INSTRUCTION MANUAL

Suction Unit for Sample Volume Flow Rates

ISOK 4 - F

Isokinetic Sampling in Gas Streams

According to VDI 2066 and EN 13284-1

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Seit 1924

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1. Technical data

Volume measurement:	Orifice plate (abs. 400 .. 1070 mbar)
Volume flow rate:	Orifice plate Orifice plate 1: circa 0.9 – 4 m³/h Orifice plate 2: circa 0.5 – 1.5 m³/h (related to the conditions at the orifice plate)
Modes of operation:	Isokinetic sampling with gas velocity measuring device Isokinetic sampling with zero pressure tube Constant sample volume flow rate Additional volume flow rate
Number of measuring points:	1 - 35
Sampling duration:	1 – 1500 min per measuring point
Nozzle diameter:	1 – 40 mm
Additional volume flow rate:	-2 – 2 m³/h (standard conditions: 0 °C and 1013 mbar respectively 760 mm Hg)
Power supply:	230 V, 50/60 Hz
Dimensions:	Width 360 mm Height 440 mm Depth 360 mm
Weight:	approx. 16 kg
Operating condition:	0 – 50°C

Subject to alterations

2. Principle

The suction unit for sample volume flow rates **ISOK4** serves the isokinetic sampling in gas streams.

The sample volume flow rate is sucked through the entry nozzle (with a filter following downstream) from the gas stream by a frequency controlled gas-tight rotary vane vacuum pump. The sample volume flow rate is measured between the filter and the pump by means of an orifice plate and controlled by a frequency converter. If the static pressure of the orifice is below 400 mbar, the pump must be installed in front of the ISOK.

The orifice plate can be calibrated and checked in the laboratory or at the measuring site, e.g. by means of a rotameter connected to the entry of the orifice plate's housing.

3. Mode of function

3.1 Modes of operation

The unit is designed for the following modes of operation:

1. Isokinetic sampling with gas velocity measuring device

   For this mode of operation, the velocity of the gas stream must be continuously measured by means of a gas velocity measuring device (e.g. Brandtl or Pitot tube). The sample volume flow rate is automatically controlled in such a way that the entry nozzle always sucks off the sample volume flow rate over-isokinetical by about 5 %. Hence, the actual sample volume flow rate is in the middle of the range from – 5 % up to + 15 % deviation from the isokinetic sampling as prescribed in the EN 13284-1 for valid sampling in gas streams.

2. Isokinetic sampling with zero pressure tube

   In this mode of operation, the sample volume flow rate is controlled in such a way that the pressure drop measured by the zero pressure tube is always equal to zero.

3. Sampling with constant sample volume flow rate

   In this mode of operation, the pre-selected sample volume flow rate is kept constant during sampling.

4. Additional volume flow rate

   Furthermore, the sampling train can be operated with an additional volume flow rate (negative and positive). This additional volume flow rate is to be branched off in front of the unit's orifice plate and to be maintained constant by a separate pump (see chapter **3.3 Sampling**). When entering " + " , a part of the sample volume flow will be taken of, when entering " - " a flow will be added. For the calculation of the total sample volume flow rate the additional volume flow rate is taken into consideration as follows:

   Flow rate through orifice plate (controlled) +/- additional volume flow rate (constant) = total sample volume flow rate.

   Furthermore, the unit can be also operated with a **fixed gas temperature** and a **fixed static pressure of the gas**, if these parameters are not measured in the gas stream during sampling. These parameters must be entered into the system prior to sampling (see chapter **3.3 Sampling**).

3.2 Application

The unit has to be set up rainproof at the measuring site. The unit can be also set up on the legs mounted at its back. This way, the display can be read from above without difficulty.

When using the unit, attention must be paid that all hoses and electrical lines are correctly connected (orifice plate, gas velocity measuring device, zero pressure tube, sensor for the temperature of the gas stream, motor of the bypass control valve).

The unit is designed for volume flow rates passing the orifice plate from about **0.4 up to 4 m³/h**. These flow rates are related to the conditions at the orifice plate (temperature and pressure). You have to pay attention that the sample volume flow rate sucked up directly from the gas stream can be considerably higher than the volume flow rate passing the orifice plate, e.g. due to the high temperature of the gas stream and/or a high additional volume flow rate.

In order to cover the complete range from 0.4 up to 4 m³/h two orifice plates with bores of different sizes are needed. These orifice

plates are to be put in the housing of the orifice plate mounted at the unit's back. For that purpose, the **left** part of the housing (viewed from the back of the unit) is to be screwed off and the appropriate orifice plate is to be put in **with the expand of the bore facing the back**.

- Orifice plate No. 1 (big bore)
  volume flow rate about 0.9 – 4 m³/h

- Orifice plate No. 2 (small bore)
  volume flow rate about 0.5 – 1.5 m³/h

Orifice plates for other ranges can not use.

It is important for the correct operation of the unit to use the appropriate orifice plate for the wanted sample volume flow rate and to enter the number of the inserted orifice plate into the system as described under the menu feature 4) SAMPLING← (see chapter **4.1 Menu-guided operation).**

Furthermore, the sample volume flow rate is determined by the entry nozzle's diameter. **The diameter of the nozzle is also to be entered into the system as described under menu feature 4) SAMPLING ←**

If the pressure drop across the orifice plate of 90 mbar (67.5 mm Hg) is exceeded or a pressure drop of about 0 mbar is reached or the static pressure in front of the orifice falls below 400 mbar (300 mm Hg), the unit is out of its controlling range. In this case the display shows crosses (xxx) for the sample volume flow rate.

It is recommended to switch on the unit by means of the red main power switch about 20 minutes before operation in order to warm up the electronics.

3.3 Sampling

By means of the potentiometer (adjusting knob under the red main power switch) the parameters measured in the gas stream can be damped by averaging these values. It is recommended to turn the potentiometer completely to the right (maximum damping). Intermediate positions should be tested at the site.

