Repeatability: 3% or less  
Hysteresis: 10% or less

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Flow rate control range Note)</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air, Inert gas</td>
<td>0 to 6 L/min</td>
<td>PVQ10</td>
</tr>
<tr>
<td></td>
<td>0 to 100 L/min</td>
<td>PVQ30</td>
</tr>
</tbody>
</table>

Note) Varies depending on the model.

Control the flow rate smoothly according to the current

![Flow Rate Characteristics Diagram]

- Flow rate curve with decreasing current
- Flow rate curve with increasing current
- Repeatability
- Hysteresis
- **Service life:** Lasts 25 million cycles. (PVQ30)  
  (SMC in-house life test conditions)  
  Specially coated sliding surface realized 25 million cycles within set operating range

- **Body material:** Equivalent to C37 or Stainless Steel 304 (PVQ30)

- **Seal material:** FKM (PVQ10, PVQ30)

- **Valve returns to closed position when power supply is turned off.**

- **Leakage amount:** 5 cm³/min or less at OFF

- **Can be used with vacuum.** (Minimum operating pressure 0.1 Pa-abs)

- **Operation noise during opening/closing of the valve reduced**

<table>
<thead>
<tr>
<th></th>
<th>PVQ10 ON</th>
<th>30 dB or less</th>
<th>PVQ30 ON</th>
<th>43 dB or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>32 dB or less</td>
<td></td>
<td>OFF</td>
<td>50 dB or less</td>
</tr>
</tbody>
</table>

* Background noise: 20 to 25 dB

- **Can be mounted on manifolds**
  When continuously energizing adjacent valves at the same time, ambient temperature rises since the coil generates heat. Implement measures to exhaust excess heat so that the temperature remains within the range of the table on the right.

### Working Principle

The armature is attracted to the core by electromagnetic force as the coil is energized. When the applied current varies, the attraction force also varies proportionally to it. The flow rate is controlled by the movement (stroke) of the armature, depending on the balance between this attraction force and the spring load.

**Note:** Sliding resistance at this point is the hysteresis of the flow.

### Table: Coil outer surface temperature range

<table>
<thead>
<tr>
<th>Model</th>
<th>Coil outer surface temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVQ10</td>
<td>90°C or less</td>
</tr>
<tr>
<td>PVQ30</td>
<td>100°C or less</td>
</tr>
</tbody>
</table>

* Ambient temperature: 50°C at the valve proximal section (approx. 1 mm) when the maximum current is applied

### Proportional Solenoid Valve

Flow rate can be controlled smoothly with one proportional solenoid valve by current control.

### Current (2 port valve)

One 2-port valve is required for each flow rate.
### Applications

**Air-blow**
- Blow-off of debris or water.
- Work transportation

**Spin control of handpiece**

**Blood pressure gauge**

**Vacuum chamber supply flow control**
Smooth air supply/exhaust is possible by reducing the initial air supply. Prevents dust being stirred up inside the chamber.

---

#### Model Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>PVQ13</th>
<th>PVQ31</th>
<th>PVQ33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping type</td>
<td>Base mounted</td>
<td>Body ported</td>
<td>Base mounted</td>
</tr>
</tbody>
</table>

#### Valve Construction

<table>
<thead>
<tr>
<th>Valve type</th>
<th>Orifice size (mm)</th>
<th>Max. operating pressure differential (MPa)</th>
<th>Flow rate (L/min)</th>
<th>Applied current (Power supply)</th>
<th>Port size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct operated poppet</td>
<td>N.C.</td>
<td>0.3</td>
<td>0.7</td>
<td>0 to 5</td>
<td>0 to 85 mA (24 VDC)</td>
</tr>
<tr>
<td>Direct operated poppet</td>
<td>N.C.</td>
<td>0.4</td>
<td>0.45</td>
<td>0 to 6</td>
<td>0 to 170 mA (12 VDC)</td>
</tr>
<tr>
<td>Direct operated poppet</td>
<td>0.6</td>
<td>0.2</td>
<td>0.1</td>
<td>0 to 5</td>
<td>0 to 165 mA (24 VDC)</td>
</tr>
<tr>
<td>Direct operated poppet</td>
<td>0.8</td>
<td>0.7</td>
<td>0.35</td>
<td>0 to 100</td>
<td>0 to 330 mA (12 VDC)</td>
</tr>
<tr>
<td>Direct operated poppet</td>
<td>1.6</td>
<td>0.12</td>
<td>0.05</td>
<td>0 to 0</td>
<td>0 to 0</td>
</tr>
</tbody>
</table>
<To use orifice Ø1.6 (See PVQ30: Chart 1)>

