Repair Instructions

Bosch Emissions Analysis
BEA 150
BEA 250
BEA 350

In conjunction with Service
software for PC

BOSCH

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# 1. Important information

Installation and/or repair may only be performed by trained and instructed service staff at Robert Bosch GmbH or by an organization nominated by Robert Bosch GmbH. All warranty claims are rendered null and void in the event that any devices are opened or modified by a non-authorized person.

Electrical systems and equipment may only be operated in proper working condition (see also Test Equipment Information 0108_084). This requirement is met if it is ensured following a modification or repair (initial test) that the applicable electrical engineering standards have been complied with. To this end, tests based on the type and scope of measures specified in the electrical engineering standards (e.g. in Germany BGV A2) are to be carried out. The type and scope of tests to be carried out is specified for Germany in VDE 0701/0702 Part 1. Compliance with the corresponding national standards for countries outside Germany must be ensured.

When the BEA is used in systems for which calibration is required by law, legal provisions in the country of use regarding operation, maintenance and calibration must be observed.

The BEA carries dangerous contact voltage. Unsatisfactory or insufficient maintenance and repair work may lead to a risk of accident through electric shock.

The BEA must not be used to measure explosive gases. The exhaust-gas analyzer must not be operated in rooms where there is a risk of explosion.

During work with toxic gases, care must be taken to ensure that a concentration which is hazardous to health cannot arise in the workplace.
Improperly conducted maintenance and repair work may lead to a risk of intoxication when working with toxic gases.

**The printed circuit boards contain electrostatic sensitive devices.**
**Observe ESD regulations!**

## 1.1 Compulsory calibration

The regulations governing the calibration of exhaust-gas analyzers in the specific country of use must be complied with.

**At half-yearly intervals**
the BEA must be serviced by expert, instructed persons.
If an official test seal is broken during such work, proper and expert repair must be performed and confirmed by the authorized Service Agent and a new calibration undertaken by the responsible calibration authorities.

**Service work**
must be recorded in writing, including the following information:

- Time of service
- Type of service work undertaken
- Name of person or company performing the work

These records must be preserved for the duration of five years.
The Operating Instructions must be kept with the BEA so that they are available at all times.

**The owner of the BEA is responsible for compliance with calibration laws and for regular service and maintenance.**

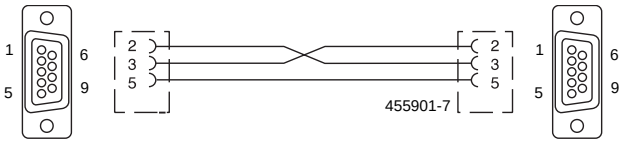
## 2. Testing equipment and settings for the Service software

### 2.1 Testing equipment

- 1 laptop or PC
- P100
- P140
- Service software for BEA
- ESA module system software to test Engine test functions
- KTS module system software to test OBD functions

The system software versions for Emissions System Analysis and the KTS module must be installed on your laptop or PC, otherwise the Service software will not be fully functional!

- BEA - PC or laptop, COM1 connecting lead.
  As an alternative to the lead shown, the connecting lead for the data terminal (DTL) 1 684 465 320, can be used.




- Adaptor cable AL350 to check OBD connecting line to control device.
- Test connector KS350 to check OBD interface in BEA
- 1 flow meter (rotameter), measuring range 1.5 to 2 l/min or 10 l/min, test medium air, 20 °C, 1 bar absolute
- 1 absolute-pressure gauge (barometer) or adjusting barometer set to absolute pressure. Measuring accuracy 5 hPa (5 mbar)
- 1 gas wash bottle (pearl bottle)
- 1 digital multimeter (DMM)
- 1 DC calibrator, 0 to 15 mV
- 1 stabilizer DC U = 0Volts - 30Volts
- Viton hose for calibrating-gas connection (do not use hoses of different material)
- 1 U-tube, water gauge 100 cm, inside diameter max. 8 mm
- Compressed air for cleaning exhaust-sample probe and hose
- Torque screwdriver 0.2 - 4 Nm
  Insert for inner TORX screws size T15

### 2.2 Calibrating gases (with manufacturer's certificate)

In order to save on calibrating-gas bottles, we recommend a calibrating-gas bottle filled with mixed gases:

No. 4 5 % CO + 7.5 % $CO_2$ + 2.000 ppm $C_3H_8$ (propane)*, accuracy of analysis ± 1%

In some countries (e.g. Germany), calibrating gases to OIML Directive R99 A and B are used for calibration. In this case, gas no. 4 can be dispensed with.

A 2000 ppm vol. $C_3H_8$ (propane)*, accuracy of analysis ± 1%
3.5 % vol. CO, accuracy of analysis ± 1%
14 % vol. $CO_2$, accuracy of analysis ± 1%

B 200 ppm vol. $C_3H_8$ (propane)*, accuracy of analysis ± 2%
0.5 % vol. CO, accuracy of analysis ± 1%
6 % vol. $CO_2$, accuracy of analysis ± 1%

* For practical reasons, the exhaust-gas analyzer module is calibrated regularly with propane instead of hexane.
When the exhaust-gas analyzer module is calibrated in the menu **Readjustment with test gas** in the **Test functions** menu, the module is informed of the concentration of the calibrating gas in **ppm propane**. The exhaust-gas analyzer automatically takes account of the required "propane factor".

**Additional test equipment and calibrating gas for optional NO measuring sensor**

- NO calibrating-gas bottle: From 1000 to 5000 ppm NO $\pm$ 2 %
- Shutoff valve
- Stopwatch
- 0 - 12 V DC stabilizer

## 2.3 Settings for the Service software

The Service software contains the functions for **AMM** (exhaust-gas analyzer module), **RTM** (opacimeter) and the **BEA** (Bosch Emissions Analysis) control module.
Your laptop or PC must also have the system software for the emission system analysis and KTS module installed.

### 2.3.1 Setting the interface for the Service program

Start the Service program **BEAKD.**
Open the **File** menu.
Select **Set** and then **Interface**.


Select the appropriate interface and confirm by double-clicking the left-hand mouse button or by pressing ↵ **Enter** .


The interface you have selected is displayed below the results window.


### 2.3.2 Service Software Language Selection

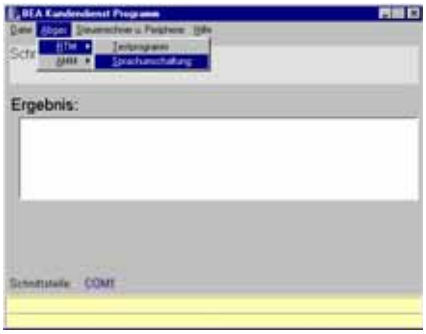
Start the service program **BEAKD**.
Open the **File** menu.
Go to **Settings** and select the **Language** menu.


Use the mouse or the ↑ and ↓ keys to select the laguage for the service program. Confirm by double clicking the mouse button or pressing the Enter ↵ key.

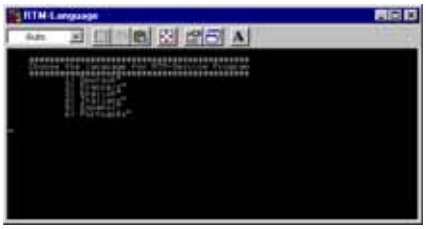
The following languages are available:
English
German
French

### 2.3.3 Language Selection for RTM 430 Smoke Opacity Module Service Software

Open the **Exhaust Gas** menu and select the **RTM** menu.
Open the **Swap Languages** menu.




A DOS window is opened with a language-selection capability.
Choose the language, by pressing the appropriate number in front of the language on your keyboard.
After entering the corresponding number, the language is automatically changed to.



# 3. Brief description of unit functions and Servicing the unit

## 3.1 Exhaust-gas analyzer module

The exhaust-gas analyzer module is designed for the following measuring ranges:

- Carbon monoxide (CO) 0...10.00 % vol.
- Hydrocarbons (HC) 0...9999 ppm
- Carbon dioxide ($CO_2$) 0...18 % vol.
- Oxygen ($O_2$) 0...22 % vol.
- Excess-air factor (lambda) 0.500...9.999
- Nitrogen monoxide (NO) 0...5000 ppm vol. NO

### 3.1.1 Analyzer part (HC, CO and $CO_2$ measurement)

The measuring channels for HC, CO and $CO_2$ function using the infrared pulsating-light method.
This technique makes use of the ability of different gases to absorb infrared rays of a certain wavelength.
An infrared ray is produced by a lamp and interrupted in cycles by a chopper wheel, then it passes through analysis systems for CO, HC and $CO_2$ in succession. The individual analysis systems are sensitive to infrared light of different wavelengths and can therefore be mechanically arranged one behind the other.
Each of these systems consists of an analysis chamber through which test gas flows, and a receiving chamber filled with a suitable gas mixture.
The systems are constructed in such a way that when zero gas (air) flows through the analysis chamber, a maximum electric alternating-voltage signal – the measured-value signal – is generated in the receiving chambers.
The signal is amplified by the appropriate channel amplifier, rectified and conveyed on the motherboard to an analog-to-digital converter (ADC). The digitalized signal is read and stored by the MPU.
When test gas containing the component to be measured flows through the analysis chambers, component-specific wavelengths of the infrared ray are attenuated accordingly. A smaller measured-value signal is generated in the receiving chambers (see gas circuit diagram, Section 12.5).

### 3.1.2 System calibration

System calibration is always started automatically when the system switches to a measuring mode and the infrared measured values at this moment differ from zero.
During system calibration, a solenoid valve switches the zero-gas inlet (with carbon canister) into the test-gas duct for the duration of calibration. During this process, zero gas (air) is used to determine the actual system sensitivity of the HC, CO and $CO_2$ measuring channels. This value is then stored as the zero point. If the exhaust-gas analyzer module is still in analysis mode after 15 minutes, system calibration is repeated. Here, the analyzer module automatically checks whether analysis is currently taking place and, if it is, delays system calibration until all measured values have fallen to zero.

### 3.1.3 Self-test

The BEA performs a self-test during which it checks all its most important functions. Any malfunctions detected result in an error message (Section 8).

### 3.1.4 Adjustment (HC, CO and $CO_2$ measuring channels)

During 1-point adjustment (recalibration) with calibrating gas, the measurement effect (difference from zero) is measured. The analyzer module is informed by means of a **nominal value** as to which concentration of calibrating gas corresponds to this measurement effect.
You may preselect different adjustment options which vary in type and frequency, to suit your application.

### 3.1.5 $O_2$ measuring channel

The sensitivity of this measuring channel is adjusted automatically during each system calibration. During this process, the measured oxygen content is set against the compensating air = 20.9 % and the condition of the $O_2$ measuring sensor is monitored. The zero point of the $O_2$ measuring channel is recognised automatically.
The oxygen measurement function can be deactivated (Section 4.5, **Write parameters** menu).

### 3.1.6 Compensation of pressure influence

Different levels of atmospheric pressure mean that different concentrations are measured in the analysis system. In order for the exhaust-gas analyzer module to achieve a correct measurement, the atmospheric pressure to be taken into consideration is determined by means of an integral pressure sensor. The exhaust-gas analyzer module can then calculate the correct displayed value itself.

### 3.1.7 Compensation of temperature influence

Temperature sensors are situated on the receiving chambers and on the infrared lamp. The operating temperatures measured there are automatically taken into account during the adjustment of the exhaust-gas analyzer module and the conversion of the measured value to the displayed value.

### 3.1.8 Measurement of excess-air factor (lambda)

The exhaust-gas analyzer module calculates the excess-air factor (lambda $\lambda$) from the measured concentrations of CO, HC, $CO_2$ and $O_2$. The lambda value is indicated on the display if the measured $CO_2$ content exceeds 2 % and both the oxygen measurement and excess-air measurement functions are activated. The oxygen measurement is extremely important for calculating the excess-air factor. An imprecise oxygen measurement leads to the incorrect calculation of the excess-air factor. The lambda measurement function can be deactivated (Section 4.5, **Write parameters** menu).

### 3.1.9 Corrected CO concentration ($CO_{vrai}$)

The exhaust-gas analyzer module calculates the true CO concentration ($CO_{vrai}$) from the concentrations of CO and $CO_2$. This process also takes , for example, factors such as leaks in the exhaust system into consideration.
This function can be deactivated (Section 4.5, **Write parameters** menu).

### 3.1.10 Parameterization

The exhaust-gas analyzer module can be parameterized for its specific intended tasks in the **Set parameters** menu (Section 4.5). Additional possibilities for parameterization are contained in the **Adjustment functions** menu (Section 9). However, these - like the adjustment functions themselves - can only be accessed if a test seal has been broken.

### 3.1.11 Filtration

Particles and aerosols are removed from the test gas by a cascade of filters.
Particles constitute solid bodies such as dust and soot, while aerosols are tiny droplets of fluid which condense in the gas duct and analysis chambers. There they form a coating which may give rise to error messages.
For this reason, it is **imperative** to ensure the correct manner of filtration.

### 3.1.12 Principle of filtration

The first filter, **GF1**, filters the majority of particles and aerosols out of the gas flow. This filter clogs most rapidly and must therefore be replaced most frequently: **about once a week.**

The inlet filter, **GF2**, at second place in the cascade, filters out a further part of particles and aerosols. The more clogged the filter is, the smaller the mesh size and thus the better the filtering action. The filter becomes wet very quickly from water in the exhaust gas. This moisture washes the aerosols out of the flow of gas and filters the particles better. **A wet filter is therefore desirable!**
This filter should be replaced from around once a month to once a year.

Filters **GF3** and **GF4** have the task of protecting the internal pumps. When the filtration system as a whole is being used correctly, these filters must only be replaced once a year, at the most.
Filter **GF4**, in particular, also has a better filtering action when wet than dry.

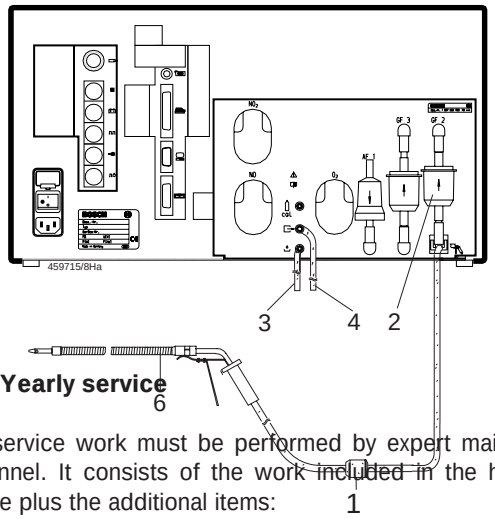
## 3.2 Servicing the unit

The service work listed below must be performed irrespective of legal requirements in the country of operation.

### 3.2.1 Half-yearly service

ℹ At this interval, only work for testing and maintaining operational readiness must be performed.

1. Replace GF1 filter (Item 1)
2. Replace inlet filter GF2 (Item 2)
3. Check that both PVC hoses are connected to the gas outlet (Items 3, 4)
4. Visual inspection of exhaust-sample probe (Item 6)
   In the case of major contamination, blow out with compressed air against the direction of suction
5. Perform leak test (Sec. 4.2)
6. Update service date (Sec. 4.7.8)




### 3.2.2 Yearly service

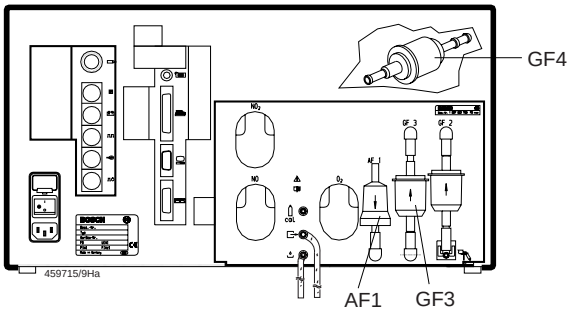
This service work must be performed by expert maintenance personnel. It consists of the work included in the half-yearly service plus the additional items:

! It is essential to read Sections 3.1.11 (Filtration) and 3.1.12 before replacing the filters!

1. Replace pump protection filters GF 3 and GF4.

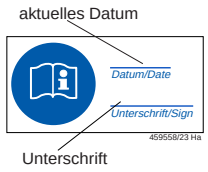
ℹ The pump protection filter GF4 is situated in the interior of the unit.

! When the GF4 filter is replaced annually, the internal piping should also always be replaced. Use the parts set 1 687 010 125 for this purpose. Be very careful to consult the gas flow plan in chapter 12.5.



**Procedure:**

Using a non-soluble felt pen, write the current date on the adhesive label 1 689 980 296 and confirm with your signature (see illustration).




Stick the completed adhesive labels onto the new GF3 and GF4 coarse filters.
Install the new GF3 and GF4 coarse filters.

2. Replace the carbon canister AF1 in the zero gas pipe.

3. Check the measuring accuracy of the exhaust-gas analyzer with calibrating gas.

Always ensure a flow rate of ≥ 1 l/min when letting gas flow through the calibrating-gas inlet. Allow a sufficient warm-up time (min: 5 minutes).
Click on **Test functions** (Sec. 4.7) and open the menu item **Analysis mode** (Sec. 4.7.6).
Automatic zero calibration takes place.
Let test gas no. 4 (sensitivity test) or single gases of the appropriate concentration in succession flow through the exhaust-gas analyzer via the calibrating-gas inlet. Note down the displayed values.
Next, use test gases no. 5 and no. 1 (gas mixture for sag test) to check linearity, and note down the displayed values.
If the display deviates from the certified calibrating-gas value during a measurement (sensitivity or linearity) by more than 5 %, replace the measuring bank (Section 10.10).

If regular calibration is required due to special regulations, execute the menu **Readjustment with test gas** (4.7.5) in the **Test functions menu** (4.7). This will reset the monitoring clock.

## 4. Checking the AMM exhaust-gas analyzer module

Open the **Exhaust gas** menu and select **AMM**.
Then choose the **Test program** menu.


The **Function selection menu** (main menu) opens.


The Function selection menu contains the following items:

| | |
|---|---|
| **Read operating mode** | Display the current status (mode) of the exhaust-gas analyzer module. |
| **Leakage test** | Perform a manual leak test. |
| **Read measurment values** | Display current measured values of HC, CO, $CO_2$, $O_2$, lambda $CO_{cor}$ and air pressure. |
| **Read parameters** | Read out set parameters. |
| **Write parameters** | Enter parameters which are important for the operation of the exhaust-gas analyzer module (country-specific stipulations). |
| **Identification** | Read out software version and checksum. |
| **Test functions** | Check unit functions. |
| **Read adjustment data** | Display setting data important for operation of the exhaust-gas analyzer module (country-specific stipulations). |
| **Adjustment functions** | Settings for the exhaust-gas analyzer module. |
| **Reset** | Restart the exhaust-gas analyzer module. (When this option is selected, the exhaust-gas analyzer module is disabled for approx. 15 s). |
| **Error inquiry** | Read out the internal fault memory. |
| **NO - Sensor** | Menu for operating the NO - Sensor. |

## 4.1 Read operating mode

The current status (mode) of the exhaust-gas analyzer module is displayed. Depending on when this menu is started, the following modes may be displayed:

- Leakage test
- Warm-up phase
- Standby
- Error message


## 4.2 Leakage test

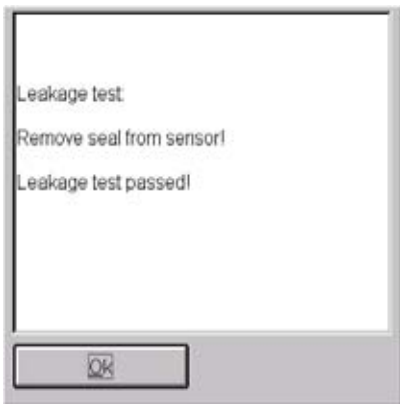
This menu allows you to perform a leakage test manually to check the tightness of the exhaust-gas analyzer module.

Seal off the exhaust-sample probe with the plastic hose or the test bush and confirm by pressing ↵ or clicking **OK**. Follow the instructions on screen.


The pump is then switched on and off in cycles over a period of approx. 3 sec. until a certain level of vacuum is reached. After this, the exhaust-gas analyzer module measures the drop in pressure over a period of 15 s. The time is counted backwards from 15 s to 0.

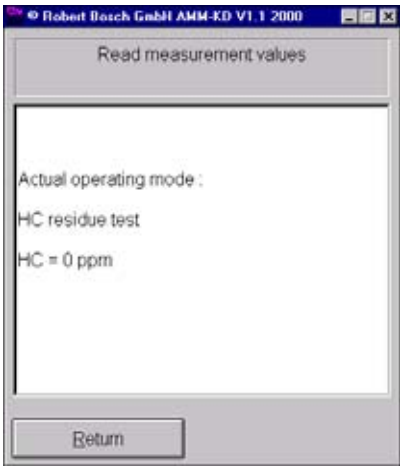

Remove the seal from the exhaust-sample probe and confirm by pressing ↵ or clicking **OK**.

If the leakage test is failed, perform trouble-shooting as described in Section 8.

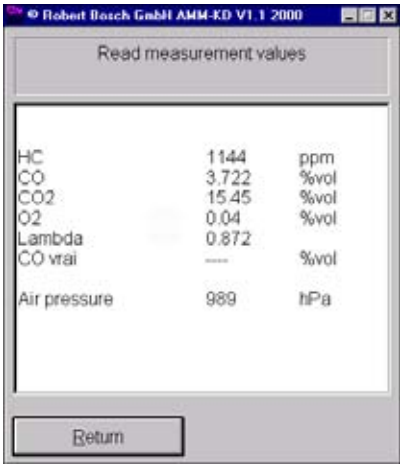


## 4.3 Read measurement values

After zero calibration, an HC residue test takes place.

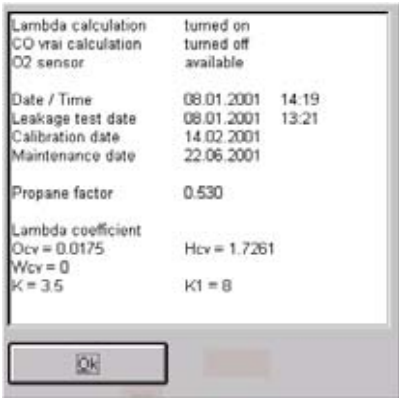



Next, the current measured values for HC, CO, $CO_2$, $O_2$, lambda, $CO_{cor}$ and air pressure are displayed.




## 4.4 Read parameters

The parameters set in the Set parameters mode (Section 4.5) are displayed. For example:




## 4.5 Write parameters

Parameters specific to the country of use or required by law are set in this menu.

### 4.5.1 Country-specific settings

**Parameter settings**

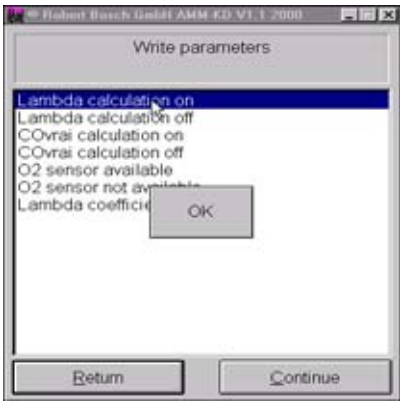
| Parameter | Germany | Standard EU | Denmark | Switz. | France | Holland | Italy |
|---|---|---|---|---|---|---|---|
| Lambda calculation | ON | ON | ON | ON | ON | ON | ON |
| $CO_{cor}$ calculation | OFF | OFF | ON | OFF | ON | OFF | OFF |
| $O_2$ measurement | ON | ON | ON | ON | ON | ON | ON |

**Adjustment data settings**

| Setting | Germany | Standard EU | Denmark | Switz. | France | Holland | Italy |
|---|---|---|---|---|---|---|---|
| Recalibration interval | 365 days | 365 days | 365 days | 365 days | 365 days | 365 days | 365 days |
| Gases for recalibration | HC, CO, $CO_2$ | HC, CO, $CO_2$ | HC, CO, $CO_2$ | HC, CO, $CO_2$ | HC, CO, $CO_2$ | No setting | HC, CO, $CO_2$ |
| Reaction when recalibration due | Disable | No setting | No setting | Disable | No setting | Message | No setting |
| Leak test configuration | Days | Days | NO | Days | NO | Days | Days |
| Leak test interval | 1 day | 1 day | NO | 1 day | NO | 1 day | 1 day |
| HC residue test | YES | YES | YES | YES | YES | YES | YES |
| National regul. complied with | YES | NO | YES | YES | NO | YES | YES |
| Change $CO_{cor}$ setting | Disabled | Enabled | Disabled | Disabled | Enabled | Disabled | Enabled |
| Service interval | 183 days | 183 days | 183 days | 183 days | 183 days | 183 days | 183 days |

### 4.5.2 Lambda calculation On

Open the **Lambda calculation on** menu using the ↑ ↓ keys and confirm with ↵ or by double-clicking the mouse.
The **OK** box is displayed for approx. 1 s.
Lambda calculation is now activated.




### 4.5.3 Lambda calculation Off

Open the **Lambda calculation off** menu using the ↑ ↓ keys and confirm with ↵ or by double-clicking the mouse.
The **OK** box is displayed for approx. 1 s.
Lambda calculation is now deactivated.


### 4.5.4 $CO_{vrai}$ calculation On

Open the **$CO_{vrai}$ calculation on** menu using the ↑ ↓ keys and confirm with ↵ or by double-clicking the mouse.
The **OK** box is displayed for approx. 1 s.
$CO_{cor}$ calculation is now activated.


### 4.5.5 $CO_{vrai}$ calculation Off

Open the **$CO_{vrai}$ calculation Off** menu using the ↑ ↓ keys and confirm with ↵ or by double-clicking the mouse.
The **OK** box is displayed for approx. 1 s.
$CO_{cor}$ calculation is now deactivated.

### 4.5.6 $O_2$ sensor available

Open the **$O_2$ sensor available** menu using the ↑↓ keys and confirm with ↵ or by double-clicking the mouse.

After confirmation that the $O_2$ sensor is not available, the measuring chamber's measuring computer (SI BENCH) is re-started. After this it jumps back to the **Set parameters** sub menu.

ℹ The exhaust-gas analyzer is then once more in the warm-up phase. Further measurement with the Service software is disabled for 60 seconds. A message appears on screen.


### 4.5.7 $O_2$ sensor not available

Open the **$O_2$ sensor not available** menu using the ↑↓ keys and confirm with ↵ or by double-clicking the mouse.

After confirmation that the $O_2$ sensor is not available, the measuring chamber's measuring computer (SI BENCH) is re-started. After this it jumps back to the **Set parameters** sub menu.

ℹ The exhaust-gas analyzer is then once more in the warm-up phase. Further measurement with the Service software is disabled for 60 seconds. A message appears on screen.


### 4.5.8 Entering lambda coefficients $OC_V$ and $HC_V$

ℹ Lambda coefficients must also be set in accordance with regulations specific to the country of use and must be stipulated by the law of that country. Lambda coefficients $OC_V$ and $HC_V$ are fuel-specific values and are required to calculate the lambda value.

Enter the values for $OC_V$ on the keyboard and confirm by clicking **OK** or by pressing ↵.
e.g.: 0.0175.

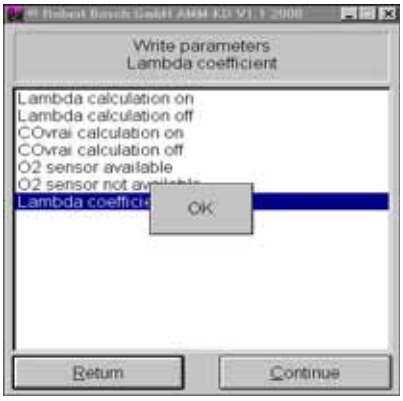

Enter the values for $HC_V$ on the keyboard and confirm by clicking OK or by pressing ↵.
e.g.: 1.7261.

### 4.5.8 Entering lambda coefficients $HC_V$ and $OC_V$

You are now asked if your entry is correct.


Confirm your entry by clicking **Yes** or by selecting **Yes** with the → ← buttons and pressing ↵.

The **OK** box is displayed for approx. 1 s. The $HC_V$ and $OC_V$ values are stored in the exhaust-gas analyzer.




If you have entered the values incorrectly, click **No** or cancel your entry with ↵. Enter the lambda coefficient values again.

## 4.6 Identification

The software version and checksum of the exhaust-gas analyzer module are displayed. For example (see screenshot):


## 4.7 Test functions

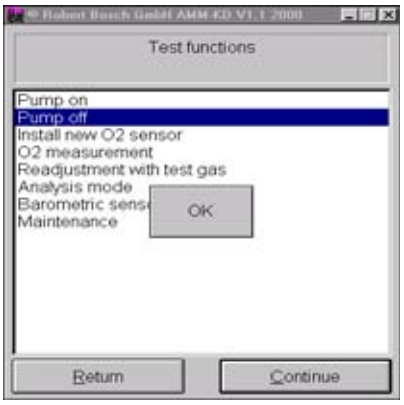
You can test various functions of the exhaust-gas analyzer module in the **Test functions** menu.

### 4.7.1 Pump On

Select this menu by double-clicking the mouse or with the ↑ ↓ keys and confirm with ↵.
The pump is switched on and the **OK** box is displayed for 1 s.
This function can be used, for example, to purge the exhaust-gas analyzer module if it has been contaminated with HC.


### 4.7.2 Pump Off

Select this menu by double-clicking the mouse or with the ↑ ↓ keys and confirm with ↵.
The pump is switched off and the **OK** box is displayed for 1 s.

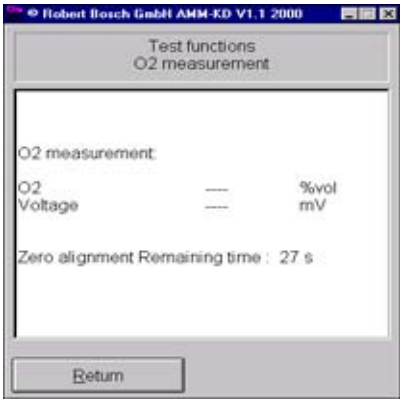



### 4.7.3 Install new O2 sensor

**See Section 10.11.**

### 4.7.4 $O_2$ measurement

Start the menu by double-clicking the mouse or with ↵.
The pump is switched on and zero calibration takes place. During this process, the $O_2$ measuring channel is recalibrated to 20.9% $O_2$ (this same calibration is also performed automatically during each system calibration with zero gas/air).




After zero calibration, the pump is switched off.
The exhaust-gas analyzer module displays the concentration of oxygen with the current ADC voltage value below it.
If the current ADC voltage lies at the lower threshold of 7 mV, you must replace the $O_2$ measuring sensor (Section 10.11).

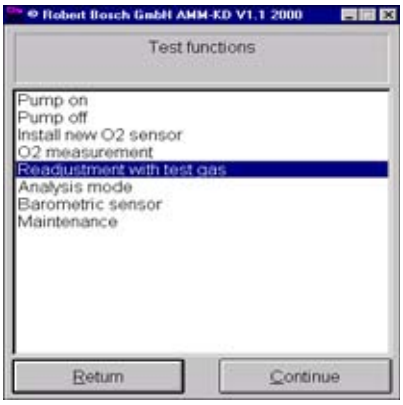
**Nominal voltage:** 7 mV - 11 mV

### 4.7.5 Readjustment with test gas

A distinguishing feature of the exhaust-gas analyzer module is the excellent long-time stability of its measuring accuracy. Despite this, the exhaust-gas analyzer may be required by law or by the regulations of approval authorities to be recalibrated with calibrating gas at given intervals.

To recalibrate the exhaust-gas analyzer, you will need a calibrating-gas mixture with the following concentrations (depending on requirements):

HC: 400 to 2000 ppm vol $C_3H_8$, entry in propane
CO: 1% to 10% vol CO
$CO_2$: 5% to 18% vol $CO_2$




Using the keyboard, enter the calibrating-gas values for **CO** as stated on the certificate.

Confirm your entry of these values by clicking **OK** or by pressing ↵.


Using the keyboard, enter the calibrating-gas values for **$CO_2$** as stated on the certificate.

Confirm your entry of these values by clicking **OK** or by pressing ↵.


Using the keyboard, enter the calibrating-gas values for **HC** as stated on the certificate.

Confirm your entry of these values by clicking **OK** or by pressing ↵.

