

Multi-channel Gas Analyser



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1. Introduction

The Biogas analyser 905 monitors either continuously or intermittently, the Biogas for any gas components and as an option, the ambient air, whereby early warnings are given of hazardous gas, explosive and non-combustible gases and vapours.

The Biogas analyser 905 consists of an electronic evaluation unit, where up to 8 sensors can be connected. Five sensor inputs can be used for sensors for measuring Biogas components; the other sensors are intended for monitoring the ambient air.

All information significant to operating the equipment is shown on a 4-line, 16 character display in the evaluation section. This includes Actual value of gas, the measured components of gas and the units used.

The Biogas analyser incorporates 16 alarms, of which 3 can be assigned to gas components. The alarm thresholds are adjustable between 10% and 100% of the measurement range. The parameters for activating the alarms when the limit values are exceeded or undermined, can also be adjusted.

Digital switching outputs are available for use as ventilation and alarm controls, as required. The interfaces incorporated include one for data communication RS 232 (optional: RS 485) and 5 current outputs 4-20 mA, that can be assigned to sensors or measuring points.

A total of 6 keys are used for operating the equipment. These keys are used for menu-assisted setup of the minimum and maximum limit values, the number of measuring points together with adjustment of other significant parameters without the need of any previous programming knowledge. A test function is incorporated to provide testing of the alarm outputs without any gas-test task being initiated.

The number of measurements per day can be set by way of an interrogation cycle. Here for example, a value of 360 minutes would correspond to 4 measurements per day. In contrast to a continuous measurement mode, this extends the life of the integrated chemical measurement cells. If no Biogas measurement is made, ambient air is sucked into the equipment, whereby the last measured value is indicated on the display again and applied to the current outputs.

The ADOS Biogas analyser 905 can be connected to 230 V~ or 115 V~ voltage supplies.

2. Brief Operating Instructions

After connecting the supply voltage, the equipment automatically switches on, or the equipment can be manually switched on via the "Standby" key.

After switch-on, the sensors require a few minutes warm-up until stable measurements can be made. Therefore, during this warm-up period, all alarms and fault messages are suppressed; this is indicated by lighting the Maintenance LED. Also in addition, the time remaining for the warm-up period is shown in the 4th. line of the display.

The warm-up period can be prematurely ended by calling the menu and then closing the menu. After closing the menu, all alarms and fault indications are signalled.

In the case of a fault or due to specially adjusted parameters, instead of the gas concentration, the following displays can be shown:

- " ? ? ? ? " : The sensor shown has dropped below its normal zero point.
- " ^ ^ ^ ^ " : The sensor shown has exceeded the measurement range.
- " * * * * " : The sensor shown is muted and is not evaluated.

The display contains several pages. Page 0 has a special status. Here, in the following notes also referred to as measuring position 0, the on-going sensor measured values can be read, irrespective of whether a measurement is current active. The following pages contain the last measured data of individual measuring points (suction point).

```
0/1---Sensor---
H2S : 0 ppm
CH4 : 0 Vol%
CO2 : 0 Vol%▼
```

```
1/1-10.01-17:45-
H2S : 200 ppm
CH4 : 60 Vol%
CO2 : 10 Vol%▼
```

- Line 1: Current page / Number of pages, for measuring points - date and time of the last measurement
- Lines 2 and 3: Sensor measured values
- Line 4: in normal operation - Sensor measured values
Alarm - Sensor/Meas. point and alarm number
Fault - Sensor
Maintenance - Remaining time for maintenance

The following settings can be made in a measurement cycle:

[M/←] Switch-over between the display pages (current sensor measured value, last measured value from the measuring point)

[↑] / [↓/→] Move the display page. If more than 3 measurements are installed, they cannot all be displayed at the same time. These measured values are outside the display area of the visible page. If the display can be moved, then in the 2nd. and 4th. line, as last character on the line, a "▲" or "▼" respectively, is inserted.



Reset for latched alarms.

[S/ESC] This key provides access to various alternatives, depending on the on-going page displayed. If page 0 is displayed (on-going sensor measured value), then this key provides direct access to the code input for the User menu. If a measuring point is being displayed (page 1, onwards), the following display is shown:

```
---Biogas905---
>Menu
Measure Pt. 1
```

The cursor key is used to select the option required:

Menu: Code input for the User menu

Measure Pt. X: Manually start a measurement at the selected measuring point

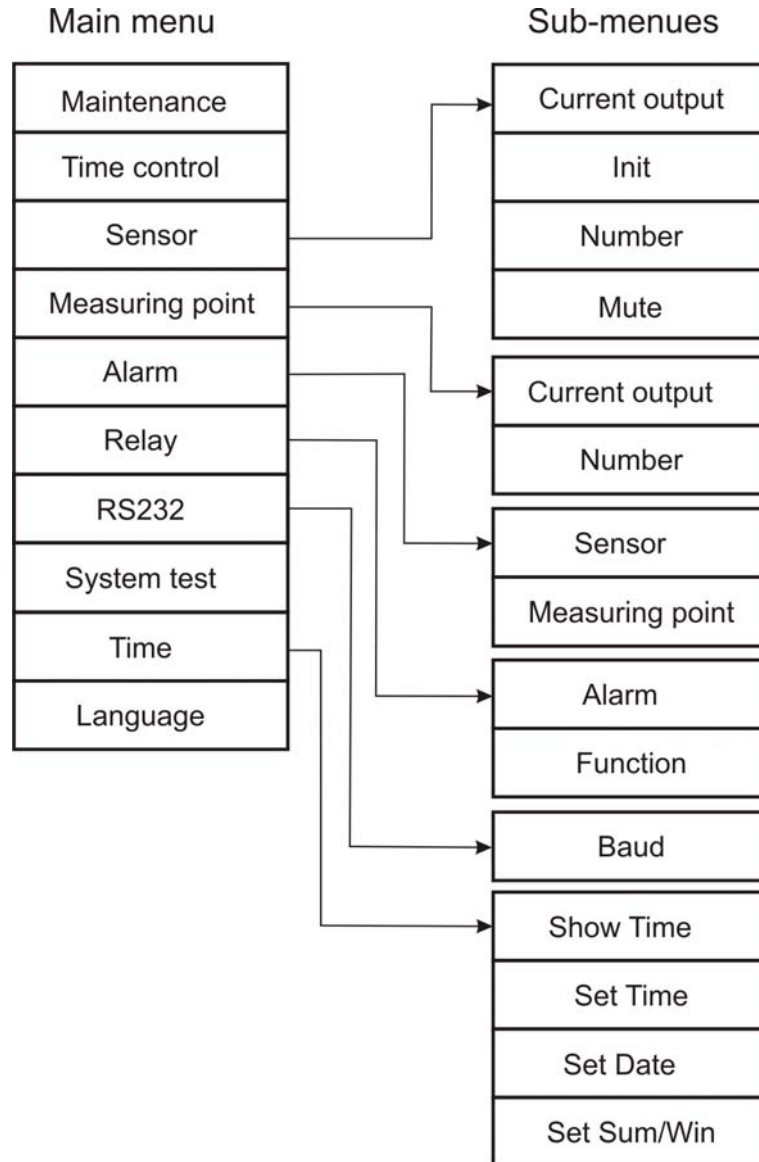
3. Equipment Description

The Biogas analyser 905 comprises the following:

- Suction pump with adjustable flow-through and flow-through indicator
- Gas components - filter system and conditioning
- Condensate separator for external installation
- Microcontroller-assisted signal processing
- LC-Display, 4-lines, each with 16 characters
- LED indicators for Operation, Fault, Maintenance and Alarm states
- 6 keys for operation
- Input / Output module BG905IO with sensor inputs, alarm relay, current output 4-20mA, digital input
- Input / Output module BG905IO EXT1 with 4 current outputs 4-20 mA and 4 digital inputs
- RS 232 or RS 485 interface
- Switched mode power supply 24V / 3A
- 5 card slots for inserting test cards for Biogas measurements.

