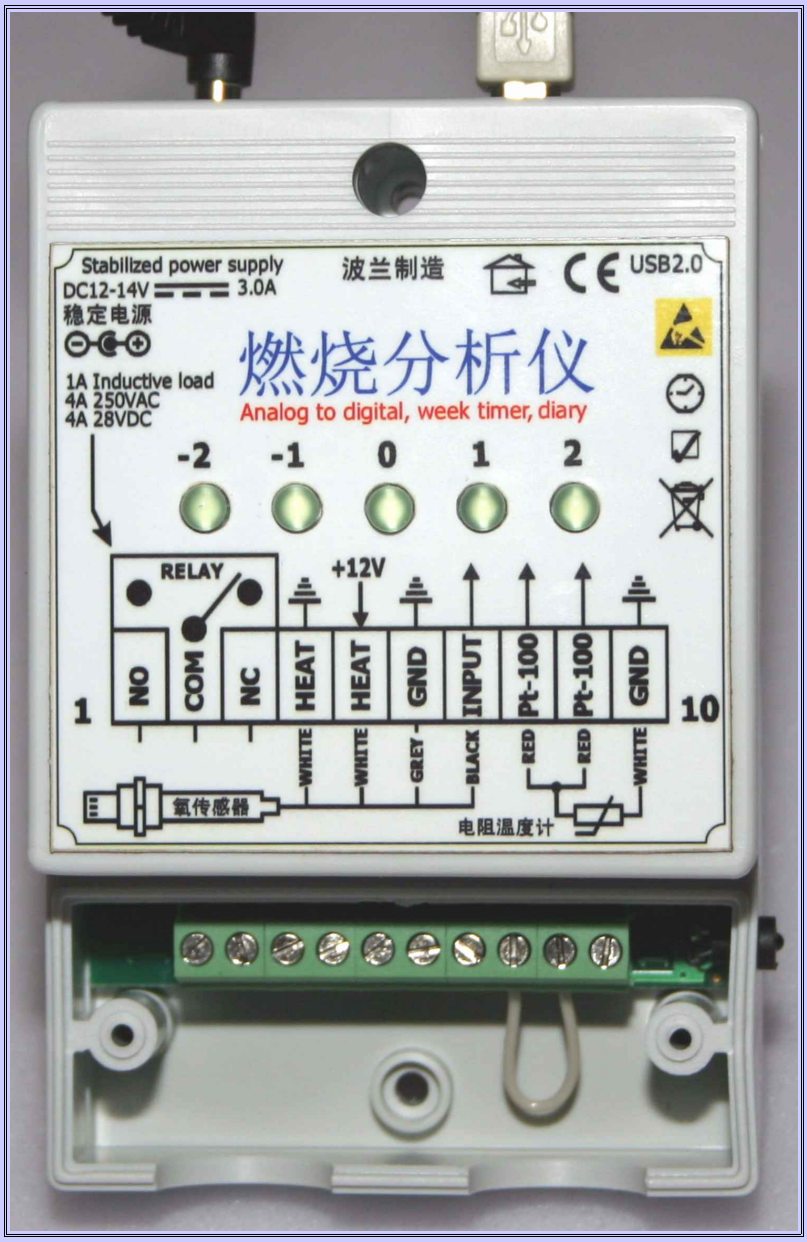
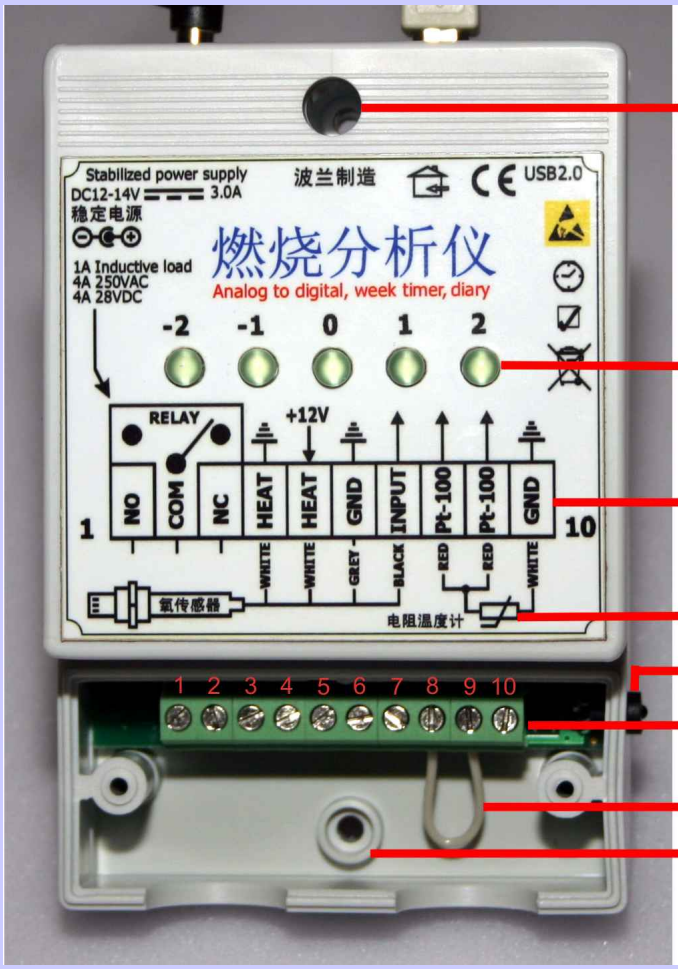
Lmbd3 Combustion Analyzer for oil or gas fired boilers, furnaces or other units with a closed combustion chamber and a fan equipped automatic burner.

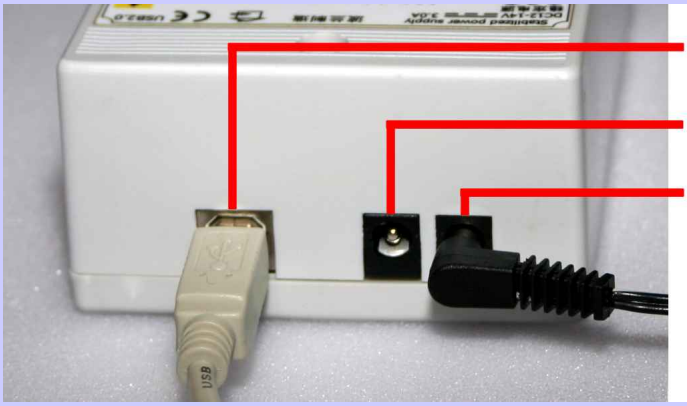


LMBD3

The Combustion Analyzer – User's Manual

1. Build


Stabilized power supply
DC12-14V 3.0A
稳定电源
波兰制造
USB2.0
燃烧分析仪
Analog to digital, week timer, diary
1A Inductive load
4A 250VAC
4A 28VDC
-2 -1 0 1 2
RELAY
+12V
NO COM NC HEAT HEAT GND INPUT Pt-100 Pt-100 GND
1
10
WHITE WHITE GREY BLACK RED RED WHITE
氧传感器
电阻温度计
1 2 3 4 5 6 7 8 9 10
WALL MOUNTING HOLE
DISPLAY LEDS
DESCRIPTION OF CONNECTORS
FLUE GAS TEMPERATURE SENSOR
ROOM TEMPERATURE SENSOR
CONNECTORS
SHORT
WALL MOUNTING HOLE


USB SOCKET
5.5/2.5 POWER SUPPLY SOCKET
5.5/2.1 POWER SUPPLY SOCKET

2. Before you start using the analyzer

Before you start using the combustion analyzer

Prior to using the device you should thoroughly read this user's manual. In it you will find tips regarding safe use of the device and it will get you acquainted with the device's build and functions.

What's in the box

- flue gas combustion analyzer central unit (CPU)
- power supply unit with a cord (12VDC= 3A, 100-240VAC, 50-60Hz)
- USB cable to connect the device to the computer (1,8m)
- CD with software, drivers and a manual
- 18 MM nut made from stainless steel used to install the lambda probe in the exhaust stack

Unpacking and check

After unpacking you should check whether the device is damaged. If you have any doubts do not launch the device. In this case you should contact the seller.

