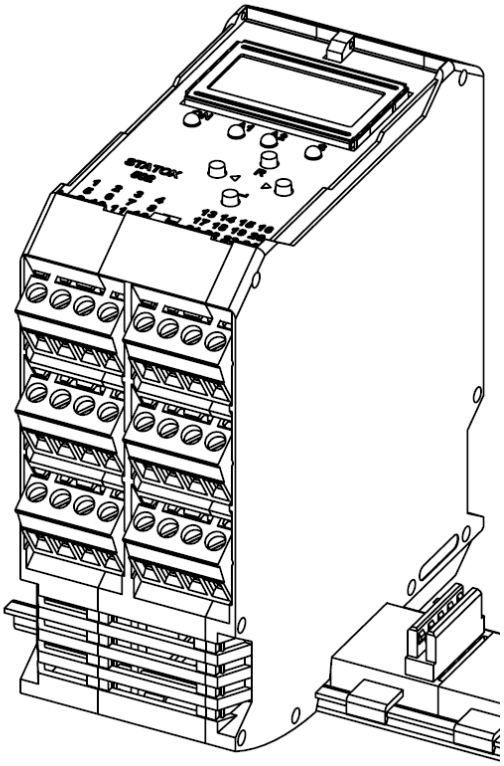
Manual

Statox 503

Control Module



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Content

1 Safety notes

- Read and observe this manual prior to installation and start-up.
- The Statox 503 Control Module is only allowed to operate under the given ambient conditions (see Technical Data). In particular, it must not be operated in potentially explosive atmospheres!
- The Statox 503 Control Module must be operated, maintained and repaired by trained and expert personnel only. Use only Compur Monitors original parts for repair and maintenance.
- Do not connect the module directly to mains!
- Do not modify the product. Do not use if damaged or incomplete.
- When installing this product observe all local standards and regulations.
- Disregarding of the above points represents a danger to people and property.

1.1 Warning Signs

Potential Danger

Note on an immediate danger to people and property.

Advice

Extra information for the proper use of the product.

2 Product description

The Statox 503 Control Module can be used in two different modes:

As a **Control Module** it supplies the sensor heads for toxic or combustible gases with energy and handles their signal. It can be configured for different gases and measuring ranges. The Statox 503 Control Module displays the concentration and converts it into a 4 – 20 mA signal at the analog output. If one of the programmed alarm thresholds is exceeded, the relevant LED goes on, the relevant relay switches and the relays status is communicated on the communication bus. The alarms can be set latching or non - latching. Latching alarms can be reset by pushing the reset button or by an external contact.

Please note:

- Sensor heads for toxic gases and oxygen (Statox 501/S, Statox 505 and Statox 506) are protected in concept Ex i (intrinsic safety) and must be connected via an intrinsically safe repeater, as far as they are intended to be installed in a hazardous area (Zone 1 or 2).
- Sensor heads for combustible gases and CO_2 (Statox 501 HRC, ARE, LCIR, MCIR and CO_2) as well as Statox 501 Infratox and Statox 560 are protected in concept Ex e (enhanced safety) or Ex d (flameproof). They can be connected directly to the Control Module even if they are intended to operate in Zone 1 or 2.

The Statox 503 can also be operated as **Common Alarm Module**. It collects the alarm signals (A1/A2/SF) of up to 25 connected control modules and generates a common alarm on LEDs, relays and its analog output. This way you can set up a multi - channel gas detection system. Prerequisite is that all modules are connected to each other via bus adapter. An error from the Control Module or the connected sensor heads will appear on the respective Control Module as well as on the Common Alarm Module.
If power supply is provided via the optional bus plugs, it is possible to replace the modules during operation without effort.

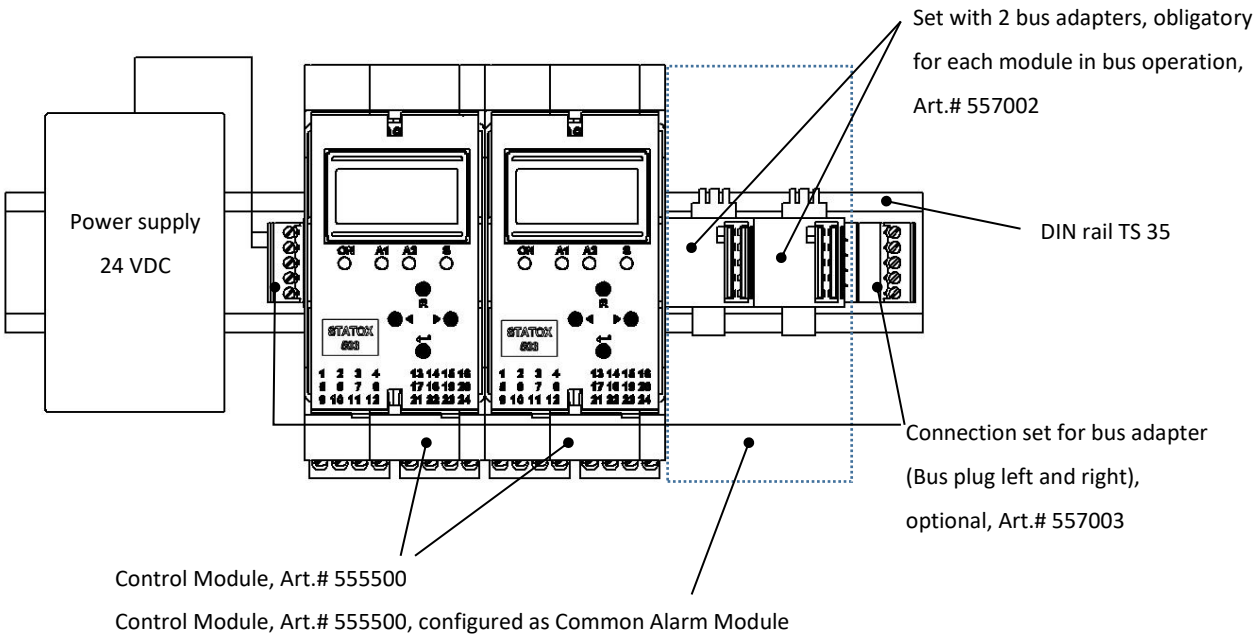


Figure 1: Requirements for bus operation, sample installation

3 Getting started

The Statox 503 control modules are designed for mounting on DIN rail TS 35. Due to the tilted mounting/dismounting of the modules the span between the outsides of the rail and the wall below and above the Statox 503 Module must be at least 80 mm (3.15 “). Furthermore at least 120 mm (4.72 “) must be remain free between two rail lines.

3.1 Mounting

! The Control Module can be operated without bus adapter, they will be mounted on the DIN rail as shown in **Figure 2**. In this case each module must be powered separately with 24 VDC.

1. Plug the bus adapters together and snap them on the DIN rail as shown in **Figure 1.**
2. Incline the module and move it to the lower part of the DIN Rail. See **Figure 2.**
3. Now push the module forward to the rail against the resistance of the spring lock, until you hear it snapping in.

You can combine modules of the Statox 503 series in any sequence. Adding or removing one module has no impact on the others. You can save wiring effort starting with the power supply on the outside and connecting it to the bus with the bus plug. Alternatively the first module in a row can be connected to 24 ± 2 VDC, the others will be supplied via bus. The power rail is rated for 30 modules max. in one row. You can interconnect multiple rows with the optional bus plugs (Connection set Art.# 557003, 1 set per rail is needed). For further information see Accessories list **chapter 12**.

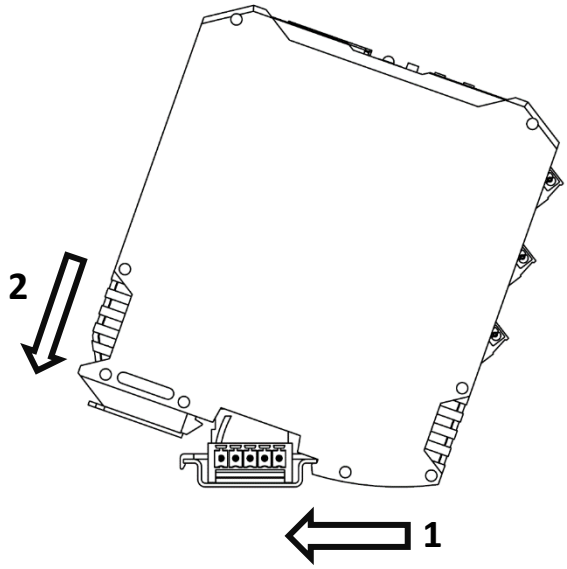


Figure 2: Mounting to DIN rail

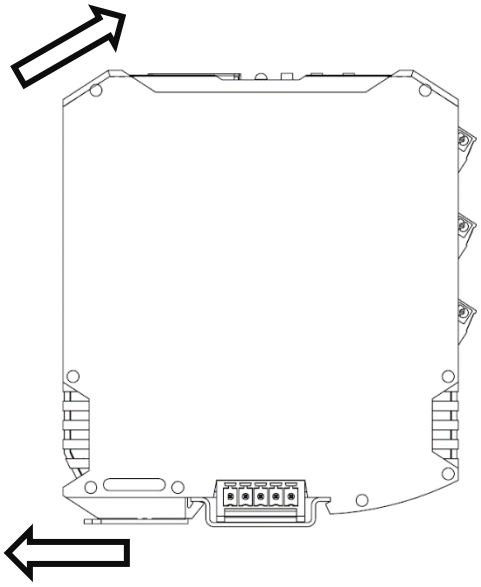


Figure 3: Dismounting from DIN rail

A combination of Statox 502 and Statox 503 Control Modules on one DIN Rail is possible. Please observe the different assignment of terminal 11.

3.2 Dismounting

Pull the spring lock with a screw driver and incline the module simultaneously, see **Figure 3**. This can be done under operating conditions.

3.3 Connecting to power supply

Do not connect the module directly to mains! Do not short circuit terminals! Both can destroy the module!

There are two options connecting the **24 VDC** power supply, see **Figure 4.**

a) Via bus plug to the communication bus

b) Directly to the relevant Statox 503 Control Module terminal

In both cases all subsequent modules are automatically connected to the power supply via bus. The terminals are rated to take a max. diameter of 2,5 mm^2. The module starts operating as soon as it is connected to power.

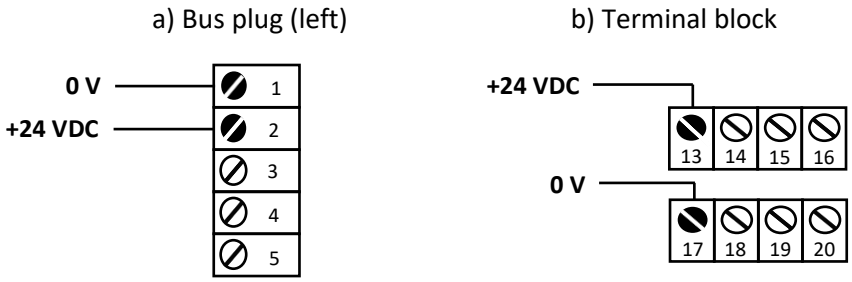


Figure 4: Connecting the power supply

3.4 Start-up

In any case make sure to select the appropriate program **prior** to connecting the sensor head. Otherwise the sensor can be damaged.

Ex works the Statox 503 is configurated to operate as Control Module. After connection to power, it performs a self-test. It displays the firmware version, then for 5 seconds the actual measuring program, then “PLEASE WAIT”. The module remains in the system fail mode until the measuring mode has successfully been activated. During this process the yellow LED “S” is on.