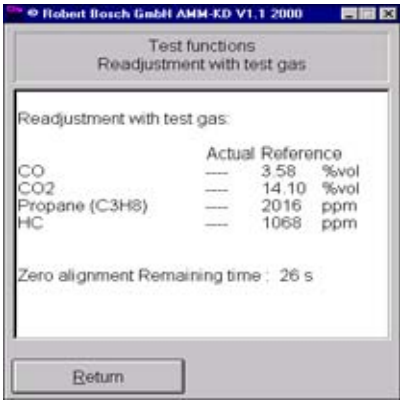
### 4.7.5 Readjustment with test gas

Set the flow to ≥ 1 l/min.

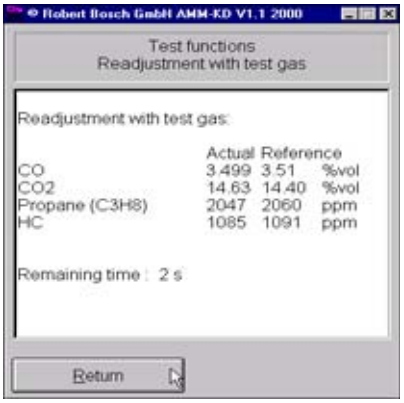
ℹ Only push the calibrating-gas hose onto the calibrating-gas inlet following successful zero calibration.

The calibrating-gas mixture must be fed into the calibrating-gas inlet.


The exhaust-gas analyzer module performs zero calibration.




After zero calibration, push the calibrating-gas hose onto the calibrating-gas inlet.
Start the flow at ≥ 1 l/min.
The calibrating-gas values are displayed.
Over a period of 30 seconds, the software of the exhaust-gas analyzer module compares the measured values with the entered nominal values.




If readjustment with test gas has been successful, quit the menu by clicking on **OK** or with ↵.
The screen now returns to the **Test functions** menu.

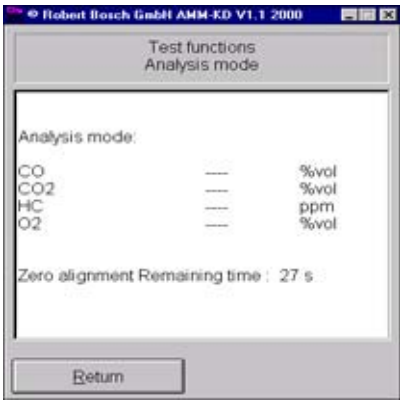
ℹ If recalibration was unsuccessful, the fault is stated in plain text. Repeat the recalibration process.

### 4.7.6 Analysis mode

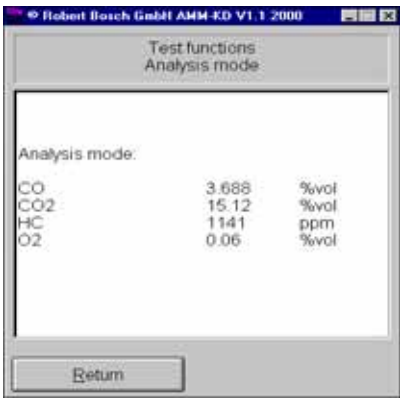
In this mode, measured values are analyzed whilst the pump is switched off. This saves on calibrating gas.

Drift correction is ineffectual in this mode, as the warm-up phase has been bypassed. The zero points therefore drift and may lead to errors.

Once you have started this menu, zero calibration takes place.



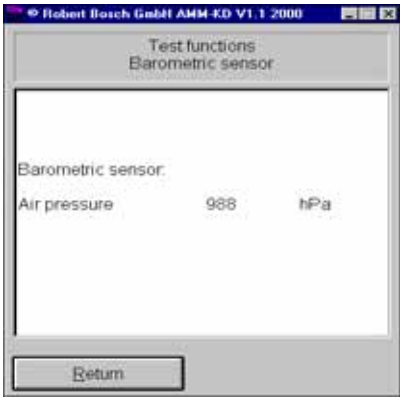

Push the calibrating-gas hose onto the calibrating-gas inlet and start the flow at ≥ 1 l/min.
Compare the measured values with the calibrating-gas values.
In the event of deviations, perform trouble-shooting as described in Section 10, Repairs.




### 4.7.7 Barometric sensor

The current air pressure is displayed in hPa.

Return to the Test functions menu by clicking **Back** or by pressing ↵ .



### 4.7.8 Maintenance (service date)

In the case of service intervals stipulated by law, confirm completed service on the exhaust-gas analyzer. This sets the internal clock to the next service date.

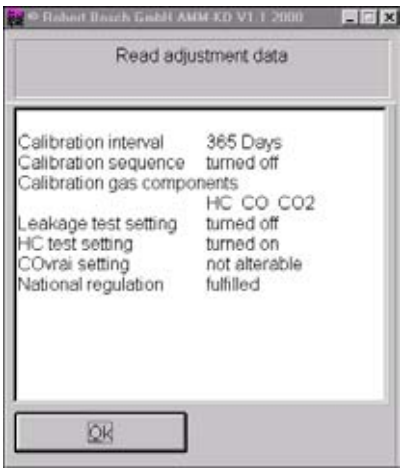
Select **Yes** by clicking on it or using the tab key ⇥.
Confirm that service has been performed by clicking **Yes** or by pressing ↵.


Confirm the new service date by clicking **OK** or with ↵. The screen now returns to the Test functions menu.


### 4.8 Read adjustment data

Here, the parameters set in the **Adjustment functions** menu are read out.

Quit the **Read adjustment data** menu by clicking **OK** or with ↵.



## 4.9 Adjustment functions

Make sure that the Service switch is set to **On** before you open the Setting functions menu.

For details on how to adjust the exhaust-gas analyzer module and undertake country-specific settings, please refer to Section 4.5.1 (country-specific settings).

Return to the function menu by clicking **Back** or by pressing keys **Alt + B.**


## 4.10 Reset

A reset must be performed when entries have been modified in the **Setting functions** menu. These modified settings will only be stored in the flashprom of the exhaust-gas analyzer module after a reset.

Select **Yes** by clicking it or with the tab key →|. Confirm that you wish to perform a reset with ↵ or by double-clicking the mouse.
The fault memory is deleted and the exhaust-gas analyzer module is restarted.

For approx. 15 s, the exhaust-gas analyzer module has no connection to the laptop or PC.
The following message therefore appears:
The measuring device reported hardware failure!
The error code must be read!

After 15 s, restart the Service program with ↵ or by clicking **OK**.



## 4.11 Error inquiry

Any current faults in the exhaust-gas analyzer module are displayed in plain text.
Confirm the readout of the fault memory with ↵ or by clicking **OK**. The fault memory is deleted and the screen returns to the Function menu.

If a fault still remains in the exhaust-gas analyzer, this will be displayed again.

## 4.12 NO-Sensor

This menu is only for BEA's equipped with a retrofit NO measuring sensor!

This menu is used for monitoring, installing and checking the NO measuring sensor.

Start the menu with ↵ or by double-clicking the mouse.


The following menus can be executed:

- Read NO-Sensor
- Set NO-Sensor
- NO-Measurement
- Mounting an new NO-Sensor
- Readjustment with test gas
- Calibration interval setting
- Calibration sequence setting


### 4.12.1 Read NO-Sensor

The status of the NO measuring sensor is displayed in this menu.


### 4.12.2 Set NO-Sensor

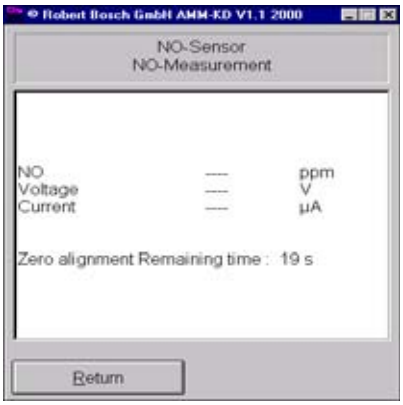
In this menu, the BEA is informed as to whether or not an NO measuring sensor is installed.

Confirm your selection of this menu with ↵ or by double-clicking the mouse.
The **OK** box appears for 1 s.

### 4.12.3 NO-Measurement

This menu is used to check the NO measuring sensor.

Start the NO test by pressing ↵ or by double-clicking the mouse.
Zero calibration now takes place.



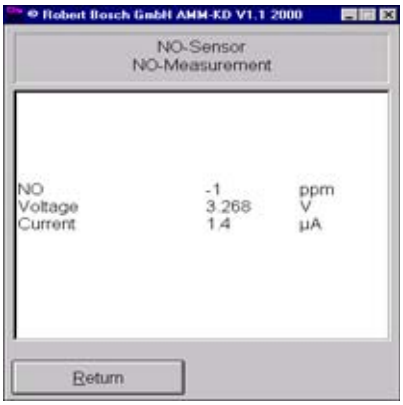

After zero calibration, the data of the NO measuring sensor are displayed.

**Limit values with air:**

| | |
|---|---|
| NO | < 20ppm NO |
| Voltage | 3.290 V ± 0.040 V |
| Current | 10 µA ± 10µA |

If the limit values are not complied with, perform trouble-shooting as described in Section 10.20.

Return to the NO menu by clicking **Back** or by pressing **Alt + B.**



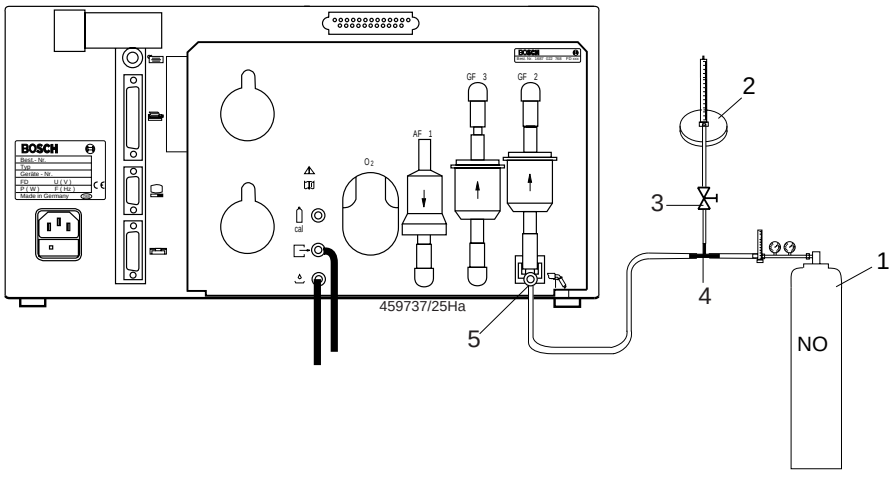

ⓘ See Section 10.20 for sensor installation

### 4.12.4 Mounting a new NO-Sensor

After the NO measuring sensor has been installed, it must be calibrated. The date of calibration is written in the flashprom, enabling the age of the NO measuring sensor to be determined subsequently at any time.

The same calibrating gas is used for calibrating the NO measuring sensor as for recalibration.

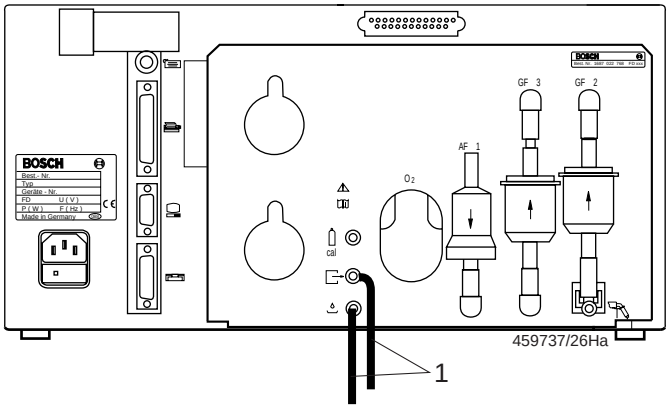
Before commencing calibration, connect the BEA to the calibrating-gas bottle as shown in the illustration below.




*1 Calibrating-gas bottle*
*2 Flow meter (rotameter)*
*3 Shutoff valve*
*4 Tee*
*5 Test-gas inlet*

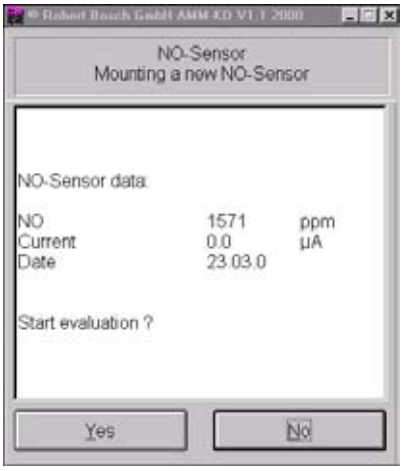
4.12.4 Mounting a new NO-Sensor

! For initial calibration, it is imperative that the hoses (1) are of the same length and are connected to the gas outlets of the exhaust-gas analyzer in the same manner as will actually be the case during subsequent operation by the user.




i If the outlet hoses are shortened or lengthened, calibration must be performed again. The signal from the NO measuring sensor is very sensitive to vibrations from the pump. The strength of these vibrations depends upon the length of the outlet hoses. Following successful calibration, the timer for monitoring the set recalibration interval is started.

- Start evaluation by clicking on **Yes** or selecting this button with the ← key and confirming with ↵.




Using the keyboard, enter the calibrating-gas value in **ppm NO.**

i If the calibrating-gas value is stated on the certificate in **mg/m³** you must convert this value to **ppm**.
The formula required for conversion is:
**Test gas value x 0.737.**
Example:
2179 mg/m³ = **1606 ppm NO**

Confirm your entry with ↵ or by clicking **OK**.

4.12.4 Mounting a new NO-Sensor

Zero calibration is performed.


Allow calibrating gas to flow through the BEA in line with the instructions on screen.
Open the Test-gas bottle sufficiently to allow some Test gas to continually flow out through the rotameter, even with the pump running (pressure-less calibration).

The NO measuring sensor is very sluggish. An "advance flow" through the NO measuring sensor is therefore necessary.

After this flow, confirm with ↵ or by clicking **OK**.


Assessment is performed. The remaining flow time is displayed.


After calibrating gas has flown through the BEA, the measured NO value, the corresponding test current and the date of calibration are displayed.

To end calibration of the NO measuring sensor, confirm **No** by pressing ↵ or clicking on **No**.

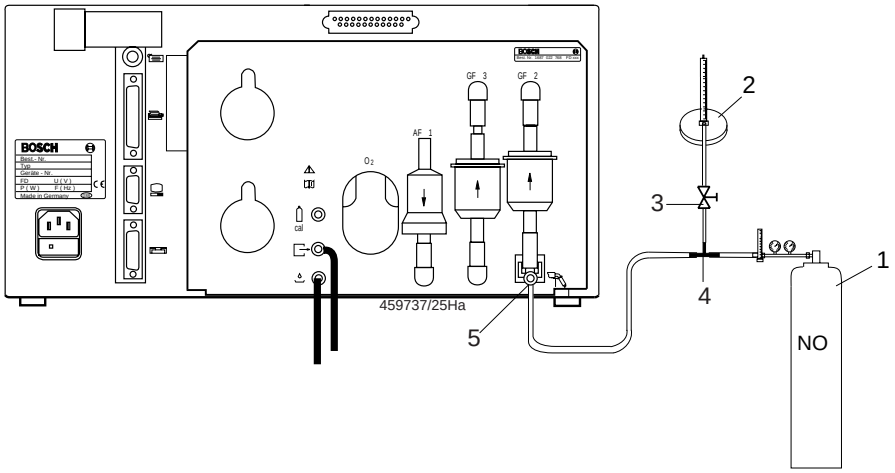
You will now return to the NO-Sensor menu, and the timer for the adjustment interval is started.

### 4.12.5 Readjustment with test gas

To calibrate the NO measuring sensor you will require a calibrating gas with the following composition:
**From 1000 to 5000 ppm NO in nitrogen (N).**

The electrochemical measuring sensor must be recalibrated at regular intervals. Only in this way can measuring accuracy be reliably maintained. The recalibration process also allows faulty NO measuring sensors to be detected.

Before commencing recalibration, connect the calibrating-gas bottle as shown in the illustration below. Connect the calibrating-gas connection to the test-gas inlet.



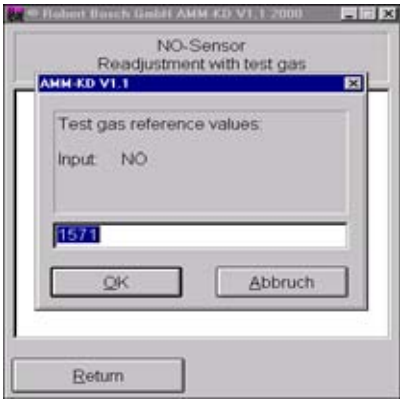

*1 Calibrating-gas bottle*
*2 Flow meter (rotameter)*
*3 Shutoff valve*
*4 Tee*
*5 Test-gas inlet*

Start recalibration with ↵ or by double-clicking the mouse.


Using the keyboard, enter the calibrating-gas value in **ppm NO.**

If the calibrating-gas value is stated on the certificate in **mg/m³** you must convert this value to **ppm**.
The formula required for conversion is:
**Calibrating-gas value x 0.737.**
Example:
2179 mg/m³ = **1606 ppm NO**

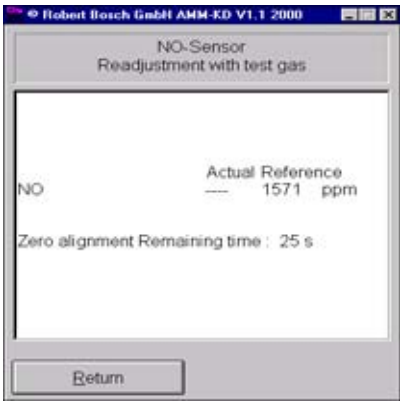
Confirm your entry with ↵ or by clicking **OK.**



### 4.12.5 Readjustment with test gas

**!** Do not yet open the gas bottle!

The BEA performs zero calibration.

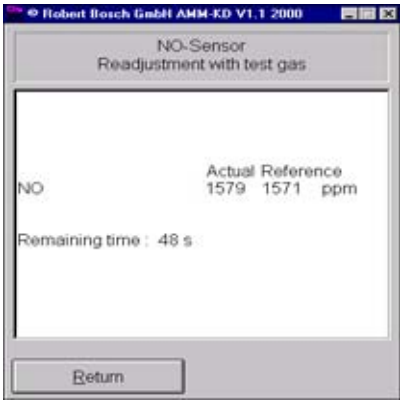



Allow calibrating gas to flow through the BEA in line with the instructions on screen.
Open the calibrating-gas bottle sufficiently to allow some calibrating gas to continually flow out through the rotameter, even with the pump running (pressure-less calibration).

The NO measuring sensor is very sluggish. An "advance flow" through the NO measuring sensor is therefore necessary.


After this flow, confirm with ↵ or by clicking **OK.**

The remaining flow time is displayed.




Once recalibration has successfully been completed, close the calibrating-gas bottle.

End recalibration by pressing ↵ or by clicking **OK**.

**!** If you have recalibrated the NO measuring sensor because you have just installed a new one, you must also proceed according to the instructions in Section 4.12.4, **Calibration of a new NO measuring sensor.**

### 4.12.6 Read calibration data

The following data are read out in this menu:

**Calibration date**
Date of next calibration.

**Calibration interval**
Interval before recalibration in days.

**Calibration sequence**
Reaction after the calibration interval has elapsed (Sec. 4.12.8).


### 4.12.7 Calibration interval setting

To access the Set calibration interval menu, set the Service switch on the test computer PCB to **On**.

In this menu, enter the number of days after which the NO measuring sensor must be recalibrated.
Enter the number of days using the keyboard.

Confirm your entry with ↵ or by clicking **OK**.
The **OK** window is displayed for 1 s.


### 4.12.8 Calibration sequence setting

This menu enables you to define how the BEA should react once the calibration interval has elapsed.

You can choose between the following options:

**Refuse access when recalibration due:**
Once the calibration interval has elapsed, the BEA is disabled and displays a message.
The BEA is only ready for measurement once more after the NO measuring sensor has been successfully recalibrated.

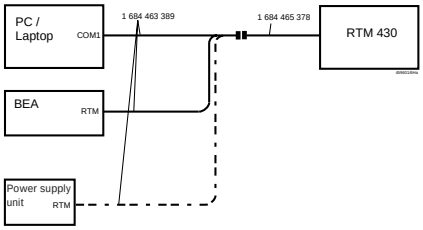
**Notify when recalibration due:**
Once the calibration interval has elapsed, the BEA displays a message but remains ready for measurement.

**Ignore recalibration due**
No message appears and the BEA remains ready for measurement.

## 4.13 Checking opacimeter RTM 430

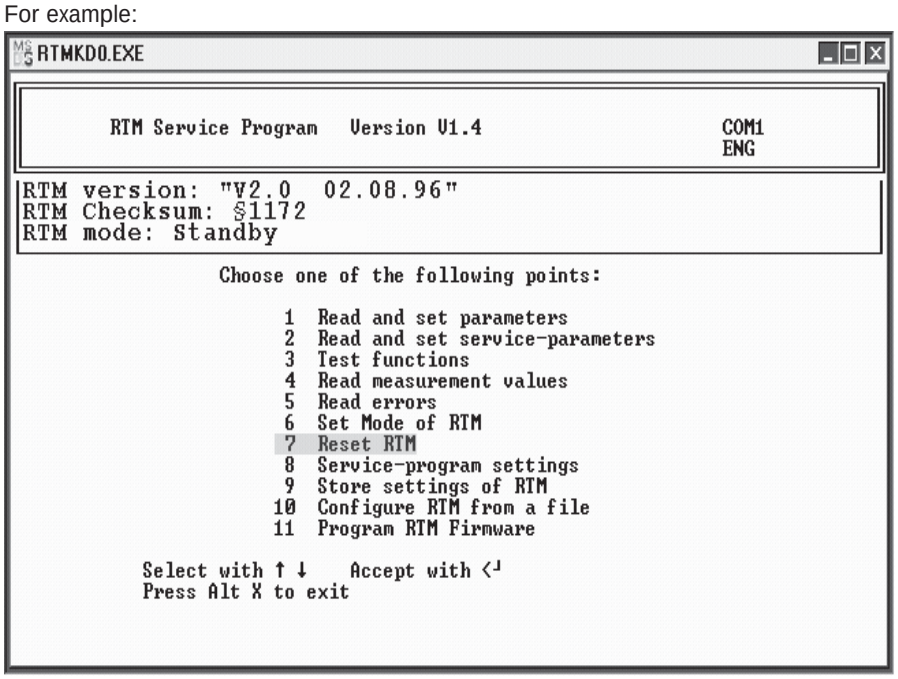
Open the **Exhaust gas** menu and select **RTM**.
Open the **Test program** menu.


Connect the Y-cable (see illustration) 1 684 463 389 to the UEA input for the RTM. Connect the RTM 430 to the Y-cable.




Start the Service program by clicking on **Start**.
The **Main menu** now opens.


When the Service program starts, you can view the software version, checksum, RTM mode and dip-switch settings via the different menu items.
For example:




! For more details on working with the Service software and repairing the RTM 430, please see EDIS 975 135.

## 5. Checking the PCB and periphery of the BEA control module

To check the interfaces of the control module PCB, you will require the following shorting plugs:

- 15-way subminiature Cannon connector for RTM interface (self-made, see Sec. 5.2)
- 20-way Micro-Match plug (new)
- 10-way Micro-Match plug (new)

Open the menu **BEA computer and periphery.**


### 5.1 Checking the interface for DTM

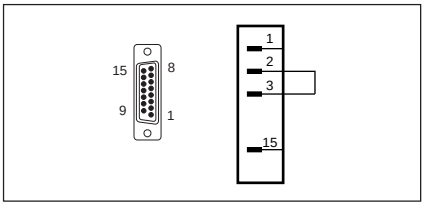
Select the **Interface test** menu and then **DTM**.


Remove the 20-way Micro-Match plug from X8 of the control module PCB.
Plug the 20-way shorting plug into X8 of the control module PCB.
Start the interface test by double-clicking the mouse or pressing Enter ↵.


If the interface test is error-free, the message **OK** appears in the results box.
If the interface test is unsuccessful, an error message is displayed.
For example: B0246:**1300.**
**1300** = No shorting plug inserted or pins 3 and 5 of shorting plug not jumpered.
If any error messages other than this one are displayed, the control module PCB must be replaced (Sec. 10.27).

## 5.2 Checking the interface for RTM

Drawing of shorting plug for testing the RTM interface.




Select the **Interfaces** menu, then **RTM**.

Insert the 15-way shorting plug in the RTM interface on the rear of the unit.
Start the interface test by double-clicking the mouse or by pressing Enter ↵ .


If the interface test is error-free, the message **OK** appears in the results box.
If the interface test is unsuccessful, an error message is displayed.
For example: B0246: **1300**.

**1300** = No shorting plug inserted or pins 2 and 3 of shorting plug not jumpered.

If any error messages other than this one are displayed, the control module PCB must be replaced (Sec. 10.27).


## 5.3 Checking the interface for AMM

Select the **Interfaces** menu and then **AMM**.

Remove the 10-way Micro-Match plug from X5 of the control module PCB.
Plug the 10-way shorting plug into X5 of the control module PCB.
Start the interface test by double-clicking the mouse or pressing Enter ↵.


If the interface test is error-free, the message **OK** appears in the results box.
If the interface test is unsuccessful, an error message is displayed.
For example: B0246:**1300**.

**1300** = No shorting plug inserted or pins 3 and 5 of shorting plug not jumpered.

If any error messages other than this one are displayed, the control module PCB must be replaced (Sec. 10.27).

## 5.4 Checking the interface for OBD

Select the **Interfaces** menu and then **OBD**.

Remove the 10-way Micro-Match plug from X6 of the control module PCB.
Plug the 10-way shorting plug into X6 of the control module PCB.
Start the interface test by double-clicking the mouse or pressing Enter ↵.

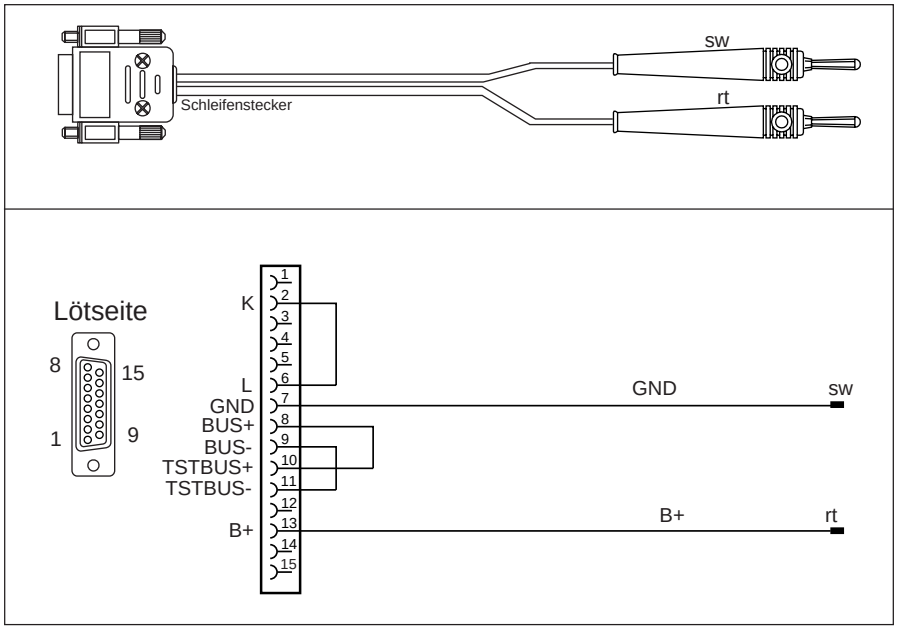

If the interface test is error-free, the message **OK** appears in the results box.
If the interface test is unsuccessful, an error message is displayed.
For example: B0246:**1300**.

**1300** = No shorting plug inserted or pins 3 and 5 of shorting plug not jumpered.

If any error messages other than this one are displayed, the control module PCB must be replaced (Sec. 10.27).


## 5.5 Checking the interface for OBD extern (without CAN-protocol)

For the functional test of the OBD printed circuit board you will require a 15-pin sliding connector (shop made, see image below).




This menu allows you to test the function of the OBD PCB "to the outside" (i.e. to the vehicle). This enables you to determine whether the fault lies in the vehicle or in the BEA.

In the BEA Service program, open the menu **Interface test.**
In this menu, select the submenu **OBD extern.**

Start the menu **OBD external.**

## 5.5 Checking the interface for OBD external

Open the **Configuration** menu by pressing F7 on your keyboard or by clicking on F7 with the mouse.


**Language menu for Service program:**
Select **Language** menu using the tab key ⇥ or by clicking on the Language field, then confirm with Enter ↵. Choose the required language using the ↑ or ↓ keys and confirm with Enter ↵.

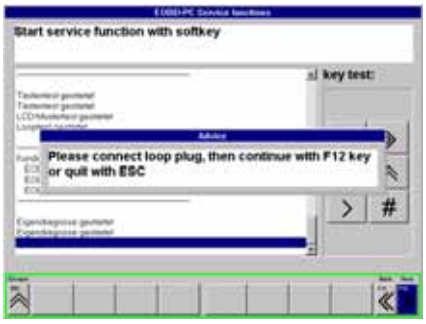

The settings will be activated when the next menu is selected.

The menus **Serial port, Window size** and **Data storage** are not relevant to the function test of the OBD PCB.

### 5.5.1 Loop test

The loop test examines the functional ability of the interface in communication with external equipment.

Perform the loop test by pressing F1 on your keyboard or by double-clicking on the loop test button . Plug the banana plug + (rd) and GND (bk) into the + and - jacks of your DC stabilizer (or of your P 100).




If the loop test has been concluded with no errors detected, the message:
BsTest "Loop" "TFau" $0000 "TSchr".
appears. Of importance here is the digit after "**TFau**" (TFau = **T**ype of **Fau**lt). If the self-diagnosis revealed no faults, this must appear as $0000.
For error messages see Section 4.4.5.3, Error messages.

### 5.5.2 OBD error messages

| Error message | Possible cause | Remedy |
|---|---|---|
| Timeout: The OBD module did not react within the waiting time. | B+ and B- cables not connected. | Connect B+ and B- cables. |
| | Interconnecting cable from control module PCB to OBD PCB not connected or faulty. | Test interconnecting cable and ensure that it is securely fastened, replace if necessary. |
| | Interface on control module PCB faulty | Test interface according to repair instructions, Sec. 4.4.4, replace control module PCB. |
| | Faulty OBD PCB | Perform self-diagnosis as per Section 3.1. |
| BsTest "Loop" "TFau" **$4000** "TSchr" | B+ and B- cables not connected.<br>Faulty OBD PCB. | Connect B+ and B- cables.<br>Perform self-diagnosis as per Section 3.1. |

If any other error messages appear, perform trouble-shooting as described in the Repair Instructions.

## 5.6 Testing 26-pin interface for OBD external (with CAN protocol)

For functional testing of the OBD/CAN circuit board and the connection cable to the vehicle control unit, you will need the short circuit plug KS 350 and the adapter cable AL 350 (both customer service tools are obtainable from Müller Elektronik).

**Loop test**

**Procedure:**

1. To open this, press the F2 key on your keyboard, or click with the mouse on F2 , the **Customer Service** menu.
2. Perform the loop test by pressing the F1 key on your keyboard or by double clicking with the mouse on the **Loop Test** button.
3. Plug the KD adapter cable AL 350 into the OBD/CAN connection cable.
4. Plug the banana plugs B+ (red) and GND (black) of the KD adapter cable AL 350 into the B+ and B- sockets of the P 100 or a stabilized DC + 12V power supply.


5. If the loop test has proceeded without errors, the following message will be displayed: BsTest "Loop" "SDTEST" $0000 "LBCCTEST" $0000 "DLCTEST" §0000 "CANTEST §0000.
   The critical aspects are the "§" numeric values following **"xxTEST"**.
   If the loop test has proceeded without errors these will be shown as **"$00"**.


If an error message has been generated, the test must be repeated using the short circuit plug KS 350. This will narrow down the error.