Any materials from the package (foil, rubber etc.) should be kept away from children as they may be dangerous to them.

Connecting to mains electricity

Connection to mains electricity must be done accordingly to the manufacturers guidance and the binding safety regulations.

To do this you should use the power supply provided together with the device and:

- put the power supply on a non-flammable surface or
- hang the power supply or

- put the power supply on a non-flammable dais (e.g. brick)
- put the power supply in a place where it is safe from being accidentally flooded with water
- do not put the power supply on the floor because any water leak can flood it
- do not put the power supply too close to heat sources
- mount the power supply away from flammable liquids and gases prone to ignition and self-ignition
- the guidances above should also be applied to the device itself

The mains electricity socket you are connecting the device to must be equipped with an appropriate fuse (depending on the circuit) and a residual current device to ensure the user will not be electrocuted due to insulation being ruptured, a short circuit, touching, flooding etc. The electrical installation should be done accordingly to binding safety regulations.

The manufacturer is not responsible for any damage to third parties or objects caused by not adhering to the manufacturers guidances.

3. Preparing to launch

The LMBD3 combustion analyzer is designed to be used with any boiler unit with a closed combustion chamber and a blowtorch where all exhaust gases are not additionally mixed with air and the whole amount of air needed for the combustion process is delivered by the blowtorch so we can analyze their unchanged composition immediately after they are blown out from the boiler unit.

The combustion analyzer is designed to use an universal lambda probe that is normally used to analyze the composition of exhaust gases in cars.

You should only use a four-wire, zirconium lambda probe with a built-in heater. The heaters grounding, signal wire and internal ground potentials should be physically isolated from the metal case of the probe.

You can buy and calibrate the probe on your own, buy a probe with known parameters or use an additionally bought calibrated probe. The lambda probe is not an element of the package and you need to buy it separately.

The durability of the probe depends on the fuel type and the temperature it is working in. When the fuel that is burned is free of sulfur and other chemical contaminations then the probe should last anywhere from a year to a couple of years. However, if we experiment with solid fuels, varnished woodwork wastes, coal, charred coal, used engine oil or fuel contaminated with plastic we might damage the probe in just a few days.

4. How to prepare and where to place the lambda probe

For the device to start working you first need to properly prepare the lambda probe. After being unpacked the probe should be heated. Connect the probe to the device (the connection scheme is placed on the devices front panel), then turn on the power supply and leave the probe for around an hour while it heats up and burns any contaminations.

!!! Connecting the lambda probe to power supply in an improper way will cause damage to the probe.

!!! Please remember that the probe heats up to temperatures up to 200°C (392°F) and more and touching it when it reaches that temperature will result in burns. Please be very careful when handling the lambda probe.

During the heating process, the probe should be placed on a non-flammable, preferably stony or ceramic (brick, tile, concrete) surface in free air.

The lambda probe is very sensitive to falls. Dropping it will result in permanent damage, the zirconium oxide tube will crack.

After the probe heating process is complete you can connect the device to a laptop (or any other computer you wish to use the device with) using the USB cable received in the package. The USB socket is placed next to the power supply sockets.

The device has two sockets for two different types of plugs.

!!! Connect only one power supply to a fitting socket !!!

After you install the drivers and the device is recognized by the operating system, run the software (found on the CD) to operate the device. Just copy the software from the CD to the hard drive and run it (the software does not require installation).

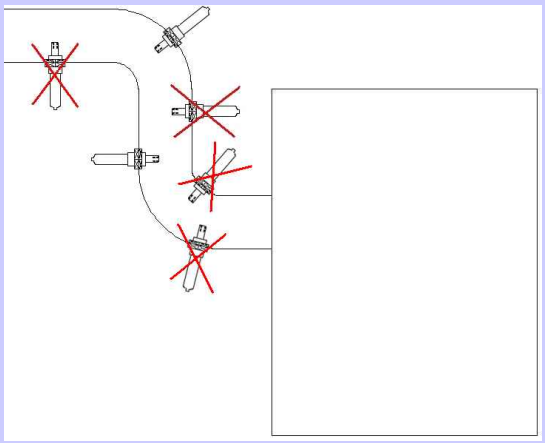
!!! It is impossible to use the software without installing USB drivers first !!!

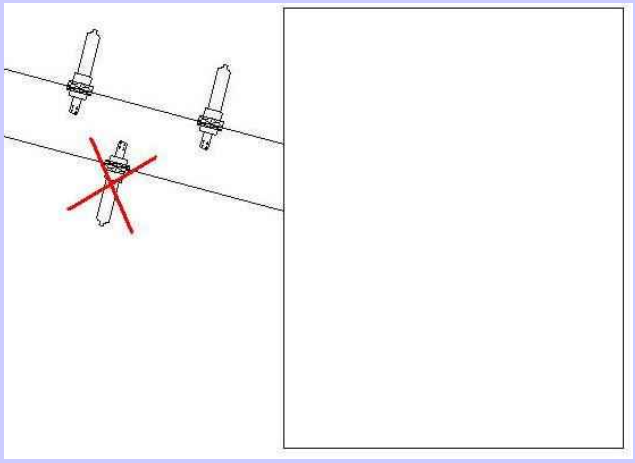
Without proper drivers, every time you try to run the software it will cause a system error saying some system files are missing. This is normal and should not cause concern.

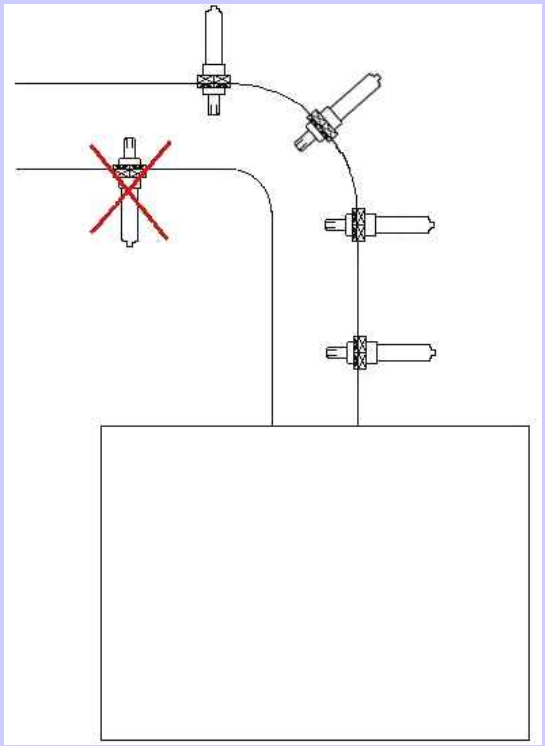
You should first connect the device to the computer with an USB cable, then turn on the power supply, wait for Windows to ask for the drivers and then install them from the CD. Windows will ask for the drivers twice and you should pick the folder on the CD where they are stored.

!!! Only after installing the drivers you will be able to run the software !!!

Picking the mounting spot







These pictures show different ways to mount the probe in your exhaust stack depending on its shape. Due to their design, some probes should not be mounted horizontally as it will cause drip to accumulate. Probes mounted in improper ways were marked with a red 'X'. The probes should always be mounted vertically, at an angle pointing downward or – as a last resort – horizontally and as close to the boiler units exhaust as possible. Do not mount the probe upside down or at an angle where the cables are pointing downward.

The probe should be protected so that water does not get inside it through the wires. You cannot seal the spot where the wires enter the probe.

A prepared probe should be mounted in a spot suitable for doing measurements, that is as close to the boiler units exhaust as possible (as seen on the pictures above). When possible, the probe should be placed in the exhaust gases draft where the temperature is the highest, not further from the exhaust than at a distance of four times the diameter of the exhaust stack. The closer to the boiler unit and it's exhaust, the better.

