Gas Odorization System

GOE 07

Operating Instructions

for gas odorization systems fitted with a diaphragm pump

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Reliability in gas supply –
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Introduction

Gas leaking out of pipes and equipment must immediately be detected in order to avoid explosions. Due to the fact that natural gas is odorless, it must be provided with a characteristic odour, so that it can be perceived far below its explosive limit.

Natural gas is given this characteristic odour by way of odorization, i.e. by adding a strong-smelling odorant. Mainly tetrahydrothiophene (THT), but in many cases also mercaptans are used as odorants.

Special proportioning methods are required to add the odorant to the natural gas. On the one hand, a safe and constant odor intensity is desired, but on the other hand, adding too much odorant must be avoided to prevent unnecessary and unpleasant smells.

In order to achieve this purpose, the injection method has become widely accepted. With this method, precisely proportioned quantities of odorant are added to the natural gas. For this purpose, the volume pulses of a corrector are used which are proportional to the gas volume. This ensures an absolutely constant odorant concentration which is independent of any variations in the gas flow rate.

At the heart of the RMG odorization system lies a low-wear, electro-magnetically operated diaphragm proportioning pump. The system is self-priming and requires no additional auxiliary power to draw the odorant from its tank.

All venting devices of the odorization system form a closed system and are connected to the outside via a venting pipe with an activated carbon filter, so that the operating staff is not exposed to any unpleasant smells.

Functional Description

Mechanical System

The odorization system (Fig. 5) operates in accordance with the injection method. Volume-proportional pulses detected by a volume meter cause the electromagnetically operated diaphragm proportioning pump (2) to perform strokes via the control unit. With each stroke, the pump delivers the preset odorant quantity (mm^3) via the injection nozzle into the gas flow. The proportioning pump (2) replenishes its supply of odorant by drawing odorant from the interchangeable odorant tank (5) through a permanently filled 5-litre reserve tank (4). There is a vacuum in the reserve tank and in the pipes upstream of the pump which is built up by a hand vacuum pump (6) on starting up the system. Therefore, the system is self-priming and the odorant level in the reserve tank falls only when the interchangeable odorant tank is empty.

Control Unit

The control unit is supplied either in a wall-mounting case (Type 7-IG 4) or installed in a 19" subrack (Type 7-EU 4). It comprises the following modules (Fig. 1):

– **Intrinsically safe (Ex-i) MC 13-241 ExO-T input card**
  As 2-channel explosion-proof isolation of volume pulses from hazardous areas (explosion-protected corrector, turbine meter, etc.).

– **Intrinsically safe (Ex-i) MC 13-36 ExO-R input card**
  For explosion-proof isolation of signals from the manual button of the odorization system.

– **Intrinsically safe (Ex-i) MC 13-36 ExO-R/C16 input card (option)**
  For explosion-proof isolation of signals from the flow monitor, float switch (reserve tank) and level indicator of the odorant tank.

– **MC 41-31R/S272-4 control card**
  For pulse scaling and processing and indicating faults or alarms.
  With an internal pulse generator for continuous odorization without being controlled by volume pulses and with an automatic/manual changeover switch.

– **MC 82-SSI power supply card**
  24 V supply unit for the control system; power unit (200 V/DC) for controlling the proportioning pump.

Every fault indication causes a relay to switch in the control unit. The switching contacts are connected to the terminals. Fault indications can thus be transferred to the outside.

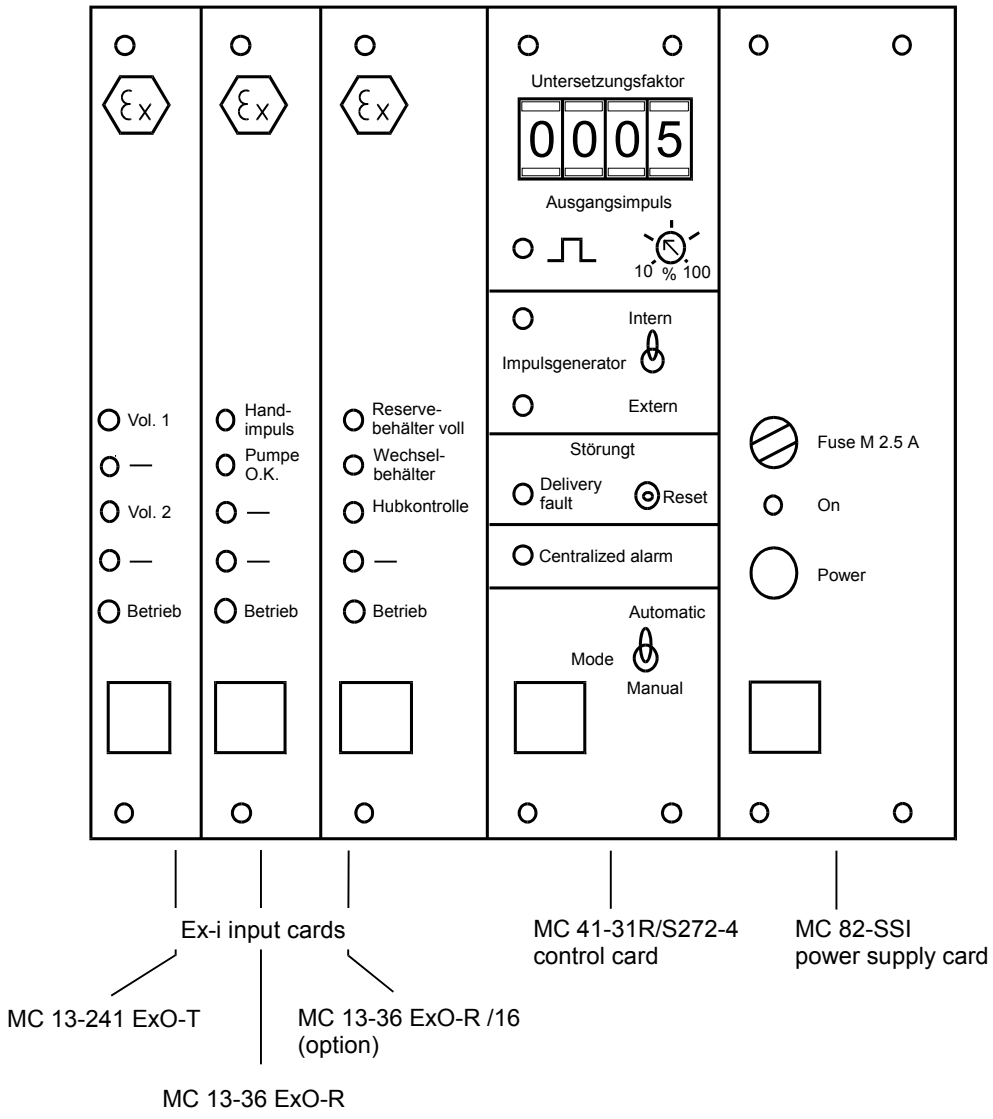


Fig. 1: 7IG-4/7EU-4 odorization control unit

Basically, there are three ways to control the proportioning pump:

– Through volume-proportional pulses outputted by a volume pulse transmitter. This provides constant odorant concentration in the gas flow.
– By means of an internal pulse generator enabling the proportioning pump to be controlled independently of a volume pulse transmitter.
– By pressing the manual button (25), the proportioning pump can be switched independently of the volume pulse transmitter and the internal clock-pulse generator (initiation of individual strokes).

The pulse sequence from the volume pulse transmitter or the internal pulse generator is converted via the control card to a pulse sequence which is appropriate for controlling the proportioning pump (max. 1.5 Hz). Scaling ratios of 1:1 to 1:9999 can be set via four button coding switches.