For sampling the following parameters are to be entered into the system (see chapter **4.1 Menu-guided operation)**:

Menu feature **3) STACK VALUES ←**

- Standard density of the gas in kg/m³
  related to standard conditions
  (0 °C and 1013 mbar resp. 760 mm Hg)
- Humidity of the gas in kg/m³
- Fixed static pressure of the gas in mbar (if wanted)
- Fixed temperature of the gas in °C (if wanted)

Menu feature 4) **SAMPLING ←**

- Orifice plate no. 1 or no. 2
- Number of measuring points
- Sampling duration in min
- Nozzle diameter in mm
- Factor for velocity measuring device
  (isokinetic sampling)
- Additional volume flow rate in m³/h
  related to standard conditions
  (0 °C and 1013 mbar resp. 760 mm Hg)

Menu feature **5) CONTROL ←**

- Isokinetic sampling with gas velocity measuring device
- Isokinetic sampling with zero pressure tube
- Sampling with constant sample volume flow rate

Menu feature **6) SET CLOCK ←**

- Current time (system time)
- Current date

(if not already entered into the system)

If necessary, the orifice plates and the sensors are to be calibrated according to the following menu features:

7) CALIBRATING ORIFICE PLATE ←
and
8) CALIBRATING SENSORS ←

These calibrations can be also done e.g. in the laboratory (see chapter **3.4 Laboratory test**).

The course of sampling is comprehensively described under menu feature
1) START ←

The entered parameters are stored in the unit's memory and are preserved also after switching off the unit.

In case of changing the measuring task other related parameters have to be entered under the menu features mentioned above prior to starting the sampling process according to the menu feature
START ←
The sample volume flow rate sucked up from the gas stream is shown on the display and recorded in m³/h (related to the conditions in the gas stream). All further measuring data for each measuring point are recorded as well. The additional volume flow rate pre-selected in terms of m³/h related to standard conditions is also converted to m³/h related to the operating conditions in the gas stream and is taken into consideration in these units for the calculation of the total sample volume flow rate.

Every measurement can be stopped by pressing down the grey cursor key for a while.

3.4 Laboratory test

In order to test the unit with connected gas velocity measuring device or zero pressure tube in the laboratory, a small flow channel consisting of a fan blower (adjustable by the voltage supply) with a tubing at its exhaust is needed. Both probes can be placed upstream in this tubing.

For the laboratory test, the corresponding parameters are also to be pre-selected, as described under chapter **3.3 Sampling**. Instead of the standard density of the gas the standard density of the air (1.293 kg/m³) and for the humidity the value 0.00 kg/m³ is to be entered.

When using the orifice plate no. 1 (big bore), it is recommended to pre-select a big nozzle diameter, and for the orifice plate no. 2 (small bore) a small nozzle diameter should be pre-selected.

After pre-selecting the menu features

7) CALIBRATING ORIFICE PLATE ←
and
8) CALIBRATING SENSORS ←

all necessary calibrations can be done.

3.5 Report

After finishing the samplings, all measured parameters and results can be **printed** respectively stored in a **Memory Stick**. All parameters and results are internally stored and saved against power break down.

For printing the results please proceed as follows:

1. Connect the serial interface RS232 of the unit (below the display) with the printer by means of the printer cable.

   Please note: Remove cable during the measurements, as otherwise data can be falsified.

2. Go to menu feature **10) REPORT ←** by using the white keys (see chapter **4.1 Menu-guided operation)**.

3. The **display** shows:
   Line 1: REPORT
   Line 2: PRINT? NO ←

   By using the upper white key
   YES ←
   can be pre-selected.

   After pressing the grey key the measured parameters and results will be printed:

   Section 1: Ident.No. of the unit
   Date
   Time

   Section 2: Mode of operation
   Further e.g.:
   Pre-selected flow rate
   Number of measuring points
   Gas density
   Gas humidity
   etc.

   Section 3: Mean values during sampling, e.g.:
   Damping
   Temperature at the gas meter
   (additional volume flow rate)
   Sample volume flow rate

Gas temperature
Gas pressure
etc.

For storing the data in a **Memory Stick** previously stuck in the lower connector please proceed as follows:

Please confirm
PRINT? NO ← (see item 3/page 8)
by pressing the grey key. The **display** shows:

Line 1: REPORT
Line 2: STICK? NO ←

By pressing the upper white key
YES ←
can be again pre-selected.

After that the **display** shows:
Line 1: REPORT
Line 2: PLEASE WAIT X %

The information behind PLEASE WAIT shows the percentage of the data already taken over of the Memory Stick.

After PLEASE WAIT is not shown in the display anymore the stick can be removed and a new stick can be stuck in. The stored data can be downloaded from the stick in a PC via a **Docking Station** and the attached special software **ISOKVIEW**. Afterwards the data can be imported into an Excel table.

3.6 Downloading of data by PC

Instead of a printer also a PC or laptop can be connected to the unit's serial interface. By means of the special software **ISOKVIEW** all data can be downloaded in the computer. This communication is only possible in the main menu.

Please note: **Remove the cable during the measurements, as otherwise data can be falsified.**

4. Operation

4.1 Menu-guided operation

The menu operation is self-explanatory.

Switching on: Press the red main power switch.

Display shows: **ISOK 4 SAMPLER**

After that:
1) START ←
2) VACUUM CHECK

Following menu features can be selected:
3) STACK VALUES
4) SAMPLING
5) CONTROL
6) SET CLOCK
7) CAL. ORIFICE
8) CAL. SENSORS
9) INFORMATION
10) REPORT

upper white cursor key — menu forward

lower white cursor key — menu backward

When using the white cursor keys the following principle applies: Press down the keys: Display will continuously advance: first slowly, then rapidly.

The menu feature currently selected is marked by an arrow ←

1) START ←

Press the grey key.

Display Line 1: MEMORY RESET?

Line 2: NO ←

If the stored data of the previous measurements shall not be cancelled, e.g. when in transition of a sampling from one cross-section measurement to another, the grey key has to be pressed again.

If the stored data of the previous measurements shall be cancelled, the upper white key is to be pressed.

Line 2: YES ←
After that, press the grey key.

Display Line 1: MEMORY RESET?

Line 2: PLEASE WAIT

Then:

Display Line 1: MOVE PROBE

Line 2: ACKNOWLEDGEMENT
Now press the grey key again.

Display Line 1: SELECT MEASURE

Line 2: 01 ←
By pressing the white keys the pre-selected measuring points or STOP of the measurement can be set.

If the previously set operating parameters shall not be changed any- more, the unit can be put into operation by pressing the grey key.

