



ISO 9001

## Air / Gas Ratio Controller

SKP50...



The SKP50... controls the differential pressure in the gas supply line in function of the differential pressure in the supply air duct.

The air / gas volume ratio thus remains constant regardless of air volume changes.

The SKP50... also provides the functions of a safety shutoff valve to EN 161 when used in connection with Landis & Staefa gas valves type VG...

The SKP50... and this data sheet are intended for use by OEMs which integrate the air / gas ratio controller in their products!

## Use

Control of the air / gas volume ratio on multi-stage or modulating gas burners with a central or decentral air supply.

Major fields of use:

- In burner plants with integrated heat recovery systems
- On burners with an adjustable air / gas mixing facility in the burner head
- In plants where, in the case of load changes, the pressure conditions in the burner and in the combustion chamber **do not** change in a linear fashion
- In plants with negative pressures on the gas or air side

With the SKP50... - in contrast to conventional compound control - air volume variations caused by

- ⇒ mains voltage fluctuations
- ⇒ dirty fan wheels
- ⇒ changes in the combustion chamber pressure
- ⇒ associated heat recovery systems

have no impact on the quality of the combustion process.

When using the SKP50..., a separate gas pressure governor is **not** required.

Since the integrated gas pressure controller does not cause any additional pressure losses, a smaller valve size than usual can be chosen on most applications.

The usual measures required for ensuring the minimum air volume must also be taken when using the SKP50....

## Warning notes



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To avoid personal injury, damage to property or the environment, the following warning notes should be observed!

It is not permitted to open, interfere with or modify the air / gas ratio controller!

- Before performing any wiring changes in the connection area of the SKP50..., the controller must be completely isolated from the mains supply!
- Check the wiring, the connections of the impulse pipes and all safety functions to eliminate the risk of explosions!

## Engineering notes

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- Installation of the impulse pipes
    - The impulse pipes **must** be run such that the differential pressure will be measured with no impact from disturbances.  
The impulse pipes at the measurement points **may not** protrude in the flow, but **must** be flush with the inner wall of the pipe or duct
    - Minimum inside diameter of the impulse pipes 6 mm
  - **Recommendation:**  
Minimum distance of the connecting point for the gas impulse pipe from the gas valve: 5 x the nominal valve size
  - All impulse pipes connected to the SKP50... **must** be as short as possible, enabling the controller to respond quickly to sudden load changes
- Notes on the design of the gas train
    - If the available gas pressure exceeds the valve's maximum permissible operating pressure, the gas pressure **must** be lowered by means of a pressure controller upstream of the gas valve
      - ⇒ Refer to data sheet 7651
    - Install a gas pressure monitor on the outlet side of the SKP50...
    - With the SKP50... , the gas pressure monitor for the minimum gas pressure must **always** be installed upstream of the valve
    - The usual measures required for ensuring the minimum combustion air volume must also be taken when using the SKP50...

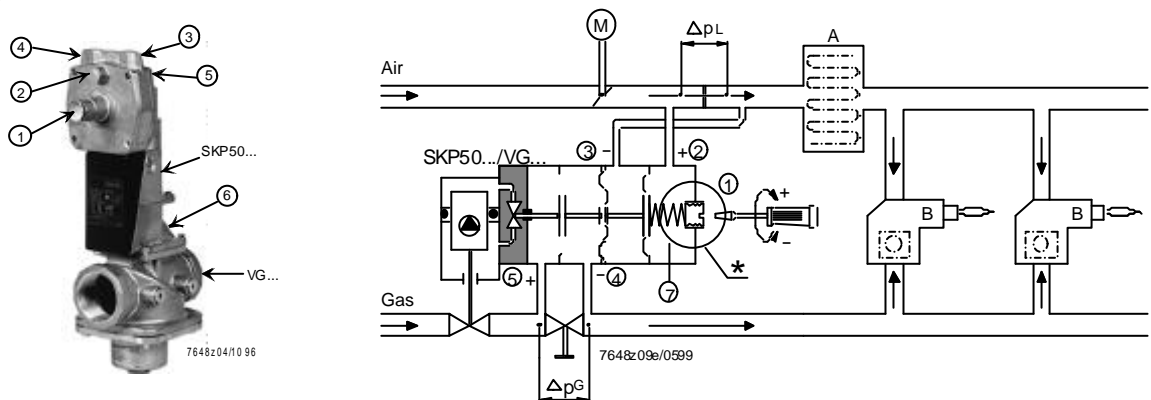
## Mounting notes

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- The relevant national safety regulations must be observed!
  - The mounting instructions supplied with the SKP50... must be observed!