A built-in heater makes the lambda probe less sensitive to the distance from the exhaust and the exhaust gas temperature. However, pick the mounting spot with care as you want to be sure that the exhaust gases are hot and make contact with the probe. Sometimes a few attempts of picking the mounting point are needed before the right one is found.

The durability of the probe will be shortened if the gases are too hot.

The outer part of the probe should be kept clean. Liquids should not be used to clean the probe as they can leak into the casing through the front of the probe or the back where the cables are placed. The probe should not be cleaned using solvents or wire brushes.

!! ATTENTION !!!

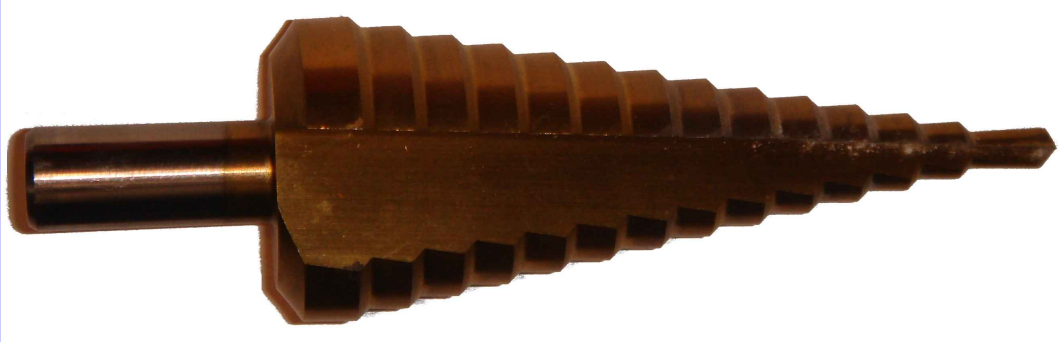
After the lambda probe is placed inside the exhaust - pipe it must at all times be heated by the built-in heater. The device takes care of heating the probe. If you plan any breaks in using the device (e.g. you plan to disconnect the power supply from the device) you should remove the lambda probe from the exhaust pipe. Otherwise it will soon become damaged or degraded.
Remember to always keep the heater's power supply on!

Drilling the hole in the exhaust - pipe

The probe's screw-thread is 18mm in diameter and has a pitch of 1.5mm.

To mount the probe on the inside of the exhaust - pipe use the nut made of stainless steel, received in the package. To place the probe in the exhaust - pipe you first need to drill a hole in it. The hole should be drilled on a flat part of the exhaust - pipe so that the nut can stick to the exhaust pipe relatively flat and not deform it.

Below is a picture of the recommended drill bit (cone drill). It does not shred the hole's edges.



The probe must enter the hole perpendicularly to the surface. The probe must be mounted air-tight or the results of the measurements will be skewed because air will be sucked into the exhaust - pipe from the outside. ***Remember, a ragged graph is an indication that 'fake' air is getting inside to the boiler unit.***

We advise you to use the drill bit shown above when drilling in exhaust - pipe made of stainless steel. After many tests we have come to a

conclusion that this type of drill bit causes a minimum amount of damage to the hole's edge making the mounting air-tight. Other drill bits shred the edges.

The hole should have a diameter of exactly 18mm so the probe's screw-thread does not fit loosely. The nut should be screwed very strongly but be careful not to damage the probe in the process.

Sealing the exhaust stack

!!!ATTENTION!!!

DO NOT additionally seal the probe in the hole with any kind of chemical substances (glue, silicone) as that causes a risk of damaging the surface of the probe's electrodes. This is called *poisoning*. Substances based on silicone and many types of glue are known to permanently damage lambda probes. If you find the hole you drilled unusable, drill a new one and hermetically close the old one.

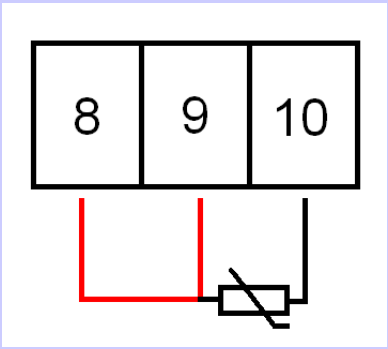
You must also remember to seal the exhaust stack in the places where its parts connect with each other, especially if the exhaust - pipe has regulated bent pipes (elbow - pipe). These types of elbows should not be used between the boiler unit's exhaust and the probe as they are never completely air-tight. The places where the parts connect can be sealed using aluminum tape resistant to high temperatures (such as used to fire-places). It is most important to seal the parts between the exhaust and the probe. Otherwise the results of the measurements will either be completely skewed or will constantly oscillate between minimum and maximum. This oscillation indicates that '*fake air*' is being sucked into the exhaust - pipe from the outside.
It is important that the combustion chamber is properly sealed using a sealing rope. The revision door also need to be leak-proof and the viewer needs to be shut. If you think air is getting to the combustion chamber, seal any place where the suspected leak may be with aluminum tape.

!!! The only source of air for the combustion process should be the burner itself !!!

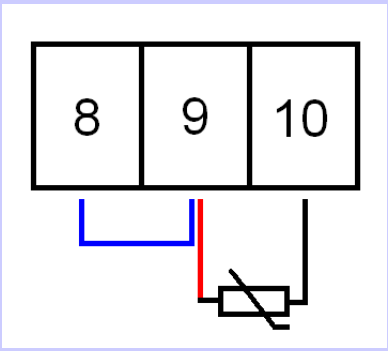
5. Picking the Pt-100 temperature sensor mounting point

The Pt-100 sensor is not required for the device to work properly. The sensor gives information needed to calculate combustion efficiency but the temperature of the exhaust gases can be measured in another way or simply estimated and set to a desired value after taking control of this measuring channel.
If you do not plan on using the sensor simply build a 'bridge' with a piece of cord between pins 8 and 9 as shown on the picture below and skip to the part regarding software.

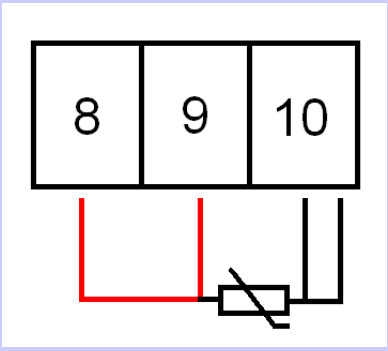
If we do not build the 'bridge' when not using the sensor, the device may start to malfunction or stop reacting to the software and go into firmware update mode. We don't need the 'bridge' when we want to use the sensor. In that case connect the sensor to the device accordingly to the scheme on the device's front panel.



Normal Pt-100 sensors have 3 cords.