If no sensor head is connected, an error message is generated (ERROR 2 or ERROR 5, depending on measuring program). In this case activate the appropriate program as described in **chapter 6.1.** Then connect the sensor head as described in **chapter 9.**

If a sensor head has been connected and the appropriate program has been selected, the measuring mode will start.

Sensor heads for combustible gases, type HRC, ARE, LC IR, MCIR, CO_2 and PID must be calibrated after being connected.

Exception: A line calibration has been done by Compur.

! The message „CALIB. REQUIRED“ alternating with the measured value, tells you that the combination sensor head / control module has not been calibrated together. The control module operates with default sensor parameters. By pushing ENTER, the message „CALIB. REQUIRED“ can be blanketed. By pushing ENTER in the measuring mode, this message can be recalled: if there was no initial calibration, “NO VALID CAL. DATA“ is shown for 5s.

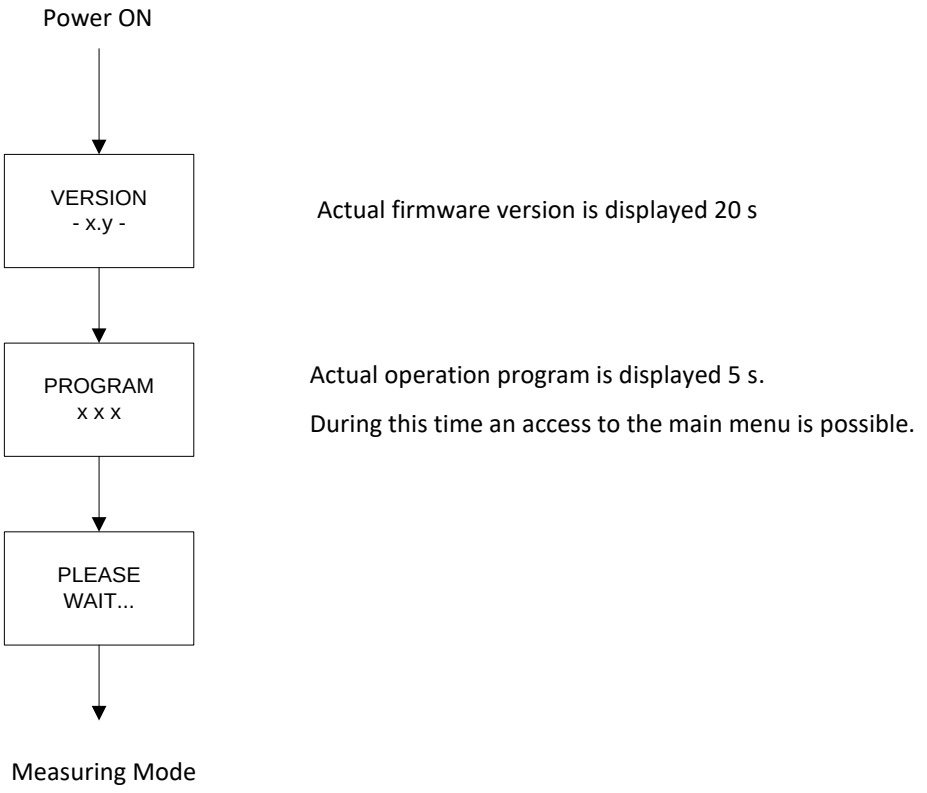


Figure 5: Start-up sequence

4 Product characteristics

4.1 Controls

The Statox 503 has four push buttons.

Button		Function
↵	Enter	Enter. Check calibration status (see chapter 3.4).
R	Reset	Deletes wrong entries, resets the alarm relays, goes one step back in the menu.
◄	Left*)	Navigates left in the menu, reduces a programmed figure, changes the first display line when in the measuring mode.
►	Right*)	Navigates right in the menu, increases a programmed figure, changes the first display line when in the measuring mode.

*) In some menus a continuous push activates the fast mode

4.2 LEDs

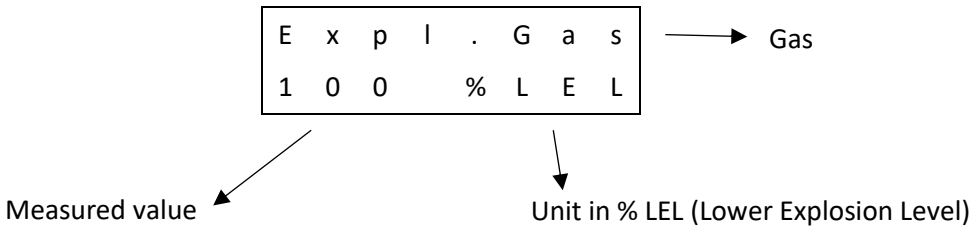
The Statox 503 has 4 status LEDs. The function of the individual LEDs is subsequently explained.

Description	LED	Function
ON	Green	Power supply: „ON“ Power ON „OFF“ Power voltage off or too low
A1	Red	Relays 1: Alarm threshold exceeded
A2	Red	Relays 2: Alarm threshold exceeded
S	Yellow	Failure or service request: „Flashing“ Service Mode „ON“ System Failure „OFF“ Measuring mode

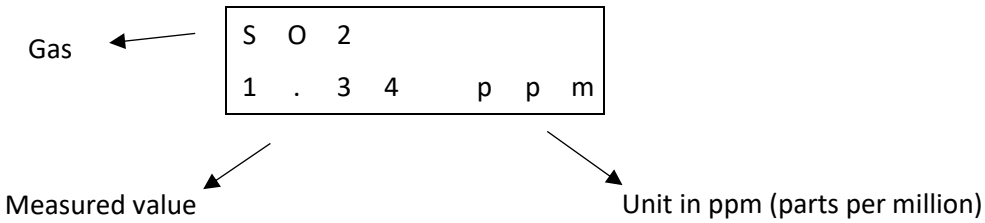
4.3 Display

In the measuring mode the display shows the target gas, the actual measured value and the unit.

Example 1 (Combustible gas)

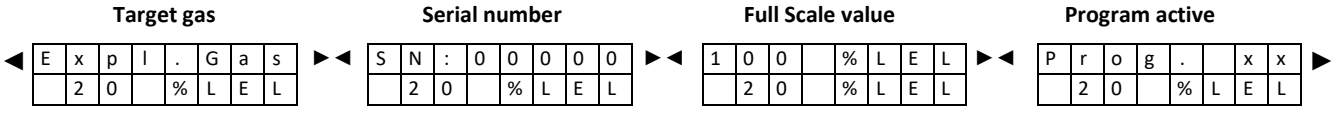


Example 2 (Toxic gas)



In case of an over range exposure, the full scale value is going to flash.

The ►- or◄-button change the content of the upper line to display the serial number of the module, the end of range value and the actual program . After 20 seconds the display goes back to the standard content – the target gas.



4.4 Communication bus

The bus interfaces the 24 V-power supply and the alarm signals from one module to the next.

A Common Alarm Module can evaluate the alarm signals.

Bus ports	Description
0 V	Zero - 0 V
+24 V	Positive 24 ± 2 VDC
A1	Exceeding alarm threshold 1 sets the signal on terminal A1 to Low(0V)
A2	Exceeding alarm threshold 2 sets the signal on terminal A2 to Low(0V)
SF	A system failure sets the signal on terminal SF to Low (0V)

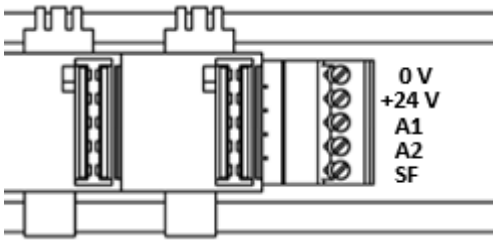


Figure 6: Bus terminals

4.5 Electrical connections

The Statox 503 operates at 24 ± 2 VDC. Higher voltage or short circuits on the terminals may destroy the module.

The terminals are pluggable. To remove the terminal blocks, set the screwdriver directly over the screws and press the block to the front side.

The terminals can take cable diameters up to 2.5 mm^2.

Terminal	Contact	Function
1	External Reset	Remote Reset
2	GND (External Reset)	
3	0 – 22 mA analog output	Analog output (must be short – circuited if not in use)
4	GND (0 - 22 mA output)	
* 5	Bridge supply -	Sensor head power supply
* 6	Bridge Sense -	Negative sense-lead for 5 wire operation
* 7	Bridge supply 19 ± 1 VDC	Sensor head power supply
** 7		Sensor head power supply without repeater
* 8	Bridge Sense +	Positive Sense-lead for 5 wire operation
* 9	Bridge center	Sensor Signal (mV)
** 10	0 – 22 mA Current input	Sensor Head Transmitter Signal (mA)
11	Statox 560 ST Trigger	Remote Trigger for selftest (R + ↵)
** 12	GND	0 V Sensor Head (Transmitter)
13	24 V Power supply	Power supply + 24 V DC
14	Relay SF NC	System failure relay - break contact
15	Relay SF NO	System failure relay - make contact
16	Relay SF C	System failure relay - central contact
17	GND	Power supply negative
18	Relay A2 NC	Alarm relay 2 – break contact
19	Relay A2 NO	Alarm relay 2 – make contact
20	Relay A2 C	Alarm relay 2 – central contact
** 21	24 ± 1 V Voltage output	Sensor head power supply with repeater
22	Relay A1 NC	Alarm relay 1 – break contact
23	Relay A1 NO	Alarm relay 1 – make contact
24	Relay A1 C	Alarm relay 1 – central contact

* Sensor heads type
- Statox 501 HRC
- Statox 501 ARE
- Statox 501 LCIR and CO_2
- Statox 501 MCIR
- Statox 501 PID

** Sensor heads type:
- Statox 501/S
- Statox 501 Infratox
- Statox 505
- Statox 506
- Statox 560

Detailed connection advice in chapter 9 and in the manuals of the different sensor heads.

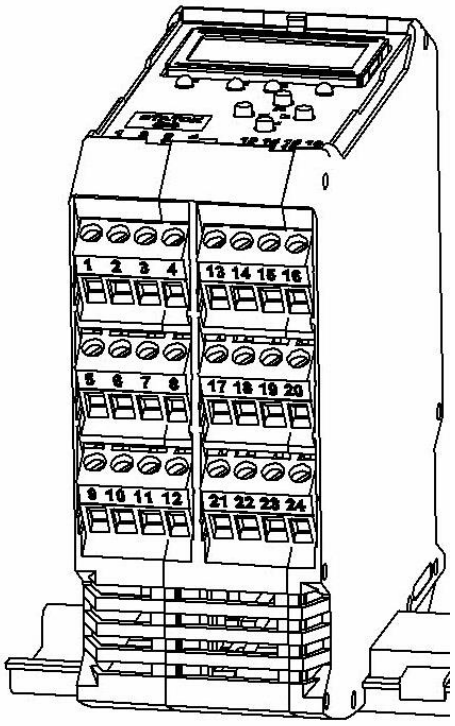


Figure 7: Pluggable terminal blocks with terminal numbers

4.5.1 Connecting the external reset and analog output

A GND-signal on terminal 1 initiates a reset just as pushing the RESET button.

The analog output generates a current analog to the actual measured value with 4 mA corresponding to zero and 20 mA to end of scale. A measured value higher than end of scale generates 22 mA.

A system failure causes a current of 0 mA, the service mode causes a current of 2 or 4 mA (selectable).

If the current output of the Control Module is not in use, terminals 3 and 4 must be short - circuited, in order to avoid an Error 13!