When the unit is running, the following parameters are displayed depending on the mode of operation:

Isokinetic sampling:

Display Line 1: Velocity of the gas stream vK in m/s
Temperature of the gas stream TK in ° C

Line 2: Sample volume flow rate VK in m³/h (related to the conditions prevailing in the gas stream)
Deviation from isokinetic sampling in %

Zero pressure tube

Display Line 1: Zero pressure Z in mbar
Temperature of the gas stream TK in ° C

Line 2: Sample volume flow rate VK in m³/h (related to the conditions prevailing in the gas stream)

Constant sample volume flow rate

Display Line 1: Ambient temperature Ta in ° C

Line 2: Sample volume flow rate Va in m³/h
(related to conditions in the gas stream)

By activation the unit, recording of the measuring data for the current measuring point is also started.

By pressing the lower white key during operation the display will show:

Display Line 1: Pre-selected volume flow rate Vb passing the orifice plate in m³/h
(related to the conditions at the orifice plate)
No. of the current measuring point

Line 2: Static pressure pK in the gas stream in mbar
Adjustment of the potentiometer POT (at the front) for damping of currently measured parameters by averaging these values

After finishing the sampling at each measuring point, the display shows:

Display: MOVE PROBE
ACKNOWLEDGEMENT

Hereby recording of the measuring data of this measuring point is finished.

Press the grey key.

Display Line 1: SELECT MEASURE

Line 2: e.g. 02 ←
By pressing the white keys a different measuring point can also be set.

The nozzle is to be moved to the next wanted measuring point. (While moving the nozzle, the pump is continuously running in the controlled mode.)

Press the grey key.

The next measurement and recording of the related parameters start.

Depending on the mode of operation, the display shows again the parameters for isokinetic sampling, for the operation using the zero pressure tube or for the operation at constant sample volume flow rate.

After finishing the sampling at the last pre-selected measuring point the display shows:

Display: MOVE PROBE
ACKNOWLEDGEMENT

Press the grey key.

Display Line 1: SELECT MEASURE

Line 2: e.g. 01 ←

Now the unit can be shut down by pressing down the grey key.

Display Line 1: 1) START ←
Line 2: 2) VACUUM CHECK

If the unit shall be operated with an additional constant volume flow rate, this volume flow rate is to be branched off before the orifice plate.

2) VACUUM CHECK ←

The vacuum check tests, whether there are leakages in the tubings between the entry and the outlet of the gas-tight vacuum pump. For this test must installed the pump behind the ISOK and a shut off valve in front of the pump.

Press the grey key.

The unit starts.

Display Line 1: VACUUM CHECK

Line 2: Current pressure Pb in mbar
at the orifice plate

Seal the hose connected to the entry of the orifice plate's housing respectively the entry of the system.

Adjust the flow rate of pump by pressing the white keys in such a way that the static pressure Pb at the orifice plate reaches the wished value [**mbar]**.
After that, control the wrong air flow at the gas meter. The leak test is successfully if the wrong air flow is below 2% of the sampling gas flow.

After that, close the shut off valve and press the grey key.

After that, the automatic vacuum check starts. It is an additional check and not necessary according to EN 13284-1, The results of this test is secondarily to the result of the gas meter test. After finishing this check the display shows:

Display: VACUUM CHECK OKAY
or
LEAKAGE

After that, this menu feature is automatically exited.

It should be noted that after switching off the unit and therefore the pump, firstly an increase in the static pressure occurs due to the pressure balance with the gas in the tubings behind the pump. By adjusting the static pressure it is achieved that the pressure does not exceed the value of 750 mbar after switching off the pump.

3) STACK VALUES ←

The standard density and the water content of the gas must be known and entered into the system.

Press the grey key.

1. Enter the standard density (0 °C and 1013 mbar resp. 760 mm Hg) of the gas in the range from 1.200 up to 2.000 kg/m³ by pressing the white keys.

   Confirm input by pressing the grey key.

2. Enter the humidity of the gas in the range from 0.00 up to 8.00 kg/m³ by pressing the white keys.

   Confirm input by pressing the grey key.

   Afterwards, the **display** shows:

   Line 2: pK FIXED? NO ←

If the static pressure pK of the gas stream is not measured during sampling, a constant (fixed) gas pressure can be pre-selected. If you want to operate the unit with a fixed value for the static gas pressure, press the upper white key.

Line 2: pK FIXED? YES ←

Enter a pressure value in the range from 700 up to 1050 mbar by using the white keys.

Confirm input by pressing the grey key.

Afterwards, the **display** shows:

Line 2: TK FIXED? NO ←

If the temperature TK of the gas stream is not measured during sampling, a constant (fixed) gas temperature can be pre-selected. If you want to operate the unit with a fixed value for the gas temperature, press the upper white key.

Line 2: TK FIXED? YES ←

Enter a temperature value in the range from 0 up to 500 °C by pressing the white keys.

Confirm input by pressing the grey key.
It will automatically exit this menu feature.

Note: For operating the unit at ambient conditions, e.g. in the laboratory, the standard density of the air of 1.293 kg/m³ and for the humidity the value 0.00 kg/m³ is to be entered into the system. Please note that the water content of the air is negligible under ambient conditions.

4) SAMPLING ←

Press the grey key.

1. Enter the number of the orifice plate by pressing the white keys:

   - Orifice plate 1
   Volume flow rate from about 0.9 up to 4 m³/h
   (related to the conditions at the orifice plate)

- Orifice plate 2

Volume flow rate from about 0.5 up to 1.5 m³/h
(related to the conditions at the orifice plate)

Confirm input by pressing the grey key.

2. Enter the number of measuring points (01 – 35) by pressing the white keys.

   Confirm input by pressing the grey key.

3. Enter the sampling duration per measuring point in the range from 01 up to 1500 min with the white keys.

   Confirm input by pressing the grey key.

4. Enter the diameter of the entry nozzle in the range from 1.0 up to 40.0 mm with the white keys.

   Confirm input by pressing the grey key.

5. Enter the factor for the gas velocity measuring device in the range from 0.80 up to 1.10 with the white keys.

   Confirm input by pressing the grey key.

6. Enter the additional volume flow rate in the range from –2.00 up to 2.00 m³/h (related to the standard conditions, 0 °C and 1013 mbar resp. 760 mm Hg) with the white keys.

   Confirm input by pressing the grey key.
   It will automatically exit this menu feature.

5) CONTROL ←

Press the grey key.

1. Call up of isokinetic sampling with gas velocity measuring device:

   Display Line 2: NO ←
   If the unit shall be used in this operating mode, the upper white key is to be pressed.
   Line 2: YES ←

   Confirm input by pressing the grey key.
2. Call up of isokinetic sampling with zero pressure tube:

   Display Line 2: NO ←
   If the unit shall be used in this operating mode, the upper white key has to be pressed.
   Line 2: YES ←

   Confirm input by pressing the grey key.

