

CHS - 580

Carbon / Hydrogen / Sulfur
Determinator

ELTRA

Analysers made in Germany

OPERATION MANUAL



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OPERATION MANUAL CHS-500

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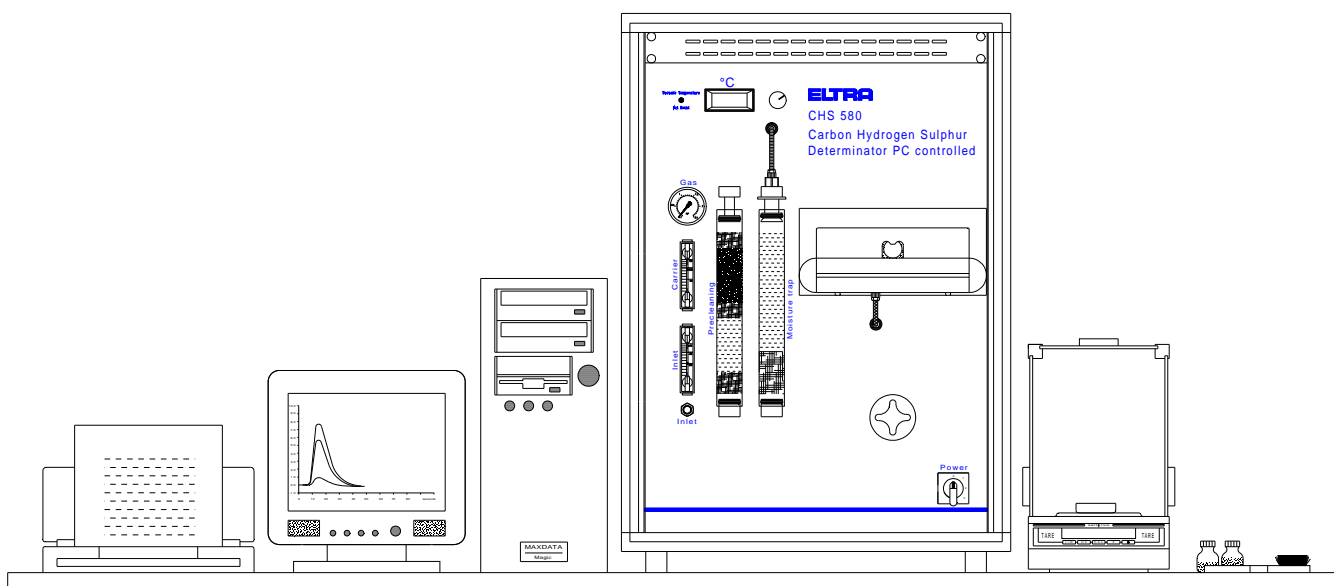
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1 INSTALLATION

1.1 Setting up

As the device and the furnace are rather light, there are no strong recommendations concerning the stability of where it is set up. Due to the balance, the platform should be placed to be as free of vibration as possible. Placing the furnace to the right of the analyser is generally recommended. The position of the balance is optional. Generally, placing it on the right is recommended. The size of a desktop is sufficient for the entire set-up.

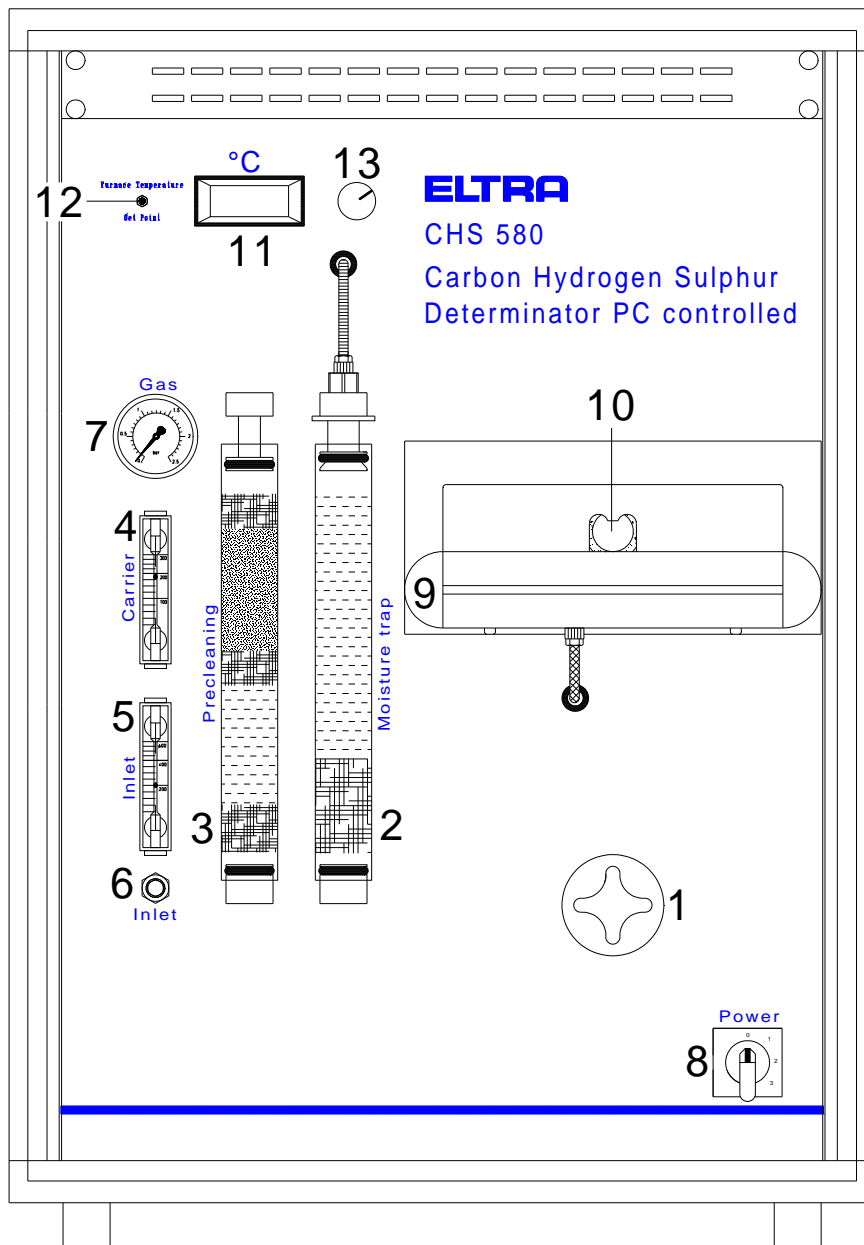
Below is an example of installation:



The environment of the device must not necessarily be air-conditioned, although it is best if the room temperature remains between **18°C** and **30°C**.

**Under no conditions should the device be placed in direct sunlight!
Avoid places exposed to the wind of air conditioners or to the wind blowing through open windows or doors.**

1.2 Front panel illustration

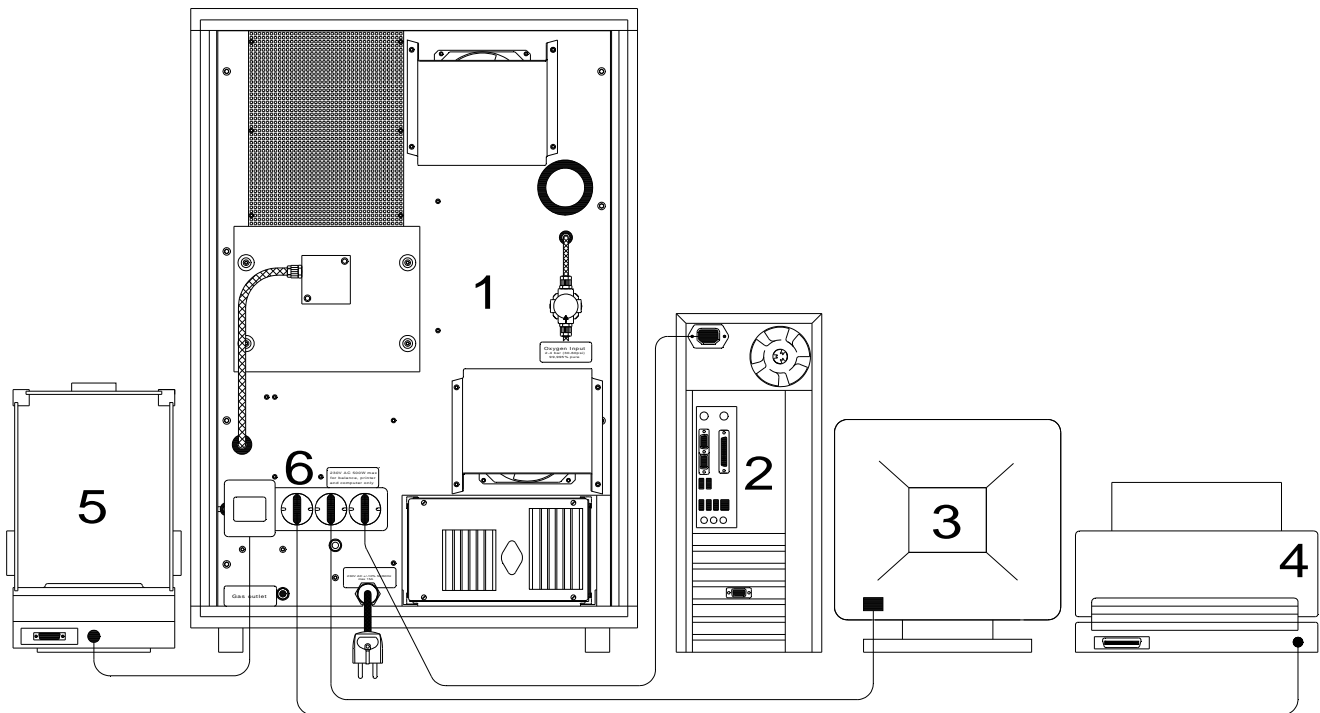


- 1 Dust filter
- 2 Moisture trap
- 3 Carrier gas purification
- 4 Carrier gas flow meter
- 5 Furnace inlet flow
- 6 Furnace inlet flow adjustment
- 7 Pressure gauge
- 8 Mains power switch
- 9 Combustion boats platform
- 10 Furnace entrance
- 11 Set point / Furnace temperature display
- 12 Set point / Furnace temperature switch
- 13 Furnace temperature adjustment

1.3 Mains power connections

Since the infrared cell requires about **1 hour** to reach a stable operating temperature, it is advisable to connect the analyser to the **mains power** first and switch on before further installation work is carried out.

This waiting time is only necessary when **installing** the analyser. Since it is normally not switched off, and is always in operating temperature.

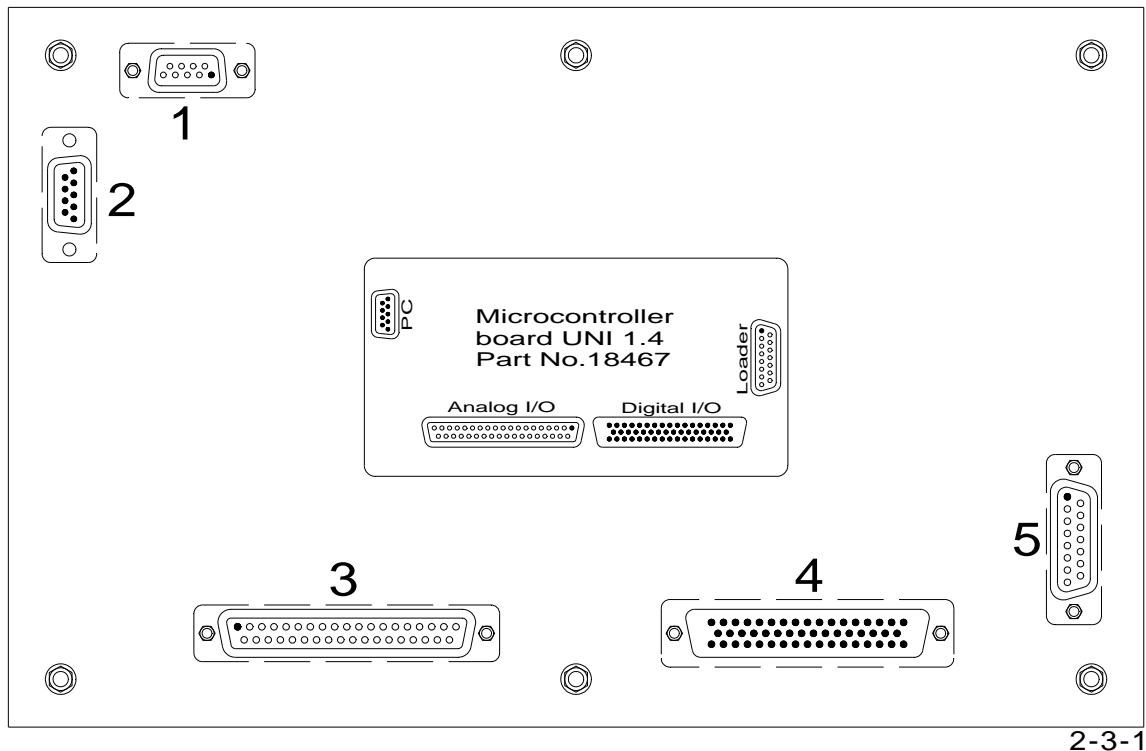


- 1 Analyser
- 2 Computer
- 3 Monitor
- 4 Printer
- 5 Balance
- 6 Quad socket

The analyser is connected to the mains socket. The computer (2), the monitor (3), the printer (4) and the balance (5) should be plugged into the **four power outlets (6)** on the **rear-side** of the analyser.

1.4 Data Interface

When all the units are connected to the mains power, then data connections can be made. **The analyser is connected to the PC** using supplied zero-modem cable (9-pin female – 9 pin female, DB-type). One plug of the cable is connected to the socket **(2)** of the UNI-board (see below) and the other plug of the cable is connected to the serial interface socket on the PC (COM-port). In order to get access to the UNI-board remove the left-side panel of the analyser. Pass the cable through the hole provided in the right side panel of the analyser or in the bottom plate of the analyser.



Rear side of UNI board:

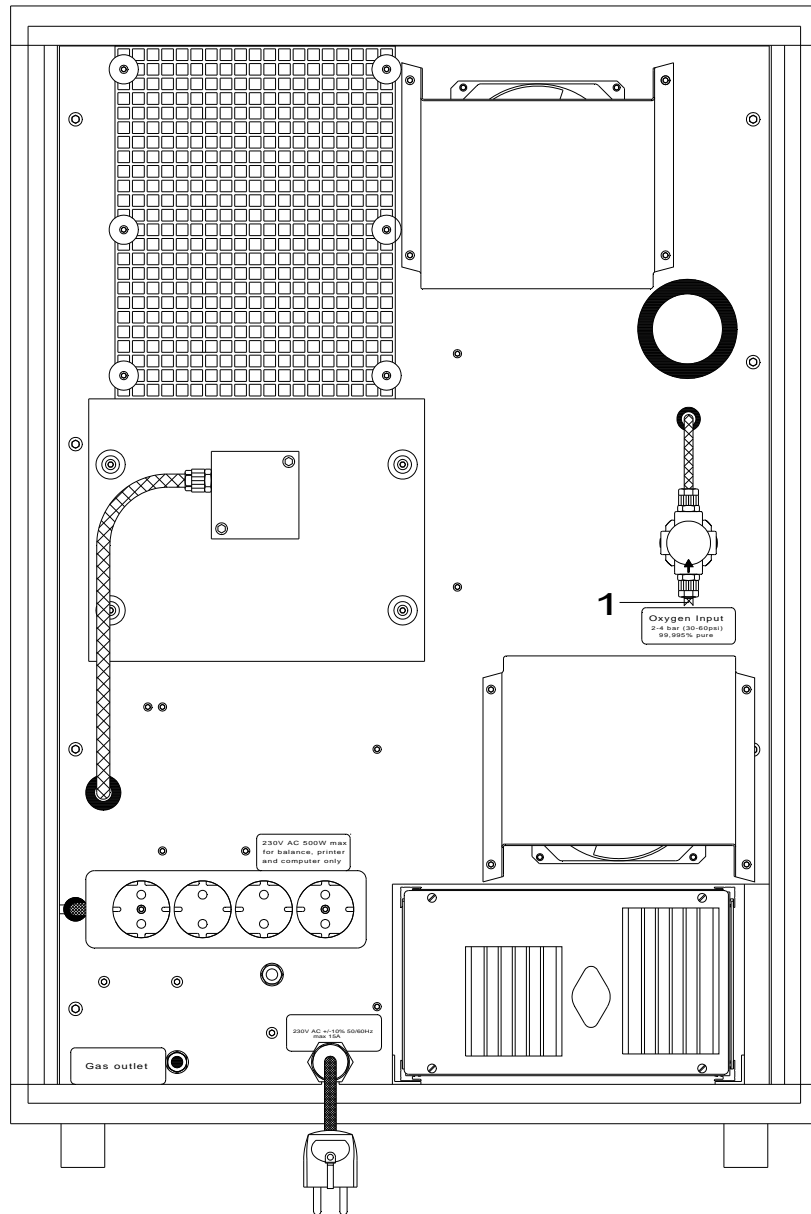
- 1 Spare serial interface
- 2 PC connection
- 3 Analogue input/output signals (analyser's internal cable)
- 4 Digital input/output signals (analyser's internal cable)
- 5 Autoloader connection (analyser's internal cable)

The balance is connected to the PC. The interface cables may differ, depending on the model of the balance. The balances, supplied by ELTRA together with the analyser, always have a suitable cable. Connect one plug of the cable to the socket provided on the balance and another plug of the cable to the serial interface socket on the PC (COM-port).

The PC is already provided with the operating system and software for controlling the analyser (UNI-software). All necessary settings are made as well. The serial interface of the balance, supplied together with the analyser, is already configured. By default, the PC is connected to the COM1-interface and the balance to the COM2-interface.

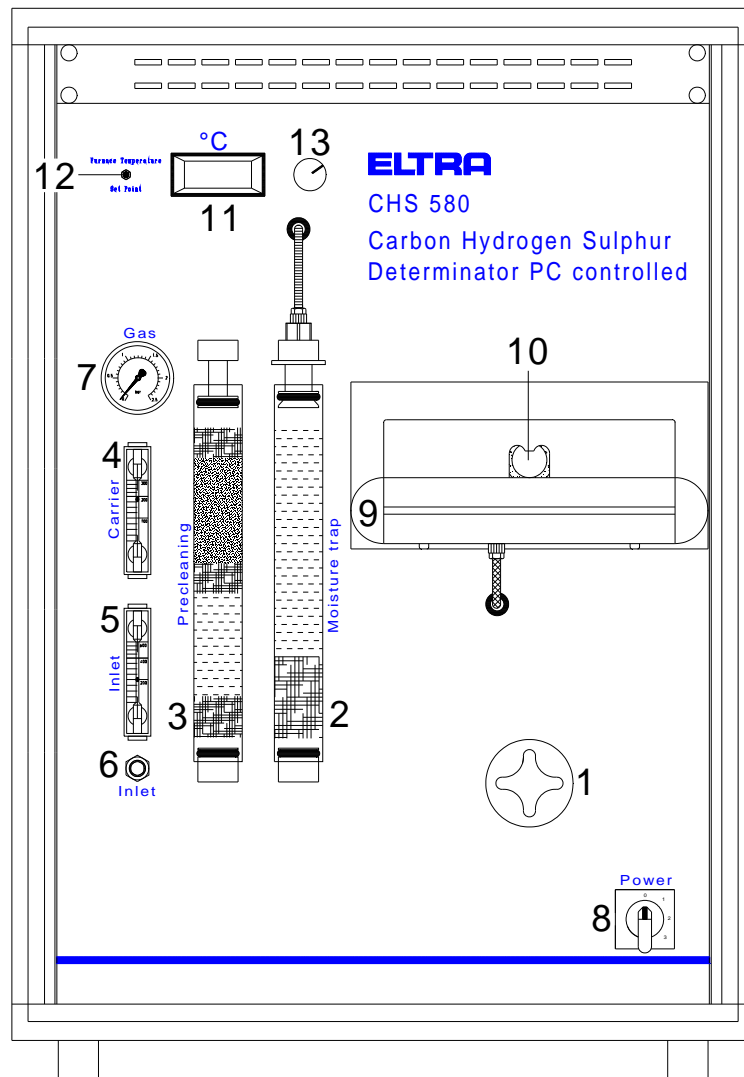
1.5 Oxygen connections

The necessary tube for connecting the analyser to the **oxygen** supply is shipped with the device.



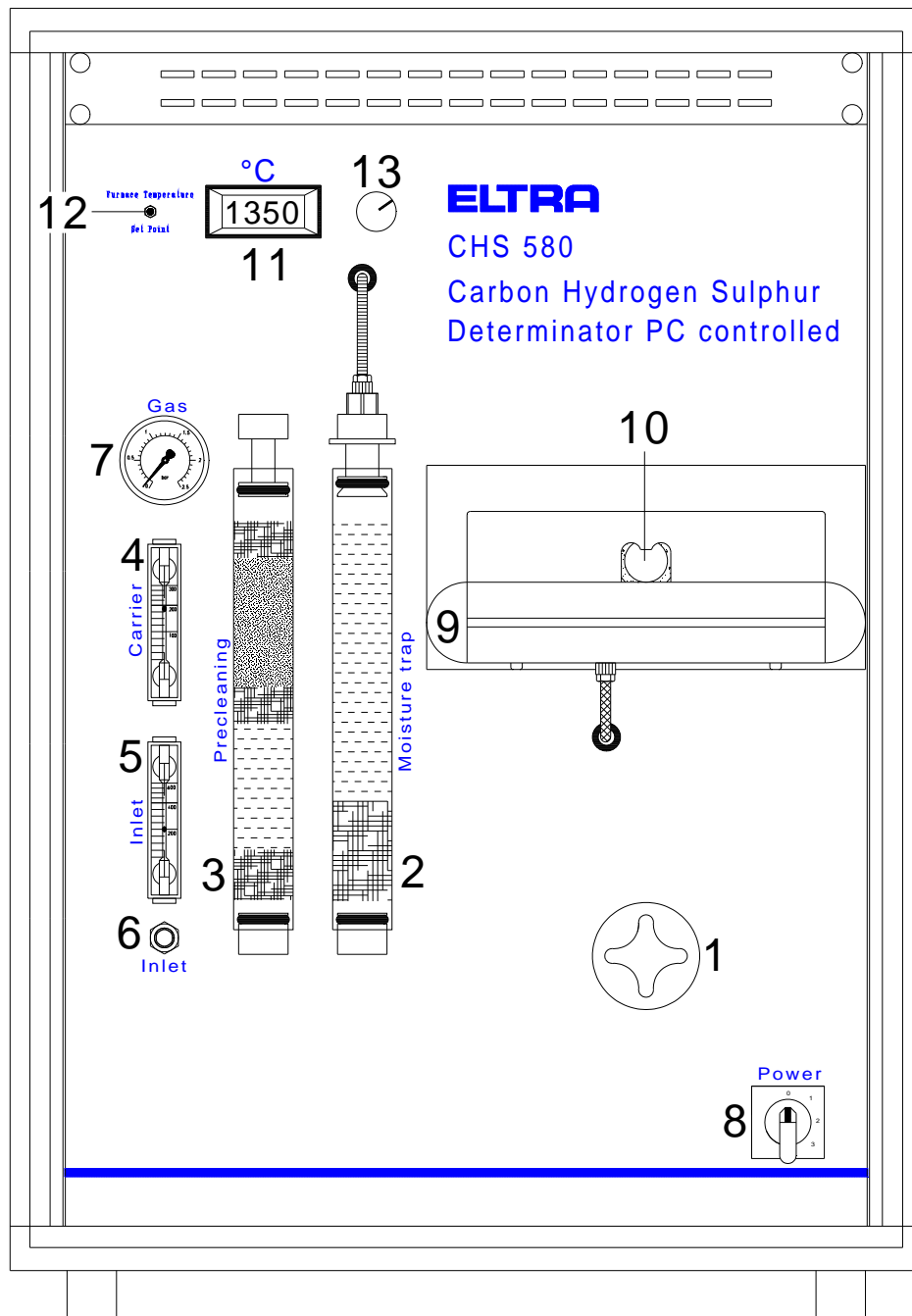
The tube connects the device through the fitting **(1)** with the **oxygen** bottle, or **oxygen** supply, through a pressure regulator. This connection must be very secure, considering that the operating pressure in the tube is **2 to 4 bar** (30 to 60 psi).

1.6 Adjusting the gas flow



- The analyser is connected to the oxygen supply. See [1.5](#).
- Adjust 2 to 4 bar (30 to 60 psi) on the pressure regulator of the oxygen supply (oxygen cylinder).
- Set the mains power switch (**8**) of the analyser to position 1.
- Read 1.5 bar on the pressure gauge (**7**).
- Adjust the restrictor (**6**) to read about 200 l/h on the flow meter (**5**).
- The pump in the analyser is now in operation and the flow of about 180 l/h is displayed on the upper flow meter (**4**). This flow is electronically controlled. An external adjustment is neither necessary nor possible.

1.7 Adjusting the furnace temperature



- Set the mains power switch (**8**) to **position 2**.
- Set the switch (**12**) to "**Set Point**" position.
- Adjust **1350** on the display (**11**) by turning the potentiometer (**13**).
- Set the switch (**12**) to "**Furnace temperature**" position.
- The display (**11**) shows now the actual furnace temperature.
- Normal operation temperature for the **CHS-580** is **1350°C**.

2 ANALYSIS

2.1 Working procedure

With the CHS-580 a wide variety of materials can be analysed. The analysis methods are therefore diverse. As different materials burn differently, the chosen sample weight, the accelerators (mostly not necessary), the procedure of inserting the sample into the furnace and, finally, the sensitivity of the infrared cell will all be different. The user of the device can receive from us free information regarding the different methods involved for different materials. The sensitivities of the infrared cells are optimised by us, free of charge, for each individual purpose.

In the following, the procedure of coal analysis is described.

Before starting making analyses ensure the following:

- The temperature of the analyser is stable (at least one hour on setting 1). See [2.3](#).
- The moisture trap (2, [1.2](#)) is checked and, if necessary, the magnesium perchlorate is replaced. See [3.4](#).
- The incoming oxygen supply has a pressure of 2-4 bar (30 to 60 psi).
- The mains switch is set to setting 3 for at least 10 to 15 minutes.
- The furnace has reached its operating temperature. See [1.7](#).
- The software is started on the connected PC. Please, refer to the “Help” function in the software for all instructions concerning the operation of the software.

1. Weighing the sample and entering the sample weight in the software:

Sample must be weighed before analysis. Place an empty ceramic boat on the balance and tare it, by pressing the **TARE** button on the balance or “**F6-Tare**” button in the software. Put about 200 mg of the sample in the boat. If the balance is connected to the PC, the sample weight is transferred from the balance by clicking the “**F4-Balance**” button with the mouse or simply by pressing F4 on the keyboard. It is displayed then in the “**Weight, mg**” input field in the “**Analysis control**” window of the software. The transfer of the weight from the balance can be performed many times, if necessary, for example, for correction of falsely entered weight. The sample weight, shown in the “**Weight, mg**” input field at the moment of starting the analysis is the sample weight, which will be taken for the analysis result calculation. The sample weight can be transferred from the balance during a running analysis, i.e. the sample for the next analysis can be weighed, while an analysis is in progress. If necessary, the accelerator can be added to combustion boat, after the sample weight is transferred to the PC. For the coal analysis, as well as for the majority of the analysed materials, the accelerator is not necessary. However, for analyses of some materials, which contain hard-to-burn components, the accelerators are necessary, see [2.3](#).

If necessary the sample weight can be entered into the “**Weight, mg**” input field of the software manually. The optional sample ID (sample description) can be also entered into the “**ID:**” input field of the “**Analysis control**” window of the software.

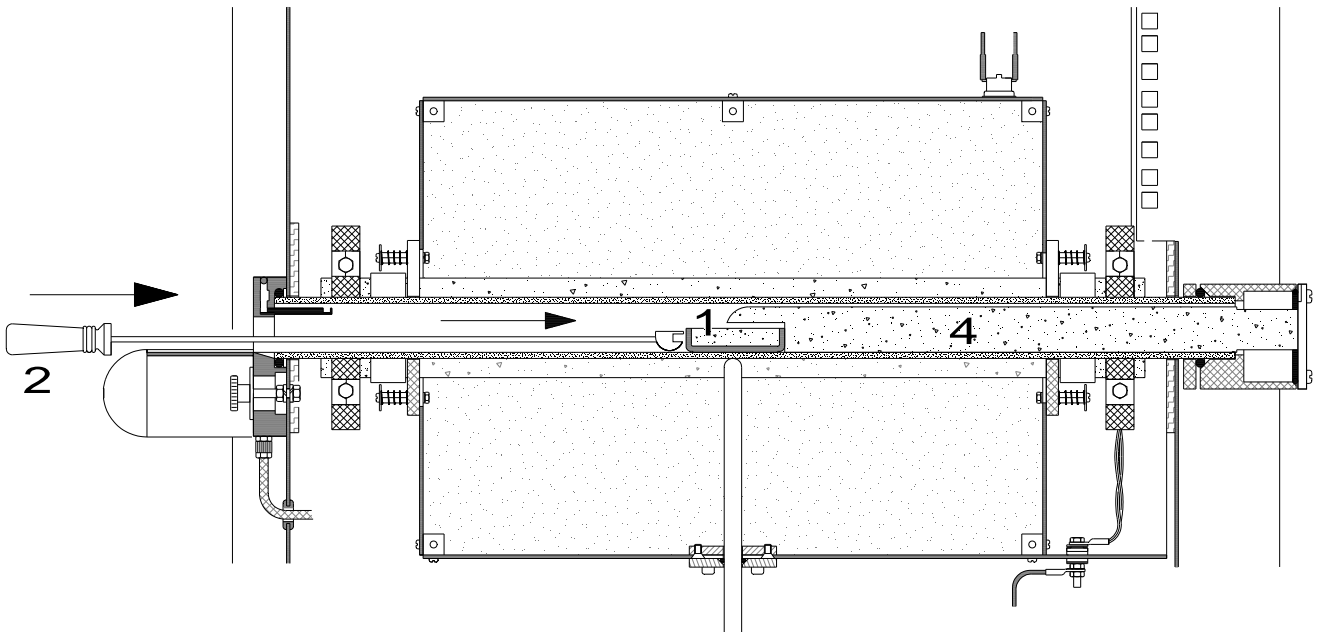
CAUTION:

Only the sample weight should be transferred to the PC with the weight transfer button or entered manually and in no event the weight of the ceramic boat or accelerator.

NOTE: For all instructions on operating the PC software refer to the Help-function of the software.

2. Pushing the combustion boat into the furnace, analysis of the sample:

Place the boat with the sample on the combustion boat platform (9, [1.2](#)) in front of the furnace opening (10, [1.2](#)). Start the analysis, by clicking the “F5-Start” button with the mouse or simply by pressing **F5** on the keyboard. At this moment the message “Analysis...” appears in the “Status” window of the software, indicating the start of analysis. Immediate thereafter push the combustion boat (1) into the hot zone of the furnace. This is done with a metal rod (2). The rod is pushed into the furnace far enough so that the combustion boat reaches the boat stop (4). Afterwards, the rod is pulled out of the furnace.



The analysis then runs automatically, so that no more handling is necessary. The infrared cell signals can be observed and followed up on the PC screen.

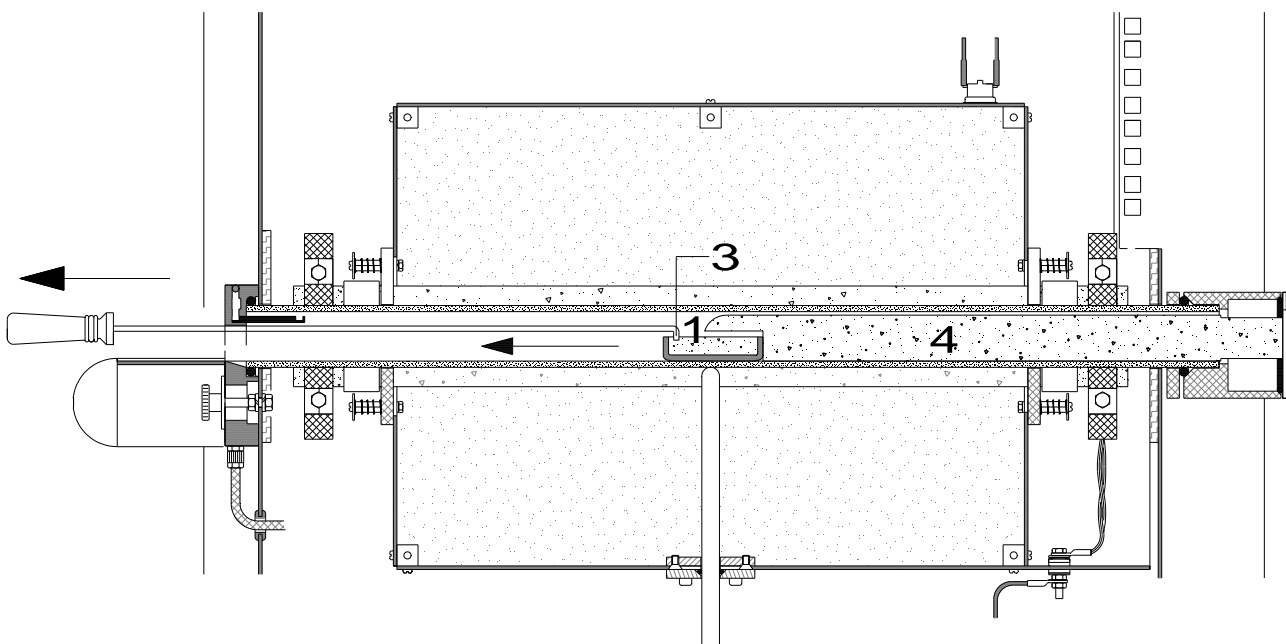
NOTE: If the message “Waiting for stability” is displayed in the “Status” window of the software, after pressing “F5-Start” button, it is essential to wait until this message disappears and the message “Analysis...” appears instead. Only then, the combustion boat can be entered into the furnace.