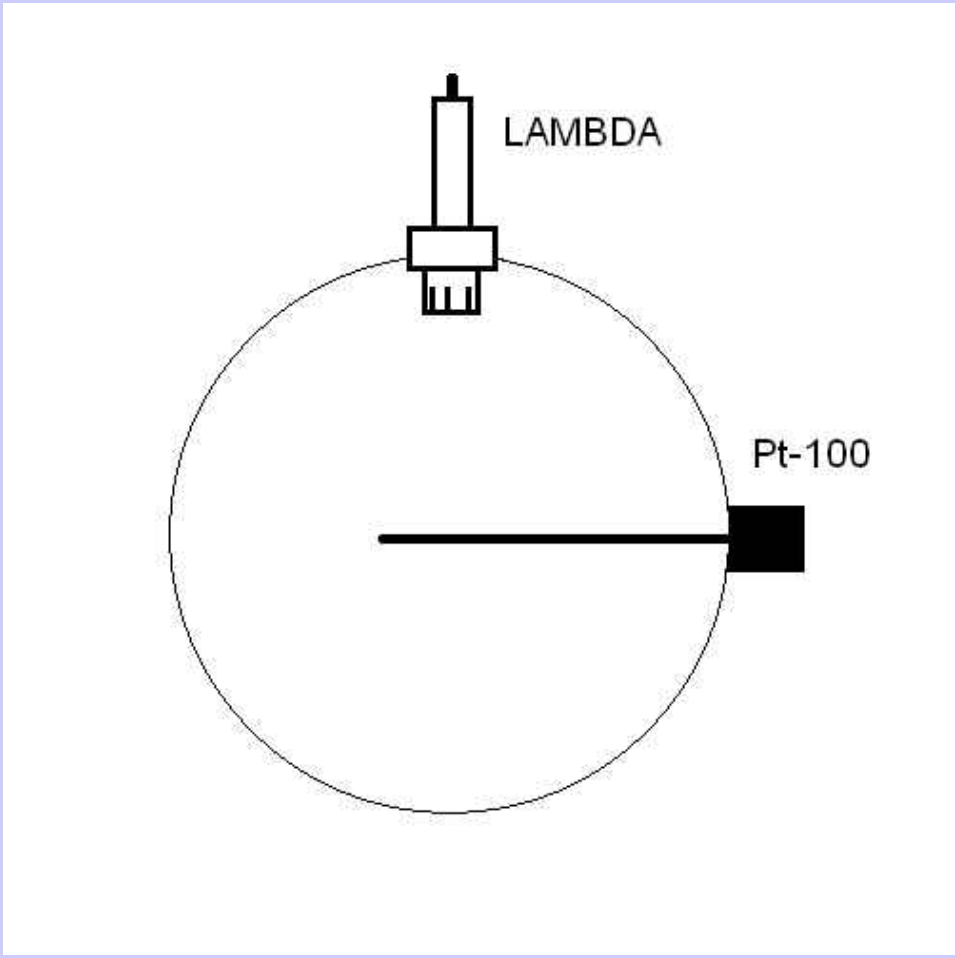
Some have only 2 cords. In this case connect the sensor between pins 10 and 9 without removing the 'bridge'.



Also available are sensors with 4 cords where usually we connect the two white cords together and treat them as one.

Mount the sensor accordingly to the sketch and:

- the sensor must have a length of at least half of the exhaust stack's diameter (ideally 1-2cm longer)
- be hermetically mounted
- be made from stainless steel
- mounted not further away from the boiler unit's exhaust than at a distance of 2 diameters of the exhaust stack



6. Updating firmware

The device has it's own and independent firmware besides having the software you use on your computer. This firmware needs to be updated from time to time.

Detailed instructions on how to update the firmware are placed in a separate FIRMWARE UPDATE MANUAL.

7. Electromagnetic relay

The device has a built-in electromagnetic relay that is coactive with a week-long clock. In the ***TIMER*** section you can regulate the work of the relay, turn it on for a set number of minutes or turn it off completely.

The clock is designed to control any electric circuit e.g. a hot water circulation pump used to heat the water before the desired time of baths. This clock can also be used in any other way.

The relay's contacts are not protected or connected to any fuse.

8. Pin description

Lp.	Symbol	Description
1	RELAY NO	Normally opened contact of the built-in electromagnetic relay
2	RELAY COM	Joint contact of the built-in electromagnetic relay.
3	RELAY NC	Normally closed contact of the built-in electromagnetic relay
4	HEAT ground	od masy sygnałowej i masy grzałki. Stabilized, negative supply voltage output to the lambda probe's heater. This is usually a white cord. The order of both white cords of the heater is irrelevant. The probes ground and its casing must be isolated from …
5	HEAT +12	Stabilized, positive supply voltage output to the lambda probe's heater. This is usually a white cord. The order of both white cords of the heater is irrelevant
6	GND ground	Ground, zero potential of the lambda probe. The probe's ground and its casing must be isolated from …

		This is usually **a grey cord.**
7	INPUT	Measurements signals from the lambda probe input. This is usually **a black cord.**
8	Pt-100	Pt-100 sensor input. This is usually **a red cord.**
9	Pt-100	Pt-100 sensor input. This is usually **a red cord.**
10	GND ground	Pt-100 sensor ground. This is usually **a white cord.**

9. Front panel LED description

On it's front panel the device has five LEDs which show the lambda parameter's value while the device is working.

These LEDs should be set up initially:

- after regulating the burner and ***finding the wanted value of the lambda parameter*** you should ***enter this value*** in the 'LAMBDA Center value' box in the 'FRONT LED' window that you can find in the 'Settings 2' tab.
- This will be our ***average value*** that we want to retain and it will be represented by ***three LEDs (-2,-1,0) on the front panel being on at the same time***
- lower, in the 'LAMBDA Measuring range +/-' box we can set the range of indication for the LEDs e.g. if we set the center value to 1.200 and enter 0.100 as the range of indication then:

- The LED '0' will represent lambda value 1.200
- The LED '1' will represent lambda value 1.250
- The LED '2' will represent lambda value 1.300 (0.100 more than the center value)
- The LED '-1' will represent lambda value 1.150
- The LED '-2' will represent lambda value 1.100 (0.100 less than the center value)

Assuming this, the Lambda coefficient value shown by the LEDs on the picture is between 1.25 and 1.3 (4 LEDs are on)

We can also tighten the range of the readings so we can better observe the combustion process.

The LEDs on the front panel allow us to constantly observe the value of the Lambda parameter and how it changes without having to connect the device to a computer.

If you change any of the settings remember to save them with the ***'SAVE parameters to the Analyzer'***

10. Technical data and guidances

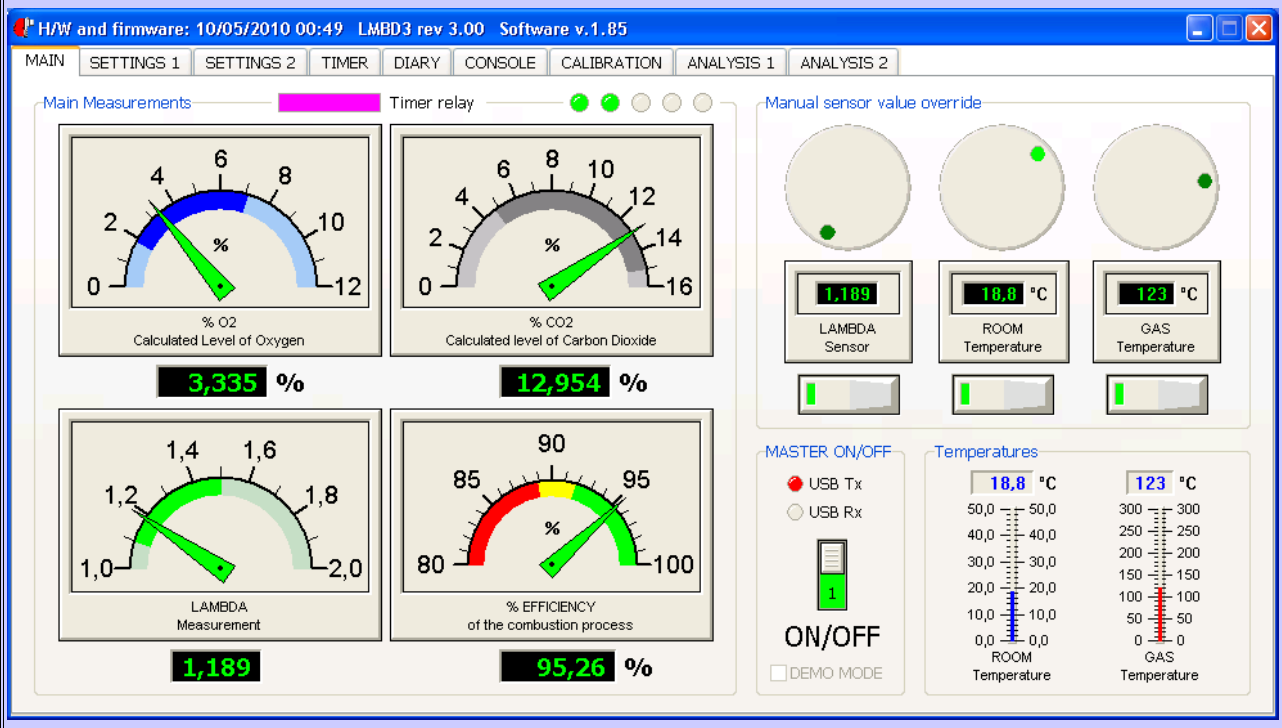
Measured values	O2 Exhaust fumes temp. Air temp.
Calculated values	CO2 Efficiency Lambda
Recommended maximum length of the lambda probe cords (the shorter, the better)	1 m
Minimal cross-sectional area of the lambda probe cords	1.5 mm2
Recommended length for the Pt-100 cords	3 m
Measurement accuracy of the lambda coefficient depends mostly on what probe is used. For a BOSCH LSU probes the values are: LAMBDA=1.3 LAMBDA=1.8	 <0.013 <0.050
Maximum exhaust gases temperature	600 ^{O}C
Exhaust gases temperature influence on the lambda coefficient for a new BOSCH LSU-11 probe in a range of 130^{O}C to 230^{O}C	<0.010
Recommended minimal power of the lambda probe heater	18W
Nominal voltage (stabilized)	12V
Electricity consumption	<100mA
Work temperature	0..40 ^{O}C
The lambda measuring range is dependent on the probe used. It is usually between 1.1 and 1.5 but please check these values in your probe's documentation.	1.1 to 2