3. Call up of sampling with constant sample volume flow rate:

   Display Line 2: NO ←
   If the unit shall be used in this operating mode, the upper white key is to be pressed.
   Line 2: YES ←

   The gas flow is the flow according to condition of the actual measured static pressure and of the actual measured temperature. It must install the NiCr-Ni thermocouple, apart from that the gas flow will be set to the condition at 500°C.

   Confirm input by pressing the grey key.

If NO ← has been entered for all 3 operating modes, the sampling will take place in the previous operating mode.

After entering YES ← and pressing the grey key, this menu feature will be automatically exited without any further queries.

6) SET CLOCK ←

Under this menu feature the current time (system time) and the current date can be entered into the system, if the system time and date have not already been entered previously.

Press the grey key.

1. Enter the current time with the white keys.

   Confirm input by pressing the grey key.

2. Enter the current year with the white keys.

   Confirm input by pressing the grey key.

3. Enter the current day/month with the white keys.

   Confirm input by pressing the grey key.

Afterwards, the **display** shows:

Line 1: SAVE VALUES?

Line 2: NO ←
If the entered data shall be saved, the upper white key is to be pressed.

Line 2: YES ←

Confirmation of the input and exit of this menu feature by pressing the grey key.

7) CALIBRATING ORIFICE ←

The orifice plate can be calibrated under ambient conditions, e.g. in the laboratory or at the site. For that result, only the number of the orifice plate that shall be calibrated is to be entered into the system under menu feature

4) SAMPLING ←

- Orifice plate 1
  Volume flow rate about 0.9 – 4 m³/h

- Orifice plate 2
  Volume flow rate about 0.5 – 1.5 m³/h

For calibrating the orifice plate, a laboratory-rotameter (measuring uncertainty < 2 %) with filter at the outlet (e.g. gas-tight filter holder with 47 mm or 50 mm glas fibre filter) must be connected to the entry of the orifice plate's housing, e.g. using a hose. The NiCr-Ni thermocouple must plug in the ISOK and be sure that the pump don't influence the orifice!

When using a rotameter, please remember that its readings must be related to the current parameters (temperature, pressure) of the ambient air.

Conversion of the rotameter reading into the volume flow rate under current ambient conditions:

$$V_a = V_R \cdot \left[\frac{T_a \cdot p_{cal}}{T_{cal} \cdot p_a} \right]^{1/2}$$

Conversion of the volume flow rate under current ambient conditions into the rotameter reading:

$$\dot{V}_R = \dot{V}_a \cdot \left[\frac{T_{cal} \cdot p_a}{T_a \cdot p_{cal}} \right]^{1/2}$$

$\dot{V}_a$ Flow rate under current ambient conditions

$\dot{V}_R$ Flow rate indicated at the rotameter

T_a Absolute ambient temperature:
273K + ambient temperature in °C

p_a Ambient barometric pressure in mbar or mmHg

T_{cal} Rotameter calibration condition (absolute) temperature
(commonly: 293K or 273K)

P_{cal} Rotameter calibration condition barometric pressure
(commonly: 1000 mbar resp. 750 mmHg)

Before calibrating the orifice plate, the unit's electronics shall be

warmed up by switching on the red main power switch about 20 minutes before calibration.

Press the grey key.

Display Line 1: CAL. ORIFICE?
Line 2: NO ←

If the orifice plate shall be calibrated, the upper white key is to be pressed.

Display Line 2: YES ←

Press the grey key.

After that the **display** shows in line 2:

Left: Actual volume flow rate

Right: Set point
for orifice plate 1: 3.50 m³/h
for orifice plate 2: 1.20 m³/h

The actual volume flow rate has to be adjusted with the white keys in such a way that the rotameter connected to the entry of the orifice plate shows the value of 3.50 m³/h respectively 1.20 m³/h. The actual volume flow rate shown on the display (left side) will also show the value of 3.50 m³/h respectively 1.20 m³/h after exact adjustment.

Afterwards press the grey key.

The **display** shows:

Line 1: SAVE VALUES?

Line 2: NO ←

If the calibration data shall be saved, the upper white key is to be pressed.

Line 2: YES ←

Confirmation of the input and exit of this menu feature by pressing the grey key.

Note: The actual volume flow rate shown on the display can occasionally differ from the rotameter reading. The new

calibration data will be only entered into the system after pressing the grey key and will not be updated automatically. The shown value is in relation to the temperature of the NiCr-Ni Thermocouple (if no NiCr-Ni: reference: 500°C).

8) CALIBRATING SENSORS ←

The sensors can also be calibrated under ambient conditions, e.g. in the laboratory or at the site.

Press the grey key.

Display Line 1: CAL. SENSORS

Line 2: NO ←
If the sensors shall be calibrated, the upper white key is to be pressed.

Display: Line 2: YES ←

Afterwards press the grey key.
The **display** shows:

CAL: SENSORS
PLEASE WAIT

Now the **display** shows in line 2:

Left: The offset for the zero point of the pressure drop PK of the gas velocity measuring device and the zero pressure tube

For calibration neither of the two probes may be connected to the unit, as differences from the zero point can occur otherwise.

Right: The pressure drop for the gas velocity measuring device and the zero pressure tube

The offset (left side) has to be changed with the white keys until the value 0.00 (right side) is shown for the pressure drop.

Confirm calibration by pressing the grey key.

After that the **display** shows in line 2:

Left: The offset for the static pressure pK in the gas stream

Right: The static pressure pK in mbar

The offset (left side) is to be changed with the white keys until the pressure value shown on the right side corresponds to the current static pressure. If the calibration is done, e.g. in the laboratory or in the ambient air, the pressure value has to be adjusted to the current ambient pressure. If the static pressure of the gas stream is measured at the site (e.g. by means of a gas velocity measuring device connected to the unit), the pressure value has to be adjusted to the static pressure in the gas stream.

Confirm calibration by pressing the grey key.

After that the **display** shows in line 2:

Left: The offset for the temperature TK of the gas stream

Right: The temperature TK in °C of the gas stream

The offset (left side) is to be changed with the white keys until the value displayed on the right side corresponds to the current temperature. If the calibration is done in the laboratory or in the ambient air, the temperature value is to be adjusted to the current ambient temperature. If the temperature of the gas stream is measured at the site (e.g. by means of a temperature sensor connected to the unit), the temperature value is to be adjusted to the temperature in the gas stream.