## Installation notes

- Installation and commissioning work may **only** be carried out by qualified staff!
- Before putting the SKP50... into operation, check the wiring carefully!
- Adjustment of the controller on modulating burners prior to startup:
  - The setting screw (1) on the SKP50... should be adjusted such that the gas / air ratio curve intersects the zero point.  
The controller is supplied with this setting.  
If required, on site readjustments can be made as follows:
    - Fit the cap before measuring the combustion value and after making the setting
    - Turn the setting screw (1) in anti-clockwise direction until the spring (7) becomes completely loose
    - Shut off the gas supply to the SKP50...
    - Switch the SKP50... on.
    - Turn the setting screw (1) in clockwise direction until the valve opens
  - Set the adjustable orifice to the precalculated value.  
That value with the same pressure differential on the air and gas side **must** result in largely stoichiometric combustion
  - Start the burner up and run it at about 90 % of its nominal output
  - Measure the quality of combustion and adjust the flow rate by means of the adjustable orifice until optimum values are obtained (fine tuning)
  - Return to low-flame operation.  
Check the combustion and, if necessary, readjust the working characteristic with the setting screw (1) on the SKP50... until optimum values are obtained.  
Direction of rotation:
    - Clockwise  $\Rightarrow$  more gas
    - Anti-clockwise  $\Rightarrow$  less gas, which means parallel displacement of the working characteristic towards lack of air
  - Limit the air damper position (M) for low-flame operation
  - If a considerable parallel displacement of the working characteristic was required, the adjustment at 90 % of the full output **must** be checked again and corrected if necessary
  - Run the burner to the required nominal output using the air damper (M) and limit the air damper position for this output
  - Check the flue gas values at several levels of the output range.  
If readjustments are necessary:
    - In the nominal output range, readjust with the orifice
    - In low-flame operation, readjust with the screw (1) on the SKP50...

## Basic diagram



- \* **Notes on safety:**
- Air damper / orifice **must always** be located as shown, that is, downstream from regulating units
  - Combustion values **must** be checked with the cap fitted

### Legend

- |   |   |              |   |
|---|---|--------------|---|
| ① | Adjustm. of parallel displacement of the working characteristic | $\Delta p_G$ | Diff. press. across the orifice on the gas side |
| ② | Connecting nipple for the air pressure (+)                      | $\Delta p_L$ | Diff. press. across the orifice on the air side |
| ③ | Connecting nipple for the air pressure (-)                      | A            | Air heater, recuperator                         |
| ④ | Connecting nipple for the gas pressure (-)                      | B            | Burner  |
| ⑤ | Connecting nipple for the gas pressure (+)                      | M            | Air damper actuator                             |
| ⑥ | Indication of stroke  |              |   |
| ⑦ | Spring  |              |   |

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### Actuator

The electro-hydraulic actuator consists of

- a cylinder filled with oil
- an electric oscillating pump with piston and check valve

The relief valve, which is hydraulically actuated by the pump pressure, is located in the bypass between the suction and the pressure side of the pump.

The cylinder carries a seal which hydraulically separates the inlet from the outlet side of the pump, also serving as a guidance for the piston. The rod transfers the travel of the piston directly to the valve stem.

In addition, the piston is guided by a rod which is rigidly connected to the piston.

The rod carries a disk the position of which is visible through a window in the console  
⇒ Indication of stroke

Using a lever system, the disk also actuates the auxiliary switch (if fitted) to indicate the fully closed position or other positions.

The switching position is adjustable over the entire stroke.

The setting screw is located in the terminal compartment.

