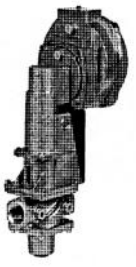
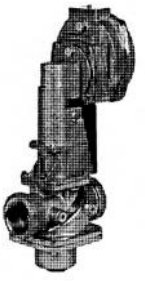
Air/Gas Ratio Controllers SKP70...

FM739/1

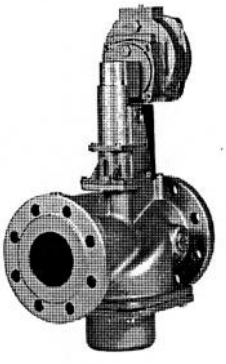
For supplementary Data Sheets, refer to «Type Summary/Valves»



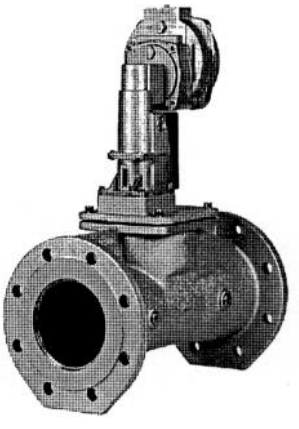
SKP70...VGG/1"



SKP70...VGG/2"



SKP70...VGF/DN80



SKP70...VGH/DN125

Air/gas ratio controller
with integrated safety shutoff function for natural gas, town gas or liquid gas in the low pressure range.

Electro-hydraulic actuator, delayed opening, rapid closing.

Application

The SKP70...air/gas ratio controller for forced draught gas burners controls the gas pressure in function of the pressure of the combustion air so that the gas to air ratio remains constant over the entire output range (shifting the desired value by the static pressure of the combustion air).

Changes in the air volume that are caused by voltage fluctuations, contamination of the fan wheel and the like, have therefore no impact on the efficiency of the combustion process – in contrast to conventional compound control.

With the SKP70... controller, deviations from the correct gas to air ratio caused by varying pressure in the combustion chamber can be eliminated in a straightforward manner. To achieve this, the controller is provided with an additional impulse pipe which connects the controller to the combustion chamber so that the pressure in the combustion chamber can be used as a disturbance value in a compensating circuit (refer to «Function»).

When using the SKP70..., a separate gas pressure governor is not required. The gas train is thus shorter, simpler and offers considerable cost savings.

Since the integrated governor does not cause any additional pressure losses, a smaller valve size than usual can be used in most applications. For control reasons, it is even desirable to have the valve size as small as possible. For more information on the layout of gas trains, refer to page 3.

Ordering

When ordering, please give name and type reference of actuator, for example:

- **SKP70.111B27** air/gas ratio controller for static pressure signals, AC 230 V, with auxiliary switch

The valves must be ordered separately and are supplied as separate items.

In case the actuators and valve bodies are used with gas, they are part of a safety device. Any opening, exchanging of parts or modification of the original version is carried out at one's own responsibility and risk!

Type Summary

The complete air/gas ratio controller consists of **actuator** and **valve** body.

Actuators

All B-series actuators Operating voltage	AC 100...110 V	AC 220...240 V
Standard version for the usual amount of excess air in low-fire operation		
• without auxiliary switch IV	1)	**SKP70.110B27**
• with auxiliary switch IV	**SKP70.111B17**	**SKP70.111B27**
Version for great amounts of excess air in low-fire operation		
• without auxiliary switch IV	1)	1)
• with auxiliary switch IV	**SKP70.121B17**	**SKP70.121B27**

1) not included in the range

Accessories for actuators

Damping throttle (see page 4)	**AGA75**
Pressure reducing T-fitting (see page 4)	**AGA78**

Valves

The SKP70... can be used with the following types of valve bodies:

Type reference	For use with	Data Sheet No.
VG...	natural, town or liquid gas	7641E
VR...	slightly aggressive biogas	7633E
VL...	cold or hot air	7637E

All information given in the above mentioned Data Sheets and relating to

- available valve versions,
- operating pressure,
- design features,
- technical data,
- flow chart,
- strainer inserts, and
- service replacement sets

also apply to the SKP70...