Communication with the computer	USB2.0 Full speed

11. Software operation

The software does not have to be installed on your computer. Just copy the program to any location and run it.

MAIN window where we can view combustion parameters



This is the main window of the program. In this tab there is the ***'MASTER ON/OFF'*** switch that is used to start or end measurements. When ***ON*** we can observe current values of the measured or calculated parameters and the readings from the temperature sensor.
When ***OFF*** we can change the program's and the device's settings and save them.

In the ***Main Measurements*** window we observe:

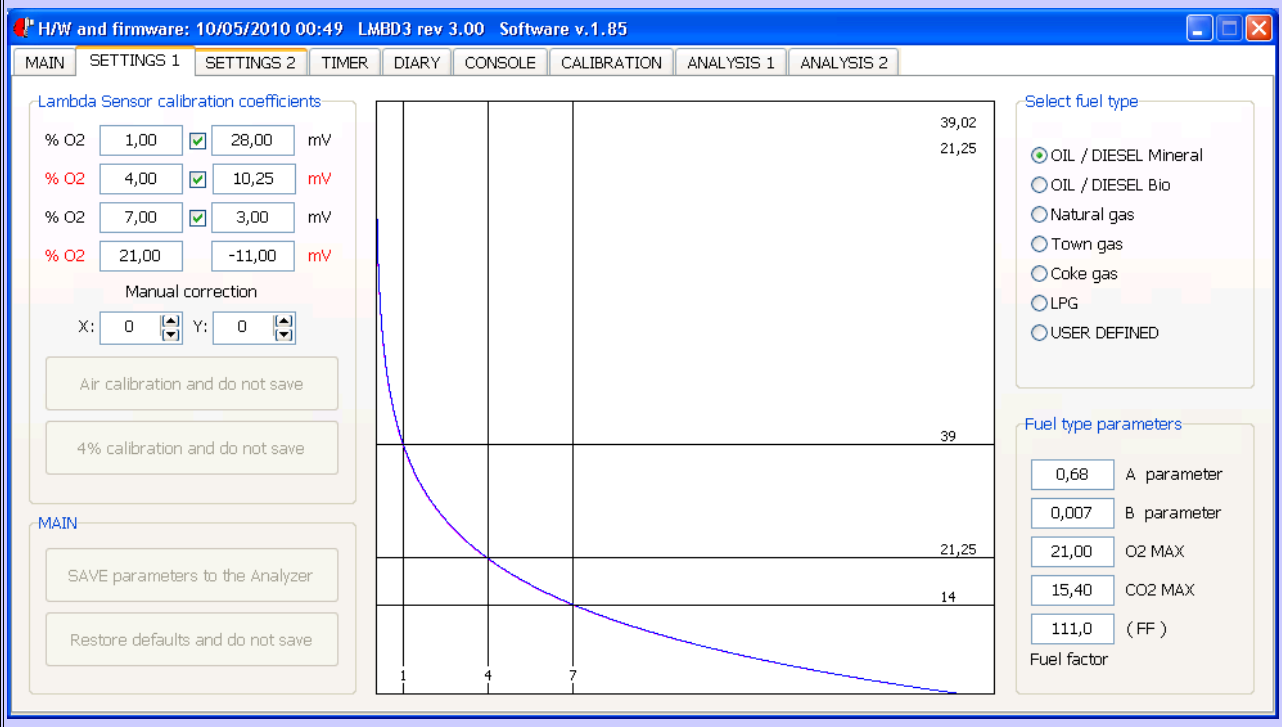
- % O2 – calculated excess of oxygen
- % CO2 – calculated excess of carbon dioxide
- Lambda – measured by a oxygen sensor (in our case that is a lambda probe) placed in the exhaust stack
- calculated efficiency of the combustion process (in %)

At the top you will find five lights. While the the device is working and is connected to a computer, these lights show the same thing as the LEDs on the front panel and the lights in the 'Settings 2' tab.

In the same window we also see a rectangular relay state indicator light which, when the device is connected to the computer, shines with a violet light if the relay is on.

Manual sensor value override – if we switch off the flow of data (the switch color changes from green to red) from the temperature and oxygen sensors to the device then we can manually (using adjusting knobs) set the values of three parameters: ***Lambda, Room temperature and Gas temperature.***
The knobs can be turned using the mouse or the arrow keys on the keyboard.
This lets us simulate different values of the parameters and see how this affects e.g. the combustion process efficiency.
In case you do not have a temperature sensor in your exhaust stack you can use this feature to manually set the gas temperature value that you have measured in a different way.

SETTINGS 1



In this window we enter the ***Lambda sensor calibration coefficients***. In the right column we enter the mV values for 4% and 21% of O2. ***These values you receive together with your probe and they are different for every probe. You should store them in case you need to reenter them.***

Important calibration values are: calibration parameter for 4% and 21% (red font). The other, 1% and 21% are used to evaluate the probe. Their use will be described in another manual. You do not have to set them up as they do not take part in any ongoing calculations.

The ***Air calibration and do not save*** and ***4% calibration and do not save*** buttons are used to calibrate the lambda probe by yourself. If your probe is already calibrated then do not use these buttons.