4. Equipment Configuration / Menu

The system is configured with the aid of a menu, where the parameters can be modified. The menu has the following tree structure:



The menu is operated with the following keys:

- [S/ESC] Entry to the main menu, otherwise Cancel the action
- [↑] Increment the input value
- [↓/→] Decrement the input value
- [M/←] Confirm / Accept the set values

4.0.1 Navigation in the Menu

- Select the menu item required with [↑] and [↓/→].
- With [M/←] move to the sub-menu function marked with the arrow symbol in line 2.

For easier orientation, the upper line always shows the current menu, sub-menu or the menu function.

An exit is made from a sub-menu with the [S/ESC] - key followed by a return to the main menu at the previously marked location.

When an exit is made from the main menu with the [S/ESC] - key, a query box is opened to avoid unintentional exit. To exit the menu and return to the measurement mode, this query must be confirmed with [M/←]. The [S/ESC] key cancels the procedure and a return is made to the main menu.

```
-----Menu-----
Exit Menu ?
```

In the menu mode, any procedure can be cancelled with the [S/ESC] - key. Any value changed in the active menu is discarded and is not accepted.

To accept a value, the [M/←] - key must be pressed. The message shown here is output which confirms a successful save process in the equipment. This must be acknowledged with the [S/ESC] or [M/←] keys.

```
---Limit value---
Value saved
```

4.0.2 Accessing a Menu

To prevent unauthorised changes to the system, before calling a menu a code must be entered. For this system, the code is "905".

- In measurement mode, press the [S/ESC] - key, "Code" is shown on the display. The field above the cursor is empty.
- Enter the first digit with [↑] and [↓/→].
- [M/←] moves the cursor one position to the right.
- Repeat until the code number "905" has been entered
- [M/←] activates the menu mode.
- [S/ESC] cancels the procedure and the system returns to the measurement mode.

```
Code: 905
```

When the menu is opened, all alarms and faults are automatically reset and the Maintenance LED is lit.

If a key is not pressed within 90 seconds, the system automatically returns to the measurement mode.

4.1 Menu Function "Maintenance"

Switch the maintenance mode on or off.

- [↑] Activates the maintenance mode
- [↓/→] Deactivates the maintenance mode
- With [M/←] the value is saved and a confirmation message is displayed.
- Continue with [S/ESC] or [M/←].

```
--Maintenance--
Maintenance 0N
```

If maintenance is activated when the menu is closed, alarms and faults are not evaluated. The maintenance state is signalled on the status line and by the Maintenance LED.

After 60 minutes, the maintenance mode is automatically switched off.

4.2 Menu Function "Time Control"

Settings for the cycle, measurement and pre-suction times for the measuring points.

The **cycle time** specifies the time interval at which the equipment should complete intermittent measurements. A cycle time of zero, deactivates an automatic measurement. A measurement can then only be started manually or via the digital input on the BG905IO-module. For measurements with an integrated H₂S-cell, the cycle time should be at least 60 minutes.

```
--Time Control--
Cycle:      180min
Measure:    300sec
Presuct.:   120sec
```

- Set the cycle time required with the [↑] and [↓/→] keys.
- The value is saved with [M/←] and an acceptance message is displayed.

The **measurement time** specifies how long the sampled gas should be applied to the sensors.

- Set the measurement time required with the [↑] and [↓/→] keys.
- The value is saved with [M/←] and an acceptance message is displayed.

The **pre-suction time** is the time after which the measured data from the sensors is processed, to suppress the transient response and dead time of the sensors, caused by the length of hoses in the suction line. It is adjustable in the range from 0 to the measurement time - 1. In the example shown, the sampled gas is sucked in for 300 seconds, the evaluation of the measured values however, begins after 120 seconds pre-suction time.

- Set the pre-suction time with the [↑] and [↓/→] keys.
- The value is saved with [M/←] and an acceptance message is displayed.

4.3 Menu "Sensor"

All settings relevant to the sensors are made in the sub-menu "Sensor".

4.3.1 Menu Function "Current Output"

Assigns a sensor to a current output.

- Select the sensor with the [1] and [1/→] keys.
- Confirm with [M/←]
- Select the current output of a module with [1] and [1/→].
- "---" indicates that a current output is not assigned.
- Confirm with [M/←]

```
-Current Output-
Sensor 1: CH4
```

```
-Current Output-
Sensor 1: CH4
Mod.: ---
Ch. : ---
```

4.3.2 Menu Function "Init"

Basic settings for a sensor: Gas, Format, Units

- Select the sensor (for 0, the following changes will be accepted by all sensors)
- Set the type of gas
- Set the maximum number of integers in the measured value
- Set the number of decimal places in the measured value
- Set the Unit for the gas measurement

```
-----Init-----
Sensor : 2
Gas Format Unit
CH4: 2.1 %LEL
```

Setting the measurement range. The on-going values are shown in brackets.

- Set the lower value for the measurement range (default: 0)
- Set the upper limit for the measurement range
If the cursor is at the first, empty position, the old value can be accepted with [M/←]. [S/ESC] cancels the input and the old value remains valid.

```
-----Init-----
Sensor : 2
Min(0.0):
Max(100.0):
```

4.3.3 Menu Function "Number"

Set the number of sensors connected. After any changes, the equipment must be initialised, which will result in a loss of all previously measured data.

If the number of sensors has been increased, the settings for the sensors in section 4.3.2 should be re-checked.

```
-----Number-----
No. Sensors
 4
```

4.3.4 Menu Function "Mute"

This menu item is used for temporarily switching a sensor on or off. This function can be of use for example, if a measurement in a section of the system is temporarily shut down.

- Select the sensor
- ON: Sensor activated (normal case)
- OFF: Sensor is ignored

```
-----Mute-----
Sensor : 1
Sensor : 0N
```

4.4 Menu "Measuring Point"

All settings relevant to measuring points are made in this sub-menu, "Measuring Point".