3. Removing the combustion boat after the end of analysis

When analysis is finished, the results are displayed on the screen and stored in the database on the hard drive of the PC. The message “**Analysis**”, shown in the in the “**Status**” window of the software during analysis, disappears.

The combustion boat (1) should be removed immediately at the end of the analysis. During the removal, the hot combustion boat (1) might possibly burn dust or sample remains in the combustion tube, thereby altering the base line of the infrared system. When this occurs after starting, then the message “**Waiting for stability**” appears after starting the next analysis in the “**Status**” window of the software.

To remove the combustion boat (1) grab it with the hook (3) and pull it out.



Remarks:

Any overloaded range is automatically deactivated during an analysis. Any deactivated range is automatically reactivated after the end of the analysis. Only manually deactivated ranges remain inactive, until manually reactivated.

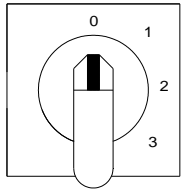
The sulphur range should be deactivated when only carbon is required. This will avoid undue delay of the analysis caused by sulphur compounds which are difficult to burn. Make sure that the boat stop (4) is in the right position. See the picture above.

The sample weights are valid when the analysers have appropriate sensitivities and the right path lengths of the IR-cells. If not, the analysis condition can be improved by sample weight variation. Generally, the weight has an optimum size when the peaks on the screen reach the middle of the range, i.e. the maximum peaks go up to 4 to 6 volts. The sample weight should be reduced when the IR-cell is saturated. However, when the weight is lower than 100 mg, the accuracy will be reduced due to the samples being not homogeneous and due to lower weighing accuracy.

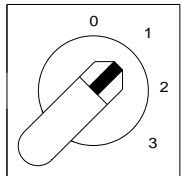
When the samples evaporate during combustion, the sample should be analysed like oil.

2.2 Work breaks

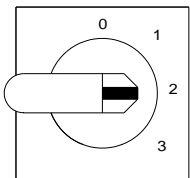
The mains switch of the analyser has 4 positions:



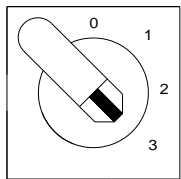
0 - Off. Analyser is switched off.



1 - Stand by. The thermostatic control of the IR-cell is on, furnace is switched off and there is no gas consumption.



2 - Furnace on. The furnace is switched on and heating up, while the gas flow is still disabled.



3 - Operation. All systems of the analyser are in operating modes.

In case the instrument was switched off (**pos. 0**), it should be switched on **pos. 1** for at least **1 hour**, in order for the IR-cell to reach the stable operating temperature.

When beginning the work, the mains switch is set first to **pos. 2**, for the furnace to reach the operating temperature. Usually it takes about 20-30 minutes. Then the mains switch is set to **pos.3** for about **15 minutes** before starting the first analysis. It can be set to pos. 3 in a moment when furnace not yet reached its operating temperature, but needs still about 15 minutes to do it. Air, and any moisture which has entered the analyser is expelled by the **nitrogen flow**. The slight influence which the **nitrogen flow** has on the temperature of the **infrared cell** is balanced out.

During work breaks, e.g. **lunch breaks**, the mains switch remains on **position 3**. During **longer** interruptions, e.g. after finishing work for the day, the mains switch is set to **position 1** (standby). The analyser's thermostatic control is then still working and no long warm-up time is needed, when re-starting the analyser. Energy consumption and wear are negligible on standby.

The analyser may only be switched off (**pos. 0**) when it is not used for several days or weeks. The analyser is designed for long term use, so that no **damage** results.

2.3 Applications

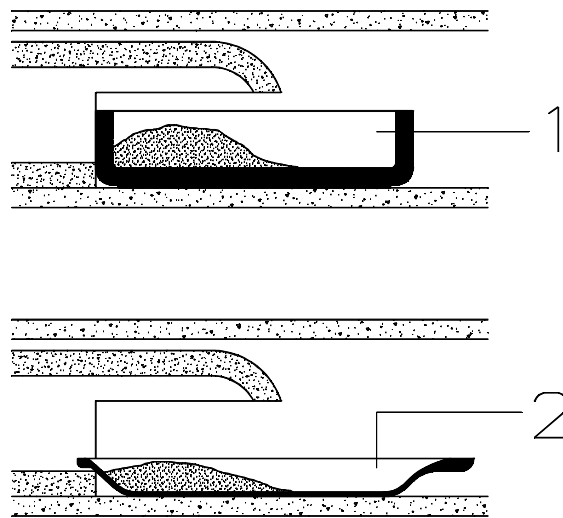
ANALYSIS of COAL.

Furnace temperature 1350°C.

Sample weight around 300mg, depending on the sensitivity of the analyser and on the C and S content of the sample. The sample weight should not be higher than 500mg.

The sample should be put into the front part of the combustion boat. The combustion boat is pushed directly into the hot zone up to the boat stop after pressing "START". Usually, no accelerators are needed. Only in exceptional cases, when the sample contains pyrites, the furnace temperature has to be set at 1500°C or approx. 300mg of iron phosphate have to be spread upon the sample.

There are two different types of combustion boats available:



Due to the front shape of the combustion boat type 2, it should be carefully pushed up to the boat stop, otherwise it may slide into the boat stop. Stop pushing as soon as the boat stop is reached.

The combustion boat **(1)** is reusable (10, 20, 30 analyses or more).
The combustion boat **(2)** can only be used once.

ANALYSIS of OIL, ASPHALT and RUBBER.

Using fuel oil and other thick oils, the sample weight is approx. 80mg.

The sample weight should never exceed 100mg.

Using thin oil analysis, the sample weight should not be higher than 50mg.

Adjust the furnace temperature to 1450 °C.

Weigh the sample of the above mentioned materials, 50 to 100mg.

Transfer the weight to PC.

Start analysis.

Insert the boat very slowly into the furnace.

When you hear the noise of the ignition, stop pushing and put a marker on the insertion rod, at the beginning of the platform of the boats.

The marker can be a piece of tape wrapped around the rod. Check the right position of the marker by pushing another sample up to the level of the marker. The marker is at the correct position when the sample takes 3 to 5 seconds to ignite after stop pushing. Otherwise repeat and check again.

Once the marker is at the correct position, all the samples of this kind of material are inserted in the furnace shown by the marker on the rod and left there for analysis. This position corresponds to an area inside the furnace, situated just before the hot zone. The sample then ignites in about 3 to 5 seconds. The signals of the IR-cell go up. They can be observed on the computer screen.

When the signals are moving down and have reached about 25% of their maximum peaks, push the combustion boat up to the boat stop to reach the middle of the hot zone, to completely burn any rest of the sample.

CAUTION:

It is extremely important to run the analysis this way!

Never push such kinds of samples immediately into the hot zone.

Some fumes may leave the hot zone without being completely burned. They may contaminate the gas flow system, including the infrared cell.

Some users push the sample "slowly" into the furnace up to the hot zone. This is wrong. The sample must stay at the ignition point and after the peak came down to a low level, then the boat should be pushed into the hot zone.

ASH ANALYSIS (C and S determination in ash).

Adjust the furnace temperature to 1450 °C.

Take 200 mg sample weight. The weight can also be much higher, depending on the C and S concentrations and on the sensitivity of the IR-cells.

After starting the analysis, push the sample up to the middle of the hot zone, resp. up to the boat stop.

ASH CONTENTS DETERMINATION.

Close the adjustable flow restrictor (on the front panel, below the flow indicator). Turn it fully clockwise. Adjust the furnace between 790 °C and 800 °C. Take about 1g of sample in a quartz boat. Insert the sample into the furnace, just at the beginning of the hot zone. Leave the sample for one minute. Push the sample into the hot zone and leave it there for 6-7 minutes.

After combustion, remove the sample. After cooling down, weigh the sample again. This is the weight of the remaining ash.

The percentage of the ash contents is calculated as follows:

$$C[\%] = \frac{W_{after}}{W_{before}} \cdot 100$$

where: C – ash contents in the sample;
W_{after} – sample weight after combustion;
W_{before} – sample weight before combustion;

CAUTION:

For sulphur and carbon analysis, readjust flow restrictor until lower flow indicator shows 200 l/h. Ensure that the moisture absorber is dry, replace if necessary, even if the signals from the infrared cells are ignored. The gases passing through the IR-cells have to be dry in any case.

GRAPHITE ANALYSIS.

Analysers with a range of 100% C can be calibrated with graphite.

Any furnace temperature over 1000 °C is sufficient.

Sample weight approx. 400 mg.

The boat is pushed directly up to the boat stop.

ANALYSIS of CALCIUM CARBONATE.

This can be used for calibration in the range of 12% C.

Depending on the sensitivity of the IR-cell, the weight can be between 100mg and 500mg.

Any furnace temperature over 800 °C is high enough.

The sample is directly pushed up to the boat stop.

LIMESTONE ANALYSIS.

The furnace temperature 1250 °C or higher.

Calibrate with calcium carbonate of 12% C.

The usual weight is 500mg.

Push directly up to the boat stop.

CEMENT ANALYSIS.

If only the carbon value is required, deactivate the sulphur range.

The sample weight is between 200mg and 500mg, depending on the C-concentration and on the sensitivity of the IR-cell.

Adjust the furnace temperature to 1250 °C.

Enter the sample directly up to the boat stop.

For sulphur analysis in cement we recommend an induction furnace analyser.

ANALYSIS of GYPSUM and desulphurisation products (of power plants). If only the carbon value is required, deactivate the sulphur range.

For carbon analysis:

Adjust the furnace temperature to 1250 °C.

Take 300 to 1000mg sample weight, depending on the C content and the sensitivity of the IR-cell. Enter the boat directly up to the boat stop.

For sulphur analysis:

Take nitrogen as carrier gas (instead of oxygen).

Adjust the furnace temperature to 1450 °C.

Take 30 to 50mg sample weight. Add 500mg iron phosphate.

Enter the sample directly up to the boat stop. The calibration can be done with pure gypsum 18.6 % S.

ANALYSIS of PLASTICS.

Adjust the furnace temperature to 1450 °C.

Weight the sample of the above mentioned materials, 50 to 100mg.

Enter the boat very slowly into the furnace.

When you hear the noise of the ignition, stop pushing and put a marker on the insertion stick, at the beginning of the platform of the boats

The marker can be a piece of tape wrapped around the stick. Check the right position of the marker by pushing another sample up to the level of the marker. The marker is at the right position when the sample takes 3 to 5 seconds to ignite. Otherwise correct and check again. After the marker is at the right position, all samples of this kind of material are inserted up to the beginning of the hot zone and left there for analysis.

They ignite after 3 to 5 seconds. The signals of the IR-cell go up. They can be observed on the computer screen. When the signals are moving down and have reached about 25% of their maximum peaks, push the combustion boat up to the boat stop to reach the middle of the hot zone, to completely burn any rest of the sample.

ANALYSIS OF WOOD.

Use the big ceramic boats (58 x 22 x 14 mm).

Adjust the furnace temperature to 1300 °C.

Take 350 mg of sample.

Set the minimum analysis time to 50 s.

Set the comparator level to 150.

LOW CARBON ANALYSIS

The IR-path of the low carbon is usually 10mm only. The maximum possible length is 320mm. Even though with 10mm IR-path a sample of 50ppm can give reasonable results and good carbon peaks. This shows that the CHS-580 is capable to analyse even much lower carbon values when the path length is 15 times longer! Please, note that it is not a problem to make the CS-580 very sensitive in carbon. The limits are set by the air entering the system and by the blanks of the boat. The good results can be obtained by using quartz boats. **NO CHANCE** to measure in this low range if you use ceramic boats. Their blanks and their deviations are huge compared to the sample's carbon.

Even without using any low carbon attachment for preventing the air from entering the furnace, it is possible to obtain acceptable results in the 50ppm range.

A PC should be connected so that the base line and the peaks of combustion can be seen. A first thing to do is to check the base line. The blank value should be set to zero and the analyser should be calibrated with a higher sample so that the calibration factor is at least in a correct range.

Enter manually a usual sample weight taken for low carbon analysis, i.e. about 1000mg. Start the analysis cycle without entering sample or boat into the furnace. Repeat this 3 to 5 times. This way you know what is the reading caused by the air entering the furnace as well as by the base line drift and noise. So, when you run analyses later on, any higher value comes from sample and boat.

Of course the boats themselves can also be tested without sample: Enter manually 1000mg, press START and enter empty boats. The difference of the results to those without boat give evidence about the blanks of the boats. These blanks and their deviations must be much lower than the expected sample results and much lower than the expected sample deviations, otherwise an analysis doesn't make any sense.

For even lower carbon samples, a furnace extension piece, supplied by ELTRA, needs to be attached to the furnace inlet.

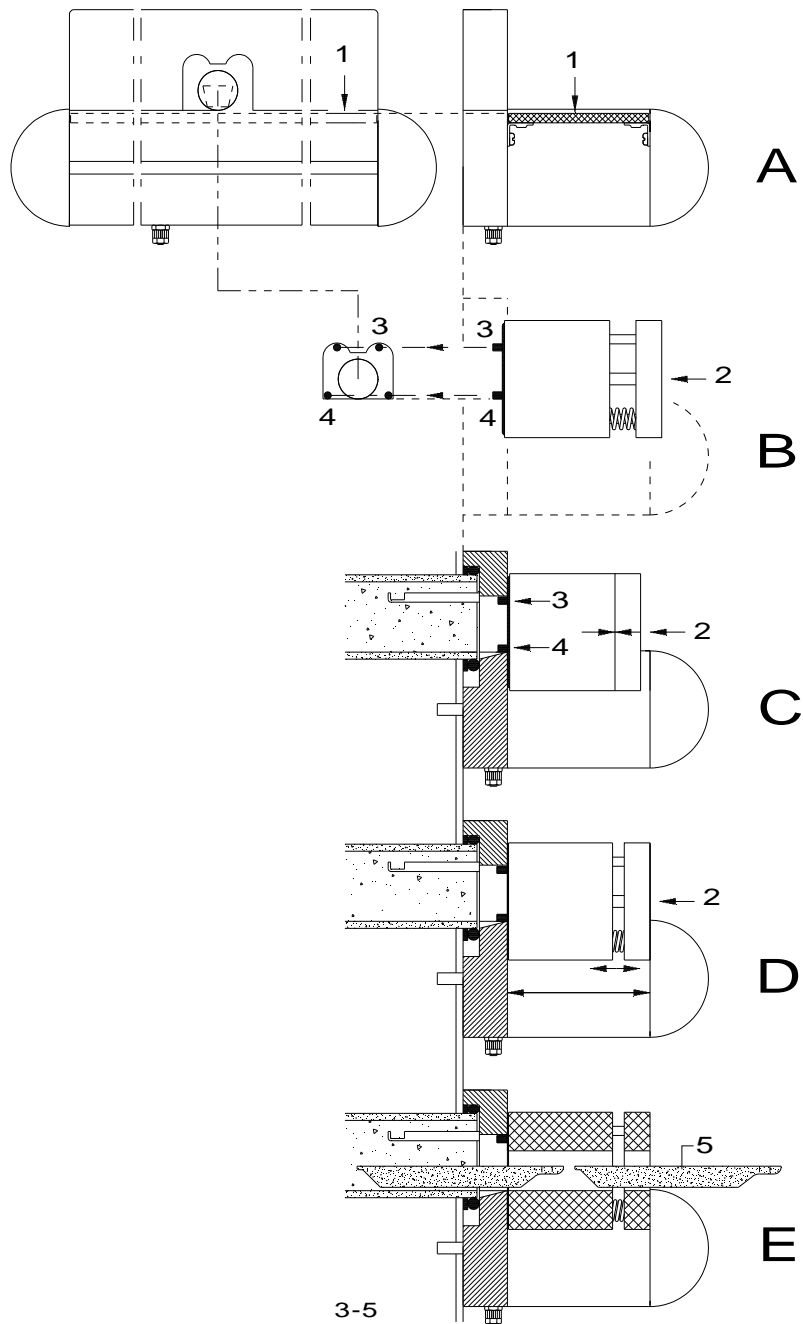
The reason is that the thick short combustion tube allows some air to enter the combustion area. The air contains some CO₂ which is detected by the carbon cell. As the CO₂ concentration resp. the air flow entering the furnace is not necessarily constant, the varying CO₂ of the air will lead to a corresponding variations of the base line. Using high carbon analysis in % range, resp. for high carbon IR-cells, the CO₂ of the entering air, practically doesn't have any influence on the results. For low carbon analysis, with sensitive CO₂ cells, the entrance of the resistance furnace has to be restricted.

The combustion boats that are used are the **slim quartz** boats. They have to be used, not only because the **bigger ceramic** boats can not pass through the restriction attachment, but also because the **quartz** boats have much **lower blanks** than the **ceramic** boats.

Even if the ceramic boats were able to pass through the attachment, they couldn't be used for **low carbon** analysis anyway, because of their high **carbon blanks**.

To install the low carbon attachment: See drawing next page.

Installing the low carbon attachment.



Lift and remove the glass platform (1) from the furnace inlet.

Make sure that the two hexagon socket screws (2) are turned clockwise up to the end. Use a 4mm socket wrench.

Attach the device to the furnace inlet, so that the pins (3) and (4) fit into the furnace inlet.

Loosen the two screws (2) until the ring (5) holds the device firmly in place.

The combustion boats (6) can now be moved in and out the furnace

3 MAINTENANCE

3.1 General information

- The content of the **left glass** tube on the analyser's front should be **replaced** every **100 analyses**.
- The chemicals in the **right glass** tube on the analyser's front are for purifying the carrier gas. The depleting of these chemicals depends on the purity of the carrier gas used.
- The **CO₂** absorber in the **upper half** of the glass tube changes its colour from black to grey after separation.
- The moisture trap in the **lower half** doesn't change its colour. When the particles at the upper end of this column don't move when knocking on the glass, a replacement is necessary. See [3.2](#) and [3.3](#).
- Further maintenance is only to clean the dust in the furnace outlet, see [3.7](#) which is only necessary after **hundreds** of analyses, depending on the kind of samples. Further maintenance is not necessary.

Remark:

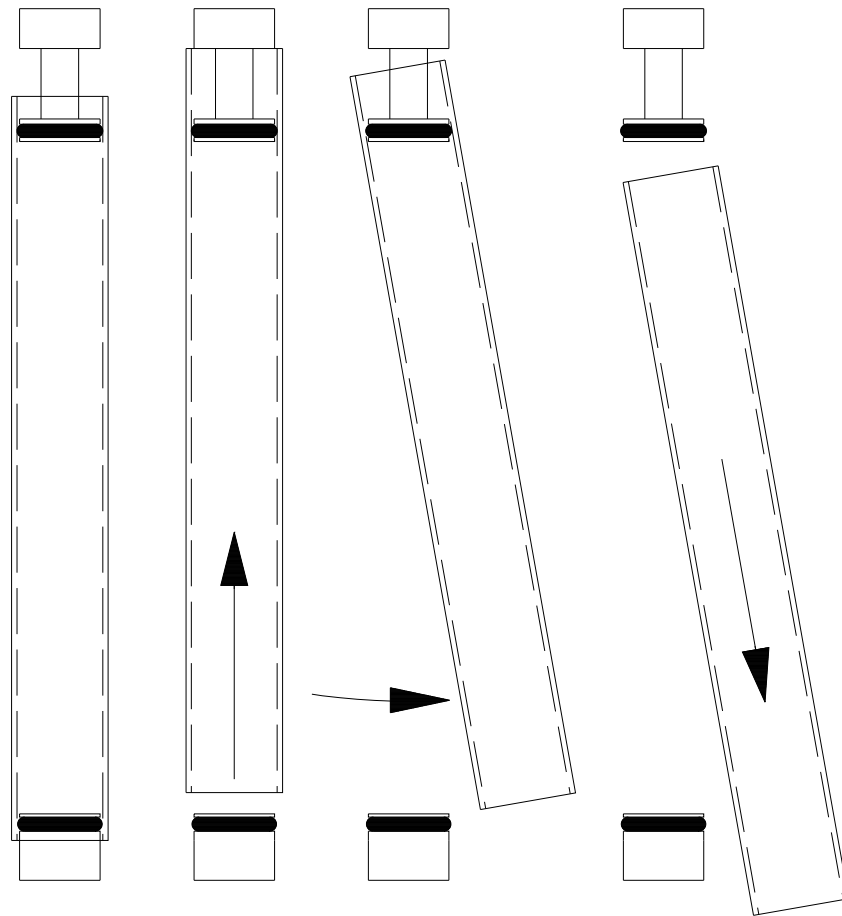
According to our experience in most cases when users report deviation of the results, the problem is solved by replacing the **magnesium perchlorate**. This means that the **importance** of the condition of the chemicals used, are **underestimated**.

CAUTION:

There are specially developed chemical qualities and accelerators for analysis devices:

- **Anhydron, ascarite, iron phosphate**, among others. Normal commercially available materials of this type either fall short or are entirely useless for this purpose.
- Normal **magnesium perchlorate**, for example, causes memory effects and therefore, is not repeatable. A further typical effect is that the analysis takes too long and often never comes to an end. This effect also occurs with **magnesium perchlorate** of suitable quality if it is saturated.
- Normal sodium hydroxide binds **CO₂** quite inadequately at room temperature. The special quality, on the other hand, reacts quite well at room temperature and has at the same time an indicator.
- The **glass tubes** and the **O-rings** should only be greased with **high vacuum grease**. Ordinary silicon grease is inadequate.
- It is left to the user to test normal materials. The device will **not** be damaged. When there are problems, the proper quality materials should be used, and these should be in absolutely unsaturated condition, **before** technical service is called.
- The chemical containers must be immediately and quite securely closed, so that they are not saturated with **CO₂** or **moisture**.

3.2 Installing and removing the reagent tubes



To replace the reagent tubes:

The reagent tubes are first lifted, then swung to one side, detached diagonally downwards and emptied.

IMPORTANT:

The dimensions for filling the glass tubes given in the schematic of [3.3](#) should be respected in all cases.

When, for example, there is not enough of quartz wool in the bottom of the glass tube, it is possible that dust, forming **magnesium perchlorate** can fall through and block the fitting below or this can **damage** the analyser and the **infrared cell**.

NOTE:

Before the reagent tubes are fitted, both the O-rings and the inner ends of the tubes are lubricated with **high vacuum silicon grease**.

The components are refitted in reverse order.

3.3 Filling the reagent tubes

The following chemicals are used :

Magnesium perchlorate (anhydrous)	as moisture absorber
Sodium hydroxide	as CO ₂ absorber

The chemicals are replaced when they are saturated. See [3.1](#).

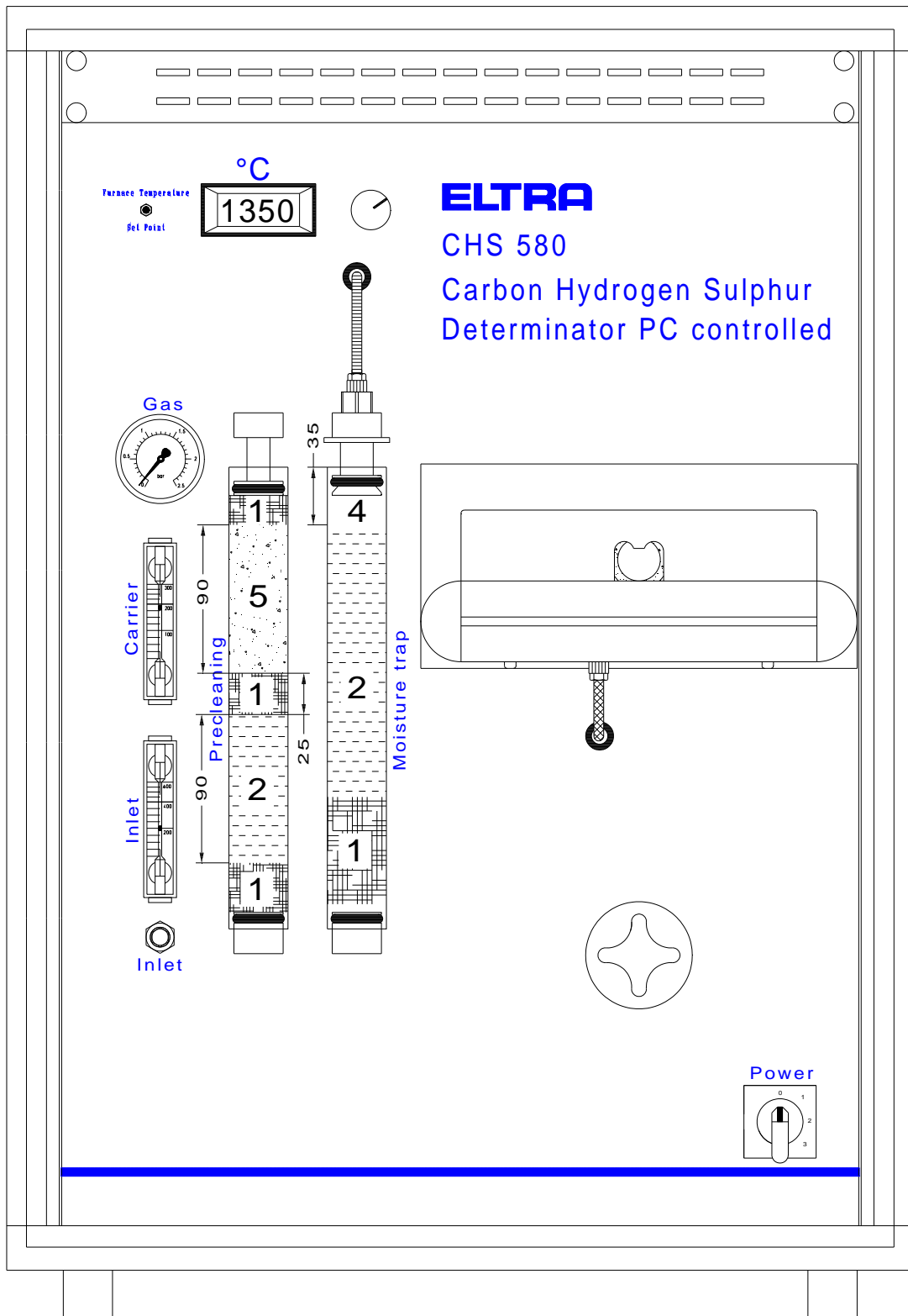
It is not possible to dry the **magnesium perchlorate** and use it again, as it is chemically changed after reacting with the moisture. If the absorber particles do not move (e.g. tapping on the glass), then this is a sign that the **magnesium perchlorate** is saturated. It is essential to change the absorber before it is completely solid. The saturation of the Sodium Hydroxide is changing its colour (**it turns to light grey**).

Since different samples could be analysed, it is hard to give a precise number of analyses that can be made before the contents of the reagent tubes should be replaced. In addition, the saturation level of the absorber are at highest at the gas entry point and fall off toward the exit. For example, the first absorber after the furnace (**thick glass tube**) would be changed more often than the **second**; or the top half of the first absorber should be replaced. A clear sign of total saturation is when the absorber's particles do not move freely when the glass tube is tapped. Under any circumstances neglect the changing of the absorbers until it is completely hard. Normally, the moisture absorbers should be checked after **30 to 40 analyses**.

Please refer to the following schematics to identify the glass tubes on the analyser. In addition to the reagents in the glass tube, fill the bottom end of the tube with **annealed quartz wool**. One should pay attention that the quartz wool should be only as **thick** as necessary, otherwise the flow of gas can be **choked**. Under no conditions should the amount of quartz wool be less than that given in the following schematics, since fine particles of **magnesium perchlorate** can pass through the wool and collect itself at the bottom of the tube, causing severe damage.

It should be pointed out that **magnesium perchlorate** is a very strong **oxidative material**. At both ends of the glass tube, you should leave sufficient space for the gas connections to be fitted. The free space at the tube ends serve as sealing space. They must be cleaned after filling. The **O-rings** must be cleaned. Both the **O-rings** as well as the **sealing** areas of the tube must be greased with **high vacuum silicon grease**. This eases the assembly as well as the disassembly and further improves the seal. The assembly of the tubes follows in reverse order from the procedure given in [3.2](#).

Make sure that the O-rings are completely sealed around the glass tubes.



The filling quantities have tolerances of $\pm 20\%$

- | | |
|--------------------------|-------|
| 1. Glass wool | 90331 |
| 2. Magnesium perchlorate | 90200 |
| 3. Sodium hydroxide | 90210 |
| 4. Free (empty) | |

3.4 Replacing the O-rings

The **O-rings** are only replaced when they can no longer adequately seal, due to severe damage or age. When removing the **old** O-rings, be sure that the sealing area of the fittings are not damaged. The groove in which the old O-rings sat must be cleaned, so that it is completely **free of grease**.

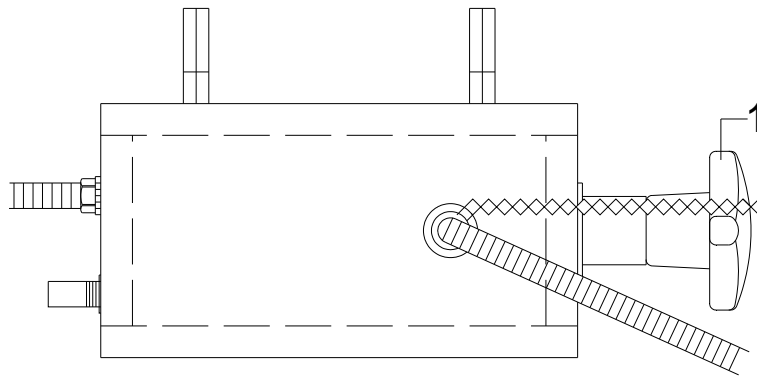
The new O-rings should under **no-circumstances** be greased before installing, **only** after installation. Otherwise, **the O-rings will turn with the glass tubes** when trying to remove it.

3.5 Cleaning the dust trap

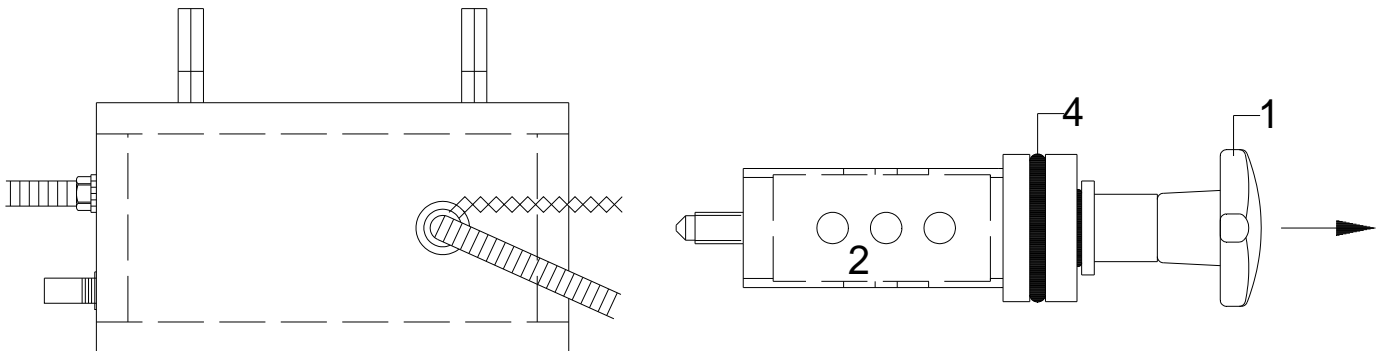
Any **dust** or **particles**, which may come out of the furnace with the carrier gas are trapped in the **dust filter**. The dust filter must be replaced, if it is saturated. Different samples produce different amount of dust during combustion, so the frequency of replacement depends on the samples. With the coal samples, the filter must be replaced after 2-5 thousands of analyses.

NOTE: Once the filter block is disassembled for checking, **the new paper filter element should be used in any case**. Filter is sealed by pressing it from both sides, which causes its deformation and it may not provide proper sealing after being used once.

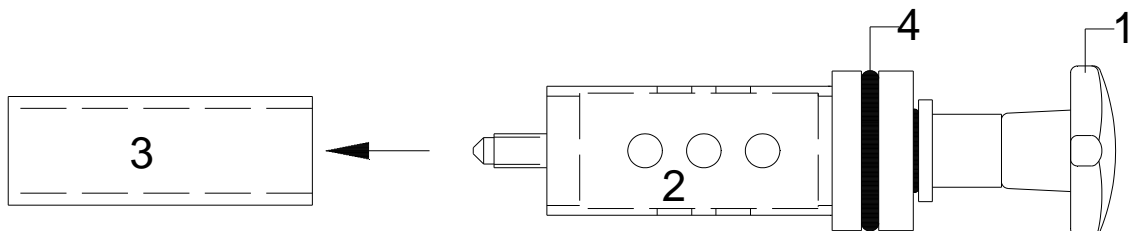
1. Turn the cock **(1)** counter clockwise for about 10 turns.



