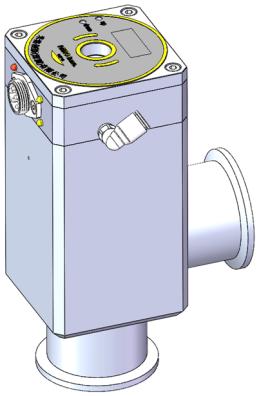
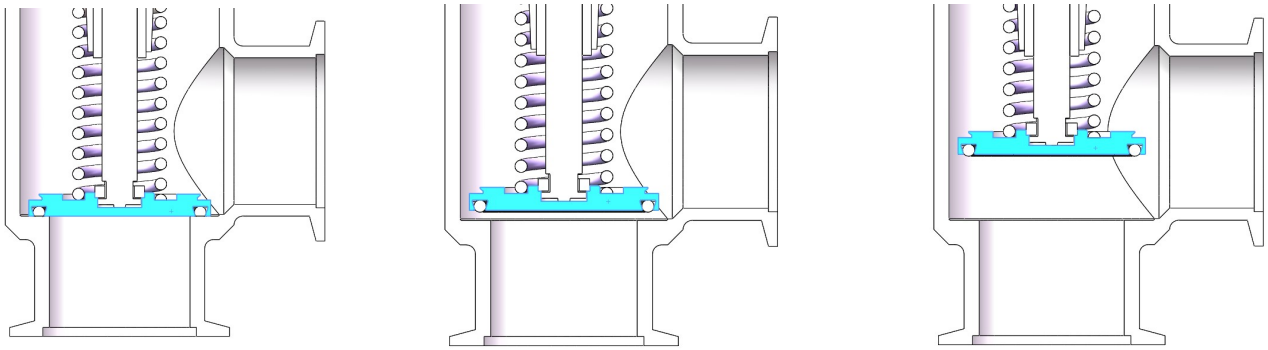
Two-Step High Vacuum Poppet Valve Technical Parameters

Introduction

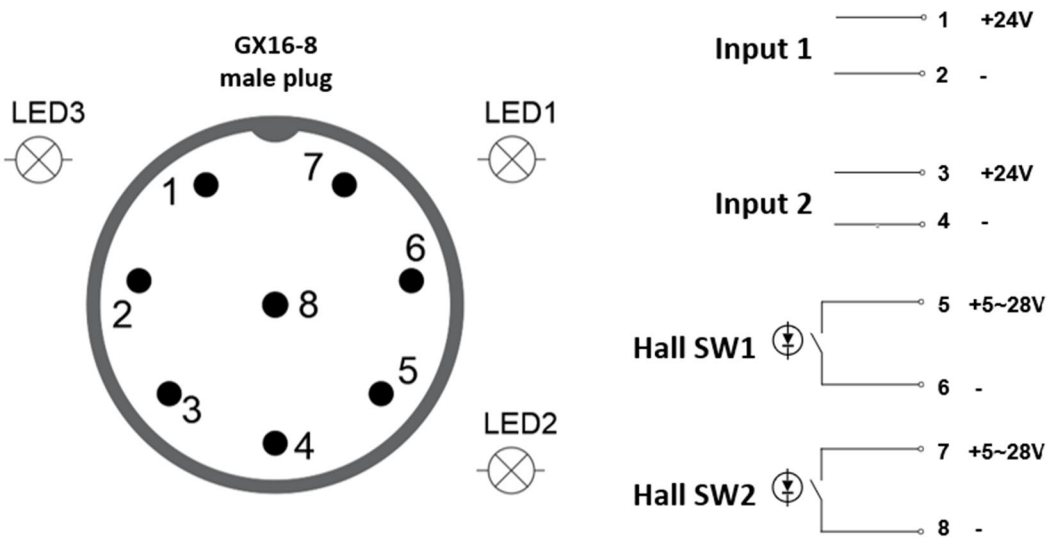


- Through PID control, the valve plate opening height is controlled with an accuracy of ±0.02mm, allowing the valve to be in closed, partially open, or fully open states. This realizes the valve's two-step control function, including a soft start feature.
- The electrical wiring is exactly the same as traditional dual-valve dual-solenoid two-step valves, so customers do not need to make any changes to the electrical wiring.
- When partially open, the valve plate height can be adjusted in real-time, with an adjustable height range of 0.7~3.7mm.
- The appearance and dimensions are the same as the MAC series vacuum angle valves.