### Gas pressure controller

The gas pressure controller is attached to the valve actuator and has three diaphragms which, via a lever system, actuate a ball valve located in the bypass between the suction and the pressure side of the pump.

On the diaphragm,

- the differential pressure of the combustion air orifice downstream from the damper acts on the one side
- the differential gas pressure of the adjustable orifice downstream from the valve on the other



The differential pressure ratio is 1:1

⇒ The differential pressure on the gas side equals the differential pressure on the air side

Other gas / air volume ratios require an appropriate modification of one of the differential pressure orifices or the use of an adjustable device, such as a

- valve
- flap
- or similar

### Valves

Refer to «Type summary».

## Type summary

### Actuators

Electro-hydraulic, with attached air / gas ratio controller

		Without auxiliary terminal	With auxiliary terminal
AC 220...240 V	Without auxiliary	SKP50.110C27	
	With auxiliary switch	SKP50.111C27	SKP50.111C27R
AC 100...110 V	With auxiliary switch	SKP50.111C17	SKP50.111C17R

### Valves

The SKP50... can be used in connection with the following types of valves:

Type reference	Suitable for	Data sheet
VGG.../VGF.../VGH...	<ul style="list-style-type: none"><li>• Natural gas</li><li>• Town gas</li><li>• Liquid gas</li></ul>	7641
VR...	Slightly aggressive biogas	7633
VL...	Cold or hot air	7637
VGD...	<ul style="list-style-type: none"><li>• Natural gas</li><li>• Town gas</li><li>• Liquid gas</li></ul>	7631

All data contained in the above mentioned data sheets also apply when the valves are used in connection with the SKP50... .

**Exception:** minimum flow rate required (refer to «Technical data»).



If the actuators are used with gas valves of other manufacture, it must be ensured that the maximum stroke of 18 mm will **not** be exceeded.  
If such gas valves are used, please contact Landis & Staefa.  
A mechanical stop **must** be provided!

### Accessory

Manual adjustment for VG... gas valves: - AGA61

## Ordering

When ordering, please give the type references. The actuator complete with the controller and the valve must be ordered as separate items.

### Example:

Air / gas ratio controller, AC 220 V, with auxiliary switch:  
– SKP50.111C27  
– VG... valve (refer to «Type summary» and «Dimensions»)  
– AGA61

## Technical data

### Actuator and controller

Mains voltage	AC 220 V -15 %...AC 240 V +10 % AC 100 V -15 %...AC 110 V +10 %	Nominal frequency	50...60 Hz ±6 %
Power consumption	9...13 VA (depending on the mains voltage)	Setting range of auxiliary switch	4...96 % stroke
Switching capacity of the built-in auxiliary switch	6 (2) A, AC 250 V	On time	100 %
Compensating variable	Differential pressure of the combustion air	Differential pressure ratio gas / air	1:1
Perm. differential pressures the controller may be subjected to during operation	Gas / air	Perm. test pressure (gas)	1 bar
	min. 0.3 mbar	Perm. negative pressure (gas)	200 mbar
	max. 200 mbar	Closing time in the event of a power failure	< 1 s
Mounting orientation		Degree of protection	IP 54
- Optional		Weight	approx. 1750 g
- But with the diaphragms always in the vertical position		Min. period of time required when load changes from high- to low-flame	approx. 5 s
- From DN65 (2½ in.) <b>never</b> with the actuator in a suspended position		Control accuracy	typically Δpmin 0.5 %... Δpmax. 10 %
- When controller is inclined by 30...60°, the dead time may reach 1 s!			



#### Environmental conditions

<b>Transport</b>	IEC 721-3-2
Climatic conditions	class 2K2
Temperature range	-40...+60 °C
Humidity	< 95 % r.h.
Mechanical conditions	class 2M2
<b>Operation</b>	IEC 721-3-3
Climatic conditions	class 3K5
Temperature range	-15...+60 °C
	At temperatures below 0 °C, the opening times will become longer
Humidity	< 95 % r.h.