Confirm calibration by pressing the grey key.

After that the **display** shows:

Line 1: SAVE VALUES?

Line 2: NO ←

If the calibration data shall be saved, the upper white key has to be pressed.

Confirm input and exit of this menu feature by pressing the grey key.

9) INFORMATION ←

Press the grey key.

Afterwards the **display** shows:

1. Date of the last calibration of the orifice plate.

   Press the lower white key.

2. Software

   Press the lower white key.

3. Hardware

   Press the lower white key.

4. Identification number of the unit

   Press the lower white key.

By pressing the grey key the menu feature will be exited.

10) REPORT ←
(see chapter **3.5 Report)**

4.2 Selecting a language

The unit language is installed on the EPPROM and can not change. A new language can only installed by overwriting the EPPROM. Selected can between:
English

German

France

5. Safety Advice

The electronics of the unit may only be opened by a specialised expert. Before opening the electronics pull out the plug. Repair of the electronics or mechanics without the aid or advice of the manufacturer excludes any sort of warranty.

For safety reasons, the unit may only be operated in connection with grounded safety contacts.

This equipment is classified as class A. This equipment can cause radio interference in residential buildings. In this case ask for assistance. It is not allowed to install this equipment close to life saving systems.

The seller cannot foresee all possible modes of operation in which the instrument may be used. Therefore the user assumes all liability associated with the use of this instrument. The seller further disclaims any responsibility for consequential damages.

6. Guarantee

If putting the appliance to improper use, the guarantee will expire. The ISOK is only developed for the standard environmental sampling. The ISOK is not for extreme situations like no difference pressure of the pitot tube, very high humidity and high working place temperatures.

7. Generally Notes

7.1

Each pump (whether membrane- or rotary van pump) caused a pulsation flow. This pulsation can influenced flow meter and orifice. To be sure, that the orifice of the ISOK and the flowmeter shows the correct value, must installed pulsation dumper between pump and orifice/flowmeter. In the delivery capacity from the ISOK and from the pump is a pulsation dumper with hoses. Only if the pulsation dumper is installed between the pump and the ISOK as delivered, we can guarantee a faultless working. (see installation note).

In principle, we recommend to use the ISOK only at the vacuum side of the suction pump, especially when volume flow rate is below 1 m^3/h. If the ISOK installed the exit of the pump, pressure side connected, faulty-measurements on the basis of the pump pulsation can appear particularly at low volume flow rate.

7.2

The display can be cancelled through electromagnetic disturbances and voltage-inductions of unstable power supplies. The controlling function remains independent from it. An initialization of the display is reached by a menu-change. During a measurement, the display can through short pressing of the white (middle) button again initialized. The ad appears after it like accustomed.

7.3

Please connect only indirect thermocouples, otherwise the ground loop makes galvanic connections and destroy the electronics.
By indirect thermocouples is the coat galvanic separated from the thermo-wire.

Moreover, the protection-tube of the thermocouple must always be grounded. Especially if used closed to electrostatic precipitator. In case that the over-voltage from the protection tube cannot drain off to the grounding and will be drain off through the ISOK, no guarantee exists for damages resulting from it (NiCr-Ni-transmitter and main-circuit board will be destroyed). Expressly, we point that the thermocouple inside the cooled and not heated combination-probes has no grounding!

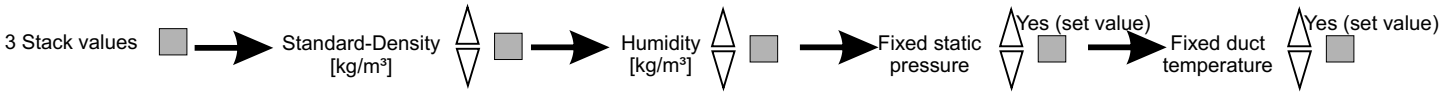
Please provide over-voltage protection for the ISOK power supply and for the thermocouple if it is connected with the ISOK and has no ground through a probe.

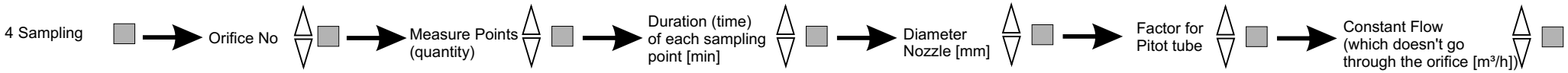
How to start a measurement:

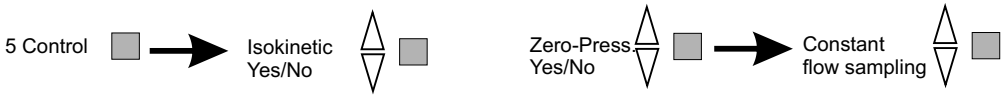
How to start a measurement?
ISOK-Sampler

Switch on the power and wait 15 minutes to warm up the instrument and the sensors.

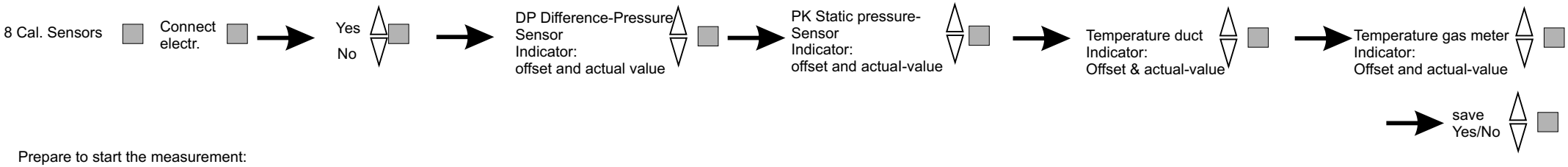
Set up the duct parameter and the sampling parameter:



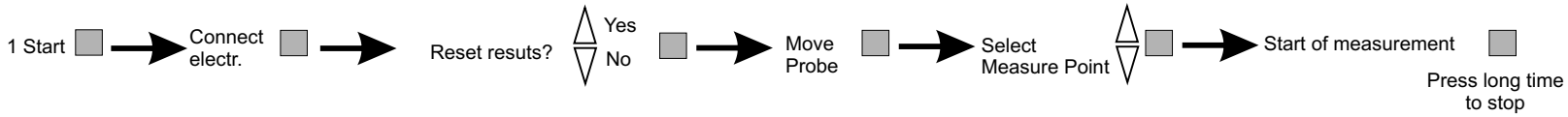




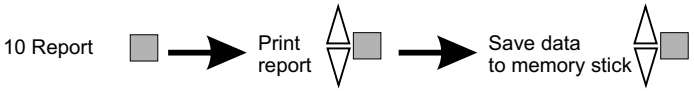
After 15 minutes warming up, control the offset of the difference pressure sensors. Disconnect the hoses to the pitot tube. Set the difference pressure to zero. The change of the thermocouple and static pressure offset is not necessary. Write down the ambient pressure for later calculation.