Closed | Partially Open | Fully Open

GX16-8 Aviation Connector Electrical Pins (Male)



Note 1: Input1 (positive pin1 and negative pin2) and Input2 (positive pin3 and negative pin4) have a maximum current of about 130mA.

Note 2: The factory wire color sequence is 1 red, 2 black, 3 white, 4 yellow, 5 green, 6 blue, 7 brown, 8 orange.

Control method:

By controlling the voltage signals of Input1 and Input2, the valve can be in three states: closed, fully open, or partially open. The valve is normally closed, i.e., it is in a closed state when powered off.

Input 1	Input 2	Valve states	Signal output	Signal indication
0V	0V	Closed	SW2 closed	LED2 on
0V or 24V	24V	Fully open	SW1 closed	LED1 on
24V	0V	Partially open		LED3 on

Important: When the valve is in the "partially open" state, fluctuations in pressure may trigger the SW2 closed signal. At this time, SW2 should not be used to determine the valve's status. Therefore, the PLC's judgment of the status should adopt a mode that combines input signals and output signals:

Fully open state: IF (SW1=1) THEN…

Closed state: IF (Input1 = 0) AND (Input2 = 0) AND (SW2 = 1) THEN…

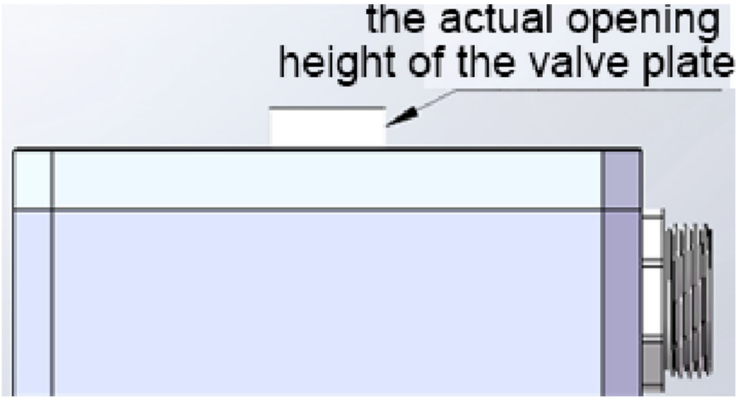
Partially open: IF (Input1 = 1) AND (Input2 = 0) THEN… // At this time, SW1 may trigger a closed state.

Adjusting the height of the valve plate when partially open:

1. The valve enters a partially open state (i.e., Input 1 is connected to a 24V power signal, Input 2 has no input).
2. The controllable height range of the valve plate is 0.7~3.7mm, with a factory default initial height of 0.7mm (the minimum opening height can be customized to 0.4mm for the customer).
3. Holding down the up button without releasing it, LED3 flashes once every 0.5 seconds, and the valve plate rises by 0.04mm every 0.5 seconds, up to a maximum height of 3.7mm. Releasing the up button, the position information of the valve plate is stored in the valve, and can be retained after power off.
4. Holding down the down button without releasing, LED3 flashes once every 0.5 seconds, and the valve plate decreases by 0.04mm every 0.5 seconds, down to a minimum height of 0.7mm. Releasing the down button, the position information of the valve plate is stored in the valve, and can be retained after power off.
5. When the valve is connected to a driving gas source, holding down the up/down button without releasing, the valve plate will actually rise/fall by 0.04mm every 0.5 seconds; when not connected to a driving gas source, holding down the up/down button, the position information of the valve plate is stored in the valve. For example, in the first operation, the factory-set valve plate height is 0.7mm, holding down the up button for 15 seconds, the indicator light flashes a total of 30 times, then the height of the valve plate when the valve is partially open is 0.7+0.04*(15/0.5)=1.9mm.

   Measure the actual opening height of the valve plate by the protruding height of the valve stem:

   - First, fully open the valve so that the valve stem rises to its highest position, then close the valve so that the valve stem descends to its lowest position. At this point, the position of the valve stem represents the zero-height position, which is generally flush with the valve cover, but there may be minor errors. Additionally, due to manufacturing reasons, the valve stem at the zero position can move down by 0.3-0.4mm. The correct zero position of the valve stem is only established after the valve is fully opened and then closed.
   - Place the valve in a partially open state and measure the height position of the valve stem, which represents the actual height to which the valve plate is opened.