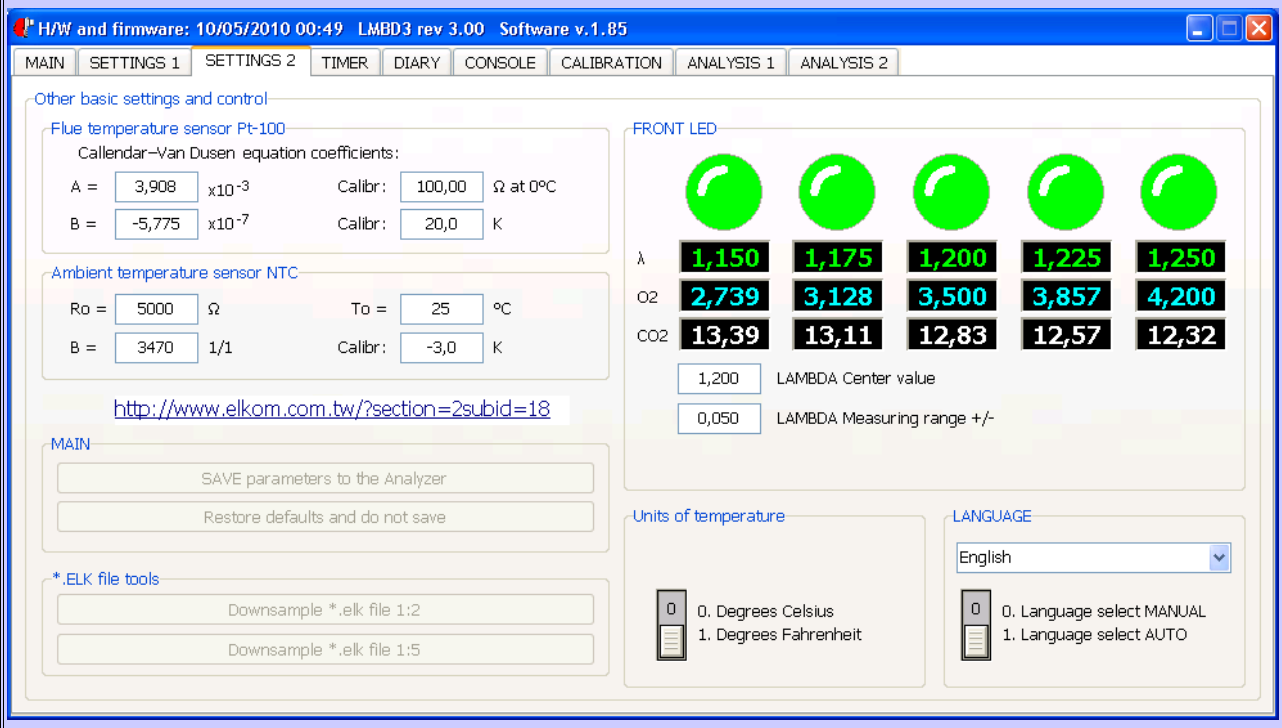
In the ***Select fuel type*** column you pick the type of fuel that you use. The last option is to enter the parameters of your fuel by yourself if it does not match any of the types of fuel on the list in the program. Tables with fuel parameters are available on the internet and fuel suppliers.

The settings are save using the ***SAVE parameters to the Analyzer*** button.

In case you make an error you can always return to default values by pressing the ***Restore defaults and do not save*** button.

Remember, to start the measurements you first must enter the probe's parameters, pick the type of fuel and save these settings.

SETTINGS 2



In this tab

Units of temperature

- we can pick the scale we want the temperature to be measured in:
  - degrees Celsius – switch set at 0
  - degrees Fahrenheit – switch set at 1

Language

- we can pick the language of the software:
  - switch set to 0 if you want to pick the language manually
  - switch set to 1 if you want the language to be picked automatically

You should save any changes you make or else these changes will be discarded when you close and reopen the software.

The ***Front LED*** window is used to set up the LEDs on the device's front panel.

Detailed description of how to set up the LEDs is found in section 9 – Front Panel LED Description

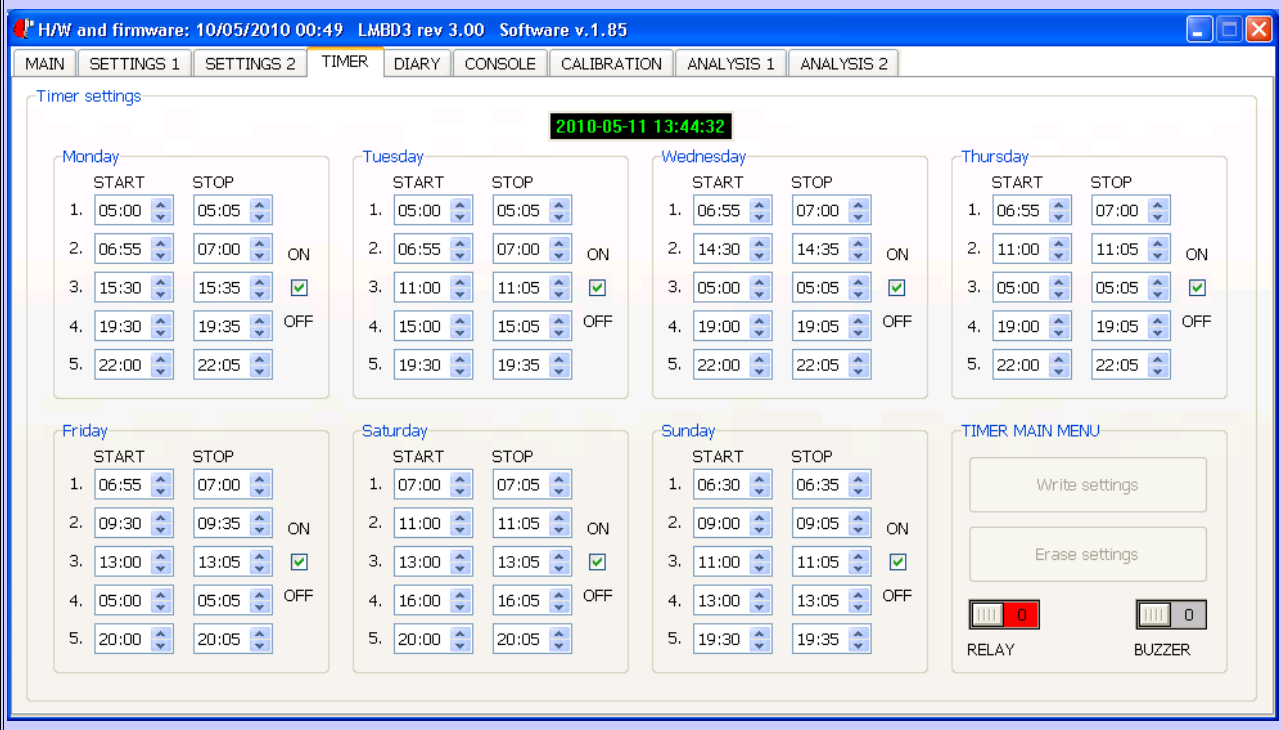
In the ***Settings2*** window there is a link to the manufacturers website where you can find new versions of the software. ***Remember to check this website for updates on a regular basis.***

Remember always to save any changes you make to the LED settings. You save the changes by clicking the ***SAVE parameters to Analyzer.***

In the ****.ELK file tools*** window we can compress the times of the previously saved graphs (*.elk files). For instance, we set the ***Time interval*** value to 10s. To compress the time in the recorded file in a rate of 1:2 press the ***Downsample *.elk file 1:2*** button. You should then pick and open the file you want to compress. In the folder where the file is placed a new file will be created. It's name will be the same except '***resampled_1to2'*** will be added to the name. After loading the compressed file into the program we see that the graph looks exactly the same except it is presented as if the ***Time interval*** parameter was set to 20s. This function is useful when we make and record long measurements. We can record the measurements in very small intervals (0,1 of a second) so they are very detailed and accurate and we can later compress them to see general tendencies in the boiler-units behavior over a longer period of time.

Week-long TIMER window

The device is equipped with a built-in, electromagnetic relay that you can program using the week-long timer – see the manual's section 7 - ***Electromagnetic Relay***



For every day of the week separately we can set up the times of starting and stopping e.g. a water circulation pump. We can set the times so that the pump only mixes the water when we know we will need hot water to take a shower. This eliminates inessential work of the pump and reduces fuel consumption as the water is not heated up unnecessarily during the night or when nobody is home.

After setting the times when the relay should be on and off (***Start*** and ***Stop***) remember to check the ***On/Off*** box. If this box is not checked, the relay will not be activated on that day

The ***Relay 0/1*** switch is used to turn the relay off and on. (0 – the relay will be inactive, the timer will not work)

Additionally you can turn on the ***Buzzer***. It will signalize when the relay is activated.

The '***Turn off after [min]***' field is used to turn on the relay immediately for a set amount of minutes (e.g. To heat up the water right before taking a shower). You enter the number of minutes manually and confirm it with the ENTER button. After confirming it the relay switch will change to position 1 (on). Then, when the set number of minutes have passed the relay will switch off automatically. Instead of entering the number you can also use the up/down arrows. In this case you do not need to confirm, the relay turns on when you press the up arrow.

We can delete the settings using the ***Erase settings*** button.

After you change the settings, save them using the ***Write settings*** button.