**Key to "xxTEST":**

"SDTEST" = Testing the ISO interface
"LBCCTEST" = Testing the SAE interface
"DLCTEST" = Testing the SAE interface
"CANTEST" = Testing the CAN interface

See section 8.12 for error messages for "xxTEST".

## 5.7 Checking the interface for the data terminal (not for BEA-Euro)

Select the **Interfaces** menu and then **Data terminal.**

Remove the 10-way Micro-Match plug from X10 of the control module PCB.
Plug the 10-way shorting plug into X10 of the control module PCB.
Start the interface test by double-clicking the mouse or pressing Enter ↵.


If the interface test is error-free, the message **OK** appears in the results box.
If the interface test is unsuccessful, an error message is displayed.
For example: B0246:**1300**.

**1300** = No shorting plug inserted or pins 3 and 5 of shorting plug not jumpered.

If any error messages other than this one are displayed, the control module PCB must be replaced (Sec. 10.27).


## 5.8 Checking the hard disk (if it installed)

Open the menu **Store meiadia test** and then select **Hard disk.**


The hard disk test is executed automatically.


If the hard disk test is error-free, the message OK appears in the results box.
If the test is unsuccessful, an error message is displayed.
For example: B0246:**1300**.
**1300** = No connection to hard disk

ⓘ In such a case of an error either the printed circuit board 1 688 400 223 and/or 1 682 666 118 also to old firmware taped or the silicon disc 1 687 370 291 can be defective.

## 5.9 Checking the Floppy disk drive

Insert an OS9-formatted floppy disk in the disk drive.
Open the menu **Store media test** and then select **Floppy disk**.


The Floppy disk drive test is executed automatically.

If the disk drive test is error-free, the message **OK** appears in the results box.
If the test is unsuccessful, an error message is displayed.
For example: B0246:**1300**.
**1300** = No connection to disk drive


## 5.10 Checking the internal printer

Open the **Printer test** menu, then select **Intern**.


The printer test is executed automatically.
A printout is produced on the internal printer bearing the possible font.
The message **OK** appears on screen if the printer test is passed.


## 5.11 Checking the external printer

Open the **Printer test** menu, then select **Extern**.

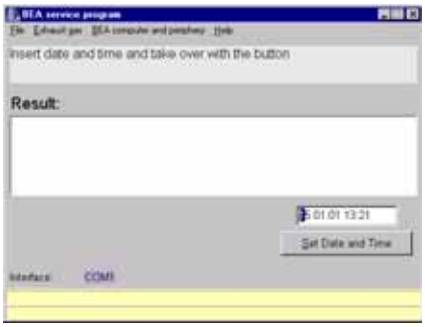
## 5.11 Checking the external printer

The printer test is executed automatically. A printout is produced on the external printer bearing the possible font.
The message **OK** appears on screen if the printer test is passed.


## 5.12 Setting the date and time

Select the **Date/Time** menu, then open **Date/Time** by double-clicking the left mouse button or by pressing Enter ↵ on the keyboard.


Enter the date and time using the keyboard.




Confirm your entry by clicking the **Set date and time** button.
The date and time you have entered now appear in the results box so that you can check them.


## 5.13 Video RAM test

Select the **Video RAM test** menu, then open **Video RAM test** by double-clicking the left mouse button or by pressing Enter ↵ on the keyboard.

Various screen tests are now performed on the TFT display of the BEA.

## 5.14 Display test (Testing TFT display)

This menu serves to test the TFT display.

Select the **Display test** menu and open the **Display test** menu by double clicking on the left-hand mouse button or using the Enter E key on the keyboard

Various image tests are performed on the TFT display of the BEA.

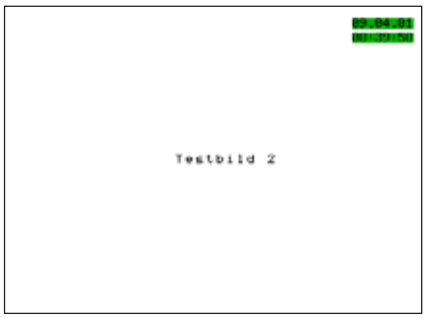

## 5.15 Display test geometry image

Select the **Geometry image** menu and open the menu by double clicking on the left-hand mouse button or using the Enter ↵ key on the keyboard
The geometry image is generated on the BEA's TFT display.


If the geometry image is in order, then the Service software image displays the following reference:
Geometry image OK.
In the event of a fault a clear text message is issued.


## 5.16 Display test full screen all white

Select the **Full screen, all white** menu and open the menu by double clicking on the left-hand mouse button or using the Enter ↵ key on the keyboard
The geometry image is generated on the BEA's TFT display.




If the full screen white is in order, then the Service software image displays the following reference:
Full screen all white OK.
In the event of a fault a clear text message is issued.

## 5.17 Display test full screen all black

Select the **Full screen, all black** menu and open the menu by double clicking on the left-hand mouse button or using the Enter E key on the keyboard
The geometry image is generated on the BEA's TFT display.


If the full screen black is in order, then the Service software image displays the following reference:
Full screen all black OK.
In the event of a fault a clear text message is issued.


## 5.18 Checking the Foil keypad

In the **Input test** menu, open the **Foil keypad** menu by clicking it or by pressing Enter ↵ on the keyboard.


Press membrane keys ESC, F1, F2, F3, F4 and F5 one after the other.
Each membrane key you press is displayed in the results box.
End the test of the membrane keypad by clicking the **End** button.


## 5.19 Checking the PC keyboard

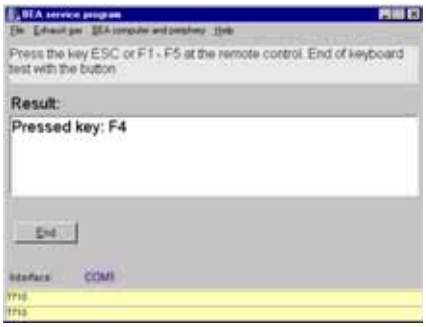
In the **Input test** menu, open the **PC keyboard** menu by clicking it or by pressing Enter ↵ on the keyboard.

Press the PC keys ESC, F1, F2, F3, F4 and F5 one after the other.
Each PC key you press is displayed in the results box.
End the test of the PC keyboard by clicking the **End** button.

## 5.20 Checking the remote control

In the **Input test** menu, open the **Remote control** menu by clicking it or by pressing Enter ↵ on the keyboard.

Press keys ESC, F1, F2, F3, F4 and F5 on the remote control one after the other. Each remote-control key you press is displayed in the results box.
End the test of the remote control by clicking the **End** button.




## 5.21 Checking the Test calibration switch for Customer Service

Select the menu **Test calibration switch** and open by clicking or by pressing Enter ↵ on the keyboard.
The current switch setting is displayed.


## 5.22 Reading out the Error list

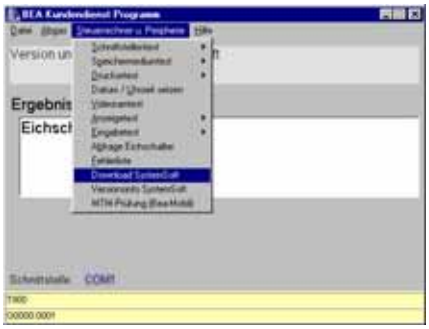
Select the **Error list** menu and open by clicking or by pressing Enter ↵ on the keyboard.


The last 20 stored error messages are displayed.
This menu is particularly helpful for dealing with sporadically reported faults.


## 5.23 Download SystemSoft

**!** This menu is usable for the BEA module (BEA 050) and BEA mobile only.
Downloading of the system software for BEA 1xx, 2xx and 3xx is done over the installed floppy disk drive!

If you should inadvertently run a download for BEA 1xx, 2xx or 3xx with this program, then after the download is completed the system software for BEA 1xx, 2xx or 3xx has to be installed back using the system software diskette.



## 5.24 Version information system software

In this menu you can read out the current system software for BEA and the AMM exhaust-gas analyzer module.


## 5.25 MTM testing

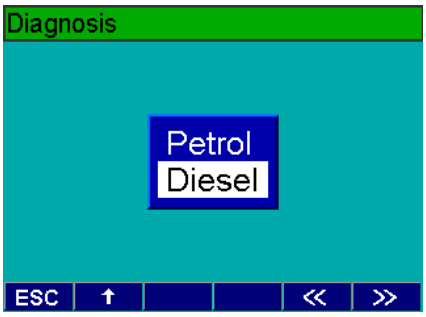
This menu only functions with **BEA Mobil!**

## 6. Checking the engine-speed and temperature measuring module (DTM)

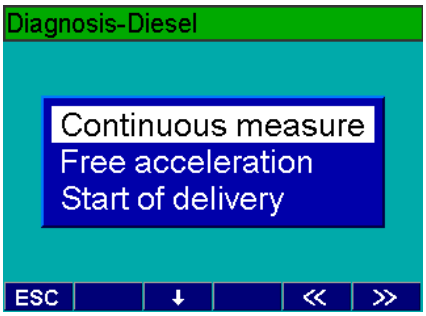
Before you replace the PCB of the DTM you must first check the function of the internal interface from the DTM PCB to the control module PCB (Section 5.1) and then the function of the individual sensors (see following sections).

### 6.1 Checking oil temperature and engine speed in Diesel Diagnosis

1. Switch on the BEA and wait until the self-test is completed.
2. Select the **Diagnosis** menu by pressing F2 or ↓, and open by pressing F5 **>>** or ↵.
3. Next, select the **Diesel** menu by pressing F2 or ↓, and open by pressing F5 **>>** or ↵.

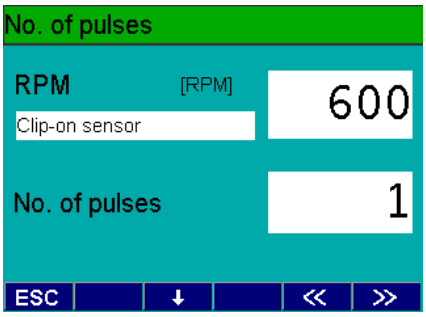



4. Press F5 **>>** or E to open the **Continuous measurement** menu.

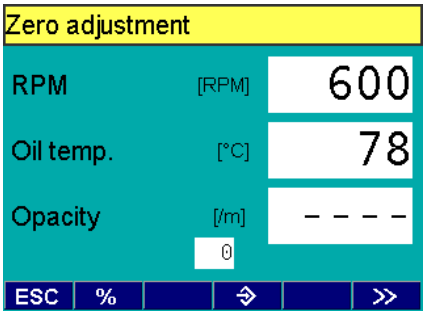



5. Connect the clamp-on pickup lead of the P 140 to the clamp-on pickup input of the BEA.
6. Connect the temperature lead of the P 140 to the temperature-measurement input of the BEA.
7. Switch on the P 140.

8. In the **No. of pulses** menu, set the number of pulses to **1** using the ↑ or ↓ keys.

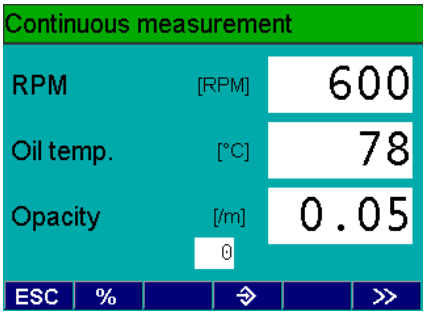



9. First of all, automatic zero calibration takes place.

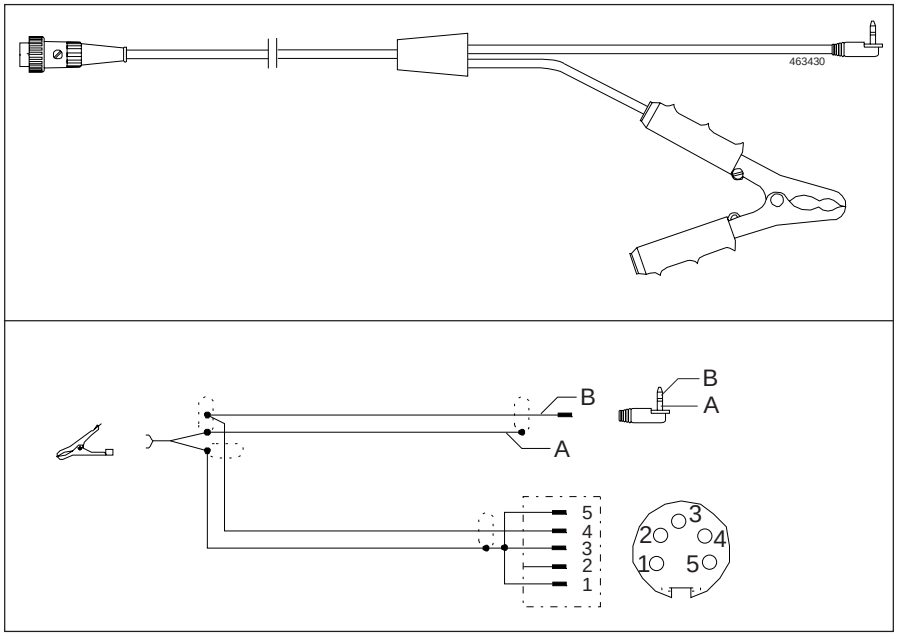



10. Set the temperature selector switch of the P 140 first to 80°C, then to 120°C.
**Nominal values:** 80°C ± 3°C
120°C ± 3°C

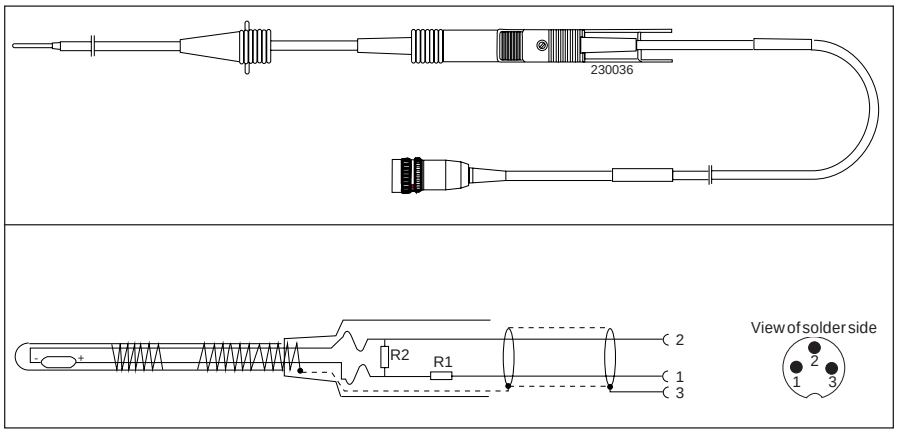
11. Set the speed selector switch of the P 140 to the engine speeds from 600 - 6000 rpm one after the other:
**Nominal Values:**
600 rpm ± 10 rpm
1500 rpm ± 10 rpm
4000 rpm ± 10 rpm



### 6.1.1 Terminal diagram of connection cable for clamp-on pickup




### 6.1.2 Terminal diagram of temperature sensor

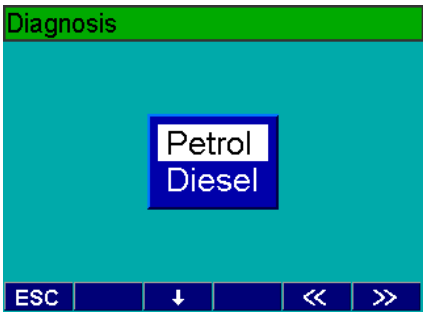



**Resistance test with digital multimeter:**

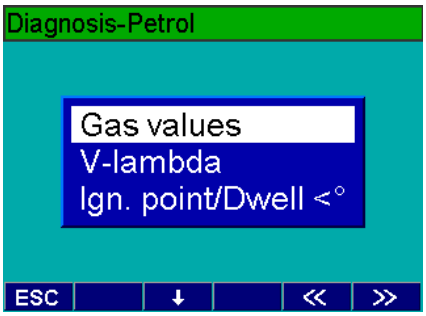
Measured on 3-way amphenol plug, pin **1** to pin **2**
R (25°C) = 1005 Ω ± 5 Ω
R (90°C) = 1530 Ω ± 12 Ω

## 6.2 Checking oil temperature and engine speed in Petrol Diagnosis

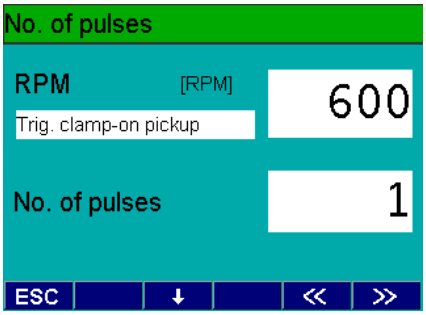
1. Switch on the BEA and wait until the self-test is completed.
2. Press F2 or ↓ to set the **Diagnosis** menu and open this by pressing F5 **>>** or ↵.
3. Select the **Petrol** menu by pressing F5 **>>** or ↵.



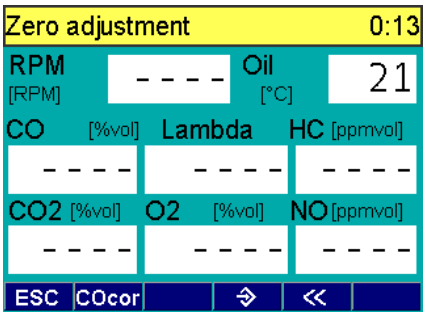

4. Press F5 **>>** or E to open the **Gas values** menu.
5. Connect the clip-on trigger sensor to the BEA.
6. Clamp the clip-on trigger sensor over the loop of your P 140.
7. Connect the temperature lead of the P 140 to the temperature-measurement input of the BEA.
8. Switch on the P 140.



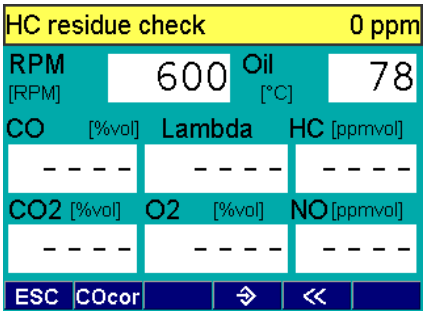

9. In the **No. of pulses** menu, set the number of pulses to **1** using the ↑ or ↓ keys.




10. First of all, automatic zero calibration takes place.




11. After zero calibration, an HC residue test is performed.

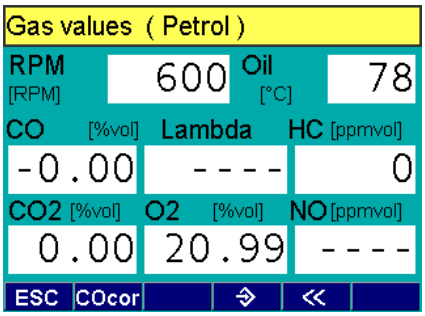


## 6.2 Checking oil temperature and engine speed in Petrol Diagnosis

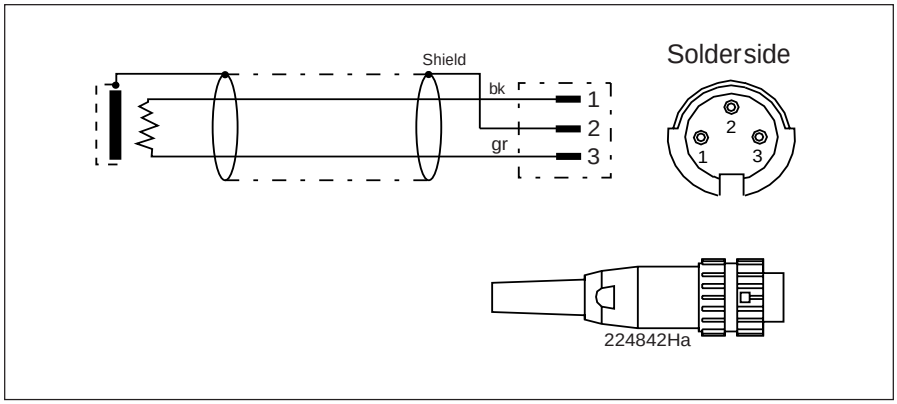
12. After the HC residue test, the RPM and oil temperature are displayed.

13. Set the temperature selector switch of the P 140 first to 80°C, then to 120°C.
**Nominal values:** 80°C ± 3°C
120°C ± 3°C

14. Set the speed selector switch of the P 140 to the engine speeds from 600 - 6000 rpm one after the other:
**Nominal values:** 600 rpm ± 10 rpm
1500 rpm ± 10 rpm
4000 rpm ± 10 rpm
6000 rpm ± 10 rpm



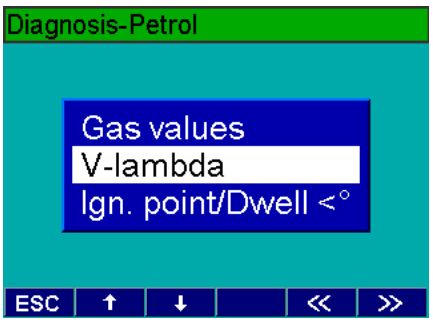

### 6.2.1 Terminal diagram of inductive clip-on trigger sensor



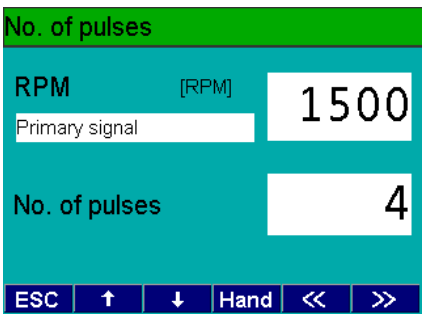

## 6.3 Checking V-lambda

To perform the V-lambda voltage test you will require connection cable 1 684 465 463.

1. Press F2 or ↓ to go to the **V-lambda** menu and open it by pressing F5 **>>** or ↵.

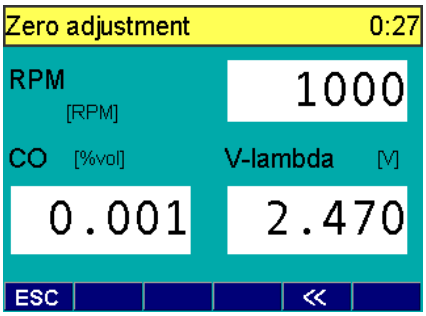



2. In the **No. of pulses** menu, set the number of pulses to **1** using the ↑ or ↓ keys.

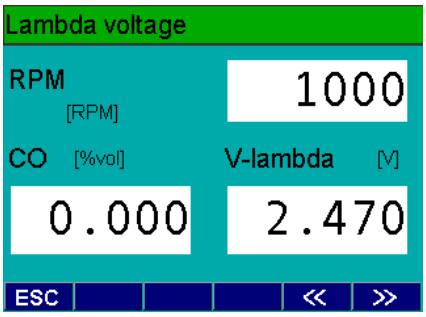


## 6.3 Checking V-lambda

First of all, automatic zero calibration takes place.

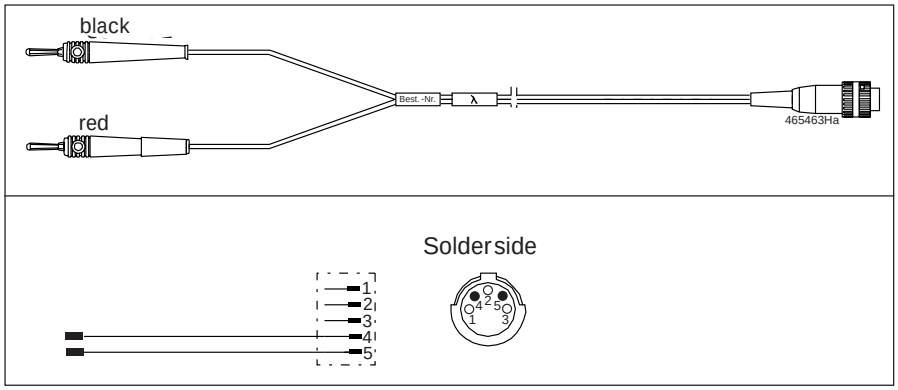



3. Connect the clip-on trigger sensor to the BEA.
4. Clamp the clip-on trigger sensor over the loop of your P 100.
5. Connect the B-cable of the BEA to the B-jack of your P 100.



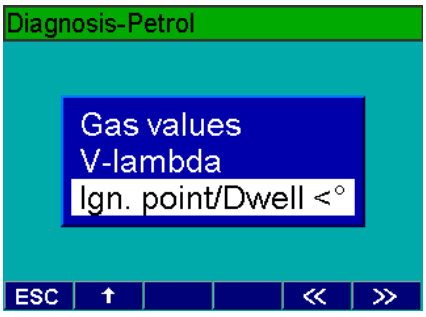

6. Connect the V-lambda cable to voltage output V, C, R and rR of your P 100.
7. Connect a digital multimeter parallel to this.
8. Set the voltage to 2.500 V.
9. Compare the value on your digital multimeter with the value displayed on the BEA.
   **Nominal value: 2.500V ± 0.1V**

### 6.3.1 Terminal diagram of V-lambda cable

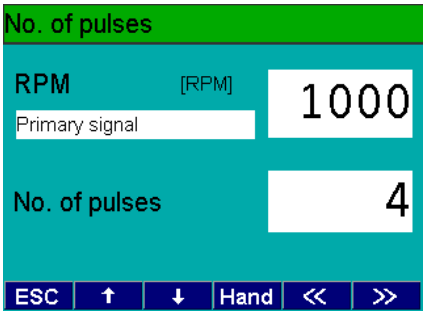



## 6.4 Checking the ignition point and dwell angle

In order to check the ignition point and the dwell angle, you will require the TD/TN/Term1 connection cable, Part No.: 1 684 460 196 (SZB) and timing light 1 687 022 767 (SZB).



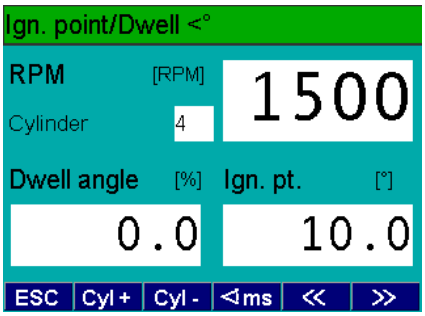

1. Press F2 or ↓ to go to the menu **Ignition point/Dwell angle** and open it by pressing F5 **>>** or ↵.



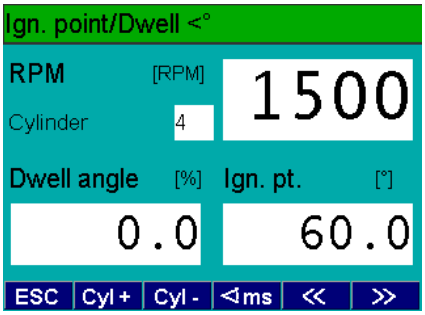

2. In the **No. of pulses** menu, set the number of pulses to 1 using the ↑ or ↓ keys.

## 6.4 Checking the ignition point and dwell angle

3. Connect the clip-on trigger sensor to the BEA.
4. Clamp the clip-on trigger sensor over the loop of your P 100.
5. Connect the B-cable of the BEA to the B-jack of your P 100.
6. Switch on the P 100. The timing light begins to flash.
7. Flash the timing light at the photo diode in the P 100 and set the ignition point to 10°crankshaft using the adjusting wheel of the timing light.
8. Compare the value on your P 100 with the value displayed on the BEA.
   **Nominal value:**
   **10°crankshaft ± 0.5°crankshaft**



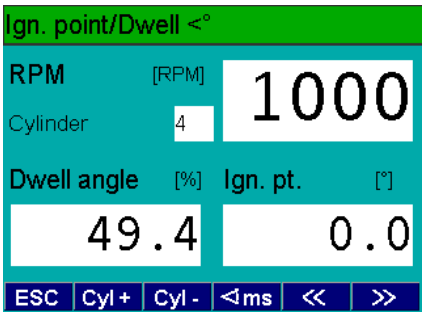

9. Repeat the test with an ignition point of 60°crankshaft
   **Nominal value:**
   **60°crankshaft ± 0.5°crankshaft**



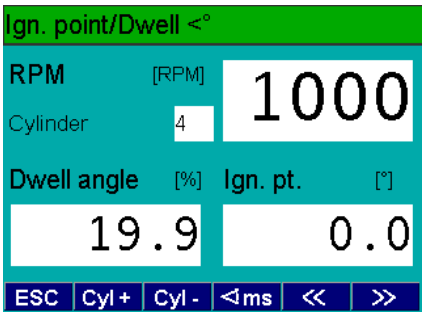

## 6.5 Checking the dwell angle

Use F3 to change the dwell angle between %, ms or degrees (°).