Exception: minimum flow rate required (see page 4).

Function

When the gas valve is closed, that is, during the pre-purge and pre-ignition time, only the pressure of the air supplied by the fan acts on the controller. It causes the air diaphragm to move to the left and thus, via the lever system, the ball valve in the actuator's bypass to close.

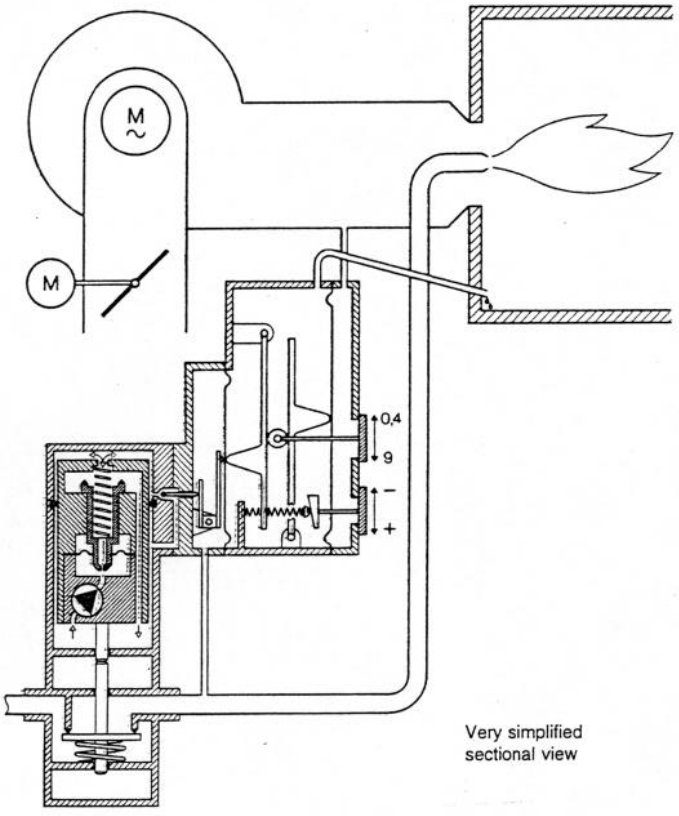
The actuator can therefore open the gas valve if, at the beginning of the safety time, the burner control gives the appropriate command.

When the gas valve opens, the pressure downstream from the valve increases immediately and thus the pressure at the gas diaphragm. As soon as the forces acting on both diaphragms are in balance (taking the lever ratio into account), the ball valve in the bypass is opened to such an extent that the return flow through the bypass valve and the flow supplied by the pump are identical.
This means that the piston of the actuator and thus the disk of the valve remain in the position reached.

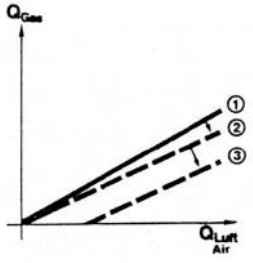
If the heat demand increases and the burner's air damper opens further, or the fan's speed increases, the controller closes the ball valve again – due to the greater pressure on the air diaphragm – so that the actuator will open the gas valve further until the forces acting on the air/gas ratio controller are in balance again.

The gas to air pressure ratio and thus the gas to air volume ratio remain constant over the entire output range, provided the orifices in the burner head do not change during output variations, neither for the combustion air nor for the gas.

Because of the small mixing energy at the low-fire level, it is often necessary to deliver somewhat more air in order to achieve optimum combustion. The characteristic of the controller can therefore be displaced parallel.



Very simplified sectional view



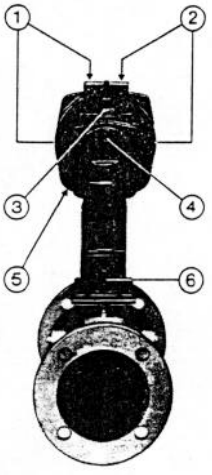
Characteristics of the controller:

① Gas to air ratio for stoichiometric combustion

② Adjusted gas to air ratio for burner operation with excess air. **The excess air in percent is constant over the entire range.**

③ When the characteristic is displaced **parallel**, the amount of excess air in percent at the **low-fire level is greater than that at the high-fire level.**

The controller permits parallel displacement either towards «excess air» or «lack of air».