4.4.1 Menu Function "Current Output"

With this menu function, a value from a specified measuring point, can be assigned to a current output.

- Select the measuring point with [↑] and [↓/→]
- Confirm with [M/←]
- Select the measured variable with [↑] and [↓/→]
- Confirm with [M/←]
- Select the current output of a module with [↑] and [↓/→]
- "--" indicates that a current output has not been assigned.
- Confirm with [M/←]

```
-Current Output-
Meas Point: 1
Sensor      : CH4
```

```
-Pt.:1-S:CH4-
Mod.: ---
Ch. : ---
```

4.4.2 Menu Function "Number"

This menu is used to set the number of measuring points (suction point).

- Select the number of measuring points with [↑] and [↓/→]
- Confirm with [M/←]

```
-----Number-----
Meas Point No:
1
```

4.5 Menu "Alarm"

This menu is used to assign alarms to sensors and measuring points.

4.5.1 Menu Function "Sensor"

- Select the sensor with [↑] and [↓/→]
- Confirm with [M/←]
- Set the number of the alarm for this sensor with [↑] and [↓/→]
- Confirm with [M/←]
- Select a free (unused) alarm with [↑] and [↓/→]. If the alarm is already assigned, the associated number of the measuring point and sensor is displayed.
- Confirm with [M/←] and assign the free alarm

```
-----Alarm-----
Sensor 1: CH4
```

```
--Pt.:0-S:CH4--
Alarm No.: 1
```

```
-M.pt:0-S:CH4 --
Alarm 1/1
All: unused
```

The next display shows the on-going limit value (LV) set for the alarm. Below this, new values can be entered.

- Set the switching direction for LV1:
" < " Alarm when limit value is undermined
" > " Alarm when limit value is exceeded
- Set the limit value: If the cursor is at the first, empty position, the old value can be accepted with [M/←].
- Set the response of the alarm:
auto: Alarm is automatically reset as soon as it is inactive.
manual: Alarm must be reset via the keyboard.

```
--Pt:0-S:CH4--
Alarm 1/1-> All
GW 1:> 50.00Vol%
GW 1:> _
```

```
--Pt:0-S:CH4
Alarm 1/1-> All
All: auto
```

4.5.2 Menu Function "Measuring Point"

- Select the measuring point with [↑] and [↓/→]
- Confirm with [M/←]
- Select the sensor with [↑] and [↓/→]
- Confirm with [M/←]
- Set the number of alarms for this sensor with [↑] and [↓/→]
- Confirm with [M/←]
- Select a free (unused) alarm with [↑] and [↓/→]. If the alarm is already assigned, the associated number of the measuring point and sensor is displayed.
- Confirm with [M/←] and assign a free alarm

```
-----Alarm-----
MeasPoint: 1
```

```
-----Alarm-----
MeasPoint: 1
Sensor   : CH4
```

```
--Pt:1-S :CH4--
Alarm No.: 2
```

```
--Pt:1-S :CH4--
Alarm 1/2
All: free
```

The next display shows the on-going limit value (LV) set for the alarm. Below this, new values can be entered.

- Set the switching direction for LV1:
" < " Alarm when limit value is undermined
" > " Alarm when limit value is exceeded
- Set the limit value: If the cursor is at the first, empty position, the old value can be accepted with [M/←].
- Set the response of the alarm:
auto: Alarm is automatically reset as soon as it is inactive.
manual: Alarm must be reset via the keyboard.

```
--Pt:0-S :CH4--
Alarm 1/1-> All
GW 1:> 50.00Vol%
GW 1:> _
```

```
--Pt:0-S :CH4--
Alarm 1/1-> All
All: auto
```

4.6 Menu "Relay"

4.6.1 Menu Function "Alarm"

Assigning a relay to an alarm:

- Select an alarm with [↑] and [↓/→].
- Confirm with [M/←].
- Select the number of relays with [↑] and [↓/→].
- Confirm with [M/←].
- Select a relay with [↑] and [↓/→] and each time, confirm with [M/←].

```
--Alarm Relay--
Alarm :  1
Number:  1
Relay 1/1: K1
```

4.6.2 Menu Function "Function"

Specifying the type of relay contacts, "n.c." or "n.o.".

- Select a relay with [↑] and [↓/→].
- Confirm with [M/←].
- Select the operating function, "n.c." or "n.o." [↑] and [↓/→].

```
-----Relay-----
Relay:
  K1
normally open
```

4.7 Menu "RS232"

4.7.1 Menu Function "Baud"

Setting the transfer rate for the serial interface.

- Select the transfer rate with [↑] and [↓/→].
- Confirm with [M/←].

```
-----Baud-----
9600 Baud
```

4.8 Menu Function "System Test"

With the aid of the system test, assigned alarms together with their associated relay contacts can be tested. First, the alarms of the sensors are tested, followed by the alarms for the measuring points. Finally, the functions for maintenance, fault messaging and the serial interface, are all tested.

4.9 Menu "Time"

4.9.1 Menu Function "Show time"

Displaying the date and time saved in the equipment

4.9.2 Menu Function "Set time"

The cursor is at the hours detail.

- Set the hours with [↑] and [↓/→].
- [M/←] moves the cursor to the minutes.
- Set the minutes with [↑] and [↓/→].
- [M/←] moves the cursor to the seconds.
- Set the seconds with [↑] and [↓/→].
- The values are accepted with [M/←].

```
----Set Time----  
Time  
08:30:00
```

A confirmation message is shown on the display. This can be acknowledged with the [S/ESC] - or [M/←] - key.

4.9.3 Menu Function "Set date"

The cursor is at the day of the month.

- Set the value with [↑] and [↓/→].
- [M/←] moves the cursor to the next entry item.

```
-Set Date-  
Datum      10.12.03
```

After all values have been entered, a confirmation message is shown on the display. This can be acknowledged with the [S/ESC] - or [M/←] - key.

4.9.4 Menu Function "Set sum/win"

This menu item is used to activate or deactivate the automatic time change to Summer or Winter time. As default, this function is activated.

- [↑] Activates the automatic time change.
- [↓/→] Deactivates the automatic time change.
- The value is saved with [M/←] and a confirmation message is displayed.
- Continue with the key [S/ESC] or [M/←].

```
---Sum/Win---  
auto. time  
change
```

4.10 Menu Function "Language"

- Select the language required with [↑] and [↓/→]. A choice can be made between English, German and French.
- confirm the selection with [M/←].

5. Serial Interface

The values measured by all sensors are collectively output to the serial interface at the end of a measurement cycle.

Interface parameters:

| | |
|--------------------|------|
| Baudrate: | 9600 |
| Parity: | None |
| Data bits: | 8 |
| Stopbit: | 1 |
| Hardware protocol: | None |

Example of a printout::

```
01.01.2000 08:15
Meas.Pt: 1 - H2S:    200 ppm
Meas.Pt: 1 - CH4:    60 Vol%
Meas.Pt: 1 - O2:    0.0 Vol%
```

6. Equipment Configuration

The basic version of the Biogas analyser 905 is set for intermittent measurement.