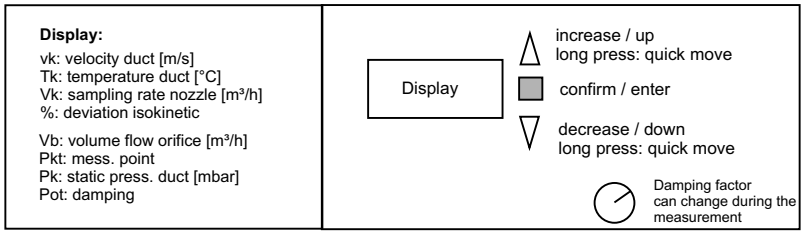


Prepare to start the measurement:
Follow the menu until “select the measure point”, place the probe and push the grey button to start the sampling.



At the end of the measurement, store the data to the memory stick or PC and print the report.





Short manual ISOK-Sampler

1 Start → Connect electr. → Reset resuts? (Yes / No) → Move Probe → Select Measure Point → Start of measurement

Press long time to stop

2 Vacuum check → Pump starts and evacuate the system (-500 mbar vacuum)

Attention, the bypass-valve is closed (max flow rate). After the vacuum check turn the valve in a average position.

3 Stack values → Standard-Density [kg/m³] → Humidity [kg/m³] → Fixed static pressure → Yes (set value) → Fixed duct temperature → Yes (set value)

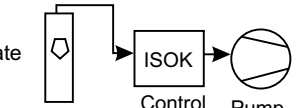
4 Sampling → Orifice No → Measure Points (quantity) → Duration (time) of each sampling point [min] → Diameter Nozzle [mm] → Factor for Pitot tube → Constant Flow (which doesn't go through the orifice [m³/h])

5 Control → Isokinetic Yes/No

Zero-Press. Yes/No → Constant flow sampling

6 Set Clock → Hour → Year → day/month → Save values

Installation to calibrate the orifice



7 Cal. orifice → Connect electr. → Calibration orifice → Pump starts Indicator: right: actual, left: nominal

Change with buttons the sampling rate that the flow meter show the correct value 3,5 m³/h. Confirm. → save Yes/No

8 Cal. Sensors → Connect electr. → Yes / No → DP Difference-Pressure Sensor Indicator: offset and actual value → PK Static pressure-Sensor Indicator: offset and actual-value → Temperature duct Indicator: Offset & actual-value → Temperature gas meter Indicator: Offset and actual-value → save Yes/No

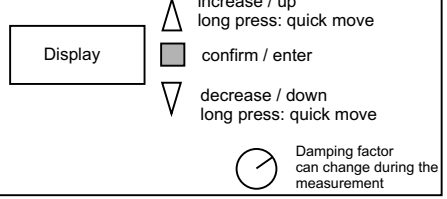
9 Information → Calibration Software Hardware I-Dent. No.

10 Report → Print report → Save data to memory stick

Display:

vk: velocity duct [m/s]
Tk: temperature duct [°C]
Vk: sampling rate nozzle [m³/h]
%: deviation isokinetic

Vb: volume flow orifice [m³/h]
Pkt: mess. point
Pk: static press. duct [mbar]
Pot: damping



Informationen zu den ISOK-View Einzeldaten.

Der ISOK versucht seinen Speicher so optimal wie möglich zu nutzen. Dazu berechnet er die kürzeste Zeit zwischen zwei Datenspeicherungen, die innerhalb der Messzeit möglich ist, ohne den Datenspeicher zu überfüllen.

Folgendes ist dabei zu beachten:

1. Nach dem Ablauf einer Messzeit eines Messpunktes, werden keine weiteren Daten zu dem Messpunkt gespeichert. Der Impulszähler arbeitet aber weiter. Die Regelung ist aktiv.

2. Wird eine sehr kurze Zeit zwischen zwei Speicherereignissen gesetzt, kann es vorkommen, dass einzelne Speicherungen nicht stattfinden, weil die Steuerung zur Isokinetik die Datenspeicherung blockierte. Am Ende eines Messpunktes werden die nicht genutzten Speicherereignisse als Striche gekennzeichnet. Unterschiedliche Anzahl an Strichen resultiert aus unterschiedlichen Querstörungen. Die Gesamtzahl der möglichen Messereignisse pro Messpunkt ist aber immer gleich.

3. Die Summe aller möglichen Speicherdaten beträgt 1000 Sätze. Je nach Menge der einzelnen Messsätze, können letztendlich zwischen 800 und 900 Datensatzspeicherungen erfolgen.

Information to the ISOK-View single-data.

The ISOK try to storage as optimal as possibly. He calculates the shortest time between two data-storages which are possible within the sampling time per point, without overfilling the data-storage.