2. Pull the cock **(1)** and remove the filter assembly out of the housing.

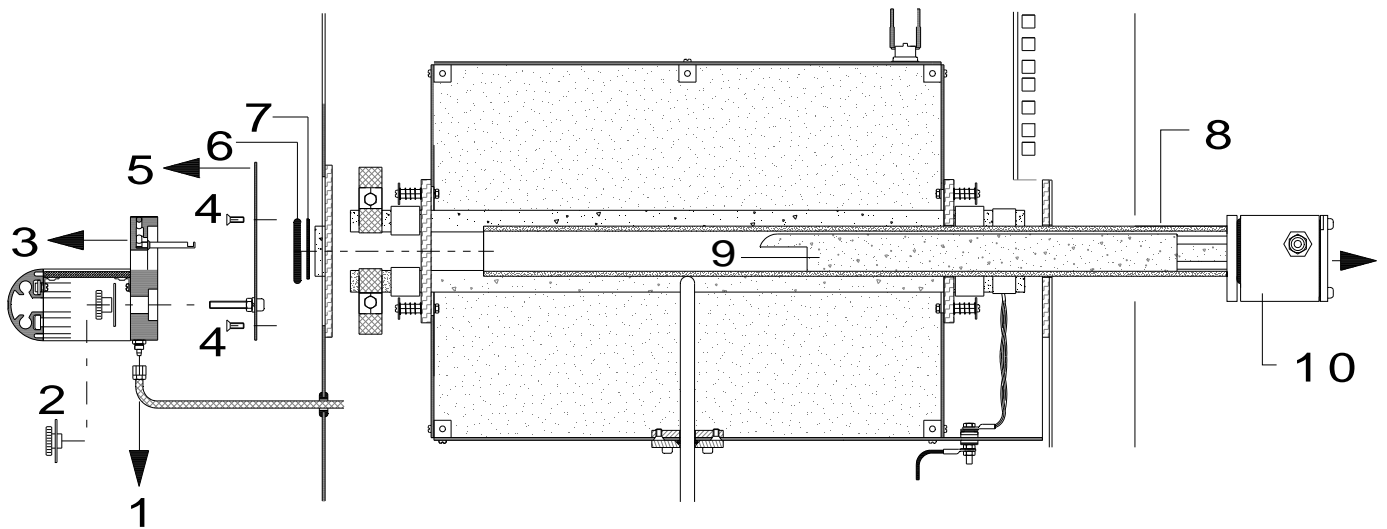


3. Remove the filter **(3)** out of the cylinder **(2)**.



4. Enter a new filter **(3)** into the cylinder **(2)**.
5. Lubricate the O-ring **(4)**.
6. Assemble again in reverse order.

3.6 Replacing the combustion tube



CAUTION: Unplug the main cable before opening this device!

Switch off the furnace and disconnect the power plug.

Remove the oxygen tube (1).

Unscrew the screws (2) and remove the front assembly (3).

Remove the O-ring (4) and the safety spring (5).

Remove the plastic tube from the dust box (8) at the furnace outlet.

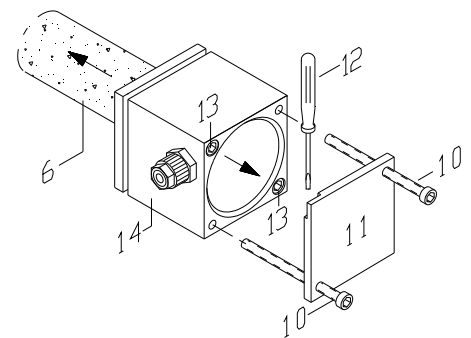
Pull the dust box (8) together with the combustion tube (6) out of the rear of the furnace.

Remove the boat stop (7) out of the combustion tube.

Dismantle the dust box by removing the screws (10) and remove the cover (11) using a screw driver if necessary (12).

Unscrew the screws (13) and remove the complete dust box assembly (14).

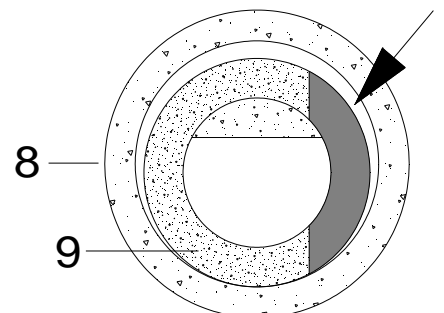
Remove the old combustion tube (6), install the new one.



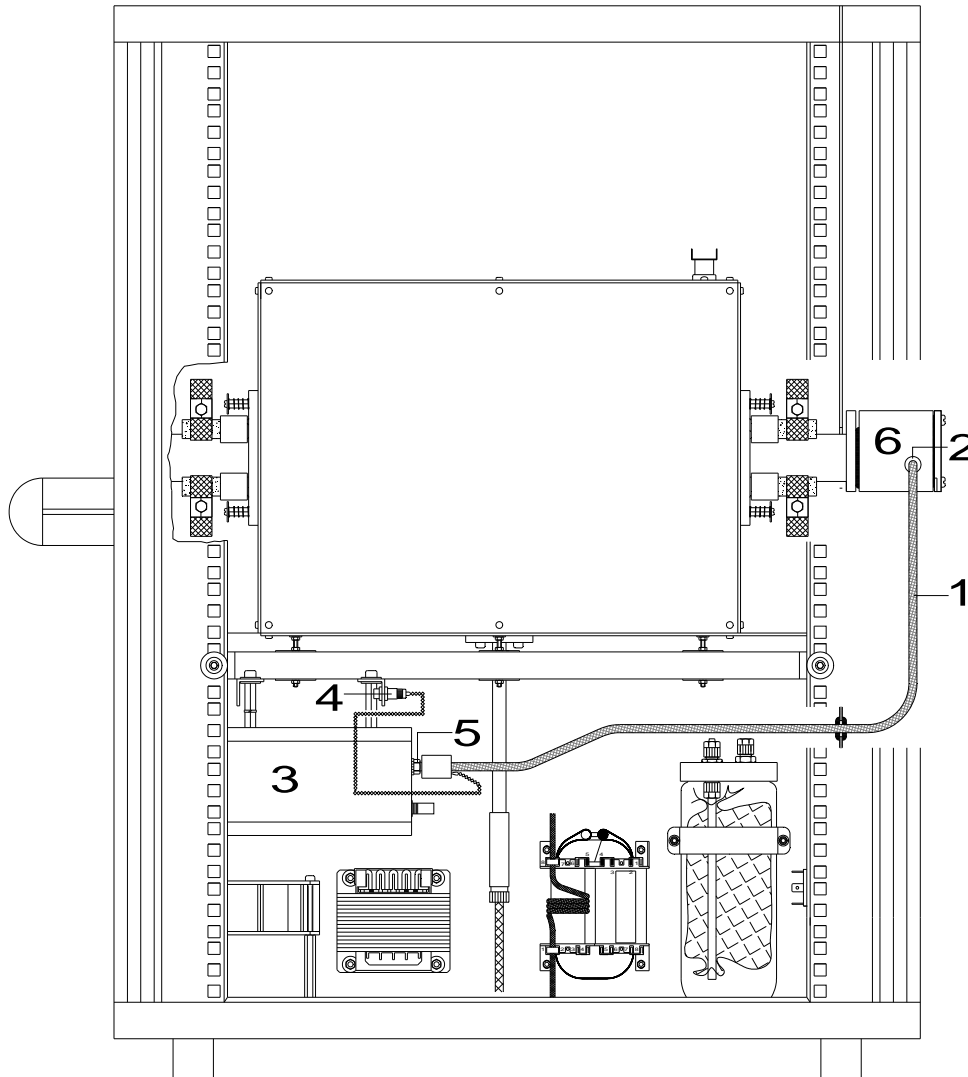
CAUTION:

Slide the new combustion tube **very slowly** and **perfectly horizontally** into the furnace, otherwise the heating elements may get damaged.

Slide the boat stop (7) into the combustion tube and ensure that it is positioned according to this drawing, (furnace rear-side).
Reinstall furnace in reverse order



3.7 Cleaning the tube



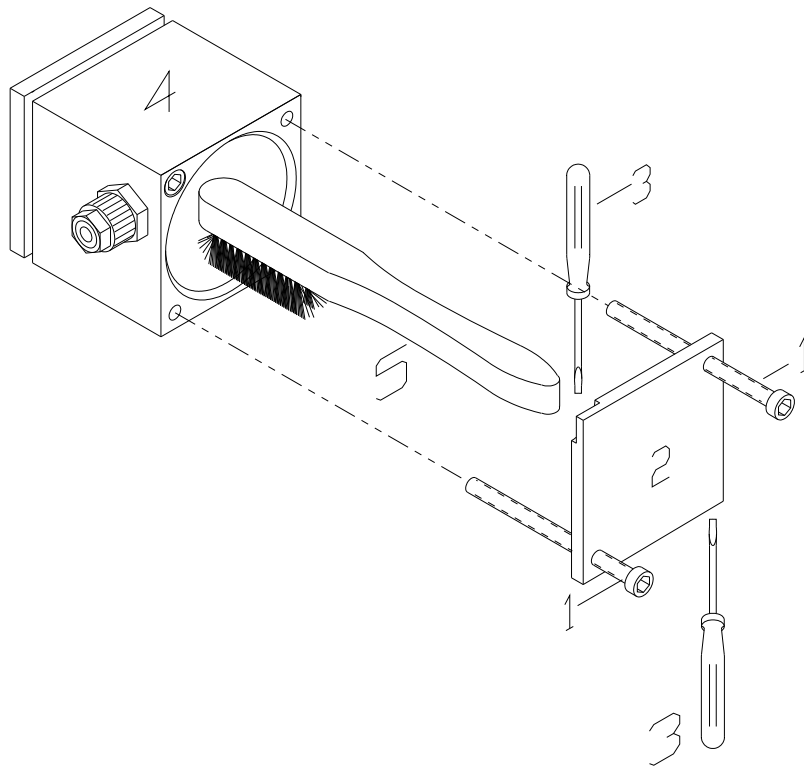
CAUTION! Electrical shock hazard!
Before opening this device, switch off the analyser (pos. 0) and unplug the mains power!

The heated tube between dust box **(6)** and dust filter block **(3)** has to be cleaned from dust and soot regularly, approx. every 1000 analyses. For cleaning the tube it should be removed out of the analyser:

- Pull the plug **(4)** out of the socket.
 - Unscrew the nut **(5)** on the dust filter block **(3)** and pull the heated tube from the fitting.
 - Unscrew the nut **(2)** on the dust box **(6)** and pull the heated tube from the fitting.
- The heated tube is cleaned then with appropriate pipe brush and/or purged with compressed air.

Connect the tube as before after the cleaning. Please, let the instrument enough time to stabilize, after switching it on. See [2.2](#).

3.8 Cleaning the dust box

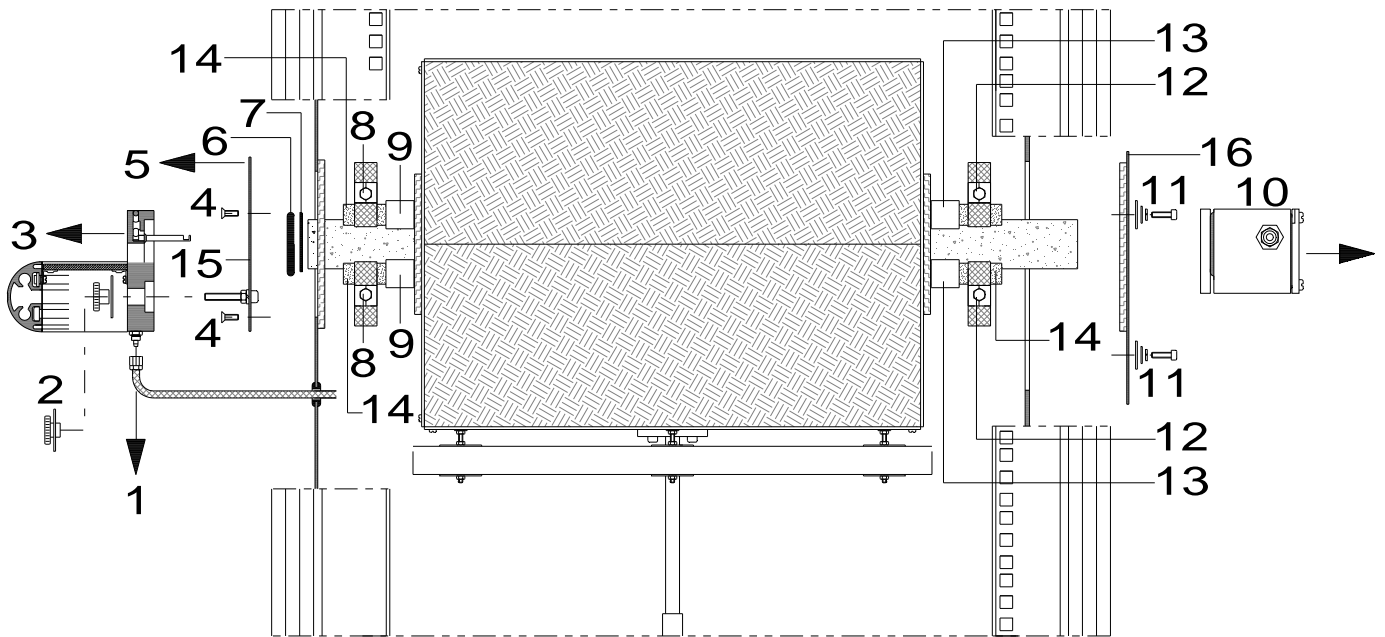


- Remove the two screws (1).
- Remove the cover (2) using a screw driver if necessary.
- Remove the dust from the inside of the dust trap (4) using the brush (5).
- Do the assembling in reverse order.

CAUTION:

The two screws (1) should be properly tightened to make sure that the system is sealed.

3.9 Replacing the heating elements



Disconnect the oxygen tube (1).

Unscrew the two knurled nuts (2) and remove the front assembly (3).

Remove the O-ring (6) and the safety spring (7) from the front end of the ceramic tube.

Pull the dust trap (10) with the ceramic combustion tube out of the furnace.

Unscrew and remove the four screws (4) and (11)

Remove the front (15) and the rear (16) stainless covers.

Remove the clamps (8) and (12) from the heating elements.

Remove the ceramic spacers (9) and (13).

Remove the heating elements (14)

Re-assemble in reverse order.

CAUTION:

Install the clamps (8) and (12) in a position which allows the heating elements to move at least 5 mm in horizontal (axial) direction.

4 SOFTWARE HELPS

4.1 Description

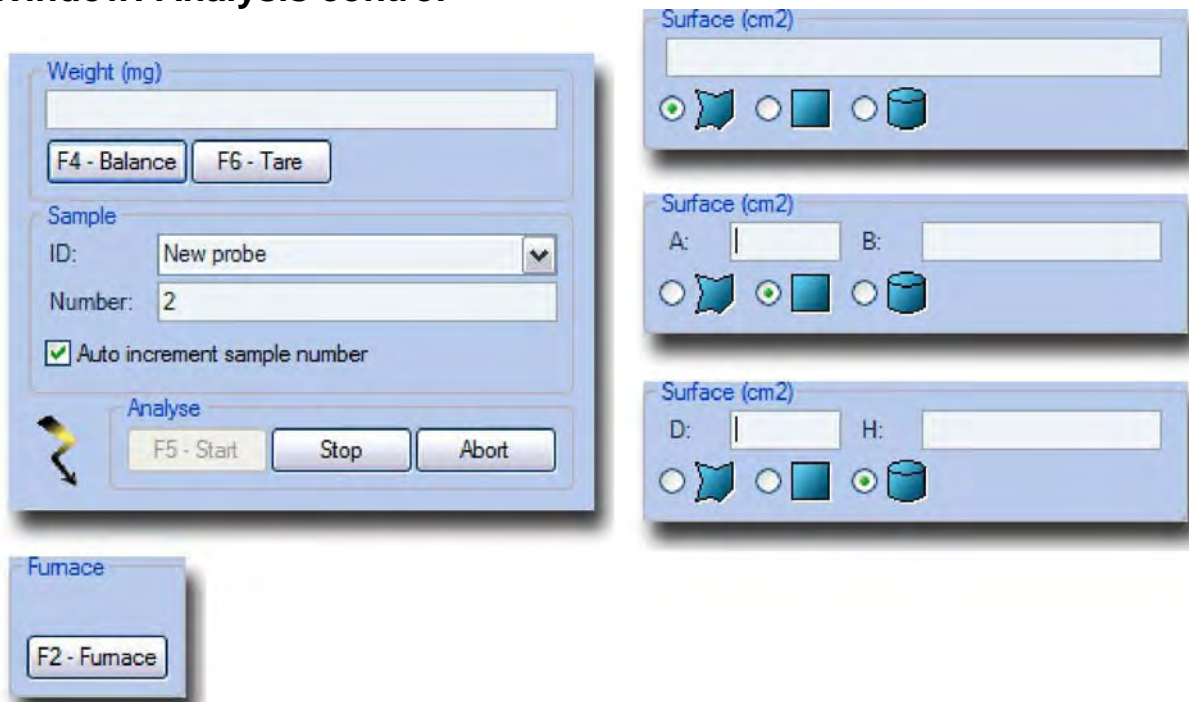
Minimal system requirements

Operating system	Windows XP Home/Professional Edition SP2, Windows 2000
Processor (CPU)	Intel Celeron 1 GHz
Memory (RAM)	256 Mb
Free hard disk space	15 Mb

About

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Window: Analysis control



This window provides to the user analysis procedure controls. In order to start analysis of the sample, the sample weight (or the sample area for the SC-500 instrument) must be entered. The sample ID and the analysis running number are optional. The analysis is started by pressing the *Start* button. The analysis procedure is carried out automatically, so no further manual intervention is necessary (except the manual sample loading mode in ON/OH/ONH instruments). The information about analysis being carried out is displayed in the [Status](#) window. The analysis can be interrupted at any time. This may be necessary, for example, when error message appears or in case of emergency or malfunction.

The description of the controls is given below.

Furnace

This button is used to open/close the furnace and is available for the instruments with pneumatic furnace lift - CS-800, CS-2000, ON/OH/ONH.

F2 - Furnace

Every click on this button will close the furnace if it is opened and open the furnace if it is closed. The furnace lift control is disabled during analysis (the button is inactive (turns grey)).

For the ON900, OH900, ONH2000 instruments in "manual sample loading" mode furnace control will be enabled during analysis in order to load the sample.

Weight

The sample weight must be entered in order to start analysis.

Weight

The sample weight can be entered manually in this field.

*The sample weight is entered in **mg** (milligrams). To avoid wrong entries the values less than 5 mg are not accepted.*

F4 - Balance

Use this button to read the weight from the balance connected to the analyser. The error message appears if the balance is not connected properly and/or communication interface is not adjusted properly (for the list of supported balances and settings refer to [Theory: Balance](#)).

F6 - Tare

Use this button to tare the balance.

Surface

This option is available only for SC-500 instrument. The sample surface area (in cm²) is entered in this field.

Arbitrary shape

Enter the self calculated surface area (in cm²) of the sample which has arbitrary shape.

Rectangle

Enter A and B (length and width in cm) of the sample which has rectangular shape. The surface area of one side will be calculated automatically.

Cylinder

Enter D and H (diameter and height in cm) of the sample which has cylindrical shape. The surface area of one side will be calculated automatically.

Sample

In order to identify the sample, the name should be assigned to it. Such name, which is commonly called *sample ID*, can be entered before analysis and will be saved together with other analysis data in the results data base. Sample ID can be the combination of letters and numbers. Special characters are also allowed.

The sample number can be appended to the sample ID. It can be useful to identify the certain analysis in the series of analyses of the sample with the same sample ID.

ID

The sample ID can be entered into this input field.

*All entered ID's are saved and can be chosen later from the pop-up list. Use the key combination **ALT + DOWN ARROW** to open the list. Use the **F3** key to place the focus on the **sample ID** input field.*

Number

The sample number can be entered into this input field.

Sample ID and sample running number are saved in the same text-field of the results data base. The default separator between them is "-". Others separators can be chosen in the configuration window.

Auto increment sample number

The running sample number can be enabled/disabled with this check-box. If checked - the sample running number will be increased by 1 after each analysis. If unchecked - the sample running number is disabled.

The sample number is set automatically to 1 after enabling "Auto increment sample number". Any number can be entered into this field manually and it will be increased by 1 after each analysis.

Analysis

If attempt is made to start the analysis without entering the sample weight (area fro SC-500 instrument) the error message is displayed.

F5 - Start !

Use this button to start the analysis procedure. This button becomes inactive during for the whole analysis procedure. The animated bolt sign is displayed if the analysis procedure is initiated.

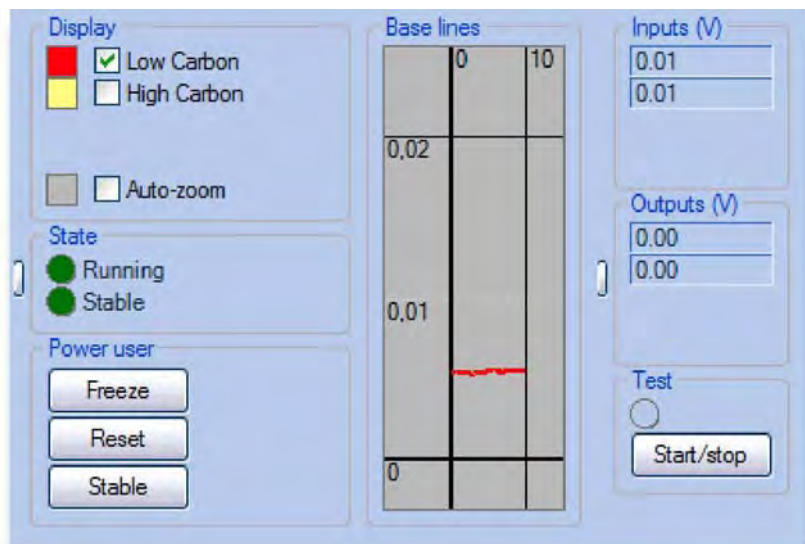
Stop

Use this button to stop the analysis procedure and get results (if available).

Abort

Use this button to abort the analysis procedure without calculating analysis results (emergency stop).

Window: Base lines



This window represents the automatic zero-regulation of the detectors' output signals. The controls of this process are available only for the power user. The detector's output signal in regulated and stable condition is taken as a reference zero level during analysis and is commonly called "*Base line*". The automatic zero adjustment of the detectors' output signals is commonly called "*Base line regulation*". See also [Theory: Base line](#).

Display

The appearance of the graphic elements of this window can be specified here.

Colours

Click on the corresponding colour box to choose the colour for the lines and the background.

Channels

Use the corresponding check-box to enable/disable display of the base line regulation for the certain channel.

NOTE: Disabling the display does not switch off (deactivates) the signal processing of the corresponding measuring channel!

Auto zoom

Use this check-box to enable/disable automatic adjustment of the maximum possible zoom for the content of the graphics area of the window.

Status

The status of the base line regulation procedure is displayed in this area.

Running

The green indicator informs that the base line regulation procedure is running.

Stable

The green indicator informs that the base lines of all channels are stable.

Power user

These controls provide the possibility to control the base line regulation procedure.

Start/stop

Use this button to start/stop the test of the detectors' output signals. The base line regulation is disabled (regulating outputs are set to 0) during test and automatically enabled as soon as test finished. For additional information about test, please, refer to

[Theory: Base line](#).

This feature is available for power user only!

Reset,

Use this button to clear the graphics area of the window. *This feature is available for power user only!*

Stable

Use this button set the status of the base line regulation to "Stable" by force. *This feature is available for power user only*

Base lines

The base line for each channel is displayed on the graphic area as well as horizontal line indicating the deviation level. To change the zoom use the scroll wheel of the mouse (rotate the scroll wheel to change the scale of the vertical axis, hold SHIFT and rotate the scroll wheel to change the scale of the horizontal axis). The content of the graphic area can be moved by dragging (move the mouse while keeping the left button pressed) it with the mouse.

Graphics

The output signals of all available and activated detectors are displayed in this area.

Inputs

The actual values of the input signals to the microcontroller (output signals of the detectors) are displayed in these fields.

Outputs

The actual values of the zero regulation output signals of the microcontroller (input signals to the detectors) are displayed in these fields.

Test On/Off

This indicator turns green if the test is enabled. *This feature is available for the power user only.*

Window: Communication test

The screenshot shows the 'Communication test' window with the following sections:

- Com Test:** Includes buttons for 'Balance', 'Tare', 'DAC Update', 'Get TP', 'Clear error', and 'Eeprom'. It also has a 'Packet' section with a 'Receiving' indicator and a 'Digital outputs' status bar.
- Dac:** A table with 3 rows and 2 columns for DAC values.
- Misc:** Checkboxes for 'Follow tab' and 'Outputs sync'.
- Version/Type:** Fields for '10' and '0'.
- Device state:** A table with columns for 'Signals', 'Balance', and 'TP'. It includes a 'Counter' field showing '60' and a 'Flag' status bar.
- Digital inputs:** A status bar with 16 indicators.
- Digital outputs:** A status bar with 16 indicators.
- Dac (right):** A table with 4 rows and 2 columns for DAC values.

The 'Balance' window displays:

- Weight:** 3.7491
- String:** + 3.7491 g

The 'TP' window displays:

- Internal adc:** A table with 5 rows (0-4) and 1 column for ADC values.

This window is used to check the communication and test the analyser (see [Theory: Controller](#)). It is available only for technician/service personnel!

ATTENTION: Unskilled or inexperienced operations with the controls in this window can lead to malfunction or even damage to the analyser! Please, do not perform any operations with the controls until you know exactly what you do!

Commands

The list of the available commands for the microcontroller.

Balance

Sends the instruction to switch the connection to balance and get (with the parsing following) the weight.

Tare

Sends the instruction to switch the connection to balance and tare it.

DAC update

Sends the instruction to update the DAC values. There are 4 analog outputs available on the microcontroller board and updating for all of them is taking place simultaneously. The values for each output are specified in the input field *DAC* (see below).

DAC

The voltages (V) for 4 analog outputs are entered in these input fields.

Get TP

Sends the instruction to switch to the mode of gathering the voltage values on the test points. In this mode the ADC is deactivated for the next cycle (half a second) and microcontroller performs the internal ADC (connected to test points) signals processing.

ATTENTION: Do not switch this mode during analysis!

Clear error

Sends the instruction to reset the transmission error.

EEPROM

Sends the instruction to memorize the current digital outputs state to the nonvolatile memory. This state is set when the connection to the PC-software is lost or when the PC is disconnected.

When loading the profile on PC, the state of digital outputs memorized in EEPROMS is verified and restored (if necessary).

Digital outputs

Sends the instruction to set/reset the digital output. See [Theory: Microcontroller](#) for the list of inputs/outputs.

ATTENTION: If the "Output sync" is unchecked, current state of all digital outputs will be changed when changing the first digital output!

Packet receiving

The indicator flashes red/green when a packet is received.

Version/Type

Displays version and type of incoming packet.

Follow tab

If checked, the tab (signals, balance and TP) of the device state is activated appropriate to the packet type (see below).

Output sync

Switch on/off the synchronization of digital outputs. If switched on, the actual state of digital outputs (right upper corner of the window) is transferred automatically to the *digital outputs* field (left lower corner of the window).

Device state

The internal state of the micrcontroller is displayed here.

Signals

The device state is displayed here (analog inputs (ADC), analog outputs (DAC), digital inputs/outputs, counter and flag).

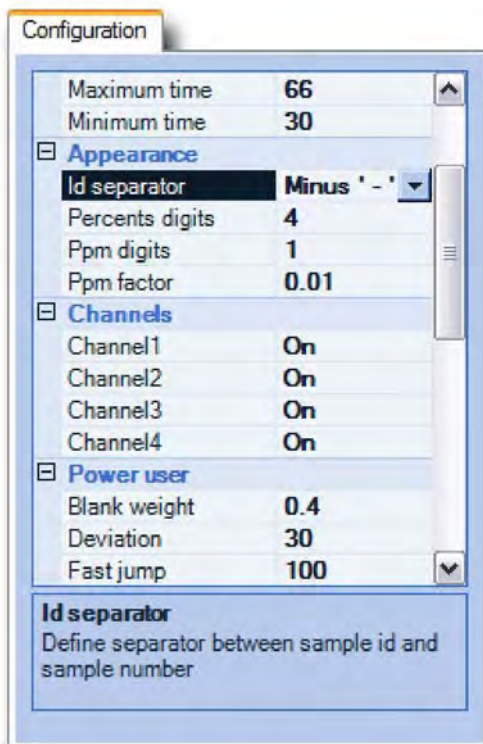
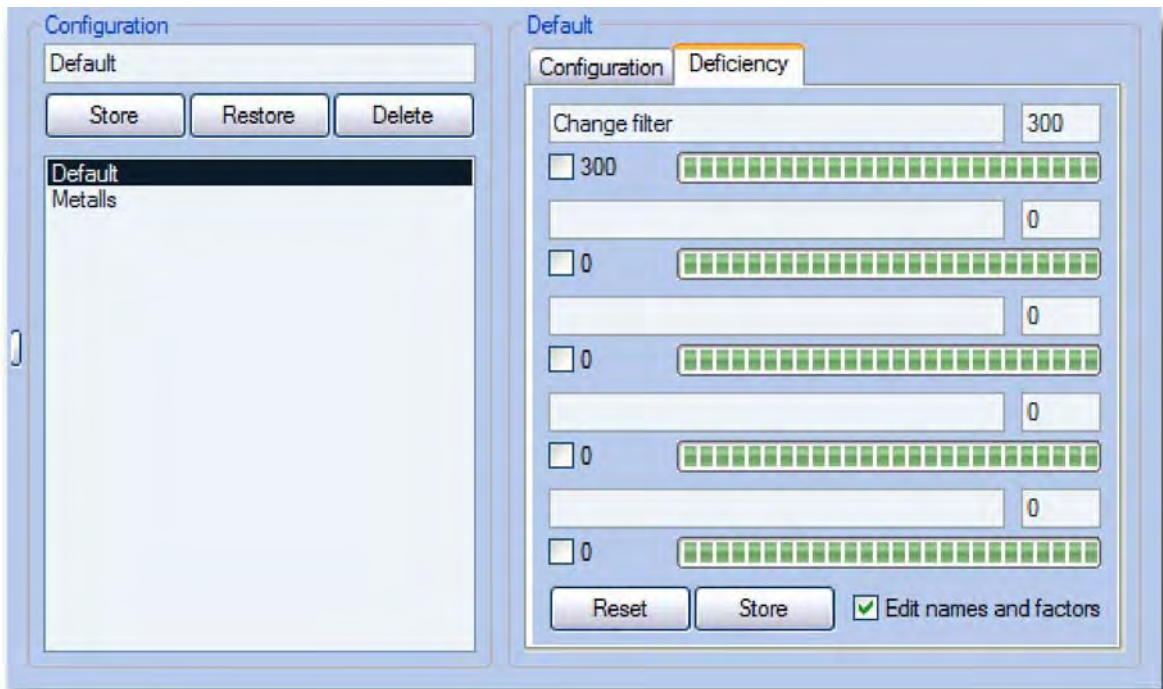
Balance

Displays the last value read from th balance: weight (parsed string) and string (received string).

TP

Displays the test point values (internal ADC).

Window: Configuration



The settings of the software can be specified in this window (see [Theory: Configuration](#)), the applications can be saved and recalled (see [Theory: Application](#)), the deficiency criteria can be configured (see [Theory: Deficiency](#)).

Application

The application can be saved and recalled here.

Name

The name for the application to be saved is entered into this input field.

Save

Use this button to save the application with the given name.

Restore

Use this button to restore the saved application.

Delete

Use this button to delete the chosen application.

Application list

The list of saved applications is displayed here.

For the analysers which have 2 configurations (CS-2000, ONH-2000) application list is loaded when changing the operation mode (resistance/induction furnace for CS-2000, ON/OH for ONH-2000). The applications saved for different operation modes are available only when working in corresponding operation mode. For example, in CS-2000 analyser, the application saved in resistance furnace operating mode is not displayed when working in induction furnace operation mode, and vice versa.

Configuration

The list of all settings available in the software. Some settings can be hidden for the lower access levels (operator, administrator).

Configuration name

The name of the last loaded or saved configuration is displayed here.

Settings list

The list of available settings.

The short description for selected setting is displayed at the bottom of the Configuration window.

Deficiency

Names

The names of the deficiency counters. There are 5 counters and their names are the same for all applications.

Counters

Enter the number of analyses for the each counter. This number can be different for different applications.

Rest

The number of analyses left to the activation of the deficiency error message when analysis procedure is initiated. The rest is different for different applications if the counters values are different.

Reset]

Use this button to reset the counter (set the counter value to initial value).

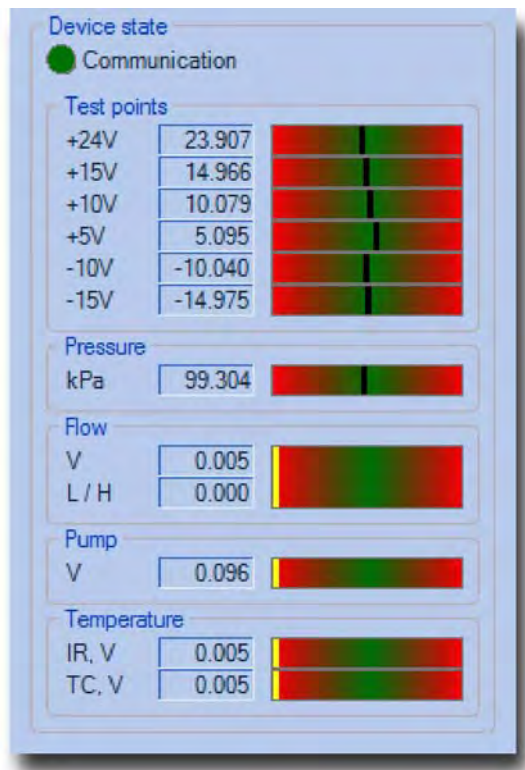
Store]

Use this button to store the changes made to the fields *Name* and *Counter*.

Edit names and factors

Use this check-box to enable/disable edit-mode for *Names* and *Counters*.

Window: Device state



This window is used to observe the parameters of the analyser. The indicator in green zone means optimal value.