Sub-assembly, Continuous Measurement

With this option, the components CH₄, CO₂ and/or O₂ are permanently measured, whilst the H₂S measurement is made, intermittently. To calibrate a sensor card, designed for continuous measurement, a change-over can be made in the maintenance mode of the equipment, from sampled gas to test gas. At the same time, a floating maintenance contact is initiated that allows an external PLC system to be controlled.

Sub-assembly, Measuring Point Selector

The Biogas analyser can be fitted with a measuring point selector with which, for example, two fermentation plants can be monitored. The two gas lines are installed to the analyser and the change-over between the two channels, takes place in the equipment. Three signals lines via floating contacts must be available from the external PLC system:

- Measuring point 1 enabled (permanent signal)
- Measuring point 2 enabled (permanent signal)
- Initiation of a special measurement (short pulse < 1s)

The sub-assembly "Measuring point selector" can be combined with the "Continuous measurement" sub-assembly, so that with the exception of H₂S, all other components can be continuously analysed.

Sub-assembly, Desulphurization

With this configuration, the Biogas can be analysed before and after the desulphurization. The analyser incorporates two H₂S sensors with different measurement range end values. Selection of the more suited sensor, is made by enabling the corresponding measuring point.

Special Sub-assembly, Ventilator Monitoring

In addition to the two ventilation grids on the housing for inflow and outflow of air, a ventilator fan is fitted that ensures sufficient air exchange within the housing. The ventilator functions in conjunction with a 'Vent-Captor', that detects the failure of the ventilation fan by sensing the change in air-flow. In the case of failure, a relay on the rear wall of the housing, is activated. The failure of the ventilator fan is also indicated at the front of the analyser on the display unit of the evaluation electronics.

The 'Vent-Captor' is set in the ADOS factory to a suitable sensitivity level. Generally, the sensor needs no further adjustment, but if necessary, it can be adjusted by following the separate operating instructions supplied for the 'Vent-Captor'.

7. Installation of the Biogas Analyser

Installation location

The analyser must be installed in a well-ventilated room.
The equipment must be protected against direct sunlight.
The condensate and gas outflow lines must be laid to the outside air.

With intermittent measurements, under no circumstances may the gas outflow line be fed back into the Biogas line, since for 70-80% of the time, air is delivered.
The currently valid regulations regarding electric connections, must be observed at all times.

Extraction line

The location of the gas extraction (sampling), must always be on the upper surface of the pipeline, so that condensate cannot flow directly into the analyser.

A suitable shutoff valve (V4A material) must always be fitted at this location. Only Teflon hose (or V4A) is suitable for an extraction line to the Biogas analyser. For extraction lines less than 10 m, a hose with 6 mm clear opening is recommended, for longer lengths of hose a clear opening of 4 mm is recommended.

**PVC or PE hoses are not suitable for sampling Biogas.
V2A pipe is also unsuitable, since it reacts with H₂S.**

8. Maintenance

The following maintenance work is based on twice yearly tests that may only be completed by fully trained personnel.

The End-user can undertake a Maintenance contract with the manufacturer, ADOS GmbH, where the equipment servicing is completed by the company's own customer service.

Maintenance work can be divided into testing the sensor and checking the gas suction to the Biogas analyser 905.

On all sensors being used, the calibration checks with reference gas and calibration gas, as outlined in the relevant operating instructions, must be completed since over a period of time, the sensors are subject to change.

For this reason, once a loss of sensitivity has been established, the sensor must be re-calibrated and replaced if necessary.

Large filter cartridges are on the front side of the Biogas analyser 905. After a time, these become saturated with for example, hydrogen sulphide and the cartridges cannot be regenerated.

The filters must immediately be replaced when the compensating filter turns green.

Continued operation without changing the filter at the correct time, will result in serious damage to the measuring equipment.

At the microcontroller-aided gas warning equipment, the accuracy of the standard interface signals should be checked, also the functionality of the output signals.

The automatic test routine in the Basic settings menu eases the task of checking the floating output contacts, in combination with the ventilation control, acoustic and optical warnings, etc.

9. Calibration

The following test gases are required for calibrating the sensor cards:

| Component | Zero point adjustment | Range adjustment |
|------------------|--|---|
| H ₂ S | Ambient air (when free of H ₂ S), otherwise, synthetic air | H ₂ S in synthetic air; concentration depends on measurement range |
| CH ₄ | Ambient air; or synthetic air | 60% CH ₄ + 40% CO ₂ (or N ₂) |
| CO ₂ | Ambient air; or synthetic air | 60% CH ₄ (or air) + 40% CO ₂ |
| O ₂ | 100% nitrogen; or test gas 60% CH ₄ / 40% CO ₂ | Ambient air; or synthetic air |

The sensor cards are in the rear section of the equipment. For calibration, the front panel can be swung open by loosening the 4 screws at the left hand side.

The electrochemical sensors (H₂S, O₂) incorporate a %-potentiometer ("span"), a 0-pot. ("zero") and 2 test sockets (from top to bottom).

On the IR sensor card, the 0-pot. ("zero") is at the top and the %-pot. ("span") one position lower. The potentiometers at positions 3 and 4 are not used for the calibration and their setting must not be altered.

The test gas is applied at the relevant input at the front of the equipment. This input is automatically enabled when the maintenance function is activated. At the same time, the maintenance contact on the BG905IO module is enabled, that can be used for feeding maintenance information to the process monitoring.

When using test gas bottles, a pressure regulator must be fitted. For all calibration tasks, the gas flow-through should be 30 litres per hour. The zero point adjustment is always completed before adjusting the measurement range.

Calibrating the CH₄ and CO₂ sensors

Zero point adjustment:

Apply the relevant gas to the test gas input. Read the concentration shown on the "Sensor" page of the display. If necessary, adjust the value to 0,0% with the 0-pot. ("zero").

CAUTION: THE REACTION OF THE DISPLAY IS SLIGHTLY DELAYED!

Range adjustment:

Apply the relevant gas to the test gas input. Read the concentration shown on the "Sensor" page of the display. The value displayed must be the same as the concentration of the test gas applied. If necessary, adjust the %-pot. ("span").

CAUTION: THE REACTION OF THE DISPLAY IS SLIGHTLY DELAYED!

Calibrating the H₂S sensor

Zero point adjustment:

Apply the relevant gas to the test gas input and measure the voltage at the test sockets. When the sensor output signal has settled, adjust the 0-pot. ("zero") for a voltage of 204 mV.