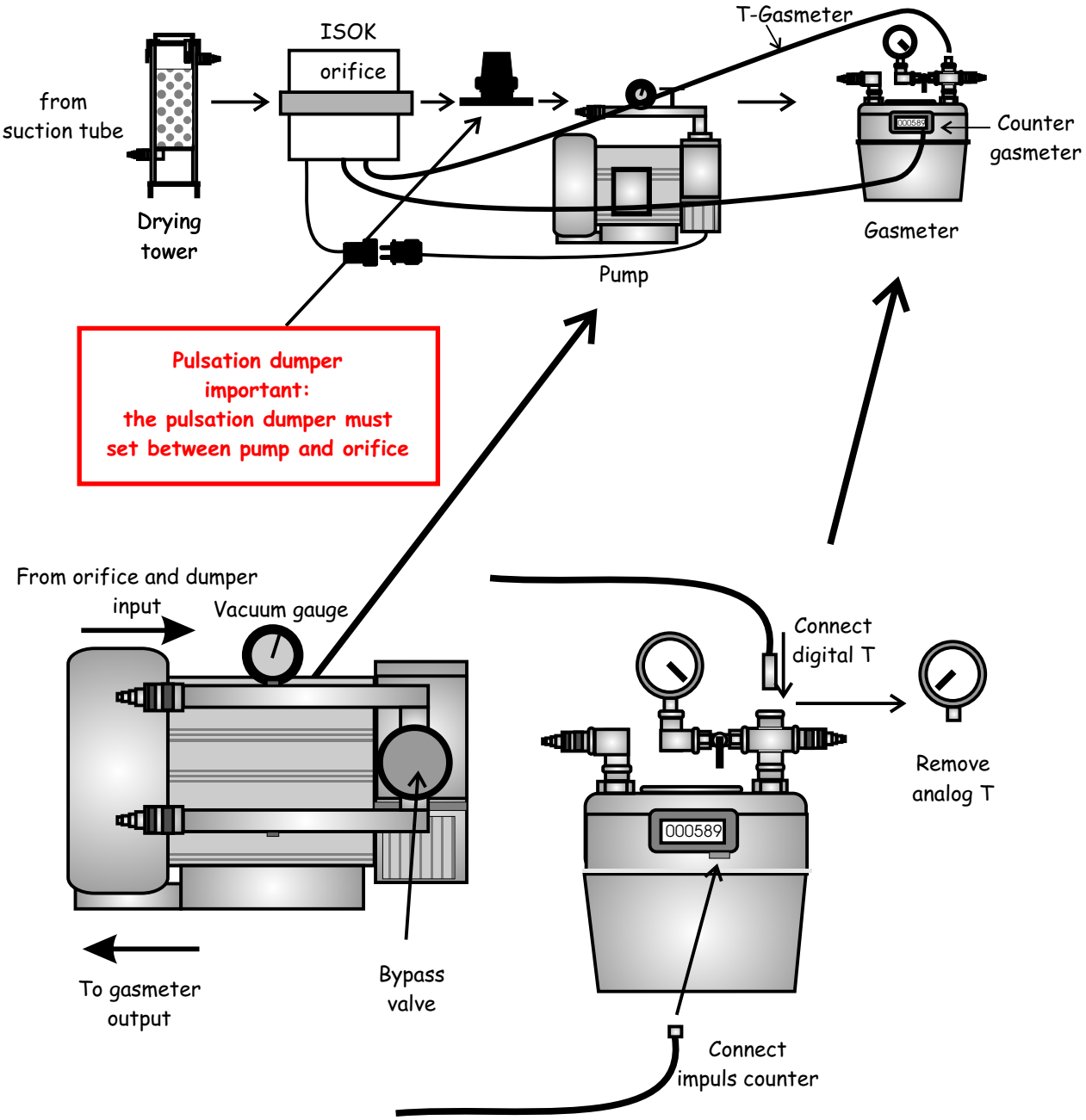
Following is to be heeded:

1. After the end of the sampling time from one measuring point, no more data are stored from this measuring point. However, the impulse-counter works on. The regulation is active.

2. If a very short time is set between two storage-events, it can occur that single storages don't take place, because the controlling of the isokinetic blocked the data-storage. In the report of one measuring point, you can see the not used storage-space are marked as lines. Different number of lines results from different cross-disturbances. However, the total number of the possible measuring events per sampling point is always the same.

3. The sum of all possible storage-data amounts to 1000 events. Depending of the quantity of the single data, the amount of data events can alternate ultimately between 800 and 900.

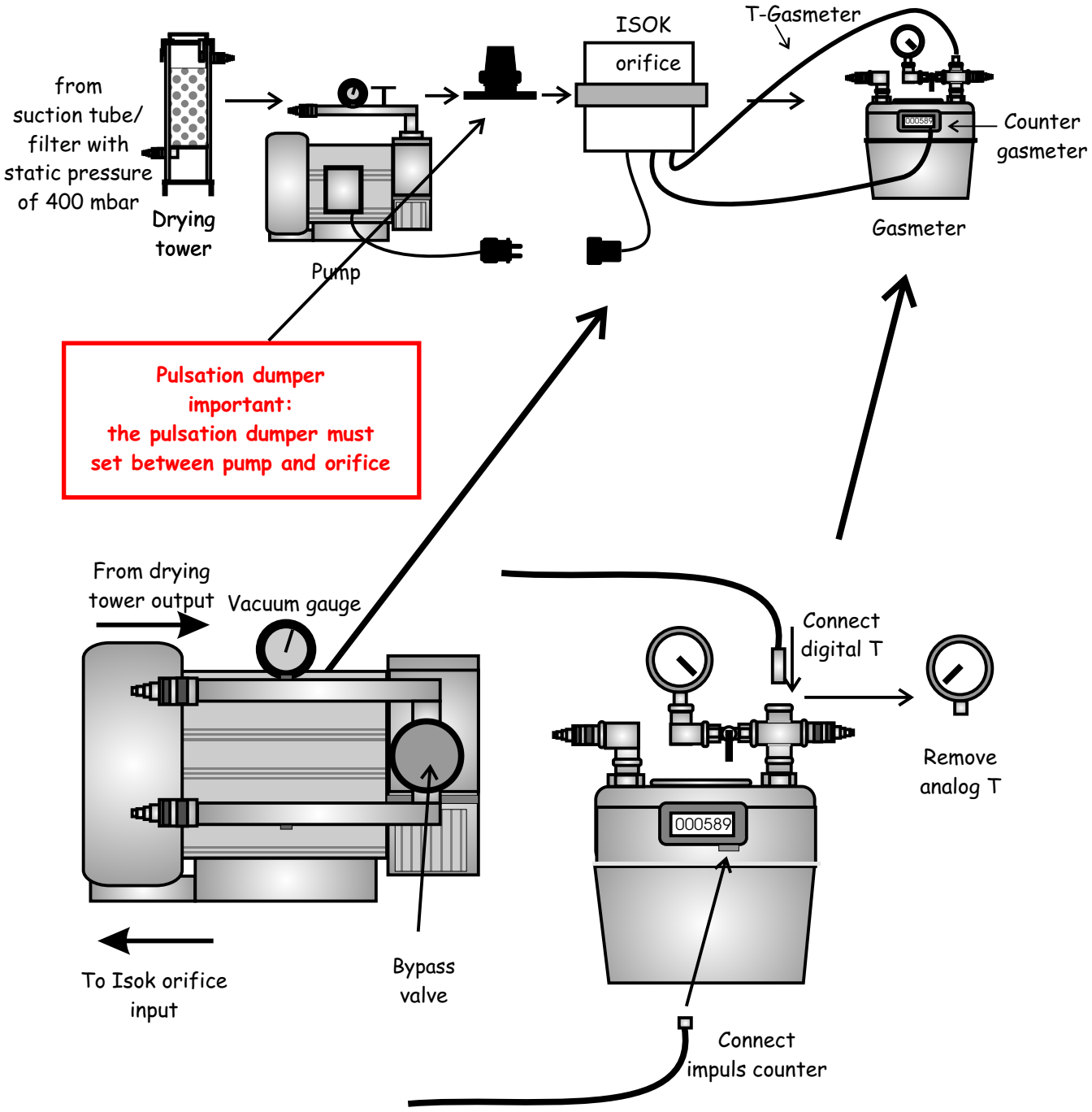
How to connect the ISOK?