For the timer to start working you need to:

- enter appropriate settings for the desired days of the week
- set the ***Relay*** switch to 1 (switch will be green)
- save the settings using the ***Write settings*** button

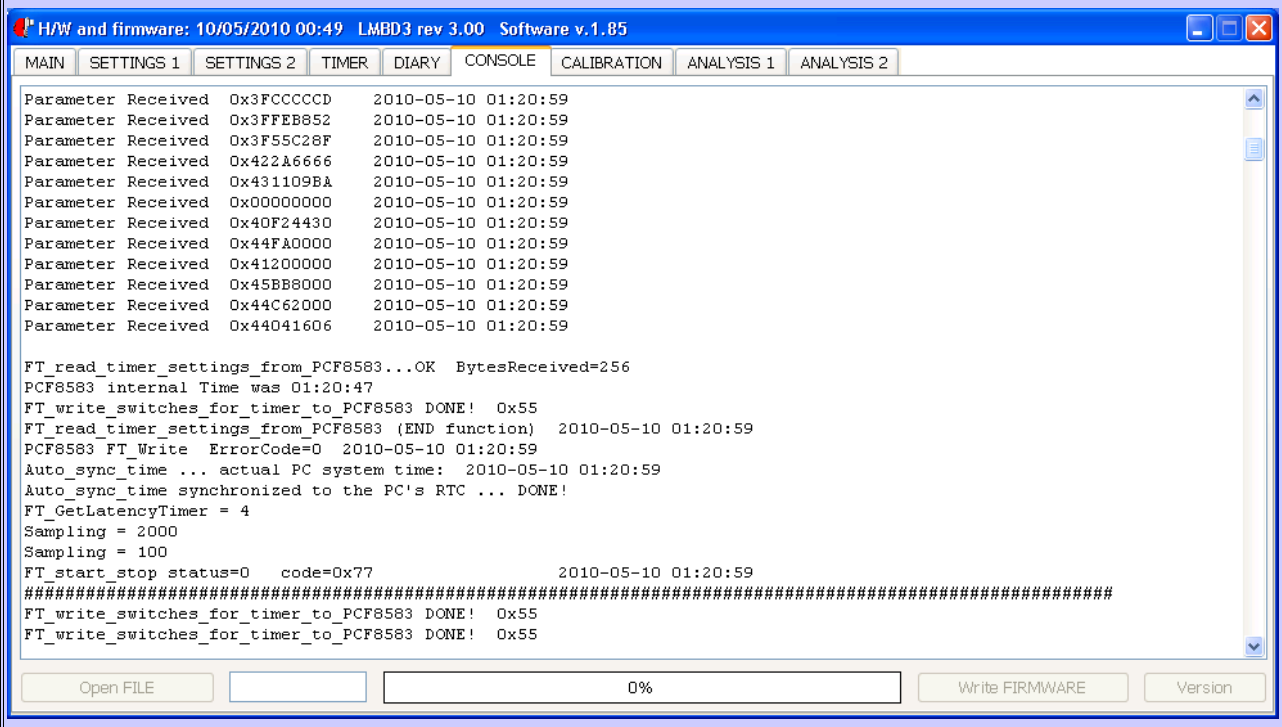
DIARY window

In here you can make and save any notes (***SAVE DIARY***).

After reconnecting the device to the computer you can reload your previous notes using the ***LOAD DIARY*** button.

To clear the notes you just need to delete them and press ***SAVE DIARY***.

CONSOLE window

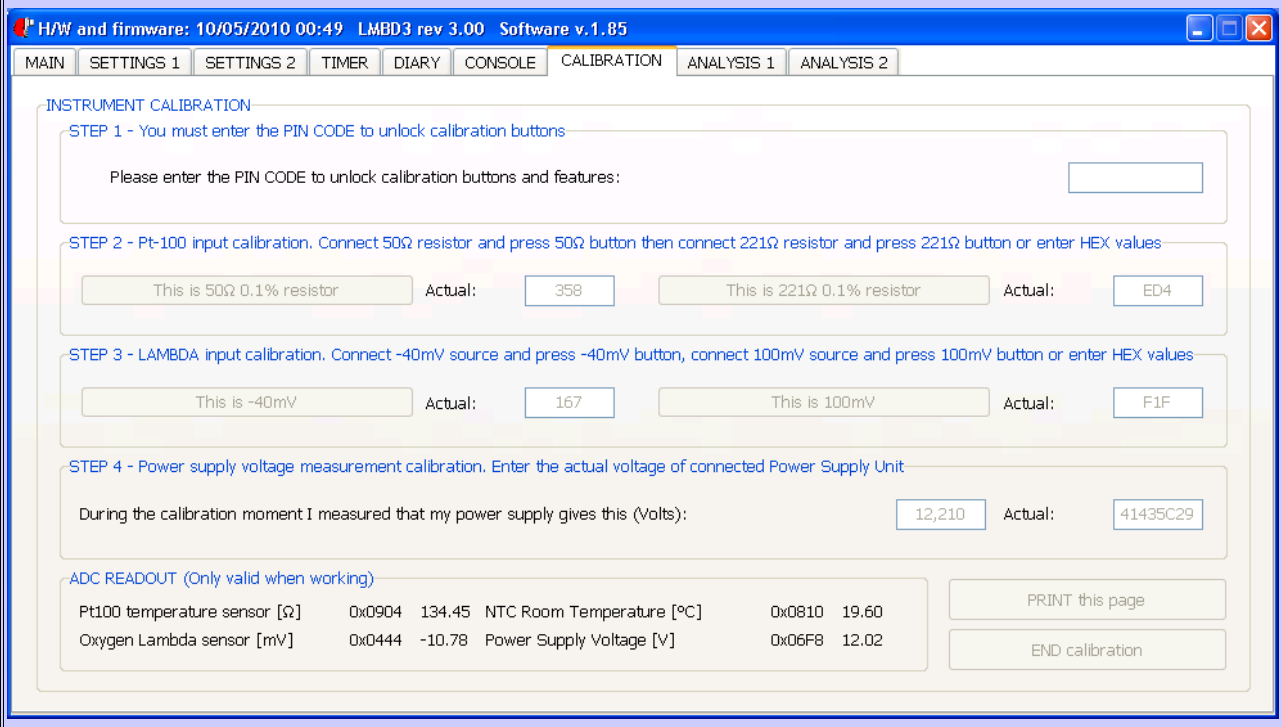


In this window we can update firmware using the ***Write Firmware*** button.

Detailed description of this process can be found in a seperate Firmware Update Manual.

Information about new firmware can be found on the manufacturers website (link in the Settings2 window).

CALIBRATION window



Use the ***PRINT this page*** button to print – preferably to a pdf file - the contents of this tab in case you need them in the future to reenter the calibration parameters manually.

You can also simply print this window to a page or make a screenshot. To make a screenshot use the buttons Alt+PrtScr and save it as a display file such as jpg or bmp.

ANALYSIS 1 window

In this window we can:

- observe the combustion process parameters in the form of a graph
- record these parameters to a text file (*.txt) and a graph (*.elk)
- open and view previously saved graph files

How to start the recording:

- set the wanted ***Time interval*** e.g 10 seconds
- set the wanted ***Pen width*** – this parameter determines the thickness of the lines in the graph
- select the parameters you want to be displayed on the graph
- set the ***Log to ELK file*** switch to **1**

If we want to save the data to a text file we follow the same steps as before except we set the ***Log to TXT file*** switch to **1**.

We can also save the data as a graph and as a text file at the same time.

The recording ends when we uncheck the ***Start recording*** box or when we shut down the program.