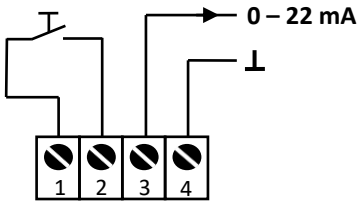


Figure 8: Connections external reset and analog output

4.5.2 Self Test Trigger for Statox 560

Push the buttons **R** and **Enter** for **3** sec at the same time connects terminal 11 to ground. This will trigger a self test on a Statox 560 sensor head. The display on the control module shows now „START SELFTEST“ for a few seconds.
In order to activate this function connect lead 5 of the sensor head to terminal 11 on the control module.

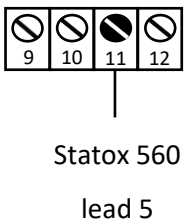


Figure 9: Statox 560 Self Test Trigger Connections

4.5.3 Connecting the internal relays

Statox 503 has three relays, each equipped with one make and one break contact. Two relays monitor alarm threshold exceeding, one system failure.

> ! System failure relay: The SF-relay coil is always active and drops out in case of a system failure or voltage drop.

The alarm relay parameters can be set in the main menu. The SF-relay settings cannot be changed.

Figure 10 shows the contacts:

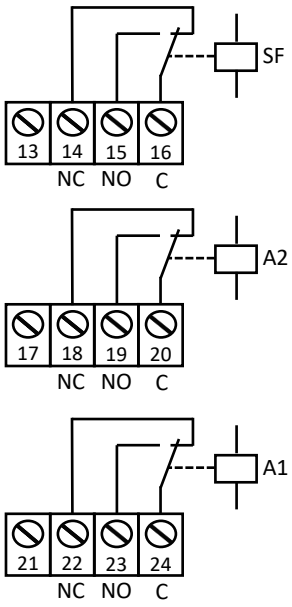


Figure 10: Relay contacts (coil de-energized)

If inductive loads are switched with the relay contacts, appropiate protection must be provided.

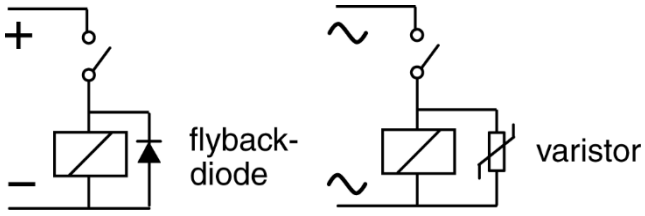


Figure 11: Left: Flyback diode in a DC circuit to prevent voltage peaks, Right: Varistor in an AC circuit to protect against overvoltage.

5 Statox 503 main menu

5.1 Password

The main menu is password protected. No matter if in the measuring, the failure or the start mode: below procedure gives access to the main menu.

The password is: **1994** (not changeable)

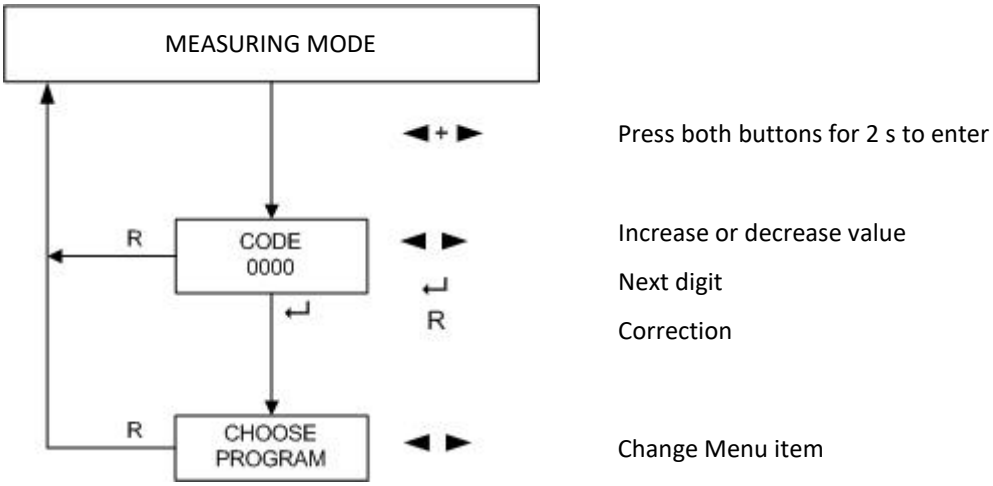


Figure 12: Password menu

1. Push ◄- and ► -button together for 2 s.
2. Enter the first digit with ◄ or ►. Use the Reset button for corrections.
3. Confirm with Enter.
4. Continue with the next 3 digits the same way.
5. After confirming the last digit with Enter you have access to the main menu, provided the correct password has been entered.

   If message „CODE INVALID“ appears, a wrong password has been entered. Try again after two seconds.

5.2 Main menu structure

After pushing ◄- and ► -button together for 2 s and entering the password, you have access to the main menu. It is structured as a ring with 9 different submenus in which you can set parameters or perform a calibration. See **Figure 13**. Pushing the Reset–button always brings you back into the measuring mode.

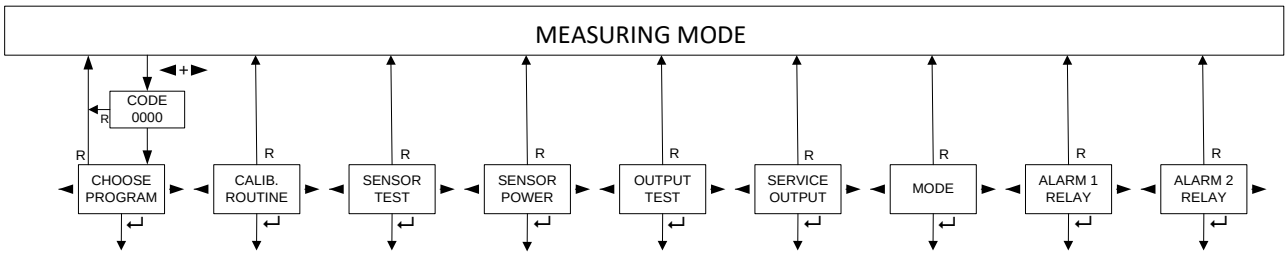


Figure 13: Main menu structure

Submenu	Description	Chapt.
CHOOSE PROGRAM [1)]	Selecting the appropriate program for the relevant sensor head	**6.1**
CALIB. ROUTINE [1) 2)]	Calibration with gas	**6.2**
SENSOR TEST[1) 2)]	Display of the bridge signal in % LEL or mV	**6.3**
SENSOR POWER [1) 2)]	Switches sensor power off or on	**6.4**
OUTPUT TEST	Test of the LEDs, relays, alarms and the analog output	**8.1**
SERVICE OUTPUT	Setting of the analog output in the service mode	**8.2**
MODE	Altering the operation mode (Common Alarm Module or Control Module)	**8.3**
ALARM 1 RELAY	Setting Alarm 1 relays parameters	**6.5**
ALARM 2 RELAY	Setting Alarm 2 relays parameters	**6.5**

[1)] no access if the Statox 503 is operated as Common Alarm Module.

[2)] no access if a program for the operation of a 4 – 20 mA transmitter is active.

! „MENU NOT ACTIVE“ will be shown for 2 s if a menu is not accessible in the actual mode or program.

5.3 Service Mode

As soon as the menu is entered, the module goes into the service mode. The LED „S“ is flashing. In the service mode the analog output is locked at 2 or 4 mA. The alarm LEDs and relays are inhibited.

If no button is pushed within 30 seconds, the module returns to measuring mode. This time-out it **not active**

- during zero adjustment and calibration in the menu „CALIB ROUTINE“
- when switching the sensor head power supply on or off in the menu „SENSOR POWER“ (display shows „SENSOR ON“ or „SENSOR OFF“)
- during the program selection in the menu „CHOOSE PROGRAM“
- during the bridge voltage is displayed in the menu “SENSOR TEST”. In this mode the time - out is 60 minutes to allow enough time for maintenance work.

6 Statox 503 in Control Module Operation

The sensor heads for toxic gases, oxygen or combustible gases measure the concentration of the target gas in the field. Statox 503 evaluates the signal and displays the value. Any alarm threshold exceeding is signaled by an LED and the alarm relays is activated. The alarm is also communicated on the bus.

6.1 Selecting the measuring program

In this menu the appropriate measuring program can be selected. The program defines the target gas, the measuring range, the concentration window for span gas and the ex - works settings of the relays. See an overview of all available programs in the program listing enclosed with each module.

In any case the first step is always to select the appropriate program. This must be done before the sensor head is connected, otherwise the sensor can be damaged.

If a new program is selected, the alarm settings and relay configurations according to the program listing are valid and the calibration data for the sensor heads type HRC, ARE, LCIR, MCIR, CO_2 and PID will be erased. A new calibration is necessary.

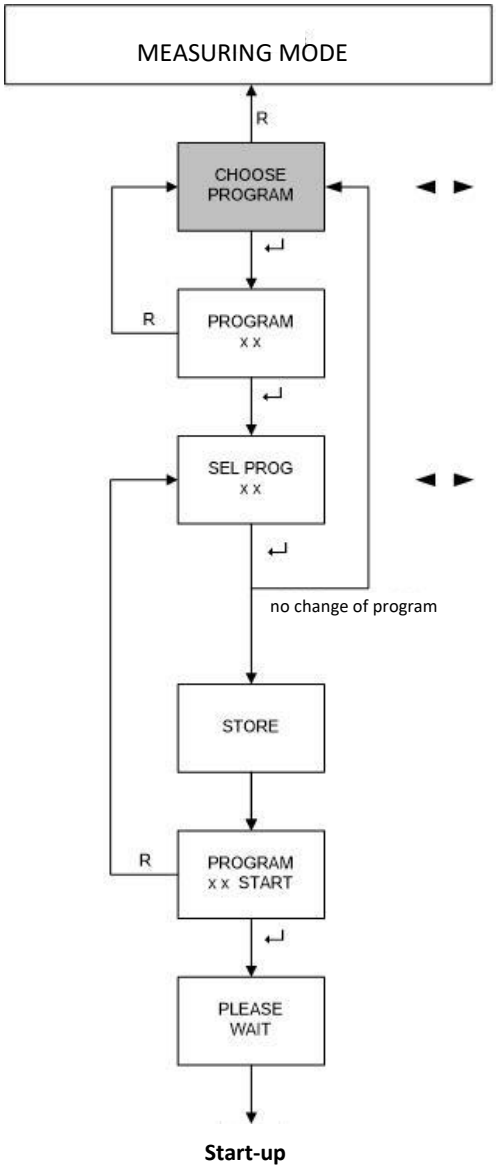


Figure 14: Program selection diagram

1. Push the ↵ - button to enter the „CHOOSE PROGRAM“ menu.
2. The active program is shown on the display.
3. Push the ↵ - button to start the program selection

! Now the time-out is deactivated!

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4. Select your program with the ◄- or ►- button. Push and hold ◄ or ► for the fast mode.
5. Confirm by pushing the ↵- button.
6. The display shows „Store“ for 2 seconds.
7. Then the number of the new program is shown.
8. Confirm by pushing the ↵ - button to start measuring with the new program.

6.2 Calibration

In this menu you can perform a calibration of sensor heads type Statox 501 HRC, ARE, LCIR, MCIR, CO_2 and PID detecting combustible gases, carbon dioxide (CO_2) and volatile organic compounds (VOC). The test gas concentration must be within the permitted range, see program list.