**Condensation, formation of ice and ingress of water are not permitted!**

#### CE conformity

According to the directives of the European Union  
Electromagnetic compatibility EMC  
89/336 EEC incl. 92/31 EEC  
Directive for gas appliances 90/396 EEC

### Valves

Refer to «Type summary»

Weights without actuator

VGG¾"	approx. 0.8 kg	VGF40	approx. 6 kg
VGG1"	approx. 0.75 kg	VGF50	approx. 7.5 kg
VGG1½"	approx. 1.4 kg	VGF65	approx. 15.3 kg
VGG2"	approx. 1.95 kg	VGF80	approx. 17.9 kg
VGG3"	approx. 13.4 kg		
		VGD20.403	approx. 3.2 kg
VGH80	approx. 16.3 kg	VGD20.503	approx. 3.1 kg
VGH100	approx. 18.6 kg		
VGH125	approx. 23.4 kg	AGA41	approx. 270 g
		AGA51	approx. 270 g

## Function

When the gas valve is closed, during the pre-purge and pre-ignition time, only the differential pressure of the air supplied by the fan acts on the controller.

It causes the diaphragm on the air side to move so that the ball valve in the actuator's bypass will close.

The actuator can open the valve if, at the beginning of the safety time, it receives an appropriate command from the burner control.

When the gas valve opens, the differential pressure downstream from the valve immediately increases, and thus at the controller's gas diaphragm also.

As soon as the forces acting on the diaphragms are in equilibrium, the ball valve in the actuator's bypass will be opened to such an extent that the return flow through the bypass and the flow delivered by the pump are identical.

The piston of the actuator and the valve disk remain in the position reached.

If, with more demand for heat, the burner's air damper opens further, or the fan speed increases, the controller will close the ball valve again - due to the greater differential pressure on the diaphragm on the air side - so that the actuator will open the gas valve further until the forces acting on the controller's diaphragm are in equilibrium again.

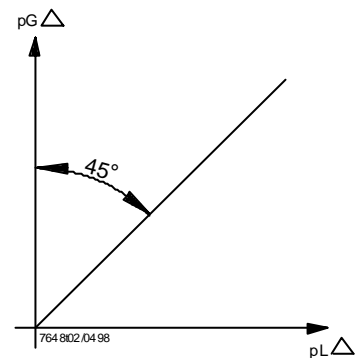
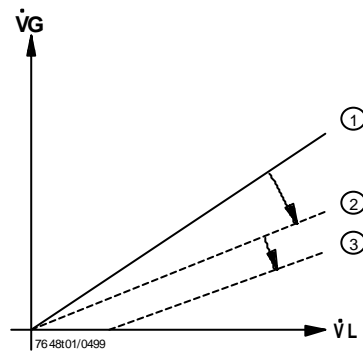
The gas / air differential pressure ratio and the gas / air volume ratio remain constant over the entire output range.

Because of the smaller mixing energy in low-flame operation, it is often necessary to provide somewhat more combustion air in order to ensure optimum combustion.

For that purpose, the controller's working characteristic can be displaced parallel, either towards excess air or lack of air, in order to somewhat increase the air number in low-flame operation.

This setting can be made while the burner is running. Always make the measurement with the cap fitted.

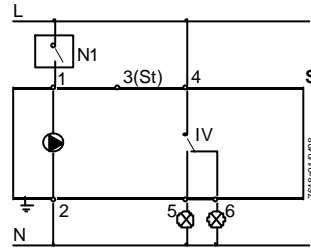
## Function diagrams



### Legend

- ① Gas / air ratio for stoichiometric combustion
  - ② Adjusted gas / air ratio for burner operation with excess air.  
The percentage of excess air is constant over the entire load range.  
Adjustment of the gas / air ratio with the orifice on the gas or air side
  - ③ In low-flame operation, the parallel displacement of the working characteristic produces a larger percentage of excess air.  
The controller allows a parallel displacement either towards excess air or lack of air.  
The parallel displacement is made with the setting screw (1) on the SKP50...
- $\dot{v}G$  Volumetric gas flow
- $\dot{v}L$  Volumetric air flow