If a number of input pulses has been detected which equal the preset scaling factor, the control card outputs a signal which causes the proportioning pump to perform a stroke. At the same time, the output pulse indicator lights up. The length of the output signal can be set between 0.1 and 1 second (100% corresponds to 1 second).

Manual control is independent of the pulse scaler. Each time the manual button is pressed (and the "Mode" *(Betriebsart)* switch is in its "Manual" *(Hand)* position), a control signal is outputted to the proportioning pump.

Flow Monitor (Option)

The flow monitor (11) is installed vertically in the injection pipe of the proportioning pump. It monitors the delivery of the odorant into the injection pipe with each pump stroke. The flow monitor will operate if its pointer shows a deflection beyond the relevant limit (see page 15).

If there is no deflection on the flow monitor after a preset number of output pulses (adjustable from 1 to 9 on the control card, see chapter "Operation"), the control unit will indicate "Delivery fault" *(Förderfehler)*, and the relay at the terminals 28/30/32 will switch. "Delivery fault" will be indicated until you acknowledge this fault indication by pressing the reset button.

Float Switch (Option)

The float switch (14) in the reserve tank monitors the odorant level in the reserve tank.

If the odorant level falls below the minimum mark, the float switch will open a contact. This will cause the "Reserve tank full" *(Res. Behälter voll)* indicator to go out and the "Centralized alarm" *(Sammelstörmeldung)* indicator to light up. At the same time, the relays at the terminals 23/24 (min. level) and 27/29/31 (centralized alarm) will switch.

The functioning of the float switch can be checked by draining the reserve tank below the switching point (approximately 13 cm from the top edge of the reserve tank).
The current odorant level is shown by the measuring burette.

Safety Instructions

Our equipment is manufactured in conformity with current standards and regulations. The relevant certificates of conformity of the German Federal Institute of Physics and Metrology (PTB) are included in the annex. Nevertheless, dangers may occur if the equipment is operated wrongly.

The GOE 07 odorization system serves to add an odorant (tetrahydrothiophene or mercaptan) to odour-free natural gas.

Any persons installing or operating the GOE 07 odorization system must be familiar with current standards and regulations concerning protection against explosion hazards.

Follow the instructions below:

Explosion hazards
In this manual, this symbol warns you of explosion hazards. Follow the instructions given next to this symbol. As to explosion hazards, you must observe the following in particular:

- Tetrahydrothiophene (THT) which is mainly used as odorant is assigned to Explosion Hazard Group IIA, Temperature Class T4. Therefore, each area where this odorant is present is a location subject to explosion hazards. Electrical equipment used here must be appropriately designed.
- The control unit must be installed in a non-hazardous area.

Toxic odorant
Toxic odorant which is a hazard to the environment may be released by way of leakage. Leaks may occur when retightening the joints of Swagelok connections or if ambient temperatures violate the temperature range of +5°C to +40°C.

Damage to property
In this manual, this symbol warns you of possible damage caused to property. The instructions given next to this symbol tell you how to prevent damage to the GOE 07 odorization system.

In the event of improper intervention in the odorization system, all warranty claims shall expire.

Installation

Installation Site

When installing the mechanical system components, the guidelines mentioned in the relevant work sheets (e.g. G 280) of the German Association of Gas and Water Technology (DVGW) must be observed.

In accordance with these guidelines, odorization systems must not be installed in controller rooms. We would recommend installing the odorization system in a separate room protected from frost.

The control unit must be installed in an area not subject to explosion hazards.

Ambient temperatures must be in the range of +5°C to +40°C, otherwise the pump may become leaky due to flocculation occurring in the odorant.

The working solenoid of the pump is explosion-protected as per EEx e G4. The pump may be installed in hazardous areas.

The standard model of the GOE 07 odorization system is suitable for odorizing heating gases, especially natural gases. For odorization of other gases (e.g. oxygen), the relevant guidelines for installation and operation must be obtained from RMG.

Cabinets for installing odorization systems are available on request.

Mounting

The mounting plate is designed for wall or stand installation. In order to ensure self-priming operation of the odorization system, the installation height h1 must not exceed 1.1 m for THT and 0.9 m for mercaptan (measured from the lower edge of the interchangeable odorant tank to the lower edge of the odorization system). In addition, the control elements mounted at this height can easily be reached by the operator (Fig. 5).

You must observe the following when connecting odorant pipes:
– The injection pipe must be made of 6 x 1 mm stainless steel.
– PTFE tubes with stainless steel sheathing (available as accessories) should be used as connecting lines between the interchangeable odorant tank and the odorization system.
– The venting pipe downstream of the activated carbon filter must be made of 6 x 1 mm or larger steel piping and led into the atmosphere.

- Avoid leaks when installing odorant pipes. Odorant is toxic and a hazard to the environment and must not be released. We offer collectors preventing odorant from escaping into the sewage system or into the soil.
- All connections of the odorization system are provided with 6 mm Swagelok joints. Do not retighten these joints, otherwise they will become leaky. If you must do assembly work here, follow the assembly instructions for Swagelok joints in the annex.

Suitable odorant tanks as per DIN 30650

Only DIN/DVGW-approved transport odorant tanks complying with DIN 30650 Part 1 (THT) and Part 2 (mercaptan) may be used.

Volume in litres	Tank height h2 (THT) in mm	Tank height h2 (mercaptan) in mm
200	1000	985
100	–	895
50	835	895
25	470	505

Odorant tanks complying with DIN 30650 Part 1 for THT odorization have standardized "S" suction and "D" venting connections (Ermeto 12L DIN 2353).

RMG accessories

VA / PTFE tubes:
750 mm long, with preassembled connections for THT or mercaptan odorization.

Connecting tubes (12) should be installed with a rise from the interchangeable odorant tank to the odorization system. This ensures that no odorant will remain in the connecting tubes when the odorant tank is changed.

In the event of mercaptan odorization, additional quick-action shut-off couplings should be installed in the connecting tubes (see DIN 30650 Part 2).

Collectors:
VA material, with grid, collecting capacity 50, 100 or 200 litres**.**

Flow monitor (option)

The odorization system can be supplied with a flow monitor installed. Important for refits: The flow monitor must be installed **vertically** in the pressure pipe of the proportioning pump, upstream of the shut-off valve (20).

Electrical Connections

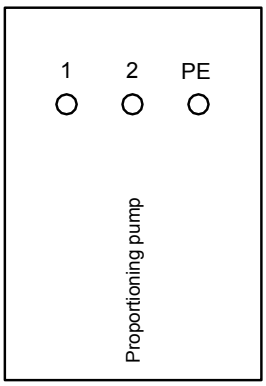
The German standards VDE 0100, VDE 0171 and VDE 0165 apply to the installation of the electrical equipment.

Tetrahydrothiophene (THT) which is mainly used as odorant is assigned to Explosion Hazard Group IIA, Temperature Class T4. Therefore, each area where this odorant is present is a location subject to explosion hazards.
Electrical equipment used here must be appropriately designed.

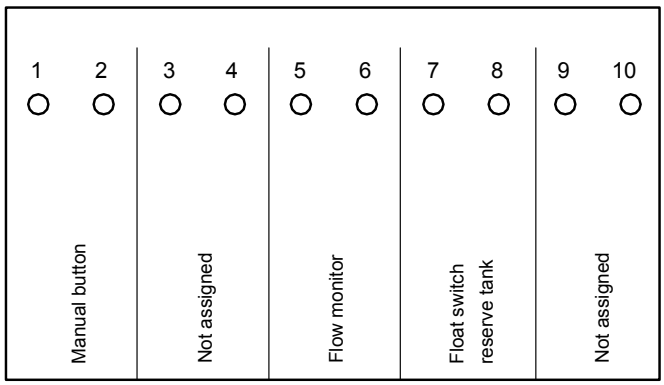
3 x 1.5 mm^2 NYY-J cable must be used for the line to the proportioning pump, whereas 0.25 to 0.5 mm^2 LIYCY cable (blue) must be used for all the other electrical connections.