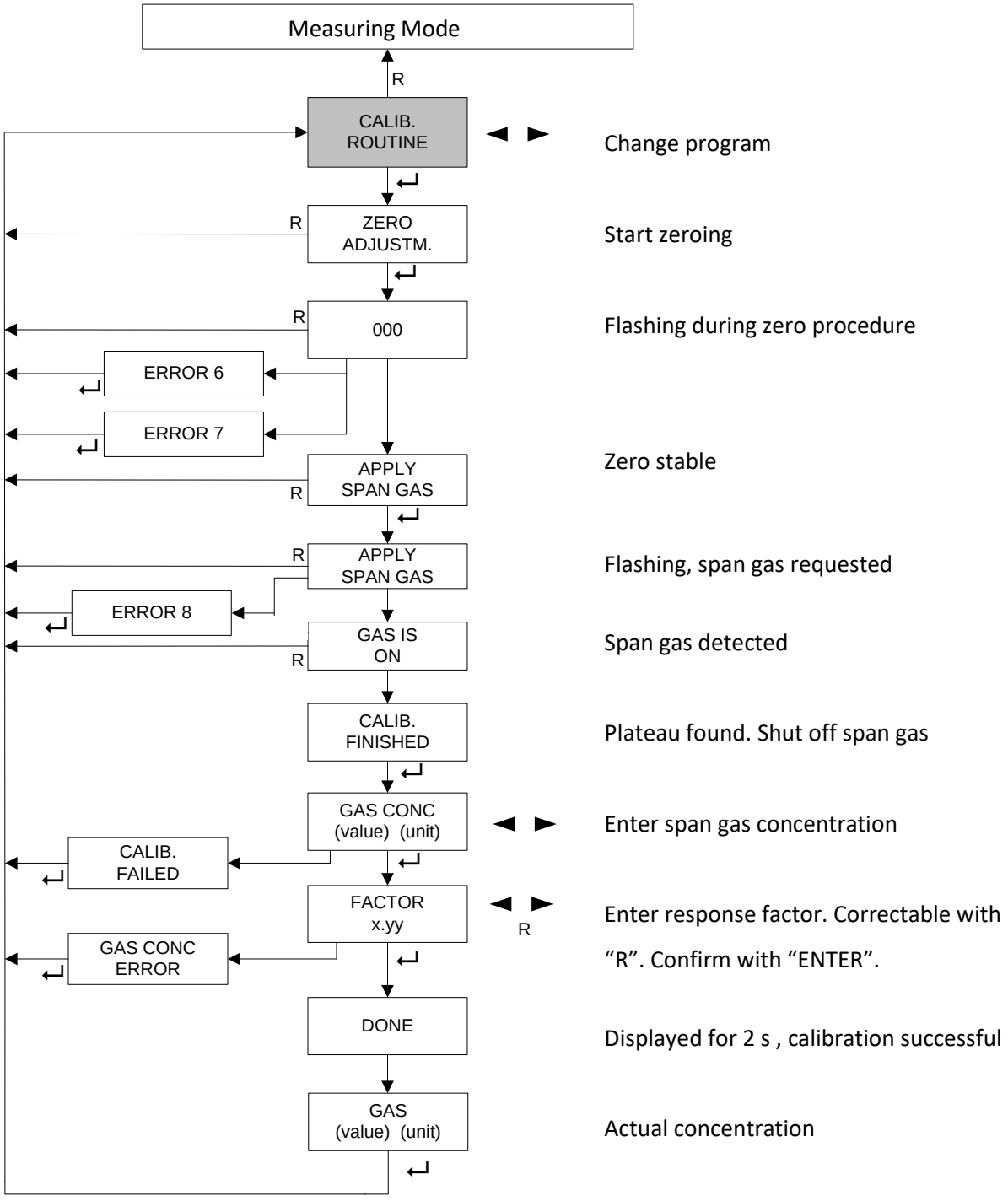


Figure 15: Calibration menu diagram

1. Enter the menu „CALIB. ROUTINE“ by pushing ↵.
2. The display shows: „ZERO ADJUSTM.“

> ! Beginning with step 3, the automatic Time-out is not active.

3. Push the ↵ - button. Display: „000“ flashing. The Control Module adjusts the actual zero point. Therefore this procedure must be performed in clean or synthetic air.
4. „APPLY SPAN GAS“ tells you, that the zero point has been found and saved. If you do not want to perform a gas calibration leave the calibration routine with “R”.
5. Push the ↵ -button. Display: „APPLY SPAN GAS“ - flashing. Connect the test gas adapter and turn on the gas. The module starts searching a stable signal.

> ! Make sure that sufficient test gas is available. If no test gas is applied or there is not enough test gas for the adjustment in the cylinder, the module reports “ERROR 8”.

6. If span gas is detected, “GAS IS ON” is flashing.
7. „CALIB. FINISHED“ tells you that the signal is stable – a plateau has been found. Turn off the gas.
8. Push the ↵ - button.
9. In case the display does not show the concentration of the gas cylinder, adjust it by pushing the ◄- or ► - button. Push and hold ◄ or ► for speed mode. Entering the concentration must be carried out in the respective display unit, e.g. combustible gases are shown in % LEL. See the last column of the program listing. Confirm with Enter.
10. If needed you can enter a reference factor for the calibration with reference gas. Program it with the ◄- or ►- button. Any entered figure must be confirmed with “Enter”. If you need to correct your entry, push „Reset“. How to use response factors is described in the relevant sensor head manual. If **no factor** needs to be programmed, leave the default value **1.00**.
11. Close the menu with Enter.
    a) Display: **„GAS CONC ERROR“**: (only possible if the response factor is not 1). This tells you that the product (response factor * span gas concentration) is not within the permitted range for span gas. Confirm with ↵. This brings you back into the main menu. Check the input for reference factor and gas concentration and accordingly use a test gas with suitable concentration for recalibration.
    b) Display: **„CALIBR. FAILED“**:
    Calibration failed, because the calculated plateau signal is too low. Confirm with ↵-button. This brings you back into the main menu. Check the values for response factor and gas concentration. Repeat the calibration with a test gas with higher concentration or replace the sensor.

c) Display **„DONE“:**

The calibration was successful. After 2 s the display changes.

12. The display will now show the actual measured value with unit.

> ! In order to avoid unrequested alarms make sure the signal created by the test gas has dropped below the alarm threshold prior to returning into the measuring mode.

13. Confirm with ↵ to return to the main menu.
14. Return into the measuring mode by pushing Reset.

> ! If the calibration has not been completed successfully (ERROR 8, CALIBR. FAILED or GAS CONC ERROR), the module will continue with the most recent valid data. The display shows alternating „CALIB. FAILED“ and the measured value. A new calibration should be done as soon as possible.

6.3 Reading the bridge voltage

Active in the programs for Statox 501 HRC, ARE, LCIR, MCIR, CO_2 and PID sensor heads.

The current bridge voltage of the sensor can be displayed. If the sensor power supply has been switched off (e.g. at Error 5) „SENSOR OFF“ is displayed for 2 s when the menu is entered.

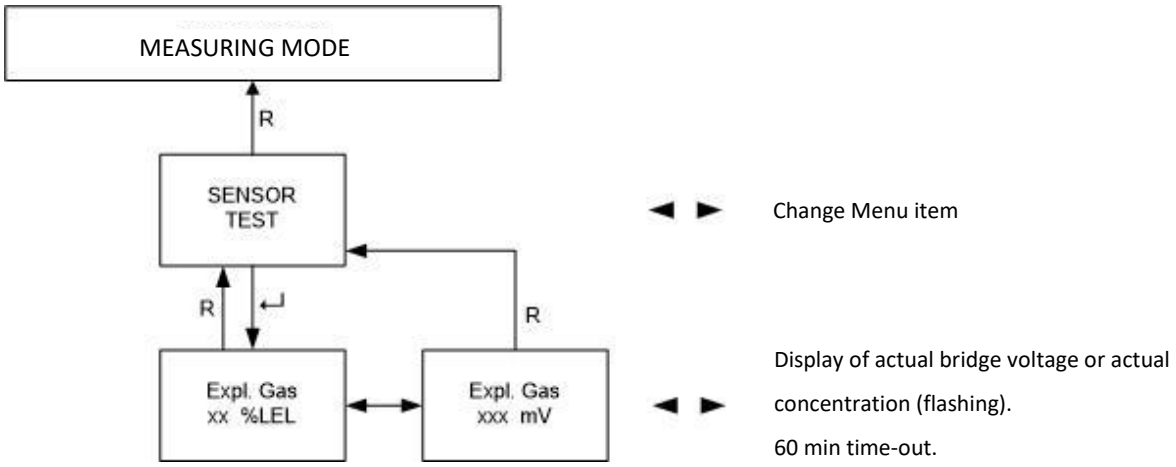


Figure 16: Sensor test menu diagram

1. Enter the menu „SENSOR TEST“ by pushing ↵ in the main menu.
2. With ◄- or ► you can navigate between the display modes..

> ! During this procedure the automatic time-out is 60 min.

3. Push Reset to return to the main menu and again to return to measuring mode.

6.4 Switching the sensor power supply off

This menu is active for Statox 501 HRC, ARE, LCIR, MCIR, CO_2 and PID sensor head programs. It disconnects the sensor head for service purposes.

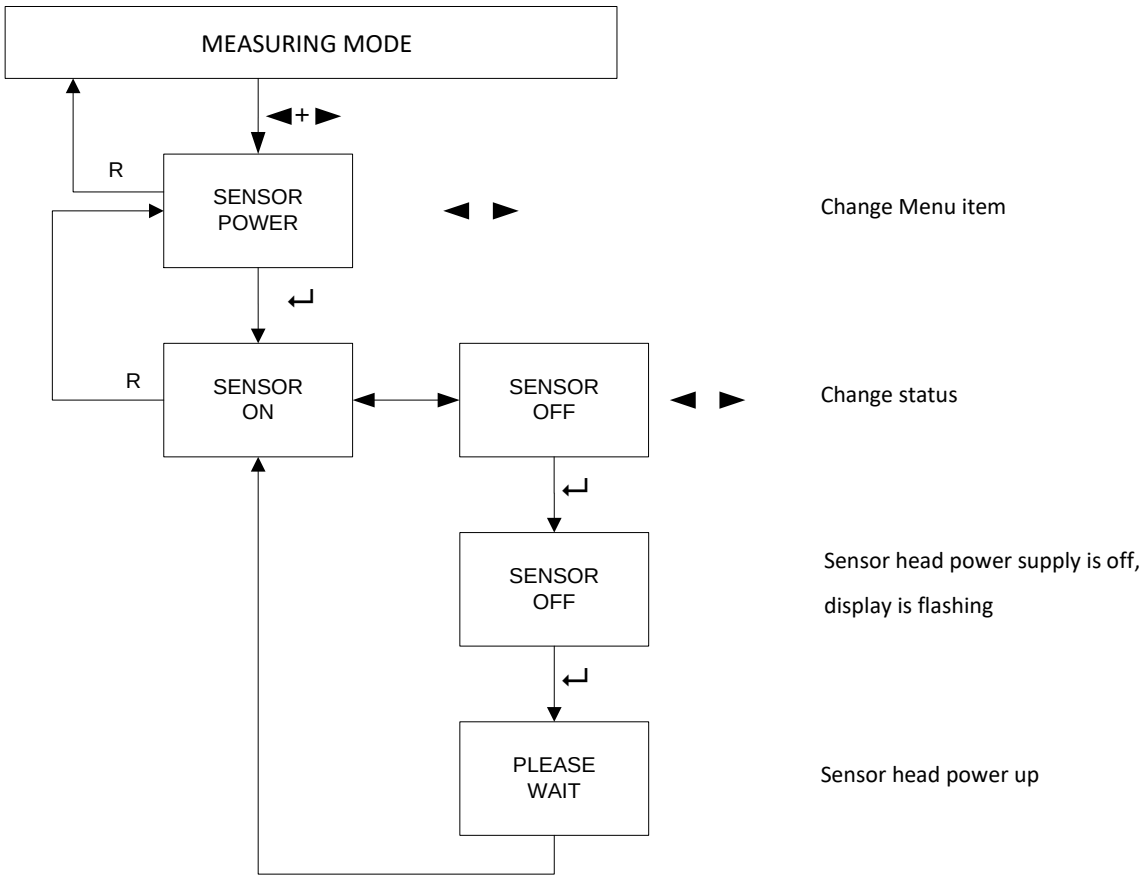


Figure 17: Diagram sensor head deactivation

1. Enter the menu „SENSOR POWER“ by pushing ↵.
2. Display „SENSOR ON“.

   Exception: if the sensor power supply has been switched off (e.g. at Error 5), blinking „SENSOR OFF“ is displayed. Continue with ↵ (point 6).