Condition 1. \( P_1 = 0.7 \text{ MPa}, P_2 = 0 \text{ MPa} \) (Atmospheric pressure)

Refer to curve A when \( \Delta P \) is 0.7 MPa.

Ex) At increasing current, the flow rate when 140 mA current is applied is 85 L/min. (See ①.)

If current decreases at this point, the flow rate may not change by 135 mA due to hysteresis. (See ②.)

The flow rate at increasing current and decreasing current are not the same due to hysteresis. (① 85 L/min., ③ 93 L/min.)

Condition 2. \( P_1 = 0.7 \text{ MPa}, P_2 = 0.2 \text{ MPa} \)

Refer to curve B when \( \Delta P \) is 0.5 MPa.

Ex) At increasing current, the flow rate when 150 mA current is applied is 65 L/min. (See ④.)

If the outlet pressure \( P_2 \) increases by 0.15 MPa, \( \Delta P \) decreases by 0.15 MPa and becomes 0.35 MPa (See curve C), and the flow rate when the same current is applied is 40 L/min. (See ⑤.)

- The flow rate decreases due to change (increase) in outlet pressure, even if the inlet pressure and current value are the same.

Condition 3. In a vacuum

- For vacuum specifications, the operating pressure range is from 0.1 Pa-abs to max. operating pressure differential.
- A(2) port is applicable with vacuum pressure.

<Chart 1> PVQ30 (Ø1.6)
Q. Required flow rate = 0 to 75 L/min.

P₁ = No conditions, P₂ = 0 MPa (Atmospheric pressure)

In this case, all orifice sizes of PVQ30 series satisfy the required flow rate. (Flow rate when rated current is applied)

The table below shows the pressure differentials to satisfy the required flow rate. In the flow rate characteristics charts, a pressure differential over the flow rate indicated by the dashed line (75 L/min.) up to the max. operating pressure differential will satisfy the required flow rate.

**Table. Pressure differential to satisfy required flow rate = 0 to 75 L/min.**

<table>
<thead>
<tr>
<th>Orifice Size (mm)</th>
<th>Pressure Differential (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø1.6</td>
<td>0.7 to 0.05</td>
</tr>
<tr>
<td>ø2.3</td>
<td>0.35 to 0.25</td>
</tr>
<tr>
<td>ø4.0</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Note**

1) Follow the same procedure for selecting PVQ10 series.
2) Flow rate depends on individual differences between valves and piping conditions. Refer to flow rate characteristics chart to select the model with adequate margin for required flow rate.
### Compact Proportional Solenoid Valve

**PVQ10 Series**

#### How to Order

Base mounted

**PVQ 13** – 5 **L** – 03 – M5 – **A**

- **Valve type**
  - 13 N.C.
- **Voltage**
  - 5 24 VDC
  - 6 12 VDC
- **Electrical entry**
  - L plug connector
  - With lead wire (Length 300 mm)
  - L plug connector
  - Without connector
  - M plug connector
  - With lead wire (Length 300 mm)
  - M plug connector
  - Without connector

**Symbol**
- **L** (IN)
- **M** (OUT)

- **Body/Seal material**
  - Symbol: A
  - Body: C36
  - Seal: FKM

- **Port size**
  - Nil
  - Without sub-plate (with mounting screw M1.7 x 17L, 2 pcs.)
  - M5
  - With sub-plate M5 x 0.8

- **Orifice size**
  - Symbol: 03, 04, 06, 08
  - Orifice dia.
  - Max. operating pressure differential
  - 03: 0.3 mmø, 0.7 MPa
  - 04: 0.4 mmø, 0.45 MPa
  - 06: 0.6 mmø, 0.2 MPa
  - 08: 0.8 mmø, 0.1 MPa