Terminal Assignments for the Proportioning Equipment

EEx e terminal box (27)



EEx i terminal box (28)



Terminal Assignments for the Control Unit

Terminals

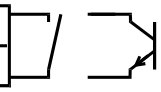
L
N
PE

230 V / 50 Hz mains supply

+
-
PE

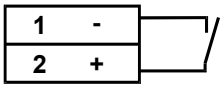
200 V DC connection for the proportioning pump

17	**+**
18	**-**

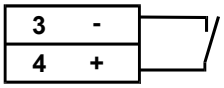


Input from the Non Ex volume pulse transmitter (corrector, demand meter, etc.)

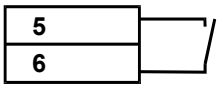
EEx i input terminals



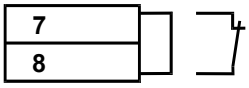
Input 1 from the volume pulse transmitter (corrector, gas meter) contact or Namur



Input 2 from the volume pulse transmitter (corrector, gas meter) contact or Namur



Input from the manual button



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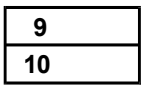

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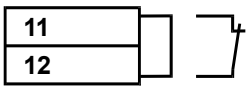
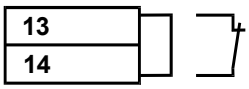
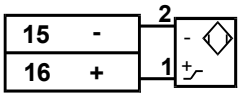


Input from the float switch in the 5-litre reserve tank (option)



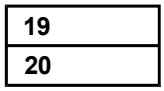
Input from the minimum contact of the level indicator of the odorant tank (option)



Input from the pulse transmitter (Namur) of the flow monitor (option)

The control unit is supplied with jumpers on the terminals 7/8, 11/12 and 13/14. Remove the jumpers when connecting these terminals.

Relay outputs, alarm indications



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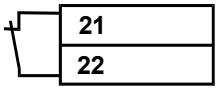

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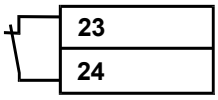
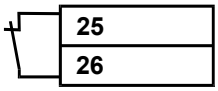
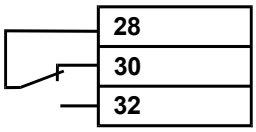


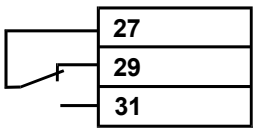
Indication of "Min. level in the reserve tank" *(Füllstand min. im Reservebehälter)*



Indication of "Min. level in the odorant tank" *(Füllstand min. im Odormittelbehälter)*



Indication of "Delivery fault of proportioning pump" *(Förderfehler Dosierpumpe)*



Centralized alarm indication. The relay operates with every fault occurring and indicates "Power failure" *(Netzausfall)*.

All alarm relays are closed in trouble-free operation and release when a fault occurs and in the event of a power failure.

Startup

Check whether the shut-off valve (20) to the injection pipe and the stopcock (19) are closed. Then open the shut-off valve (21) to the injection nozzle.

Initial Filling

When filling the system for the first time, you must fill the reserve tank (4) to its maximum mark using the hand vacuum pump (6) drawing odorant from the connected odorant tank. To do this, follow these steps:

- Make sure that the stopcocks (23) and (24) are closed.
- Open the stopcocks under the vacuum pump (18), the measuring burette (16) and the reserve tank (17).
- Then continuously actuate the vacuum pump by pulling until the odorant level reaches the maximum mark visible on the measuring burette.

Take care that the odorant level does not exceed the maximum mark and pump carefully if the reserve tank is nearly full. Otherwise the odorant may reach and damage the vacuum pump or escape.
In addition, care must be taken to avoid that the vacuum on the pressure gauge (10) exceeds p_v = 250 mbar, otherwise damage may be caused to the pressure gauge.

- Then close the stopcock under the vacuum pump (18) again.

Venting the Proportioning Pump

The proportioning pump can only be vented if the interchangeable odorant tank is connected, since odorant must be supplied back into the tank via the recirculating pipe.

If the reserve tank is filled, you can vent the proportioning pump as follows:

- Make sure that the stopcocks (16) and (17) under the measuring burette and the reserve tank are open.
- Close the shut-off valve (20) to the injection pipe and and then open the stopcocks (19) and (23). The vacuum will be compensated, and at the same time, the remaining air in the pipes and the pump will evacuate via the activated carbon filter.
- After approx. 1 minute, close the stopcock (23) again and rebuild up a vacuum (open the stopcock (18), pump until a vacuum of approx. 150 mbar is built up, and close the stopcock (18) again).
- Loosen the locking screw (knurled thumb screw) on the handwheel (8) of the proportioning pump and set the handwheel to 80 mm^3 per stroke.
- Set the coding switches on the control unit to "0 0 1 0" and the "Pulse generator" (*Impulsgeber*) switch to its "Internal" (*Intern*) position.
- Switch on the power switch.
  The proportioning pump will now operate at a frequency of 3600 strokes per hour.
- Then close the stopcock (17) and do not open it until the measuring burette is nearly empty (do not completely empty it!).
- Repeat the previous step about four times until you can see no more air bubbles in the measuring burette.
- Close the stopcock (19), and then open the shut-off valve (20) to the injection pipe.

The odorization system will now inject the preset odorant quantity via the injection pipe into the gas flow. To conduct a test for correct functioning, close the stopcock (17) under the reserve tank and monitor the measuring burette. The odorant level of the measuring burette will fall with each pump stroke.

Do not completely empty the measuring burette, otherwise you must repeat the venting process.

The system is now ready for operation. Open the stopcock (17) and switch off the control unit. You can now make your normal service settings on the proportioning pump and the control unit.

Flow Monitor (Option)

Type KCI-K 170

When starting up the system, you must adjust the limit indicator on the flow monitor approximately one third below the pointer deflection. Please note that a delivery volume of at least 60 mm³ per stroke is necessary to ensure proper functioning of the flow monitor. Follow these steps to adjust the flow monitor:

- Loosen the four screws on the front and remove the cover.
- Loosen the knurled nut on the left.
- Adjust the limit indicator by shifting it.
- Retighten the knurled nut.
- Screw the front cover on again.

In trouble-free operation, the "Stroke monitor" (*Hubkontrolle*) indicator lights up almost at the same time as the output pulse indicator on the control unit.