! Up to step 7 the automatic time-out is not active.

---

3. Change the status of the sensor head power supply with ◄ or ►.
4. Confirm with Enter.
5. „SENSOR OFF“ flashing tells you that the sensor head power supply is off.
6. Push ↵ to switch the power supply on again.
7. „SENSOR ON“ tells you that the sensor head power supply is on.
8. Push Reset to return to the main menu and again to return to measuring mode.

6.5 Programming the alarm relays

In this menu you can set parameters of the alarm relays A1 and A2:

1. Alarm thresholds. A1 must be lower than A2.
2. High or low alarm
3. Latching (HOLD) or non-latching (AUTO RESET)
4. Coil active (ACTIVE) or non-active (PASSIVE)

The ex – works settings of the alarms are listed in the program list, which comes with each control module, or is accessible in the internet: www.compur.com

If an alarm threshold is exceeded, the LEDs A1 and A2 are on, and the relays switch. Alarms can be reset, provided the reason for the alarm has disappeared. If the alarms have been programmed to be latching, you have to push reset button or use the external reset to delete the alarm message. For additional information see chapter 4.5.1.

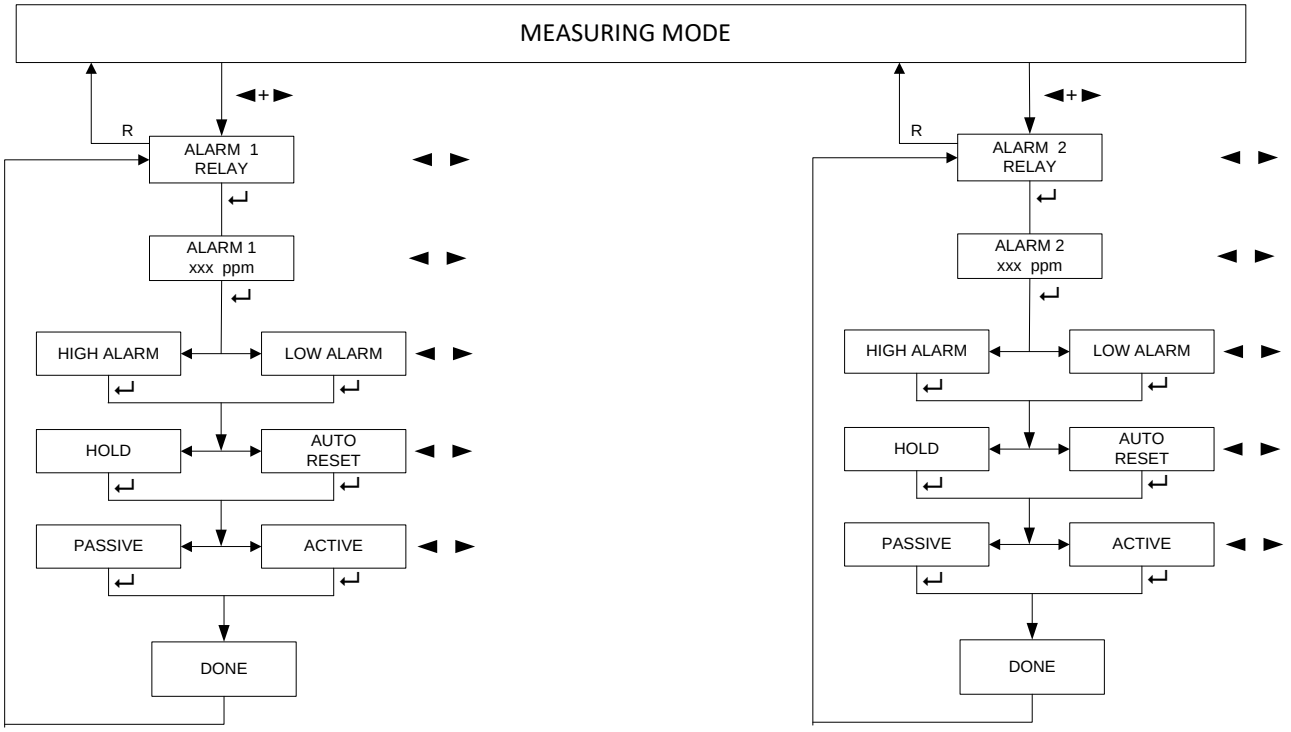


Figure 18: Control Module - alarm relays setting

1. Enter the menu „ALARM 1 RELAY“ or „ALARM 2 RELAY“ by pushing ↵.

   The procedure is identical for both relays.

! With the next alarm the new settings will be effective.

---

2. Program the alarm threshold with ◄ or ►. Push and hold ◄ or ► button for speed mode.
3. Confirm with Enter.
4. Select an alarm type with ◄ or ►.
5. Confirm with Enter.
6. Select a Reset-setting (latching or non-latching) with ◄ or ►.
7. Confirm with Enter.
8. Select a relay setting with ◄ or ►.
9. Confirm with Enter.
10. Display „DONE“ for 2 seconds.
11. The program returns automatically to the main menu.
12. Push Reset to return to the measuring mode.

7 Statox 503 in Common Alarm Module Operation

The ex-works setting of the Statox 503 is Control Module mode. See chapter 8.3 for changing to Common Alarm mode.

After being connected to power, the Statox 503 performs a self-test. Then the display shows the actual firmware code. As far as there is no alarm signal on the bus, the display shows „COMMON OK“.

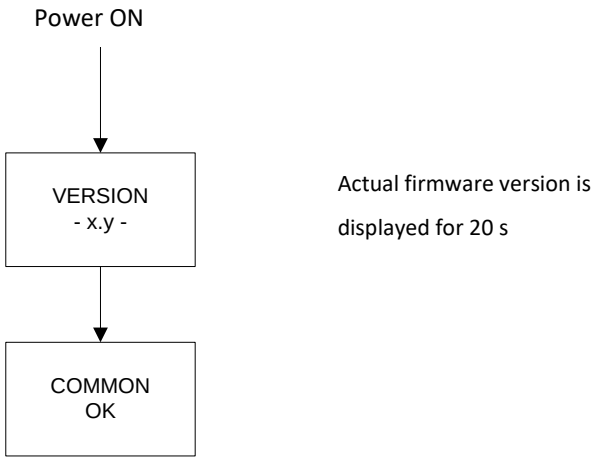


Figure 19: Start procedure in Common Alarm mode

When operating in common alarm mode, the module monitors the status of up to 25 control modules connected to the bus. As soon as one control module generates an alarm, the common alarm modules LEDs, relays, LCD and analog output go into the alarm status.

Alarm on Bus	Status	Analog output	Display
	Normal	4 mA	COMMON OK
A1	Alarm 1	12 mA	COMMON ALARM 1
A2	Alarm 2	16 mA	COMMON ALARM 2
SF	System failure	0 mA	COMMON FAILURE
	Service Mode	2 or 4 mA	(main menu)

If several alarms occur at the same time, the priority is:

Service Mode > A2 > A1 > SF

Example:

On the bus are 3 control modules and 1 common alarm module. The first control module is in alarm 1 status, the second control module is in alarm 2 status, and the third control module submits system failure. All LEDs and relays on the common alarm module will be activated, the analog output will generate 16 mA, and the display will show „COMMON ALARM 2“.

7.1 Alarm relays configuration

In this menu you can set the parameters of alarm relays A1 and A2:

1. Latching (HOLD) or non-latching (AUTO RESET)
2. Coil active (ACTIVE) or passive (PASSIVE) in case of an alarm.

As long as an alarm is submitted via bus, the relevant LEDs are on and the corresponding relays are switched. If an alarm threshold is exceeded, the LEDs A1 and A2 are on, and the relays switch. Alarms can be reset, provided the reason for the alarm has disappeared. If the alarms have been programmed to be latching, you have to push reset button or use the external reset to delete the alarm message. For additional information see chapter 4.5.1.

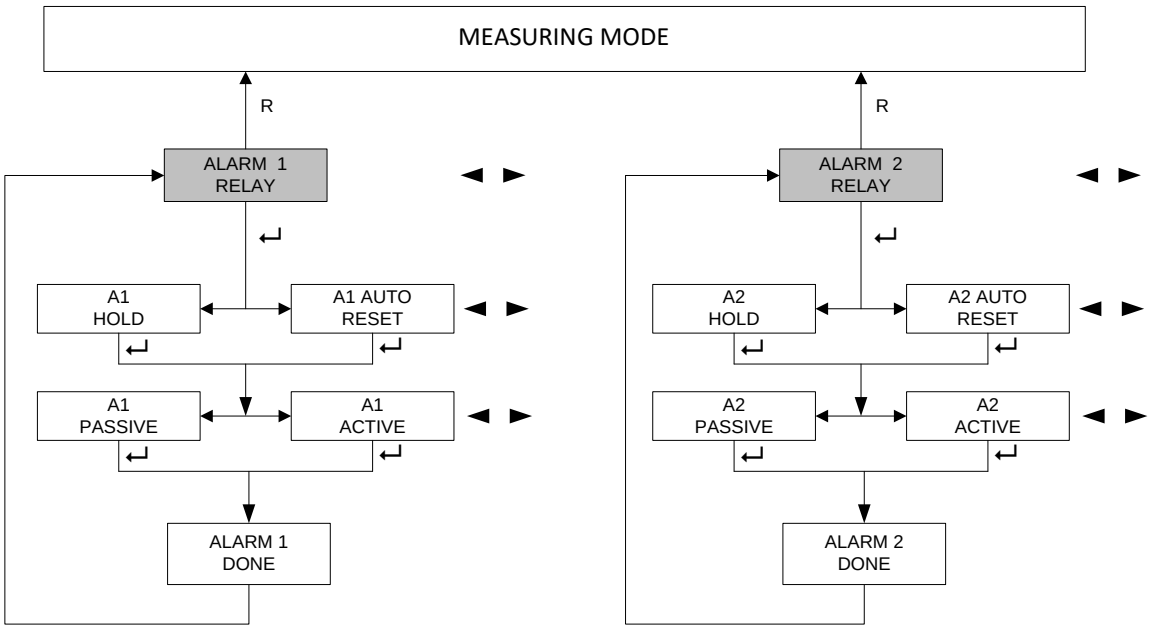


Figure 20: Common Alarm Module - alarm relays setting

1. Enter the menu „ALARM 1 RELAY“ or „ALARM 2 RELAY“ by pushing the ↵-button.
   The procedure is identical for both relays.

> ! With the next alarm the new settings will be effective.