1. Connect the Term.1 connection cable (green banana plug) to the Term.1 jack of your P 100.
2. Connect the B-cable of the BEA to the B-jack of your P 100.
3. On your P 100, set an engine speed of 1000 rpm.
   Then set the P 100 to a dwell angle of 50%.
   **Nominal value: 50% ± 0.5%**

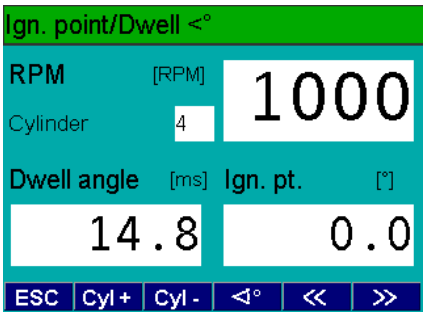



4. Repeat the test with a dwell angle of 20%
   **Nominal value: 20% ± 0.2%**

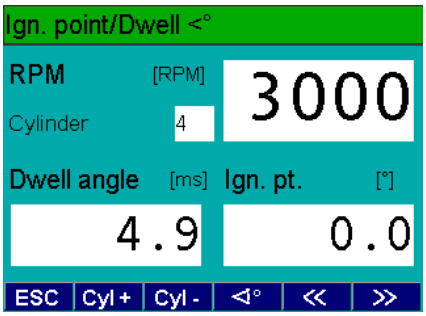


## 6.5 Checking the dwell angle

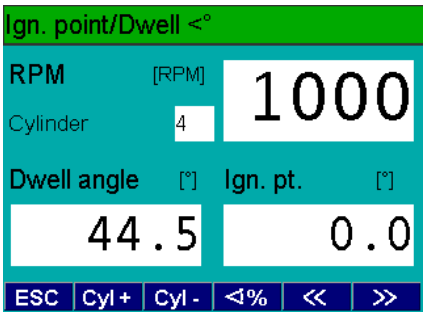
5. Set your P 100 to a dwell angle of 50 % and an engine speed of 1000 rpm.
6. Press **F3** on the BEA to view the dwell angle in **ms.**
   **Nominal value: 15ms ± 0.45ms**



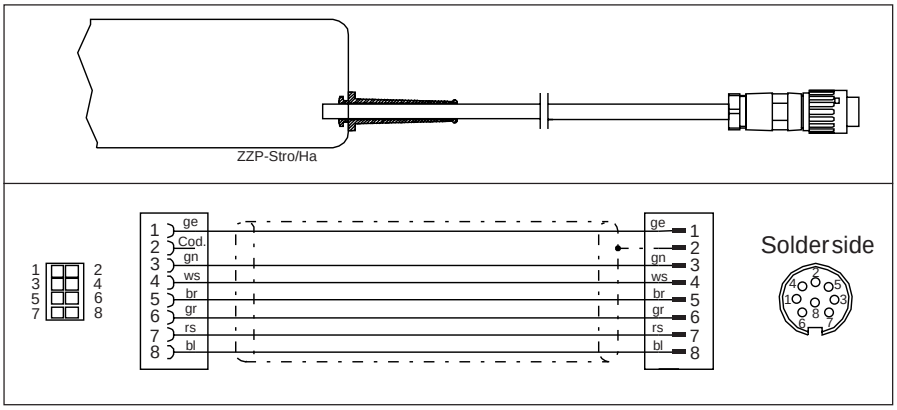

7. Repeat this measurement with a dwell angle of 50 % and an engine speed of 3000 rpm.
   **Nominal value: 5ms ± 0.15ms**



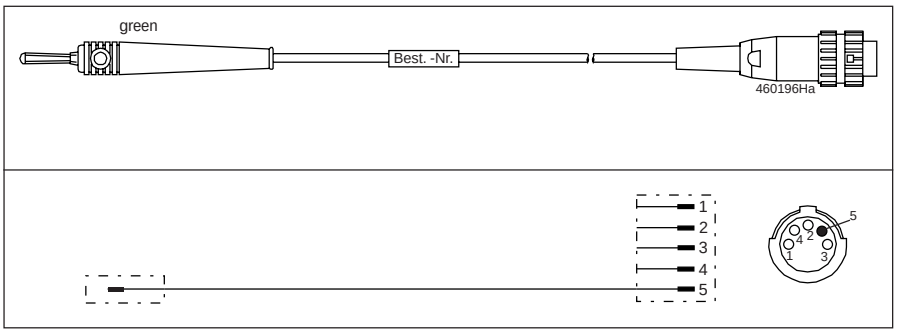

8. Set your P 100 to a dwell angle of 50 % and an engine speed of 1000 rpm.
9. Press **F3** on the BEA to view the dwell angle in **degrees °.**
   **Nominal value: 45° ± 0.5°**




### 6.5.1 Terminal diagram of timing light




### 6.5.2 Terminal diagram of TD / TN connection cable



# 7. Technical information (measuring ranges, resolution and tolerances)

## 7.1 Exhaust-gas analysis in petrol-driven vehicles

| Component | Measuring range | Resolution | Accuracy ** from measured value | or absolute |
|---|---|---|---|---|
| CO | 0.000 ... 10.00 % vol.<br>0.000 ... 5.000 % vol. | 0.001 % vol.<br>0.001 % vol. | - - -<br>± 5 % | - - -<br>+ 0.06 % vol. |
| $CO_2$ | 0.00 ... 18.00 % vol.<br>0.00 ... 16.00 % vol. | 0.01 % vol.<br>0.01 % vol. | - - -<br>± 5 % | - - -<br>+ 0.5 % vol. |
| HC | 0 ... 9999 ppm vol.<br>0 ... 2000 ppm vol. | 1 ppm vol.<br>1 ppm vol. | - - -<br>± 5 % | - - -<br>± 12 ppm vol. |
| $O_2$ | 0.00 ... 22.00 % vol.<br>0.00 ... 21.00 % vol. | 0.01 % vol.<br>0.01 % vol. | - - -<br>± 5 % | - - -<br>± 0.1 % |
| λ | 0.500 ... 9.999<br>0.700 ... 1.300 | 0.001<br>0.001 | - - -<br>± 4 % | - - -<br>- - - |
| NO | 0 ... 5000 ppm vol.<br>0 ... 4000 ppm vol. | <= 1 ppm vol.<br><= 1 ppm vol. | ± 4 %<br>± 8 % | ± 25 ppm vol.<br>± 50 ppm vol. |
| NO2 | 0 ... 100 ppm vol. | <= 1 ppm vol. | - - - | ± 25 ppm vol. |

** The largest tolerance in each case is permitted

## 7.2 Opacity measurement

| Measured variable | Measuring range | Resolution | Calibration error limit |
|---|---|---|---|
| Opacity | 0 - 100 % | 0.1 % | Country-specific |
| Absorption coefficient k | 0 - 9.99 $m^{-1}$ | 0.01 $m^{-1}$ | 0.3 or 0.45 $m^{-1}$ in Germany<br>± 0.15 $m^{-1}$ for k ≤ 1 $m^{-1}$<br>± 0.15 $k^{1}$ for k > 1 $m^{-1}$ |

## 7.3 Engine measurement system TDM+

### 7.3.1 Temperature measurement

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| Temperature sensor | -20°C ... + 150°C | 0.16°C | 2% from (m.v. -25°C) ± 1.5% |

### 7.3.2 RPM measurement, petrol-driven vehicles

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| Terminal 1/TD/TN/EST | 100 ... 15000 rpm | 10 rpm | ± 10 rpm |
| Clip-on trigger sensor | 100 ... 15000 rpm | 10 rpm | ± 10 rpm |
| OT/sensor wheel/opt. sensor | 100 ... 8000 rpm | 10 rpm | ± 10 rpm |

### 7.3.3 RPM measurement, diesel vehicles

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| BDM | 600 ... 6000 rpm | 10 rpm | ± 2% from measured value |
| Clamp-on pickup | 250 ... 7200 rpm | 10 rpm | ±10 rpm |
| RIV pickup | 250 ... 7200 rpm | 10 rpm | ±10 rpm |
| OT sensor | 100 ... 7200 rpm | 10 rpm | ±10 rpm |
| TD / TN signal | 100 ... 7200 rpm | 10 rpm | ±10 rpm |

### 7.3.4 Multiple measurements

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| Lambda sensor voltage | 0.000V ... 5.000V | 10 mV | 1% from measured value ± 2 mV |

### 7.3.5 Ignition point / timing

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| OT/reference-mark sensor | -179 ... 180 °crankshaft | 0.1 °crankshaft | ± 0.8 °crankshaft ± 1 dig. |
| to Term.1 or clip-on trigger sensor, stroboscope to term.1 at or clip-on trigger sensor | 0.0 ... 60 °crankshaft<br>100 ... 8000 rpm | 0.1 °crankshaft | ± 0.5 °crankshaft ± 1 dig. |

### 7.3.6 Dwell angle

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| Terminal 1 | 0 ... 100 % | 0.1 % | ± 1 % |
| | 0 ... 360 °advance angle | 0.1 ° | ± 0.5 ° |
| | 0.0 ... 50.0 ms | 0.01 ms | ± 0.3 % from meas. value + 1 dig. |
| | 50.0 ... 99.9 ms | 0.1 ms | ± 0.3 % from meas. value + 1 dig. |

### 7.3.7 Start of delivery / Injection timing

| Sensor | Measuring range | Resolution | Tolerance |
|---|---|---|---|
| Clamp-on pickup to OT or stroboscope | -179 ... 180 °KW | 0.1 °crankshaft | ± 1 °crankshaft ± 1 dig. |

# 8. Trouble-shooting by message number

References shown on display when malfunctions occur. By acknowledging the message the reference is deleted. However, it will reappear if the malfunction has not been eliminated. If several references are given then the next reference follows the acknowledgement. The individual references are listed in the following tables. Displayed are the reference number, reference text and remedial measures.
If a reference number is displayed which is not listed in the following chapters then please notify our hotline of it.

## 8.1 Explanations on reference numbers

| | |
|---|---|
| 0000 ... 255 | Malfunction messages of OS9 operating system |
| 1000 ... 1099 | Malfunction messages for boot test functions |
| 1100 ... 1099 | Malfunction messages on software installation functions |
| 1200 ... 1207 | Malfunction messages on print functions |
| 1300 ... 1399 | Malfunction messages of hardware test over remote |
| 2000 ... | Malfunction messages of RTM |
| 3000 ... | Malfunction messages of MTM |
| 4000 ... | Malfunction messages of Gas Analysis Module (GAM) |
| 5000 ... | Malfunction messages of HC11 download |
| 6000 ... | Malfunction messages on OBD printed circuit board |
| §00xx | Malfunction messages for testing OBD printed circuit board with KTS115PC program |

## 8.2 General messages

| No. | Message | Possible cause | Remedy | Section |
|---|---|---|---|---|
| 1000<br>1001<br>1002<br>1003<br>1004<br>1005<br>1006 | Error creating glob. data module<br>Error installing MTM task<br>Error installing PRN task<br>Error installing RTM task<br>Error installing EAM task<br>Error installing IO task<br>Error installing AWN-Task | Software error | Re-boot BEA, if error still present:<br>Re-install system software | 5.23 |

### 8.3 Messages about boot test functions

| No. | Message | Possible cause | Remedy | Section |
|---|---|---|---|---|
| 1010 | Checksum error in flashrom | Error in software | Re-boot BEA, if error still present: Re-install system software | 5.23 |
| | | Faulty flashrom | Replace control module PCB | 10.27 |
| 1011 | RAM test error | Faulty RAM module | Re-boot BEA, if error still present: Replace control module PCB | 10.27 |
| 1012<br>1013<br>1014<br>1015<br>1016<br>1017 | Error in data bus dt1<br>Error in data bus dt2<br>Error in data bus dt3<br>Error in data bus dt4<br>Error in data bus p1<br>Error in data bus p2 | Error in control module PCB | Re-boot BEA, if error still present: Replace control module PCB | 10.27 |
| 1018 | Disk error | Disk write-protected | Remove write protection | |
| | | Loose interconnecting cables | Check that interconnecting cables secure, check for continuity | 12.1 and 12.4 |
| | | Error in voltage supply | Check voltage supply | 10.2 and 10.3 |
| | | Faulty disk drive | Check disk drive | 5.9 |
| 1019 | Battery undervoltage | Battery faulty or discharged | Check battery, replace if necessary | 10.32 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1020<br>1021 | Error in data bus dt5<br>Error in data bus dt6 | Error in control module PCB | Re-boot BEA, if error still present: Re-install system software | 10.27 |
| 1022 | Error in video RAM | Faulty video RAM module | Perform video RAM test<br>Replace control module PCB | 5.13<br>10.27 |
| 1023 | HD error | Loose interconnecting cables | Check that interconnecting cables secure, check for continuity | 12.1 and 12.4 |
| | | Error in voltage supply | Check voltage supply | 10.2 and 10.4 |
| | | Faulty hard disk | Check hard disk, if error still present: replace hard disk | 5.8 and 10.23 |
| 1030 | Clock faulty or shows incorrect time | Date and time incorrectly set | Set date and time correctly, if error still present: replace control module PCB | 5.12<br>10.27 |

### 8.4 Messages about software installation functions

| No. | Message | Possible cause | Remedy | Section |
|---|---|---|---|---|
| 1100 | Disk read error: format? no disk? | Faulty disk<br>Disk drive error | Check disk, replace if necessary<br>Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Error in voltage supply | Check voltage supply | 10.2 and 10.4 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1101 | Missing install configuration file | Faulty disk | Insert new disk | |
| | | No OS9-formatted disk inserted | Format disk using OS9 Service disk | see EDIS |
| 1102 | Incorrect configuration file format | Faulty disk | Insert new disk | |
| | | No OS9-formatted disk inserted | Format disk using OS9 Service disk | see EDIS |
| | | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1103 | Not enough memory | Video RAM | Perform video RAM test | 5.13 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1104 | Not enough disk space available | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Hard disk error | Perform HD test<br>Format HD using Service disk<br>If error still present:<br>replace HD | 5.8<br>11.1.3<br><br>10.23 |
| 1105<br>1106<br>1107 | Error opening file<br>Errror reading file<br>Errror writing file | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Error in voltage supply | Check voltage supply | 10.2 and 10.3 |
| | | Error in software | Re-install system software | 5.23 |
| | | Faulty disk drive | Check disk drive | 5.9 |
| 1108<br>1109<br>1110<br>1111<br>1112<br>1113<br>1197<br>1198<br>1199 | Errror loading file<br>Errror copying file<br>Errror deleting file<br>Errror creating directory<br>Errror deleting directory<br>Errror renaming file or directory<br>Setup errror encountered<br>System errror encountered<br>Internal errror encountered | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Error in voltage supply | Check voltage supply | 10.2 and 10.3 |
| | | Error in software | Re-install system software | 5.23 |
| | | Faulty hard disk | Format HD using Service disk, replace HD if necessary | 11.1.3<br>10.23 |

### 8.5 Messages about printing functions

| No. | Message | Possible cause | Remedy | Section |
|---|---|---|---|---|
| 1200 | Internal printer not connected | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Faulty controller PCB of internal printer | Replace controller PCB | 10.21.3 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1201 | Printer not ready | No paper inserted | Insert paper | |
| 1202<br>1203<br>1204<br>1205<br>1206<br>1207 | Other printer errors<br>Incorrect text to be entered in printer memory<br>Error linking data module<br>Error unlinking data<br>Error opening internal printer interface<br>Error opening external printer interface | Software error | Re-boot BEA, if error still present:<br>Re-install system software | 5.23 |
| | | RAM error | Check printer driver | 5.11 and 5.12 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |

### 8.6 Messages about hardware test functions

| No. | Message | Possible cause | Remedy | Section |
|---|---|---|---|---|
| 1300 | Time out – no characters received | Error in control module PCB | Replace control module PCB | 10.27 |
| 1301 | Error opening serial interface | Software error | Reboot BEA, if error still present: Re-install system software | 5.23 |
| 1302 | Error writing serial interface | Faulty interface | Perform interface test | 5.1 - 5.4 |
| 1203 | Error reading serial interface | Error in control module PCB | Replace control module PCB | 10.27 |
| 1304 | Send data different from receive data | Error in control module PCB | Replace control module PCB | 10.27 |
| 1305 | Error opening disk interface | Software error | Reboot BEA, if error still present:<br>Re-install system software | 5.23 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1306 | Error reading disk | Faulty disk | Insert new disk | |
| 1307 | Error making temporary filename | No OS9-formatted disk inserted | Format disk using OS9 Service disk. | see EDIS |
| 1308 | Error creating temporary file | Error in voltage supply | Check voltage supply | 10.2 and 10.3 |
| 1309<br>1310<br>1311 | Error writing on disk<br>Error reading back<br>Error comparing data | Loose interconnecting cables | Check that interconnecting cables secure, check continuity | 12.1 and 12.4 |
| | | Hard disk error | Perform HD test<br>Format HD using Service disk<br>If error still present:<br>Replace HD | 5.8<br>11.1.3<br><br>10.23 |
| | | Error in control module PCB | Replace control module PCB | 10.27 |
| 1312<br>1313 | Time format error<br>Error setting time | Software error | Reboot BEA, if error still present:<br>Re-install system software | 5.23 |

## 8.7 Messages about opacimeter RTM 430

| No. | Message | Remedy | Section |
|---|---|---|---|
| 2000 | Dirt on RTM transmitter / receiver | Clean transmitter / receiver<br>Replace transmitter / receiver<br>Trouble-shooting to RTM Repair Instructions | |
| 2001 | Measured-value range too small | Clean transmitter / receiver<br>Replace transmitter / receiver<br>Trouble-shooting to RTM Repair Instructions | |
| 2002 | Supply voltage outside tolerance | Check voltage supply | 12.1 and 12.4 |
| | | Check interconnecting cable VSM to RTM<br>Trouble-shooting to RTM Repair Instructions | |
| | | Replace control module PCB | 7.27 |
| 2003 | Error in purge-air curtains | Trouble-shooting to RTM Repair Instructions | |
| 2004 | Calibration necessary | Initiate RTM calibration | |
| 2005 | EPROM checksum error | Trouble-shooting to RTM Repair Instructions | |
| 2006 | EPROM checksum error | Trouble-shooting to RTM Repair Instructions | |
| 2007 | Calibration necessary | Perform RTM calibration to RTM Repair Instructions. | |
| 2008 | Linearity check necessary | Perform linearity check to RTM Repair Instructions. | |
| 2009 | Too much light on receiver | Trouble-shooting to RTM Repair Instructions | |
| 2010 | Faulty switchover valve | Replace switchover valve<br>Trouble-shooting to RTM Repair Instructions | |
| 2011 | Faulty exhaust-gas temperature sensor | Replace exhaust-gas temperature sensor<br>Trouble-shooting to RTM Repair Instructions | |
| 2012 | Faulty measuring-chamber temperature sensor | Replace measuring-chamber temperature sensor<br>Trouble-shooting to RTM Repair Instructions | |
| 2013 | Faulty D/A converter | Replace D/A converter<br>Trouble-shooting to RTM Repair Instructions | |
| 2014 | Negative opacity encountered | Zero calibration was performed with gas or calibration filter:<br>Perform correct zero calibration, if error still present:<br>Check solenoid valve and replace if necessary to RTM Repair Instructions | |
| 2020<br>2021<br>2022<br>2023<br>2024<br>2025 | Command not allowed at present time<br>Tester reports error<br>Unable to open interface<br>Unable to close interface<br>Interface write error<br>Interface read error | Software error: Reboot system, if error still present:<br>Re-copy system software on VSM, replace control module PCB | 5.23<br>10.27 |
| 2026 | RTM reports parameter error | Trouble-shooting to RTM Repair Instructions | |
| 2027<br>2028<br>2029<br>2030<br>2031<br>2032<br>2033<br>2034 | RTM has received unknown command<br>Invalid function call<br>Interface is not open<br>Unexpected / unknown reply<br>Memory full<br>Incorrect module identification<br>Faulty CRC from / to RTM<br>Missing / incorrect parameters from RTM | Software error: Reboot system, if error still present:<br>Re-copy system software on VSM, replace control module PCB | 5.23<br>10.27 |
| 2035 | Clock error | Check battery voltage, replace if necessary<br>Replace RTM computer PCB | |
| 2090 | Unknown error | Software error: Reboot system, if error still present:<br>Re-copy system software on VSM, replace control module PCB | 5.23<br>10.27 |
| 2099 | RTM does not respond | Check voltage supply<br>Check interconnecting cable VSM to RTM<br>Trouble-shooting to RTM Repair Instructions<br>Replace control module PCB | 12.1 and 12.4<br><br><br>10.27 |

## 8.9 Messages about EAM exhaust-gas analyzer module

| No. | Message | Remedy | Sectio |
|---|---|---|---|
| 4000<br>4001<br>4002<br>4003<br>4004<br>4005<br>4006<br>4007<br>4008 | Error opening interface<br>Error writing to interface<br>Error reading interface<br>Error closing interface<br>Exhaust-gas interface not open<br>Command not allowed at present time<br>Unexpected / unknown reply<br>Memory full<br>Exhaust-gas analyzer module reports parameter error | Software error: Reboot system, if error still present:<br>Re-copy system software on VSM, replace control module PCB | 5.23<br>10.27 |
| 4027<br>4028<br>4029 | Calibration of HC channel outside tolerance<br>Calibration of CO channel outside tolerance<br>Calibration of $CO_2$ channel outside tolerance | Replacing measuring bank | 10.10 |
| 4030 | $O_2$ sensor voltage below minimum allowable level | Replace $O_2$ measuring sensor<br>Check continuity of connection cable, replace if necessary | 10.11<br>12.1 and 12.4 |
| 4031 | Supply voltage outside tolerance | Check mains voltage, if mains voltage is out of tolerance, changeover transformer connections accordingly.<br>Check interconnecting cable to DMM, replace if necessary<br>Check voltage supply<br>Replace control module PCB<br>Replace measuring bank | 10.1<br>10.2<br>10.3<br>10.27<br>10.10 |
| 4032 | Analyzer part temperature measurement malfunction | Replace measuring bank | 10.10 |
| 4033 | Faulty air-pressure measurement | Replace measuring bank | 10.10 |
| 4034 | Insufficient flow | Check coarse filters GF1, GF2, GF3 and GF4, replace if necessary<br>Check suction power of pump, replace if necessary<br>Check flow sensor, replace if necessary<br>Check hosing as per gas circuit diagram<br>Clean condensate separator | <br>10.13 u. 10.14<br>10.15<br>12.5<br>10.18 |
| 4035 | No temperature compensation | Replace measuring bank | 10.10 |
| 4036 | Recalibrate with calibrating gas | Perform recalibration with calibrating gas | 4.7.5 |
| 4040<br>4041<br>4042<br>4043<br>4044<br>4050<br>4051<br>4052 | Calibration for HC signal outside tolerance<br>Calibration for CO signal outside tolerance<br>Calibration for $CO_2$ signal outside tolerance<br>Analyzer part does not respond<br>Incorrect channel assignment<br>HC channel not calibrated<br>CO channel not calibrated<br>$CO_2$ channel not calibrated | Replace measuring bank | 10.10 |
| 4053 | Carbon canister contaminated with HC residues | Replace carbon canister<br>Check cross sensitivity to water vapour<br>Replace hosing as per gas circuit diagram<br>Clean analyzer chambers, **not in warranty cases!**<br>Replace measuring bank | <br>10.12<br>12.5<br>10.9<br>10.10 |
| 4055 | Leak test failed | Check exhaust-sample probe and hose for cracks<br>Check hosing as per gas circuit diagram<br>Perform leak test of measuring bank, replace measuring bank if necessary | <br>12.5<br>10.7<br>10.10 |
| 4057 | HC residues in gas sampling system | Purge exhaust-gas analyzer module with fresh air,<br>if error still present: replace internal hosing (see gas circuit diagram) | 4.7.1<br>12.5 |

| No. | Message | Remedy | Section |
|---|---|---|---|
| 4058 | Faulty calibration of $O_2$ sensor | Repeat $O_2$ calibration<br>Replace $O_2$ sensor | 4.7.4<br>10.11 |
| 4059 | A/D converter off-scale | Replace measuring bank | 10.10 |
| 4061 | CRC checksum error | Perform download for exhaust-gas analyzer module<br>Replace measuring bank | 9.9<br>10.10 |
| 4062 | Exhaust-gas analyzer module has received unknown command | Reboot BEA, if error still present:<br>Install BEA system software | <br>5.23 |
| 4063 | Channel not ready for measurement | Replace measuring bank | 10.10 |
| 4066 | Calibration of NO channel outside tolerance | Calibrate NO channel<br>Check internal hosing as per gas circuit diagram<br>Replace NO sensor | 4.12.5<br>12.5<br>10.20 |
| 4067 | Recalibrate with calibrating gas | Calibrate NO channel | 4.12.5 |
| 4068 | Valve test after leak test not OK | Replace valve | 10.19 |
| 4090 | Unknown error | Replace measuring bank | 10.10 |
| 4091 | Parameter error when function called | Perform download for exhaust-gas analyzer module<br>Replace measuring bank | 9.9<br>10.10 |
| 4099 | Exhaust-gas analyzer module does not respond | Check voltage supply<br>Check connection cable<br>Replace measuring bank | 10.2 and 10.3<br>12.1<br>10.10 |

### 8.10 Reference numbers when downloading DTM firmware

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 5000<br>5001<br>5033<br>5034 | Wrong number of arguments<br>Unknown interface<br>Cannot open interface<br>Cannot load data module | Check AMM connecting cable to DTM using ohmmeter.<br>Replace LP control computer<br>Replace DTM-LP | <br>10.27<br>10.28 |
| 5036 | Chip ID timeout | Connecting cable not plugged in or faulty<br>Check connecting cable using ohmmeter | <br>12.4 |
| 5037<br>5038<br>5039<br>5040<br>5041<br>5042 | Chip ID faulty<br>Boot2 Echo Compare error<br>Boot2 Echo Timeout error<br>Protocol STX Timeout<br>Protocol DLE Timeout<br>Init. message from C167 missing or faulty | Replace DTM-LP | 10.28 |

### 8.11 Reference messages on OBD printed circuit board

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 6005 | Error group „Fatal“ | | |
| 6006 | Error group „Status fault“ | | |
| 6007 | Error group „Download fault“ | | |
| 6008 | Error group „Communication fault“ | | |
| 6009 | Error group „Not supported“ | Run interface test | 5.1 - 5.4 |
| 6010 | SST could not be opened | Check AMM connecting cable to measuring technology | |
| 6011 | SST could not be closed | using ohmmeter. | |
| 6012 | Write error on interface | Check connecting cable for OBD printed circuit board | |
| 6013 | Read error from interface | to CPU printed circuit board using ohmmeter | |
| 6014 | OBD module does not respond | OBD printed circuit board faulty —> replace | 10.30 |
| 6017 | Function call invalid | CPU printed circuit board faulty —> replace | 10.27 |
| 6018 | Interface not open | | |
| 6019 | Unknown error | | |
| 6030 | Unexpected / unknown response | | |
| 6031 | Buffer overrun | | |
| 6032 | Module ID incorrect | | |
| 6033 | CRC incorrect | | |
| 6034 | OBDM parameter missing / wrong | | |
| 6035 | No memory for fault text | | |

#### 8.11.1 Reference numbers for errors in "Fatal" group

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 6050 | Internal module error | OBD printed circuit board faulty —> replace<br>CPU printed circuit board faulty —> replace | 10.30<br>10.27 |

#### 8.11.2 Reference numbers for errors in "Status error" group

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 6060 | Faulty CRC16 checksum | OBD printed circuit board faulty —> replace<br>CPU printed circuit board faulty —> replace | 10.30<br>10.27 |
| 6061 | Level circuit 30 line low | Check connecting cable for OBD printed circuit board to CPU printed circuit board using ohmmeter | |
| 6062 | Unknown command to OBDM | | |
| 6063 | Invalid command parameter | OBD printed circuit board faulty —> replace | 10.30 |
| 6064 | Command not permissible | CPU printed circuit board faulty —> replace | 10.27 |
| 6065 | Command not possible in device | | |
| 6066 | Memory overrun at U-lambda | | |

#### 8.11.3 Reference numbers for errors in "Download" group

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 6070 | DBoot module not loaded | Re-boot BEA if fault | |
| 6071 | Other module not loaded | remains present: Re-install system software | 5.23 |
| 6072 | Date sequence not OK | OBD printed circuit board faulty —> replace | 10.30 |
| 6073 | Module combination does not match | CPU printed circuit board faulty —> replace | 10.27 |
| 6074 | Download package incorrectly received | | |
| 6075 | Module checksum n. o.k. | | |

### 8.11.4 Reference numbers for errors in „Communication error“ group

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 6080<br>6081<br>6082<br>6083<br>6084<br>6085<br>6086<br>6087<br>6088<br>6089<br>6090<br>6091 | Control module timeout<br>Control module reception fault<br>OBDM reception error<br>Invalid baud rate<br>Invalid KeyBytes received<br>Communication terminated<br>Wrong command to control module<br>Invalid checksum from control module<br>Communication ended with error<br>Invalid data frame (KWP2000)<br>Control module busy<br>Service not supported by control module | Run interface test<br>OBD printed circuit board faulty —> replace<br>CPU printed circuit board faulty —> replace<br>Control unit defective. | 5.1 - 5.4<br>10.30<br>10.27 |
| 6100<br>6101<br>6102<br>6105 | Faulty dyn. OBD text<br>Error when allocating memory<br>Error when opening OBD text file<br>OBD module transmits unknown special code | Run interface test<br>OBD printed circuit board faulty —> replace<br>CPU printed circuit board faulty —> replace | 5.1 - 5.4<br>10.30<br>10.27 |

### 8.12 Reference numbers in combination with AWN.Modul

| No. | Designation | Remedy | Chapter |
|---|---|---|---|
| 7099 | No connection to Awn@Chip module | Check connecting cable for AWN printed circuit board to CPU printed circuit board using ohmmeter<br>AWN printed circuit board faulty —> replace<br>If error persists, notify system administrator as error may be in the software of the order processing. | 12.4<br>10.31 |

### 8.13 Malfunction messages for testing OBD printed circuit board with KTS115PC program

Multiple errors may be reported simultaneously, e.g. = $0001 + $ 0002 + $ 0004

#### 8.13.1 Error messages for "SDTEST"

| No. | Possible cause | Remedy | Chapter |
|---|---|---|---|
| $0001<br>$0002 | OBD/CAN-LP defective | OBD/CAN-LP replace | 10.30 |
| $0004 | OBD/CAN connection cable<br>or OBD/CAN-LP defective. | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-<br>connecting cable should be replaced.<br>If malfunction continues then OBD/CAN-LP<br>to be replaced. | 10.30 |
| $0008 | No power supply.<br>or OBD/CAN-LP defective. | Banana plugs B+ (red) and GND (black) of OBD/CAN-<br>Connect adapter line connecting cable AL 350 to voltage supply.<br>Repeat test using AL 350.<br>If error message still<br>present, repeat test using short circuit plug KS 35.<br>If malfunction no longer present, OBD/CAN-<br>connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP<br>to be replaced. | 10.30 |
| $0016<br>$0032<br>$0064<br>$0128<br>$0256<br>$0512 | OBD/CAN connection cable<br>or OBD/CAN-LP defective. | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-<br>connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP | |

#### 8.13.2 Error messages for "DLCTEST"

| No. | Possible cause | Remedy | Chapter |
|---|---|---|---|
| $0001<br>$0002 | OBD/CAN-LP defective | OBD/CAN-LP to be replaced. | 10.30 |
| $0003<br><br>$0016 | B+ not connected, or<br><br>OBD/CAN-LP defective | Banana plugs B+ (red) and GND (black) of<br>the adapter cable<br>Connect AL 350 to power supply.<br>Repeat test.<br>If malfunction still present, repeat test<br>using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-<br>connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP to be replaced. | 10.30 |
| $0004-<br>§0015 | OBD/CAN-LP defective | OBD/CAN-LP to be replaced. | 10.30 |

### 8.13.3 Error messages for "LBCTEST"

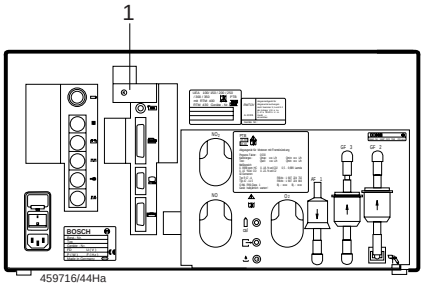
| No. | Possible cause | Remedy | Chapter |
|---|---|---|---|
| $0001<br>$0002<br>$0003 | Bus+ fault or<br>OBD/CAN-LP defective | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP to be replaced. | 10.30 |
| $0004<br>$0008<br>$0012 | Bus fault or<br>OBD/CAN-LP defective | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP to be replaced. | 10.30 |

### 8.13.4 Error messages for "CANTEST"

| No. | Possible cause | Remedy | Chapter |
|---|---|---|---|
| $0001<br>$0004 | OBD/CAN connection cable CAN-L or OBD/CAN-LP defective. | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-connecting cable should be replaced.<br>If malfunction still present, OBD/CAN-LP to be replaced. | 10.30 |
| $0002<br>$0008 | OBD/CAN connection cable CAN-H or OBD/CAN-LP defective. | Repeat test using short circuit plug KS 350.<br>If malfunction no longer present, OBD/CAN-connecting cable should be replaced.<br>If malfunction still present, IOBD/CAN-LP to be replaced. | 10.30 |

## 9. Adjustment functions

In order to enable the Adjustment functions menu, first unscrew the cover (1) from the rear of the BEA. To do so, you must break the security seal. Behind this cover is a adjustment switch, with which you can remove the write-protection of the flash-prom.




### Overview of Adjustment functions menu

Remember to set the setting switch back to **Off** once you quit the **Adjustment functions** menu.

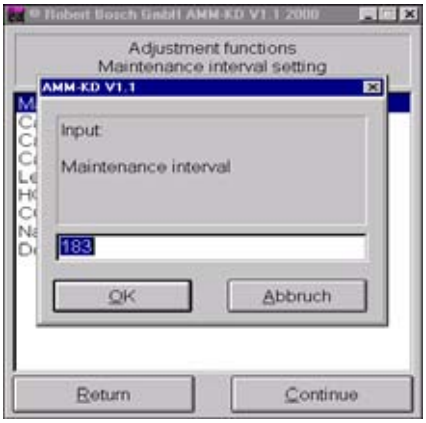
Select the menu with the ↑ and ↓ keys and confirm with ↵ or by double-clicking the mouse.


### 9.1 Setting the Maintenance interval

In this menu you can enter the interval between services in days.
If the set time has elapsed, a message about the next service appears on the display of the BEA.

Observe legal requirements when entering the service interval!

Enter the service interval using the keyboard, e.g. **180**.
Confirm your entry with ↵ or by clicking **OK**.



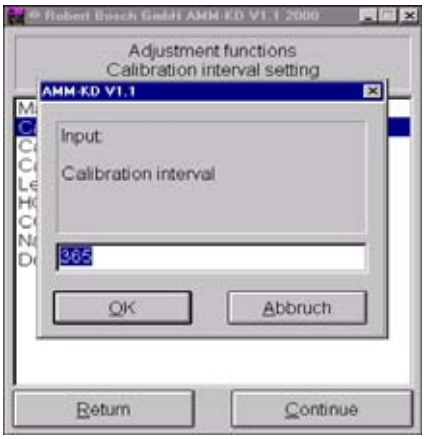

The **OK** box is displayed for 1 s.
The service interval setting function is now complete.

## 9.2 Setting the calibration interval

In this menu you can enter the interval at which the BEA must be recalibrated with calibrating gas.

! Observe legal requirements when entering the calibration interval!
Once you have made these entries, please refer to Sections 6.4 and 6.5.