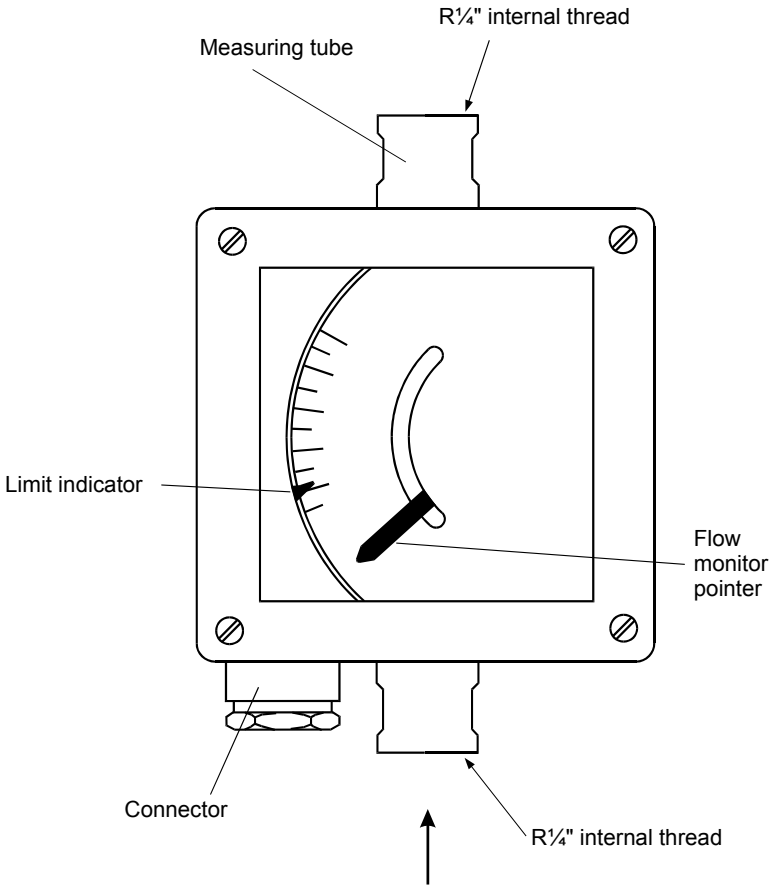
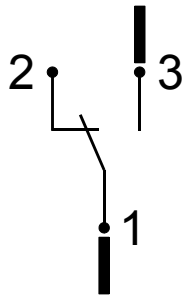


Fig. 2a: Flow monitor type KCI-K 170

Type FS 01



Pin assignment

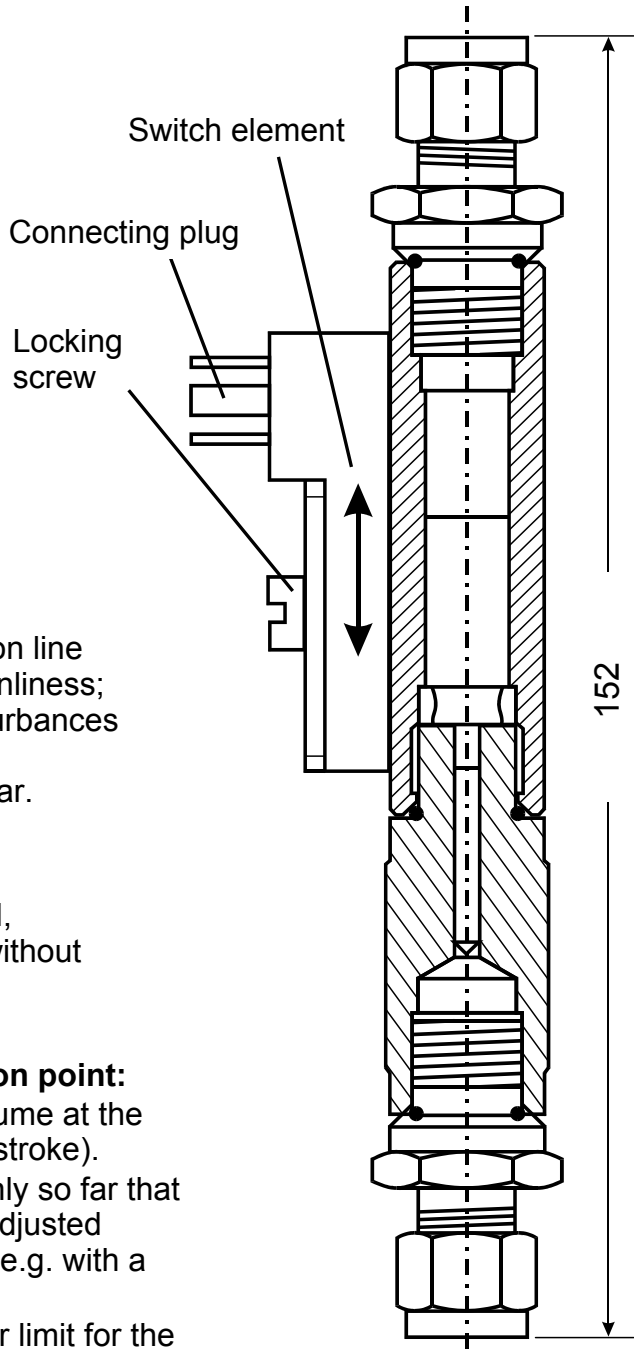


Fig. 2b: Flow monitor type FS 01

Installation:
Perpendicularly into the injection line (pay attention for extreme cleanliness; contamination can lead to disturbances or total failures)
Operating pressure max 100 bar.

Electrical connection:
terminals 1 and 3 with shielded, blue cable, core-end sleeves without isolation

Setting of the switch actuation point:

- Adjust the displacement volume at the dosing pump (min. 15 mm^3/stroke).
- Loosen the locking screw only so far that the switch element can be adjusted vertically by easy knocking (e.g. with a screwdriver).
- Find out the upper and lower limit for the switch actuation point under observation of the light emitting diode "stroke control" in the control unit and mark both limits on the scale.
- Then place the switch element centrically between the upper and lower marking and firmly tighten the locking screw again.

Operation

Normal Service Setting

Two different types of proportioning pumps are supplied, namely MH-6-47 and MH-6-65. Both operate at a maximum frequency of 5400 strokes per hour = 1.5 Hz.

If the maximum output frequency of the control pulses from the volume meter exceeds 1 Hz, you should reduce the input frequency on the control unit by means of the pulse scaler.
Pulse scaling is also necessary if the delivery volume of the proportioning pump to be set is too low (less than 15 mm^3 per stroke). In this case, set a higher delivery volume and increase pulse scaling by the same factor.

In continuous operation, the pump should be operated at a stroke frequency not exceeding 3600 strokes per hour (1 Hz) to protect the pump against excessive wear. A lower stroke frequency at the same delivery volume can also be achieved by setting a higher delivery volume and a higher scaling factor.

Setting the delivery volume

The delivery volume of the proportioning pump is limited by the operating pressure. The following maximum values apply:

Type	max. backpressure	max. displacement volume
MH-6-47:	40 bar	80 mm³
MH-6-65:	20 bar	150 mm³

To set the delivery volume, loosen the locking screw on the handwheel (8) of the proportioning pump. Then set the desired delivery volume (scale on the handwheel) and retighten the locking screw to protect your setting against unwanted readjustment.

The pulse signal from the electronic control system must be at least as long as the duration of the pump stroke. If you set a large delivery volume (stroke), it may be necessary to increase pulse duration on the control card.

Setting the stroke frequency

The frequency of pulses outputted by the volume transmitter or the internal pulse generator is scaled by the control card to a pulse sequence suitable for controlling the proportioning pump.

On the pulse scaler, you can set scaling ratios of 1:1 to 1:9999 by means of four button switches.

Example: Scaling ratio 1:20

Switches : 0 0 2 0

One pump stroke will be performed after 20 volume pulses.

After changing the scaling factor, you must acknowledge the new setting by pressing the reset button.

If the number of pulses corresponding to the scaling factor has been reached, the component will give a control signal to the proportioning pump.
At the same time, the output pulse indicator will light up.