Power user (service personnel) has at his disposal "communication test" window (see [Window: Communication test](#)), where more information is available.

Device state

The internal state of the instrument is shown here (the parameters may vary depending on the type of the instrument).

Communication

The indicator flashes red/green if the data transmission from the analyser takes place.

Test points

Displays the test points values of the microcontroller board. *The values are updated once per 10 seconds.*

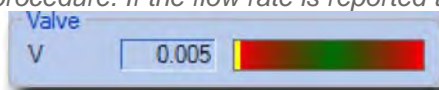
Pressure

Displays the atmospheric pressure.

Flow

Displays the output signal of the flow meter (Volts) and calculated by the software flow rate (l/h, litres per hour).

The power user has to adjust the setting "Normal flow" in the "Configuration" window in order the correct flow rate value can be calculated by the software. This value is checked when starting the analysis procedure. If the flow rate is reported too low - the error message is displayed.



Pump/Valve

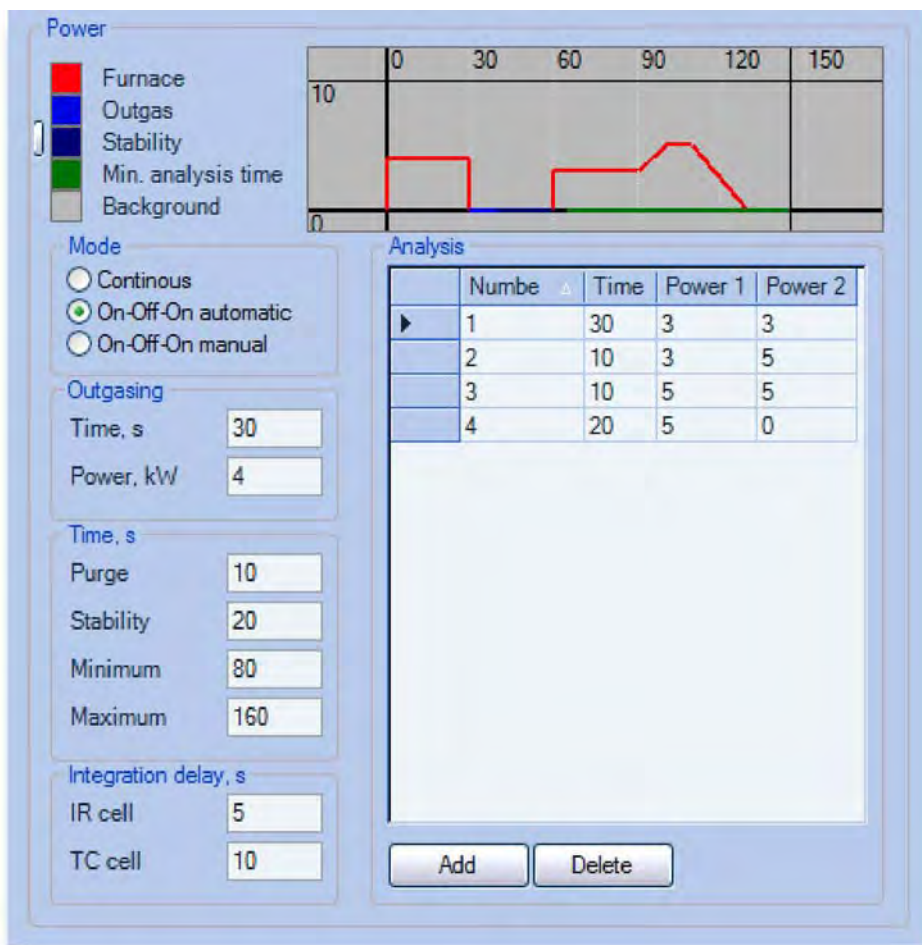
Displays pump voltage (CS-500, CS-2000 (resistance furnace operation), ON/OH/ONH, SC-500, CHS-500, H-500, CW-800) or flow regulating valve voltage (CS-800, CS-2000 (induction furnace operation)).

Temperature

The displayed value (Volts) represents the temperature stabilisation process of the IR-rack and TC-cell.

Refer to the service manual of the corresponding analyser for detailed information.

Window: Furnace power



This window is used to adjust the electrode impulse furnace parameters for ON/OH/ONH analysers.

Graph

The graphical representation of the analysis procedure with the selected power mode and settings is shown on this area.

Colours

The colours for phases of analysis procedure and the colour for the background can be specified here.

Graph

The phases of analysis are shown graphically on this area. The zoom can be changed. See the [Window: Graph](#) for more information on zoom.

Mode

The power mode in combination with sample drop mode can be selected here. See the operation manual of the corresponding analyser for more information about furnace power for specific sample material.

Continuous, automatic

The furnace power is set to the "*Analysis furnace power*" after outgasing phase and remains at this level until the "*Analysis*" phase begins. Only automatic sample drop mode is available in this furnace power mode.

On-Off-On, automatic

Furnace is powered during "*Outgasing*" and "*Analysis*" phases. During "*Purging*", "*Stabilising*" and "*Sample drop*" phases the furnace is unpowered. The sample drop is carried out automatically.

On-Off-On, manual

Furnace is powered during "*Outgasing*" and "*Analysis*" phases. During "*Cooling*", "*Sample loading*" and "*Stabilising*" phases the furnace is unpowered. The user is prompted to load the sample manually, afterward the analysis is continued. To open and close the furnace use the "F2-Furnace" button in "Analysis control" window (see [Window: Analysis control](#)).

Outgasing

The setting for the "*Outgasing*" phase.

Time

Set the time for "*Outgasing*" phase in seconds.

Power

Set the furnace power for "*Outgasing*" phase in kW.

Time

Different time settings.

Purging

Set the time for "*Purging*" (automatic sample drop) or "*Cooling*" (manual sample drop) phases in seconds.

Stabilisation

Set the time for "*Stabilising*" phase in seconds.

Minimum

Set the minimum analysis time. The minimum analysis time must be set so, that the peaks from all measuring ranges start to rise until it is expired. If the peaks do not rise over the comparator level until minimum analysis time is expired, the analysis is stopped.

Maximum

Set the maximum analysis time. The maximum analysis time must be set so, that the peaks from all detectors are descended below the comparator level, until it is expired and analysis will be stopped automatically. If the analysis is stopped at maximum analysis time and the peaks of the detectors are still at considerably high level (more then 2-3% from the peak maximum), such analysis should be considered as wrong.

Integration delay

The integration delay time for IR-cell (O) and TC-cell (N/H) can be set here. The combustion gases from the furnace reach the detectors after some time from begin of fusion of the sample in the furnace. In order to avoid the influence of the base line drift or the noise of the signals from the detectors on the results, the integration delay time is set. Thus the integration (calculating of the result) begins not at the same moment, when fusion of the sample in the furnace begins, but only after integration delay time is expired. In order to determine the integration delay time it should be set to 0 first and analysis should be carried out. Then determine the time when the peak starts to rise. Set the integration delay 5 seconds less then this time. The integration delay time for IR-cell and TC-cell are different, as well as for different sample materials.

IR-cell

Set the integration delay for the IR-cell in seconds.

TC-cell

Set the integration delay for the TC-cell in seconds.

Analysis

The settings for "Analysis" phase.

The list of power levels

The list of the power levels of the furnace is displayed here. By specifying several levels the temperature profile for the fractional analysis can be created. The ramping is also possible for every analysis level by setting different power settings for start and end of the level. *Existing power level can not be edited! To change the settings for a level, create new level with desired settings and delete the unnecessary one.*

| Add |

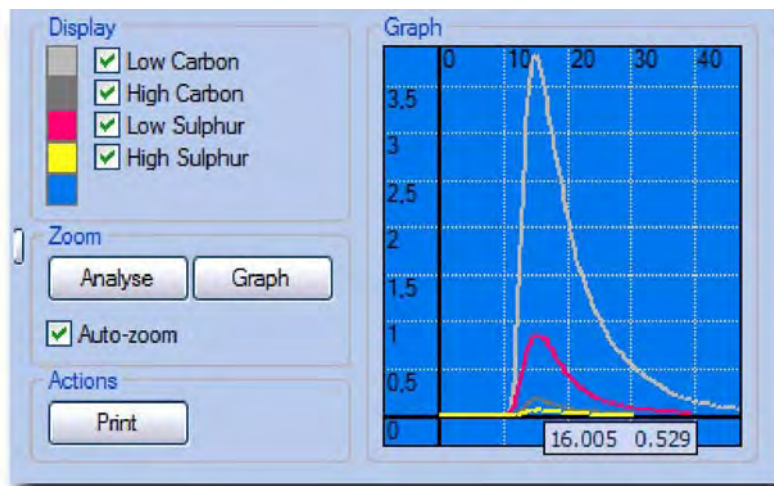
Use this button to display the "Add level" window. (see [Form: Add level](#)).

Delete

Use this button to delete selected level(s).

The list of the levels can not be empty! If the last level is deleted - the new level with default setting will be created automatically.

Window: Graph



The graphs (detectors' output signals) for the current or selected analysis are displayed here.

Display

The appearance of the graph's elements can be specified here.

Colours

Click on the corresponding colour box to choose the colour for the lines and the background.

Channels

Use the corresponding check-box to enable/disable display of the signal for the certain channel.

NOTE: Disabling the display does not switch off (deactivates) the signal processing of the corresponding measuring channel!

Zoom

Zoom controls

Analysis

Use this button to set the scale to 10 Volts and maximum analysis time.

Graph

Use this button to set the scale to the maximum possible zoom for the content of the graphics area.

Auto-zoom

Use this checkbox to enable/disable the automatic setting of the maximum possible zoom for the content of the graphics area.

This option is equivalent to the click on the button "Graph" after every change of the graphics area content.

Actions

Different operations with graphics. **Print I**

Use this button to display the print preview window for further printing. (see [Form: Print preview](#)).

Current view of the graphic area will be printed. Use the zoom controls to get desired view for printing.

Graph

The graphics area of the window. To change the zoom arbitrarily, use the mouse' scroll wheel (rotate the scroll wheel to change the scale of the vertical axis, hold SHIFT and rotate the scroll wheel to change the scale of the horizontal axis). The content of the graphic area can be moved by dragging (move the mouse while keeping the left button pressed) it with the mouse.

Graph

Graphs are shown in this area.

Window: Linearity

The screenshot shows the 'Linearity' window with the following data:

Channel	Now	New	Deviation %
<input checked="" type="checkbox"/> Low Carbon	5.51	5.1	0.905514
<input type="checkbox"/> High Carbon	4.98	1	10.298899
<input type="checkbox"/> Low Sulphur	21.017	100	56.22379
<input type="checkbox"/> High Sulphur	18.447	100	13.117779

Calculation parameters:

From: 1
To: 100
Step: 0.1
Now: 100.0999999

Buttons: Calculate, Break, Apply, Edit

Date / time	Sample	Factor
18.09.2004 11:08:30	0.048%C 14 (0.0948 %) (0.0157 %)	48
18.09.2004 11:10:18	0.048%C 15 (0.0912 %) (0.0161 %)	48
18.09.2004 11:15:36	0.016%C 19 (0.0360 %) (19.1 ppm)	16
18.09.2004 11:16:49	0.016%C 20 (0.0368 %) (17.0 ppm)	16

The linearity factors can be calculated or entered manually in this window (see [Theory: Linearisation](#)). This window is available for the power user only.

Factors

The linearity factors for all channels are displayed here.

Channel

All available channels are displayed in this area.

Now

The currently valid linearity factors for all channels are displayed in this column.

New

The new linearity factors can be entered manually in these input fields. If the linearity calculation procedure was used to find the linearity factors, the results of the calculation will be written in these fields.

Deviation

The deviation of the results from their standard values is displayed in these columns.

Calculation

The parameters for automatic linearity factor calculation are displayed here.

From, To, Step, Now

The linearity factor range (the range where the procedure will look for the best linearity factor) and the step to advance in this range, as well as current value of the linearity factor are displayed here. Automatic linearity calculation is carried out by recalculating the analyses results for every linearity factor in the specified range with the specified step. The linearity factor at which the deviation is minimal is displayed and the calculation is stopped at this point.

! Edit !

Use this button to display the "Linearity limits" window, where the range and the step can be specified.

Linearity

Controls for the linearity calculation procedure.

Calculate

Use this button to start the calculation of the linearity factors.

Break!

Use this button to break the calculation cycle.

This can be useful if the desired linearity factor is found, but the calculation is still running for other channels.

Apply

The click on this button will cause the following:

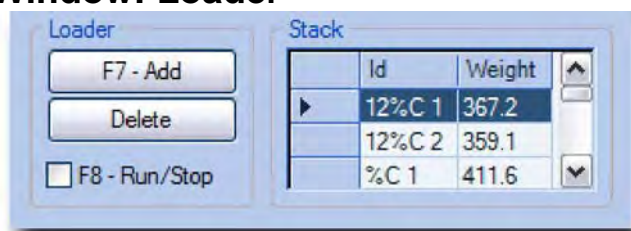
- for the channels with the marked checkbox the linearity constant value will be changed;
- the linearity window will be reset to the initial state;

Results

The analyses results, taken for the linearity factor calculation are displayed here. The "factor" must be entered for every analysis. The "factor" is the standard value of the sample, i. e. the concentration of the measured element in the sample.

To delete the results lines from the list, mark the desired line(s) and press DELETE key. Ctrl + A will mark the complete list.

Window: Loader



The samples queue for the autoloader is saved and displayed in this window. (see [Theory: Loader](#)). The analyses sequence can be initiated or stopped here.

If the profile was created without autoloader, this window can be used as sample stack for further manual analyses.

Loader

Controls for the operation of the loader or manual operation with the sample stack.

F7 - Add

Use this button to add a sample into the queue. The sample weight and the sample ID have to be already entered in "Analysis control" window.

If the "auto-increment sample number" is activated, the sample number will be increased after every click on the F7 button.

Delete

Use this button to delete selected samples from the queue.

F8 - Run/Stop

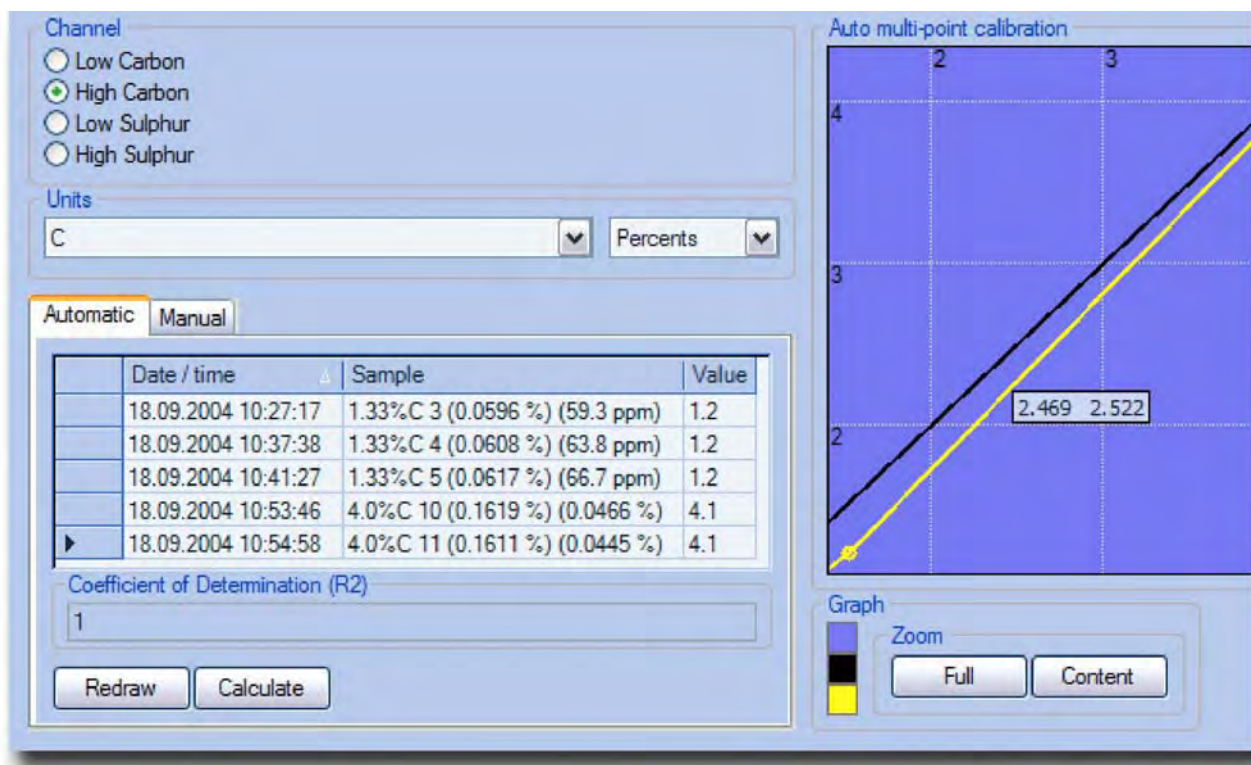
Mark the check-box to run the analyses sequence. The next analysis (if available) will be started as soon as the previous is finished. The sample ID and the sample weight will be taken from the first item in the list (queue) and will disappear from the list. The "Run/Stop" check-box will be unchecked automatically, if the queue is empty. The sample can be added to the queue or deleted from the queue even if analyses sequence is running. *To stop the analyses sequence - unmark the "Run/Stop" check-box - the sequence will be stopped as soon as the current analysis is finished. If the current analysis must be interrupted (by pressing the "Stop" or "Abort" button in "Analysis control" window), take care to unmark the "Run/Stop" check-box, otherwise the sequence will be continued and the next sample will be taken for analysis as soon as the current analysis is stopped. If this window is used as a weight stack (without autoloader) the "Run/Stop" check-box is unmarked automatically after each analysis in the queue..*

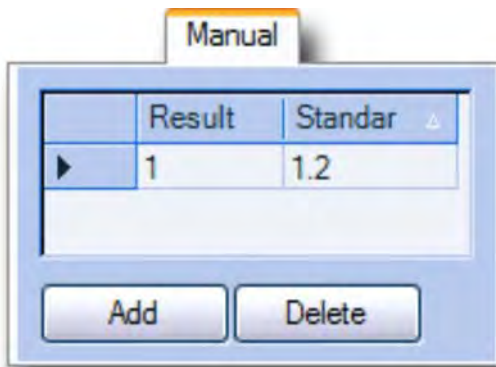
Queue

The list of the samples (sample ID and sample weight) for consequential analyses.

It is not possible to change the order of samples in the queue, but the sample can be added and deleted at any time.

Window: Multipoint calibration





This window provides a possibility to calculate and review multipoint calibration. (see [Theory: Multipoint calibration](#)). This window is available for power user only.

There are two tabs in this window: Automatic and Manual. The multipoint calibration is the calculation of the points to build the broken line for the results correction. The points can be calculated from the results of analyses carried out before (Automatic) or entered manually as Result/Standard value. The valid points, which are taken for the correction are shown in Manual tab, whereas Automatic tab is necessary to enter the "value" (standard value of the sample).

Channel

Channel where the multipoint calibration will be calculated has to be

Channel

The measuring selected here.

ATTENTION: Please, take care to select the correct channel! It is recommended to select the desired channel first and then carry out further operations in order to avoid possible confusions.

Units

Select the desired measurement units here for selected channel.

Automatic

This tab is used to prepare the data and perform the multipoint calibration.

Results list

The results lines, dragged from the "Results" window to calculate the multipoint calibration are displayed here. The correct (standard) value must be entered into the "Value" field for every result line. *To delete falsely selected results use the DELETE key. To mark all results - use Ctrl + A key combination.*

Redraw

Use this button to redraw the graphics area.

This can be necessary after entering correct values, deleting or adding new points.

Calculate

Use this button to calculate the multipoint calibration for the selected channel.

For the results with the same standard value, the average will be taken for calculation. Existing points will be overwritten, new points will be added.

Manual

This tab displays the points, calculated in "Automatic" mode and provides a possibility to enter points manually.

List of the points

The valid points of the multipoint calibration are displayed here. The result of analysis is displayed in the field "Result" and the desired result (with the multipoint calibration correction) is displayed in the "Standard" field.

It is recommended to check the points after making changes in multipoint calibration. If the deviation of the desired result and obtained result is very big, this point should be considered as wrong! Otherwise the points with the very big deviation can essentially worsen the precision of the measurements of others samples.

| Add |

Click on this button will display the "Add point" window for manual specification of the point. (see [Form: Add point](#)).

Delete

Use this button to delete selected points in the multipoint calibration.

Graph

The broken line representing the multipoint calibration is displayed here. The line differs depending on the selected tab (*Automatic or Manual*).

Colours

The colour for the lines and background can be specified here.

Automatic multipoint calibration

The graph shows the points for the selected results in this mode.

Manual multipoint calibration

The graph shows the correction which is done by multipoint calibration in this mode.

Zoom

Zoom controls are available here.

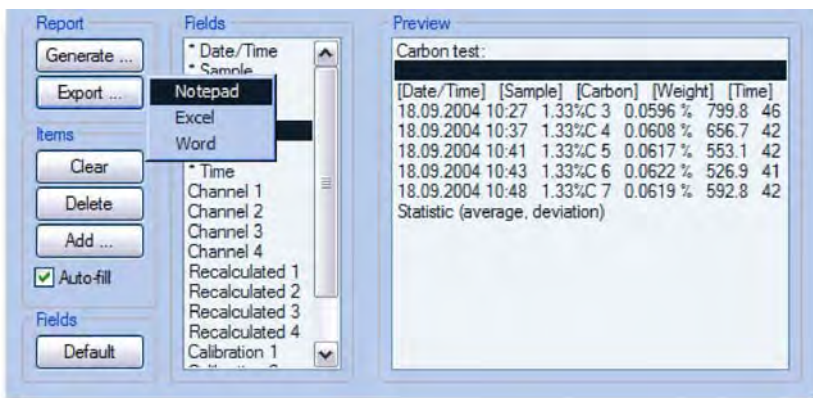
| Full |

Use this button to display the whole available area (from 0% to 100%).

Content

Use this button to set the maximum possible zoom for the content of the graphics area. Arbitrary zoom is also possible. See [Window: Graph](#) for more information on zooming the graphics area.

Window: Report



This window provides a possibility to create reports for printout or export (see [Theory: Report](#)). In fact it is a template for further forming of the printout or export file.

Report

! Generate...

Use this button to display the pop-up menu of the available report templates. After generation a print preview window will be displayed (see [Form: Print preview](#)).

Standard report

Generates *standard report*.

ATTENTION: The default printer must be installed in the operating system, otherwise error message appears!

Export...

Use this button to display the pop-up menu with the available export type. *The report can be saved in the application, where it was exported to.*

Notepad

Export to *Microsoft® Notepad*. The result of the export is a text-file in Unicode format.

Excel

Export to *Microsoft® Excel*.

If this application is not installed, the error message will be displayed.

Word

Export to *Microsoft® Word*.

If this application is not installed, the error message will be displayed.

Items

The report controls are displayed here.

Clear

Use this button to clear the *Elements* list.

Delete

Use this button to delete the selected item from the *Elements* list.

Auto-fill

If marked, the fields captions and statistic will be appended automatically to the inserted to report group of results.

Add ...I

Use this button to display pop-up menu, where add-on items to the *Elements* list can be selected.

Field captions

Adds the field captions to the current position of *Elements* list.

Statistic (average, deviation)

Adds the statistical calculations for **all** fields, which can be used for calculation of average and deviation.

Statistic is calculated for the lines from the beginning of the list or from previous Statistic occurrence in the list.

Text

Displays "Add text" window (see [Form: Add text](#)) to insert the text to the *Elements* list.

Fields

Controls for displaying/hiding the fields for *Elements* list.

Default]

Use this button to display default fields.

Fields

Double-click on the desired field (or select the field and press *Space* key) to display/hide the field from *Elements* list. To change the order of the fields drag the desired field name with the left mouse button in the list.

Elements

Elements list

Preview

This list is a template for further report or export-file. The results of analyses from *Results* window are dragged into this area (see [Window: Results](#)). To change the position of the elements in the list - drag them to the desired place with the left mouse button.

Window: Results

Date /time	Sample ID	Carbon	Sulphur
18.09.2004 11:43	0.230%S 32	3.1413 %	0.0161 %
18.09.2004 11:44	0.230%S 33	3.1548 %	0.2297 %
18.09.2004 11:46	0.336%S 34	0.0661 %	0.0246 %
18.09.2004 11:47	0.336%S 35	0.0669 %	0.3494 %
18.09.2004 11:48	0.336%S 36	0.0670 %	0.0241 %
18.09.2004 12:10	13.7%S 37	0.1177 %	***
18.09.2004 12:54	13.7%S 38	0.2835 %	0.9767 %
18.09.2004 12:55	13.7%S 39	0.1074 %	0.9625 %
18.09.2004 12:56	0.336%S 40	0.0641 %	0.0253 %
18.09.2004 12:57	0.336%S 41	0.0663 %	0.0251 %
18.09.2004 12:59	1.0%S 42	4.1740 %	0.0703 %
18.09.2004 13:00	100%S 43	0.4456 %	7.0093 %

This window displays the analyses results and contains controls for analysis data handling (see [Theory: Results](#)).

Filter

Use this button to define a filter to display the subset of the results from the data base for further operations.

ATTENTION: Do not change the filter during carrying out linearisation and multipoint calibration!

Today

Use this button to set the default filter *Today*, to display all the analyses results of the current date.

[Custom

Use this button to display the filter definition window (see [Form: Filter](#)).

Actions

Different operations with the results selected in the window.

Calibration

Use this button to display the calibration window (see [Form:Calibration](#)).

First select the results of analyses of the standard sample used for calibration! If there is no result selected, click on this button is ignored.

Blank value]

Use this button to display the blank value determination window (see [Form: Blank value](#)).

First select the results of analyses for the blank values determination! If there is no result selected, click on this button is ignored.

Columns ...

Use this button to open the pop-up menu where the columns of the *Results* window can be shown/hidden.

LIMS

Use this button to perform the LIMS data export (see [Theory: LIMS](#)).

For each selected result the .xml-file will be created and the LIMS-converter will be executed.

Drift

Use this button to display the window for drift visualisation (see [Form: Drift](#)).

First select the results for the drift visualisation. If there is no result selected, click on this button is ignored.

Fraction

Use this button to show the fractions calculation window (see [Form. Fractions](#)). *First select an analysis result. If there is no result selected, click on this button is ignored.*

Base factor

Use this button to display the window for base calibration calculation (see [Form: Base calibration](#)).

First select the analysis results of the standard sample used for base calibration calculation! If there is no result selected, click on this button is ignored. Available for service personnel only!

Results

The list of the analyses results.

Filter

The current filter displayed here.

Results list

The list of results, taking into account filter, is displayed here.

*The width of the columns can be adjusted, by changing the width of the columns' heading. The result currently selected is marked with the black triangle in the selection column (most left column). The selection of the several results lines succeeds only using the selection column! Use **Ctrl I** and **Shift** button in combination with mouse to mark the results selectively or to mark a group of results. **CTRL + A** selects all results.*

Information

The additional information on the selected results is displayed in this part of the window.

Administrator information

The detailed information for the selected analysis result is displayed here. The number is displayed for each channel (0, 1, 2, 3). If the channel was deactivated or overloaded the asterisk is displayed next to channel number (*). The number of points used to plot the graph (detectors' output signals) is displayed in square brackets (2 points per second). Next two lines are results of analysis, taking into account the measurement unit selected: first line - the analysis result, calculated with the settings valid on the moment of analysis (saved in the data base), second line - the analysis result, calculated with the actual settings (recalculated). For each result the unrounded value is displayed in brackets.

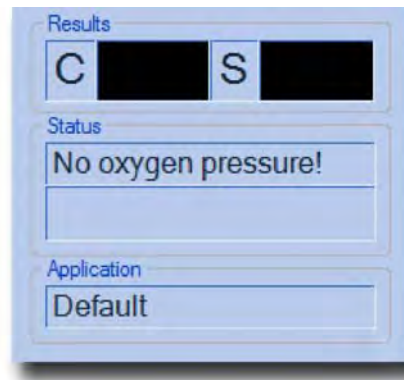
Available for power user only!

Statistics

The simple average and standard deviation are displayed for selected results. The relative standard deviation (RSD) is displayed in brackets.

In order to get the statistics calculation displayed select at least 2 results lines.

Window: Status



This window displays the analyses results, information on current phase of analysis procedure, error messages, current analysis information (sample weight, sample ID etc.) and current application name.

Results

Results of last analysis in selected measurement units for every element are displayed here.

Results

The results of analysis will be displayed here after analysis finishes. *If the measurement channel is deactivated or saturated the "****" will be displayed.*

Status

Status

The current phase of analysis or error message is displayed here.

Information

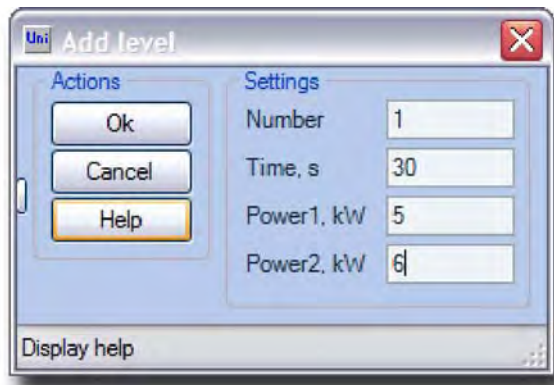
Sample weight, sample ID, etc. are displayed here.

Application

Application

The selected application name is displayed here.

Form: Add level



This window appears after clicking "Add" button in "Power" window (ON/OH/ONH analysers) (see [Window: Furnace power](#)).

Actions

Ok

Use this button to check the entered values, add a level and close the window.

Cancel

Use this button to close the window without adding a level.

Help

Use this button to display the help.

Settings

The settings for the new furnace power level.

Number

The number of the level in the list of power levels.

The numbers less than 1 or greater than the maximum available are not allowed!

Time

Enter the duration (in seconds) of the level in this input field.

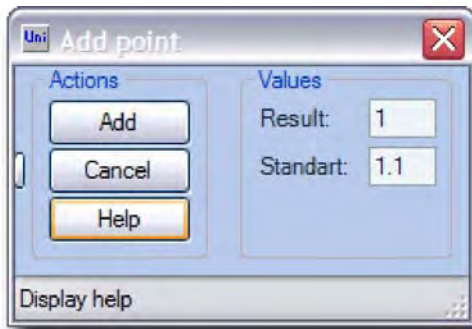
Power1

Enter the initial power for the level in kW.

Power2

Enter the finite power for the level in kW.

From: Add point



The new point for multipoint calibration for selected measuring channel can be entered in this window (see [Window: Multipoint calibration](#)).

Actions

| Add |

Use this button to check the entered values, save the point and close window.

Cancel

Use this button without applying any changes (point will not be calculated).

Help

Use this button to display the help.

Values

These values are coordinates of new point.

Result

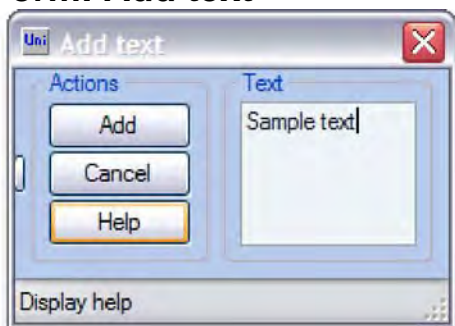
The analysis result.

Standard

Standard (expected) value.

The values equal to existing points are not allowed.

Form: Add text



This window is displayed after selecting "Add... Text" command in the "Report" window. It provides a possibility to add the text into report template (see [Window: Report](#)).

Actions

I Add I

Use this button to add the text into report and close the window.

Cancel

Use this button to close the window without applying any changes.

Help

Use this button to display the help.

Text

Text

Enter the text which will be inserted into the report in this input field. *This field can be left blank intentionally to insert an empty separator line into the report.*

Form: Base calibration

Channel	Now	Value	Units
<input checked="" type="checkbox"/> Low Carbon	418470129031439	1.33	C
<input checked="" type="checkbox"/> High Carbon	17.4545667203352	1.33	C
<input type="checkbox"/> Low Sulphur	1.07039668399441		S
<input type="checkbox"/> High Sulphur	13.0672926600986		S

Percents

The base calibration can be calculated in this window (see [Theory: Base calibration](#)). *This window is available for power user only!*

Actions

Apply

Use this button to calculate and save the calculated base calibration factors for selected channels.

After carrying out the base calibration, the user calibration factors will be set to 1.

Close

Use this button to close the window.

Reset,

Sets the calibration factor for selected channels to 1.

Help

Use this button to display the help.

Factors

Channel

All measuring ranges (channels) available in the analyser are displayed here and can be selected for the base calibration factor calculation or for resetting the factor.

Now

Current base calibration factors for all measuring ranges are displayed in this column.

Result

The standard value of the sample, taken for calibration must be entered in the corresponding field for the desired channel.

Units

Choose the desired measurement units for every channel here.

Form: Blank value

Channel	Now (%)	Value	Units
<input checked="" type="checkbox"/> Low Carbon	0.0007	0	CO2
<input type="checkbox"/> High Carbon	0.0000		CO2
<input checked="" type="checkbox"/> Low Sulphur	0.0046	0	S
<input type="checkbox"/> High Sulphur	0.0000		S

Percents

The blank value can be calculated in this window (see [Theory: blank value](#)).

Actions

Apply

Use this button to calculate and save the calculated blank value for selected channels.

Close

Use this button to close the window.

Help

Use this button to display the help.

Clear

Use this button to clear the blank value for selected channels. *This window is available for power user only!*

Factors

Channel

All measuring ranges (channels) available in the analyser are displayed here and can be selected for the blank value calculation or for to clear the blank value.