① Adjustment and indication of the gas to air ratio

② Adjustment and indication of the parallel displacement of the characteristic

③ Connecting nipple for combustion chamber pressure

④ Connecting nipple for gas

⑤ Connecting nipple for combustion air

⑥ Indication of stroke

Technical Data

Actuator and controller

Operating voltage [2]	AC 220 V –15%...240 V +10% AC 100 V –15%...110 V +10%
Frequency	50 Hz –6%...60 Hz +6%
Power consumption	9...13.5 VA (depending on the operating voltage)
Switching capacity of auxiliary switch IV (if fitted)	6(2) A, AC 250 V
Setting range of auxiliary switch	4...96% stroke
Switch-on time	100%

If the actuators are used with non-LG valves, it must be ensured that a maximum stroke of 18 mm will not be exceeded. In any case, a mechanical stop must be provided.

Reference value	pressure of combustion air
Control characteristic	P (proportional action)
Setting range of gas to air pressure ratio	0.4...9
Control accuracy	<10% at P_{min} < 2% at P_{max}
Max. perm. inlet pressure	same as valve
Vent pipe	not required with inlet pressures up to 100 mbar

During operation, the following pressures may act on the SKP70... controller

gas pressure:	min. 1 mbar max. 100 mbar
air pressure:	min. 0.5 mbar
by P_{gas} / P_{air}	
>2.0:	max. 30 mbar
≤2.0:	max. 50 mbar

Higher pressures: see **AGA78**

	SKP70.11..	SKP70.12..
Parallel displacement of working characteristic	1.0 mbar	1.0 mbar
Excess gas	1.0 mbar	4.5 mbar
Excess air		

Min. period of time required when load changes from high-fire to low-fire	5 s
Permissible test pressure (gas)	1 bar
Permissible vacuum (gas)	200 mbar
Max. permissible pressure on air and combustion chamber side	as for permiss. control pressure
Opening time for full stroke	6...12 s, depending on nominal size [1]
Closing time in the event of voltage failure	<0.8 s
Mounting position	horizontal or vertical with actuator on top
Degree of protection	IP54
Perm. ambient temperature	–15...+60°C [1]
Weight	2430 g

[1] At temperatures < 0°C: opening time is extended
[2] Refer to «Type Summary»

Design Features of the Controller

The controller is fitted to the housing of the valve actuator and has two diaphragms which, via a lever system, act on a ball valve located in a bypass between the suction and pressure side of the pump.

The pressure of the combustion air acts on one diaphragm, the gas pressure downstream from the valve on the other.

The selected gas to air pressure ratio is indicated in a viewing glass.

The selected characteristic for the pressure ratio can also be displaced parallel, either towards «excess air» or «lack of air», to increase the amount of air at low-fire levels, for example.

The extent of parallel displacement is indicated in another viewing glass.

Notes on Engineering

Pressure in the combustion chamber as a disturbance value

In installations where the resistance of the «combustion chamber – flueways – stack» complex is constant, the pressure in the combustion chamber changes in proportion to the gas and combustion air pressure, as the output of the burner changes.
In burner plants of this type, it is therefore **not** necessary to compensate for the pressure in the combustion chamber, i.e. no disturbance value needs to be fed to the air/gas ratio controller.

If, however, the pressure in the combustion chamber does not change in proportion to the gas or air pressure – as this in is the case in burner plants with flue gas fans or continuously operated flue gas dampers – a compensating circuit is required. This means the pressure in the combustion chamber must be connected to the SKP70... so that the controller can automatically offset the pressure changes.

This compensating circuit should also be used if pressure shocks and vibrations, which adversely affect burner start-up, develop in the combustion chamber during the start-up phase.

Naturally, it must always be taken into consideration that the burner output decreases as the pressure in the combustion chamber increases, and vice versa.