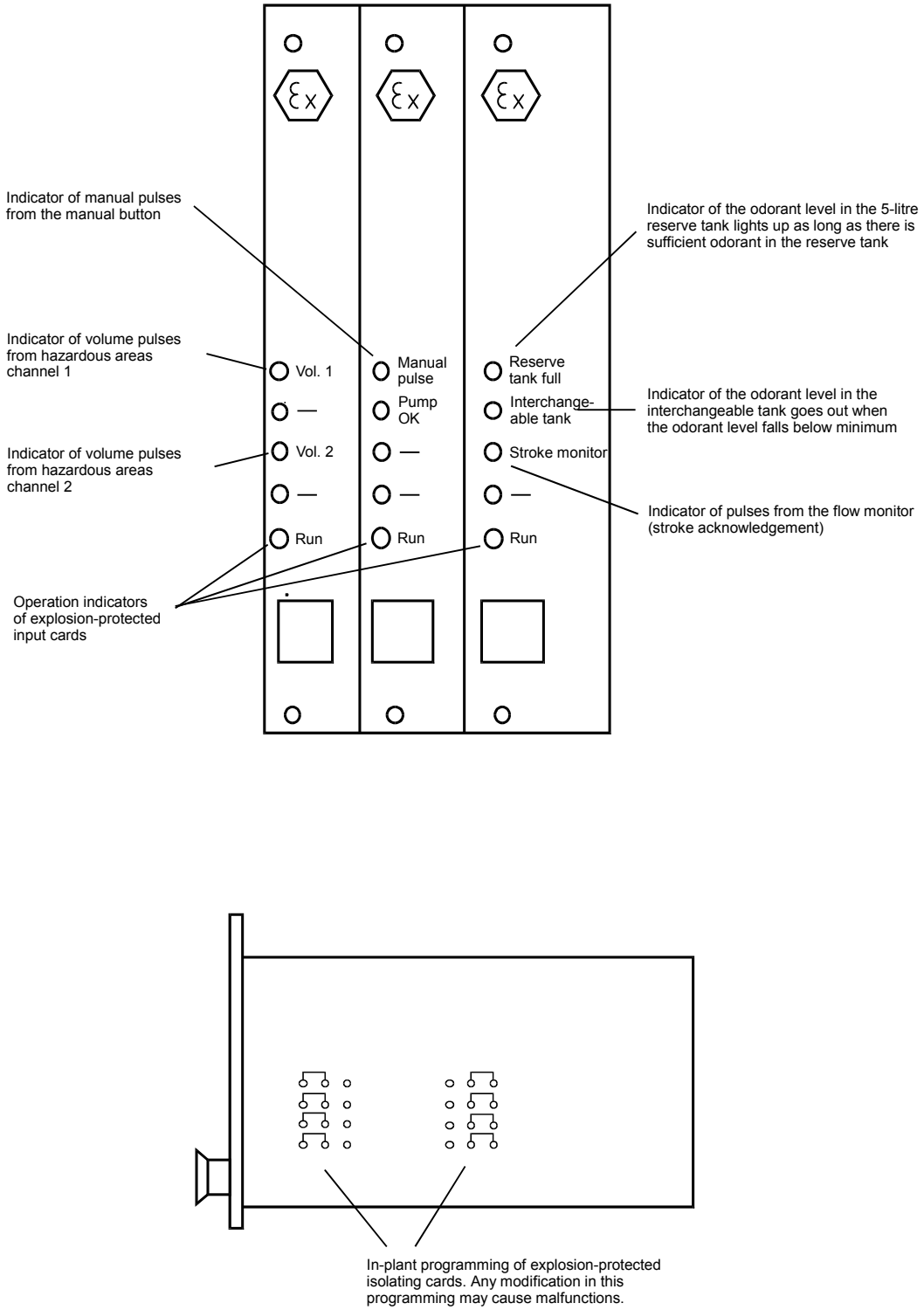


Fig. 3: Input cards

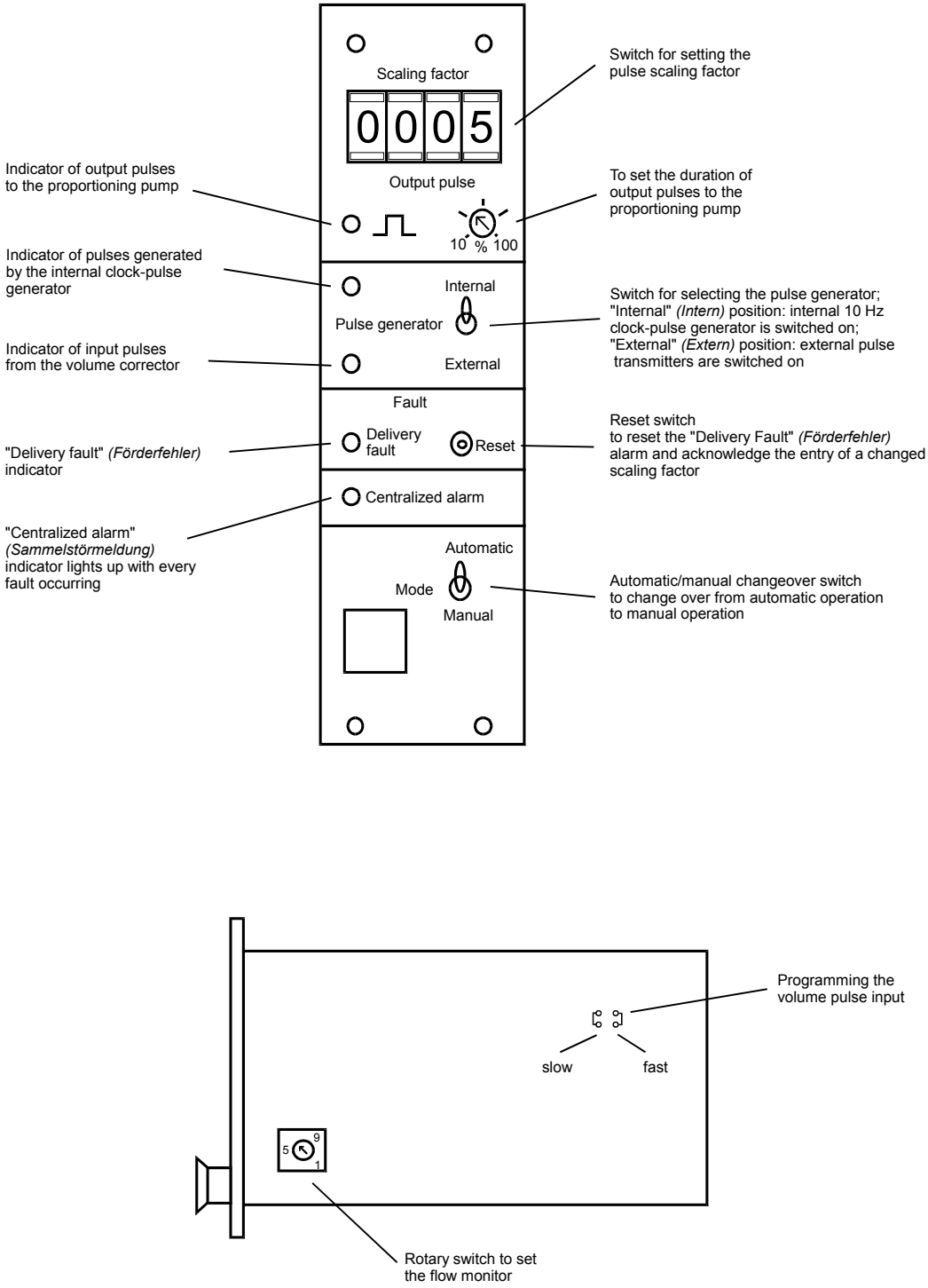


Fig. 4: Control card

Control Modes

Control via volume transmitter

The volume-proportional pulses from the volume transmitter enable the proportioning pump to be controlled in such a way that constant odorant concentration is achieved. Refer to the relevant bases of calculation on page 23.