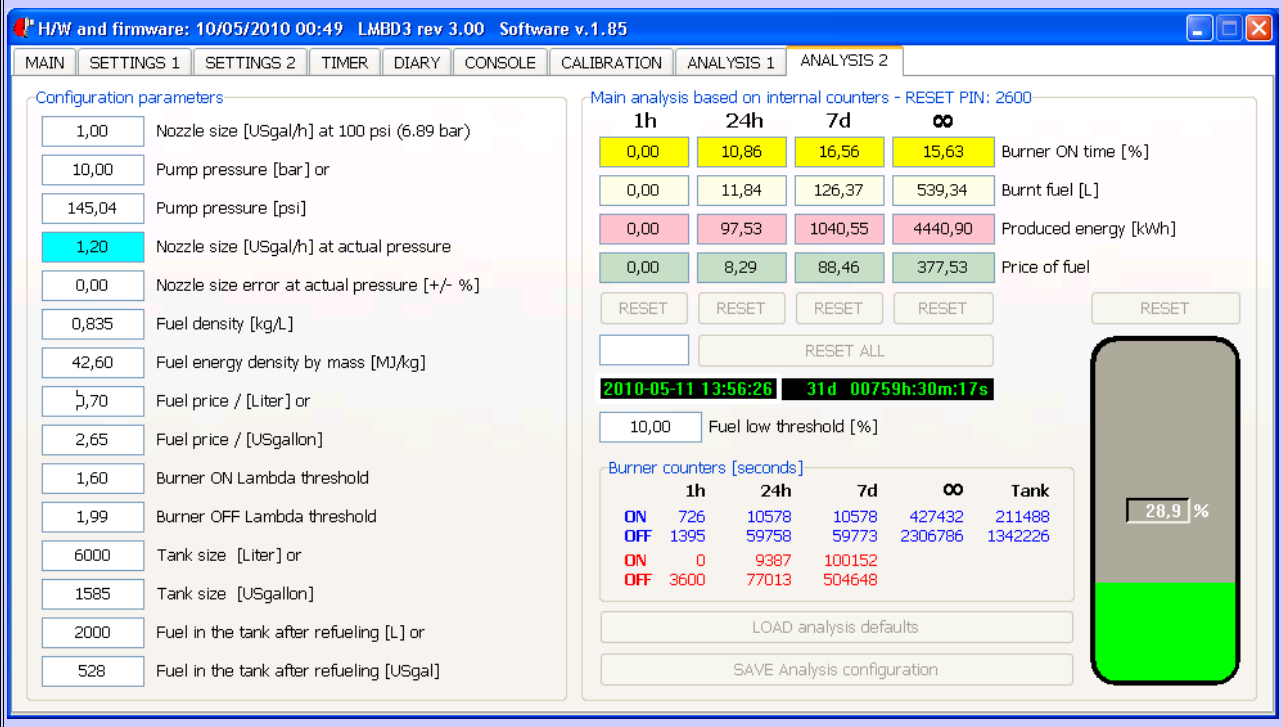
When you start to record again a new file is created. The file name is always the date and the time of the recording.

If the recording lasts a couple of days then a new file with a new name is automatically created everyday at midnight.

We can record without any breaks, as long as we have space on our hard drive.

We can compress the saved files – see the description of the ***Settings2*** window.

ANALYSIS 2 window



This tab allows you to analyze and plan expenses connected to heating and purchasing fuel.

To use it you first need to enter the required ***Configuration parameters*** such as the ***'Nozzle size'*** [Usgal/h].

The ***'pump pressure'*** can be given either in bars or pounds per square inch (you only need to fill one of the boxes, the second value will be calculated automatically).

'Nozzle size at actual pressure' – this box will be filled automatically after the ***'Nozzle size'*** and ***'Pump pressure'*** are given.

The ***'Fuel density'*** and ***'Fuel energy density by mass'*** can be found in special documents with fuel parameters that can be found on the internet or available through your fuel supplier. Values shown on the picture above are correct for mineral oil.

The ***'Fuel price'*** can be given for liter or for gallon.

The ***'Tank size'*** (volume) can also be given in liters or gallons. This is the total volume of the tank.
However the value in the '***Fuel in the tank after refueling***' box should be reentered manually after each refueling. It is important to correctly measure and give the amount of fuel in the tank after refueling because the graphic representation of the amount of fuel left in the tank and the low fuel alarm work partially based on this information.

'Burner ON lambda threshold' **–** here you enter the value of the lambda coefficient below which the burner will be recognized as working (eg. on the picture above this value is 1.60, when the lambda coefficient reaches that value, the device will recognize the burner as working)

'Burner OFF lambda threshold' – the value above which the device will recognize the burner as not working

Main analysis based on internal counters

The device has internal counters which work independently from whether the device is connected to a computer or not.
Based on these readings and entered configuration parameters we can estimate the ***'Burner ON time in %', 'Burnt fuel', 'Produced energy'*** and ***'Price of fuel'.***

There are four types of counters – hourly, daily, weekly and indefinite which can be reset e.g. after every refueling or at the beginning of the heating season to check the heating costs for the whole season.

On what basis does the burners counter work?
If the device measures that the Lambda value crosses the border value that we set (in this case 1.60) it starts to count the amount of ***'ON'*** seconds.
In other words – the burner turns on, the scale tips left, crosses 1.60 – in this moment the counter starts to count ***'ON'*** seconds, the scale drops further and stabilizes eg. at 1.20 – the counter is still counting ***'ON'*** seconds. When the burner stops working and the lambda value rises the scale tips right and when in our case it reaches 1.99 the counter starts to recognize the burner as not working and will start to count ***'OFF'***

seconds.

In the ***'Burner counters [seconds]'*** area you can see exactly for how many seconds the burner was on and off.

The total time of work of the furnace is displayed on the counter on the right of the timer, under the Reset buttons. It displays the the time of work of the furnace in hours, minutes, second and rounded-off to full days.

RESETING the counters

The counters can be easily reset at any moment.
This can be done using the ***RESET*** buttons below the counters.
To reset the counters you first need to enter the PIN code in the box beside ***RESET ALL*** button.
PIN code for ***RESET*** is **2600**

After resetting one counter you must enter PIN code again to reset the next counter.
You can also reset all counters simultaneously by pressing RESET ALL button.

Low fuel threshold - enter the fuel tank level (in %) below which the graphic low-fuel-level alarm will turn on (change color).

FINAL REMARKS

Should be remembered:

- **USB DRIVERS**

It is impossible to use the software without installing USB drivers first. Without proper drivers, every time you try to run the software it will cause a system error saying some system files are missing. This is normal and should not cause concern.
You should first connect the device to the computer with an USB cable, then turn on the power supply, wait for Windows to ask for the drivers and then install them from the CD. Windows will ask for the drivers twice and you should pick the folder on the CD where they are stored. Only after installing the drivers you will be able to run the software.

- **LAMBDA PROBE CALIBRATION COEFFICIENTS**

The calibration coefficients received with the probe should be stored in case there is a need to reenter them. There is no other way to later retrieve the data from the sticker received with every probe.

- **CALIBRATION OF THE DEVICE**

You should make a printout of the CALIBRATION window and store it in case you need to reenter the calibration parameters manually. You can also simply write them down in a notebook.

- **USB EXTENSION CORDS**

A lot of clients ask us whether it is possible to extend the USB cord to an adjoining room. There are a couple of ways to do that. We can try connecting the analyzer and the computer with a basic USB extension cord. We can also buy an active USB extension which would give us the ability to control a device placed even 100m away if we use a twisted-

pair wire. There is a wide range of such devices. Some are made of an USB-to-LAN converter on one side and driver software on the side of the computer. The USB device is then seen in the local network. Other require a small device to be plugged into a free USB port. All these methods are more or less effective. The cause of any trouble usually are noises affecting the long cord between the device and the computer.

12. Safety measures

The carton packing is suitable for recycling and is marked with the recycling symbol.

The device should be scrapped accordingly to local regulations about waste disposal.

Do not let children play with the device. Remember to mount the device in a place unavailable for children.

Remember to disconnect the device's power supply before any maintenance work.

To clean the casing use a neutral detergent and a moist cloth.
Do not use abrasive detergents.
Do not wet the device.

The device is designed to be used only indoor in temperatures above 0°C

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