#### Specifications

<table>
<thead>
<tr>
<th>Standard specifications</th>
<th>Direct operated poppet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valve construction</strong></td>
<td>Direct operated poppet</td>
</tr>
<tr>
<td><strong>Fluid</strong></td>
<td>Air</td>
</tr>
<tr>
<td><strong>Seal material</strong></td>
<td>FKM</td>
</tr>
<tr>
<td><strong>Body material</strong></td>
<td>C36</td>
</tr>
<tr>
<td><strong>Fluid temperature</strong></td>
<td>0 to +50°C</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>0 to +50°C</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>N.C. (Normally closed)</td>
</tr>
<tr>
<td><strong>Mounting orientation</strong></td>
<td>Unrestricted</td>
</tr>
<tr>
<td><strong>Port size</strong></td>
<td>M5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coils specifications</th>
<th>24 VDC</th>
<th>12 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>24 VDC</td>
<td>12 VDC</td>
</tr>
<tr>
<td><strong>Power current</strong></td>
<td>0 to 85 mA</td>
<td>0 to 170 mA</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>0 to 2 W</td>
<td></td>
</tr>
<tr>
<td><strong>Coil insulation</strong></td>
<td>Class B</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Indicates the ambient temperature when the valve is not energized.

When the valve is continuously energized (when applying maximum current) and the ambient temperature is kept at 50°C due to the convection of the air around the valve, the coil outer surface reaches approximately 90°C, and the coil proximal section (1 mm) reaches approximately 60°C. Use the product at a temperature of not more than 50°C.

* Refer to the Specific Product Precautions “Continuous Energization.”

**Note 2:** Maximum operating pressure differential indicates pressure differential (difference between inlet and outlet pressure) which can be allowed for operation with the valve closed or open. If the pressure differential exceeds the max. operating pressure differential of orifice, the valve may leak.

**Note 3:** For vacuum application, max. operating pressure range is 0.1 Pa abs to max. operating pressure differential. A(2) port is applicable for vacuum pressure.
Compact Proportional Solenoid Valve **PVQ10 Series**

### Flow Rate Characteristics

**PVQ10 (ø0.3)**

- $\Delta P = 0.7 \text{ MPa}$
- $\Delta P = 0.5 \text{ MPa}$
- $\Delta P = 0.35 \text{ MPa}$
- $\Delta P = 0.2 \text{ MPa}$

**PVQ10 (ø0.4)**

- $\Delta P = 0.45 \text{ MPa}$
- $\Delta P = 0.35 \text{ MPa}$
- $\Delta P = 0.25 \text{ MPa}$
- $\Delta P = 0.15 \text{ MPa}$

**PVQ10 (ø0.6)**

- $\Delta P = 0.15 \text{ MPa}$
- $\Delta P = 0.1 \text{ MPa}$
- $\Delta P = 0.05 \text{ MPa}$

**PVQ10 (ø0.8)**

- $\Delta P = 0.08 \text{ MPa}$
- $\Delta P = 0.05 \text{ MPa}$
- $\Delta P = 0.02 \text{ MPa}$

Note: Flow rate varies depending on model differences and piping conditions. Select the model that fully satisfies the necessary flow rate based on the flow rate characteristics graphs.

### Construction

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solenoid coil assembly</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Core</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Return spring</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Armature assembly</td>
<td>Stainless steel, Aluminum, FKM</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Body</td>
<td>C36</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>O-ring</td>
<td>FKM</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Round head combination screw</td>
<td>Steel</td>
<td>M1.7 x 0.35 x 17L, 2 pcs.</td>
</tr>
<tr>
<td>8</td>
<td>Sub-plate</td>
<td>C36</td>
<td>Part no: PVQ10-15-M5</td>
</tr>
</tbody>
</table>

*Connector assembly

**AXT661 - 14A -**

**Lead wire length**

- Nil 300 mm
- 6 600 mm
- 10 1000 mm
- 20 2000 mm
- 30 3000 mm

For the product with the lead wire, the lead wire length is 300 mm. To extend the lead wire length to 600 mm or more, select the valve without connector and order the connector assembly separately.
Compact Proportional Solenoid Valve
PVQ30 Series

How to Order

Body ported

PVQ 31 - 5G - 16 - 01

Base mounted

PVQ 33 - 5G - 16 - 01

Symbol

Valve type

31 N.C.

33 N.C.

Voltage

5 24 VDC

6 12 VDC

Electrical entry: Grommet

Port size

01 1/8 (6A)

Option

Nil None
F Foot bracket

* Bracket is not mounted but is provided at the time of shipment.