Enter the calibration interval using the keyboard, e.g. **365**.
Confirm your entry with ↵ or by clicking **OK**.
The **OK** box is displayed for 1 s.
The calibration interval setting function is now complete.



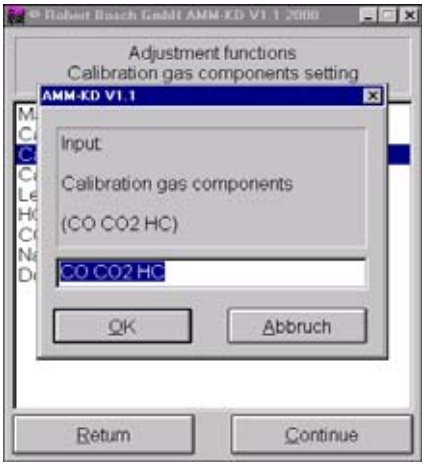

## 9.3 Setting the calibration gas components

This menu allows you to define which gas measuring channels must be recalibrated with calibrating gas during the yearly recalibration process.

! Observe legal requirements when making your entry!

ⓘ Enter the gas measuring channels in capital letters.
The components you have preselected must be contained in the calibrating gas used for recalibration.

Using the keyboard, enter which gas measuring channels are to be recalibrated.
Confirm your entry with ↵ or by clicking **OK**.
The **OK** box is displayed for 1 s.
Entry is now complete.




## 9.4 Setting the calibration sequenz

This menu enables you to define whether, once the calibration interval has elapsed, the BEA displays a message permitting further work or whether a message is displayed and the BEA is subsequently disabled and no further work permitted.

! Observe legal requirements when making your entry!

Select the appropriate setting with the ↑ and ↓ keys and confirm with ↵ or by clicking **Next**.
The **OK** box is displayed for 1 s.
Entry is now complete.

## 9.5 Setting the leakage test interval

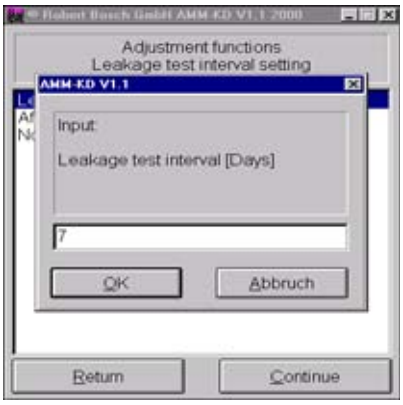
This menu enables you to define whether a leakage test must be performed each time the BEA is switched on or at certain intervals (in days).

! Observe legal requirements when making your entry!

Select the appropriate setting with the ↑ and ↓ keys and confirm with ↵ or by clicking **Next**.


If you select and confirm the option **Enter leakage test interval**, proceed to enter the appropriate interval in days using the keyboard, e.g.: **7** days.

Confirm your entry with ↵ or by clicking **OK**.
The **OK** box is displayed for 1 s.
Entry is now complete.




## 9.6 Setting the HC test

In this menu you can specify whether or not an HC residues test should be performed prior to each measurement.

Select the appropriate setting with the ↑ and ↓ keys and confirm with ↵ or by clicking **Next**.
The **OK** box is displayed for 1 s.
Entry is now complete.


## 9.7 Setting $CO_{vrai}$

This is where you can enable the change of setting for $CO_{vrai}$. This setting work is obligatory as it is a prerequisite of configuration in the **Set parameters** menu (Sec. 4.5).

! Observe legal requirements when making your entry!

Select the appropriate setting with the ↑ and ↓ keys and confirm with ↵ or by clicking **Next**.
The **OK** box is displayed for 1 s.

i If you select the option $CO_{vrai}$ setting disabled, the $CO_{vrai}$ test in the Set parameters menu (Sec. 4.5.4) can no longer be enabled.

## 9.8 National regulation settings

This menu enables you to confirm country-specific settings for the exhaust-gas analyzer module.

Select the appropriate setting with the ↑ and ↓ keys and confirm with ↵ or by clicking **Next**.

The **OK** box is displayed for 1 s.
Entry is now complete.


## 9.9 Download

Through this menu you can download new software to the exhaust-gas analyzer module.

ⓘ This is not new software for the BEA.

To confirm that you wish to perform the download, select **Yes** with the ← key and confirm with ↵ or simply click on **Yes** with the mouse.


The directory and name of the download file is displayed to allow you to check and enter new software.

Using the keyboard, enter the directory and name of the download file.

Confirm your entry with ↵ or by clicking **OK**.


As a safeguard, you are asked once again whether download should really be performed.

To confirm that you wish to perform the download, select **OK** with the ← key and confirm with ↵ or simply click on **OK** with the mouse.

! For further procedure, it is essential that you follow the on-screen instructions!

Click on Break if your wish to end the download program.

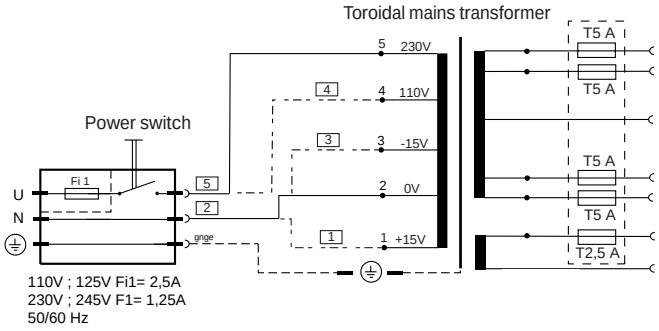
## 10. Repairs

### 10.1 Adjusting mains voltage for toroidal mains transformer

Before putting the Bosch Emissions Analysis into operation, you must check that the set voltage of the toroidal mains transformer is the same as that of the mains voltage. The Bosch Emissions Analysis is factory-set to 230V.

The transformer mains voltage may only be set by authorized Service personnel. The Bosch Emissions Analysis must be off circuit.

1. Remove housing cover.
2. Remove connection cable 5 of the toroidal mains transformer (see diagram) from the mains input connector.
3. Connect the required connection cable (see diagram) to the mains input connector.
   Possible settings (see table):
   230V (factory setting), 245V, 125V, 110V, 95V.
4. Close housing cover.
5. Perform safety test as per regulations in country of use (e.g. to VDE in Germany).




| Mains voltage | Transformer voltage | | | | |
|---|---|---|---|---|---|
| | 230V | 110V | -15V | +15V | 0V |
| 230V | X | | | | X |
| 245V | X | | | X | |
| 125V | | X | | X | |
| 110V | | X | | | X |
| 95V | | X | X | | |

If the mains voltage connection changes, the adhesive label on the rear of the unit bearing the voltage must be replaced.

### 10.2 AC / DC voltage supply to control module PCB

**Voltage supply AC**
**Connector X 18:**

Pin 3 (⊥) to Pin 1 = ~ 14.5 V
Pin 3 (⊥) to Pin 2 = ~ 11 V
Pin 3 (⊥) to Pin 4 = ~ 11 V
Pin 3 (⊥) to Pin 5 = ~ 14,5 V

Pin 7 (⊥) to Pin 6 = ~ 22 V

**Voltage supply for RTM 430**
**Connector X 3:**
Pin 4 (⊥) to Pin 6 = ~ 14.5 V
Pin 4 (⊥) to Pin 7 = ~ 14.5 V
Pin 4 (⊥) to Pin 8 = ~ 14.5 V

Pin 5 (⊥) to Pin 10 = ~ 14.5 V
Pin 5 (⊥) to Pin 11 = ~ 14.5 V
Pin 5 (⊥) to Pin 12 = ~ 14.5 V

**Voltage supply for TFT display**
**Connector X 4:**

Pin 2 of connector X4 carries extremely high voltage. Only measure the voltage using a high-voltage probe.

Pin 1 (⊥) to Pin 2 = 1 KV

**Voltage supply for OBD PCB**
**Connector X 6:**
Pin 9 (⊥) to Pin 2 = + 5 V
Pin 9 (⊥) to Pin 4 = + 5 V

Pin 9 (⊥) to Pin 6 = - 12 V
Pin 9 (⊥) to Pin 8 = + 12 V

**Voltage supply for RPM / temperature PCB**
**Connector X8:**
Pin 1 (⊥) to Pin 2 = + 5 V
Pin 1 (⊥) to Pin 4 = + 5 V

Pin 1 (⊥) to Pin 6 = - 12 V
Pin 1 (⊥) to Pin 8 = + 12 V

Pin 1 (⊥) to Pin 11 = 9 V - 16 V
Pin 1 (⊥) to Pin 13 = 9 V - 16 V

Pin 1 (⊥) to Pin 16 = - 5 V

**Voltage supply for heating**
**Connector X 19:**
Pin 3 (⊥) to Pin 1 = + 12 V
Pin 3 (⊥) to Pin 2 = 9 V - 16 V

**Voltage supply for exhaust-gas analyzer module**
**Connector X 22:**
Pin 1 (⊥) to Pin 2 = 9 V - 16 V

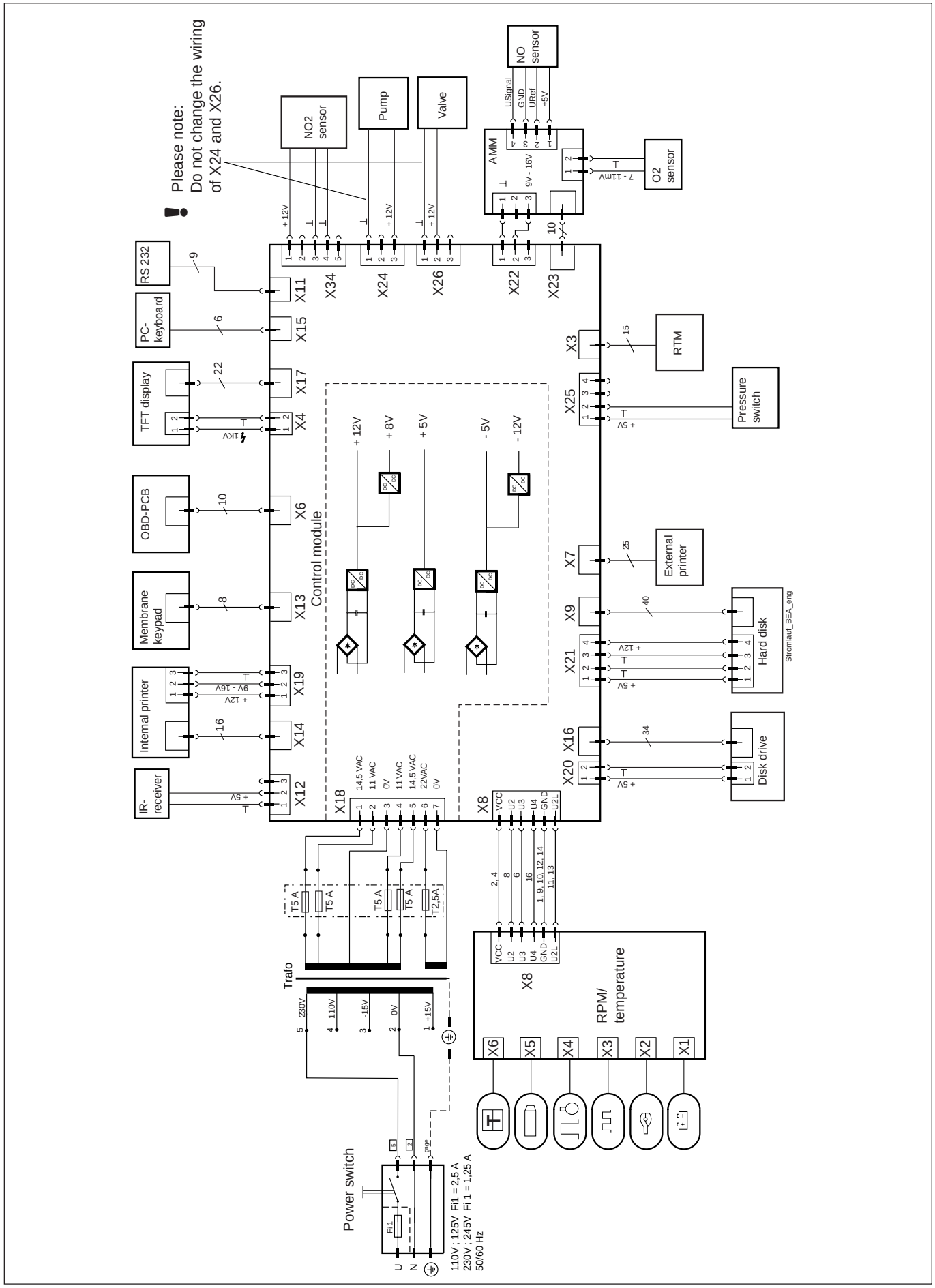
**Voltage supply for pump**
**Connector X 24:**
Pin 1 (⊥) to Pin 3 = + 12 V

**Voltage supply for pressure switch / pressure sensor**
**Connector X 25:**
Pin 1 (⊥) to Pin 2 = + 5 V

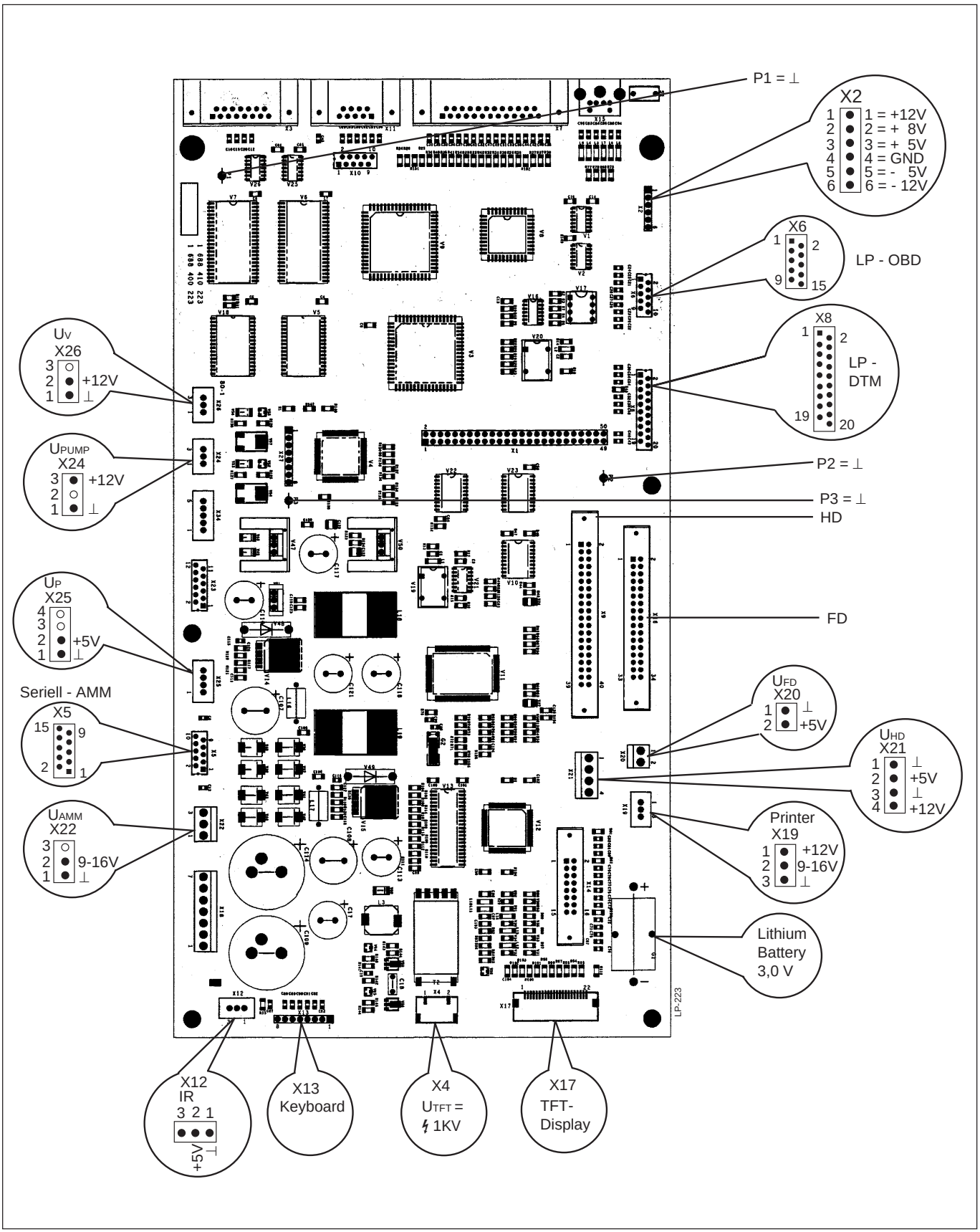
**Voltage supply for solenoid valve**
**Connector X 26:**
Pin 1 (⊥) to Pin 2 = + 12 V

**Voltage supply for NO2 measuring sensor**
**Connector X 34:**
Pin 3 (⊥) to Pin 1 = + 12 V

## 10.3 Block circuit diagram of voltage supply



## 10.4 View of equipment side of control module PCB



### 10.5 Visual inspection of measuring bank of exhaust-gas analyzer module

- Is the measuring bank damaged on the outside?
- Are the glass connectors of the HC, CO and $CO_2$ detectors broken off or damaged?
- Is the sheet-metal frame of the measuring bank bent?
- Are analysis-chamber connectors broken off or damaged?
- Are motherboard components (e.g. pressure gauge) broken off or damaged?

If any of the above is the case, the measuring bank must be replaced.

### 10.6 Electrical test of measuring bank of exhaust-gas analyzer module

After the supply voltage for the measuring bank (9.6 V to 16 V) has been switched on, the light-emitting diode on the motherboard must first light up brightly and then halve its brightness after a few seconds.

- The yellow LED does not light up when the voltage supply to the measuring bank is switched on:
  There is a fault in the motherboard. Replace the measuring bank.

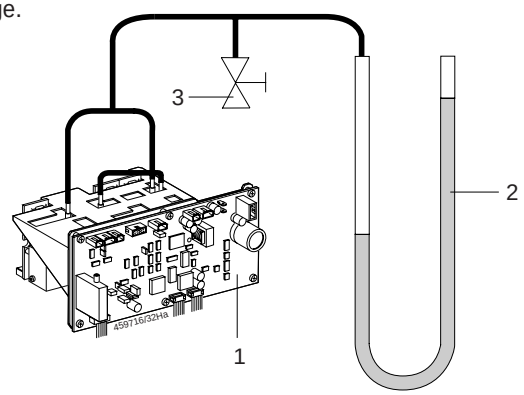
- The LED remains bright; its brightness is not diminished:
  Load valid software in the measuring bank.
  Replace the measuring bank.

- The LED lights up brightly at first, then halves its brightness, but then commences this cycle again after a short time:
  The power supply to the measuring bank is not capable of supplying the high making current once the lamp has been switched on.
  Check the power supply, ensure that higher making currents are possible.
  Replace the measuring bank.

- There is no communication between the measuring bank and a computer or higher-order system:
  Ensure correct plug connections.
  Replace the measuring bank.

### 10.7 Leak test of measuring bank

1. Connect the measuring bank (1) as shown in the diagram.
2. At the valve (3), generate a gauge pressure of approx. 100 cm water gauge.
3. Close the valve.
4. Observe the pressure drop in the U-tube gauge (2).
   The drop in pressure may not exceed 1 cm water gauge per minute.
   If the drop in pressure is greater than 1 cm/min, this indicates a leak in the gas routing system of the measuring bank.
5. Clean and check the measuring chambers as described in ections 10.5-10.9.



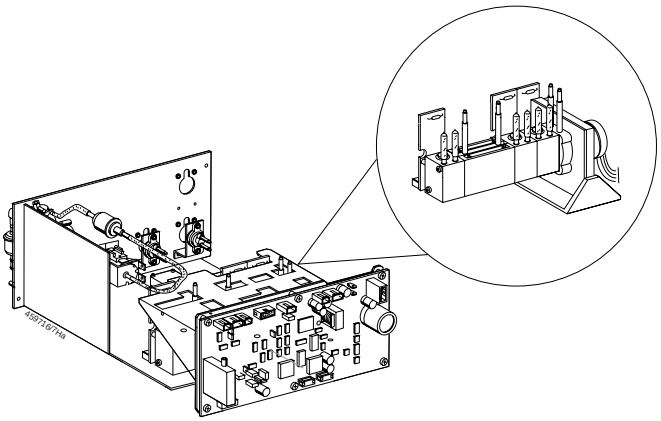
### 10.8 Cleaning the lamp reflector

Exposure to various environmental influences may cause a film to form on the surface of the reflector. This makes the lamp dark for particular wavelengths, and it must therefore be cleaned.

Recommended liquid cleaner: **Extran MA 01 alkaline**

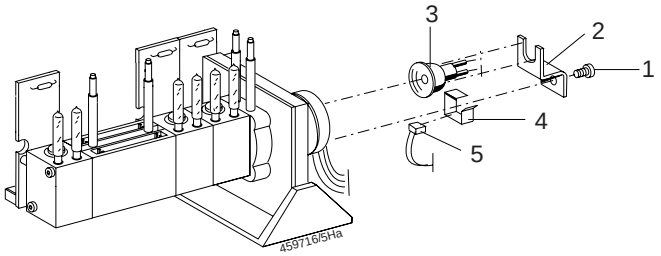
Hersteller: Messrs. E. Merck, Posfach 41 15,
Frankfurter Straße 250, 64271 Darmstadt
Tel.: (+49) (0) 6151 720

**Procedure:**




The lamp is situated on the same side as the measuring equipment (see diagram).

1. Remove the two fastening screws of the exhaust-gas analyzer module on the underside of the unit.
2. Remove the four fastening screws of the exhaust-gas analyzer module on the rear of the unit.
3. Disconnect all plug connections to the exhaust-gas analyzer module.
4. Carefully pull the exhaust-gas analyzer module out of the unit from behind.




5. Remove the fastening screw (1) for the lamp retaining clip (2).
6. Remove the retaining clip (2).
7. Carefully release the retaining clip (4) of the temperature sensor (5) and take out the temperature sensor.
8. Disconnect the interconnecting cable for the lamp from the motherboard of the measuring bank.
9. Dip the lamp in the liquid cleaner until the film has disappeared. Do not use any mechanical tools as these could damage the lamp filament or reflector surface.
10. Rinse the lamp thoroughly with distilled water. Next, immerse the lamp in alcohol and dry with a hot-air drier. This process should ensure that all water is removed and no water spots remain on the surface.

After you have cleaned and re-installed the lamp, you must perform the following calibration work:

1. Check of measuring accuracy (Section 4.3).

### 10.9 Cleaning the analysis chambers and windows

! The glass connectors of the detectors are breakable. If one is broken, the detector can no longer be used.
The panels of the analysis chambers are breakable. Take care not to leave fingerprints on the aluminium surfaces in the analysis chambers or on the windows of the analysis chambers and detectors.

i To clean the analysis chambers, please use liquid cleaning agent **Extran MA 01** (see Section 10.8, Cleaning the lamp reflector).

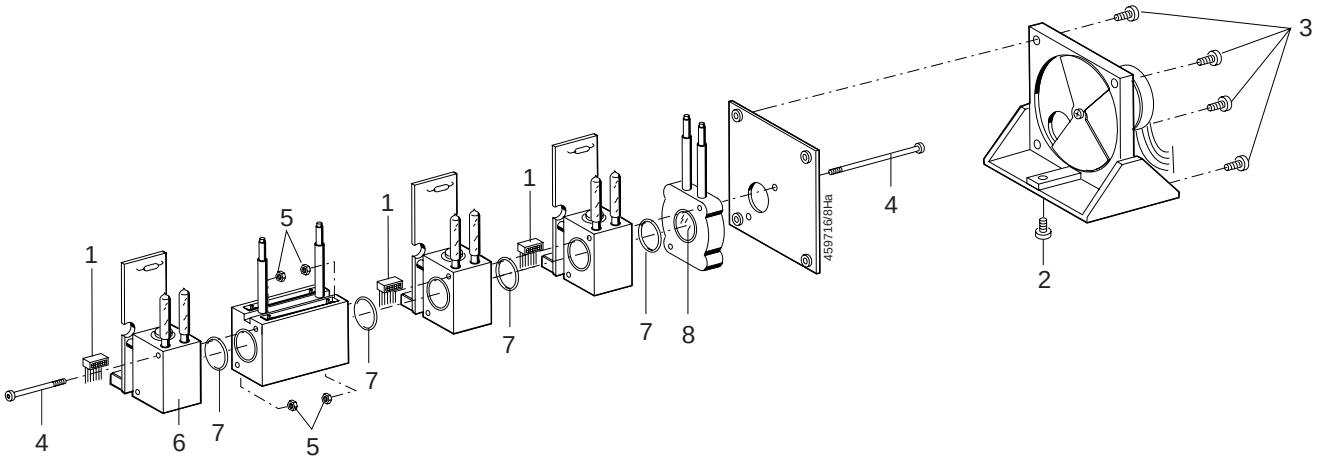
1. Remove all hose lines from the measuring bank.
2. Disconnect all connectors from the motherboard of the measuring bank.
3. Unscrew the three fixing bolts (1) for the measuring bank from the underside of the exhaust-gas analyzer module.
4. Carefully remove the connectors (2) from the PCB's of the receiver chambers.
5. Slacken the four fixing bolts (3) on the lamp side, so that the analyzer part can be pushed out of the sheet-metal frame. Watch out for the glass connectors of the detectors!
6. Now unscrew the four fixing bolts (3) completely and remove the chopper part from the analyzer part.
7. Slacken the two fixing bolts (4) of the analyzer part. Take care to ensure that the two nuts (5) do not get lost inside the analysis chamber.
8. Unscrew the HC receiver chamber (6). Take care to ensure that the two nuts (5) do not get lost inside the analysis chamber.
9. Remove the O-rings (7) and windows (8) of the analysis chambers.

**Cleaning the analysis chambers:**
Immerse a soft bottle brush in liquid cleaning agent which has been diluted as specified, and carefully brush the inner aluminium surfaces of the analysis chambers.

Take care: that no liquid, if possible, gets behind the aluminium panel
not to scratch the inner surfaces
not to turn the aluminium panel
the holes in the panel must line up with the drill holes of the connectors

1. Flush out the clean analysis chamber with demineralized water, taking care to ensure that as little water as possible gets between the aluminium panel and the plastic part.
2. Dry the analysis chambers with a hot-air drier.

**Cleaning the windows:**
Immerse the windows (8) in liquid cleaning agent and rub gently with a soft sponge. Rinse the windows in demineralized water.




! On assembly, take care to ensure that the sealing O-rings (7) of the analysis chambers are properly seated in the groove and that the windows (8) of the analysis chambers are in the recesses provided.
**Do not tighten the fixing bolts to a torque in excess of 1.6 Nm.**

Perform the following adjustment work:
- Leak test, Section 10.7
- Check the measuring accuracy of all three infrared components, Section 4.3
- Check cross sensitivity to water vapour, Section 10.12

## 10.10 Replacing the measuring bank

1. Remove the two fastening screws on the underside of the exhaust-gas analyzer module.
2. Remove the four fastening screws on the rear of the exhaust-gas analyzer module.
3. Remove all hose lines from the measuring bank.
4. Disconnect all connectors from the motherboard of the measuring bank.
5. Unscrew the three fastening screws for the measuring bank from the underside of the exhaust-gas analyzer module.
6. Insert the new measuring bank and secure by screwing the three fastening screws into the underside of the exhaust-gas analyzer module.
7. Push all hose lines back onto the measuring bank.
8. Insert all connection cables in the measuring bank PCB.
9. Fasten the exhaust-gas analyzer module by securing the four fastening screws in the rear of the unit.
10. Fasten the exhaust-gas analyzer module by securing the two fastening screws in the underside of the unit.

Perform the following adjustment work:

- Leak test, Section 10.7
- Check the measuring accuracy of all three infrared components, Section 4.3
- Check cross sensitivity to water vapour, Section 10.12

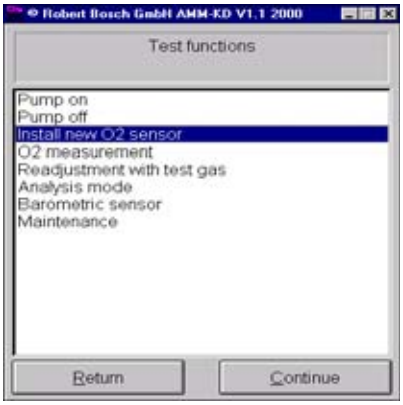
## 10.11 Install new $O_2$ sensor

**!** After unpacking the new $O_2$ sensor, allow it to be preconditioned to the ambient air for at least 30 minutes. Only then can correct zero calibration and measurement be guaranteed.

1. Unscrew the cap for the $O_2$ sensor from the back of the unit.
2. Pull off the connection cable and unscrew the $O_2$ sensor.
3. Screw the new $O_2$ sensor securely in place by hand. Do not use tools and do not use excessive force.

4. Execute the installation routine for the new $O_2$ sensor.
5. In the Function menu, open the **Test functions** submenu.

6. With the ↑ and ↓ keys, select the menu **Install new $O_2$ sensor.**




7. Confirm with ↵ or by clicking **Next**. The data from the last $O_2$ calibration are displayed.
8. Start the evaluation of the new $O_2$ sensor.

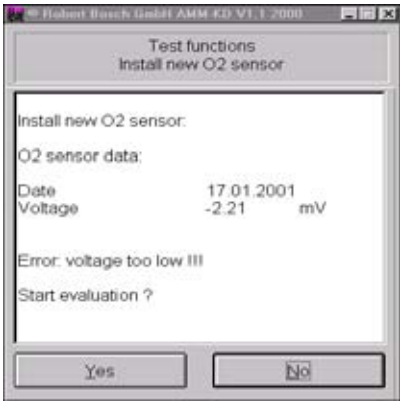
## 10.11 Install new $O_2$ sensor

9. Zero calibration is now performed for a duration of 30 seconds.


10. Following correct $O_2$ calibration the new data are displayed.

11. End $O_2$ assessment with ↵ or by clicking **No**.


If there is a fault during calibration, this is displayed in plain text.
In this case, repeat calibration. The $O_2$ sensor may need to be replaced again.

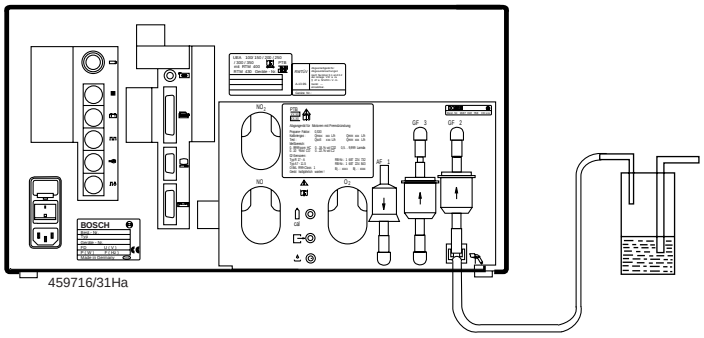


## 10.12 Checking cross sensitivity

Here, the cross sensitivity of the measuring bank to water vapour is tested.
To this aim, connect the exhaust-gas analyzer as illustrated below.

**Procedure:**

1. Remove the test-gas hose from the exhaust-gas analyzer.
2. Prepare the gas wash bottle (pearl bottle), filled with a 3 cm effective water gauge, as illustrated below, but do not yet connect to the exhaust-gas analyzer.



459716/31Ha

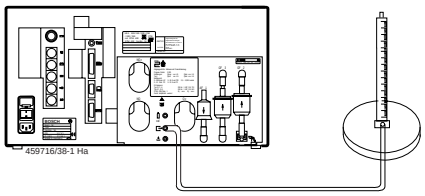
3. In the **Read measured values** menu (Sec. 4.3), start the test.
4. Wait for zero calibration and possibly the HC residues test to be completed.
5. Take note of the values on which the displays of the gas measuring channels settle.
6. Connect the gas wash bottle to the test-gas inlet (diagram, Item 5) of the exhaust-gas analyzer via a hose.
7. Test the influence of water vapour.
   The maximum disturbing influence must **not** exceed the following values:

| | |
|---|---|
| HC measuring range | **< 10 ppm HC** |
| CO measuring range | **< 0.005% vol.** |
| $CO_2$ measuring range | **< 0.1% vol.** |

If the unit demonstrates an impermissibly high level of cross sensitivity to water vapour, clean the analyzer part (Sec. 10.9).