# Connection diagram



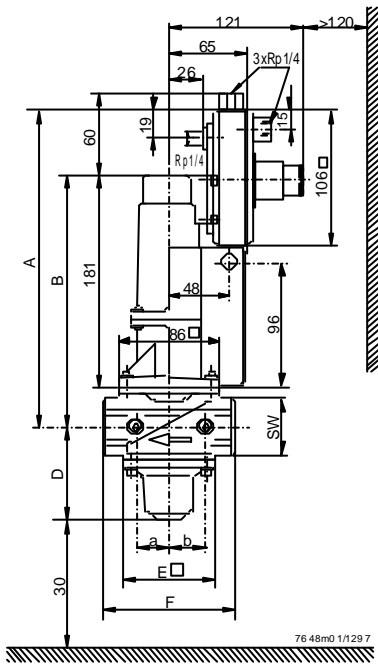
## Legend

- IV Adjustable (refer to «Technical data»)  
⇒ Only for versions with auxiliary switch (refer to «Type summary»)
- N1 Controller, switch, ...
- (St) Auxiliary terminal, only available with the versions having type suffix ...R (refer to «Type

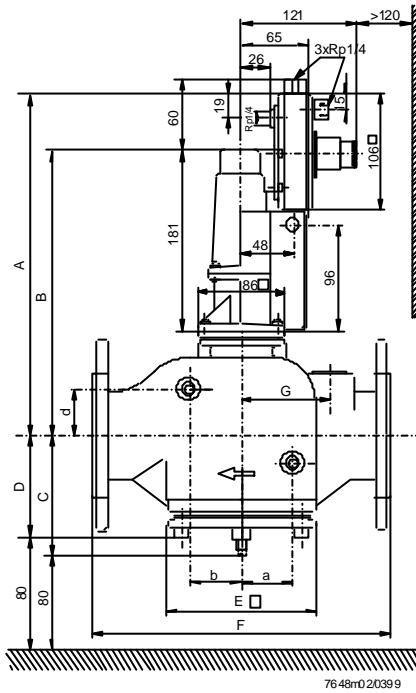
# Dimensions

Dimensions in mm

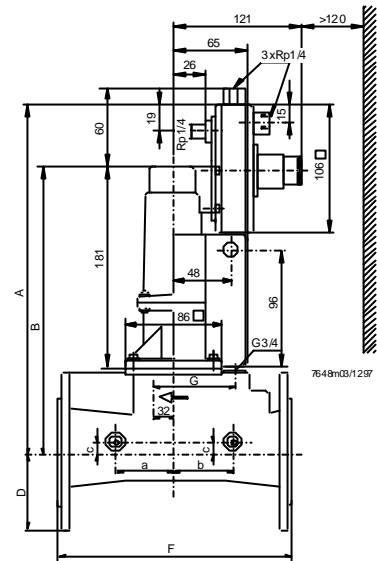
SKP50... with VGG...



SKP50... with VGF...



SKP50... with VGH...



## Table of dimensions

Type	DN <sup>1)</sup>	A	B	D	E	F	G	H	a	b	c	D	SW <sup>2)</sup>
VGG...	¾"	261	213	79	80	110	---	---	31	28	---	---	46
	1"	261	213	79	80	110	---	---	31	28	---	---	46
	1½"	270	222	102	126	150	---	---	36	36	---	---	60
	2"	279	231	107	126	170	---	---	42	42	---	---	75
	3"	344	296	100	146	310	90	70	50	50	36	51	120
VGF...	40	270	222	102	126	200	---	---	36	36	---	---	---
	50	279	231	107	126	230	---	---	42	42	---	---	---
	65	324	276	92	146	290	90	60	50	50	25	46	---
	80	344	296	100	146	310	90	70	50	50	36	51	---
VGH...	80	388	340	100	---	310	134	---	95	95	20	---	---
	100	395	347	120	---	350	134	---	95	95	20	---	---
	125	407	359	125	---	400	134	---	95	95	20	---	---

## Legend

- 1) Threads to ISO R7/1  
Flanges PN16 to ISO 2084
- 2) Width across flats