Since many boilers are not provided with a test point for the pressure in the combustion chamber, it is recommended to design the burner such that the pressure can be sensed at the boiler head.

Installation of impulse pipes

- To achieve a correct and even gas to air ratio over the entire control range, the gas and air pressure signals need to be picked up at points where there is no turbulence.

  Recommendations

  – The gas pressure should be picked up at a distance of 5 times the nominal size after the valve. With inlet pressures ≥ 100 mbar, even greater distances may be required

  – The lateral test points on the valve body must **not** be used for picking up the pressure signals

  – Impulse pipes must not protrude in the flow, but must be flush with the inner wall of the pipe or housing

  – If required, flow stabilizers must be used, e.g. in the form of a W-shaped piece of sheet metal, which is to be placed in the pipe

- Minimum inside diameter of impulse pipe: 6 mm.

- With gas to air pressure ratios >3, the impulse pipes for combustion air and combustion chamber pressure must have an inside diameter of at least 8 mm.

- All impulse pipes must be as short as possible, thus allowing the controller to respond quickly enough when sudden burner output changes occur.

- The impulse pipe for the combustion chamber pressure must be installed such that the gases will cool down in the area of the impulse pipe and condensing gases will not enter the controller but run back into the combustion chambers. If necessary, a water separator must be provided.

- In the pressure chambers «air» and «gas», the pressure over the entire control range must be higher than in the pressure chamber «atmosphere»; this requirement is satisfied in the majority of applications.

  However, if negative air and/or gas pressure against atmospheric pressure may occur – due to excessive stack draft in low-fire operation, for example – the chamber «atmosphere» must be connected to an even lower (more negative) pressure level. This is usually ensured by the connection with the combustion chamber.

Notes on the layout of the gas train

- If the available gas pressure exceeds the maximum permissible operating pressure of the valve, the gas pressure must be reduced by a governor installed upstream of the valve. Otherwise no pressure governor is necessary.

- It is recommended to install a pressure switch on the outlet side of the SKP70..., and to electrically connect it to the burner control in such a way that the burner control will go to lockout if, due to a fault, the maximum permissible gas pressure is exceeded.

- The pressure switch for **minimum** gas pressure in the start control loop of the burner control, when used in connection with an SKP70..., must always be mounted **upstream of the valve**.

- The measures usually necessary to ensure the minimum amount of air is delivered must also be taken when using the SKP70...

Notes on Start-up

Adjusting the controller on modulating burners

- Set the gas to air ratio to the desired value using setting screw ①/ «P_{Gas} / P_{Air}» on the left (coarse setting), and the scale with the small flame symbol to zero, using setting screw ②.

- Start the burner and run it at approx. 90% of full output.

- Measure the CO_2 or O_2 content of the flue gases and fine-tune the setting, using setting screw ①/«P_{Gas} / P_{Air}».

- Return to low-fire operation, check the CO_2 or O_2 content of the flue gases and, if necessary, correct the characteristic, using setting screw ②/ ⊏⊃ , until the measured values are at their optimum.

- Limit the air damper position for low-fire operation.

The markings on the setting screws have the following meaning:

\+ more gas
– less gas

If a significant parallel displacement of the working characteristic was required to attain optimum CO_2 or O_2 values in low-fire operation, the adjustment of the pressure ratio with full load or 90% of full load must be checked again and corrected if necessary.

- Run the burner to the required output and limit the air damper position for full output.

- Check the flue gas values at several levels of the output range. If corrections are necessary:

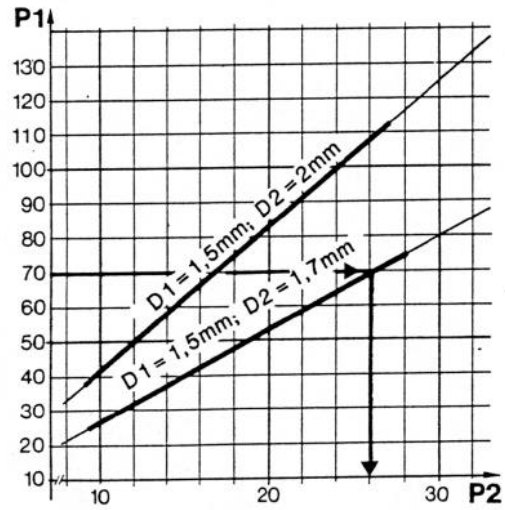
  – In high-fire operation: use setting screw ①/«P_{Gas} / P_{Air}»