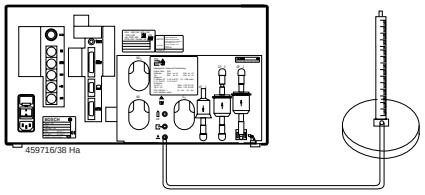
## 10.13 Checking the pump suction power

1. Connect the flow meter (rotameter) to the gas outlet of the BEA (see diagram).

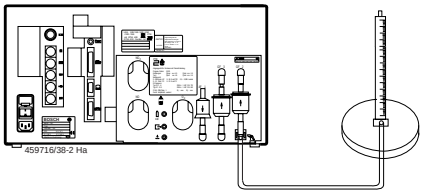

459716/38-1 Ha

2. In the Service software, open the **Read measured values** menu.
3. Read the flow on the flow meter.
   **Nominal value: 1 - 1.5 l/min.**

4. Connect the flow meter (rotameter) to the condensate outlet of the BEA (see diagram).
5. Read the flow on the flow meter.
   **Nominal value: 3 - 4 l/min.**


459716/38 Ha

6. Connect the flow meter (rotameter) to the measurment gas intake of the BEA (see diagram).
7. Read the flow on the flow meter.
   **Nominal value: 4 - 7 l/min.**


459716/38-2 Ha

## 10.14 Replacing the pump

Please also refer to Sections 12.1 and 12.5 dealing with the electrical wiring and hosing for the EAM exhaust-gas analyzer module.

1. Remove the 2-core line leading from the pump to the control module PCB.
2. Remove the hose lines from the pump heads.
3. Using a diagonal cutter, cut the cable binder (on the fastening clip) and remove.
4. Pull the pump out of the fastening clip.
5. Press the new pump into the fastening clip.
6. Insert the 2-core line leading from the pump in the control module PCB.
7. Push the hose lines onto the hose connectors of the pump as shown in the gas circuit diagram (Sec. 12.5) and fasten with hose clips.
8. Perform a leak test (Sec. 4.2) and function test (Sec. 10.13).

As from FD 07.2004 pumps of a shorter design (1 687 222 167) will be installed. In order to fasten these in place, angle bracket 1 681 332 269 also has to be fitted. For mounting details see the Installation instructions 1 689 978 483.

## 10.15 Checking the pressure sensor

1. Start the leakage test (Sec. 4.2) using the Service software.
   If a leak test can now be performed and it is passed, the pressure sensor is deemed to be in order.

   If a leakage test cannot be performed, a message appears prompting you to remove the seal.
   In this case, check the voltage supply to the pressure sensor (Secs. 10.2 and 10.3).
   If the voltage supply is in order, the pressure sensor must be replaced (Sec. 10.17).


## 10.16 Checking the response time of the pressure sensor

1. Using the Service software, start the **Read measurement values** menu.
2. Following zero calibration and the HC residues test, seal off the test-gas inlet.
3. After 5 - 7 seconds, the message **Insufficient flow** should be displayed.
   If the above message is not displayed, you must perform a leak test (Sec. 4.2).
   If the leak test is failed, check that the hosing conforms to the gas circuit diagram (Sec. 12.2).
   If the hosing is in order, replace the pressure sensor (10.17).

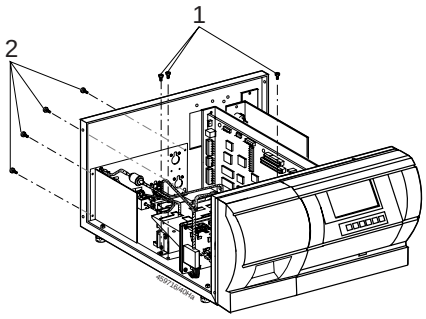
## 10.17 Replacing the pressure sensor

! To install a new pressure sensor you **must** use a Phillips torque screwdriver with a tightening torque of 0.3 Nm.

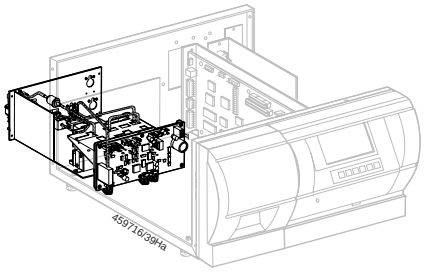
1. Remove the plastic section which holds the disk drive and the hard disk.
2. Remove from the measuring bank the 2-core connection cable leading from the pressure sensor.
3. Remove from the control module PCB the 2-core connection cable leading from the pressure sensor.
4. Pull off the hose line from the pressure sensor.
5. Remove the pressure sensor by unscrewing the two fastening screws.
6. Fit the new pressure sensor by proceeding in the reverse sequence to removal.
7. Perform a function test of the new pressure sensor (Secs. 10.15 and 10.16).

## 10.18 Replacing the water separator

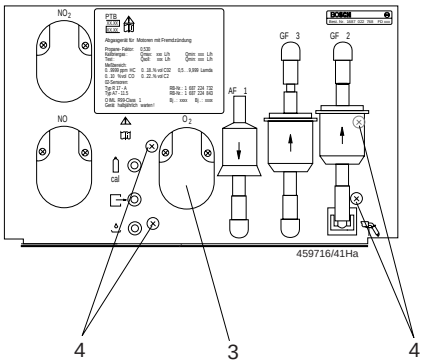
1. Remove the three fastening screws (1) from the floor panel in the interior of the unit.
2. Remove the four fastening screws (2) of the exhaust-gas analyzer module on the rear of the BEA unit.




3. Pull the exhaust-gas analyzer module approx. halfway out of the BEA.
4. Remove all hose lines from the water separator.

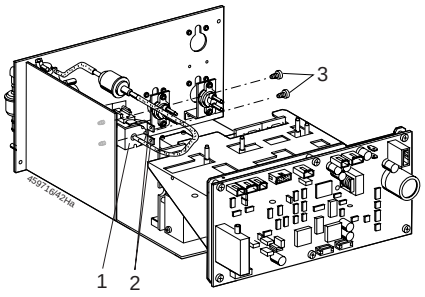



5. Remove the $O_2$ measuring sensor (3) from the rear of the exhaust-gas analyzer module.
6. Remove the four fastening screws (4) for the water separator.
7. Take out the water separator.
8. Fit the new water separator by proceeding in the reverse sequence to removal.
9. Re-attach all hose lines as shown in the gas circuit diagram (Sec. 12.5).
10. Check that interconnection cables are secure.
11. Perform a leak test (Sec. 4.2).



## 10.19 Replacing the solenoid valve

1. Remove the two power supply leads (2) from the solenoid valve (1).
2. Pull the hose lines of the solenoid valve off the hose connectors.
3. Remove the two fastening screws (3) for the solenoid valve.
4. Secure the new solenoid valve in place with the two fastening screws.
5. Push the hose lines onto the hose connectors of the solenoid valve as shown in the gas circuit diagram (Sec. 12.5).
6. Insert the power supply cables onto the connectors of the solenoid valve.
7. Perform a leak test to check for leaks (Sec. 4.2).




## 10.20 Replacing the NO sensor

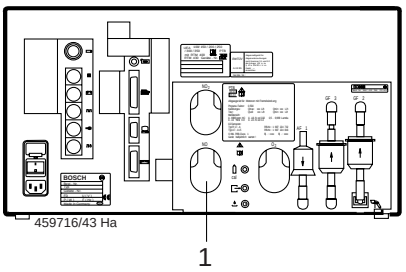
The NO sensor wears out over time. The zero point of NO measurement is monitored continually. If it deviates from the nominal value, the warning message **Calibration of NO channel outside tolerance** appears. The NO sensor must then be replaced and the NO channel recalibrated (Sec. 4.12.4).

**The NO measuring sensor contains acid.**
**Caution: can cause caustic burns!**

**!** Only use original NO measuring sensors (NX1 Nitric Oxide Sensor, Part Number 1 687 224 292).
The NO measuring sensor is hazardous waste and must be disposed of according to the valid regulations. The code number for its disposal is 16 05 02 (EAK code = Europäischer Abfall Katalog (European Waste Catalogue). As an alternative to disposal by public services, these parts may also be sent to AA/W 495 Zentralinstandsetzung (Central Repairs Dept.) for disposal.

**Procedure:**

1. Unscrew the cap (1) of the NO sensor which is on the back of the unit.
2. Unplug the sensor connector and unscrew the NO sensor.
3. Screw the new NO sensor **securely** in place by hand. Do **not** use tools and do **not** use excessive force.
4. Calibrate the NO channel as described in Section 4.12.5.

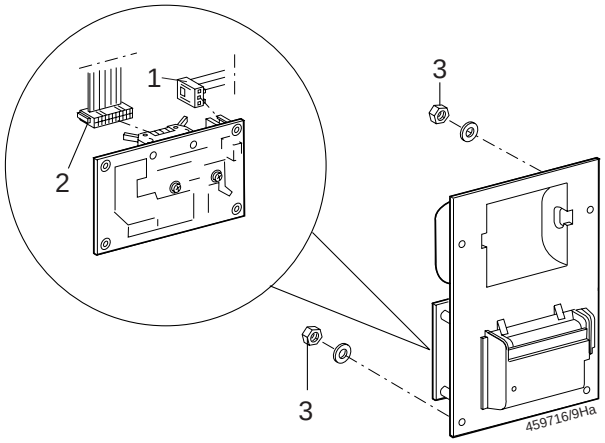


### 10.21 Replacing the internal printer

In order to remove the internal printer without problem, you must first remove the exhaust-gas analyzer module. Take out the printer paper before removing the printer.

**Procedure:**

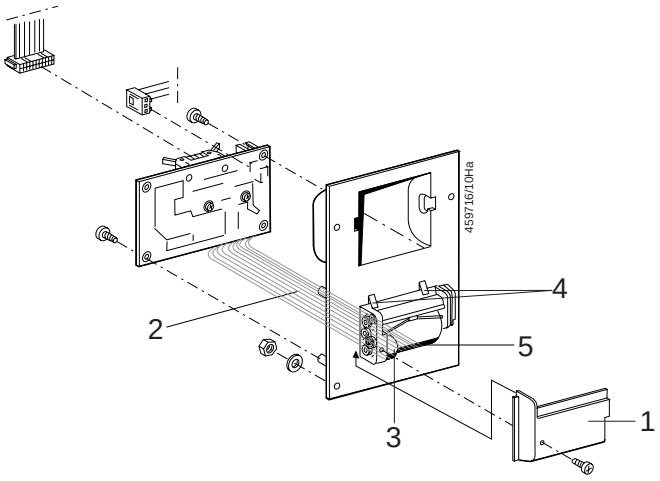
1. Remove the cables for the power supply (1) and data transmission (2) from the controller PCB of the printer.
2. Remove the four fixing nuts (3) of the printer using a size 7 socket wrench.
3. Take out the faulty printer and insert the new one.
4. Secure the new printer with the four fixing nuts.
5. Plug the power supply and data transmission cables into the printer controller PCB.
6. Perform a function test of the printer (Sec. 5.10).
7. Re-install the exhaust-gas analyzer module.




#### 10.21.1 Replacing the printing mechanism

**Procedure:**

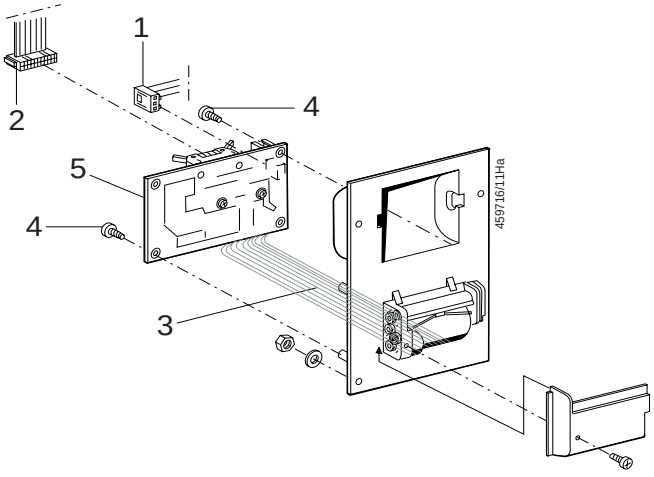
1. Remove the printer (see Sec. 10.21).
   Remove the plastic cover (1) of the printing mechanism.
2. Carefully pull the foil cable (2) out of receptacle J 10 on the controller PCB.
3. Unscrew the fixing bolt (3) for the printing mechanism (under the foil cable).
4. Pull the printing mechanism downwards and out.
5. Insert the new printing mechanism. On installing take care to ensure that the two lugs (4) of the printing-mechanism holder are in the recess of the mechanism. Take care not to damage the foil cable (2) when screwing in the fixing bolt (3).
6. Route the foil cable through the aperture (5) in the plastic panel.
7. Plug the foil cable into receptacle J 10 on the controller PCB.
8. Push in the cover for the printing mechanism from beneath and secure with the bolt.
9. Re-install the printer.
10. Perform a function test of the printer (Sec. 5.10).




#### 10.21.2 Replacing the controller PCB

**Procedure:**

1. Remove the printer (see Sec. 10.21).
2. Remove the power supply cables (1), the data line (2) and the foil cable (3) from the controller PCB.
3. Unscrew the fixing bolts (4).
4. Insert the foil cable in receptacle J 10 of the new controller PCB.
5. Secure the new controller PCB with the bolts (4).
6. Plug the power supply cables and the data line into the controller PCB.
7. Re-install the printer.
8. Perform a function test of the printer (Sec. 5.10).

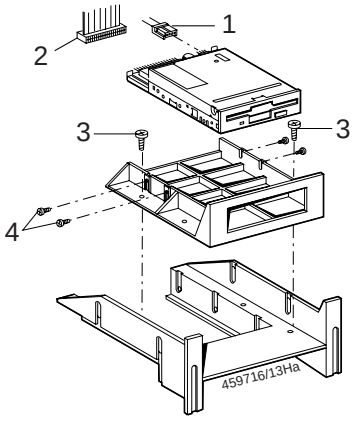


### 10.22 Replacing the disk drive

Remember to remove any inserted floppy disks from the disk drive before removal.

**Procedure:**

1. Disconnect the power supply cables (1) and the data line (2).
2. Remove the four fastening screws (3) of the disk-drive holder.
3. Take the disk drive complete with holder out of the unit.
4. Unscrew the four fastening screws (4) at the side.
5. Take out the faulty disk drive.
6. Insert the new disk drive and secure it with the four fixing bolts (4) at the side.
7. Firmly secure the plastic holder and disk drive using the fastening screws (3).
8. Perform a function test of the drive (Sec. 5.9).

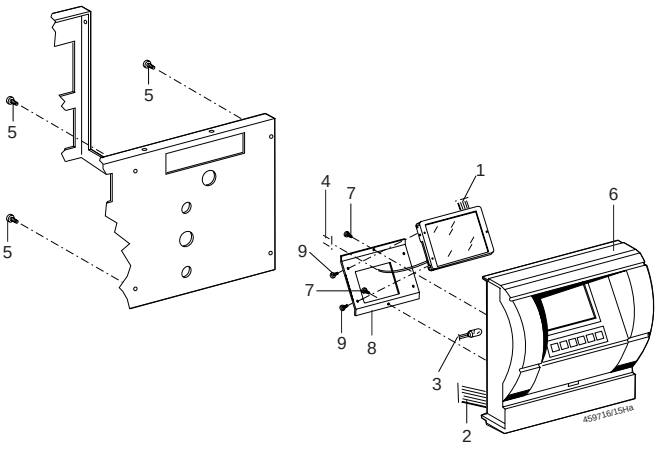



### 10.23 Replacing the TFT display

In order to remove the TFT display without problem, you must first remove the exhaust-gas analyzer module.

**Procedure:**

1. Pull the foil cable (1) of the TFT display out of receptacle X17 on the control module PCB.
2. Pull the foil cable (2) of the membrane keypad out of X13 on the control module PCB.
3. Pull the cable of the receiver diode (3) off connector X12 on the control module PCB.
4. Remove the cable (4) for the power supply to the bulb of the TFT display from the control module PCB.
5. Unscrew the four fixing bolts (5) of the front panel in the interior of the unit.
6. Remove the front panel (6).
7. Unscrew the two fastening screws (7) (at the top and bottom) of the holder panel (8) for the TFT display.
8. Remove the four fastening screws (9) from the holder panel (8) of the TFT display.
9. Remove the holder panel (8).
10. Install the new TFT display by proceeding in the reverse sequence to removal.




Ensure that the TFT display is installed in exactly the right position.

11. Route the cables through the holes in the housing and re-insert them in the control module PCB.
12. Install the front panel.
13. Perform a function test of the TFT display (Sec. 5.14 - 5.17).

### 10.24 Replacing the membrane keypad

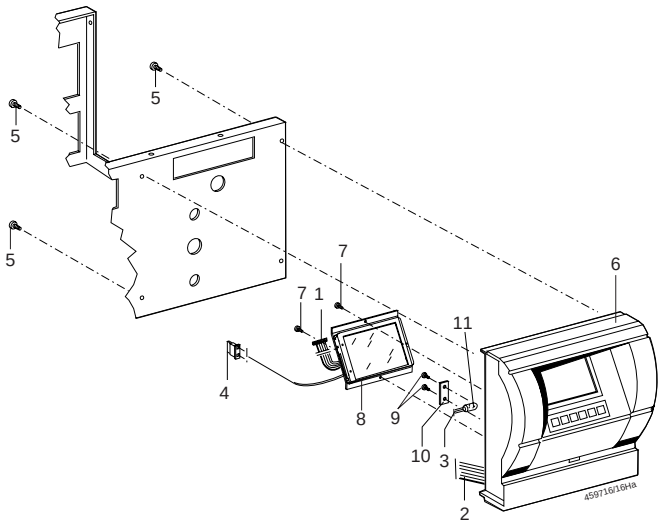
In order to remove the membrane keypad without problem, you must first remove the exhaust-gas analyzer module.
The membrane keypad is fixed in the front panel with adhesive. You must therefore replace the front panel complete with membrane keypad.

1. Pull the foil cable (1) of the TFT display out of receptacle X 17 on the control module PCB.
2. Pull the foil cable (2) of the membrane keypad out of X13 on the control module PCB.

3. Pull the cable of the receiver diode (3) off connector X12 on the control module PCB.
4. Remove the cable (4) for the power supply to the bulb of the TFT display from the control module PCB.
5. Unscrew the four fixing bolts (5) of the front panel in the interior of the unit.
6. Remove the front panel (6).
7. Unscrew the two fastening screws (7) (at the top and bottom) of the holder panel (8) for the TFT display.
8. Take the TFT display and holder panel (8) out of the front panel.
9. Remove the two fastening screws (9) from the retaining panel (10) of the receiver diode.
10. Remove the receiver diode (11) from the front panel.
11. Fit the individual components in the new front panel in the reverse sequence to removal.

! Ensure that the receiver diode and TFT display are installed in exactly the right position.

12. Route the cables through the holes in the housing and re-insert them in the control module PCB.
12. Install the front panel.
13. Perform a function test of the membrane keypad (Sec. 5.18).



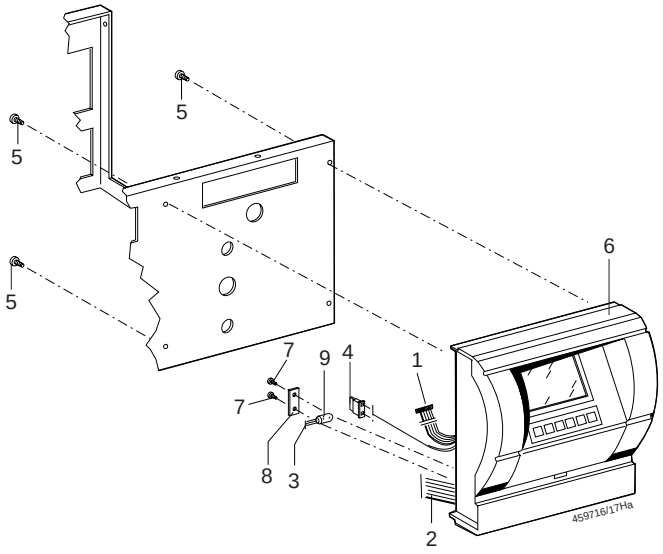

### 10.25 Replacing the receiver diode for the remote control

i In order to remove the receiver diode without problem, you must first remove the exhaust-gas analyzer module.

1. Pull the foil cable (1) of the TFT display out of receptacle X 17 on the control module PCB.
2. Pull the foil cable (2) of the membrane keypad out of X13 on the control module PCB.
3. Pull the cable of the receiver diode (3) off connector X12 on the control module PCB.
4. Remove the cable (4) for the power supply to the bulb of the TFT display from the control module PCB.
5. Unscrew the four fixing bolts (5) of the front panel in the interior of the unit.
6. Remove the front panel (6).
7. Remove the two fastening screws (7) from the retaining panel (8) of the receiver diode.
8. Remove the receiver diode (9) from the front panel.
9. Fit the individual components in the new front panel in the reverse sequence to removal.

! Ensure that components are installed in exactly the right position.

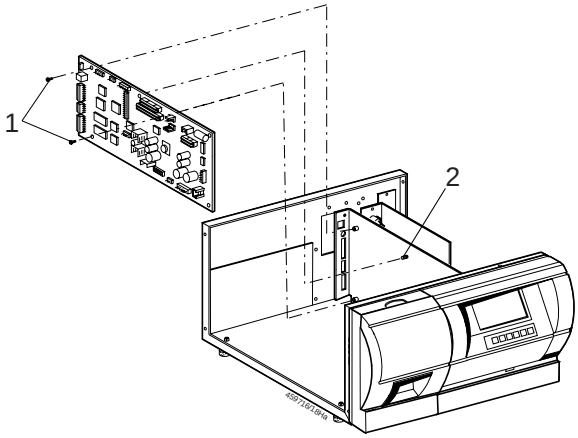
10. Route the cables through the holes in the housing and re-insert them in the control module PCB.
11. Install the front panel.
12. Perform a function test of the receiver diode (Sec. 5.20).



### 10.26 Replacing the control module PCB

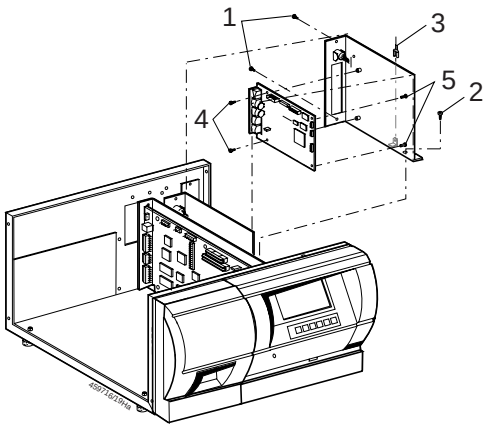
In order to remove the control module PCB without problem, you must first remove the exhaust-gas analyzer module.

1. Unplug all plug connections from the control module PCB.
2. Remove the two fastening screws (1).
3. Carefully pull the control module PCB out of the retaining panel.
4. Place the new control module PCB on the retaining panel and carefully press it onto the panel until the PCB clicks into the holder (2).
5. Plug all plug connections back into the control module PCB.
6. Perform a function test (Sec. 5.1 - 5.6).



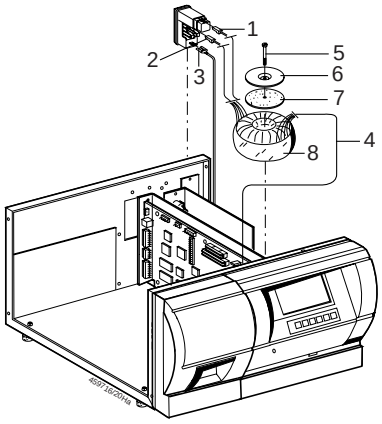

### 10.27 Replacing the temperature and RPM PCB

1. Unplug all plug connections from the PCB.
2. Remove the two fastening screws (1) from the retaining panel on the rear of the unit.
3. Remove the fastening screw (2) from the retaining panel in the interior of the unit.
4. Remove the earthing cable (3) from the retaining panel.
5. Unscrew the two fastening screws for the PCB (4).
6. Carefully remove the PCB from the retaining panel.
7. Place the new PCB on the retaining panel and carefully press it onto the panel until the PCB clicks into the holder (5).
8. Screw the retaining panel and PCB in place in the unit.
9. Push the earthing cable onto the tab on the retaining panel.
10. Plug all plug connections back into the control module PCB.
11. Perform a function test (Sec. 5.1).




### 10.28 Replacing the control-power transformer

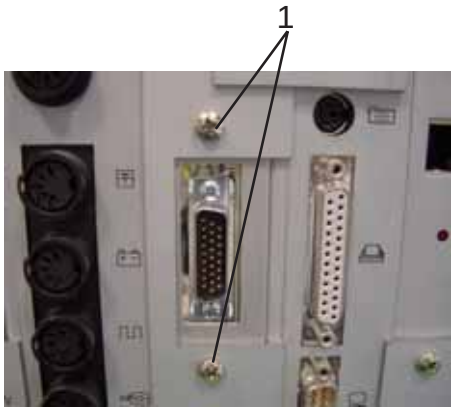
1. Remove transformer connection cable 2 (rd,1) from the fuse and transformer connection cable 5 (gn,2) from the power switch.
2. Remove the earthing cable (3) from the earthing connector on the power switch.
3. Unplug the interconnecting cable from the plug connector X 10 (4) on the control module PCB.
4. Remove the fastening screw of the control-power transformer (5).
5. Remove the retaining disc (6) and rubber disc (7).
6. Replace the toroidal mains transformer (8).
7. Push the earthing cable onto the tab of the floor panel and onto the earthing connector on the power switch.
8. Re-insert all connection cables.
9. Perform a function test (Sec. 10.1 u. 10.2).



### 10.30 Replacing the OBD circuit board

**Procedure:**

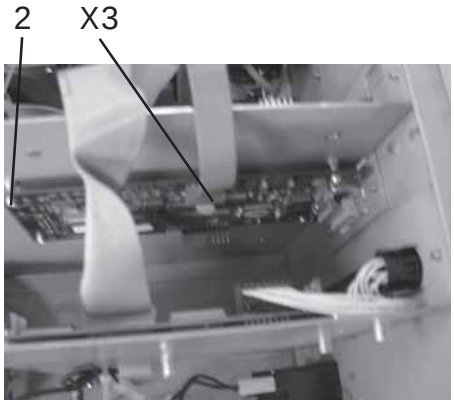
1. Remove from the rear of the BEA the 2 securing screws (1) for the installed OBD circuit board.




ℹ Take the 2 securing screws out, since they will be required for fitting the new OBD circuit board.

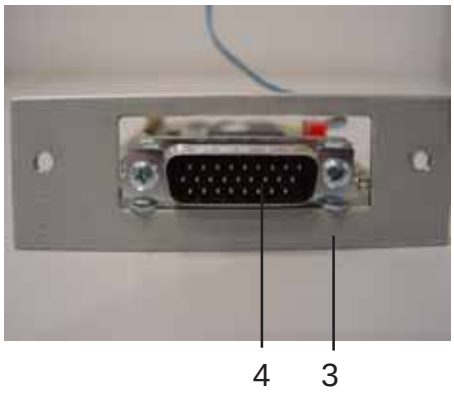
2. Unplug the ribbon cable (X3) from its socket on the OBD circuit board (2).

3. Carefully take out the OBD circuit board.




4. Pick up the cover plate (3) supplied with the retrofit kit, and thread the OBD/CAN circuit board interface plug (4) through the opening.

ℹ The opening in the cover plate for the interface plug is offset from the center. Take care that the narrow side of the plate faces upwards.

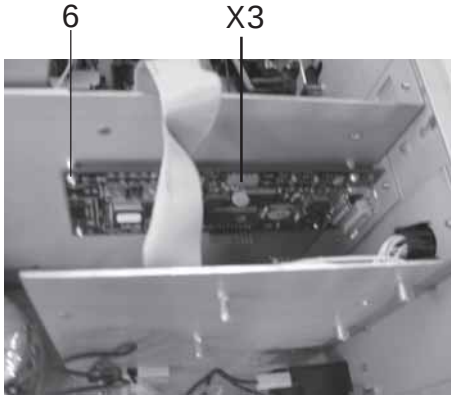



5. Pick up the circuit board and cover plate, and place the circuit board on the circuit board mounting studs (6).

6. Carefully press the circuit board on to the studs until it audibly snaps into position.

7. Fasten the cover plate to the rear of the BEA device, using the two securing screws.

8. Plug the accompanying ribbon cable into plug X3 on the OBD/CAN circuit board.

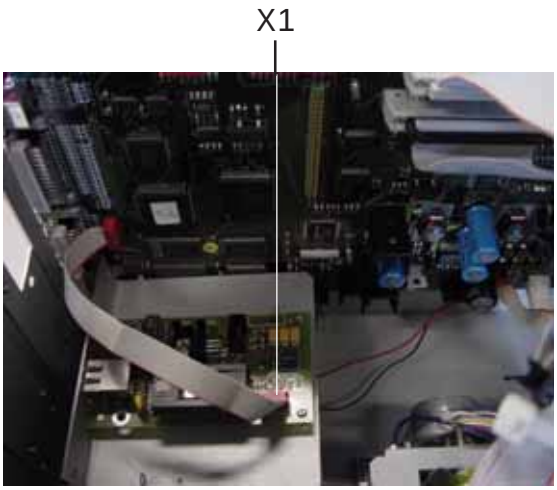


### 10.31 Replacing AWN printed circuit board

Procedure:

1. Remove the 2 fastening screws (1) for the AWN printed circuit board.

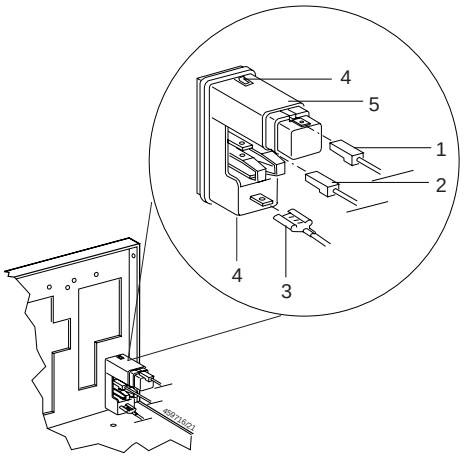

2. Carefully remove the AWN printed circuit board.
3. Detach the connecting cable for the AWN printed circuit board to the computer board on the AWN printed circuit board X1.
4. Mount the new AWN printed circuit board in the reverse sequence to dismantling it.



### 10.29 Replacing the power switch

**Procedure:**

1. Remove transformer connection cable 2 (rd,1) from the fuse and transformer connection cable 5 (gn,2) from the power switch.
2. Remove the earthing cable (3) from the earthing connector on the power switch.
3. Press the upper and lower locating springs (4) on the power switch (5) together and pull the power switch backwards and out.
4. Insert the new power switch and press it in until the locating springs click into place.
5. Push the earthing cable onto the tab of the earthing connector on the power switch.
6. Re-connect all transformer connection cables to the power switch.
7. Perform a function test (Sec. 10.1 u. 10.2).

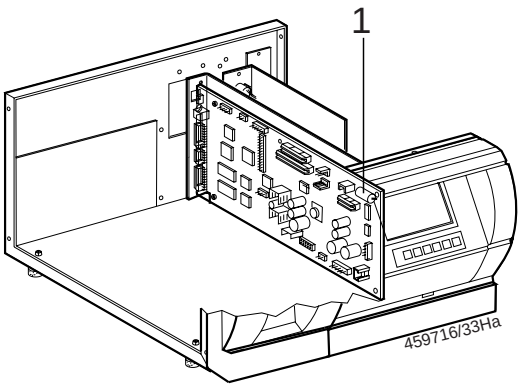



### 10.32 Replacing the battery

The battery is located on the control module PCB. As a precaution, the battery should be replaced every three years. The battery provides back-up energy for the date and time and - in the case of BEA's without a hard disk - the fault memory.

**Procedure:**

1. Unsolder the old battery (1).
2. Solder the new battery in place. Take care to ensure the correct polarity.
3. Check the date and time (Sec. 5.12).