Now

Current blank values for all measuring ranges are displayed in this column. The value is calculated for the *Blank weight* specified in the Configuration window (see [Window: Configuration](#)).

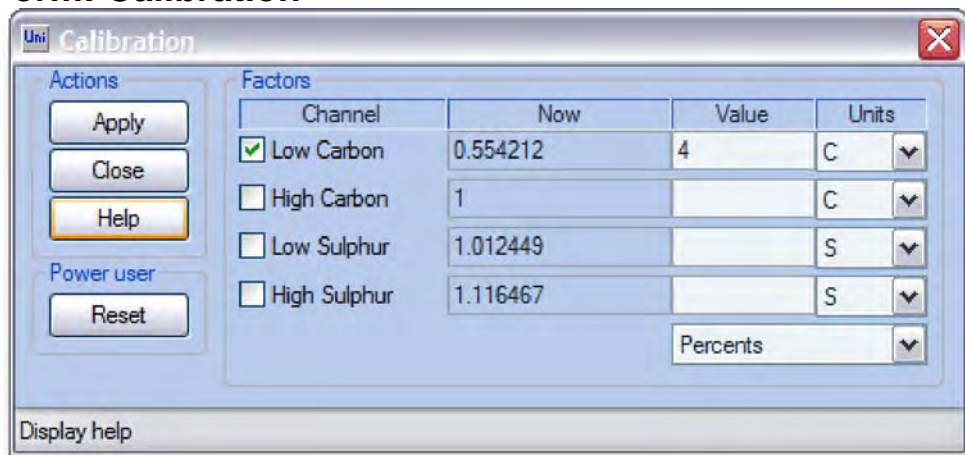
Value

0 (zero) (if the blank value is determined without the sample) or the standard value of the sample, taken for the blank value determination must be entered into this field.

Units

Choose the desired measurement units for every channel here.

Form: Calibration



The screenshot shows the 'Uni Calibration' window. On the left, there are buttons for 'Apply', 'Close', 'Help', and 'Reset'. Below these is a 'Power user' section with a 'Reset' button. The main area is a table with columns: Channel, Now, Value, and Units. The 'Low Carbon' channel is selected with a checkmark. Below the table is a 'Percents' dropdown menu. At the bottom left, there is a 'Display help' button.

Channel	Now	Value	Units
<input checked="" type="checkbox"/> Low Carbon	0.554212	4	C
<input type="checkbox"/> High Carbon	1		C
<input type="checkbox"/> Low Sulphur	1.012449		S
<input type="checkbox"/> High Sulphur	1.116467		S

Percents

The user calibration can be calculated in this window (see [Theory: Calibration](#)).

ATTENTION: The calibration factors range is 0.5 to 2!

Actions

Apply

Use this button to calculate and save the calculated user calibration factors for selected channels.

Close

Use this button to close the window.

If the calculated user calibration factors are out of range the error message will be displayed and factors will not be changed. Please, assure, that the correct channel is selected for the calibration or the standard value is entered correctly!

Help

Use this button to display the help.

Reset

Sets the calibration factor for selected channels to 1. *Available for the power user only!*

Factor

Channel

All measuring ranges (channels) available in the analyser are displayed here and can be selected for the user calibration factor calculation or for resetting the factor.

Now

Current user calibration factors for all measuring ranges are displayed in this column.

The factors, which are out of range, will be highlighted and the column caption (Now) will change it's colour to red.

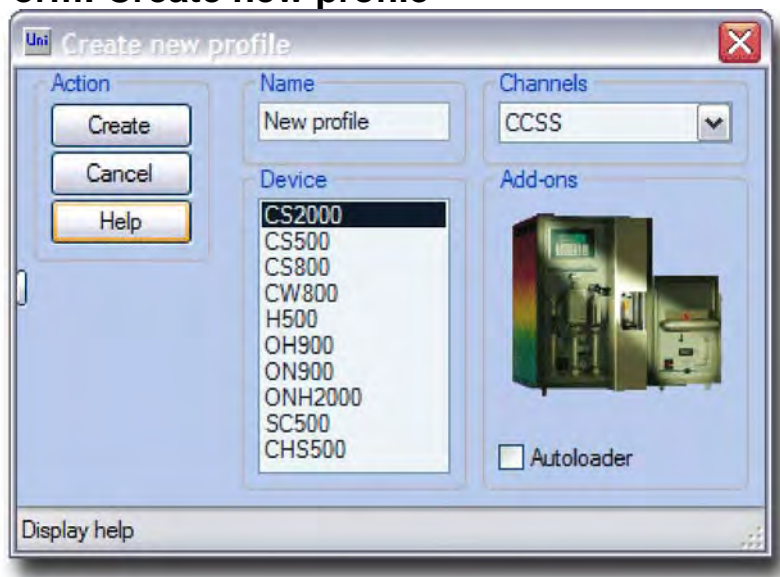
Result

The standard value of the sample, taken for calibration must be entered in the corresponding field for the desired channel.

Units

Choose the desired measurement units for every channel here.

Form: Create new profile



This window provide a possibility to create a profile for the software (see [Theory: Profile](#)). This window is available for administrator only!

Actions

Create

Use this button to confirm the selected parameters. After click on this button the profile will be created and window will be closed.

Cancel

Use this button to close the window without creating profile.

Help

Use this button to display the help.

Name

Name

The name for the profile to be created must be entered here. *The name must be unique in the list.*

Device

Type of the analyser.

Device's list

The list of available devices. Choose the desired analyser model.

Channel

Configuration of the measuring ranges for the selected type of the analyser.

Channel

Choose the configuration of the measuring ranges to correspond exactly to the analyser which will be operated.

Add-ons

Additional information and settings

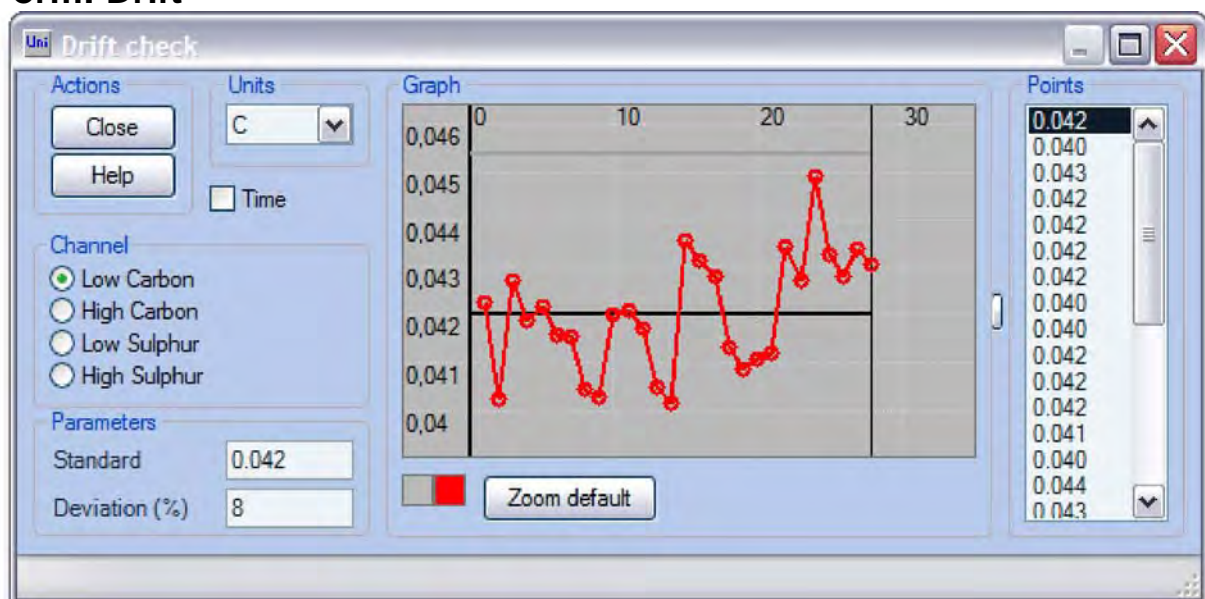
Picture

The picture of the selected analyser model.

Autoloader

Mark the check-box, if the instrument is equipped with autoloader (CS-800 and CS-2000 only).

Form: Drift



This window provides a possibility to represent graphically and check the drift of analyses of the certain sample during some period of time (see [Theory: Drift](#)).

Actions

Close

Use this button to close the window.

Help

Use this button to display the help.

Units

Changes the measurement units for selected channel.

Time

Select the display of the points on graph on time scale. If unchecked, all points are displayed with equal interval between them.

Channel

Choose the desired channel for drift control.

Parameters

Standard

Enter the standard or expected value of the sample which results drift is being checked. This value is displayed as a black line parallel to X-line.

The green colour of the numbers in the input box signalises that the validation is on. If there is no activity for 1 second, changed field is validated and the results are applied for graphics area.

Deviation

Admissible relative standard deviation (RSD) for the sample which drift is being checked can be specified in this field. It is displayed on the graph as two equidistance lines from the Standard line and parallel to it.

The green colour of the numbers in the input box signalises that the validation is on. If there is no activity for 1 second, changed field is validated and the results are applied for graphics area.

Graph

Graph

The interconnected points are displayed here. Every point represents an analysis result.

Colours

The colours of the lines and background.

Zoom default

Use this button to set optimal zoom for the content of the graphic area to see all available points.

Form: Filter

This window provides a possibility to filter the database records, in order to display only the results, matching to the specified filter (see [Window:Results](#)). After applying the new filter the entire database will be filtered.

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Actions

Ok

Converts the *Elements* list to correct sql-query, applies the filter and closes the window. The error message will be displayed if there are logical mistakes in the filter query.

Cancel

Closes the window without applying any changes to the filter.

Help

Use this button to display the help.

Edit

Editing of the list.

Clear

Use this button to clear the *Elements* list.

Delete

Use this button to delete the selected item from the *Elements* list.

Add

Insertion of new elements.

(
Inserts the symbol *Group begin* to *Elements list*.

)
Inserts the symbol *Group end* to *Elements list*.

AND

Inserts the symbol *Logical AND* to *Elements list*.

| OR |

Inserts the symbol *Logical OR* to *Elements list*.

Elements

Elements list

The filter is created here. The elements can be added to the list or the list can be left empty. These elements form the logical condition to check for all database records. Only the records (analysis results) will be displayed, which meet this condition.

The position of the elements in the list can be changed by dragging them to the desired place with the left mouse button.

Fields

Conditions on the content of fields in the database.

Fields

The field to create the condition for it's content is displayed here. The type of condition depends on the type of the field: *Date, String, Number*.

| Add |

Adds the element to *Elements list*. This element is formed from the field name, comparison operation and the value for comparison.

Number

Numeric field

=

The field content is *equal* to entered value.

< >

The field content is *not equal* to entered value.

>

The field content is *greater* then entered value.

> =

The field content is *greater or equal* to entered value.

<

The field content is *less* than entered value.

< =

The field content is *less or equal* to entered value.

String

String field.

Contains

The field *contains* entered value.

Not contains

The field does *not contains* entered value.

Equal

The field is *equal* to entered value.

Not equal

The field is *not equal* to entered value.

Date

The field of date/time type.

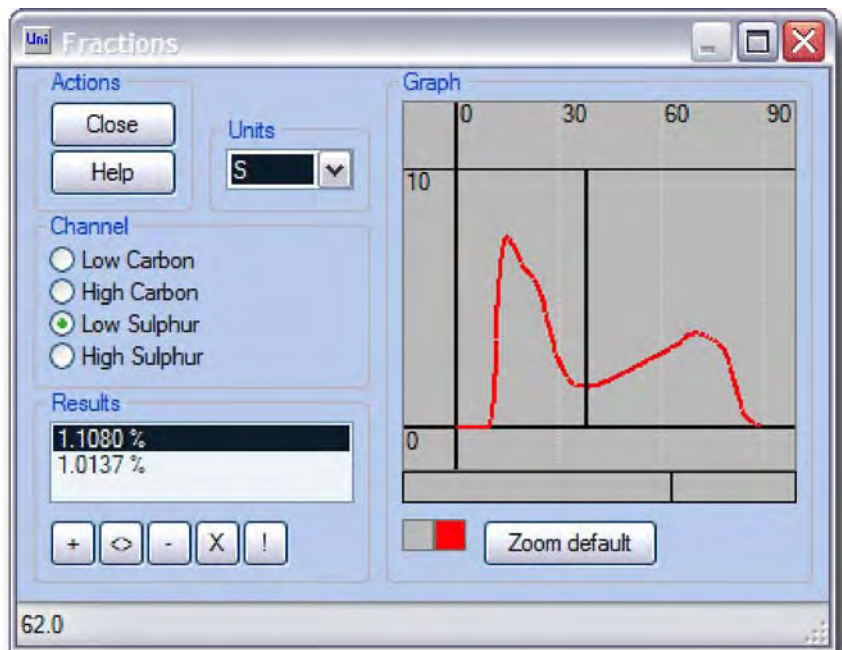
From

The field is *equal or later* than entered date/time value.

To

The field is *earlier* than the entered date/time value.

From: Fractions



The fractional analysis calculations can be carried out here (see [Theory: Fractional analysis](#)).

Actions

Close

Use this button to close the window.

Help

Use this button to display the help.

Units

Choose desired measurement units for the selected channel.

Channel

Choose the channel for fractions calculations.

Results

The list of results

This area contains results, calculated for specified fractions. The order of the results corresponds to the order of the fractions - consequently from the beginning to the end of analysis. If there are no fractions specified, the total result is displayed.

Use this button to turn on the "Add fractions" mode. Then left-click on the "Edit - stripe" (the stripe below the graphic area) to add the separator between the fractions. *This mode is turned on by default.*

<>

Use this button to turn on the "Edit fractions" mode. Then click on the "Edit - stripe" and the closest fractions separator will be moved to this position.

-

Use this button to delete the selected fraction result from the list. The fractions separator on the graph will be deleted as well.

The total result will be displayed if no fractions are specified or all fractions were deleted.

X

Use this button to delete all fractions from the list. *After deleting all fractions, the total result will be displayed.*

!

Use this button to find the fractions of the analysis automatically. If the fractions are already specified they will be overwritten after confirming the warning message. *Some of automatically found fractions may be wrong, they can be deleted manually.*

Graph

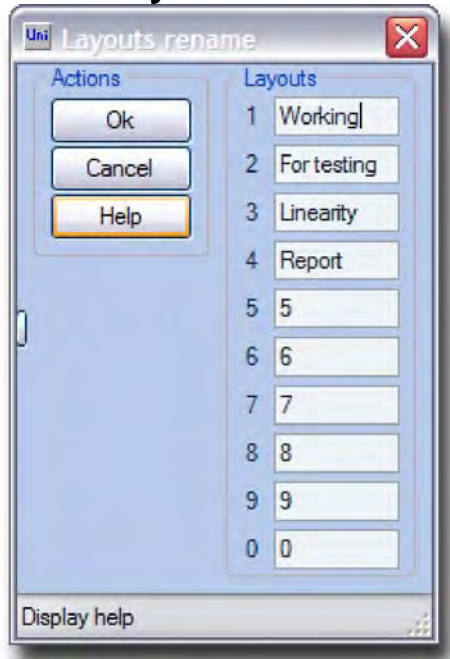
Graph

The detector's signal of the selected channel is displayed here.

Edit-stripe

This control is used for inserting new fractions separators and editing the existing ones. *If the "Edit" mode is selected, this stripe will be red-outlined.*

From: Layouts rename



The name for every layout can be specified or changed in this window (see [Theory: Layout](#)). Default layout name is its number.

Actions

Ok

Use this button to save entered layouts names and close the window.

Cancel

Use this button to close the window without applying any changes.

Help

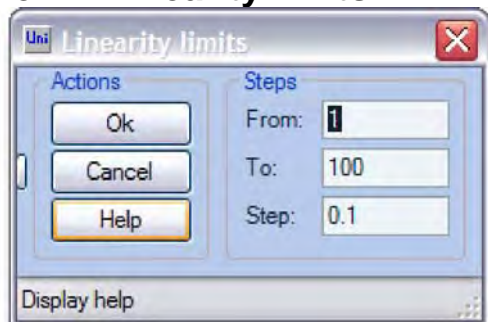
Use this button to display help.

Layouts

1, 2, 3 ...

The number and the name of the layout.

Form: Linearity limits



The linearity factor limits and step for automatic linearity calculation procedure can be specified here.

This window is available for power user only!

Actions

Ok

Use this button to check the entered values, apply them and close the window.

Cancel

Use this button to close the window without applying any changes.

Help

Use this button to display the help.

Steps

From

Initial factor value.

To

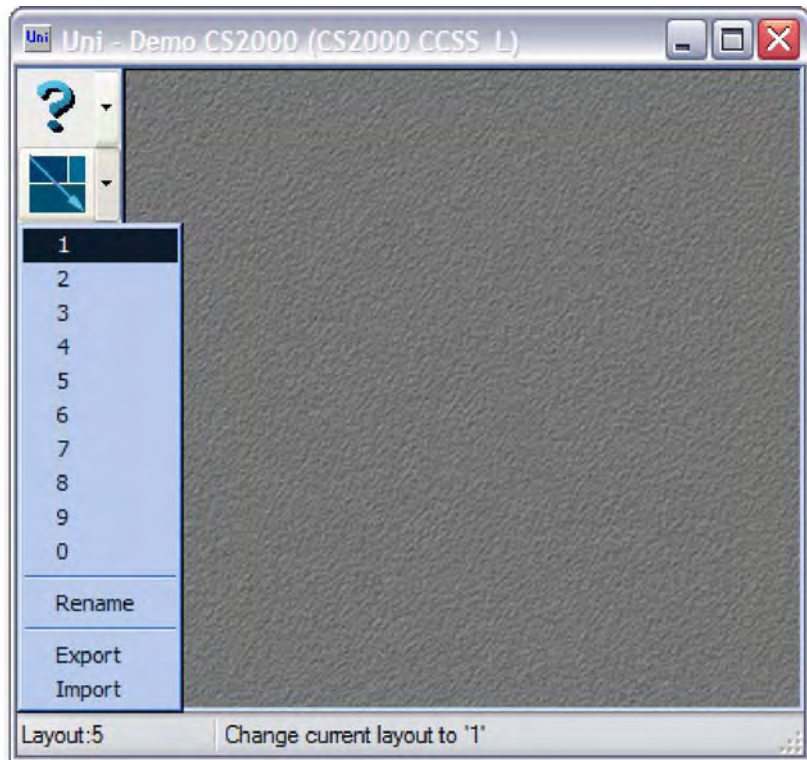
Finite factor value.

Step

Iteration value.

The step must be negative if the initial value is greater than finite value.

Form: Main window



This window is the main window of Uni software. It has two parts: *Toolbar* and *Workspace*.

Toolbar

The buttons to show/hide available windows and selecting different operations.

This is a combo-button (button and pop-up menu). Click on it will display help. The pop-up menu consists of:

Technical report

Generates technical report. The print preview window containing technical report will be displayed afterwards (see [From: Print preview](#)).

This is a combo-button (button and pop-up menu). Click it to enable/ disable window resizing and moving on Workspace area. The pop-up menu consists of:

1, 2, 3...

Selects corresponding layout.

Rename

Displays "Layout rename" window (see [From: Layouts](#)).

Export

Saves the configured layouts to file.

Import

Loads the layouts from the file.

After creating new profile it is advisable to load the layouts from the "Library" folder of the Uni software. Nevertheless the layouts can be created manually.



Workspace

The windows which form a layout will be displayed in this area.

The windows, available to all access levels:

| ^ * MI 0? JA FT)pn # ;?

The windows, available to administrator (power user):



The windows, available to technical/service personnel (power user): W0

Form: New password



The password for the current access level can be changed in this window (see [Theory: Access](#)).

If the password was lost or forgotten, print the "Technical report" and send it to ELTRA to recover the password.

Actions

OK

Use this button to save entered password and to close "New password" window.

Cancel

Use this button to close the window without saving any changes.

Password

Password

Desired password must be entered 2 times in this window. *The password can not be empty.*

Form: Password



The password to log in (for granting desired access level to the software) is entered in this window (see [Theory: Access](#)).

Actions

Ok

Use this button to confirm password entry and close the window.

Cancel

Use this button to close the window without applying any changes.

Help

Use this button to display the help.

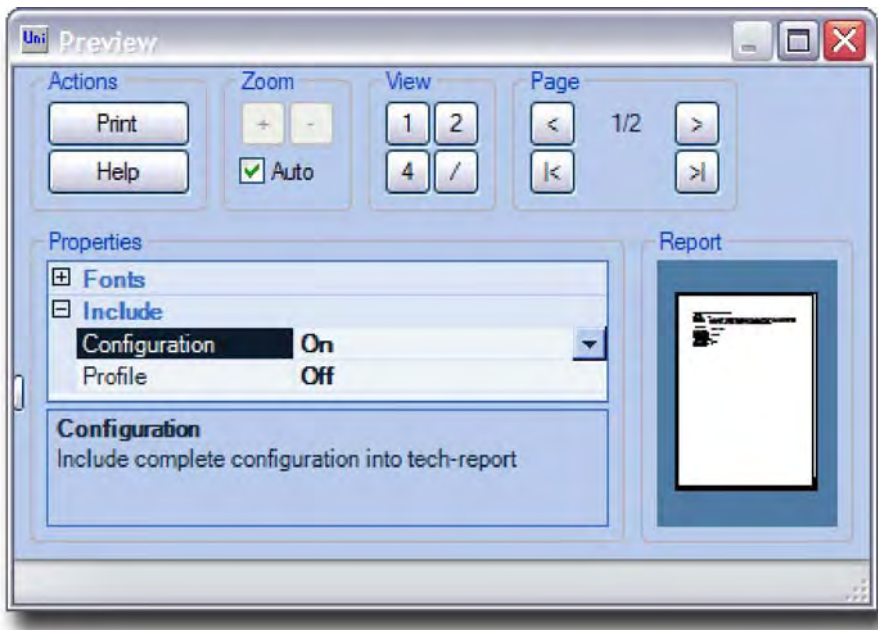
Password

Password

Enter the password into this field.

There are no "Invalid password" error message. If the false password is entered it will be ignored and the desired access level will not be granted. If the correct password was entered the "Password" button in "Profile manager" window disappears and "Power user" command group appears on its place.

From: Print preview



This window provides print preview for selected report type (see [Theory: Report](#)).

Actions

Print

Use this button to display the "Print" window of the operation system to select the printer, change the settings for selected printer and carry out the printout.

Help

Use this button to display the help.

Zoom

Zoom control for print preview. Zoom in.

-

Zoom out.

Auto

Mark this check-box to set the zoom for the whole page(s) to be visible in the print *Preview* area.

To change zoom manually, this check-box must be unmarked.

View

Controls for the preview mode.

Use this button to show 1 page on the *Preview* area.

2

Use this button to show 2 pages on the *Preview* area. Use this button to show 4 pages on the *Preview* area.

13

Use this button to switch the page orientation on the *Preview* area between *Portrait* and *Landscape*.

Pages

Controls for navigating between the pages of the report.

Use this button to navigate to the previous page.

!>!

Use this button to navigate to the next page.

Use this button to navigate to the first page.

ED

Use this button to navigate to the last page.

Properties

Report appearance settings.

Properties

Different settings for adjusting report appearance are available in this area. Available settings depend on the selected report type.

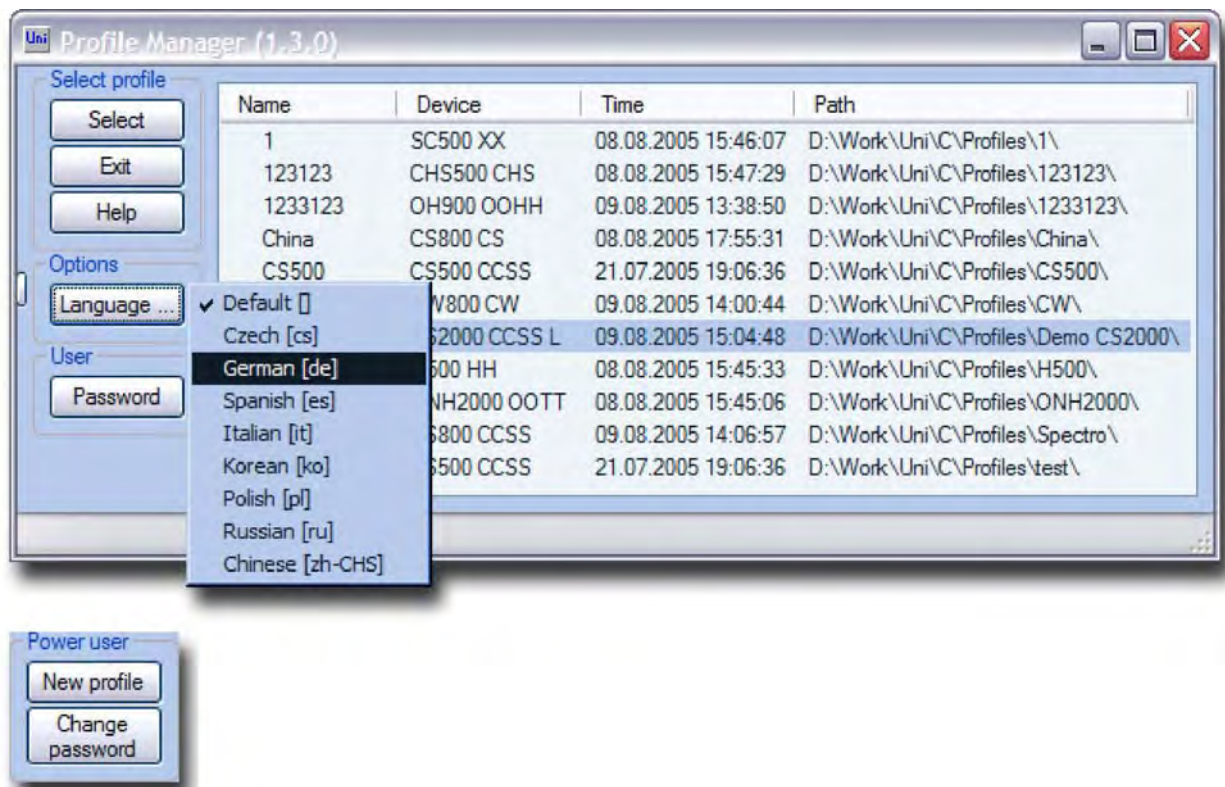
Report

Report preview area.

Report

The report is shown in this area as it will appear on the printout.

Form: Profile manager



This window appears at every start of Uni software. To continue operation of the software a *Profile* must be selected (see [Theory: Profile](#)).

Actions

Select

Continue operation of the software using selected profile.

The error message will be displayed if selected profile is already in use by another instance of the Uni software on this PC.

Exit

Use this button to exit the software.

Help

Use this button to display the help.

Settings

Configuration of the software (interface language and access level).

Language

Use this button to select the software interface and help language.

Password

Use this button to display the "Password" window (see [Form: Password](#)).

Administrator

Actions, available for power user only.

Profile

Use this button to display "Create new profile" (see [Form: Create new profile](#)). *Available for power user only!*

Change password

Use this button to display "Change password" window (see [Form: Change password](#)). *Available for power user only!*

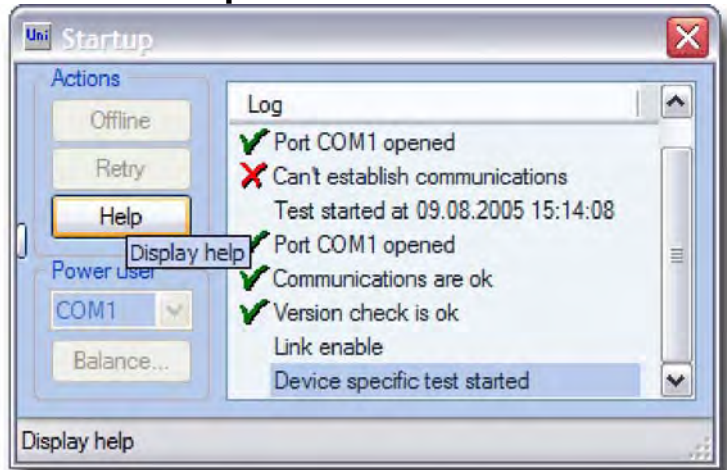
Profiles list

The list of available profiles.

Profiles

The list of available *Profiles* has following columns: *Name* - name of the profile (given by the user), *Device* - type of the analyser, *Time* - the time, when profile was last used, *Path* - the full path to the profile folder. *The last used profile is marked with a triangle in the selection column.*

Form: Start up



This window appears after selecting a profile in the "Profile manager" window (see [Form: Profile manager](#)) to display the start-up test and initialisation of the device. *The software will be exited, if this window is closed.*

Actions

Offline

Use this button to start the software in the *offline* mode (see [Theory: Offline](#)). The software is not connecting to the analyser in this mode, therefore all actions, requiring the connection to the analyser can not be carried out. However, all the other features are fully functional. For example, results of previous analyses are available, they can be reviewed, recalculated, added into the report, etc.

[Retry

Use this button to repeat the start-up test.

This option can be useful after changing the communication port or after switching the analyser on or checking the cable..

Help

Use this button to display the help.

Administrator

Communication interface

Choose the correct com-port for selected profile. *Available for power user only!*

Log

Start up test progress.

The list of log-messages

The list of log events and software actions during start-up test is displayed here.

Theory: Access

In order to avoid unauthorized access to the important functions of the software, which can influence the functionality of the analyser, there are different access levels to the software.

Procedure

- Start the Uni, by clicking the icon on a desktop, "Profile manager" window appears first (see [Form: Profile manager](#)).
- Click "Password" button and enter the password in the appeared window (see [Form: Password](#)).
- Press "Ok" button.
- If the password was entered correctly, the "Power user" command group appears instead of "Password" button.
- Repeat the password entry, if the password was entered incorrectly.

There are three access levels:

Operator. There is no password for this access level. Only basic functions are available.

Administrator. Following features appear, when logging in as administrator:

- COM-port selection for the analyser connection in the "Test" window (see [Form: Test](#));
- "Linearity" window (see [Theory: Linearity](#));
- "Multipoint calibration" window (see [Window: Multipoint calibration](#));
- base line regulation procedure (see [Theory: Base line](#));
- "Reset" button in the "Calibration" window (see [Form: Calibration](#)) and in the "Blank value" window (see [Form: Blank value](#));
- Additional information about selected result in the "Results" window (see [Window: Results](#));
- "Power user" group of settings in the "Configuration window" (see [Theory: Configuration](#)).

Service personnel. Following functions appear, when logging in as service personnel: "Communication test" window (see [Window: Communication test](#)); • "Base calibration" button (see [Theory: Calibration](#));

Note

All functions available for lower access level are available for higher access level.

Theory: Application

Description

Application is a saved configuration (see [Theory: Configuration](#)). In case, if the operator has to change frequently several settings for analysis to be carried out (for example, furnace power and time settings for different materials in ON/OH/ONH analysers), applications can be used. One can save several applications, and then merely switch over between them, while all the settings will be changed at one time, when changing an application. This will ease the operation of the analyser greatly and save the time.

NOTE! One should understand the way the saving/loading of applications functions. There is a concept of the current application:

- if the operator *saves/creates an application* with a certain name, the current configuration is copied and saved in the file;
- changes in the settings are saved automatically in the current application, when exiting the *Uni* software;

. changes in the settings do not affect anyhow the saved applications; . when *restoring (loading) the application*, the settings from the saved application are copied to current application;

Technical information

Applications contain all settings available in the "*Configuration*" window, as well as the calibration (single point and multipoint), linearity factors and blank value for all available measuring channels. They are saved as files: 0000.cfg, 0001 .cfg, ... 9999.cfg (maximum 10000 applications).

Theory: Autoloader

Description

The autoloader is used for the automation of the analyses process. In order to save time, when the series of analyses has to be carried out, the samples can be prepared by the operator and then they will be loaded and analysed automatically, without engaging the operator.

Only two signals are used for the communication with the autoloader: a command for the loader "*Load/Wait*" and a status of the loader "*Busy/Ready*" correspondingly.

The "Loader" window of the Uni software used as a sample stack for the loader, but this window can be used also when the analyser is not equipped with the autoloader, and, first, several samples are prepared and then analysed manually.

Procedure

To carry out the analyses using the autoloader or to prepare the samples stack without using the loader, for further analyses, do the following:

1. Enter the sample ID in the "*Analysis control*" window (see [Window: Analysis control](#)).
2. Enter manually or read the weight from the connected balance.
3. Click "Add" button in the "Loader" window (see [Window: Loader](#)). The entry (with the entered data) will be added to the end of the list. If the check-box "auto increment sample number" is marked, the sample number will be increased by 1 after adding the entry to the list.
4. After entering all analyses data to the list, mark the check-box "Run/Stop" and analyses will be carried out automatically. After carrying out the last analysis in the list, the check-box will be unmarked automatically.

Please, note

- The order of the entries in the list can not be changed. The entry in the list can not be edited. Any entry in the list can only be deleted.
 - If the loader is not used, the "Run/Stop" check-box will be unmarked automatically after each analysis. Then the old crucible must be removed from the pedestal and new crucible must be placed. The "Run/Stop" check-box must be then marked manually to carry out the next analysis in the list.
- . To interrupt the series of analyses, the "Run/Stop" check-box must be unmarked. The sequence will be stopped only after finishing the current analysis.
- . If the series of analyses must be interrupted, the "Run/Stop" check-box must be unmarked before the current analysis will be finished, otherwise the next analysis (if available) will be started immediately after finishing the previous one!

Theory: Balance

Description

The current version of the software supports 2 models of balances (different in communication protocol and connection type): SARTORIUS CP64 and KERN 440.

SARTORIUS CP 64

This balance is connected to the special socket of the microcontroller board (inside the analyser). By such a connection Uni shares one communication port of the PC with microcontroller and balance.