Symbol

Body/(Sub-plate) Seal material

Nil C37
H Stainless steel
FM

Thread type (with sub-plate)

Symbol

Body/(Sub-plate) Seal material

Nil C37
H Stainless steel
FM

Option

Nil None
F Foot bracket

* Bracket is not mounted but is provided at the time of shipment.

Port size

Nil

1/8 (6A)

Electrical entry: Grommet

Orifice size

Symbol Orifice dia. Max. operating pressure differential
16 1.6 mmø 0.7 MPa
23 2.3 mmø 0.35 MPa
40 4 mmø 0.12 MPa

Special specifications

Valve construction Direct operated poppet

Fluid Air

Seal material FKM

Body material C37 (Standard), Stainless steel

Fluid temperature 0 to +50°C

Ambient temperature Note 1) 0 to +50°C

Action N.C. (Normally closed)

Mounting orientation Unrestricted

Enclosure IP40

Port size Rc 1/8

Standard specifications

Power supply 24 VDC

Coil current 0 to 165 mA

Power consumption 0 to 4 W

Coil insulation Class B

Note 1) Indicates the ambient temperature when the valve is not energized.

When the valve is continuously energized (when applying maximum current) and the ambient temperature is kept at 50°C due to the convection of the air around the valve, the coil outer surface reaches approximately 100°C, and the coil proximal section (1 mm) reaches approximately 70°C. Use the product at a temperature of not more than 50°C.

* Refer to the Specific Product Precautions “Continuous Energization.”

Note 2) Maximum operating pressure differential indicates pressure differential (difference between inlet and outlet pressure) which can be allowed for operation with the valve closed or open. If the pressure differential exceeds the max. operating pressure differential of orifice, the valve may leak.

Note 3) For vacuum application, max. operating pressure range is 0.1 Pa·abs to max. operating pressure differential. A(2) port is applicable for vacuum pressure.

Specifications

Orifice diameter (mmø) 1.6 2.3 4.0

Max. operating pressure differential (MPa) Note 2) 0.7 0.35 0.12

Max. operating pressure (MPa) 1 MPa

Min. operating pressure (MPa) (Vacuum) Note 3) 0 (0.1 Pa.abs)

Flow rate (L/min) (at max. operating pressure differential) 0 to 100 0 to 75

Hysteresis (at max. operating pressure differential) 10% or less 13% or less

Repeatability (at max. operating pressure differential) 3% or less

Start-up current (at max. operating pressure differential) 50% or less 65% or less

Characteristic specifications

Note 2) Maximum operating pressure differential indicates pressure differential (difference between inlet and outlet pressure) which can be allowed for operation with the valve closed or open. If the pressure differential exceeds the max. operating pressure differential of orifice, the valve may leak.

Note 3) For vacuum application, max. operating pressure range is 0.1 Pa·abs to max. operating pressure differential. A(2) port is applicable for vacuum pressure.

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Flow Rate Characteristics

Air
PVQ30 (ø1.6)

PVQ30 (ø2.3)

PVQ30 (ø4.0)

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solenoid coil assembly</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Coil cover</td>
<td>SPCE</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Magnetic plate</td>
<td>SUY</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Adjusting screw</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Tube assembly</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Return spring</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Armature assembly</td>
<td>Stainless steel, PPS, PTFE, FKM</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Body</td>
<td>C37 or Stainless steel</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Nut</td>
<td>Steel</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Wave washer</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Round head combination screw</td>
<td>Copper</td>
<td>Base mounted only</td>
</tr>
<tr>
<td>12</td>
<td>Sub-plate</td>
<td>C37 or Stainless steel</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>O-ring</td>
<td>FKM</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>O-ring</td>
<td>FKM</td>
<td></td>
</tr>
</tbody>
</table>

Option (Body ported only)
- Bracket assembly: VDW20-15A-1

Sub-plate Part No.