  – In low-fire operation: parallel displacement of characteristic, using setting screw ② with the small flame symbol

Due to reciprocal physical actions in the air and gas flow in the burner head, it might be necessary having to move the working characteristic of the controller into the area of excess gas, although the flue gas analysis proves that there is excess air!

If the gas to air pressure ratio lies outside the setting range, the pressure at the measuring point must be increased by means of an orifice in the gas or air flow. In order to be able to do this, a sufficiently large gas or air pressure reserve at the inlet must be available.

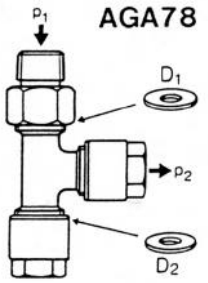
If the air pressure exceeds the maximum value of 30 or 50 mbar permitted by the controller (refer to«Technical Data»), the pressure must be reduced by means of a reducing T-fitting, type AGA78.

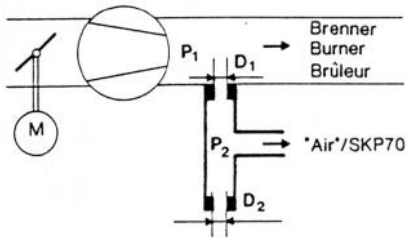


Function

The medium (air) is blown out continuously into the atmosphere via the restrictor D_2. The medium undergoes a drop in pressure across the restrictor D_1. The correlations are shown in the opposite diagram.

For example: given p_1 = 70 mbar, D_1 = 1.5 mm, D_2 = 1.7 mm
Find: pressure signal p_2 for SKP70
p_2 = 26 mbar



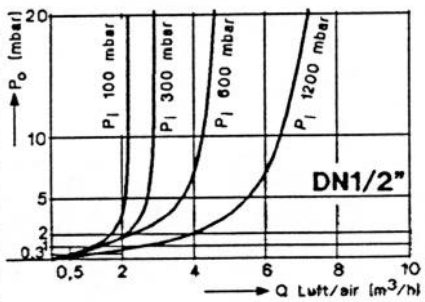


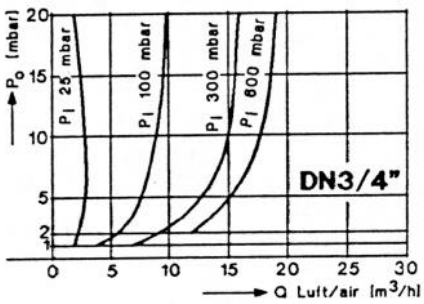
Reducing T-fitting AGA78 is supplied ready for mounting, complete with D_1 = 1.5 mm and D_2 = 1.7 mm. An additional restrictor D_2 with a dia. of 2 mm is included in the packing.

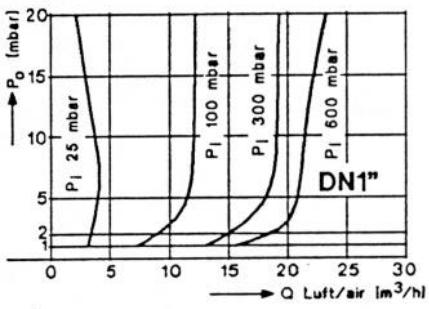
Minimum flow rate required

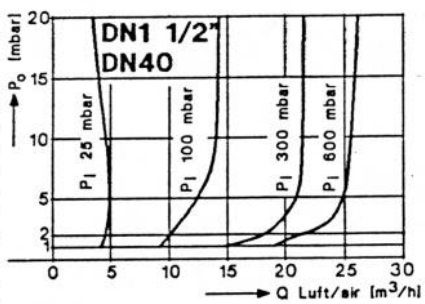
The charts below show the minimum flow rate «Q» required, in function of the inlet pressure «Pi», and the resulting outlet pressure «Po». These minimum flow rates must be observed since high inlet pressures along with too small flow rates cause the pressure control to start oscillating. By screwing the **AGA75 damping throttle** into the controller's combustion chamber connection, control oscillations can be avoided to a certain extent (start-up behaviour in low-fire operation!). This means the limit values are lower than those shown in the charts below.