In this case, the "Pulse generator" (*Impulsgeber*) switch on the control card must be in its "External" (*Extern*) position, while the "Mode" (*Betriebsart*) switch must be in its "Automatic" (*Auto*) position.

In the event of slow signals (generated by the relay switching action) coming from the volume transmitter, the jumper on the control card (see Fig. 4) must be in its "slow" (*langsam*) position. In the event of fast signals coming from an electronic control system, the jumper must be in its "fast" (*schnell*) position.

Internal control

If there is no volume transmitter available or if a time-constant odorant quantity is to be injected, an internal pulse generator (10 Hz) can be used.

For this purpose, the "Pulse generator" (*Impulsgeber*) switch must be in its "Internal" (*Intern*) position and the "Mode" (*Betriebsart*) switch in its "Automatic" (*Auto*) position.

Manual control

There is also an option to switch the proportioning pump independently of the volume transmitter or internal pulse generator.

For this purpose, the "Mode" (*Betriebsart*) switch must be in its "Manual" (*Hand*) position. Then a pump stroke will be initiated each time the manual button (25) is pressed.

Switching on the Flow Monitor

The rotary switch on the control card (Fig. 4 bottom) must be set either to 0 (flow monitor is switched off) or to a digit from 1 to 9. The "Delivery fault" (*Förderfehler*) alarm will be indicated after the preset number of non-acknowledged pump strokes has been reached.

Alarm Indications on the Control Unit

Indicator on the control unit	Fault	Relay output terminal Nos.
"Delivery fault" (*Förderfehler*) lights up	Pump does not deliver.	28/30/32 27/29/31
"Interchangeable tank" (*Wechselbehälter*) goes out "Centralized alarm" (*Sammelstörmeldung*) lights up	Minimum odorant level is reached in the interchangeable odorant tank.	25/26 27/29/31
"Reserve tank" *(Res.-Behälter*) goes out "Centralized alarm" (*Sammelstörmeldung*) lights up	Minimum odorant level is reached in the reserve tank.	23/24 27/29/31

– In normal operation, all relays are operated and the contacts are closed.
– In the event of the "Centralized alarm" (*Sammelstörmeldung*) and "Delivery fault" (*Förderfehler*) indications, both changeover contacts are taken to terminals in each case.
– In the event of a power failure, all relays will release.

Changing the Odorant Tank

To change the odorant tank, follow these steps:

- Let the vacuum of the system fall to 0. To do this, open the stopcock (23) and monitor the vacuum gauge (10).
- Lift the connecting tubes (12) to the odorant tank, so that the tubes can completely drain.
- Loosen the connecting tubes on the odorant tank and connect the new tank. Set up the odorant tank in such a way that the pipes to the odorization system are installed with a rise, if possible.
- Close the stopcock (23) again.
- To restart the system, open the stopcock (18) and use the hand vacuum pump to build up a vacuum of approximately 150 mbar.

If necessary, the reserve tank can now be replenished using the hand vacuum pump.

- Close the stopcock (18) again.

The vacuum will fall to the vacuum for the suction height h3 within a short time. Then the system will again be ready to run. If the vacuum continuously falls to 0, you must check the connections for leaks.

Closing Down the System

If you want to close down the system, switch off the power switch on the control unit and close the shut-off valve (20) to the injection pipe.

Bases of Calculation

The normal service setting of the odorization system is based on the desired odorant concentration

$$C \quad [mm^3/m^3]$$

and the standard gas volume to be odorized

$$V_n \quad [m^3/h]$$

Through the pulse value of standard volume measurement

$$PV_{VN} \quad [m^3/pulse]$$

the frequency of the input pulses on the control unit is obtained:

$$f_P = V_n / PV_{VN} \quad [pulses/h]$$

The input pulses on the control unit should be scaled if f_P exceeds 3600 pulses per hour in continuous operation or if the smallest settable displacement volume of the pump is violated downwards.

From the selected pulse scaling factor

$$S \ [pulses/stroke]$$

results the pump frequency

$$f_p = f_P / S \quad [pulses/h]$$

With each stroke of the proportioning pump, the following gas quantity is odorized

$$P_p = PV_{VN} \cdot S \ [m^3/stroke]$$

The displacement volume to be set results from the desired odorant concentration:

$$V_p = C \cdot P_p \quad [mm^3/stroke]$$

Example of calculation

The following system values are given:

Desired odorant concentration:	20	mm^3/m^3
Standard gas volume to be odorized:	10000	m^3/h
Pulse value of the volume transmitter:	2	m^3/pulse

This results in an input frequency on the control unit of

$f_P = V_n / PV_{VN} = 10000 / 2 = 5000$ pulses/h

Since the frequency is higher than 3600 pulses/h, pulses must be scaled.

$S = f_P / 3600 = 1.4 \Rightarrow$ **S = 2**

The gas quantity to be odorized with each pump stroke would thus be:

Pulse value · scaling factor = 2 · 2 = 4 m^3/stroke

Therefore, you must set the following displacement volume on the pump:

Displacement volume = desired concentration · volume/stroke

V_p = 20 · 4 = **80 mm^3**

Maintenance

The entire odorization system is maintenance-free to a large extent. Due to the particular importance of gas odorization, we would recommend that you check the correct functioning of the odorization system at weekly intervals.

In addition, you must comply with the requirements of the DVGW Guideline G280 regarding the checking and monitoring of odorization systems.

Draining the Reserve Tank

You can drain the reserve tank for repairs or servicing or for checking the correct functioning of the float switch in the reserve tank:

- To do this, set the automatic/manual changeover switch on the control unit to its "Manual" (*Hand*) position, so that the proportioning pump stops operating.
- Now open the two stopcocks (23) and (24). The odorant will then flow back into the interchangeable odorant tank.

To start up the system again, close the two stopcocks (23) and (24) and proceed as described in the chapter "Startup".

Activated Carbon Filter

The activated carbon filter (13) is intended to protect against unpleasant smells caused by odorant vapours escaping from the venting pipe. Therefore, it must be replaced at regular intervals. We would recommend that you change the activated carbon granules at least once a year.
To do this, screw off the filter pot. Then the filter cartridge will become visible.
Now you can screw out the filter cartridge and either change the granules or replace the entire filter cartridge.

Depending on the size of the two filter types, either 500 g or 1000 g of activated carbon granules are required.
The granules or the entire filter cartridge can be obtained from RMG.

Functional Test

The equipment operates properly if the "Centralized alarm" (*Sammelstörmeldung*) indicator does not light up. However, if the "Centralized alarm" (*Sammelstörmeldung*) indicator lights up, the fault can be located by means of the individual fault indication (see chapter "Operation").

– The "External pulse generator" (*Impulsgeber Extern*) indicator must light up with each pulse received from the volume corrector or gas meter.
– As soon as the number of pulses preset on the pulse scaler has been reached, the "Output pulse" (*Ausgangsimpuls*) indicator must light up.
– The "Stroke monitor" (*Hubkontrolle*) indicator must then light up for acknowledgement shortly after the output pulse (only if a flow monitor is connected).

Checking the pump

Open the stopcock (16) under the measuring burette and close the stopcock (17) under the reserve tank.
The odorant level of the measuring burette must fall with each pulse from the control unit.

Delivery check

- Set the "Mode" (*Betriebsart*) switch to its "Manual" (*Hand*) position.
- Open the stopcock (16) under the measuring burette and close the stopcock (17) under the reserve tank.
- Press the manual button until the odorant level can be read off.
- Now press the manual button to cause the pump to perform strokes at intervals of approximately 2 seconds.
  Record the volume delivered, the number of strokes and the volume set on the handwheel. One mark on the burette corresponds to an odorant quantity of 100 mm^3.