Range adjustment:

Apply the relevant gas to the test gas input and measure the voltage at the test sockets. When the sensor output signal has settled, adjust the %-pot. ("span") for the correct value of voltage V. This voltage is given by the following expression:

$$V = \frac{(1,02 \text{ V} - 0,204 \text{ V}) \times \text{Concentration of test gas}}{\text{Measurement range end value}} + 0,204\text{V}$$

Example: Measurement range end value = 2000 ppm, Test gas concentration 1600 ppm

$$V = \frac{(1,02 \text{ V} - 0,204 \text{ V}) \times 1600 \text{ ppm}}{2000 \text{ ppm}} + 0,204\text{V} = 0,857 \text{ V}$$

(Zero point and Range adjustments are also possible via the display on the evaluation unit. Refer to "Calibrating the CH₄ and CO₂ sensors")

Calibrating the O₂ sensor

Zero point adjustment:

Apply the relevant gas to the test gas input and measure the voltage at the test sockets. When the sensor output signal has settled, adjust the 0-pot. ("zero") for a voltage of 204 mV.

Range adjustment:

Apply the relevant gas to the test gas input and measure the voltage at the test sockets. When the sensor output signal has settled, adjust the %-pot. ("span") for a value of 1016 mV (at a measurement range of 0 to 21 Vol-% O₂).

10. Correcting Faults

| Fault Description | Possible Cause | Fault Remedy |
|--|--|---|
| Sensor display "????" | Sensor zero point has fallen below 4mA | Calibrate the sensor |
| | Sensor is not connected correctly to the BG905IO | Check connections |
| | Sensor is defect | Inform ADOS |
| | Insufficient warm-up time | Normal response: Initiate special measurement |
| Sensor display "^^^^" | Concentration of sampled gas is greater than the measurement range end value | -(Sensor is functioning correctly) |
| | Sensor is uncalibrated | Re-calibrate sensor |
| CH ₄ - or CO ₂ -card shows an obvious incorrect measured value | SI-filter (compensating filter) is saturated | Replace SI-filter |
| | Sensor is uncalibrated | Re-calibrate sensor |
| | Sensor is defect | Inform ADOS |
| H ₂ S- or O ₂ -card shows an obvious incorrect measured value | Electrochemical test cell is exhausted — older than 2 years | Inform ADOS |
| | Sensor is uncalibrated | Re-calibrate sensor |
| | Sensor is defect | Inform ADOS |
| Different measured values on the display and at the current output | Evaluation electronic unit defect | Inform ADOS |
| No or incorrect flow-through | Needle valve out of alignment | Adjust the flow-through by way of the needle valve, more accurately |
| | Sampled gas pump is defect | Inform ADOS |
| Evaluation electronic unit does not activate any sampled gas cycle | Equipment is not configured correctly | Repeat equipment setup |
| | 3/2-way valve is defect | Inform ADOS |
| A special measurement cannot be initiated | Digital input on the BG905IO module is defect | Inform ADOS |

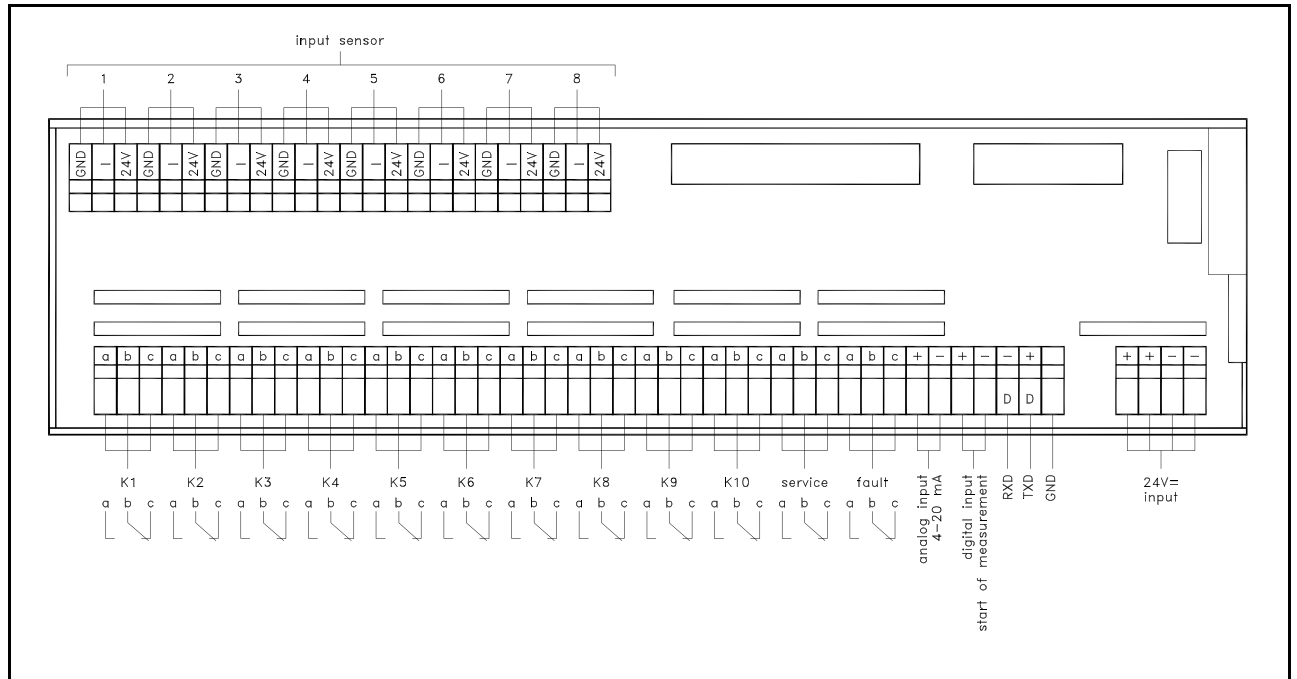
| Fault Description | Possible Cause | Fault Remedy |
|--|---------------------------------------|---|
| During a measurement, gas is sucked in at the test gas input | 3/2-way valve is defect | Inform ADOS |
| Test gas is sucked in during calibration | 3/2-way valve is defect | Inform ADOS |
| Filter material has changed its shape and form | Filter material is exhausted | Replace filter cartridges |
| SI filter material is light-blue | Filter material has absorbed moisture | – (normal condition) |
| SI filter material is dark-blue | Filter material has absorbed moisture | Filter cartridge due for a replacement, shortly |
| SI filter material is green or black | Filter material is exhausted | Replace filter cartridge |

11. Technical Data

Details for each control unit

| | |
|------------------------|---|
| Sensors: | Chemical test cells Infrared sensors Semiconductor sensors |
| Sensor input: | 2-wire sensors (592 TOX) or 3-wire sensors (GTR 196) for warning of explosive gas mixtures |
| Sensor supply voltage | 24V= / 200 mA |
| Measurement ranges: | H ₂ S: 0 - 500 ppm or 0-5000 ppm CH ₄ : 0 - 100 Vol.% CH ₄ : 0 - 100 % LEL O ₂ : 0 - 21 Vol.% CO ₂ : 0 - 50 Vol.% H ₂ : 0 - 2 Vol% Other ranges at Customer's request |
| Test gas flow-through: | 30 l/h ±10l/h |
| Pressure, extraction: | -100 mbar ... +300 mbar |
| Accuracy | < ± 3% f.s.d. of range |
| Ambient temperature: | + 5 ... + 45°C |
| Effect of temperature: | <5% for ± 20° C temperature change |
| Installation: | Wall mounting |
| Output signals: | 5 current outputs 4-20 mA Interface RS 232 or RS 485 5 floating relay contacts for alarms (min.) 1 Maintenance relay 1 Fault relay |
| Relay contact rating: | 230 V, 450 VA |
| Voltage supply: | 230 V, 50 Hz or 115V, 60 Hz |
| Power consumption: | 100 VA |
| Dimensions: | 600 x 500 x 400 mm (WxHxD) 9HU |
| Weight: | approx. 35 kg |