Parameters

1) **Drive gas:** clean compressed air or inert gas (filter size below 100μm)
2) **Drive gas pressure range: 3.0±0.20 bar**
3) **Drive gas tubing O.D.:** default 6 mm (4mm is optional)
4) **Gas direction:** Either direction
5) **Solenoid nominal voltage：** 24V (±%5)
6) **Solenoid power：** 1.3W
7) **Magnetic switch nominal voltage：** 24V(5~28V)
8) **Leakage rate：** $<1\times10^{-9}$ mbar•L/sec (1×10^{-10} m^3•Pa/sec)
9) **Min. Working pressure:** 1×10^{-8} mbar (1×10^{-6} Pa)
10) **Max. Working pressure in Opening Direction:** 2000mbar
11) **Max. Working pressure in Closed Direction:** 1200mbar
12) **Adjustable height of the valve plate: 0.7~3.7mm.**
13) **Control accuracy of the valve plate: ±0.02mm (the accuracy under stable air pressure conditions. When the valve experiences severe fluctuations near atmospheric pressure, the valve plate will be in a dynamic equilibrium bouncing state).**

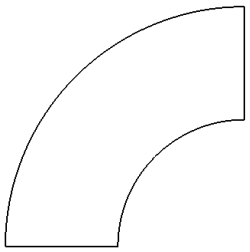
Appendix 1: Molecular Flow Conductance of the KF40 Valve (for reference)

When the pressure in the KF40 valve is approximately 10Pa or lower, the gas flow regime is molecular flow. The conductance under molecular flow can reflect the valve's flow capacity. However, it's important to note that this conductance is only a reference for the flow capacity under molecular flow and should not be used as calculation data for turbulent flow (under atmospheric pressure) or viscous flow (above 10Pa).

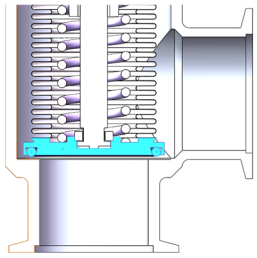
Below is the relationship between conductance and valve plate opening height under molecular flow for the KF40 angle valve, based on finite element simulation results (transmission probability method).

Note: Under the current calculation method, the conductance of a 40mm diameter elbow is simulated to be 43L/s, which is generally recorded as 45L/s on the market, and this elbow conductance is taken as the nominal conductance value of the KF40 angle valve. However, in high vacuum poppet valves with metal corrugated bellows, due to the travel limit of the metal corrugated bellows, the opening height of the valve plate is limited, and the flow capacity cannot reach 45L/s.

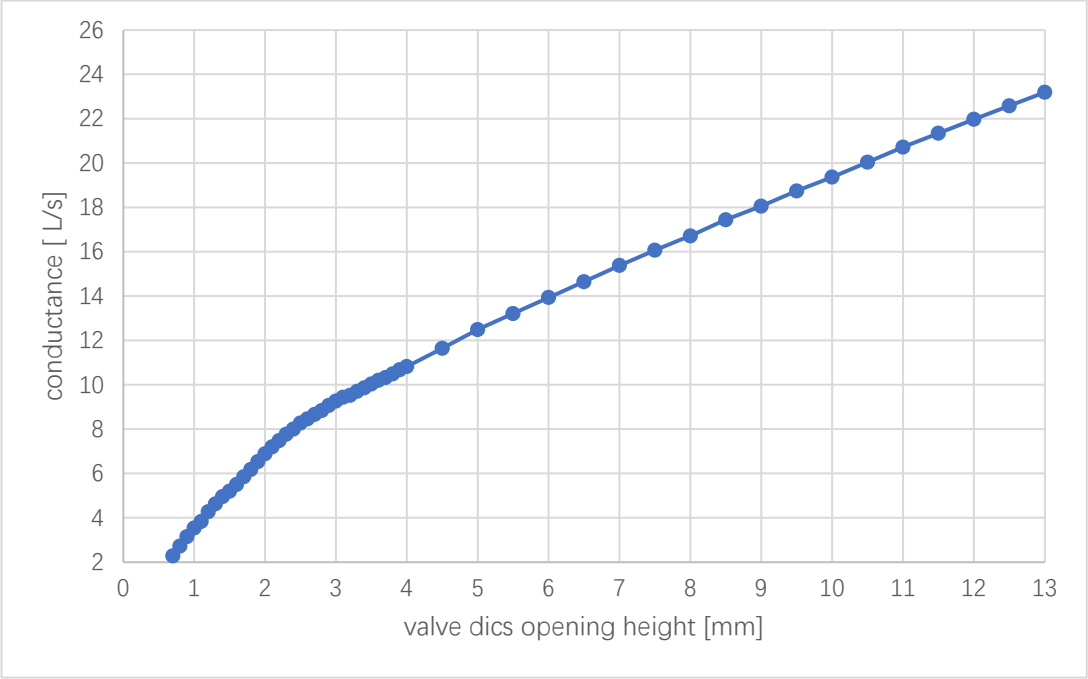
Dics height mm	Conductance L/s	Dics height mm	Conductance L/s	Dics height mm	Conductance L/s	Dics height mm	Conductance L/s
0.7	2.284754883	2	6.884937538	3.3	9.7028061	7	15.38125
0.8	2.722500124	2.1	7.200651412	3.4	9.8629371	7.5	16.06733
0.9	3.146115184	2.2	7.47908191	3.5	10.031241	8	16.71297
1	3.539030283	2.3	7.764019087	3.6	10.196313	8.5	17.44126
1.1	3.832999231	2.4	7.997258826	3.7	10.3227	9	18.05537
1.2	4.277460607	2.5	8.272765777	3.8	10.489406	9.5	18.73971
1.3	4.624231017	2.6	8.458817734	3.9	10.677279	10	19.36383
1.4	4.949772049	2.7	8.664926613	4	10.818379	10.5	20.03517
1.5	5.198885966	2.8	8.834717981	4.5	11.641701	11	20.71774
1.6	5.50417991	2.9	9.065251643	5	12.488398	11.5	21.34056
1.7	5.848418176	3	9.26261885	5.5	13.210242	12	21.97106
1.8	6.182015858	3.1	9.431503702	6	13.936327	12.5	22.57895
1.9	6.530071806	3.2	9.520158153	6.5	14.642283	13	23.19211



