meter, please check if the serial port of your computer is properly configured in A391.

In order to do so, type the F6 key and the current working parameters will be displayed.

In particular, check if the right COMx port is selected and the working communication parameters are ok. The default parameters are the following:

8 bit, no parity, 9600 Baud (for software versions higher than or equal to 2.00)



Warning: Operations marked with the symbol (###) are protected by password as only authorized personnel is enabled to do them

Factory setting data display

Shows the factory data of the smoke meter as the serial number and the software version

Workshop customisation

Allows to write 6 lines of 24 characters containing details about the workshop, as the Name, Address, Telephone and more.

These data will be printed in the test report by the smoke meter.

Customisation data displaying

Shows the Workshop details currently registered on the smoke meter.

Date & Time setting

The current PC's date and time will be transferred to the smoke meter.

Current smokemeter Date & Time display

Shows the current working date and time of the smoke meter.

Entering new expiring date (###)

The smoke meter prints in every report its expiring date.

Normally, the smoke meter should be checked and/or recalibrated every 12 months.

Through this function the technician updates the expiring date after his recalibration.

Entering the allowed K limit

It changes the internal reference of the opacity that the smoke meter uses in order to declare the test passed or not.

Temperature calibration (###)

Through this function, authorized technical people can calibrate all smoke meter's temperatures.

Reinitialise the smoke meter (###)

Through this function it's possible to restore the contents of the internal settings of the smoke meter as when it left the factory. All internal settings modified in a second time will be lost.

Analog channels voltage level

Shows the electrical level of internal analog channels for diagnostic purpose.

Create a remote connection

On developing.

Waiting for a remote call

On developing.

Printing a message on the analyzer

It simply prints a message on the smoke meter's printer.

Back to DOS

Exit the program.

8.12 TEST PROGRAM FOR RS-232

Connect the analyser or the smoke-meter to the PC through the modem cable. Start or restart the computer in DOS mode.

Run program "TESTRS.EXE" available on the diskette supplied with the equipment (or downloadable from our web site <http://www.assemblad.it>).

On the monitor will appear:

- The list of COM available on the PC.
- The COM on which the equipment is connected.
- The Baude rate.
- The model of equipment that the PC recognises.

The visualization of these data shows that equipment and PC can be connected together if the program A196 or A291 or A391 will be set with such baud rate.

To set the communication parameter on programs A196 or A291 or A391 press the key F6 and verify that baude rate, COM, etc.. are correct. Save setting, exit program, start again the program and push F6 to verify that setting have been really saved.

If all these options are verified now it's possible to use "Infplus" and/or the service program.

9 ERRORS

During the Autosetting, Autotest and measuring phases the smoke meter can and does detect certain problems. The system software makes it possible to send the operator warning messages and in serious cases, to shut down the machine.

In some cases, the system reports the error and even suggests possible remedies.

Typical error messages are:

```
ERROR 01
LIGHT SENSOR OUT RANGE
check the cleaning of
the optical parts
```

```
ERROR 02
EMITTER OUT OF ORDER
Check the lamp, light
sensor and fuse
```

```
ERROR 03
Measure of smoke is not
according to the law
Pression in chamber
over 75mm H20
```

```
ERROR 04
Measure of smoke is not
according to the law
Depression in chamber
over 75mm H20
```

The first two messages give possible remedies, for the other two the problem is caused by gas adduction, therefore the sampling point has to be shifted.

In addition, the computer system makes it possible to detect other errors that operator cannot resolve by yourself. This type of error sends a message via the printer, such as:

ERROR S.A.1. - call technical service
ERROR S.A.2. - call technical service
etc.

Function errors are indicated by the letters S.A. and a progressive number. When you call the technical service department give the complete error code, with the number.

NOTE: before calling the technical service department, switch off the smoke meter and check to make sure that all cables and wires are properly connected. Then, switch it on again and see if the error signal is still being given. If there error signal persists, call the technical service department.

APPENDIX

CONVERSION TABLE:

smoke readings expressed in percentages (%) and absorption factor k(m-1)

%	K[1/m]	%	K[1/m]	%	K[1/m]
05,0	= 0,13	44,0	= 1,45	63,0	= 2,49
10,0	= 0,26	45,0	= 1,49	64,0	= 2,55
15,0	= 0,41	46,0	= 1,54	65,0	= 2,62
20,0	= 0,55	47,0	= 1,59	66,0	= 2,70
25,0	= 0,71	48,0	= 1,63	67,0	= 2,77
30,0	= 0,89	49,0	= 1,68	68,0	= 2,85
31,0	= 0,93	50,0	= 1,73	69,0	= 2,93
32,0	= 0,96	51,0	= 1,78	70,0	= 3,01
33,0	= 1,00	52,0	= 1,83	71,0	= 3,09
34,0	= 1,03	53,0	= 1,89	72,0	= 3,18
35,0	= 1,07	54,0	= 1,94	73,0	= 3,27
36,0	= 1,11	55,0	= 2,00	74,0	= 3,37
37,0	= 1,15	56,0	= 2,05	75,0	= 3,46
38,0	= 1,19	57,0	= 2,11	76,0	= 3,57
39,0	= 1,23	58,0	= 2,17	77,0	= 3,67
40,0	= 1,28	59,0	= 2,23	78,0	= 3,79
41,0	= 1,31	60,0	= 2,29	79,0	= 3,90
42,0	= 1,36	61,0	= 2,35	80,0	= 4,02
43,0	= 1,40	62,0	= 2,42	90,0	= 5,76

Conversion : $K = - (\ln (1 - N / 100)) / L$

L = length of optical camera = 0,4

N = value in %

WARRANTY

This device was built with care and carefully inspected before it left the factory. It is guaranteed for one year from the date of purchase by the final user.

To enjoy full rights under this warranty and avoid the risk of invalidation, you must mail a copy of the Warranty Certificate to the factory within 10 days of the purchase date.

The warranty covers all defects in materials and workmanship.

The warranty does not cover: wiring, probes, the remote control unit and the accessories. These items are subject to wear and their efficiency depends on how they are handled.

The warranty does not cover damage caused by accidents, impact or dropping the instrument, or by negligence, improper use, non-compliance with the instructions and improper storage.

If the device has such defects as to require technical service, you must return it to Assemblad or an authorized service center. Shipping charges shall be covered by the customer.

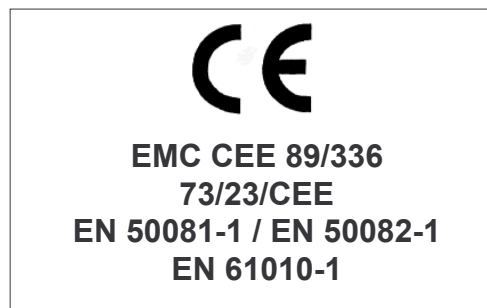
The warranty shall immediately become invalid if the device shows any signs of tampering.

The sole court of jurisdiction for any disputes arising from the application and/or interpretation of this warranty is the Court of Florence (Italy).

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