2. Select a Reset-setting (latching or non-latching) with ◄ or ►.
3. Confirm with Enter.
4. Select the relay setting with ◄ or ►.
5. Confirm with Enter.
6. Display: „DONE“ for 2 seconds.
7. The module returns now automatically into the main menu.
8. Push the reset button to return to the measuring mode.

8 Common menu items of the Statox 503

8.1 Functional test

This test can be performed in any operation mode (Control Module or Common Alarm Module). It tests the proper function of the LEDs, relays, analog output and bus.

> ! Take care not to generate an alarm on peripheral devices unintendedly!

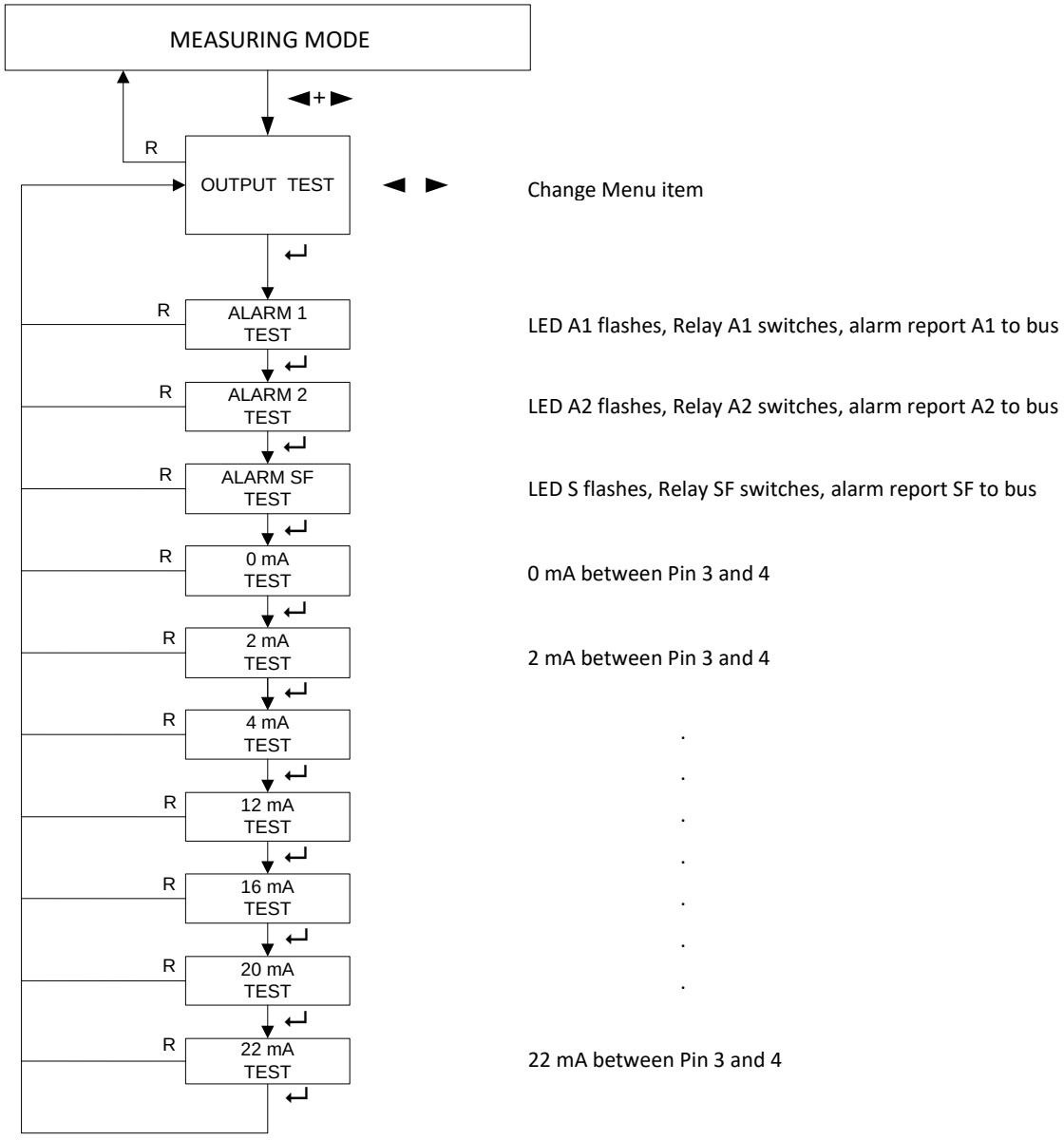


Figure 21: Diagram functional test

1. Enter the menu „OUTPUT TEST“ by pushing ↵.
2. Always push ↵ to continue with the next submenu.
3. With the last ↵ you will return to the main menu.
4. Push RESET to return to the measuring mode.

8.2 Current output in Service Mode

You can select which current the analog output generates in the service mode. The ex - works setting is 2 mA. The selected output current is conserved independent from selected program or operation mode.

> ! If you operate the module as a SIL device EN 50402 or IEC 61508, 2 mA in service mode are mandatory.

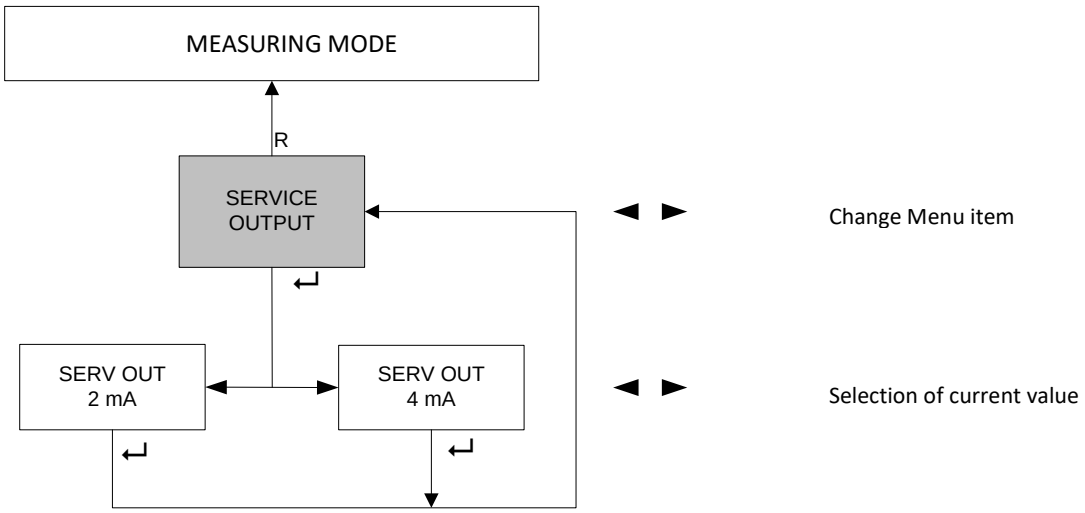


Figure 22: Diagram service output

1. Push ↵ to enter the „SERVICE OUTPUT“ menu.
2. The actual setting is shown on the display.
3. Select a new setting with ◄ or ►.
4. Confirm with Enter.
5. Push reset to return to the measuring mode.

8.3 Changing the operation mode – Control Module or Common Alarm Module

The ex - works setting of the Statox 503 is Control Module. Please find detailed information for running the Statox 503 in Control Module mode in chapter 6.

Please find detailed information for running the Statox 503 in Common Alarm mode in chapter 7.

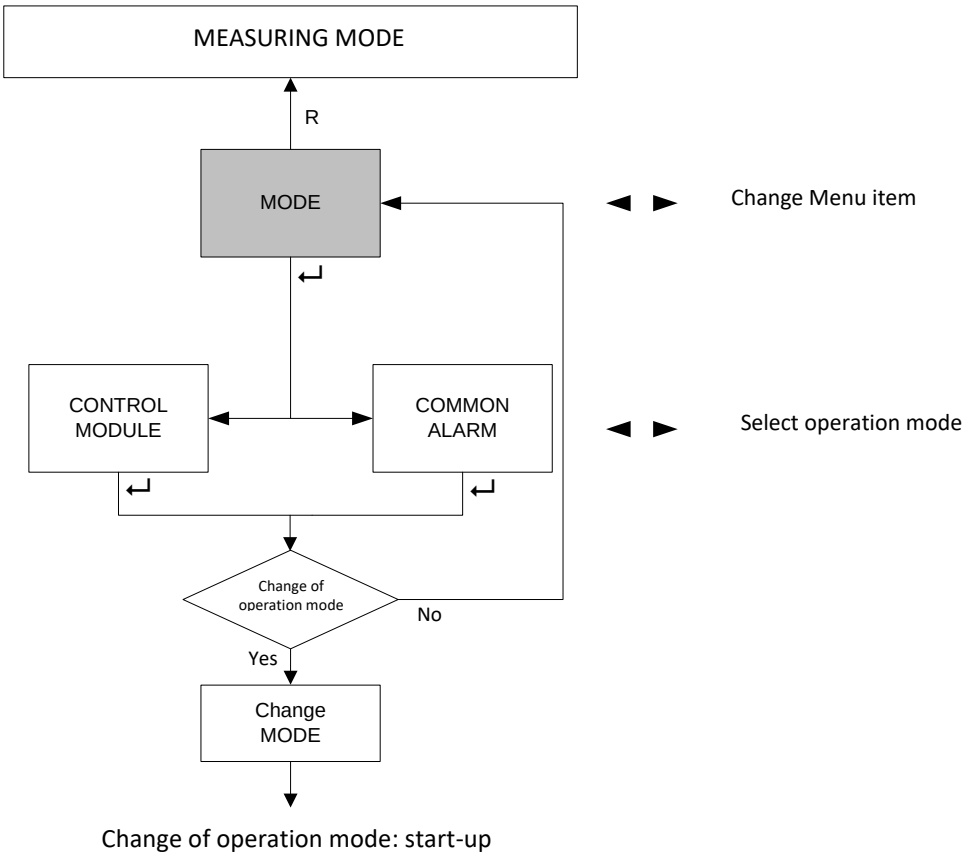


Figure 23: Change of operation mode

1. Push ↵ to enter the „Mode“ menu.
2. Select the desired mode with ◄ or ►.
3. Confirm with Enter.
   a) If you have changed the operation mode, the Statox 503 restarts in the new mode.
   b) If you have **not changed** the operation mode, the Statox 503 returns automatically to the main menu. Push Reset to return to the measuring mode.

9 Connecting the sensor heads

The sensor head power supply must be OFF before connecting a sensor head! Short circuits on the terminals or selection of a wrong program may destroy the sensor head.

Following sensor heads can be operated in voltage mode:

Statox 501 HRC, ARE, LCIR, MCIR, CO_2 and **PID** for combustible gases, CO_2 and VOC.

Together with the two internal resistors of the Statox 503 module the sensor forms a Wheatstone measurement bridge. A gas concentration-dependent resistor in the sensor leads to a change of the bridge voltage. This voltage in the mV range is evaluated by the Control Module.

The standard application is 3 wire mode. Beginning with 750 m length of cable Compur recommends to generally operate in the 5 wire mode. The two additional "sense" lines measure the sensor supply voltage and compensate for voltage drops due to long cable or extreme temperatures.

Following sensor heads can be operated in current mode (4 - 20 mA transmitter):

Statox 501/S, Statox 501 Infratox, Statox 505, Statox 506 and Statox 560.

In transmitter mode the sensor signal is transferred directly to the analog output, according to the selected program, with 4 mA as the lower end of the measuring range and 20 mA as the end of scale.

The sensor heads **Statox 501/S** and **Statox 505/506** for toxic gases and oxygen are operated as 4 – 20 mA transmitters in 2 wire mode. The **Statox 505/506** sensor heads can be operated in 3 wire mode, too. This way you can differentiate between service mode (2 mA) and system failure (0 mA).
The sensor head **Statox 501 Infratox** for combustible gases and CO_2 requires 3 or 4 wires for proper operation.
The **Statox 560** with self – test feature need 4 contacts.