The simulated conductance for a 40mm diameter elbow is 43L/s



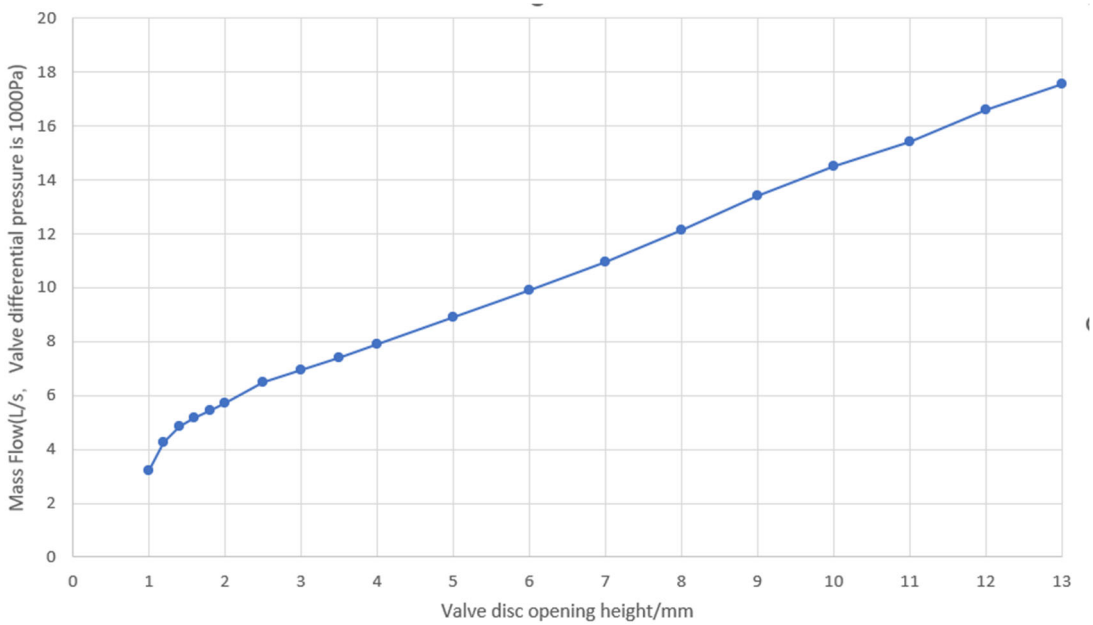
The simulated conductance for the KF40 angle valve ranges from 0 to 23L/s.



Appendix 2: Turbulent Flow Capacity of the KF40 Valve (for reference)

Under turbulent conditions (at atmospheric pressure), the concept of conductance does not apply because, in turbulent flow, the flow rate is not directly proportional to the pressure difference. However, if the pressure difference across the valve is fixed, the flow rate can be used to reflect the valve's flow capacity.

Below is the relationship between the flow rate and the valve plate opening height for the KF40 angle valve, with a fixed pressure difference of 1000Pa across the valve ends. The data are from finite element simulation results.



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