All curves of the VGG... and VGF... valves are only applicable to the versions with profile (VG...P).





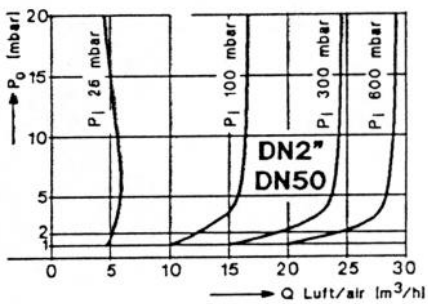


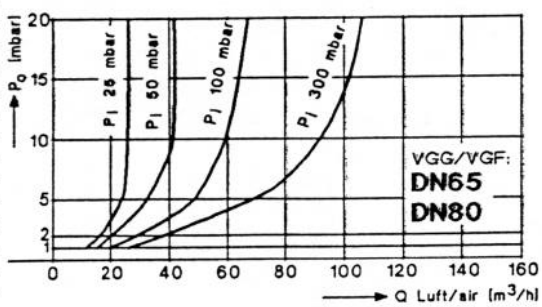


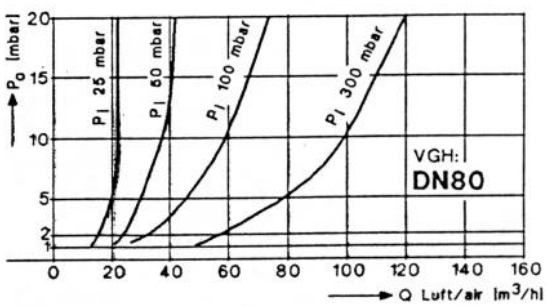
Example for 2 in. valve:

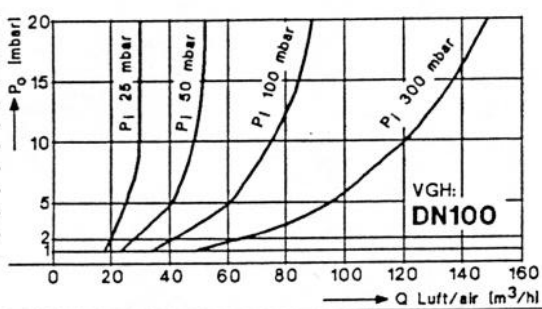
Pi = 100 mbar
Po = 7 mbar

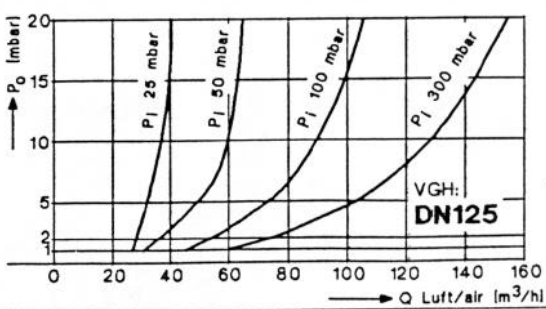
Qmin = approx. 17 m^3/h air
= 17 x 1.24 m^3/h natural gas
= **21.1 m^3/h natural gas**