The sensor heads **Statox 501/S, Statox 505** and **Statox 506** must be operated in connection with an intrinsically safe repeater if they are installed in classified area, zone 1 or zone 2. Detailed information regarding the operation with intrinsically safe repeater can be found in the manuals of the corresponding sensor heads. Connect the shield of the sensor head cable to the grounding bar. Both, grounding bar and DIN Rail must be grounded.

Sensor head type	Signal	Measuring mode	Cable	
Statox 501 HRC, ARE, LCIR, MCIR, CO_2, Statox 501 PID	Voltage in mV: non balanced bridge	Voltage mode	3 or 5	**Figure 26**
Statox 501/S,	Current: 4 – 20 mA	Current mode	2	**Figure 24**
Statox 505 Statox 506	Current: 4 – 20 mA	Current mode	2 or 3	**Figure 24**
Statox 501 Infratox Statox 501 Infratox HS	Current: 4 – 20 mA	Current mode	3 or 4*)	**Figure 25**
Statox 560	Current: 4 – 20 mA	Current mode	4	**Figure 27**

*) one or two ground wires

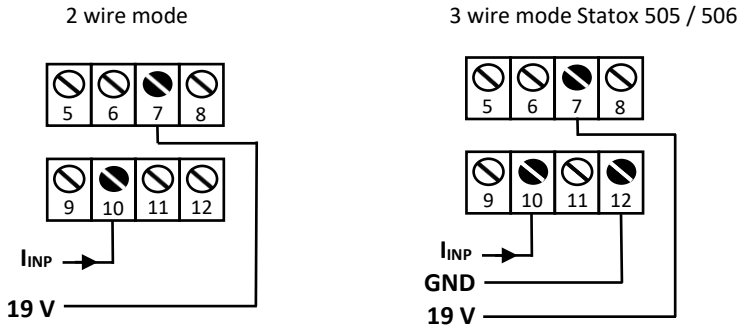


Figure 24: Connections sensor heads Statox 501/S, Statox 505 and Statox 506

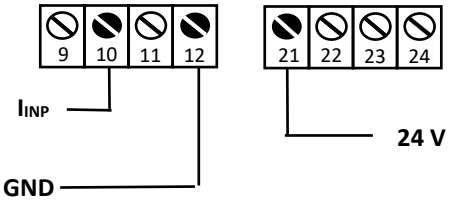


Figure 25: Connections sensor head Statox 501 Infratox / Infratox HS

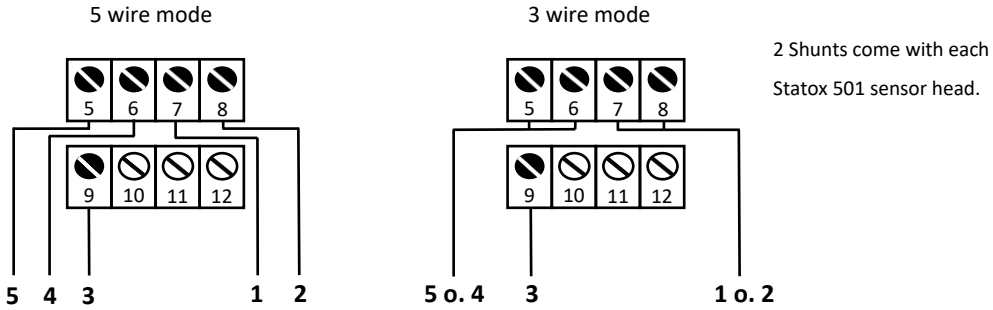


Figure 26: Connections sensor heads Statox 501 HRC, ARE, LCIR, MCIR, CO_2 and PID

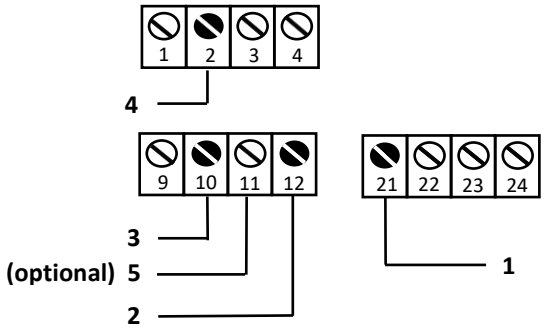


Figure 27: Connecting the Statox 560

10 Status- and error messages

In case the display stays dark, check the polarity and the voltage of the power supply. The internal fuse may be damaged.

> ! Replacement of the fuse by Compur service personnel only!

10.1 Status messages

Meaning	Upper Display Line	Lower Display Line
Actual program	PROGRAM	xx
Password entry	CODE	0000
Wrong password	CODE	INVALID
Menu program selection	CHOOSE	PROGRAM
Settings saved	STORE	
Menu relays settings alarm 1	ALARM 1	RELAY
Menu relays settings alarm 2	ALARM 2	RELAY
High alarm	Ax HIGH	ALARM
Low alarm	Ax LOW	ALARM
Reset – automatic alarm reset	Ax AUTO	RESET
Reset – latching alarm	Ax	HOLD
Relay active at alarm	Ax	ACTIVE
Relay passive at alarm	Ax	PASSIVE
Main menu SENSOR POWER	SENSOR	POWER
Sensor head power on	SENSOR	ON
Sensor head power off	SENSOR	OFF
Calibration routine	CALIB.	ROUTINE

Meaning	Upper Display Line	Lower Display Line
Zero adjustment	Z E R O	A D J U S T M .
Zeroing	0 0 0	
Zero found, apply span gas	A P P L Y	S P A N G A S
Span gas detected	G A S I S	O N
Plateau found	C A L I B .	F I N I S H E D
Enter span gas concentration	G A S C O N C	(value) (unit)
Enter response factor	F A C T O R	x . y y
Menu finished	D O N E	
Measurement during calibration routine	G A S	(value) (unit)
Span gas concentration out of range	G A S C O N C	E R R O R
Signal too low	C A L I B .	F A I L E D
(Alternating with measured value) Parameters of the most recent valid calibration are used (see chapter 6.2)	C A L I B .	F A I L E D
(Alternating with measured value) Perform a calibration (see chapter 3.4)	C A L I B .	R E Q U I R E D
Main menu SENSOR TEST	S E N S O R	T E S T
Alarm 1 test	A L A R M 1	T E S T
Alarm 2 test	A L A R M 2	T E S T
System failure test	A L A R M S F	T E S T
Current output test (0 – 22 mA)	x x m A	T E S T
Main menu functional test	O U T P U T	T E S T
4 - 20 mA sensor head in the service mode	S E R V I C E	M O D E
Main menu operation mode	M O D E	
Control module mode	C O N T R O L	M O D U L E
Common alarm module mode	C O M M O N	A L A R M
Common alarm, alarm 1 or 2	C O M M O N	A L A R M X
No common alarms	C O M M O N	O K
Common alarm, system failure	C O M M O N	F A I L U R E
Setting current for service mode	S E R V I C E	O U T P U T
2 mA output in the service mode	S E R V O U T	2 m A
4 mA output in the service mode	S E R V O U T	4 m A
Menu not active in the current mode	M E N U N O T	A C T I V E
Program selection	S E L P R O G	x x
Actual firmware version	V E R S I O N	x . y . z
Starting measuring mode	P L E A S E	W A I T . . .
Actual bridge voltage	E x p l . G a s	x x x m V
Contact terminal 11 is set to GND	S T A R T	S E L F T E S T
Memory test routine, runs once every 24 h	T E S T	M E M O R Y
No valid calibration data available	N O V A L I D	C A L . D A T A

10.2 Error messages

Many internal and external functions of Statox 503 are monitored for proper function. It can differentiate between critical and non - critical malfunctions. While critical errors always set the output current to zero, activate the system failure alarm relay and the LED „S“. Non - critical errors (such as operating errors during calibration, e.g. ERROR 6-8) have no impact on the status of the module.

> ! If an error message occurs which is not described here, please contact your Compur service partner immediately.

Display	Nature	Description	Measures
ERROR 1	Critical	Short circuit in the sensor head cable.	Check wiring and connections. Push Reset button.
ERROR 2	Critical	Cable interruption (in current mode) or a connected sensor transmits 0 mA.	Check wiring and connections. Automatic reset after error correction.
ERROR 3	Critical	Cable too long (only in voltage mode)	Check wiring and connections. Check selected program. Connect sensor head and push Reset button. Eventually change to 5 wire installation.
ERROR 4	Critical	Sensor power supply voltage cannot be controlled.	Push the Reset button. If error persists contact your Compur service partner.
ERROR 5	Critical	Cable interruption (only in voltage mode) or sensor defective. As a precaution the sensor has been powered off.	Jumper mounted in 3 wire mode? Check connections, connect sensor head and push Reset button to restart. Check power supply and voltage. Eventually change the sensor.
ERROR 6	Non critical	Zero not found during time limit	Check connections. If gas is present use zero gas. Push the Enter button and try again. The old zero value remains valid.
ERROR 7	Non critical	Zero shift out of specifications.	Check if gas is present. Push the Enter button and try again. The old zero value remains valid. Eventually replace the sensor.
ERROR 8	Non critical	Sensor sensitivity too low. No gas or no plateau found during calibration.	Check if gas is on and gas adapter tightly connected. Push ENTER and try again. The old gain value remains valid. Eventually replace the sensor.
ERROR 9	Critical	EEPROM writing error	Push the Reset button. If error persists contact your Compur service partner.
ERROR 10	Critical	Watchdog device defective	Push the Reset button. If error persists contact your Compur service partner.
ERROR 11	Critical	Current input defective	Push the Reset button. If error persists contact your Compur service partner.
ERROR 12	Critical	Relay defective	Push the Reset button. If error persists contact your Compur service partner.

Display	Nature	Description	Measures
ERROR 13	Critical	Output current out of specifications	Check connections. Terminals 3/4: evaluation unit or jumper mounted? Jumper mounted in 3 wire mode? If error persists contact your Compur service partner.
ERROR 14 24 V	Critical	Power supply voltage out of specifications 21-26 VDC.	Check power supply voltage! Push the Reset button. If error persists contact your Compur service partner.
ERROR 14 AVCC	Critical	Reference voltage failure.	Push the Reset button. If error persists contact your Compur service partner.
ERROR 14 VANA	Critical	Internal power supply failure.	Push the Reset button. If error persists contact your Compur service partner.
ERROR 15	Critical	Hardware defective.	Push the Reset button. If error persists contact your Compur service partner.
GAS CONC ERROR	Non Critical	The result of gas concentration x response factor is out of range.	Check gas concentration and response factor entry. Eventually select another span gas concentration. Push the Enter button and try again. The old gain value remains valid. Eventually replace the sensor.
CALIBR. FAILED	Non Critical	The result of $\frac{\text{sensor signal}}{\text{gas concentration} \times \text{response factor}}$ is too low.	Check gas concentration and response factor entry. Eventually select higher span gas concentration. Push the Enter button and try again. The old gain value remains valid. Eventually replace the sensor.
CALIB. REQUIRED	Non Critical	No valid calibration data. The control module operates with default sensor parameters (at start - up or after change of program).	Blanket with ENTER. The message „NO VALID CAL. DATA“ appears for 5 s. Calibration required! Check of the calibration status see chapter 3.4!