### 10.33 Replacing the hard disk

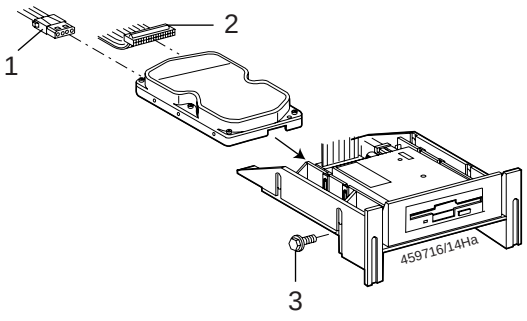
The hard drive 1 687 022 809 will no longer be available as of March 2005 as it has been replaced by the Silicon-Disc 1 687 370 291.

**!** In devices with a release date of 10/2000 or later, this hard drive must be replaced with the Siliocon-Disc 1 687 370 293 in the course of repair work. Before doing so, it is essential to read the 1 689 978 495 installation guide included.
In devices with a release date of 10/2000 or earlier, the 1 688 400 322 printed circuit board must also be replaced with a 1 682 666 118 printed circuit board with a release date of 10/2000 or later.

The procedure described below only refers to replacing and unsolder the 1 687 022 809 hard drive.

**Procedure:**

1. Disconnect the power supply cables (1) and the data line (2).
2. Remove the four fastening screws (3) of the hard-disk holder.
3. Remove the hard disk from the holder.
4. Take out the faulty disk drive completely.
5. Insert the new hard disk and secure with the four fixing bolts (3) at the side.
6. Perform a function test of the drive (Sec. 5.8).



## 11. BEA test software OS9

You must create a disk in order to test the BEA test software.

Procedure:

1. Place an empty diskette into your PC´s disk drive.
2. Open the page bea_sw.pdf at \EDIS\Software\kdsoft\bea\bea_sw.pdf.
3. Select the desired red download link.
4. Confirm your selection with the Enter key.

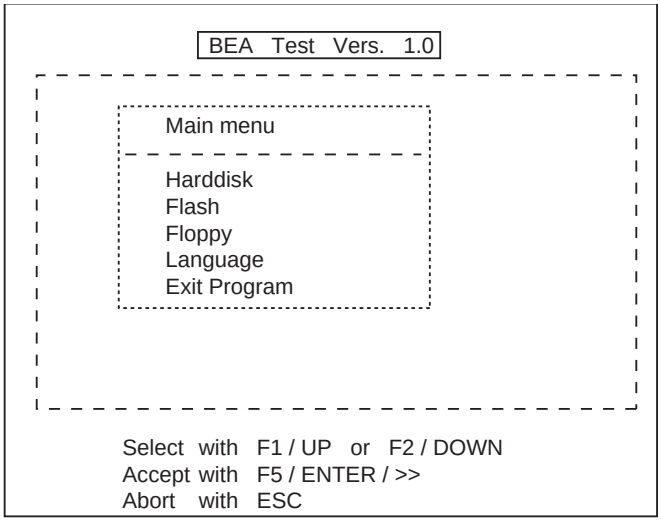
The BEA test software is used to test the internal BEA components over the OS9 operating software.

### Testing with the BEA test software

Operation of the test software ensues over an external keyboard or using the hard keys on the front side of the BEA.
The description in the following chapters refers to operation using the hard keys.

Procedure:

1. Switch off the BEA.
2. Place the disk with the BEA test software into the BEA's disk drive.
3. Switch on the BEA.
   The BEA boots with the inserted disk.




The following test options are available in the BEA test software:

- **Hard disk** (check hard disk)

- **Flash** (test)
  - Download boot loader
  - Display program memory
  - Delete program memory
  - Delete configuration memory

- **Floppy** (check floppy disk drive)

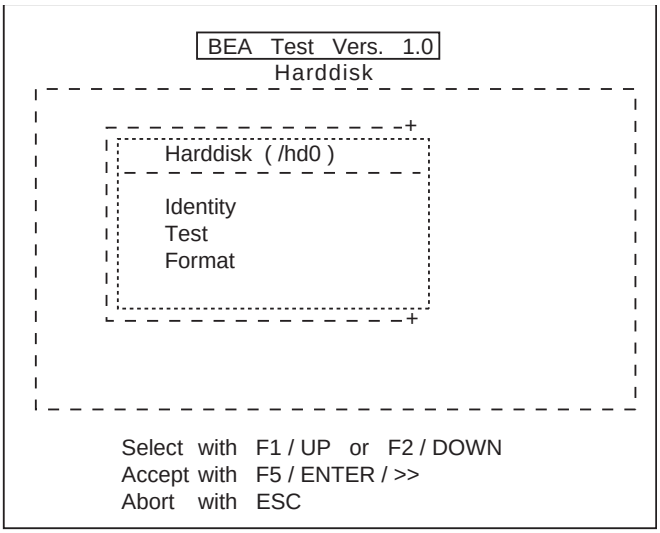
- **Language** (selection)

- **Exit programs**

### 11.1 Hard disk

Procedure:

1. Use key **F1** or **F2** to select the **Hard disk** menu.
2. Start the menu using the **F5** key.
   The following menu options are available:
   - Identification (of hard disk)
   - Testing (hard disk)
   - Formatting (hard disk)



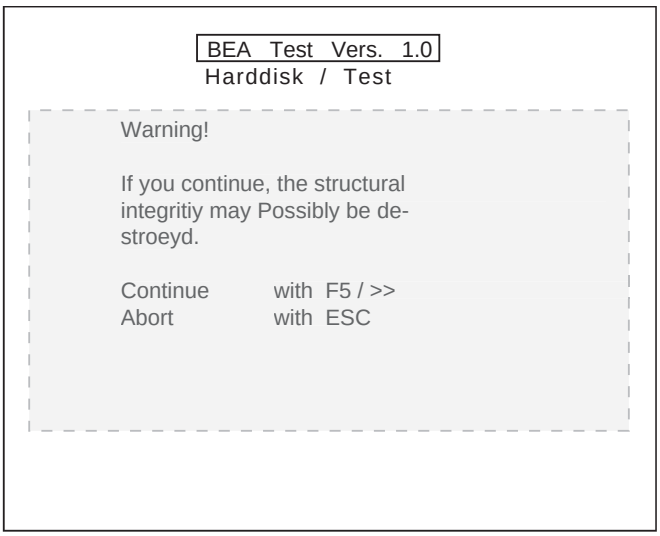

#### 11.1.1 Identification

Currently not relevant for Service!

#### 11.1.2 Testing

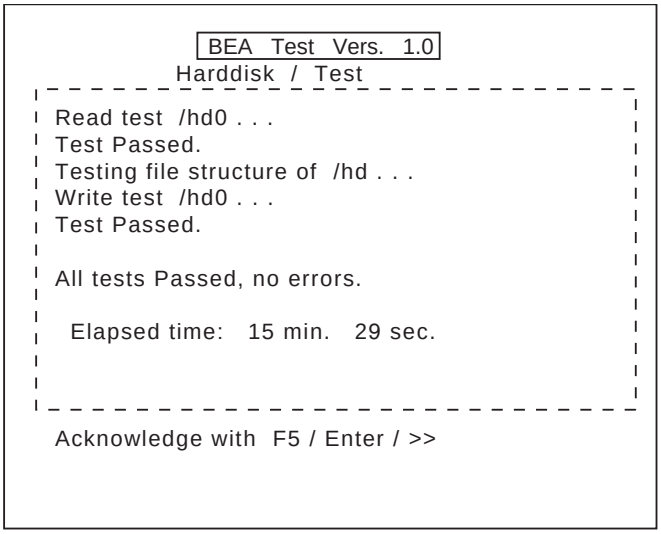
This test is used to clearly determine whether the hard disk is fault or not.

1. Use **F1** or **F2** key to select the **Test** menu.
2. Start the test using the **F5** key.
   A read test is performed. 150 MB of hard disk capacity are tested.
3. Once the test has been passed a reference text is displayed.



4. Confirm by pressing the **F5** key.
   A write test is performed. 100 MB of hard disk capacity are written to.

ℹ The write test takes about 15 minutes.

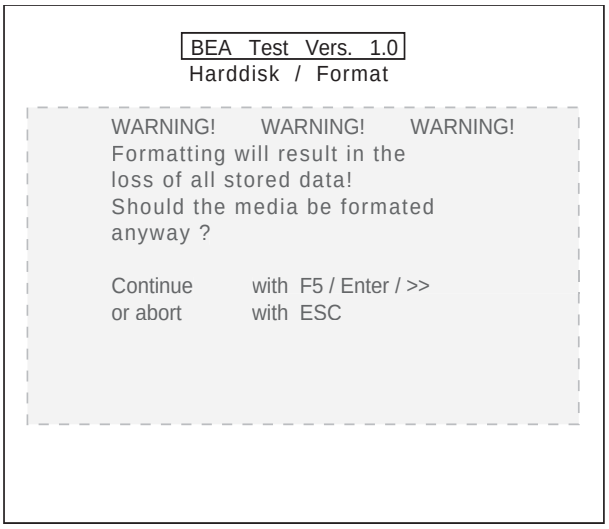



5. If the test is passed without any faults confirm by pressing the **F5** key.
   In the event of a fault you will have to format the hard disk (see chapter 11.1.2), if necessary the hard disk may have to be replaced (see chapter 10.23).

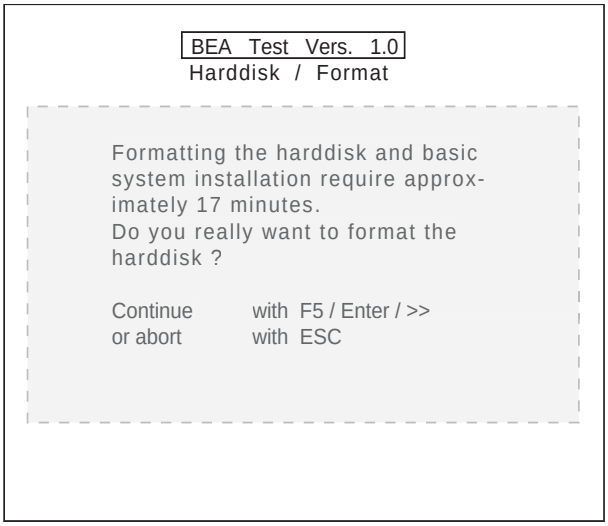
### 11.1.3 Formatting

❗ When formatting the hard disk all data on the hard disk will be deleted

1. Use **F1** or **F2** key to select the **Formatting** menu.
2. Start the test using the **F5** key.
   The following warning message is displayed.

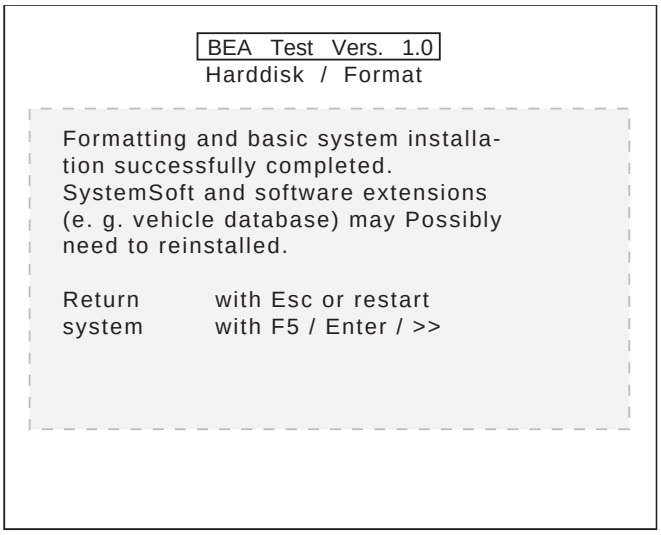



3. Confirm by pressing the **F5** key.
   The following reference is displayed for the duration of the formatting process.




4. Confirm the inquiry by pressing the **F5** key.
   Formatting of the hard disk is started.

5. The following message is shown once the formatting has been successfully performed.




   In the event of a fault the hard disk has to be replaced (see chapter 10.23).

6. Install the system software for BEA and then, if available, the vehicle database.

## 11.2 Flash

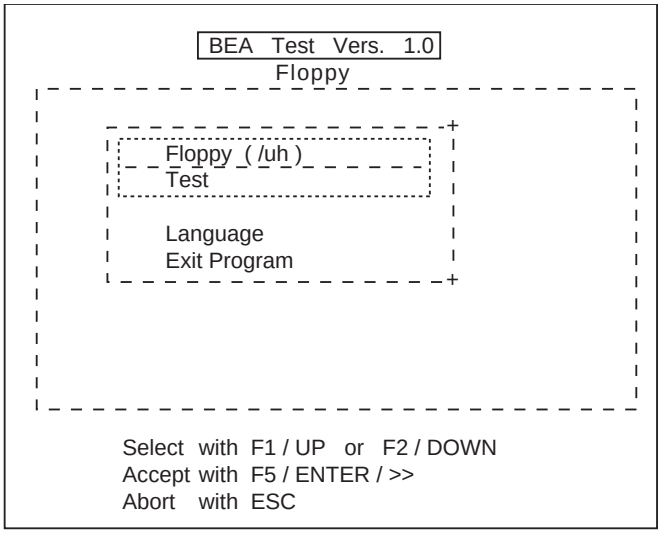
ℹ Currently not relevant for Service!

### 11.3 Floppy disk

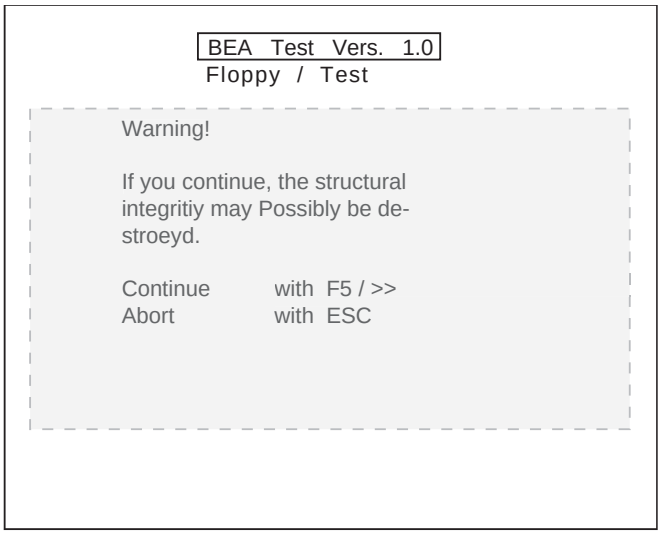
This menu serves to test the floppy disk drive on the BEA.

To test the floppy disk drive the BEA test software must remain in the drive!

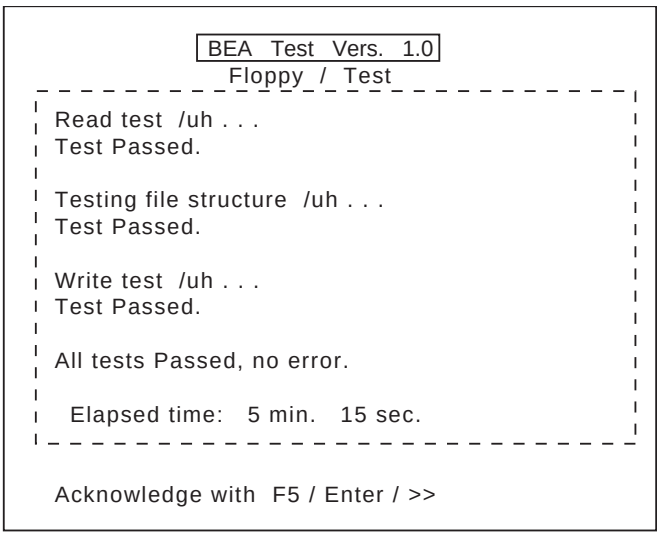
1. Use key **F1** or **F2** to select the **Floppy disk** menu.
2. Start the test using the **F5** key.
   The following picture is displayed.




3. Confirm by pressing the **F5** key.
   A read test from the disk then follows.
4. The following warning message appears once the read test ends.




5. Confirm by pressing the **F5** key.
   A write test on the disk then follows.
6. The following picture is displayed if the write test is passed.



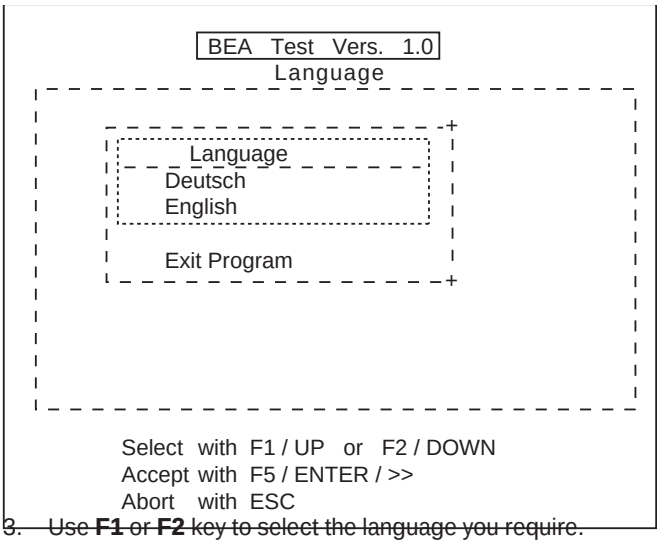

In the event of a fault the floppy disk has to be replaced (see chapter 10.22).

7. Confirm by pressing the key F5 / Enter / >>.

### 11.4 Language11.4 Language

This menu can be used to select the BEA test software language.

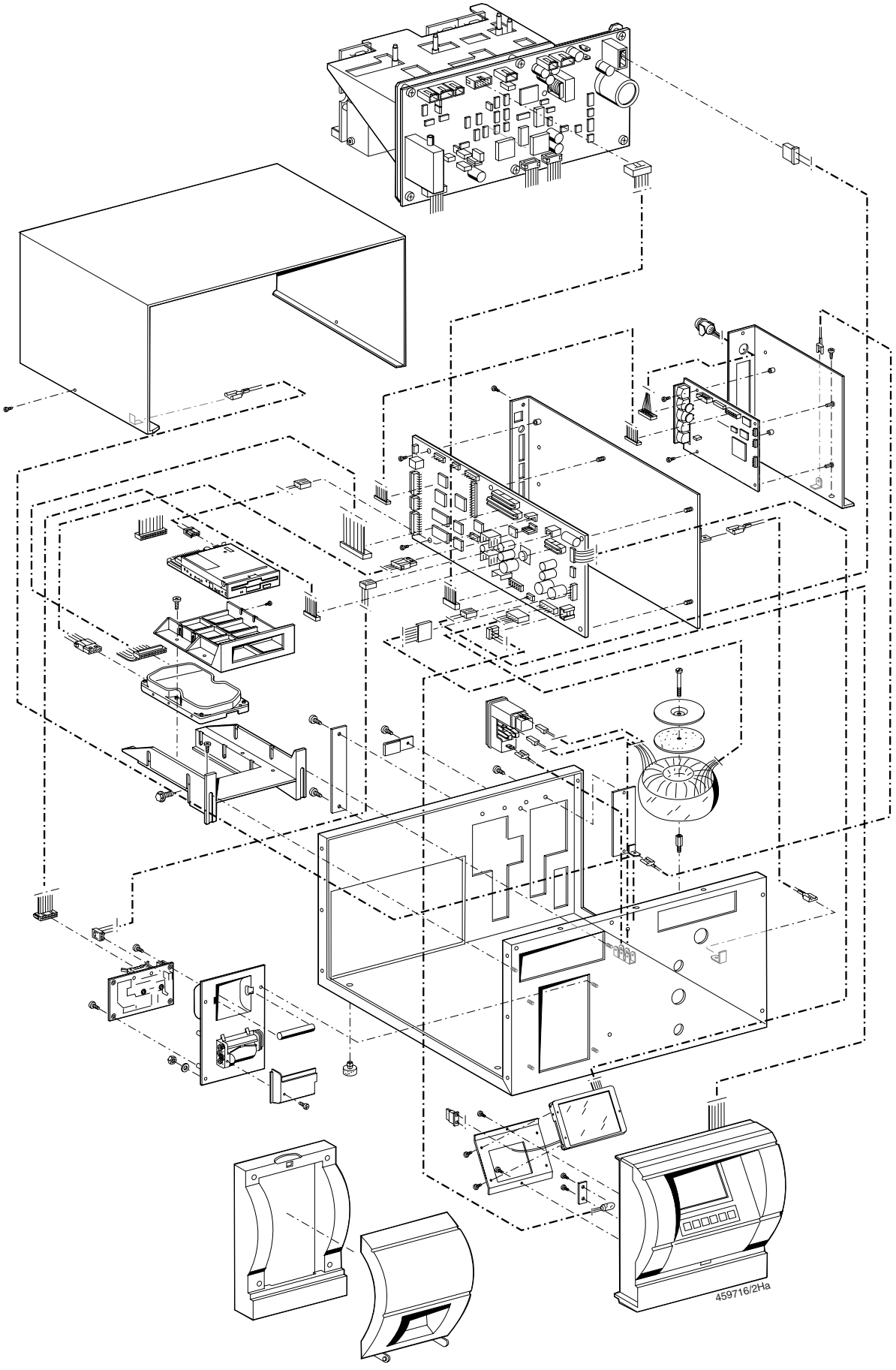
1. Use **F1** or **F2** key to select the **Language** menu.
2. Open the menu using the **F5** key.
   The following picture is displayed.



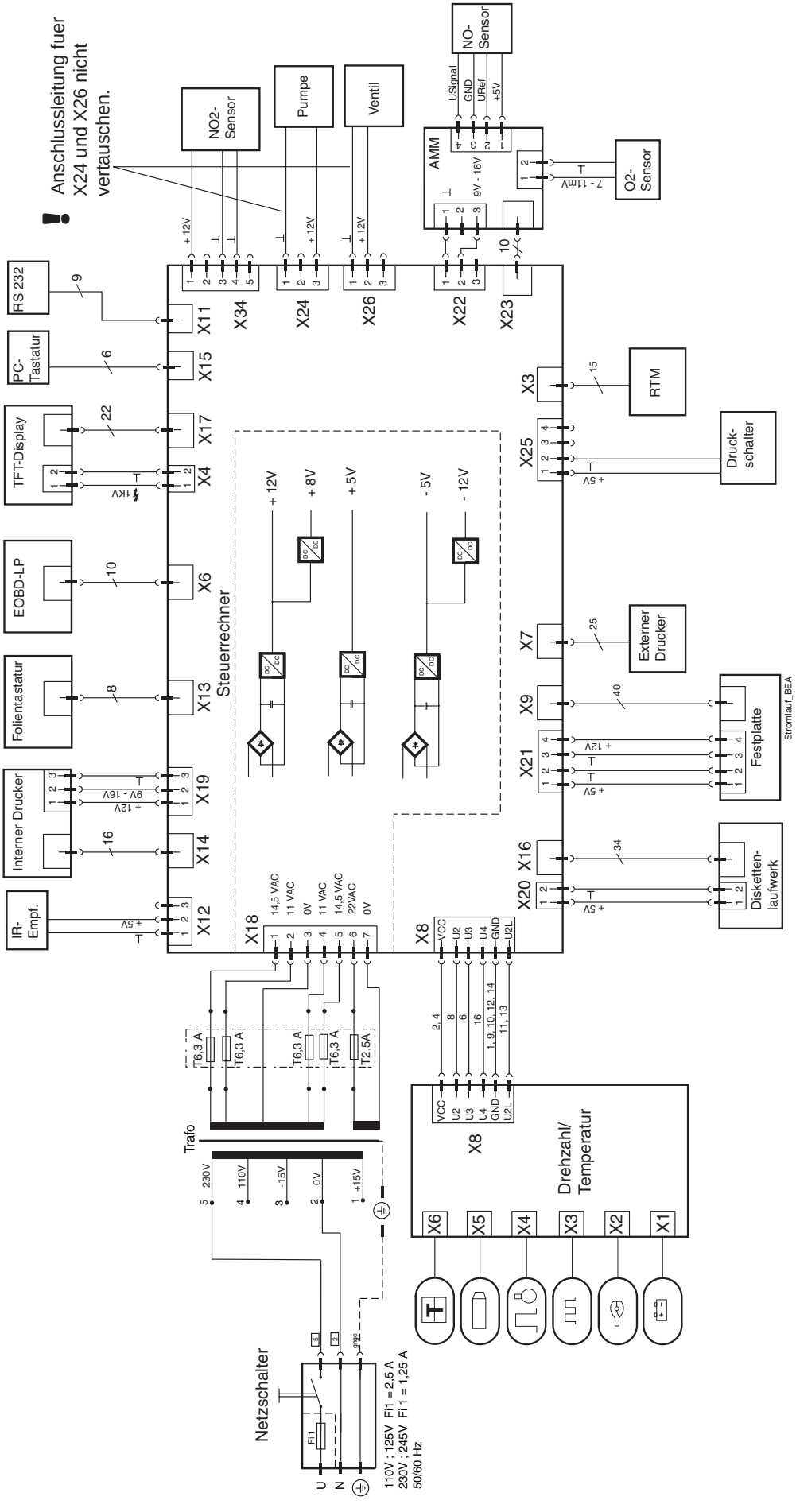

3. Use **F1** or **F2** key to select the language you require.
4. Confirm by pressing the **F5** key.
   The pre-selected language is then set.

# 12. Overview

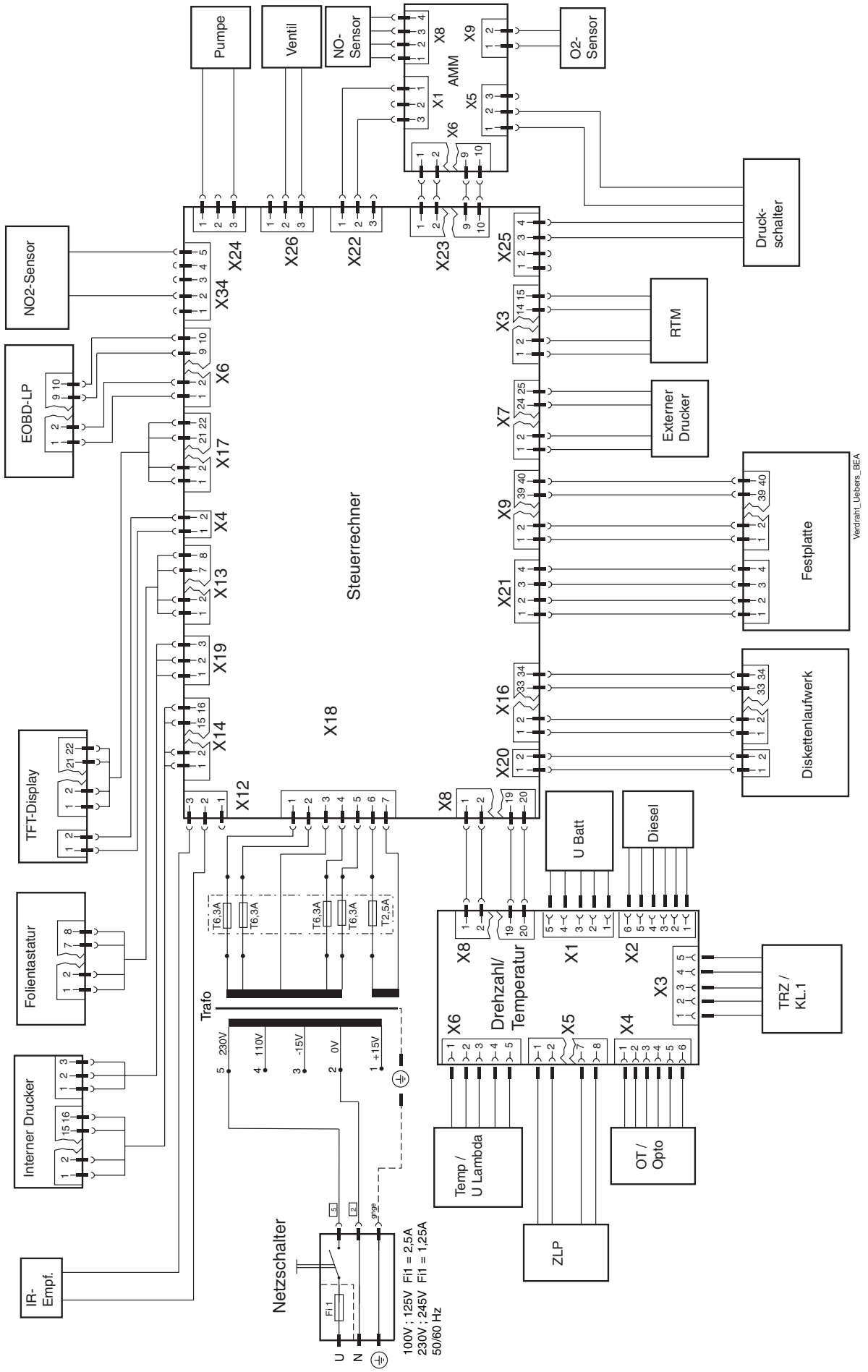
## 12.1 Electrical wiring (Siemens analysis chamber)



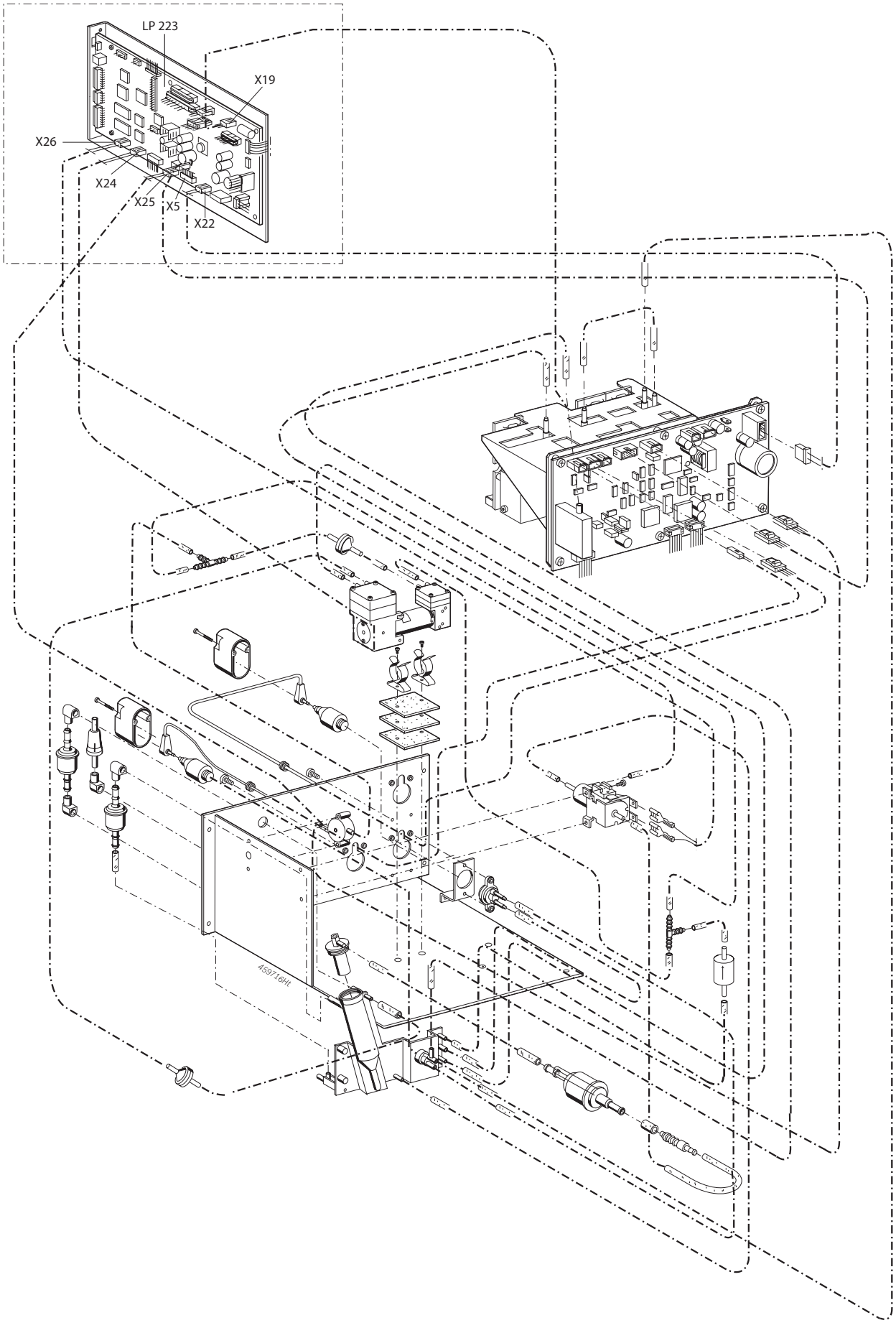
12.2 Circuit diagram (Siemens analysis chamber)