12. Input / Output Module (BG905IO)



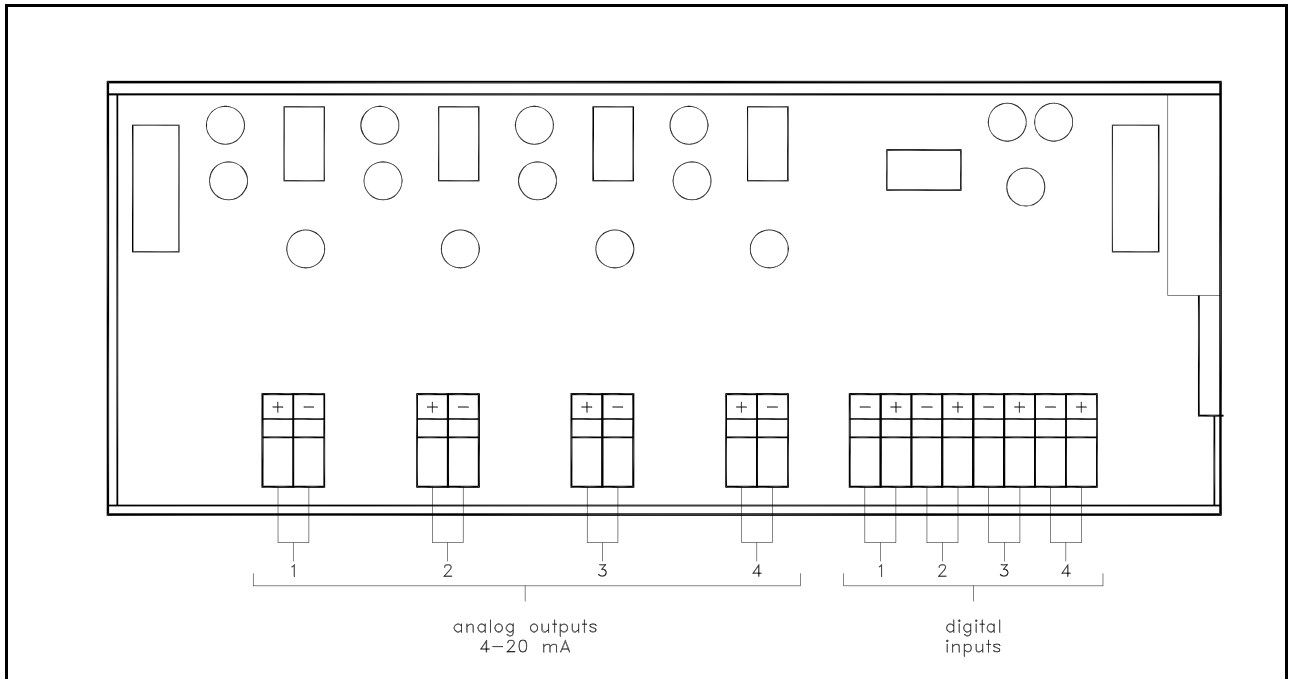
806-6191 E

| Relay | Function |
|-------|----------|
| K1 | |
| K2 | |
| K3 | |
| K4 | |
| K5 | |

| Relay | Function |
|-------|------------------------------------|
| K6 | |
| K7 | |
| K8 | Solenoid valve contin. meas. |
| K9 | Solenoid valve discontin. meas. |
| K10 | Pump, ON / OFF |

| Analog Output | |
|---------------|--|
| | |

13. Input / Output Module (BG905IO-Ext1)



806-6190 E

| Analog Outputs | Function |
|----------------|----------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

| Digital Inputs | Function |
|----------------|---------------------------|
| 1 | Measuring point selection |
| 2 | Measuring point selection |
| 3 | Measuring point selection |
| 4 | Fault: Cabinet fan |

| Control for measuring point selection | | | |
|---------------------------------------|---------------|---|---|
| Measuring point | Digital Input | | |
| | 1 | 2 | 3 |
| 1 | 0 | 0 | 0 |
| 2 | 1 | 0 | 0 |
| 3 | 0 | 1 | 0 |
| 4 | 1 | 1 | 0 |
| 5 | 0 | 0 | 1 |
| 6 | 1 | 0 | 1 |
| 7 | 0 | 1 | 1 |
| 8 | 1 | 1 | 1 |