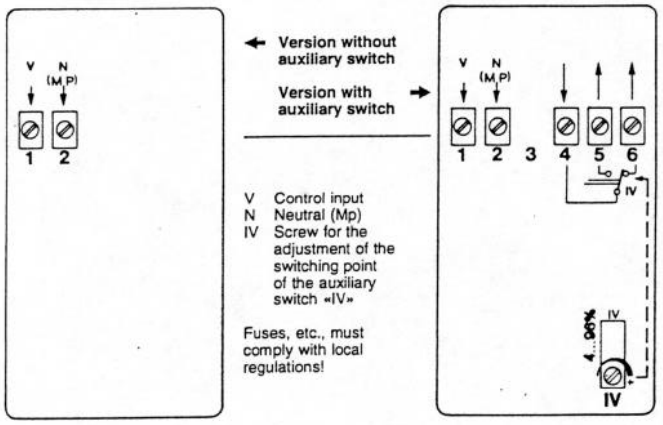








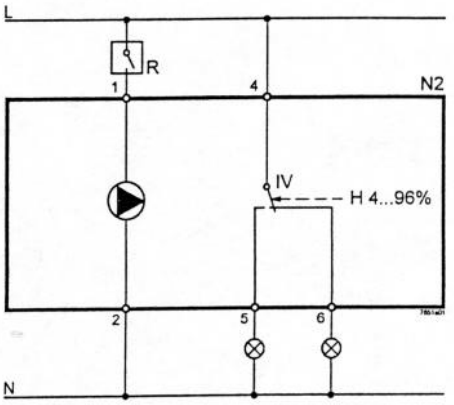
Terminal Markings



V Control input
N Neutral (Mp)
IV Screw for the adjustment of the switching point of the auxiliary switch «IV»

Fuses, etc., must comply with local regulations!

Wiring Diagram



IV Potential-free auxiliary switch, adjustable, refer to «Technical Data» (only with actuators using an auxiliary switch, refer to «Type Summary»)

H Stroke

R Controller or switch

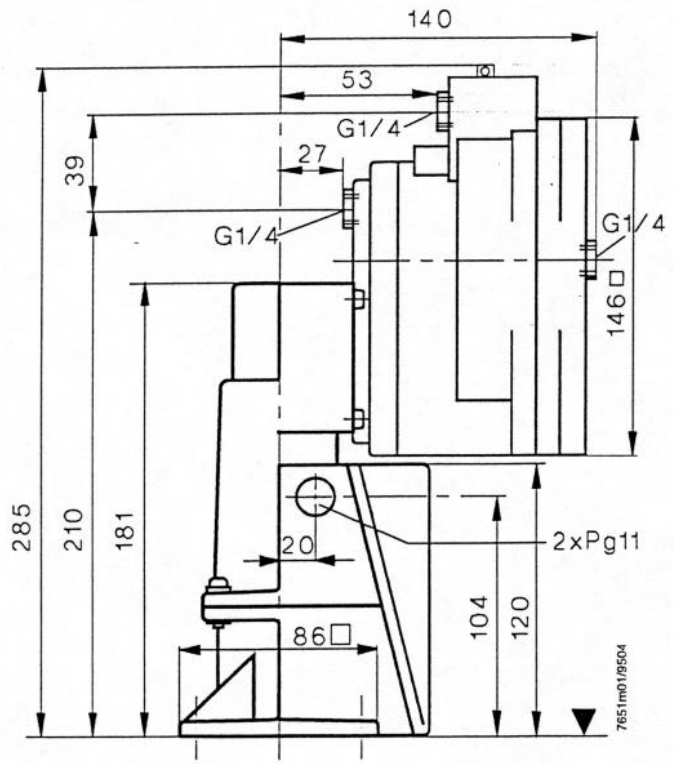
N2 SKP70...

N Neutral

L Live

Dimensions

Dimensions in **mm**



▼ Contact surface of valve
Refer to «Type Summary/Valves», Data Sheets relating to Landis & Gyr valves

Landis & Gyr Building Control (Deutschland) GmbH, Berliner Ring 23, D-76437 RASTATT
Landis & Gyr Building Control (UK) Ltd., Hortonwood 30, TELFORD GB-SHROPSHIRE TF1 4ET
Landis & Gyr Building Control (Australia), 15 Nyadale Drive, AUS-SCORESBY, Vic. 3179
Landis & Gyr Intersystem (Japan) Corporation, 4-3-1 Tsuchihashi, Miyamaeku, Japan-KAWASAKISHI 216