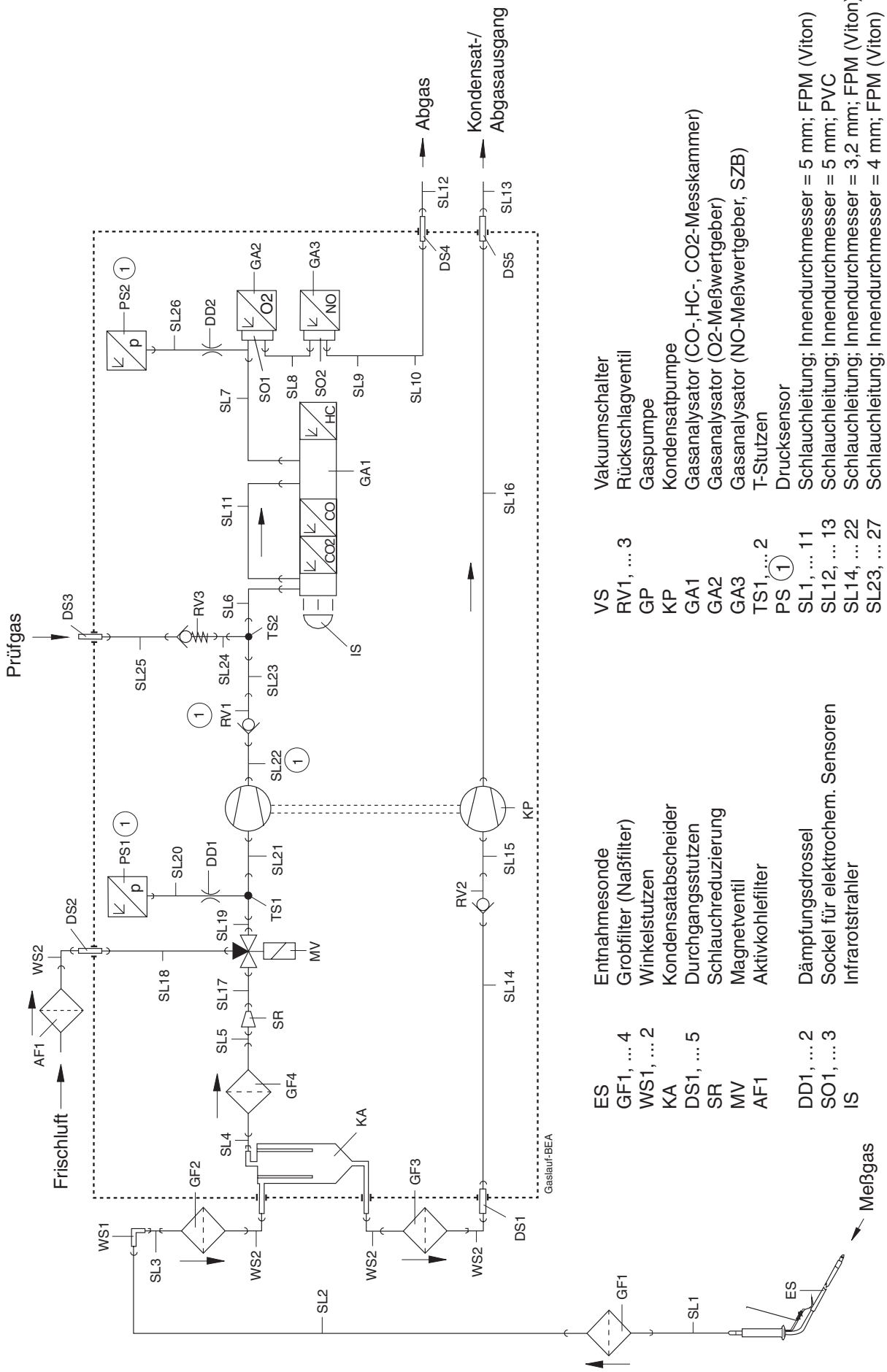
12.3 Wiring diagram (Siemens analysis chamber)



12.4 Hosing (Siemens analysis chamber)

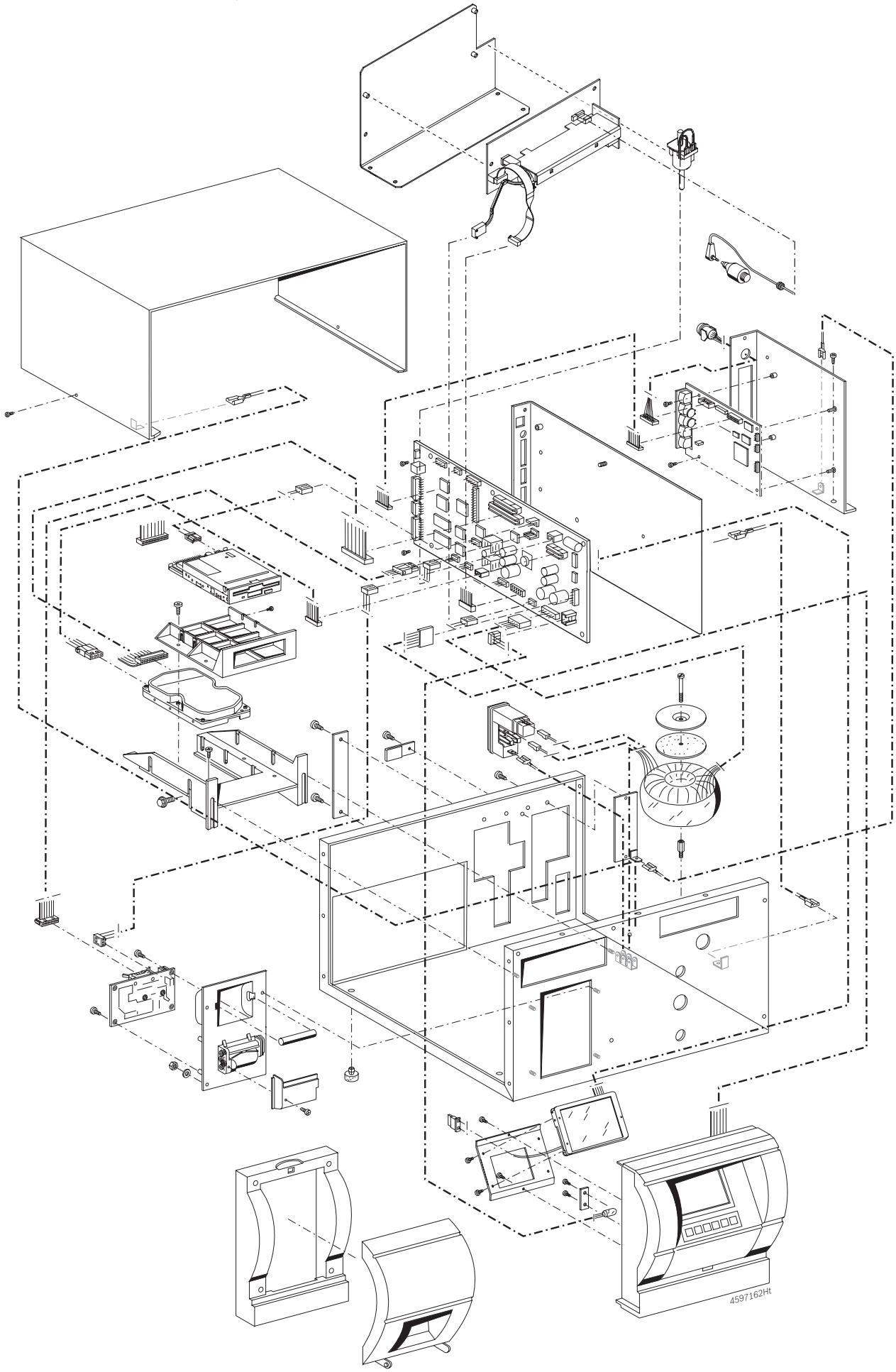


12.5 Gas circuit diagram (Siemens analysis chamber)

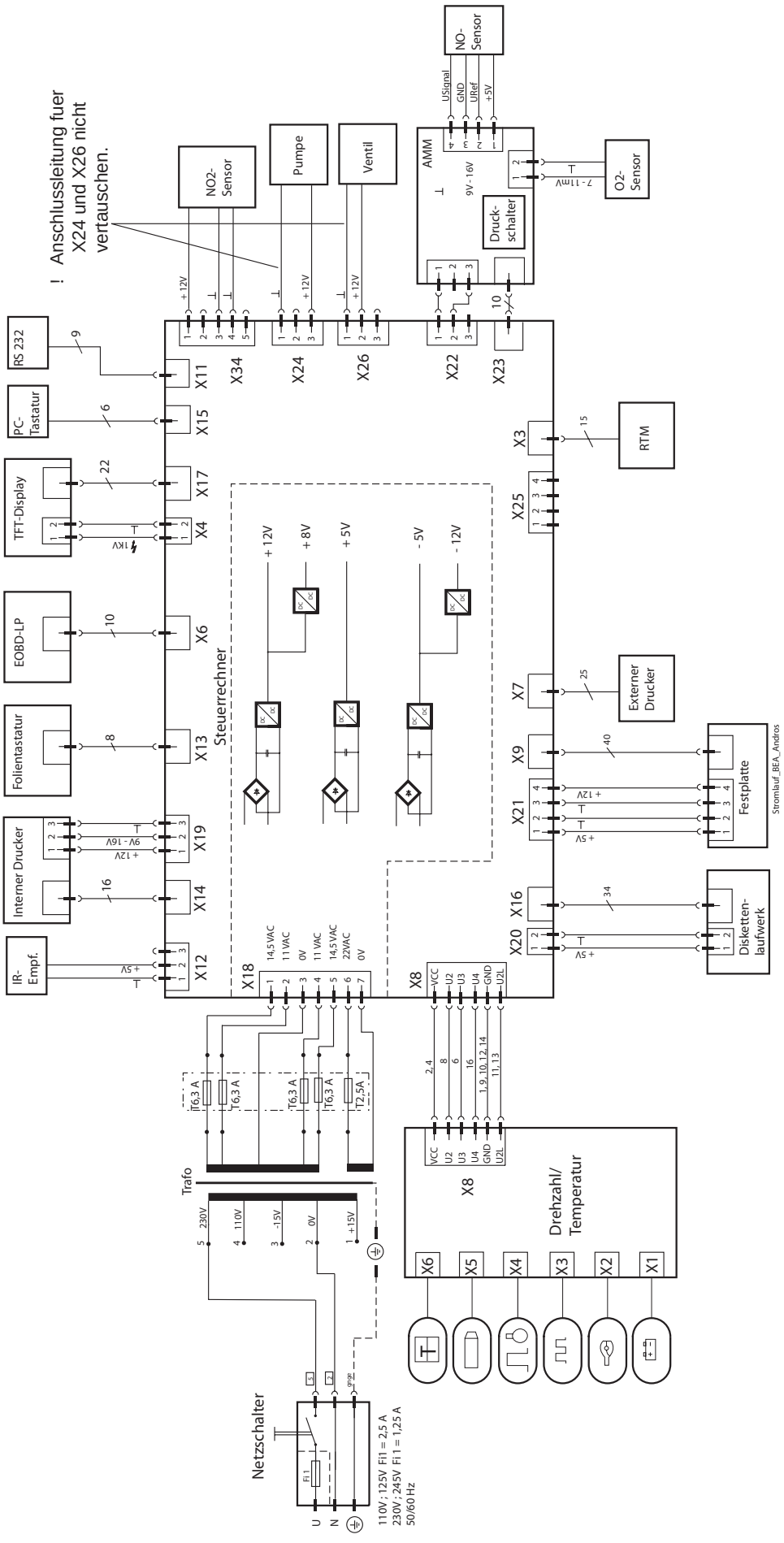



| | |
|---|---|
| ES | Entnahmesonde |
| GF1, ... 4 | Grobfilter (Naßfilter) |
| WS1, ... 2 | Winkelstutzen |
| KA | Kondensatabscheider |
| DS1, ... 5 | Durchgangsstutzen |
| SR | Schlauchreduzierung |
| MV | Magnetventil |
| AF1 | Aktivkohlefilter |
| DD1, ... 2 | Dämpfungsdrossel |
| SO1, ... 3 | Sockel für elektrochem. Sensoren |
| IS | Infrarotstrahler |
| VS | Vakuumschalter |
| RV1, ... 3 | Rückschlagventil |
| GP | Gaspumpe |
| KP | Kondensatpumpe |
| GA1 | Gasanalysator (CO-,HC-, CO2-Messkammer) |
| GA2 | Gasanalysator (O2-Meßwertgeber) |
| GA3 | Gasanalysator (NO-Meßwertgeber, SZB) |
| TS1,... 2 | T-Stutzen |
| PS (1) | Drucksensor |
| SL1, ... 11 | Schlauchleitung; Innendurchmesser = 5 mm; FPM (Viton) |
| SL12, ... 13 | Schlauchleitung; Innendurchmesser = 5 mm; PVC |
| SL14, ... 22 | Schlauchleitung; Innendurchmesser = 3,2 mm; FPM (Viton) |
| SL23, ... 27 | Schlauchleitung; Innendurchmesser = 4 mm; FPM (Viton) |

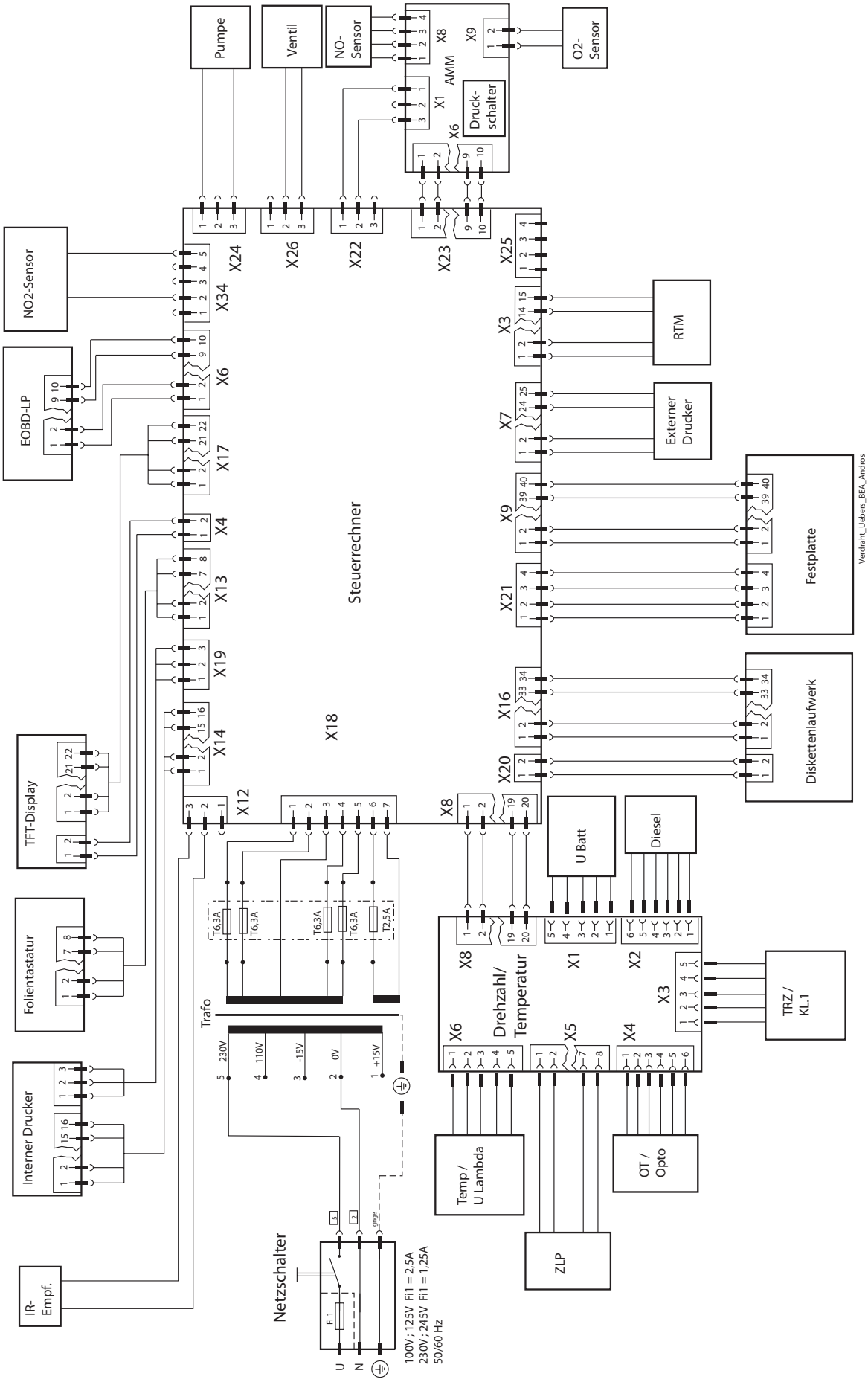
12.6 Electrical wiring (Andros analysis chamber)



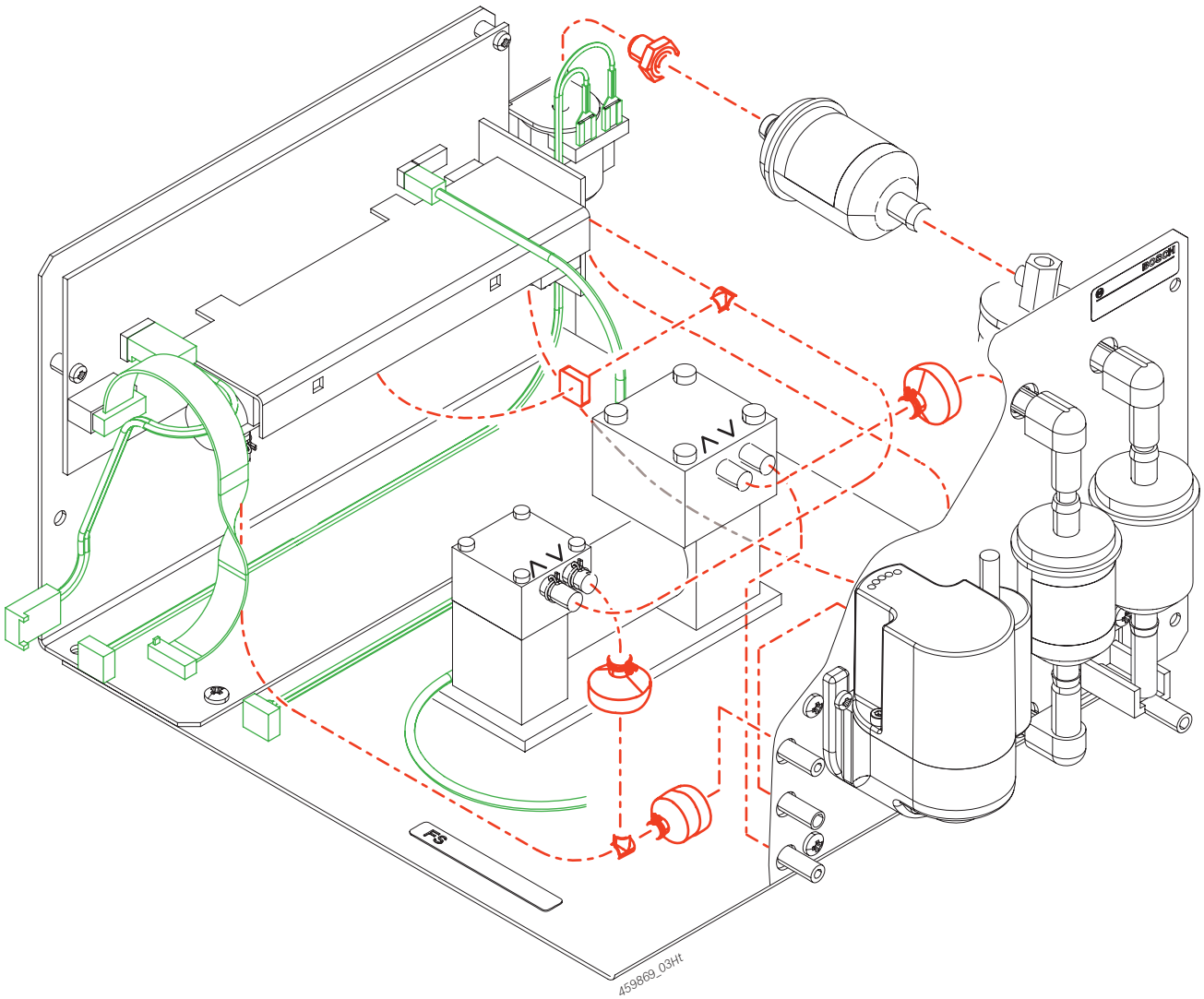
12.7 Circuit diagram (Andros analysis chamber)



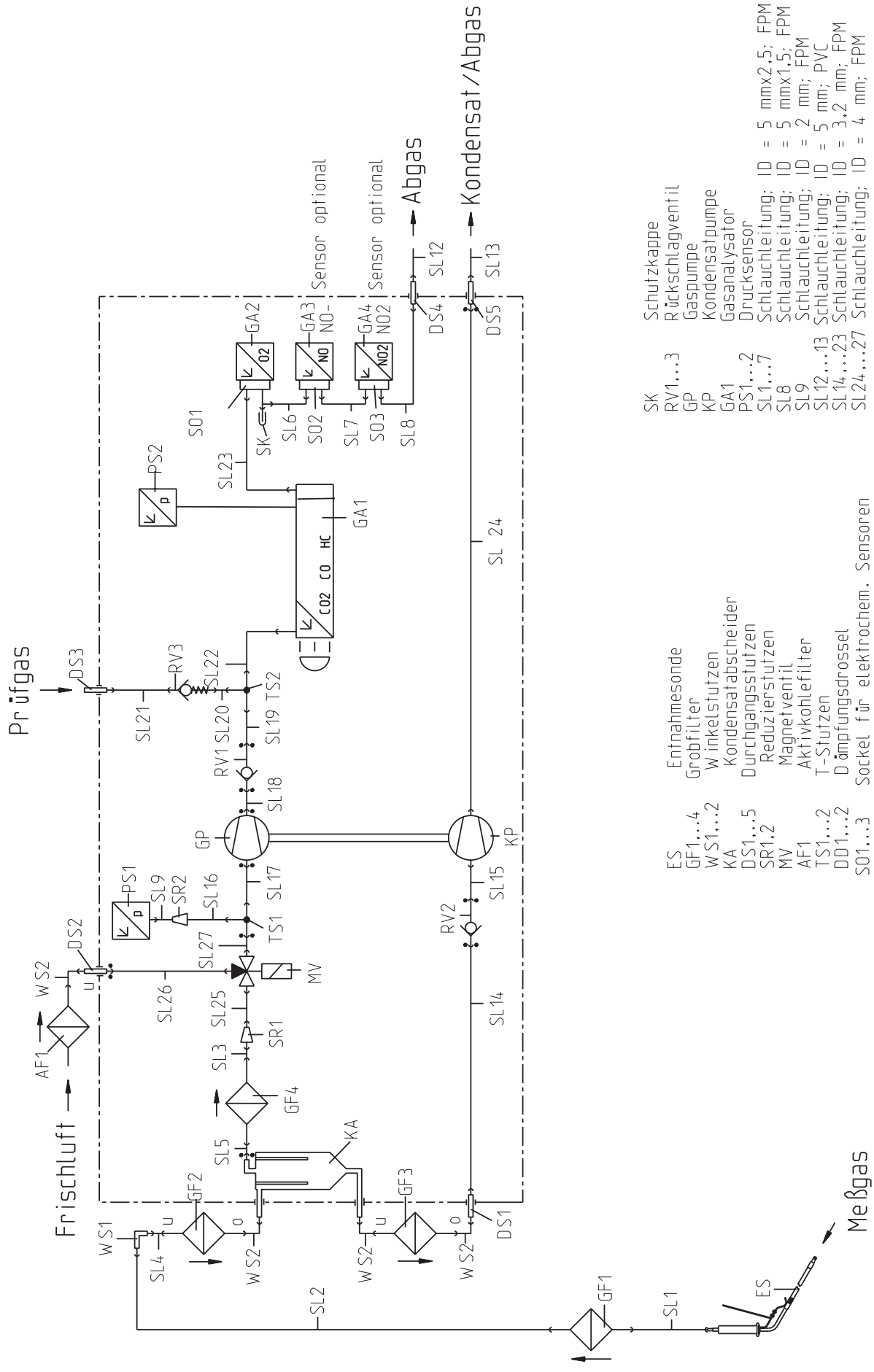
12.8 Wiring diagram (Andros analysis chamber)

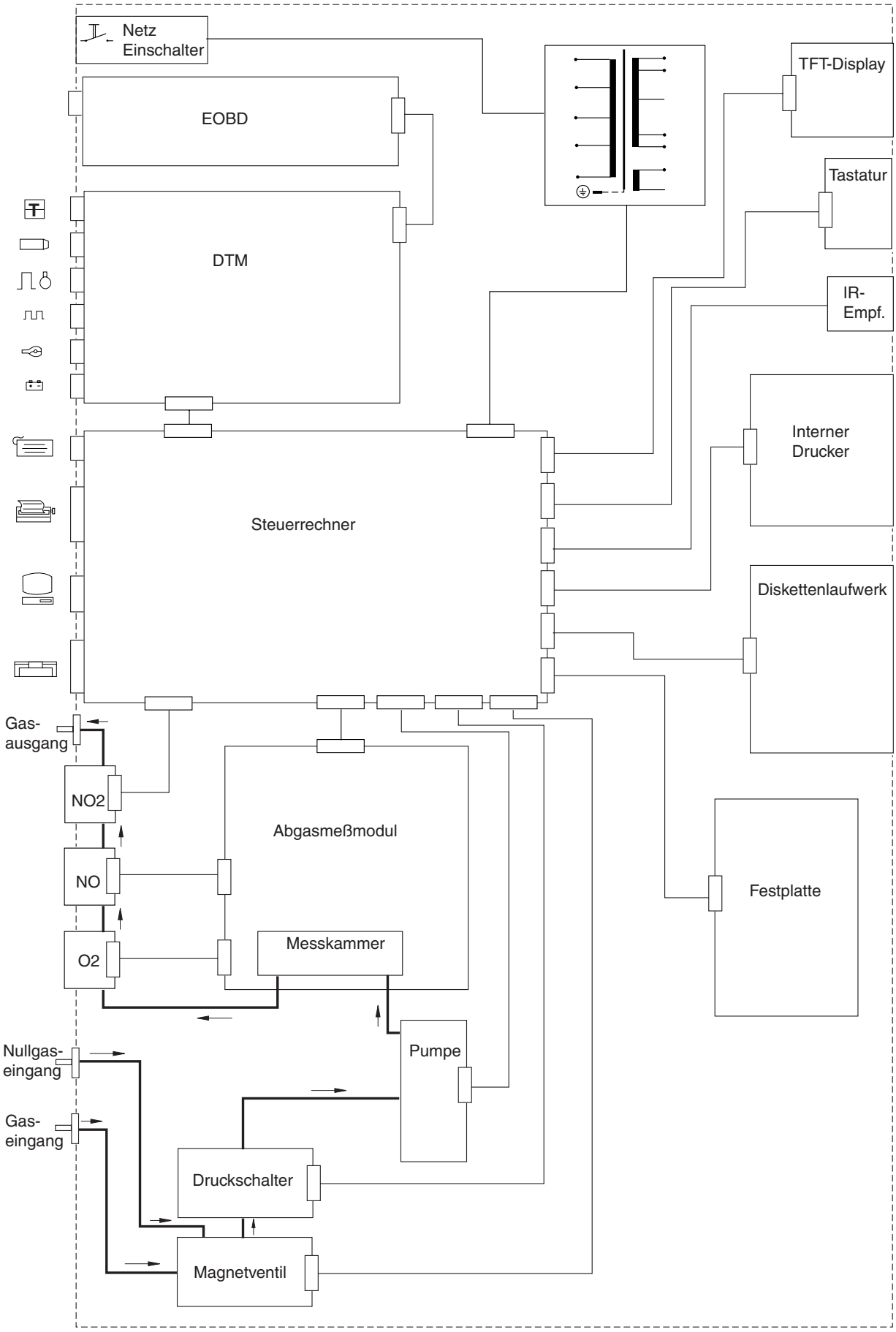


## 12.9 Hosing (Andros analysis chamber)



12.10 Gas circuit diagram (Andros analysis chamber)




Netz
Einschalter
EOBD
DTM
TFT-Display
Tastatur
IR-
Empf.
Interner
Drucker
Steuerrechner
Diskettenlaufwerk
Festplatte
Gas-
ausgang
NO2
NO
O2
Abgasmeßmodul
Messkammer
Pumpe
Nullgas-
eingang
Gas-
eingang
Druckschalter
Magnetventil
Sys_Ueber-BEA

## Changes:

| | | |
|---|---|---|
| 2008-07-24 | Chap. 12 | Andros analysis chamber added. |
| 2005-01-25 | Chap. 5.8 | Information about sources of error added. |
| 2005-01-20 | Chap. 10.33 | Information about the new hard disc (Silicon-Disc) added. |
| 2005-01-11 | | Value of the fuses at the trafo in wiring-diagram an the current-diagram actualized. |
| 2005-01-04 | Chap. 3.4 | Information about the yearly replacing of the internal hose sytem added. |
| 2004-09-27 | Chap. 3.4 | Information about the replacing of the internal hose sytem added. |
| | Chap. 12.5 | Gas circuit diagram actualized. |
| 01.06.2004 | Chap. 10.14 | Sign to the new shorter pump added. |
| 30.07.2003 | Chap. 11 | The path to the download page corrected and a short description of steps to the proceeding inserted. |
| 09.07.2003 | Chap. 5.2 | Explanation to the bridges in the short-circuit plug corrects. (Wrong pin-numbers 3 and 5, right pin-numbers 2 and 3.) |
| 22.11.2002 | General: | Chapter scope reduced and incorporated into new chapters. This enabled Table of Contents to be arranged more clearly. |
| | Chap. 2 | Test equipment AL350 and KS350 added. |
| | Chap. 5.6 | Test for 26-pin interface OBD external (with CAN protocol) added. |
| | Chap. 8 | Reference codes 5xxx, 6xxx and $xxx added. For malfunction message 4031 reference to mains voltage test and setting of magnetic core transformer added. |
| | Chap. 10.23 | Exchange of OBD printed circuit board added. |
| | Chap. 12.5 | Gas travel schedule adapted (180° rotation of measuring cell). |
| 30.09.2002 | Chapter 7 | Reference to temperature compensation deleted. Temperature compensation of AMM is not necessary and also not part of the Service software. |
| 05.02.2001 | Chapter 2.3 | Serial interface cable added. |
| | Chapter 6.1 | Temperature compensation discontinued. |
| | Chapter 7.10 | Pump suction line: Chapter and images revised. |
| | General: | Images revised (screenshots) |
| | Translation: | English added. |
| 05.07.2000 | Chapter 7.1 | Mains voltage setting for magnetic core transformer: Fuse values added. |
| | Chapter 7.2.1 | Block diagram for power supply: Fuse values added. |
| | Chapter 7.2.2 | View of population side for control computer LP: Plug positions with greater highlighting (magnified view). |
| | Chapter 4.4.2 | Image for short-circuit plug RTM interface added. |
| | Chapter 4.4.5 | EOBD external added. |

| | |
|---|---|
| BEA 150 | 0 684 105 1xx |
| BEA 250 | 0 684 105 2xx |
| BEA 350 | 0 684 105 3xx |

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