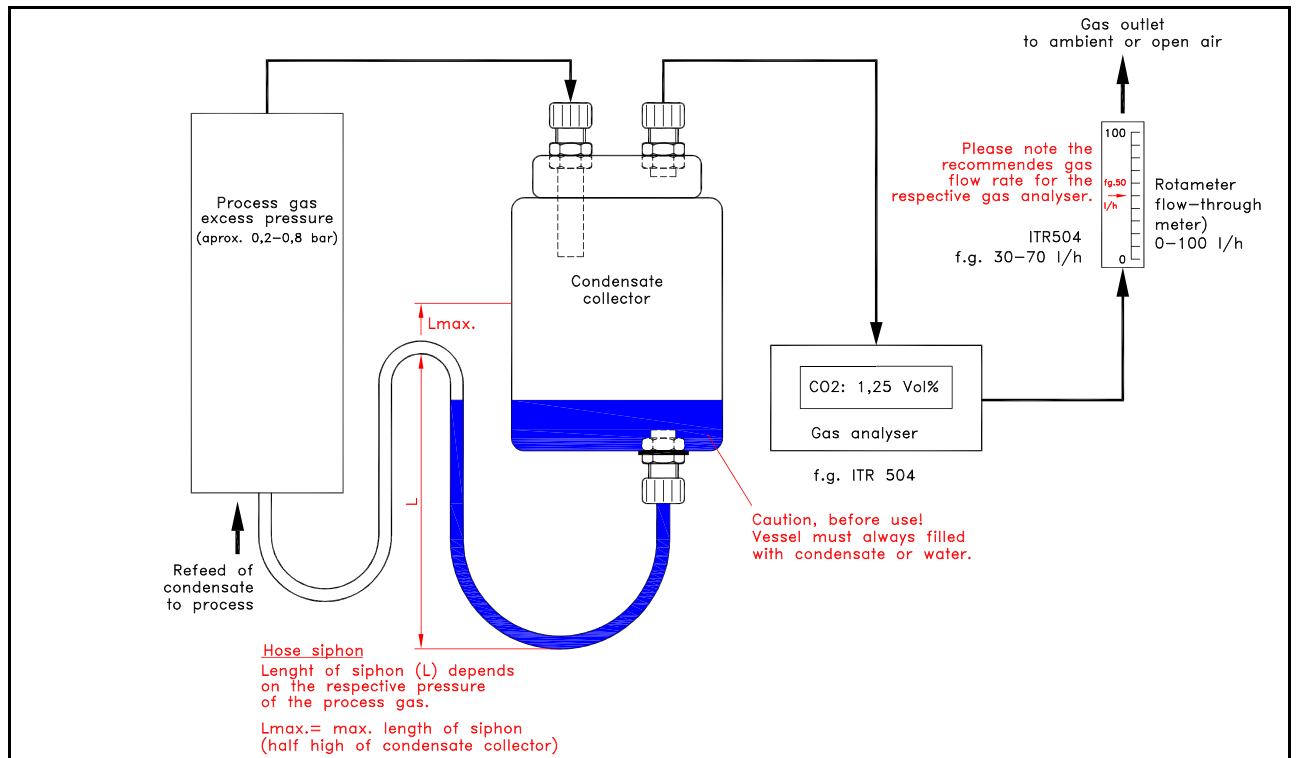
14. Spare Parts List

| | Description |
|----|--|
| 1 | Input / output module BG905IO |
| 2 | Input / output module BG905IO-Ext1 |
| 3 | Evaluation electronics 905 |
| 4 | Slide-in unit for O ₂ measurement |
| 5 | Slide-in unit for CH ₄ measurement |
| 6 | Slide-in unit for CO ₂ measurement |
| 7 | Slide-in unit for H ₂ measurement |
| 8 | Slide-in unit for H ₂ S measurement |
| 9 | Sensor H ₂ S (0-500 ppm) |
| 10 | Sensor H ₂ S (0-2000 ppm) |
| 11 | Sensor H ₂ S (0-5000 ppm) |
| 12 | Sensor O ₂ |
| 13 | Filter FF92 (dust filter) |
| 14 | Filter RE |
| 15 | Filter SI |
| 16 | Solenoid valve Biogas |
| 17 | Diaphragm pump Biogas |
| 18 | Needle valve V4A |
| 19 | Viton pump diaphragm |
| 20 | Rota-pipe 0-50 l |
| 21 | SMD fuse 1.5A |
| 22 | SMD fuse 750mA |
| 23 | Teflon hose 4/6 mm |
| 24 | Viton hose 4/6 mm |

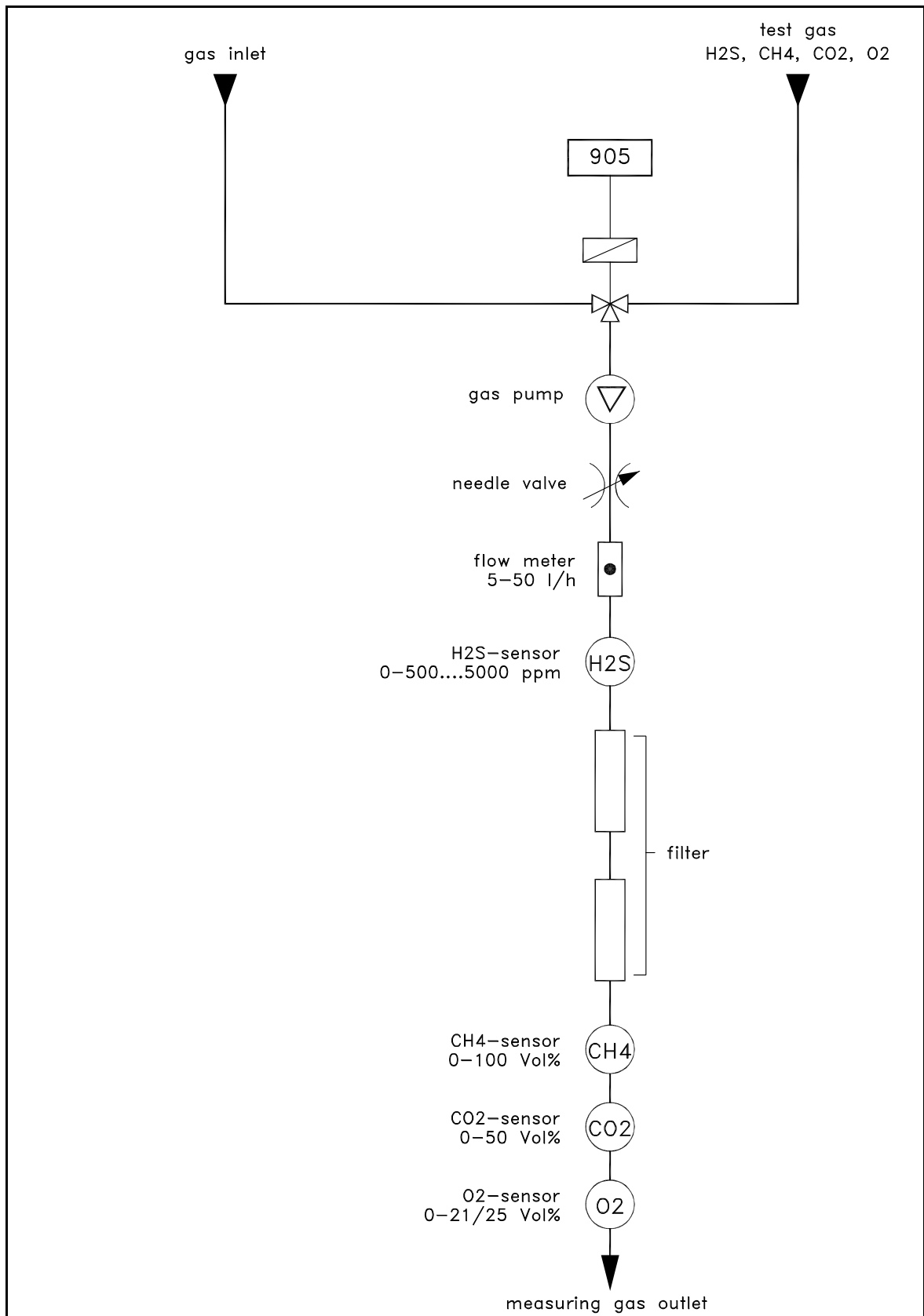
15. Accessory: Condensate Separator

The diagram below shows an installation example for systems with a high level of condensate in the process gas. The condensate separator should be installed close to, and slightly lower than the sampled gas input to the Biogas analyser 905. To avoid ambient air being sucked in through the lower connection (condensate outflow), ensure that the tank always contains a residual amount of condensate or water.