Balance settings:

- 911 - restores the factory settings (recommended in case of problems);
- .113 - unstable ambient conditions (for adapt filter);
- .518 - 19.200 baud rate;
- . 611 - manual without stability (weight output mode);
- . 721 - 16-character data format;

KERN 440

This balance is connected to the Com-port of the PC (PC must have at least 2 Com-ports: 1 for analyser and 1 for Kern-balance). In order the balance functions properly, change the setting "*Kern-balance*" (available for power user only) to specify the com-port in the "*Configuration*" window (see [Window: Configuration](#)). Empty setting must be set, if the Sartorius balance is used.

Theory: Base line

Description

The electronics of the IR-rack is designed the way, that it's output signal can have range of ± 10 VDC in order to suit the microcontroller's (MC) ADC input voltage range. The output voltage of the IR-detector depends on the intensity of the IR-radiation reaching the detector. The less radiation - the higher the output voltage. The radiation intensity, reaching the detector, depends on the IR-source, IR-path and sensetivity of the IR-detector and can vary greatly from one IR-cell to another. Therefore, there are manual adjustments provided for the output voltage of every IR-detector. The aim of the adjustment is to set the output signal to zero.

However, after manual adjustment was made, the output signal may drift with the time, due to the IR-rack temperature variations, pollution of the IR-path or agening of the electronic components. If the output signal has drifted positively and will not be regulated, only the part of the measuring range can be used. Therefore there is an auto-zero regulation input for every detector. This input is connected to the output of the MC and the MC changes the signal (voltage) on this ouput in order to set the IR-output (MC's input) to zero. If the IR-output will be stable, the MC's auto-zero regulation output will be stable as well, and the IR-output singnal will be automatically adjusted to zero.

***The IR-ouput signal in regulated stable condition is commonly called "base line".
The auto-zero adjustment of the IR-output is commonly called "base line regulation".***

The procedure of base line regulation is permanently carried out by the software for all available active channels, excluding two cases: the base line regulation is frozen (auto-zero output signals are frozen at the last value) during analysis and the base line regulation is switched off (auto-zero output signals are set to 0) if the "Test" is active in the "Base line" window. The base line regulation is carried out for every channel independently!

Besides, the stability of every channel is checked by the base line regulation procedure. The analyses may be carried only if the detectors' output signals are at zero and stable. Otherwise, for example, if the signals are drifting, the analysis results can have certainly big tolerance from the expected (or correct) value.

Technical information

The settings for the adjustment of the base line regulation procedure (see [Theory: Configuration](#)):

- . *Fast jump*. If the detector's output signal is higher than this value, the MC's auto-zero regulation output will be changed with step, equal to the half of the input value (detector's output). Thus the regulation will be not precise, but very fast.
- . *Time*. If the none of the IR-outputs deviated outside the window, confined by "0" and "Deviation" setting during this time, the base lines will be considered as stable.
- *Deviation*. The detector's output signal level confining the "stability" window. As long as the IR-output signal is within "stability" window the auto-zero regulating output signal is not changed. In order to set the correct deviation value, the base lines should be observed for some time. The deviation should be set 10-15 mV higher, than the amplitude of the noise.
- *Step*. If the IR-output signal is between the *Fast jump* level and *or Deviation*" level, the auto-zero regulating output is changed with this step. Thus the regulation will be very precise. It is recommended to set the step to the half of the deviation. In no case the step value can be higher than deviation.
- . *Sensitive channel*. The factor to divide on the signal from the H₂O - cell in CW-800 and H-cell in CHS-500 analysers. This allows to check the stability with the same parameters for all channels.

Please note:

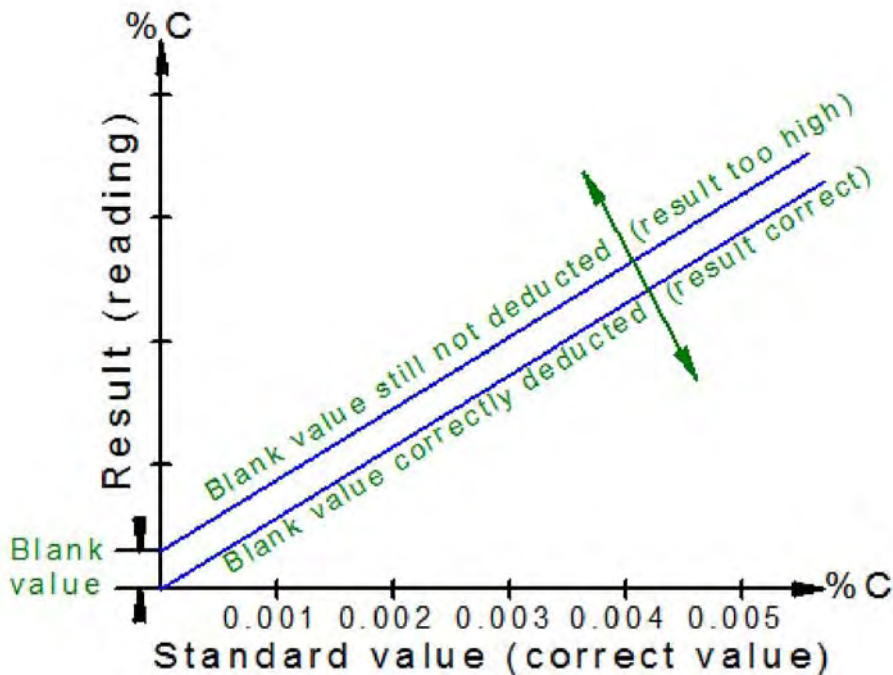
- . The TC-cell (ON/OH/ONH) base line regulation is carried out the same way. The only difference is, that TC-cell has in fact only one detector, but two measuring ranges (channels): high channel (for high concentration of measuring element) and low (amplified high) channel. Therefore there is only one auto-zero output, and a low (sensitive) channel is taken for base line regulation, assuming that, if the amplified signal is at zero and stable, then the source signal is also at zero and stable.
- The default setting of base line regulation procedure are suitable for most cases. One can change the parameters only with a deep understanding of regulation process, otherwise inexperienced changed parameters can lead to erratic analysis results or malfunction of analyser.

Theory: Blank value

Description

When making the analyses of the samples with very low content of the measuring element (up to 100-200 ppm), crucible, combustion boat, flux, accelerator or carrier gas can bring in inaccuracy to the analysis results. This inaccuracy is caused by unwanted content (impurities) of the measuring elements in them.

For example, when making the analyses of the samples with very low content of carbon and sulphur in induction furnace (CS-800, CS-2000), the ceramic crucible, tungsten and, possibly, iron chips accelerator, can contain carbon and sulphur as well as the sample. Thus, the analysis result of the sample, containing, for example, 18 ppm C can be 25 ppm C. In this case the calibration is absolutely inadmissible, because the analyses results will change proportionally in the whole measuring range (channel). This means, if the analyses of the sample with the standard value 18 ppm C provided 25 ppm C result will be taken for calibration, the analysis result of the sample with 0.067 % C standard value will be 0.048 % C, that is absolutely intolerable! Therefore the blank value is used for the correction of the analyses results in the low part of the measuring range.



NOTE: In any circumstances, the appropriate actions must be taken, which exclude or reduce the blank value. For example, as pure as possible carrier gas, the good quality consumables, preheated crucibles or boats should be used. In case if it is not possible to exclude the blank value, the blank value determination procedure should be carried out.

Blank value determination procedure:

1. Before carrying out the blank value determination, it must be assured, that the channel is calibrated using the standard sample with relatively high concentration of measuring element (maximum of the detector's signal at least 4 Volts).
2. The analyses, which will be taken for the blank value determination must be then carried out.

In the induction furnace (CS-800, CS-2000 analysers) the standard samples with very low content of measuring elements are usually analysed (according to the application for the corresponding sample material) for the blank value determination, because the temperature in the furnace depends on the kind and quantity of the materials in the crucible and the combustion of the C and S from the materials depends namely on temperature. When making an analysis with an empty crucible in the induction furnace, it will not heat up and the impurities (C and S) will not be combusted, therefore it will not be possible to determine the blank value.

In the resistance furnace (CS-500, CW-800, SC-500, H-500, CHS-500 analysers) and in the electrode impulse furnace (ONH-2000, ON-900, OH-900) as the empty crucible or combustion boat analyses so the analyses of the samples with the low content of the measuring element can be carried out for the blank value determination.

NOTE: If the analyses of empty crucible or combustion boat are carried out for the blank value determination, the nominal sample weight must be entered, in no case the weight of the boat or the crucible!

3. After making the analyses, pay attention to the analyses results (see [Window:Results](#)). If they correspond to the standard or expected value, when making

the standard sample analyses or to 0 (zero), when making the analyses of the empty crucible or boat, there is no need to perform the blank value determination. Otherwise, follow the next step.

4. Select (highlight) the analyses results which will be taken for the blank value determination.

5. Press the button "Blank value". The "Blank value" window will appear on the screen (see [Form: Blank value](#)).

6. Enter the standard value of the sample or 0 (null), if the empty crucible or boat analyses were made, into the field "Value" for the desired channel. Choose the measurements units (% or ppm).

7. Mark the check-box for the corresponding measuring channel and press "Apply" button. The calculated blank value in % will be displayed in the "Now" field.

8. Close the "Blank value" window, using the "Close" button.

From now on the newly calculated blank value will be used for all analyses results calculation. It will be subtracted from all analyses results in the corresponding measuring channel. The blank value is calculated and stored as an area of the peak, which would be produced by the signal of the detector, if the sample with the same concentration of the measuring element (and the "*blank weight*", see "[Window: Configuration](#)") as the calculated blank value would be analysed. To display the blank value as a concentration of the measured element the "*blank weight*" parameter is used. It should be set equal to the nominal (usual) weight of the sample.

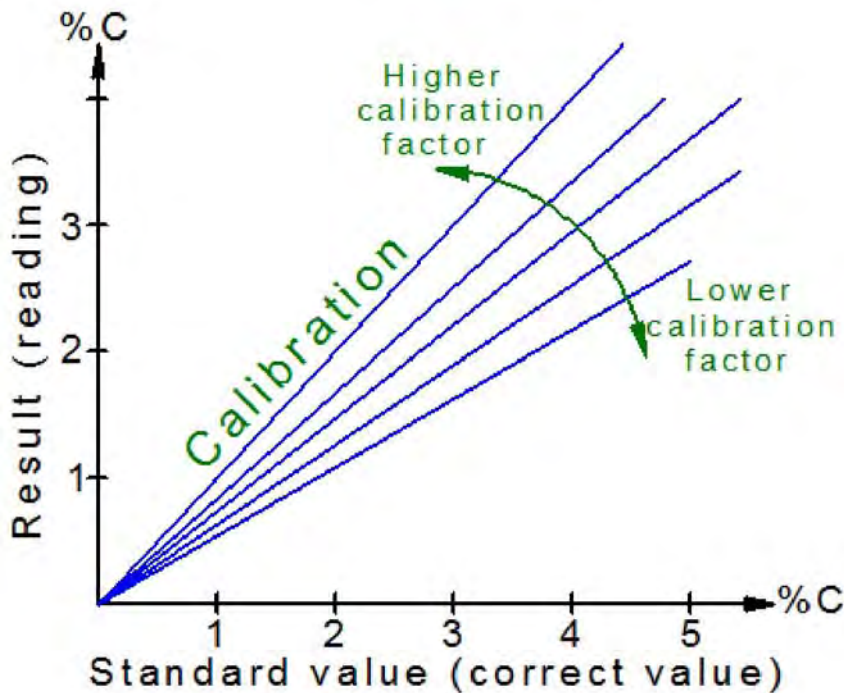
Please note

- The blank value determination makes only sense in the "*low*" (sensitive) measuring channels. The acceptable standard deviation of the analyses results in the high channels is usually at least one order higher than the blank value. Therefore the blank value does not affect the analyses results.

Theory: Calibration

Description

The basis for the analyses results calculation is the signal from the detector. To bring the gathered signal from the detector (namely "peak area (linearised signal) to sample weight" ratio) in correspondence with concentration of the measuring element in the sample, the calibration factor must be calculated. Thus, the calibration - is bringing the obtained analyses results in correspondence with standard (or expected) value of the analysed sample (true concentration of the measuring element in the sample).



The calibration of the analyser is carried out using the standard samples only, i. e. the samples the concentration of the measuring element in which is known.

The analyser is supplied with all measuring ranges calibrated, but the calibration may change with the time due to the saturation of the chemicals used in the analyser, variations of the temperature of the IR and TC detectors, atmospheric pressure variations and ageing of the electronic components. Therefore, the calibration should be checked daily, by making the analysis(es) of standard samples. The best (optimal) suiting samples for calibration are those, which produce the peak in the middle of the detector's output signal range, i. e. when the peak maximum is between 4 and 6 Volts. Nevertheless, the other samples can be used for calibrations, if required.

ATTENTION: Each of the available measuring ranges is calibrated separately! For example, if the instrument has two measuring ranges for one element, each of them must be calibrated.

Calibration procedure

1. Analyse the standard sample which provides the result in the measuring channel which calibration is to be checked. One analysis is usually enough, but for more precise calibration several analyses in series can be made. Thus the repeatability of the analyses results can be verified. The characteristic value for the repeatability is a standard deviation (absolute or relative).

2. Pay attention to the analyses results. If the result or the average of the results is within the standard deviation of the sample, there is no need to make calibration - the analyses of the samples with unknown content of the measuring element can be carried out in this channel. Otherwise, the analyser must be calibrated using the obtained analyses results.
 3. Mark (highlight) one or several results lines with the mouse pointer in the "Results" window (see [Window: Results](#)), which correspond to the analyses of the standard sample carried out in step 1.
 4. Press "Calibration" button in the right part of the "Results" window. The "Calibration" window will appear on the screen (see [Form: Calibration](#)).
 5. In the input field "Value" for the measuring channel, in which the analyses results were obtained, enter the standard value of the sample. Choose the correct measuring units (% or ppm).
 6. Mark the checkbox for the desired measuring channel and press "Apply" button. The calculated calibration factor appears in the field "Now". It must not be outside the range 0.5-2, otherwise it will not be accepted, and the previous calibration factor will be restored.
 7. Close the "Calibration" window, using the "Close " button.
- From now on the newly calculated calibration factor will be used for all analyses results calculation.

Base calibration

In order to reduce the probability of operator mistakes, when carrying out the calibration, base calibration is used. In fact two calibration factors are used for the analysis result calculation (they are multiplied). One factor is the user calibration factor, which can not be outside the range 0.5 - 2. The other factor is base calibration factor which does not have any limits, and the base calibration is available only for service personnel. If the base calibration was carried out, the user calibration factor is set to 1. In case the user calibrates the instrument and the calculated factor is outside the range 0.5 or 2 - the input error took place or the analyser is malfunctioning.

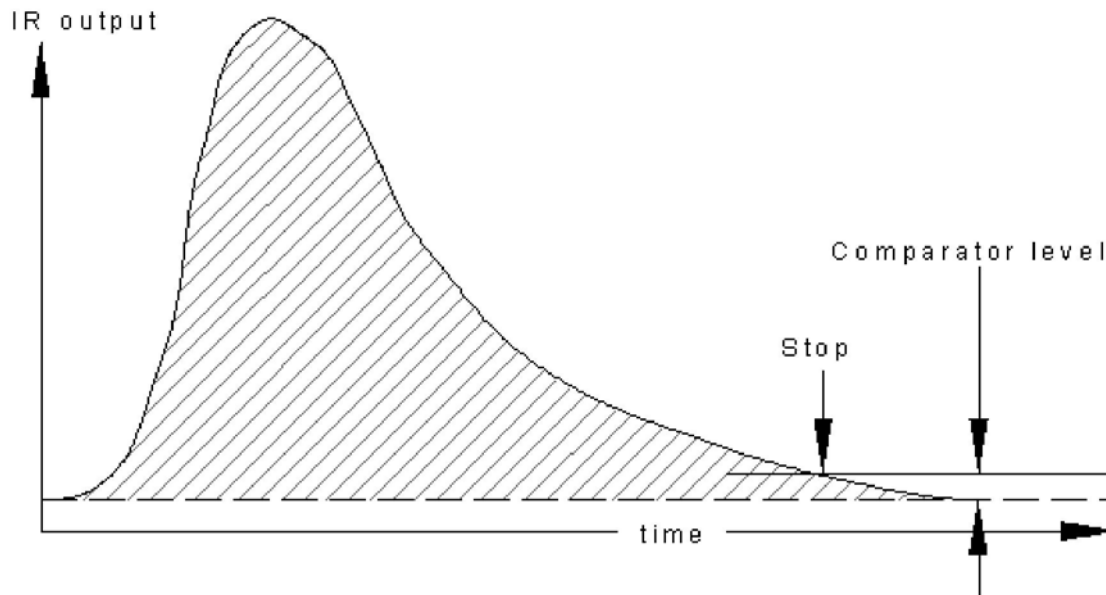
The base calibration procedure is similar to the user calibration. Merely the "Base calibration" button is clicked instead of "Calibration" button and "Base calibration" window appear, which does not have the limits for the calibration factors.

Please, note:

- The recalculated results (after carrying out the calibration) can be reviewed for all available analyses results (see [Window: Results](#)). This feature is available for power user only.
- . If the instrument has measuring ranges for different elements (for example, C and S), and there are standard values of both elements specified for the standard sample, two channels can be calibrated at one time, using the same analyses results.
- The calibration of two measuring channels for one element (for example, low and high carbon) with one standard sample is either not possible or not recommended!

Theory: Comparator level

Description



The comparator level is an artificial zero level, which rests just above the true zero level (base line) of the combustion curve diagram. **If the detector signal level descends to the comparator level before the end of the maximum analysis time, then the analysis is finished.** If the detector signal did not rise or already descended before the end of the minimum analysis time, the analysis will be continued until the minimum analysis time is expired.

The comparator level can be changed, in order to cut-out noise or any other interference, which rests on the true zero level. It is reasonable to have low comparator levels for low peaks and high comparator levels for high peaks, in order to avoid unnecessary long analysing time in case of high peaks and to avoid too low results for low peaks. For this reason, during each analysis the software detects the peak maximum from each IR-cell during the running analysis, and adjusts the comparator level accordingly (1 % from peak maximum). If the comparator level was constant for high and low peaks, the samples with low peaks would give low results compared to the results of high peak samples.

The value (in millivolts, mV) which is adjustable in the "Configuration" window corresponds to the minimum comparator level.

Theory: Configuration

Description

Configuration is a set of settings and factors for a certain device type. In the instruments with two operation modes (CS-2000 (induction and resistance furnace operation) and ONH-2000 (ON or OH operation mode)) two configurations are used. The configuration corresponding to the selected operation mode is activated automatically when switching over from one mode to another.

To change the settings in the current configuration "Configuration" window is used (see [Window: Configuration](#)). The current configuration can be saved anytime as "Application".

The list of all available settings, grouped in categories:

Administrator	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
LIMS auto	Enable/disable the automatic export to the LIMS	+	+	+	+	+	+	+	+	+	+
LIMS input	The name of the file, containing the batch query from the LIMS server	+	+	+	+	+	+	+	+	+	+
LIMS converter	Specify the external converter for LIMS	+	+	+	+	+	+	+	+	+	+
KERN balance	Specify the COM-port of the PC where the KERN balance is connected. If the SARTORIUS balance is used, choose the empty field	+	+	+	+	+	+	+	+	+	+
Fast jump	Specify the level (mV) for fast base line regulation	+	+	+	+	+	+	+	+	+	+
Time	Specify the time (s) for the procedure of base line stability evaluation	+	+	+	+	+	+	+	+	+	+
Normal flow	Specify the output voltage of the flow sensor (V) for nominal flow rate	+	+	+	+	+	+	+	+	+	+
Deviation	Specify the maximum deviation (mV) for the base line regulation and stability evaluation procedure	+	+	+	+	+	+	+	+	+	+
Negative results	Enable/disable the display of negative results. If set to off, all results below null will be set equal to null	+	+	+	+	+	+	+	+	+	+
Blank value	The sample weight for which the blank value is displayed in the "Now" field of the "Blank value" window	+	+	+	+	+	+	+	+	+	+
Sensitive channel	The factor for sensitive channel	+				+					
Step	Specify the step (mV) for the base line regulation procedure	+	+	+	+	+	+	+	+	+	+
Analysis	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Maximum time	Maximum analysis time (s)	+	+	+	+	+	+	+	+	+	+
Minimum time	Minimum analysis time (s)	+	+	+	+	+	+	+	+	+	+
Comparator level 1	Specify the comparator level (mV) for channel 1	+	+	+	+	+	+	+	+	+	+
Comparator level 2	Specify the comparator level (mV) for channel 2	+	+	+	+	+	+	+	+	+	+
Comparator level 3	Specify the comparator level (mV) for channel 3	+	+	+	+	+	+	+	+	+	+
Comparator level 4	Specify the comparator level (mV) for channel 4	+	+	+	+	+	+	+	+	+	+
Post-waiting	Specify the time (s) to wait before opening the furnace at the end of analysis				+			+	+	+	
Pre-purging	Specify the time (s) to wait before starting analysis after closing the furnace				+						
Sample drop	Additional sample drop at the end of analysis							+	+	+	
Start beep	Enable/disable the acoustic signal at	+	+	+		+	+				+

	the analysis start										
Stop beep	Enable/disable the acoustic signal at the analysis end	+	+	+		+	+				+
Appearance	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Ppm factor	Specify the minimum value for the analysis result to display in percent (%). The values less than this one will be displayed in ppm	+	+	+	+	+	+	+	+	+	+
ID separator	Specify the character-separator between sample ID and running sample number	+	+	+	+	+	+	+	+	+	+
Ppm digits	Specify the number of digits after the decimal point for the results displayed in ppm	+	+	+	+	+	+	+	+	+	+
Percents digits	Specify the number of digits after the decimal point for the results displayed in percents	+	+	+	+	+	+	+	+	+	+
Units	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Carbon	Select the measuring units for carbon channels (C/CO ₂)	*	*	*	*	*					*
Sulphur	Select the measuring units for sulphur channels (S/SO ₃)	*	*	*	*	*					*
Channels	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Channel 1	Activate/deactivate channel 1	+	+	+	+	+	+	+	+	+	+
Channel 2	Activate/deactivate channel 2	+	+	+	+	+	+	+	+	+	+
Channel 3	Activate/deactivate channel 3	+	+	+	+	+	+	+	+	+	+
Channel 4	Activate/deactivate channel 4	+	+	+	+	+	+	+	+	+	+
Valves	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Coil cooling time	Specify the time (s) for cooling the induction furnace coil after the analysis end		+		+			+	+	+	
Gas saving	Specify the idle time (min) for the gas saving mode to be switched on. Enter the 0 to disable gas saving function (continuous flow)		+		+	+		+	+	+	
Purge chamber time	Specify the time (s) from the beginning of analysis when the carrier gas is supplied to the combustion chamber of the furnace via chamber valve (T2)		+		+			+	+	+	
Purge furnace time	Specify the time (s) for the combustion chamber to be purged after closing the furnace, before analysis (T1)		+		+			+	+	+	
Purge lance time	Specify the time (s) after expiration of T2 when the carrier gas is supplied to the combustion chamber of the furnace via chamber valve and lance valve (T3). After this time is expired until the end of analysis, the gas is supplied only via lance valve (directly into the crucible)		+		+			+	+	+	
Misc	Description	CHS500	CS2000	CS500	CS800	CW800	H500	OH900	ON900	ONH2000	SC500
Signal tones	Specify the output device of the acoustic signal	+	+	+		+	+				

* Plus indicates that the setting is available for the certain type of the analyser, asterisk - the availability of the setting depends on the measuring channels combination.

Theory: Controller

Description

The Uni software, running on the PC is controlling the analyser via electronic microcontroller (MC) board. The serial interface is used for communication, the COM-port of the PC is selectable (see [Form: Test](#)).

Communication

MC electronic board features 16 digital inputs, 16 digital outputs, 4 analog inputs, 4 analog outputs, 1 serial interface (shared between the PC and the balance, see [Theory: Balance](#)), flash and EEPROM memory (default state of the digital outputs is saved in this memory). Every half a second a data packet (state dump) is received by the software from the MC and from the software to MC, containing the following information, among the other:

- *Counter* - data packets counter. It is increased by 1 after sending (by MC) a packet. Initial value is 0, maximal value is 255 (one byte, automatically reseted to 0 after reaching the maximal value).

- *Digital inputs* - 16 digital inputs:

0. Pressure switch: 0 - pressure is high, 1 - pressure is low.

1. Water flow sensor / Mains switch position.

2. Furnace overheating signal.

3. Operating mode: induction/resistance furnace (CS-2000); ON/OH operating mode (ONH-2000) .

15. Autoloader status: 0 - buzy, 1 - ready.

- *Digital outputs* - 16 digital outputs:

0. Beep: 0 - off, 1 - on. The beeper on the MC board.

1. Furnace power: 0 - off, 1 - on.

2. Bypass valve (CS-800, CS-2000)/ Gas saving mode (3 valves ON/OH/ONH).

3. Lance valve (CS-800, CS-2000)/ TC cell power (supply voltage for the thermistors, ON/OH/ONH).

4. Outflow valve (CS-800, CS-2000): 0 - deenergised, 1 - energized / Trigger signal (electrode impulse furnace control, ON/OH/ONH).

5. Flow signal (External flow enable for FC-21, ON/OH/ONH)

6. Chamber valve (CS-800, CS-2000)/ purge valve (ON/OH/ONH).

7. Coil cooling valve (CS-800, CS-2000)/ sample drop (ON/OH/ONH).

14. Autoloader control: 0 - wait, 1 - load the sample.

15. Pneumatic valve: 0 - open furnace, 1 - close furnace.

- *Analog inputs* - 16 analog inputs (detectors' signals, etc.).

- *Analog outputs* - 16 analog outputs (auto-zero regulation, furnace power level (ON/OH/ONH)).

- *Test points* - test point values (different supply voltages on the MC board).

Note: if the check-box of the corresponding input/output is marked (ticked off) - this means 1, if it is unmarked - 0. The numeration is from the right to the left (the most left bit is the highest-order - 15, the most right bit is the lowest-order - 0).

Please note

. If the counter is reseted to 0 before it has reached it's maximum value (255) - most probably the hardware reset of the MC board took place.

Theory: Deficiency

Description

The analyser must be maintained with the certain period of time or when a certain number of analyses were made: some parts have to be cleaned, wearing parts must be replaced, saturated chemicals must be replaced, etc. The software has a feature, which can be used as a reminder for the certain actions to be done. The 5 counters, which values will be decreased by 1 after each analysis, can be specified (see [Window: Configuration](#)). If any of the counters will come to 0, the warning message will be displayed, when trying to start an analysis.

ATTENTION: If working with the autoloader, the warning message is displayed for the first analysis in series (in queue)!

Example

Let us create the counter to remind to clean the filter every 200 analyses:

1. Select the tab "Deficiency" in the "Configuration" window (see [Window: Configuration](#)).
2. Mark "edit names and factors" check-box.
3. Enter "Clean the filter" into "name" input field (left), "200" into "factor" input field (right).
4. Click "Store" button.

From now on after every analysis the counter will be decreased by 1. The current counter value is shown below the "name" input field and additionally the progress bar is displayed. If the operator will try to start the 201-st analysis, the warning message will be displayed. In this case the maintenance action has to be done and the "deficiency" counter has to be reseted. To reset the counter, open the "Deficiency" tab of the "Configuration" window, mark the check-box of the desired counter and click "Reset" button.

Please, note

- . The counter name is the same for all applications (see [Theory: Application](#)), but the counter value may be different for different applications. For example, when analysing the steel samples, the filter has to be cleaned every 100 analyses. When analysing the cast iron, the filter has to be cleaned every 200 analyses. The software will automatically take notice when the application is switched over from one to another and will decrease the counter proportionally to the counter value, specified in the corresponding application.
- . If the warning message appears, the operator can ignore it and continue making analyses. The warning message will appear at every analysis start, until the counter is reseted or switched off (counter value set to 0).

Theory: Drift

Description

To check the drift of the results of certain sample the following has to be done:

1. Select the desired analyses results in the "Results" window (see [Window: Results](#)) for the standard sample which analyses results drift will be checked. Before selecting the results, the filter function of the software can be used (see [Form: Filter](#)) to display, for example, all results from the database for the sample with the specific sample ID.
2. Click the "Drift check" button in the "Results" window and the "Drift check" window will appear (see [Form: Drift](#)).
3. Select the desired measuring range (channel) and measuring units.
4. Enter the correct (standard) value in percents into the "Standard" input field.
5. Enter the RSD into the "Deviation" field.
6. On the graphic area of this window there will be displayed one black line indicating the standard value and two grey lines, indicating the RSD. Every point on the graph corresponds to one analysis result. Thus the graphical representation of the sample results drift is shown on the screen.

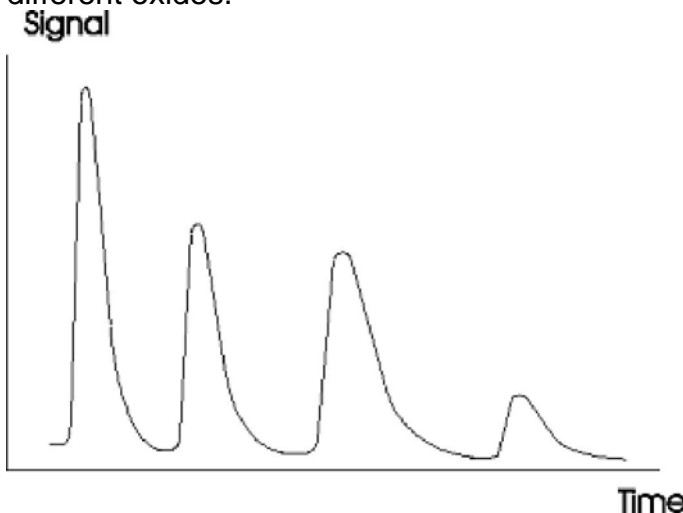
Please, note

- By default, all points have equal distance between them on the X-axis. The date/time scale of the X-axis can be used, by marking the check-box "Time".
- To print the results, used for drift check, usual report can be created (see [Theory: Report](#)).

Theory: Fractions

Description

In some cases it is useful not to only know the total content of one element in a specific sample, but also the exact amount of a specific bound or structure. In the ON/OH/ONH analysers different oxygen and nitrogen phases in the sample material can be analysed. For this purpose the furnace power is controlled to create the temperature profile, when the oxygen (oxides) and nitrogen (nytrides) phases are not extracted from the sample simultaneously, but consequently. Then not one peak (as usual) is obtained from the detector but several peaks. Each of them is corresponding to the concentration of measuring element in the certain chemical bound in the sample. For example, when making an analysis of the metall alloy, the oxygen can be present in the material in form of different oxides.



After obtaining such signal from the detector, the results for each peak must be calculated. Usually the total result is calculated.

For more information on carrying out the fractional analysis refer to the operation manual of the analyser.

Procedure

Any result from the "Results" window can be taken for fractions calculation.

1. Select (highlight) the result line in the "Results" window (see [Window: Results](#)).
2. Click "Fractions" button to display the "Farctions" window (see [From: Fraction](#)).
3. Select the measuring channel, for which the fractions calculation will be done.
4. The fractions mnnst be specified now. This can be done automatically or manually. Press "!" button to find the fractions automatically.. Press "+" button to specify the fractions manually. The fractions can be edited by switchin on the "edit" mode ("<>" button).
5. The results, corresponding to the specified fractions will appear in the list of results.

Theory: Layout

Description

Layouts are used to create the comfortable workspace to operate the Uni software. A layout contains the size and position of the windows on a workspace. Uni software can have up to 10 layouts. The quick navigation between layouts can be performed using ALT + "N" key combination, where "N" is a layout number (1 to 10, 0 is used for selecting the layout number 10). Selected layout becomes *current* and any operations with windows (resizing, moving, displaying/hiding) will be saved in this layout. After exiting Uni software, the last selected layout will be restored.

Windows in the layout may overlay each other partially or completely. To access the

62 partially overlaid window, make it active (click at any place of the window) and it will be displayed on top (over the others). If the window is completely overlaid (behind other window), use CTRL + F6 key combination and windows will be activated cyclically. Resizing of the window is performed in a usual way for Microsoft Windows operating system. To move the window, press and hold left mouse button somewhere in the window free from any control element. Move the window to the desired position and release the mouse button. To display/hide the window use the corresponding button on the toolbar (see [Form: Main window](#)).

The name of current layout is displayed on the status bar of the main window (a bar for the whole width of the window in the lower part of the window). A name can be assigned to any layout.

The set of layouts can be exported and imported (saved and loaded) to/from the file. Uni contains a set of layouts for different screen resolutions. A user layout can be created and used in newly created profiles (see [Theory: Profile](#)).

Theory: LIMS

Description

LIMS (Laboratory Information Management Systems) is a client-server system for gathering and managing the laboratory information (obtaining the results from different analysers in the laboratory on one central computer (server)). To connect the Uni software to the LIMS the LIMS-export mechanism is provided. The results are always saved in the local database. Operator can select the results to export to LIMS or switch on automatic LIMS-export after each analysis.

Uni software creates a xml-file and launches the external software (LIMS converter), which reads the necessary data from the xml-file and sends them to the LIMS-server. The LIMS converter can be developed by software engineers of the customer or by ELTRA, on request.

Procedure

After creating a profile, LIMS-export mechanism must be adjusted:

1. Specify the path to the LIMS-converter.
2. Set the LIMS auto setting to on or off.
3. Specify the path to the file, containing the batch query from the LIMS server.