An optimal regulation is reached, if the pump is driven in the middle speed-range.
The so-called "pump-volume flow rate" should set between 1,5 - 3 m^3/h.
The "sample volume flow rate" (from suction-side to pressure-side) is not meant with it! In case that the sampling volume flow rate through the sampling line should less as the pump volume flow rate in the middle range, the bypass-valve must be opened.
Now, the bigger part of the pump volume flow rate flows in the circle.
For smaller sample volume flow rate must be adapted opened the bypass-valve and again closes at high flow rate.
The optimal position of the bypass-valve can be set according to the noise of the pump.
The green and yellow LED at the ISOK should always alternate.

How to connect the ISOK

In case of high vacuum (600 mbar)



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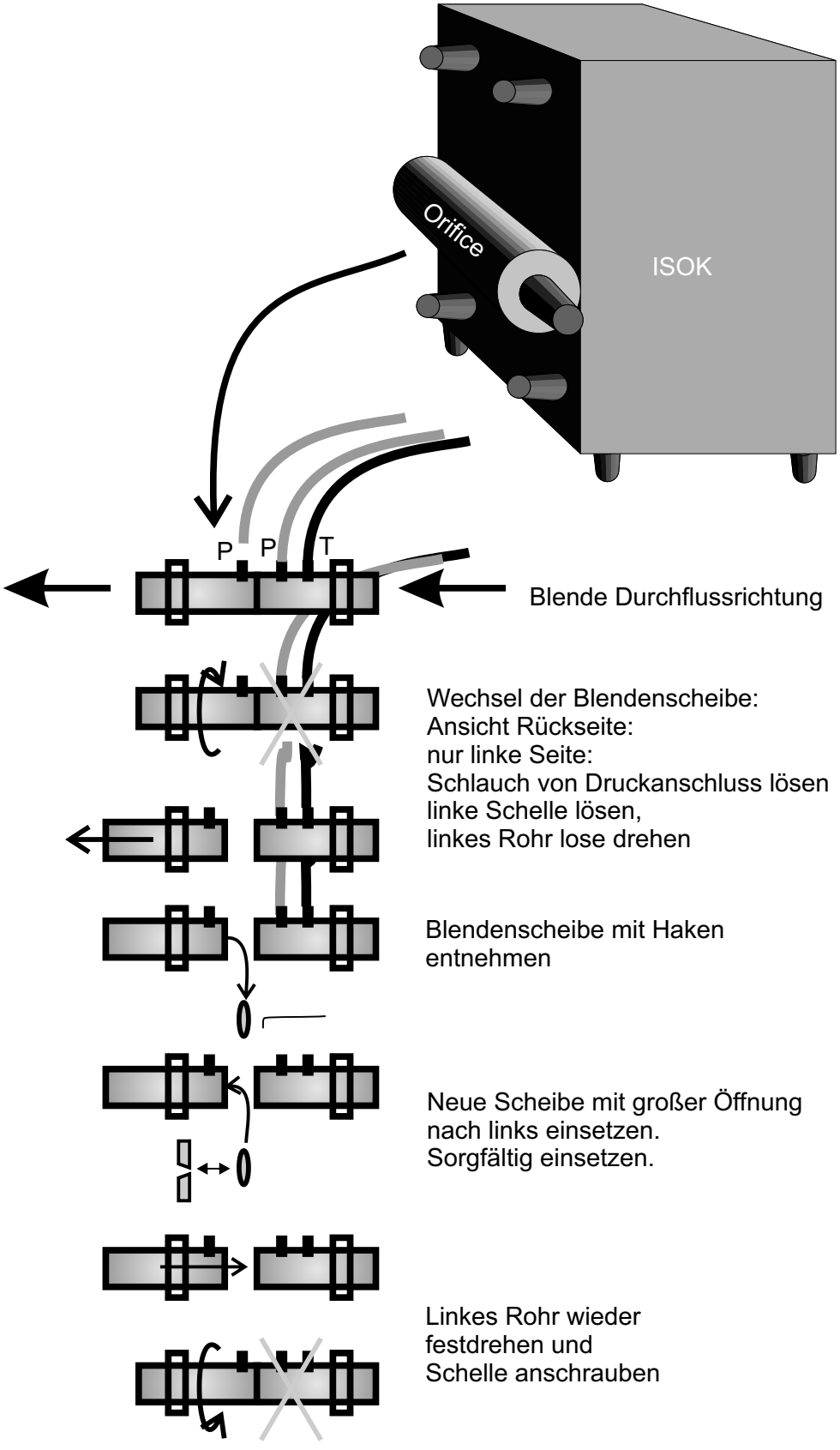
Wechsel der Messblende
How to change the orifice

Paul Gothe GmbH
www.paulgothe.de



Blende Durchflussrichtung

Orifice flow direction

Wechsel der Blendenscheibe:
Ansicht Rückseite:
nur linke Seite:
Schlauch von Druckanschluss lösen
linke Schelle lösen,
linkes Rohr lose drehen

Change of the orifice disk
view to the rear
only left side:
disconnect hose from pressure connector
open left fastening
unscrew left tube

Blendenscheibe mit Haken entnehmen

Take off the
orifice disk with hook

Neue Scheibe mit großer Öffnung nach links einsetzen.
Sorgfältig einsetzen.

New disk with big opening to the left side
Please, install carefully

Linkes Rohr wieder festdrehen und
Schelle anschrauben

Screw left tube
Screw fastener tight.