10.3 Control Module - Status diagram

Input from Sensor or transmitter	System Status	Current output	Bus signal	Display	LEDs				Relays		
					A1	A2	S	ON	A1 1)	A2 1)	SF
4-20 mA or bridge voltage	Normal	4 – 20 mA	---	Measuring value	OFF	OFF	OFF	ON	active	active	active
4-20 mA or bridge voltage	Alarm 1	4 - 20 mA	A1	Measuring value	ON	OFF 2)	OFF	ON	passive	active 2)	active
4-20 mA or bridge voltage	Alarm 2	4 - 20 mA	A2	Measuring value	OFF 2)	ON	OFF	ON	active 2)	passive	active
22 mA or mV over range	Over Range	22 mA	2)	Full scale flashing	2)	2)	OFF	ON	2)	2)	active
0 mA or Error status	System failure	0 mA	SF	Error code	OFF	OFF	ON	ON	active	active	passive
2 mA or Service Mode	Service Mode 3)	2 mA 1)	---	SERVICE MODE or menu	OFF	OFF	flashing	ON	active	active	active

1) Ex-works setting, can be changed by user.
2) Depending on actual alarm status.
3) Priority ranking: Service Mode > SF > (A1 / A2 / Over range)

10.4 Common Alarm Module - Status diagram

Bus input	System status	Current output	Display	LEDs 4)				Relays 4)		
				A1	A2	S	ON	A1 1)	A2 1)	SF
---	Normal	4 mA	COMMON OK	OFF	OFF	OFF	ON	active	active	active
A1	Alarm 1	12 mA	COMMON ALARM 1	ON	OFF	OFF	ON	passive	active	active
A2	Alarm 2	16 mA	COMMON ALARM 2	OFF	ON	OFF	ON	active	passive	active
SF	System failure	0 mA	COMMON FAILURE	OFF	OFF	ON	ON	active	active	passive
---	Service 4)	2 mA 1)	Menu	OFF	OFF	flashing	ON	active	active	active

1) Ex-works setting, can be changed by user.
4) The listed LED and relay status describes an isolated alarm event. In case of multiple alarm events combinations are possible.
The priority ranking for display and current output is: Service Mode > A2 > A1 > SF

11 Maintenance

Perform periodically visual checks for damage and soiling. Check the cable connections for tightness on a regular schedule.

Take the modules for cleaning out of service! Use a slightly wet cloth. No sharp cleaning agents, solvents, and steam jet are allowed!

Maintenance procedures for sensor heads connected to the module are described in the relevant sensor head manuals. Calibrate the sensors at regular intervals.

12 Accessories

Description	Article number
Statox 502 / 503 bus adapter set for 1 module	557002
Statox 502 / 503 connection set for bus adapter	557003
Statox 502 / 503 cabinet 400 x 300 x 150 mm	557010
Statox 502 / 503 cabinet 400 x 600 x 200 mm	557040

13 Functional Safety

The following informations are essential if you want to set up a safety instrumented system, level SIL 2. It is in the full responsibility of the user to use this device exclusively for the intended use.

13.1 Safety Functions

Safety Function 1 (SF1)

The Statox 503 Control Module monitors a 0–22 mA input signal, translates it into a concentration on the display, and provides it as an analog 0 - 22 mA current output signal. It also operates as a power supply for the sensor head. The passive system failure relay signalises any failure of the system.

IO signal status:

- 0 mA system failure
- 2 mA service mode
- 4 mA measured value is zero
- 20 mA measured value is 100 % scale
- 22 mA signalises overrange

Safety Function 2 (SF2)

The Statox 503 Control Module monitors the analog 4 – 20 mA signal and detects exceedings of the programmable alarm thresholds with the relays A1 and A2. It is also the power supply of the sensor head. A third relay, SF which is always passive, alarms in case of system failure.

Safety Function 3 (SF3)

The Statox 503 Control Module measures the bridge voltage of a catalytic sensor (HRC or ARE), converts it into a standard 0 – 22 mA signal which is accessible at the current output. It also supplies the bridge supply voltage of the catalytic sensor. A relay, SF which is always passive, alarms in case of system failure.

IO signal status

- 0 mA system failure
- 2 mA service mode
- 4 mA measured value is zero
- 20 mA measured value is 100 % scale
- 22 mA signalises overrange

Safety Function 4 (SF4)

The Statox 503 Control Module monitors the bridge signal of the sensor heads ARE or HRC and detects exceedings of the programmable alarm thresholds with the relays A1 and A2. It is also the power supply of the sensor head. A third relay, SF which is always passive, alarms in case of system failure.

13.2 Diagnostic Time and Measuring Cycle

The maximum time internal failure diagnosis is 24 h. The analog current output and the display are updated every 500 ms.

13.3 Installation and Parameter Settings

In order to maintain the specified PFD and SFF rates, the following measures must be taken!

An external alarm device must be connected to SF relay!

The output signal in the service mode must be set to 2 mA, in order to differentiate between service and measuring mode.

The specifications for the ambience must be observed.

The IP rating of the housing must be observed.

13.4 Schedule Maintenance (Prooftest)

The following procedures must be performed within a prooftest interval:

- Visual inspection for damage and pollution.
- Cables and plugs must make good contact.
- Functional test as described in chapter 8.1.
- Observe the recommendations for maintenance and cleaning in chapter 11.

13.5 Repair and Spare Parts

The instrument has no parts serviceable by the user.

13.6 Failure Rates and Safe Failure Fraction

These parameters have been achieved in a FMEDA hardware-assessment, performed by SGS-TÜV Saar GmbH (Report No. M0PE0001):

Instrument	Safety function	λ_s [FIT]	λ_{du} [FIT]	λ_{dd} [FIT]	SFF [%]
Statox 503, operating as Control Module	**SF1**	265,5	47,0	612,0	94,9
	SF2	296,0	45,8	607,4	95,2
	SF3	252,8	52,2	629,4	94,4
	SF4	283,4	51,0	624,9	94,7

FIT: Failures in Time (10^{-9} failures per hour) SFF: Safe Failure Fraction

13.7 Average Probability of Failure on Demand

The Statox 503 Control Module is classified to operate in the low – demand mode.

These PFD_{avg} calculations for a 1oo1-System with a hardware failure tolerance of 0 are based on the simplified equation $\mathbf{PFD_{avg} = 0{,}5 * T_{Proof} * \lambda_{DU}}$. It bases on the assumption that the time for repair is much shorter than the prooftest interval T_{Proof}.

	Safety function	T_{Proof} = 1 Year	T_{Proof} = 2 Years	T_{Proof} = 5 Years
PFD_{avg} for Statox 503, operating as Control Module	**SF1**	$2{,}2 \times 10^{-4}$	$4{,}3 \times 10^{-4}$	$1{,}05 \times 10^{-3}$
	SF2	$2{,}2 \times 10^{-4}$	$4{,}2 \times 10^{-4}$	$1{,}02 \times 10^{-3}$
	SF3	$2{,}5 \times 10^{-4}$	$4{,}7 \times 10^{-4}$	$1{,}16 \times 10^{-3}$
	SF4	$2{,}4 \times 10^{-4}$	$4{,}6 \times 10^{-4}$	$1{,}13 \times 10^{-3}$

PFD_{avg} = Average Probability of Dangerous Failure on Demand

13.8 Classification of the Safety Integrity Level (SIL)

The Statox 503 is classified as a complex system following IEC 61508-2 type B. At a hardware failure tolerance of 0 and a safe failure fraction > 90% at these PFD values results a SIL 2 compliance for all safety functions (see IEC 61508-2, Table 3).

13.9 Livetime

The livetime of Statox 503 is expected to be 10 years. Above failure rates are applicable within this time interval. After 10 years these data might be too optimistic.

13.10 Operating the Statox 503 with Statox 501 ARE or HRC Sensor

The catalytic sensors type Statox 501 ARE or HRC are considered as type A elements, see IEC 61508-2, section 7.4.4.1.2. The failure rates of these sensors has been evaluated from return shipments of the recent 15 years. They were evaluated by SGS-TÜV Saar GmbH (Report No. M0PE0001).

Sensor	**λ_s [FIT]**	**λ_{du} [FIT]**	**λ_{dd} [FIT]**	**SFF [%]**	**T_{Proof} [h]**	**PFD** $(0,5 * T_{Proof} * \lambda_{du})$
ARE / HRC	0	1002,1	2818,3	73,77	4380	$2,19 \times 10^{-3}$

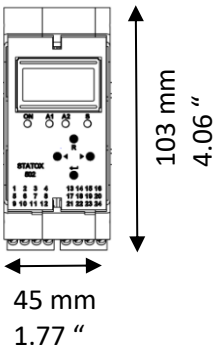
At a hardware failure tolerance of 0 and 6 month prooftest interval SIL 2 compliance is given for ARE/HRC sensors (see IEC 61508-2, Table 2).

A prooftest of a Statox 501 ARE / HRC sensor head must be done together with the connected Statox 503 control module. For this test, span gas must be used.

- Inhibit peripheral alarm devices in order to avoid false alarms.
- Sensor head and sensor must be checked for pollution and damage.
- The span gas concentration must be above the alarm thresholds. Use the original test gas adapter. Check all alarm functions.
- If necessary perform a calibration see chapter 6.2
- Reactivate peripheral alarm devices.
- Observe the ambience specifications of the ARE/HRC sensor heads and their IP rating.

14 Technical Data

Product name:	Statox 503 Control Module
Manufacturer:	COMPUR Monitors GmbH & Co. KG, D-81539 Munich
Power supply:	24 ± 2 VDC max. 200 mA
Power consumption:	max. 5 W
Current rating:	max. 8 A on communication bus
Operating temperature:	-10° C to +60° C (14°F to 140°F)
Storage temperature:	-30°C to +60°C (-22°F to 140°F)
Pressure:	900 to 1100 hPa
Humidity:	0% to 99% r. H. (non condensing)
Display:	2 x 8 digit LCD with backlight
Housing:	Polyamide, protection class IP 20
Connections:	24 terminals, can take cable diameters up to 2.5 mm^2
Relays:	2 x Alarm, 1 x System failure
Relays contact:	250 VAC, 8A
	min. burdon ≥ 12V, 10 mA (contact material: silver-nickel 90/10)
System failure relay:	In normal operation active (coil active), make contact (NO) is closed
Analog output:	0 mA in case of system failure
	2 or 4 mA in service mode, programmable
	4 - 20 mA in measuring mode, tolerance ± 2 % at -10°C to + 50°C
	22 mA at over range
Max. Burdon:	700 Ohm
Installation:	35 mm DIN-Rail
CE-Marking:	EN 61326-1:2013
Functional safety:	SIL 2 capability according to IEC 61508
Weight:	275 g
Dimensions (H x W x D):	45 x 103 x 115 mm (1.77 x 4.06 x 4.52 “)



15 Declaration of conformity

EU- KONFORMITÄTSERKLÄRUNG
EU-DECLARATION OF CONFORMITY
UE-DÉCLARATION DE CONFORMITÉ

Compur Monitors GmbH & Co.KG
Weißenseestraße 101
D 81539 München

erklärt in alleiniger Verantwortung, dass das Produkt
hereby declares in sole responsibility, that the product
déclare comme seul responsable, que le produit

Statox 503 Control Modul, Typ 5383
Statox 503 Control Module, type 5383
Statox 503 Module de Contrôle type 5383

den folgenden EU-Richtlinien und den entsprechenden harmonisierten Normen entspricht.
complies with the following EU directives and corresponding harmonized standards.
correspond aux directives européennes suivantes et à leurs normes harmonisées.

Richtlinie/Directive 2014/30/EU

EN 61326-1:2013

München, 02. 05. 2018
Munich, 2018-05-02

Dr. Hermann Schmidtpott, General Manager

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