Export file format

Below is an example of the lms0001.xml file for CS2000 analyser with the comments (in blue colour):

```
<?xml version="1.0" encoding="utf-8"?> <uni>
<header>
<version>1.1</version>  export version. Will be changed if the file format is chang
<profile>Demo CS2000</profile>  profile name
63
<device>CS2000</device>
<loader>True</loader>
<channels>4</channels>
<elements>CCSS</elements>
<date>18.04.05</date>
<time>14:40:08</time>
</header>
<analyse>
<date>22.09.04</date> <time>12:02:38</time> <application>1</application>
device type autoloader:
available (True) or not available (Fal
the number of the the configuration export date export time
result date result time
measuring ranges in the analyser of the measuring elements of the
channels
application name ID and number
sample weight analysis duration minimum analysis duration maximum analysis duration operating mode: induction
furnace
(True) or resist
number of the deficiency counter name of the deficiency counter current value of the deficiency counter initial value of
the deficiency counter
<sample>Leer 12</sample>  sample <id>Leer</id>  sample ID <number>12</number>  sample number
<weight>555</weight> <duration>30</duration> <timemin>30</timemin> <timemax>60</timemax>
<induction>True</induction> </analyse> <deficiency> <counter>
<number>0</number>
<name>Drink tea</name>
<curvalue>50</curvalue>
<maxvalue>50</maxvalue> </counter> <counter>
<number>1</number>
<name>Clear furnace</name>
<curvalue>300</curvalue>
<maxvalue>300</maxvalue> </counter> </deficiency> <results> <element>
<name>c</name>  measuring element
<value>0.000186156337031958</value> </element> <element>
<name>co2</name>
<value>0.000682099902270885</value> </element> <element>
<name>s</name>
<value>0.000121750914950204</value> </element> <element>
<name>so3</name>
<value>0.000304028592755094</value> </element> </results> <measurement> <channel>
<number>0</number>  measuring channel number
<enabled>True</enabled>  channel: activated (True),
<element>C</element>  measuring element
<result>0.000186156337031958</result>  analysis result in this channel
<zero>0.0100213718377976</zero>  base line level at analysis start (zero)
<comporator>0.01</comporator>  comparator level
<maximum>0.02779431640625</maximum>  maximum peak level
<length>62</length>  number of points obtained from the detector
<blank>0</blank>  blank value
```

obtained analysis result
deactivated/overloaded (False)

1

```
<basecalibration>0.418470129031439</basecalibration>   base calibration <calibration>1</calibration>   user
calibration factor <linearity>5.51</linearity>   linearity factor <multipoint> <point>
<position>0</position>   point number in the multipoint calibratio <result>0.0165134771633385</result> obtained
result (before correctio <standard>0.016</standard>   calculated result (after correction) </point> <point>
<position>1</position> <result>0.0474372028903042</result> <standard>0.048</standard> </point> <point>
<position>2</position> <result>0.0668160573659021</result> <standard>0.067</standard> </point> <point>
<position>3</position> <result>0.1174002720053</result> <standard>0.12</standard> </point> <point>
<position>4</position> <result>0.205463585095318</result> <standard>0.197</standard> </point> </multipoint>
</channel> <channel>
<number>1</number> <enabled>True</enabled> <element>C</element> <result>0.00321433385451238</result>
<zero>0.00771322079613095</zero> <comporator>0.01</comporator> <maximum>0.018733671875</maximum>
<length>62</length> <blank>0</blank>
<basecalibration>17.5267905799913</basecalibration> <calibration>1</calibration> <linearity>4.98</linearity>
<multipoint> <point>
<position>0</position> <result>0.201763308304433</result> <standard>0.197</standard> </point> <point>
<position>1</position> <result>1.32698457272786</result> <standard>1.33</standard> </point> <point>
<position>2</position> <result>3.99954989589202</result> <standard>4</standard> </point> <point>
<position>3</position> <result>7.03359342504803</result>
<standard>6.87</standard> </point> </multipoint> </channel> <channel>
<number>2</number> <enabled>True</enabled> <element>S</element>
<result>0.000121750914950204</result> <zero>0.0121456491815476</zero> <comporator>0.01</comporator>
<maximum>0.0195176171875</maximum> <length>62</length> <blank>0</blank>
<basecalibration>1</basecalibration> <calibration>1</calibration> <linearity>21.017</linearity> <multipoint>
<point>
<position>0</position> <result>0.0153175955998592</result> <standard>0.014</standard> </point> <point>
<position>1</position> <result>0.0246304157206754</result> <standard>0.024</standard> </point> <point>
<position>2</position> <result>0.201175331562269</result> <standard>0.192</standard> </point> <point>
<position>3</position> <result>0.24542248684223</result> <standard>0.23</standard> </point> <point>
<position>4</position> <result>0.375865462328046</result> <standard>0.336</standard> </point> </multipoint>
</channel> <channel>
<number>3</number> <enabled>True</enabled> <element>S</element> <result>0.00161886060775178</result>
<zero>0.00407466610863095</zero> <comporator>0.01</comporator> <maximum>0.00976357421875</maximum>
<length>62</length> <blank>0</blank>
<basecalibration>13.0672926600986</basecalibration> <calibration>1</calibration> <linearity>18.447</linearity>
<multipoint /> </channel> </measurement> </uni>
```

Theory: Linearity Description

The basis for the analyses results calculation is the signal from the detector. All IR-detectors have non-linear characteristic curve, i. e. the correlation between detector's output signal and concentration of the measuring element. This means, that after the calibration is carried out, the samples with different concentration will provide nonproportional analyses results. In and near the calibration point analyses results will be precise, but in the higher part of the measuring range the analyses results will be systematically lower and in the lower part of the measuring range the analyses results will be higher, or vice versa.

In order to obtain precise analyses results in the whole measuring range, the correction of the detector's output signal must be performed, whereupon the characteristic curve of the detector can be considered as linear. This correction is carried out mathematically, after digitalising the analogue detector signal and transferring it to the PC. Detector output signal is the argument of the linearisation function, which provides corrected (linear) signal. Different detectors have different characteristic curves. Therefore, the linearisation function has a factor, which defines the non linearity correction rate.

The aim of the linearity correction procedure is to find the linearity factor, at which the analyses results in the whole measuring range are correct.

The procedure of calculating the linearity factor is carried out separately for every IR-detector (measuring channel). In order to calculate the linearity factor, the peaks of different height must be obtained in the corresponding measuring range. They obtained by carrying out analysis of standard sample(s) in two ways:

1. By using one standard sample and carrying out analyses this sample with different weight. This method is usually used in instruments with resistance furnace.
2. By using different standard samples, with the same weight (according to the application). This method can be used in any analyser.

Example

Let us examine the linearity factor calculation procedure by the example of low carbon measuring channel in CS-800 analyser. 3 steel standard sample are taken in this example and analysed according to the application:

- a. 0.016 % C - height of the peak about 3 Volts;
- b. 0.048 % C - height of the peak about 5 Volts;
- c. 0.067 % C - height of the peak about 7 Volts;

Procedure:

1. Carry out the analyses of all 3 standard samples. For higher precision 2-3 analyses of every sample can be made.
2. Select (highlight) the lines in the "Results" window, corresponding to the analyses of these standard samples.
3. Drag selected results into "Linearity" window (see [Window: Linearity](#)).
4. In the column "Factor" enter the standard value for every analysis. In this example it is 0.016, 0.048 and 0.067 correspondingly.
5. Press "Calculate" button. The software will find the linearity factor by recalculating the results with every linearity constant in the preset range, with preset step (see [Form: Linearity limits](#)) and dividing them on the value entered in the "Factor" field. Then the deviation of the values obtained for every analysis is calculated. After the calculation is finished the factor appears in the field "Now", at which the deviation was minimum.
6. Mark the check-box for the corresponding channel (in this example low carbon) and press "Apply" button. From now on, the newly calculated factor will be used for calculation all analyses results.
7. Make base calibration (see [Theory: Calibration](#)). For this purpose the analyses results of one of the standard samples taken for linearity factor calculation can be used (for example, 0.048).

To check, whether the linearity factor was calculated properly, the recalculated results of the samples, which analyses were carried out before calculation, can be reviewed (see [Window: Results](#)). The similar way linearity factor calculation is carried out for all IR-detectors (measuring ranges).

Please, note

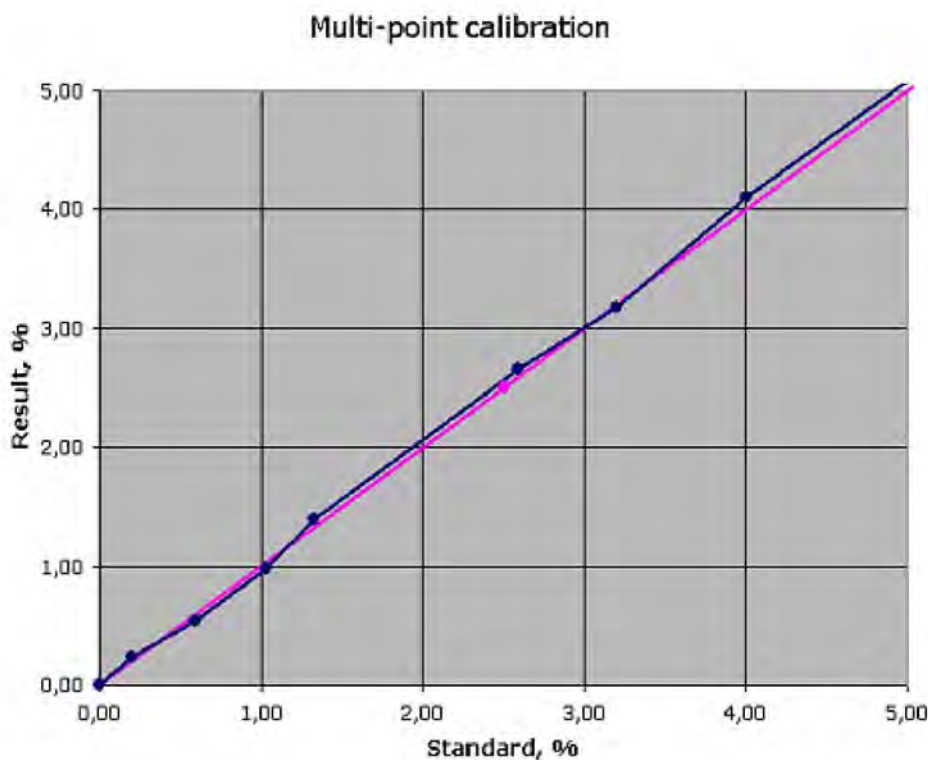
. The linearity factor is calculated when taking the analyser in operation in factory. It remains valid for the whole lifetime of the analyser. Therefore the linearity factor calculation procedure has not to be done, when receiving a new analyser. Only if the modifications of the IR-cell were made (replacing of the IR-detector, IR-path) the linearity factor calculation procedure must be carried out again.

- If after calculating the linearity factor, the newly calculated factor will be equal to one of the "linearity limits" and the deviation will be very high (50-100%), such factor can be considered as wittingly wrong. The reason can be mistakes in entering the "Factor values, wrong selected samples for linearity factor calculation or malfunctioning of the analyser.
- If after calculating the linearity factor, the newly calculated factor will be equal to one of the "linearity limits" and the deviation will be low (less then 10%) the "linearity limits" must be extended until the calculated linearity factor will be between the linearity limits and the deviation will be minimal
 - . The linearity limit, set by default, are valid for most cases.
 - . The linearity factor can be entered manually into "Now" field, if the recalculated results have to be reviewed and evaluated manually for different linearity factors. The base calibration must be done after every change of linearity factor!

Theory: Multipoint calibration

Description

When making the analyses of the samples with different concentration of the measuring element, the average of the analyses results of certain sample having good repeatability may deviate from the standard value and the results can be as higher then the standard value so lower then the standard value. On the picture below, the pink line represents one-point calibration, the blue points - results of analyses of different samples in this measuring channel. In order to get very precise analyses in the whole measuring range, the multipoint calibration has to be carried out. Then, the calibration in the whole range is divided into sections from one point to another, and on the obtained analysis results the additional correction is applied, according to the corresponding section of the broken line of the multipoint calibration. Thus the analyses results will be ultimately precise in the whole measuring range.



The software allows defining the points for multipoint calibration in two ways: by making analyses and entering the standard value (automatically) and by entering the result and standard value without making analyses (manually).

Automatic

The points for the multipoint calibration will be calculated on the results of the analyses of the samples.

1. Carry out the analyses of the standard samples, which will be taken for multipoint calibration. As one so several analyses of each standard sample can be made.

ATTENTION: Before carrying out the multipoint calibration, the measuring channel must be calibrated using one-point calibration! The correct linearity factor must be found as well (if the IR-cell is new the linearity factor was not found for it's detectors, it must be done BEFORE making multipoint calibration).

2. Drag the obtained results with the right mouse button from "Results" window (see [Window: Results](#)) into the "Multipoint calibration" window (see [Window: Multipoint calibration](#)).

3. Select the measuring channel, which the multipoint calibration is carried out for.

4. Enter the standard values of the samples into the "Value" field for each analysis line. Select the measuring units, corresponding to the entered values.

5. Click "Calculate" button. The software will calculate the points for the multipoint calibration, which will be shown in the "Manual" tab of the "Multipoint calibration" window.

NOTE: The points, displayed in the "Manual" tab, are valid and taken for the multipoint calibration results correction. The points, displayed in the "Automatic" tab are only displayed for entering the standard value for each analysis and will be deleted when the software is exited. They can be deleted manually, if necessary, by marking the desired line and pressing the *DELETE* key.

Manual

The points for the multipoint calibration can be entered manually, in the window "Add point", which is displayed by clicking the "Add" button in the "Manual" tab. The analysis result and the desired value can be entered in this window (see [Form: Add point](#)).

Please, note

- To delete a point from the multipoint calibration, it has to be selected (highlighted) in the "Manual" tab and the "Delete" button has to be clicked. . When making the analyses to define another point (when there are already points in the multipoint calibration), the new points will be calculated taking into account existing points. If the "Standard" value of the new point correspond to the one of the existing point, such point will be replaced.

Theory: Offline

Description

Offline is an operation mode of the software, when, after loading profile, the connection to the analyser is not established. In this mode Uni can not receive the data from the analyser and send the commands to the analyser. Therefore, all the functions related to the communication with the analyser are not available (for example, analysis, device test). However, all functions, which do not require connection to the analyser, can be used (analyses results review, report creation, etc.).

This operating mode allows to demonstrate the software without having the analyser.

In order to run the software in "offline" mode, the "Offline" button has to be pressed in the "Test" window (see [Form: Test](#)).

Theory: Profile

Description

Uni software is designed to operate different models of ELTRA analysers. Different analysers have different functions and settings. In order to configure software for operation of the different analysers, **profiles** are used.

Profile contains the information concerned to the type of the analyser and certain device - results of analyses (see [Theory: Result](#)), configuration (see [Theory: Configuration](#)), applications (see [Theory: Application](#)) etc. Several profiles can be created for one device. Every profile contains all operations which were carried out when using the software with this profile (analyses results, settings, appearance of the software) and other profiles are not affected anyhow, when changing something in a certain profile.

Several instances of the software can be run on one PC, each instance with different profile. If the PC has several COM-ports, then several analysers can be operated by one PC simultaneously, if it has enough computational power.

The profile is a folder with the name, corresponding to the profile name, situated in the *Profiles* folder of the Uni software. In order to make back-up of the profile, it necessary merely to copy the profile folder or the content of the folder.

After taking an analyser in operation in factory, the profile is written on CD, supplied with the analyser. It is archived and can be sent to the user of the analyser, on request.

How to create a profile

Procedure

- To create the profile, user has to log in as a power user (see [Theory: Access](#)).
- Press "New profile" button in "Profile manager" window (see [Form: Profile manager](#)). The "Create new profile" window appears (see [Form: New profile](#)).
- Enter the name for the profile.
- Select analyser type in the "Device" list.
- Select the configuration of measuring channel of the analyser from the "Channels" pop-up list.
- If the analyser is equipped with the autoloader, mark the check-box "Autoloader".
- Press "Create" button.

New profile contains all the settings by default. It means, the some settings must be changes, linearity and calibration must be carried out.

Technical information

Files in the profile folder:

- **data.mdb** - Microsoft Access database containing analyses data. The data are saved in coded form.
- **profile.xml** - file, containing specific for every device settings and appearance settings of the software.
- **config.xml** - current basic configuration of the software (settings and factors).
- **config2.xml** - current alternative configuration of the software (resistance/induction furnace operation in CS-2000, ON/OH operation in ONH-2000).
- **OOOO.cfg, 0001 .cfg, ...** - applications.
- **lock** - temporary file to lock the access to the profile, when it is already in use by an instance of the Uni.
- **notepad.txt** - temporary file for export to Microsoft Notepad.
- **loader.xml** - temporary file for saving the samples stack, if using the autoloader (see [Theory: Autoloader](#)).

. **Mms0000.xml, Nms000Lxml, ...** - temporary files for LIMS-export (see [Theory: LIMS](#)). These files will be deleted automatically when loading the profile.

Theory: Report

Description

Uni supports 3 types of the reports: standard report, technical report and graph. All reports are displayed in the "Print preview" window (see [Form: Print preview](#)). The difference between them is in their content and availability of the settings before printing.

Standard report

In order to print or to export analyses results, standard report must be created. Before the standard report can be previewed, the report template must be created. Report template can not be saved.

In order to make standard report, do the following:

1. Create new (or modify an existing) layout (see [Theory: Layout](#)) which contains "Report" window (see [Window: Report](#)) and "Results" window (see [Window: Results](#)).
2. Select (highlight) and drag the results, which will be displayed in the report, from the "Results" window to the "Report" window with the right mouse button.
3. Select the columns which should be displayed in report. The position of the report columns can be changed by dragging them with the left mouse button to the desired place.
4. Add optional elements to the report (field captions, statistical calculations, text) These elements may be used several times in the report, if necessary.
5. Now, the report can be printed or exported to other software (where it can be edited, saved, printed, etc.). To print the report from Uni, press "Generate" button and then select "Standard report" menu item. The print preview window will appear, containing the report as it will look on the hard copy. The appearance of the report can be modified, using available features. To export the report - press "Export" button and choose one of the available target applications. Current version supports export to Microsoft Word, Excel, Word.

The settings for the report appearance in the "Print preview" window:

- *Display logo* - enables/disables logo imprint on the every side of the report.
- *Fonts* - the settings of the fonts for different report elements.

Technical report

This report should be submitted if requesting technical support from the ELTRA or from the representative of ELTRA.

To prepare the technical report do the following:

1. Press on the black triangle on right part of "Help" combo-button in the main window of the software (see [From: Main menu](#)).
2. Select "Technical report" menu item. "Print preview" window, containing technical report appears.
3. Press "Print" button to print the technical report on the connected printer.

The settings for the technical report in the "Print preview" window:

- *Configuration* - include the current configuration into the report. . *Profile* - include the settings of the current profile into the report.
- *Fonts* - the settings of the fonts for different report elements.

Graph

This report is used for printing the detectors signals curves from the "Graph" window. To prepare the report do the following:

1. Select the result line in the "Results" window (see [Window: Results](#)), for which the detectors signals curves will be printed. The curves appear in the "Graph" window (see [Window: Graph](#)).
2. Adjust desired zoom for the graphic area and the visibility of the signals from different measuring channels. The content of the graphic area of the window will be printed.
3. Press "Print" button in the "Graph" window. The "Print preview window, containing the graph appears.
4. Press "Print" button in the "Print preview window" to print the graph on the connected printer.

The settings in the "Print preview" window:

- *Placement* - the position of the graph on the sheet can be specified. The position of the graph (right upper corner) can be specified by clicking on the sheet in the appeared window with the left mouse button, the size of the graph (right lower corner) can be specified by clicking with right mouse button.

NOTE

- . If there is no printer installed in the operating system, the error message will be displayed, when "Print preview" window appears.
- If the target application for export is not installed, the error message will be displayed, when trying to perform export.

Theory: Result

Description

The results of all analyses carried out are saved in the local database. For every analysis the graphs (detector signals from all available and active measuring channels) and the settings (calibration factors, linearity factors, etc.), which were valid on the moment of carrying out the analysis, are saved. Therefore, any analysis result can be recalculated with the modified settings, currently valid, and it not necessary to repeat the combustions of the samples (analyses) once again if calibration was wrong, for example.

Obtaining the results

In order to obtain the result, analysis must be carried out. The analysis procedure is different for different types of analysers (see Operation manual of the corresponding analyser). The common for all analysers is the following:

1. *Preparation* - the sample together with the accelerator, flux etc. (see Applications chapter of the operation manual) must be prepared. The weight of the sample must be entered to the software. The sample ID and sample number are optional.
2. *Base line stability check* - before carrying out any analysis, the base line stability is checked. The analysis can be started only if the base lines of all measuring channels are at zero and stable (see [Theory: Base line](#)).
3. *Analysis* - the signals from all active measuring ranges are gathered and saved in the database. These signals are displayed in the "Graph" window of the software.
4. *Analysis end* - the criterions for stopping the analysis are checked (comparator level, minimum and maximum analysis times, user stop, user abort). If analysis is finished, the software calculates the results (except the case, when user abort took place) using the current configuration (see [Theory: Configuration](#)), displays the results in the "Status" window (see [Window: Status](#)) and saves them in the database (see [Window: Results](#)). Regardless of the specified filter (see [Form: Filter](#)), the last analysis result will be displayed in the "Results" window.

5 DESCRIPTION OF FUNCTIONS

5.1 *Measuring principle*

The measuring method is based on the principle of sample combustion and the analysis of the gases given off, through infrared absorption.

A wide variety of sample materials in various forms is possible; powder, shavings, solid pieces and also some substances in liquid form. Typical materials are **coal, ashes, steel, cement, soil samples, rubber** etc.

During combustion, the sulphur, hydrogen and carbon components present in the sample are oxidised to form **CO₂, H₂O** and **SO₂**. The combustion temperatures may vary for different samples. The typical combustion temperature for coal analyses is **1350 °C**.

Combustion is obtained by supplying **oxygen**, which at the same time acts as carrier gas. An electronic flow regulator keeps the flow quantity at a constant level of **180 l/h**.

The signals emitted from the infrared cells are selective and correspond to the **SO₂, H₂O** and **CO₂** concentrations in the gas mixture. They are electronically linearised and integrated, divided by the sample weight and digitally displayed as **%C, %H** and **%S**.

Since the sample weight is taken into account, the results are not dependent on the weight. For this purpose, the sample is weighed before being analysed and entered into the analyser. If necessary, blank values can also be entered; the electronic unit takes them into account when determining the results.

The graphical representation of the detectors' signals (peaks) is shown on the PC's screen during and after analyses. At the end of analysis the results are displayed as well. All analysis data for every finished analysis are saved in the PC and remain available for review, results recalculation, calibration, etc. and can be printed out on a printer or exported to other software, if necessary.

5.2 Gas flow system

The **oxygen** supply is connected to the inlet of the **oxygen** system. Pure **oxygen** is available in steel bottles, with **99.5%** this is fully sufficient. Impurities in the oxygen are extracted in the attached trap **(12)**. The upper half of the trap is filled with a **CO₂** absorber and the lower half with a **moisture** absorber.

Magnesium perchlorate (anhydrous) acts as a **H₂O** absorber. **Sodium hydroxide** acts as a **CO₂** absorber, preferably with an indicator, so that the degree of saturation can be seen from the coloration.

The **oxygen** inlet pressure should be **2 to 4 bar**, which is then regulated inside the analyser to **1.5 bar**, as shown on the pressure gauge **(5)**. Any pressure fluctuation of the external **oxygen** supply has no influence on the accuracy of the measurements.

A pressure switch **(4)** shuts its contact at around **1 bar** (15 psi) and switches the pumps on **(20; 21)**. This will ensure that no air will come into the gas flow system. During **longer work breaks** it is advisable to turn the power switch to **setting 1**. This will shut off the oxygen supply. No further manual operations are required.

With the help of the flow adjustment **(6)** the inlet flow will be held to a level of at least **200 l/h**. The flow rate can be read on the lower flow meter **(7)** on the front panel. This flow rate level is fed into the furnace inlet **(9)**. This **tube inlet** can be found **underneath** the platform **(10)**.

The sample in the combustion boat is fed through the inlet **(9)** then to the furnace **(11)**. Combustion is obtained by supplying **oxygen**, which at the same time acts as carrier gas. An electronic flow regulator keeps the flow quantity at a constant level of **180 l/h**.

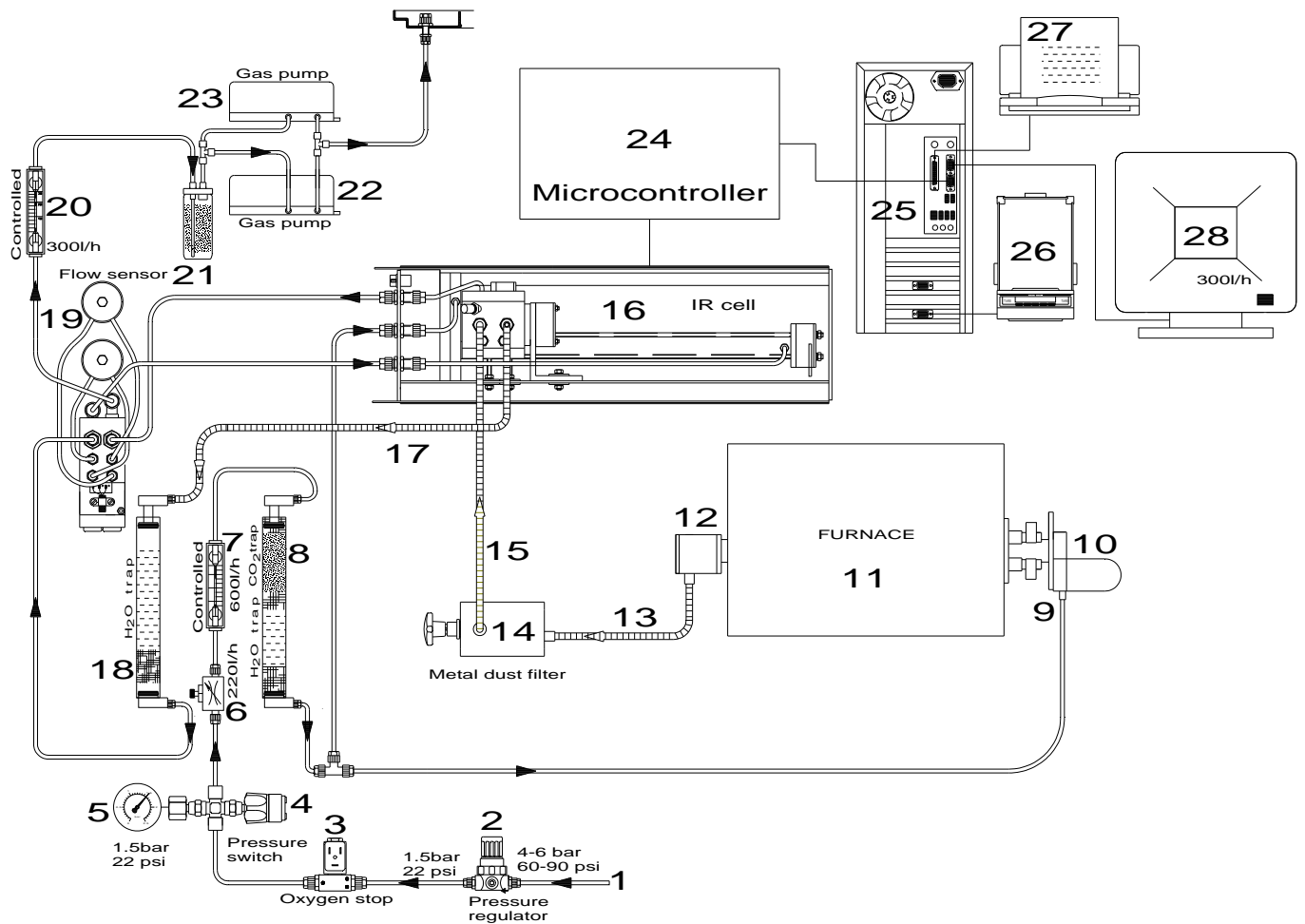
A heated tube **(13)** connects the furnace outlet **(12)** with the heated block with metal dust filter **(14)**. The gases that comes out of the furnace normally contains some dust.

First, hydrogen is analysed in heated IR-path as H₂O in form of steam. Then gas flow goes through moisture trap **(18)**.

After the gas is dried, it is led again through the infrared cell **(16)** for determination of carbon and sulphur content in form of CO₂ and SO₂, resulted from combustion.

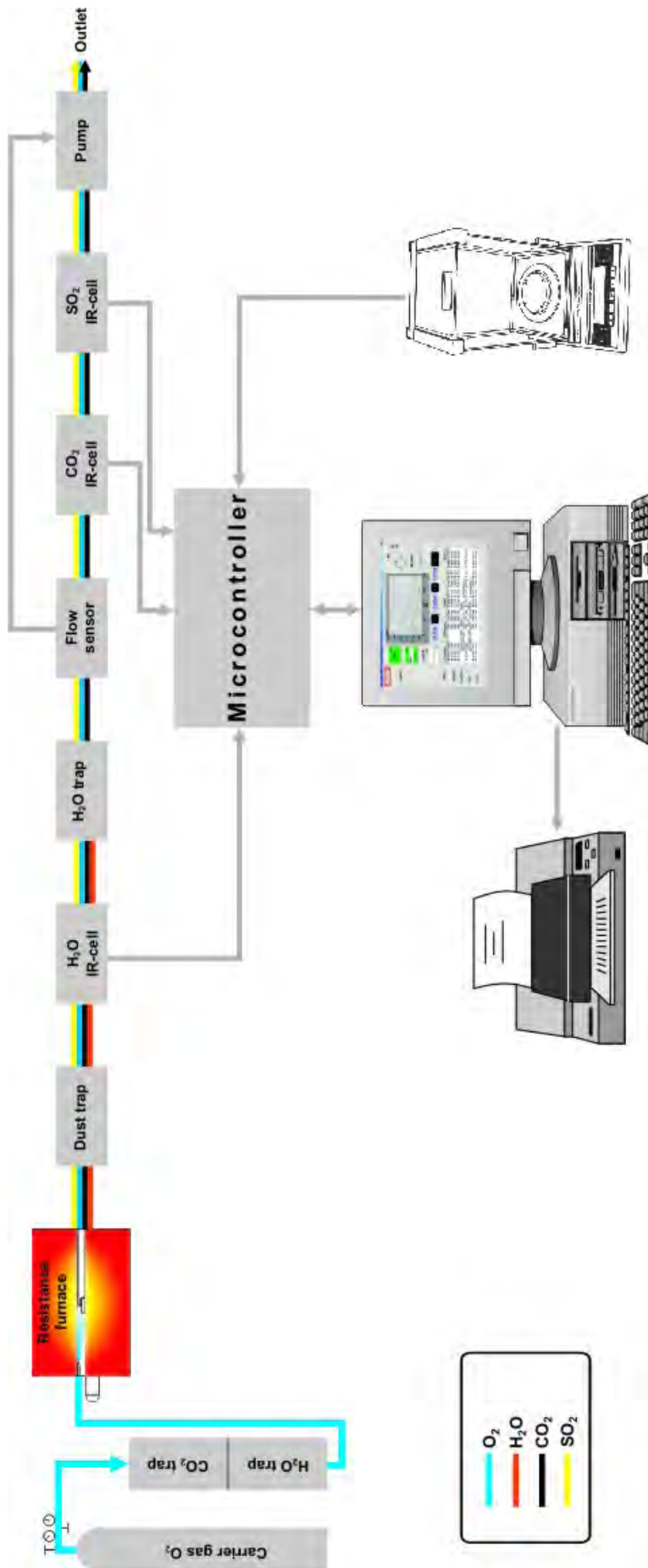
Finally, the gas is fed through the upper flow meter **(20)** on the front side of the analyser. The displayed value must be constant **180 l/h**. The flow is maintained by a pumps **(22; 23)**, which is electronically controlled, the gas flow is monitored by the flow sensor **(19)**. In order to prevent a **pulsation** caused by the membrane oscillators of the pump, damping space **(21)** are installed before and after the pump.

See [diagram next page](#)



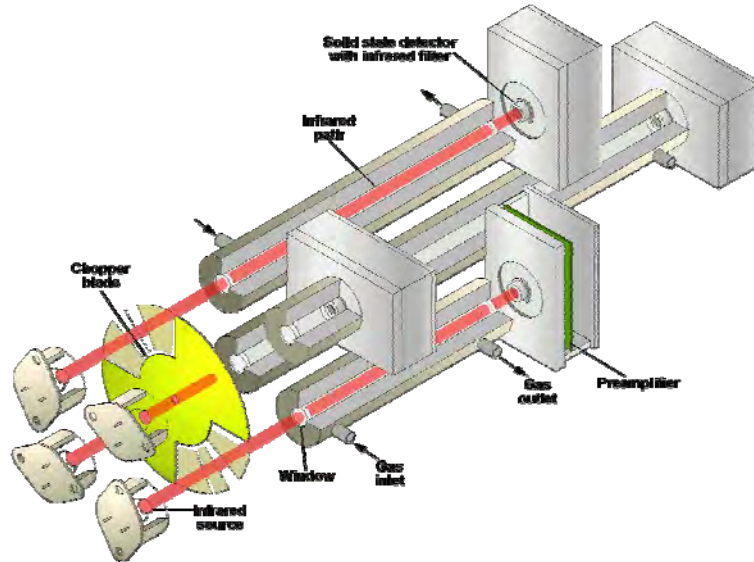
- | | | | |
|-----|------------------------------|-----|-------------------------|
| 1. | Carrier gas inlet | 15. | Heated tube |
| 2. | Pressure regulator | 16. | IR cell |
| 3. | Oxygen valve | 17. | Heated tube |
| 4. | Pressure switch | 18. | Pre-cleaning |
| 5. | Pressure gauge | 19. | Flow sensor |
| 6. | Flow adjustment | 20. | Gas flow display |
| 7. | Gas flow display | 21. | Attenuator for the pump |
| 8. | Moisture trap | 22. | Pump |
| 9. | Furnace inlet | 23. | pump |
| 10. | Furnace platform | 24. | Microcontroller |
| 11. | Furnace | 25. | Computer |
| 12. | Furnace outlet-measuring gas | 26. | Balance |
| 13. | Heated tube | 27. | Printer |
| 14. | Metal dust filter | 28. | Monitor |

Gas flow diagram:



5.3 Infrared cell

The measuring principle is based on the infrared radiation absorbing property of many gases. Each of these gases absorbs specific characteristic spectral wavelengths of infrared radiation. The absorption spectrum is determined by the number, configuration and type of the atoms in the gas molecules.