The deviation of the measured displacement volume from the required displacement volume should not exceed ±5 mm^3 per stroke.

Switching over to normal operation

Open the stopcock (17) and close the stopcock (16).
Set the "Mode" (*Betriebsart*) switch back to its "Automatic" (*Auto*) position.

GOE 07 Delivery Check

Date	Displacement volume, handwheel mm^3/stroke	Volume delivered, measuring burette mm^3/stroke	Number of strokes	Actual displacement volume measured mm^3/stroke	Displacement volume fault mm^3/stroke

Troubleshooting

In the event of improper intervention in the system, all warranty claims shall expire.

In the event of a malfunction, you must check whether the mechanical or electrical unit of the odorization system is affected.

Troubleshooting Table

Fault	Cause	Remedy
No stroke is performed by the pump, although the "Output pulse" (*Ausgangs-impuls*) indicator lights up.	Length of the output signal is too short.	Increase the length of the switching signal.
No stroke is performed by the pump, although voltage is applied to the terminals.	Solenoid actuator of the pump is defective.	Contact customer service.
High deviations in the delivery volume.	Pump is not properly vented. Valve is soiled. Pump is defective.	Vent pump. Clean valve. Contact customer service.
Vacuum indicator falls during normal operation.	Odorant tank is empty. Connections are leaking. Pump is defective.	Change odorant tank. Check connections. Run a delivery check.
"Delivery fault" (*Förder-fehler*) indicator lights up.	No more odorant is available. Pump is defective.	Check odorant. Contact customer service.
The pump does not deliver, and the oil in the sight glass has turned white.	The diaphragm of the pump has broken.	Contact customer service.

Flushing the Proportioning Pump

If it is necessary to remove the proportioning pump or clean the valves, you can flush the pump by means of a simple flushing process using spirit:

- Switch off the power switch.
- Close the shut-off valves (20) and (17).
- Open the stopcocks (19) and (16).
- Unscrew the vacuum gauge.
- Fill in the flushing liquid via the measuring burette using the supplied flushing bottle.
  If the liquid level in the measuring burette does not fall by itself, the flushing process can be supported by means of the pump.
- You can remove the pump after the flushing process has been completed.

Removing the Pump Ball Valves

After the flushing process has been completed, you can remove the ball valves:

- Loosen the screwed joints of the two bends leading to the pump head (suction and pressure pipes) and remove the two pipe sections.
- Unscrew the joints of the suction and pressure sides together with the ball valves.
- You can clean the valves without removing them further using flushing liquid or compressed air.
- Take care that you do not mix up the suction and pressure valves when reinstalling them.
- To reinstall the valves, proceed in reverse order.

Repairs

If odorization systems, proportioning pumps or parts of odorization systems must be repaired in the plant of RMG Meßtechnik GmbH, you should observe the following:

The German Toxic Substances Control Act and the German Ordinance on Dangerous Substances (GefStoffV) prohibit the release of liquid or gaseous odorants into the atmosphere.

In order to ensure this, all parts contaminated with odorant must be thoroughly cleaned before sending in the device for repair.

We would recommend that you use an odour-covering agent and a neutralizing agent for gas odorants, e.g.:

> "Penncover / Äthanol 641/642 verg. m. 1 % MEK"
> from Pennodorant

You are requested to certify to us on the enclosed declaration that such cleaning has been carried out. The relevant form is included in the annex. If we do not receive this declaration, we cannot make any repairs.

Technical Data

Total weight of the mechanical system without interchangeable odorant tank and collector: approximately 30 kg.

Option to connect the injection nozzle via weldolets (½", ¾" or 1").

Proportioning Pump

Type of pump	**MH-6-47**	**MH-6-65**
Displacement volume (mm³/stroke), steplessly adjustable	15 - 80	15 - 150
Max. number of strokes per hour*	5400	5400
Max. operating pressure (bar) at max. delivery volume	40 Higher pressures are available on request.	20
Solenoid actuator	Single solenoid actuator with the degree of protection EEx e G4, 200 V/DC 0.133 A, 100% cyclic duration factor	
Design	Enclosed pump with stainless-steel diaphragm and ball valves	
Parts in contact with fluids	Stainless steel 1.4571, 1.4404, 1.4401	
Injectable fluids	Liquids (e.g. THT, mercaptans)	
Ambient temperature range	+5 to +40 °C	

*In order to protect the pump against excessive wear, you should operate it at a frequency of less than or equal to 3600 strokes per hour in continuous operation.

Control Unit

Dimensions	7IG-4: LxWxD 215x250x260 7EU-4: 19" rack-mounting unit 42 depth units, 3 height units
Operating voltage	230 V AC /50 Hz
Pulse scaler	Scaling of externally and internally generated pulses, adjustable from 1:1 to 1:9999
Pulse generator	Internal, operates at 10 Hz clock frequency, adjustable via pulse scaler

Inputs

– Volume pulse inputs 1 and 2
Intrinsically safe [EEx ia] II C; for controlling with contact, transistor or NAMUR initiator; maximum input frequency: 500 Hz
Input pulse length: ≥ 1 ms

– Non Ex volume pulse input
Input for controlling with pulses from non-hazardous areas;
for controlling with contact or transistor;
U = 24 V
Maximum input frequency: 500 Hz
Pulse length: ≥ 1 ms

– Input from the manual button
Intrinsically safe [EEx ia] II C; to connect the manual button

– Input from the flow monitor
Intrinsically safe [EEx ia] II C; to connect the flow monitor (NAMUR initiator)

– Input from the float switch in the reserve tank and the level indicator of the interchangeable odorant tank
Intrinsically safe [EEx ia] II C; to connect the float switch in the reserve tank and the level indicator of the interchangeable odorant tank

Outputs

– Pump control
200 V DC max. 0.5 A

Alarm outputs for:
– Min. level, reserve tank
– Min. level, interchangeable odorant tank
– Delivery fault
– Centralized alarm
1 changeover contact each of max. 250 V/2 A
(break contact opens in the event of a fault or power failure)

Collectors (Accessories)

All collectors are provided with a grid, material: VA.

Max. collecting capacity	Dimensions	Wall thickness
50 ℓ	1000 x 382 x 168 mm	2 mm
100 ℓ	1000 x 650 x 168 mm	3 mm
200 ℓ	1000 x 850 x 250 mm	3 mm

Other sizes are available on request.

Activated Carbon Filters (Accessories)

Activated carbon filters with screw couplings and fastening lugs can be supplied with a content of 500 g or 1000 g.

Flow Monitor Type FS 01 (Option)

Reed kontakt für Ex i Stromkreis, passives Schaltelement, die wirksame innere Induktivität und Kapazität sind vernachlässigbar klein.