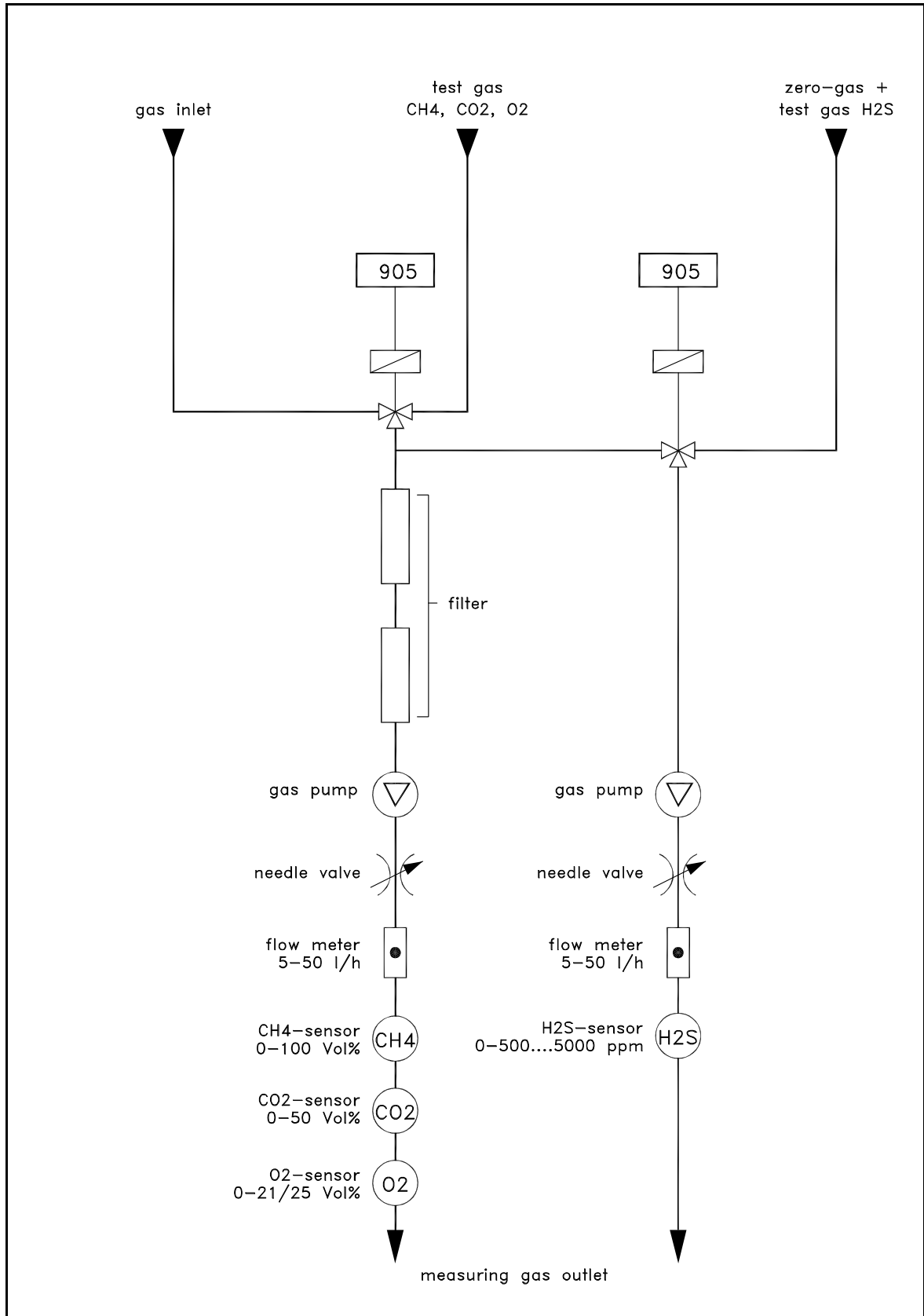
Important: The tank must never be allowed to completely fill with condensate, because this condensate will be sucked into the Biogas analyser which will cause serious damage to the equipment. As shown in the diagram, level balancing can be achieved with a hose-siphon



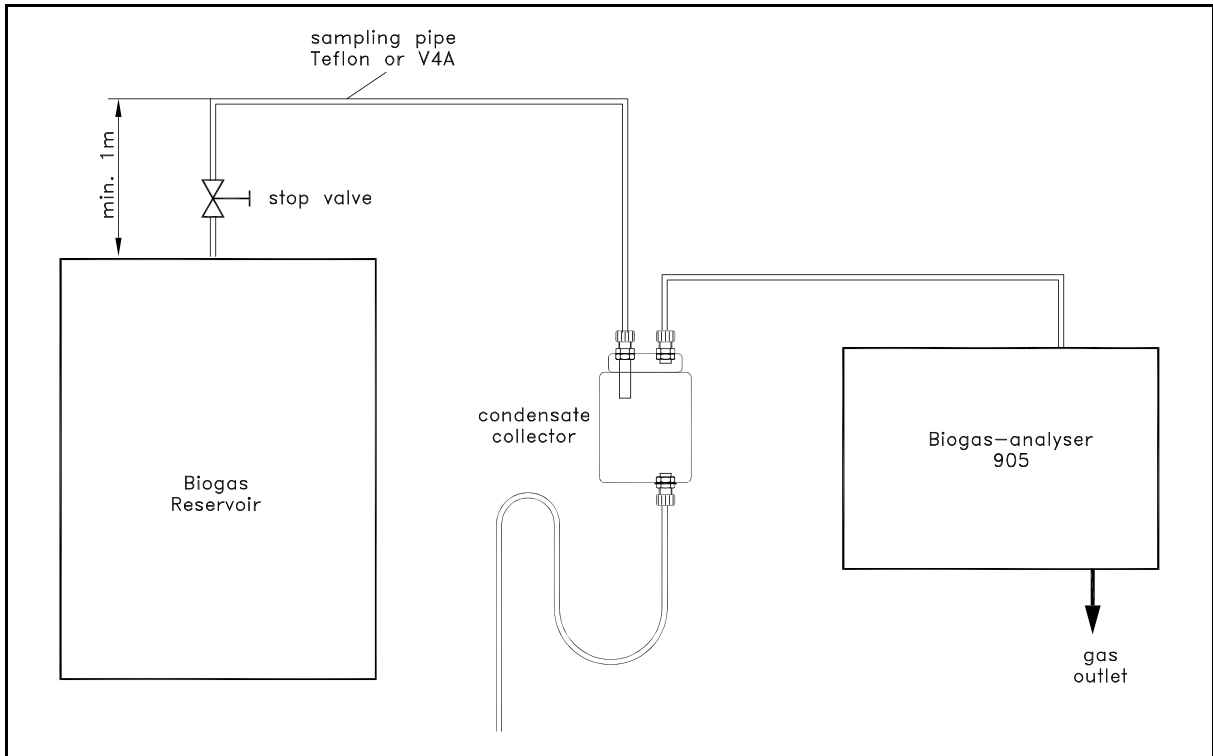
16. Hose Connections (Standard)



17. Hose Connections (with continuous measurement sub-assembly)



18. Installation Example



806-6194 E