An infrared source is electrically heated and radiates broad-band infrared radiation. The light is interrupted by a rotating chopper blade, resulting in an alternating light. The chopper is crystal controlled, so that the chopper frequency is highly stable. The infrared radiation then passes through the measuring IR-paths, through which a mixture of combustion gases and carrier gas flows.

Depending on the composition of the gas mixture, certain frequencies of the infrared spectrum are absorbed. The rate of absorption depends on the concentration of the gases.

As the infrared beam leaves the IR-path, it passes through an infrared filter, which only allows a narrow band of infrared radiation to pass. This narrow band must correspond to the IR wavelength for which the sample gas shows its maximum absorption capacity.

The intensity of the radiation after the filter thus corresponds to the concentration of a specific gas in the path. The beam finally strikes a solid state infrared detector, which emits an electrical signal, in proportion to the intensity of the beam.

Since the beam is interrupted by the rotating chopper, as mentioned above, the detector receives an alternating signal. Temperature and aging influences of the detector, as well as noise, are thereby suppressed.

The signal thus obtained is amplified and rectified, so that it leaves the infrared cell as a D.C. value. The infrared cells of the CHS-580 do not require any manual zero adjustments. The zero and sensitivity adjustments of the infrared cells are permanently and automatically controlled by the electronics. The detectors utilize solid state sensors combined with infrared filters. The sensors are not gas filled, thus eliminating long term problems due to gas leakage. The CHS-580 can be equipped with up to three independent infrared cells.

The lengths of all three cells can be individually optimised to obtain maximum precision for the target analyse levels of each customer. Each of the cells can be installed with infrared absorption lengths ranging between 1 mm and 320 mm.

The infrared cell rack is temperature controlled, so that the sample gas which flows through it, is kept at a constant temperature

5.4 Micro-controller unit and PC Software

The micro-controller module (MCU) contains all components for signal processing and control sequencing. It is working exclusively under the control of the PC software, gathering signals for sending to the PC-software and outputting signals received from the PC-software. The communication between MCU and PC is taking place via serial interface (RS-232).

The zero (base line) of every IR-output signal is automatically corrected. This correction takes place continuously, except two cases:

During analysis, it is freezed, after passing the stability-check before start of analysis. It is disabled during performing the IR-output test.

The first stage of the analogue signal processing in the PC is the linearisation. This is necessary because the output signal from the IR-detector shows an exponential characteristic as a function of the sample gas concentration.

The linearisation produces a correction which is exactly opposite to the characteristic of the detector, so that a linearised analysis signal is available.

The second stage is integration. It starts at the beginning of the analysis and ends after a pre-set minimum time. In case the combustion takes longer, the integration is prolonged. Then, the detector signal is compared to a comparator level. The integration continues as long as the IR-output signal is higher than the comparator level. When it comes down below this level, the integration is stopped. Should the IR-signal remain above the comparator level, the analysis is interrupted by a pre-set maximum time. Then the integration is also completed.

The integrated value is directly proportional to the CO₂, H₂O or SO₂ content in the combustion gases. The blank value is deducted from the integrated value.

The integrated value is then multiplied by the calibration factor. After dividing by the sample weight, a result is obtained which is independent from the sample weight.

By the multipoint calibration the results can be calculated to match exactly with the values of certified standard materials.

Finally the results are directly shown as %C, %H and %S on the PC screen.

For instructions of operating the PC-software, please, refer to the Help-function of the Software.

5.5 Furnace

Description:

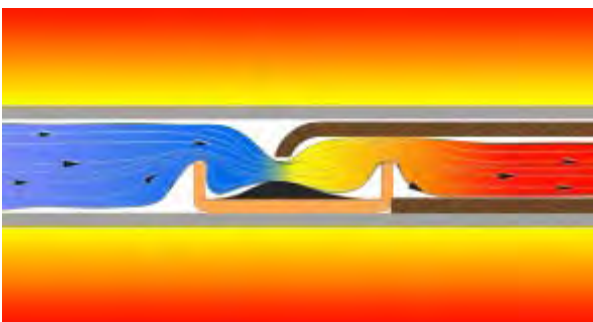
The temperature of this furnace is adjustable up to **1550°C**. The combustion tube has an inner diameter of **27 cm** and a hot zone of about **200 mm**. The temperature, which is digitally displayed, can be adjusted with an accuracy right down to **1°C**. The platform on the front-side of the furnace serves to carry samples for the analyses, as well as their hot remainders, once extracted from the furnace. Inside the furnace inlet there is gas supply jet, to ensure correct dosage of the combustion gas. On request, the furnace can be supplied with a flow meter and adjustable restrictor for the adjustment of the inlet gas flow. At the furnace outlet there is dust trap, together with tube connection. A micro filter, made of stainless steel is also available. A glass tube is connected at the furnace outlet, which can be filled with e.g. moisture absorber or any other absorber. The furnace's robust housing contains a built-in fan; thus ensuring low surface temperature, in order to prevent contact injuries.

Temperature adjustment:

The furnace employs silicon carbide heating elements. Full electronic control includes current limitation during cold-start conditions to promote long element life. A separate sensor is used to monitor ambient temperature and provide data for automatic reference point compensation ensuring that furnace temperature is not affected by fluctuations of ambient temperature. The furnace requires approximately **10 to 15 minutes** to reach the operating temperature.

Combustion efficiency:

The design of the furnace boat stop ensures **oxygen** carrier gas penetrates into the crucible, ensuring efficient combustion. This design eliminates the need for fragile lances and honeycomb boat stops which tend to block easily with ash. Additionally the boat stop protects the combustion tube from the aggressive combustion products, thus extending the life of the tube.



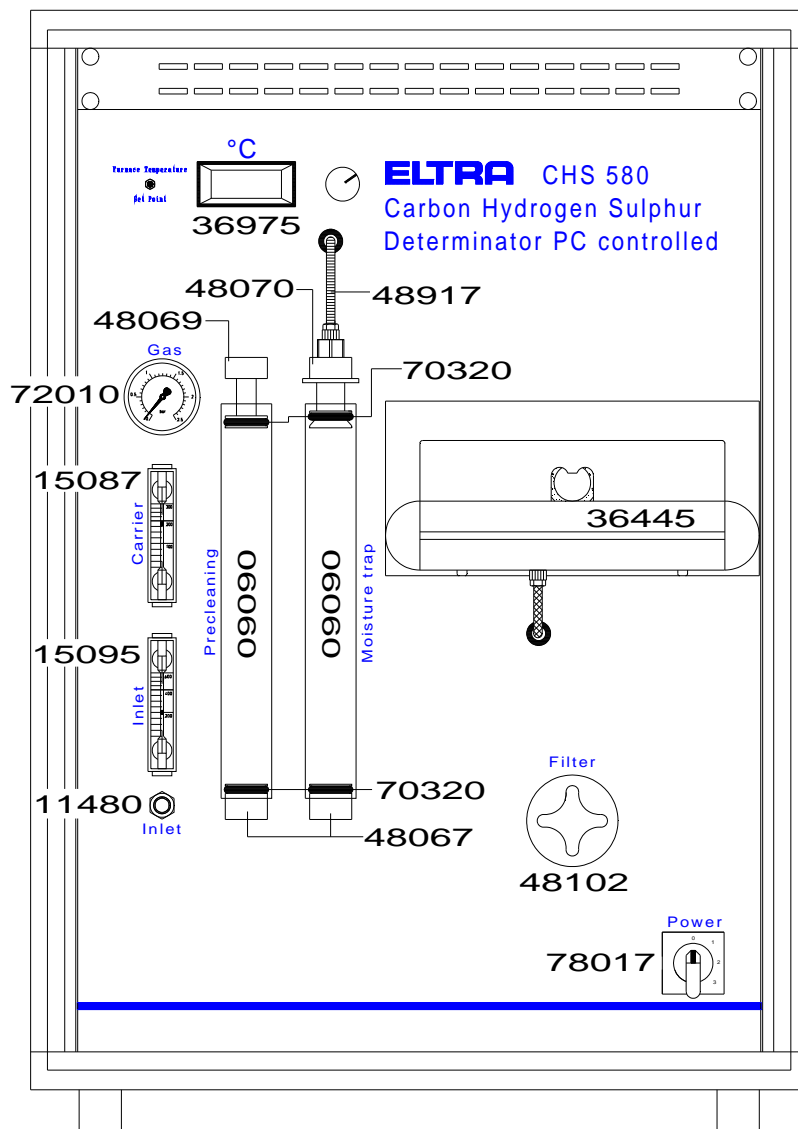
The combustion tube is a simple straight ceramic tube that is robust and inexpensive to replace. The life expectancy of the tube is measured in thousands of analyses and not hundreds as is the case with other analysers. (Protected by German utility model)

A variety of combustion boats can be used in the furnace including the reusable ceramic boats (L=57mm, W=22mm, H=13mm). Porcelain or quartz boats are also an option.

6 MISCELLANEOUS

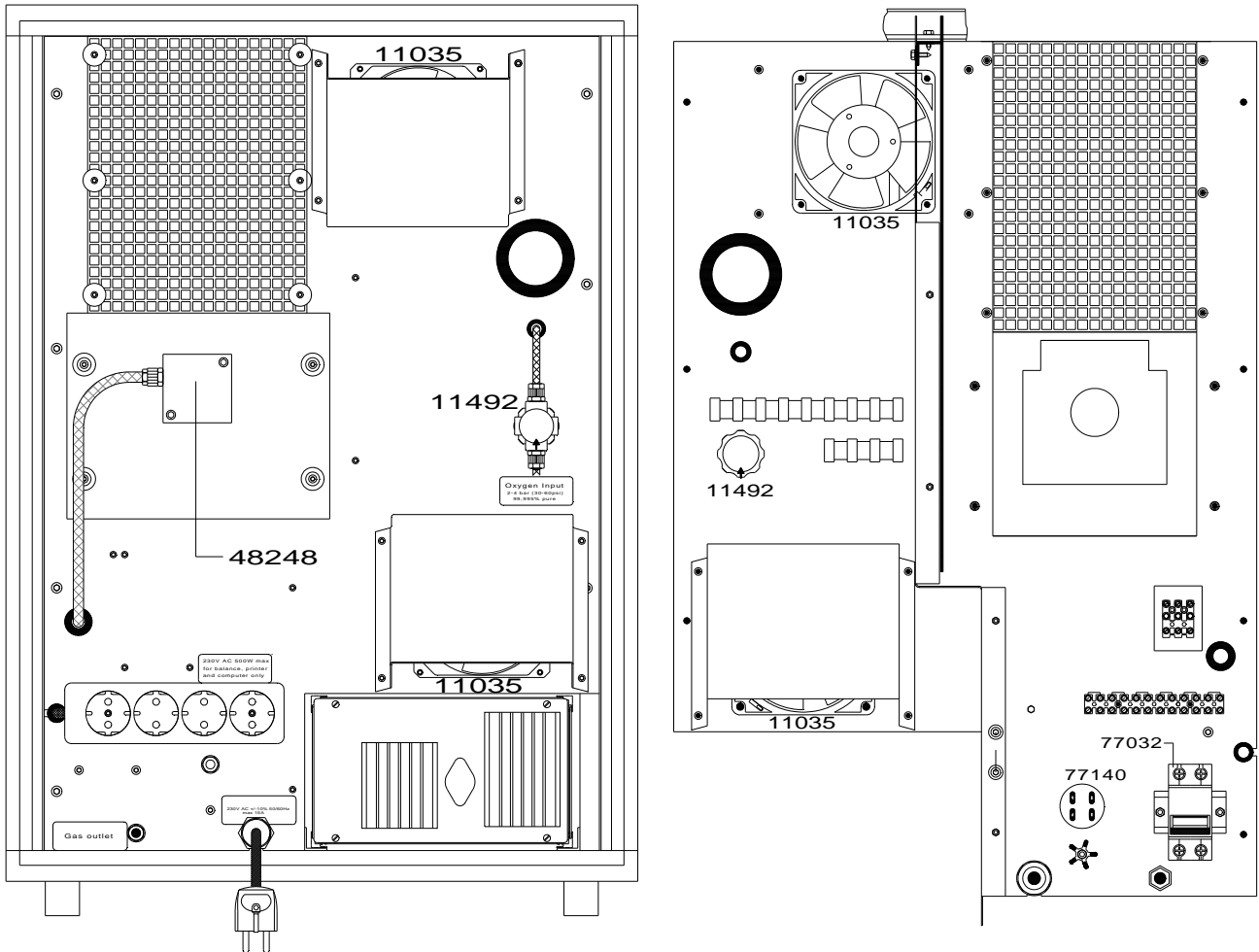
6.1 Ordering numbers

Front side



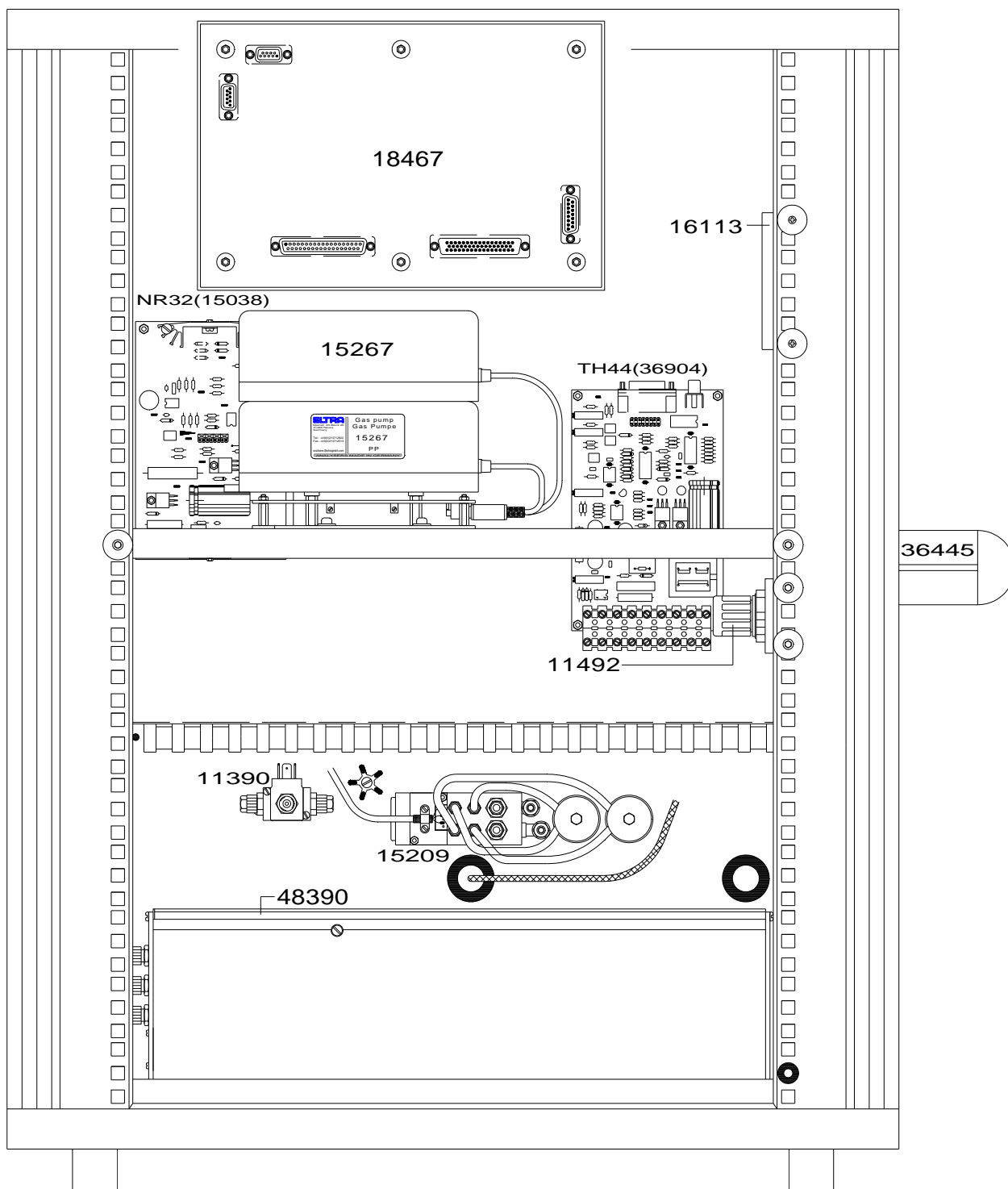
09090	Reagent tube
11480	Adjustable restrictor
15087	Flow display 300l/h
15095	Flow display 600l/h
36445	Platform
36975	Furnace display
48067-	Lower holder for reagent tube
48069	Upper holder for reagent tube
48070	Upper holder for reagent tube
48102	Metal dust filter
48917	Heated tube
70320	O-ring
72010	Pressure gauge
78017	Mains power switch

Rear side:



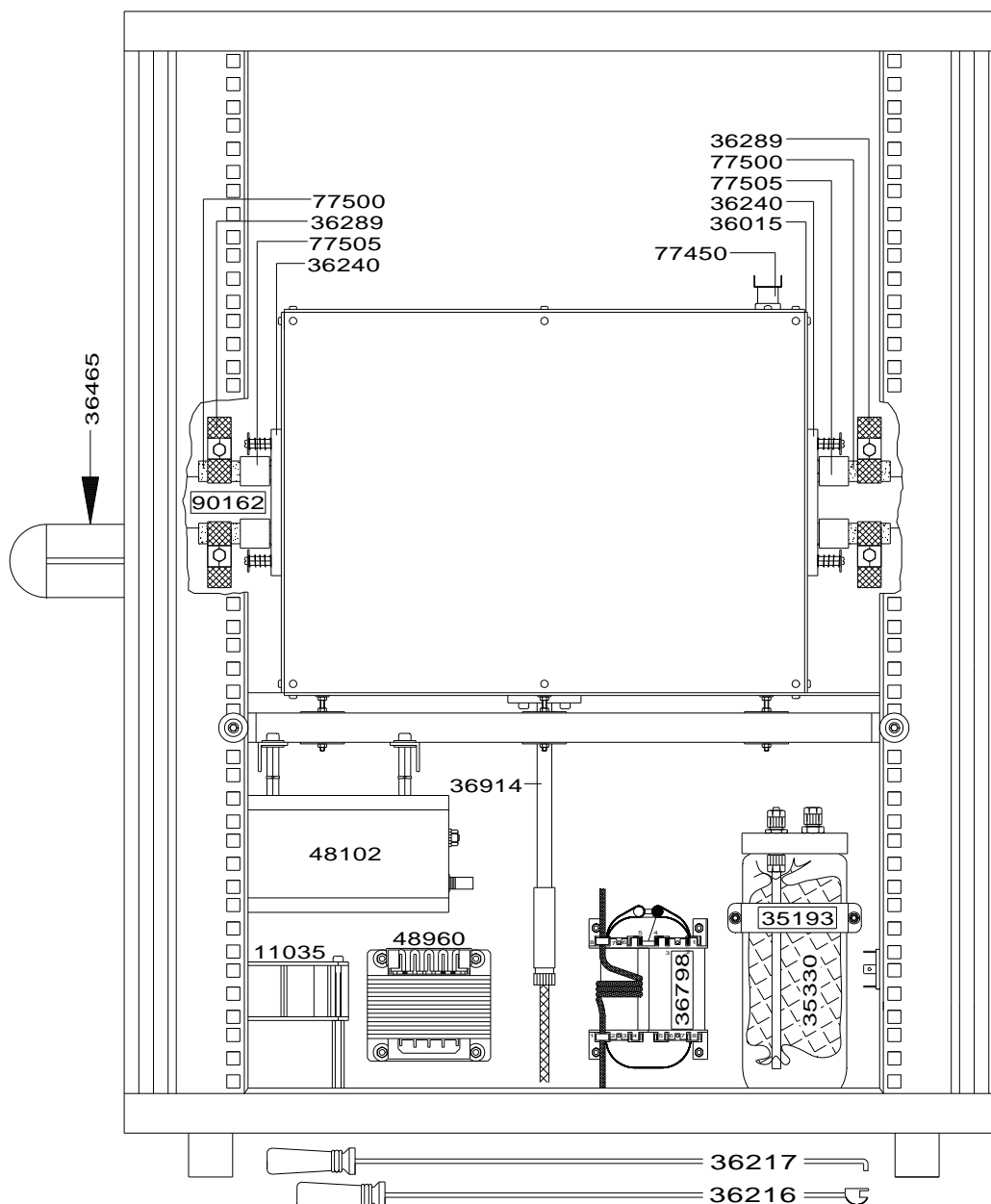
- | | |
|-------|------------------------|
| 11035 | Cooling fan |
| 11492 | Pressure regulator |
| 48248 | Dust box |
| 77032 | Solid state relays 20A |
| 77140 | HF-filter 250V |

Analyser (left side):



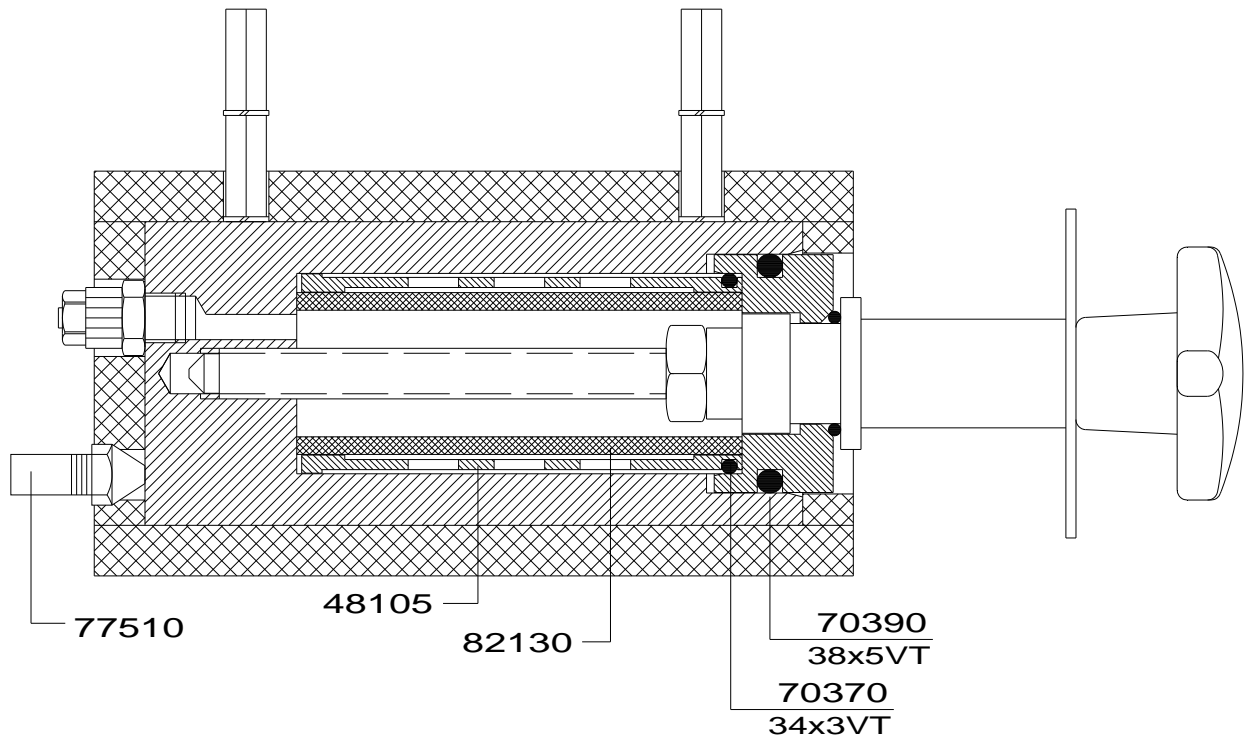
- | | |
|-------|---|
| 11390 | Oxygen valve |
| 11492 | Inlet pressure regulator |
| 15209 | Flow sensor |
| 15267 | Gas pump |
| 15038 | Voltage stabiliser NR32 |
| 16113 | Power supply |
| 18467 | Microcontroller board(18452) with housing |
| 36904 | Temperature control board TH 44 |
| 36445 | Furnace platform |
| 48390 | IR cell |

Analyser (right side):



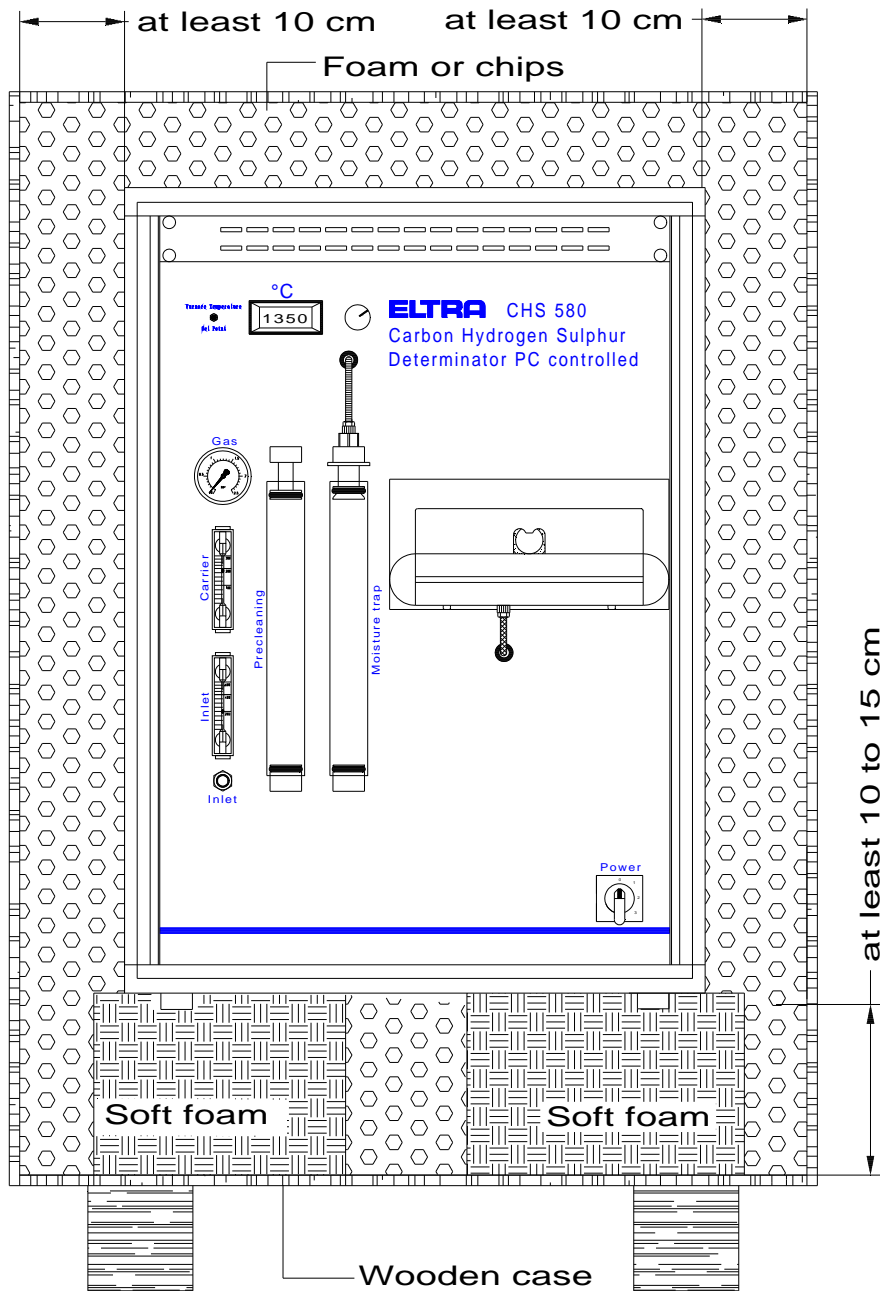
11035	Cooling fan
5330	Attenuator volume
36216	Combustion boat insertion stick
36217	Combustion boat removing stick
36240	Ceramic plate
36289	Heating element connector, 4 pcs
36465	Ceran plate
36798	Transformer
36914	Thermocouple
48102	Metal dust filter
48960	Transformer
77450	Temperature switch
77500	Heating elements, 4 pcs.
77505	Spacers, 4 pcs
90162	Combustion tube

Dust trap



48105	Filter support
70300	O-ring
70370	O-ring
70390	O-ring
77510	Heater
82130	Filter

6.2 Packing



Before being packed in a wooden case, the analyser must be wrapped in plastic foil, in order to protect it from moisture and dust. The wrapped analyser should be surrounded by a layer of **foam (chips)** of at least **10 cm**, in order to avoid any **damage** due through transport.

Especially the foam where the analyser is put on, is very important. It should be neither too hard nor too soft. When the foam is too soft, the analyser will practically touch the wood. Fix the foam on the bottom of the wooden case by gluing.

The analyser should be wrapped in plastic foil, especially when you use chips or any other kind of material in small pieces.

The glass tubes must be empty.

6.3 Pre-installation guide

Following requirements apply, when installing the Analyser ELTRA CHS-580:

Carrier gas	Oxygen 99.5% pure; 2 - 4 bar (30 - 60 psi)
Mains power supply	230 VAC \pm 10%, 50/60 Hz; 20 A solid state relays
Analyser dimension	55 x 80 x 60 cm
Analyser weight	ca. 70 kg

The balance should rest on a vibration free support.

Connections for oxygen and compressed air; outer diameter = R $\frac{1}{4}$ ".
(The tubes supplied together with the analyser have a connector with G $\frac{1}{4}$ " inner diameter).

ELTRA

CONFORMITY CERTIFICATE

We, **ELTRA GmbH**
Mainstr. 85, Block 20
41469 Neuss
Tel.: +49 02137 - 12822
Fax: +49 02137 - 12513

herewith declare, that the instrument CHS-580 produced and sold by us,
has been manufactured in accordance to the following CE standards:

73/23/EEC (Low voltage standard)
amended to: 93/68/EEC

89/336/EEC (Electromagnetic compatibility)

The instruments have been tested in accordance to the following norms:

EN 61010 part 1 (VDE 0411 part 1)
EN 61010-2-010 (VDE 0411 part 2-010)
EN55011 Gruppe 2 Klasse A: 1991+A1: 1997+A2:1996
EN 50082-2: 1995 Parts: EN 61000-4-2, EN 61000-4-3, ENV 50204, EN
61000-4-4, EN 61000-4-6

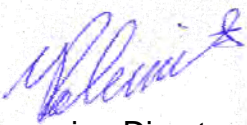
The Eltra products can only be used in an industrial environment.

This declaration is based on:
Testreport(s) of the independent and accredited EMC-Test-Laboratory

ELEKLUF T GmbH
Justus-v.Liebig-Straße 18
53121 Bonn
☎l.: +49 0228 - 6681 – 558
Fax: +49 0228 - 6681 – 792

Any alteration on the instruments without prior authorization from Eltra GmbH,
will cause this declaration to become null and void.

Signed in Neuss on this day of Februar 18, 1998


Managing Director
(J. Polemitis)



Inspection and Quality Certificate

We herewith confirm that the Eltra products manufactured according to the quality and quantity you require.

Thanks to a thorough inspection before shipment, the instrument, together with its accessories, the consumption materials and spare parts, are free of manufacturing defects and will provide excellent performance.

When treated in a proper way for the required application, according to the specifications from our offer, our order acknowledgement and in accordance with our catalogue specifications, the above products will show good results, and therefore will be used to your entire satisfaction.

Y. Polemitis

2009-08-10



Name

Date

Signature

Approved Methodologies to Which ELTRA Instruments Conform

ASTM (ANALYTICAL SOCIETY FOR TESTING MATERIALS)

Metals

Instruments	Method	Elements	Materials
CS-2000 CS-800	ISO-9556	C	Steel & Iron
CS-2000 CS-800	ISO-4935	S	Steel & Iron
CS-2000 CS-800 ON-900 ONH-2000	ASTM E-1019	C, S, N, O	Steel, Iron, Nickel/Cobalt Alloys
CS-2000 CS-800 ON-900 ONH-2000	E-1587	C, S, N, O	Refined Nickel
ON-900 ONH-2000	E-1409	O	Titanium and Titanium Alloys
ON-900 ONH-2000	E-1569	O	Titanium
ON-900 ONH-2000	E-1937	N	Titanium and Titanium Alloys
OH-900 ONH-2000	E-1447	H	Titanium and Titanium Alloys
CS-2000 CS-800 CS-500	E1915-97	C, S	Metal Bearing Ores and Related Materials (f.e. tailings, waste rock)
CS-800 CS-2000	UOP-703-98	C,S	Catalysts

Organics

Instruments	Method	Elements	Materials
CS-2000 CS-500	ASTM D-1552	S	Oils & Petroleum Products
CS-2000 CS-500	D-4239	S	Coal & Coke
	D-5016	S	Coal & Coke Ash
CS-2000 CS-500	D-1619	S	Carbon Black
CS-2000 CS-500	PN-93 G-04514/17	S	Coal & Coke
CS-2000 CS-500	DIN EN 13137	TOC	Waste
CS-2000 CS-800 CS-500	ISO-10694	TC/TOC	Soil samples