- Contact load: 500 V - 1.5 A - 50 VA
- Operating pressure: max 100 bar
- Operating temperature: max 120°C
- Inlet and outlet: SWAGELOK pipe connections for pipe Ø 6 mm

GOE 07 Gas Odorization System

(Mechanical System)

1. Mounting plate
2. Proportioning pump
3. Injection nozzle
4. Reserve tank
5. Interchangeable odorant tank
6. Hand vacuum pump
7. Sintered metal filter
8. Handwheel
9. Measuring burette
10. Vacuum gauge
11. Flow monitor (option)
12. Connecting tubes
13. Activated carbon filter
14. Float switch, reserve tank
15. Stainless steel collector
16. Stopcock, measuring burette
17. Stopcock, reserve tank
18. Stopcock, vacuum pump
19. Stopcock, starting circuit
20. Shut-off valve, injection pipe, with restrictor
21. Shut-off valve, injection nozzle
22. Non-return valve
23. Venting valve, reserve tank
24. Drain valve, reserve tank
25. Manual button
26. Connection box, proportioning pump
27. Intrinsically safe (EEx i) connection box for manual button, flow monitor and float switch
28. Holding device for tubes
29. Flushing device (option)

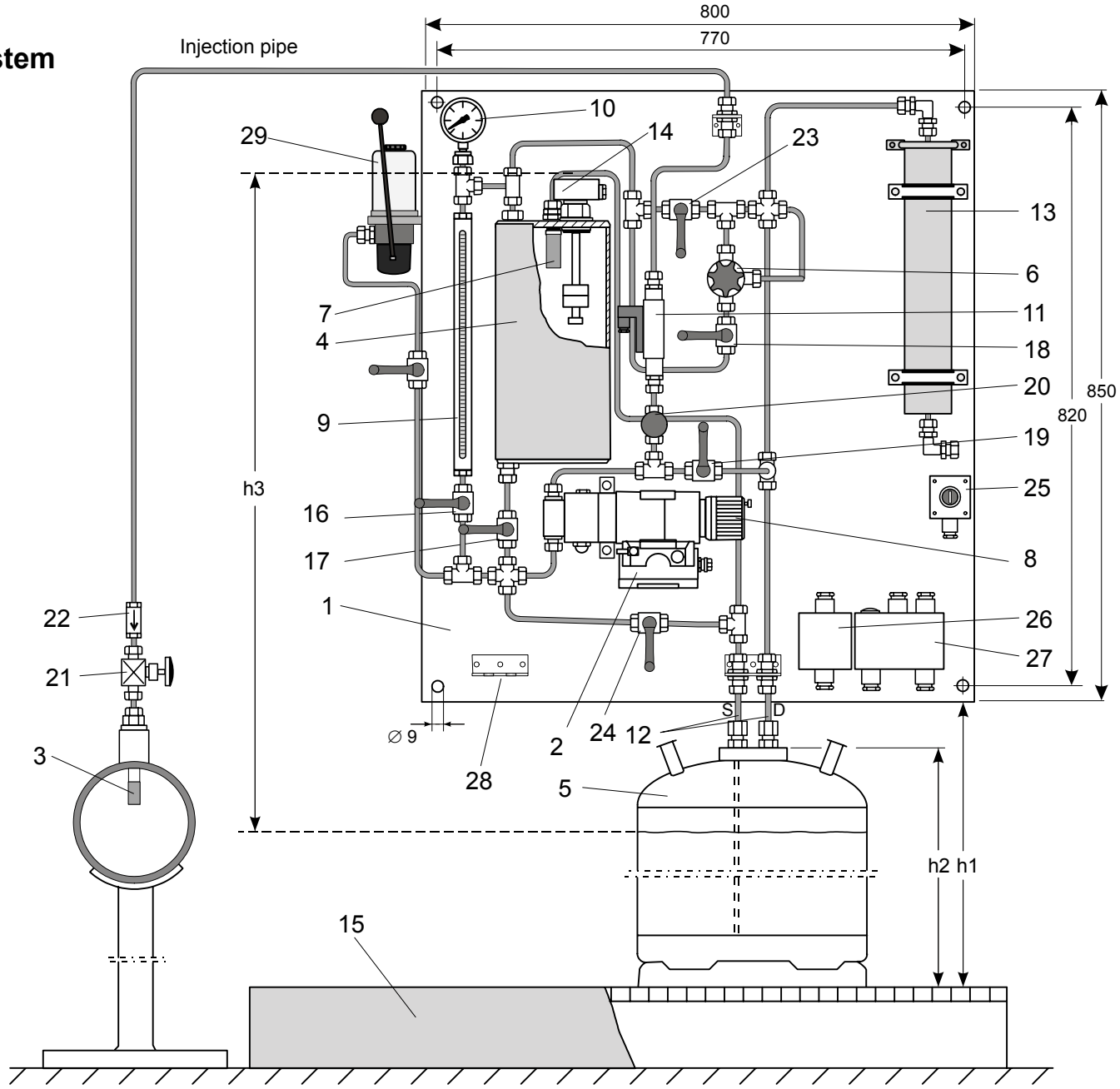


Fig. 5

Annex

Assembly Instructions for Swagelok Connections

Information Sheet

Declaration Form Concerning Equipment for Repair

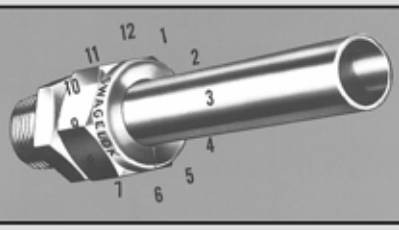
Certificates of Conformity Issued by the German Federal Institute of Physics and Metrology (PTB)

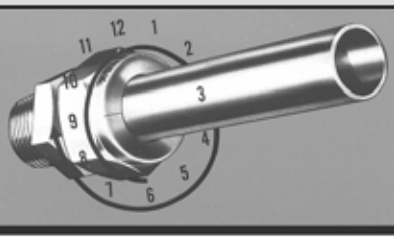
ASSEMBLY INSTRUCTIONS FOR Swagelok® PIPE CONNECTIONS

INITIAL ASSEMBLY

1 Cut pipe perpendicularly and remove fins. Insert pipe into fitting until stop is reached. Tighten nut with fingers only.

2 Prior to tightening the SWAGELOK nut, mark it in the 6 o'clock position.





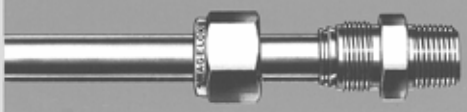
3 Then tighten nut with **1¼ turns*** until marking reaches the 9 o'clock position.

* For pipe connections sized 2, 3, 4 mm or 1/16", 1/8", 3/16", you must tighten the nut with a ¾ turn during initial assembly.

REASSEMBLY

1 Removed fitting

2 Insert pipe with clamping rings into fitting until stop is reached.



3 Tighten nut with fingers only, then use wrench to tighten it with approximately ¼ turn.

Information Sheet

for repairs of

odorization systems,
odorization pumps and
parts of odorization systems

in the manufacturing plant of
RMG Meßtechnik GmbH

The German Toxic Substances Control Act and the German Hazardous Substances Ordinance (GefStoffV) prohibit the release of liquid or gaseous odorants into the atmosphere.

In order to ensure this, all parts contaminated with odorant must be thoroughly cleaned before sending the device for repair.

You are requested to certify us on the enclosed declaration that such cleaning has been carried out. If we do not receive this declaration, we cannot make any repairs.

We would recommend you to use an odor covering and neutralizing agent for gas odorants

e.g.: "Penncover / Ethanol 641/642 verg. m. 1 % MEK"
from Pennodorant

Declaration

Reply to:

RMG Messtechnik GmbH

Otto-Hahn-Str. 5
D-35510 Butzbach (Germany)

Company name: _____

Street: _____

City: _____

Name: _____

Phone: _____

Fax: _____

Device for repair / Replacement device

Type: _____

Serial No.: _____

☐ **Prior to shipment, the device was cleaned using:**

_____

☐ **The device is free from any hazardous material in conformity with the German Toxic Substances Control Act and the German Ordinance on Dangerous Substances (GefStoffV).**

The device was in contact with the following odorant (trade name of the odorant):

☐ TETRAHYDROTHIOPHENE (THT)

☐ SCENTINEL E

☐ Other – Please state exact designation:

_____

_____

Date: _____ Signed by: _____