PVQ30-15 [ ] -01

Material

<table>
<thead>
<tr>
<th>Thread type</th>
<th>C36</th>
<th>Stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C36</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Stainless steel</td>
<td></td>
</tr>
</tbody>
</table>
Compact Proportional Solenoid Valve **PVQ30 Series**

### Dimensions

**PVQ31**

![Diagram of PVQ31 dimensions]

- **Dimensions:**
  - 2 x ø3.5
  - 20
  - 27
  - 11

- **Ports:**
  - Rc 1/8
  - 1 (IN port)
  - 2 (OUT port)

- **Other Details:**
  - ø20.5
  - 2 x ø3.4

**PVQ33**

![Diagram of PVQ33 dimensions]

- **Dimensions:**
  - 2 x ø3.4
  - 30
  - 22

- **Ports:**
  - Rc 1/8
  - 1 (IN port)
  - 2 (OUT port)

- **Other Details:**
  - ø4
  - ø13.6

---

**ARJ**

**ARX**

**AMR**

**ARM**

**ARP**

**IR**

**IRV**

**VEX**

**SRH**

**SRP**

**SRF**

**ITV**

**IC**

**ITVH**

**ITVX**

**PVQ**

**VY1**

**VBA**

**VBAT**

**AP100**

985
Proportional control
Control the fluid proportionally according to input signal (current).

Max. operating pressure differential
Indicates max. pressure differential (difference between inlet and outlet pressure) which is allowed for operation with the valve closed or open.

Max. operating pressure
This indicates the limit of pressure that can be applied to the inlet. (The pressure differential of the proportional valve must be no more than the maximum operating pressure differential.)

Orifice diameter
Diameter of the hole for sealing the valve body of the proportional valve. This does not indicate the effective cross section.

Hysteresis
Greatest flow rate difference between current increase and current decrease (with the same current). (Percentage divided by max. flow rate)

Repeatability
Deviation of output flow rate when the same current is applied. (Percentage divided by max. flow rate)

Start-up current
Current at which the flow rate is actually output while increasing current from zero. (Percentage divided by rated current)
PVQ Series
Specific Product Precautions

Be sure to read this before handling the products.
Refer to back page 50 for Safety Instructions.

⚠️ Caution
This product makes proportional control possible with constant current.
If controlled with voltage, the output flow rate cannot be kept constant due to current fluctuation. Use stable DC power source of sufficient capacity without much ripple.

⚠️ Caution
Handling
1. This product is adjusted to the respective specifications at SMC factory before delivery.
   Do not disassemble the product or remove parts as it could cause breakdown of the product.
2. Flow rate is controlled by balancing the valve body.
   Do not expose the product to external vibration and impact as it changes the flow rate.
   Vibration may occur depending on the piping conditions or control methods.

⚠️ Caution
Pressure Difference
Leakage from the valve may be caused if the pressure difference is larger than the maximum operating pressure differential of the respective models.

⚠️ Caution
Flow Rate
Flow rate varies depending on model differences and piping conditions.
Select the model that fully satisfies the necessary flow rate based on the flow rate characteristics graphs.

⚠️ Caution
Operation in Vacuum
When the product is used in vacuum, apply vacuum pressure to A (2) port.
The pressure at P(1) port should be larger than the pressure at A(2) port.

⚠️ Caution
Valve Mounting
When mounting a valve to the sub-plate, tighten the screw securely with the tightening torque shown in the table below after checking the installation condition of the O-ring on the interface side.

Proper Tightening Torque (N·m)

<table>
<thead>
<tr>
<th></th>
<th>PVQ10 (Base mounted)</th>
<th>PVQ30 (Base mounted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.15 to 0.22</td>
<td>0.8 to 1.0</td>
</tr>
</tbody>
</table>

⚠️ Warning
Continuous Energization
1. Ambient temperature and outer surface temperature
When the valve is continuously energized (when applying maximum current) and the ambient temperature is kept at 50°C due to the convection of the air around the valve, the coil outer surface reaches approximately 90°C for the PVQ10 series and 100°C for the PVQ30 series.
The valve proximal section (approx. 1 mm) reaches approximately 60°C for the PVQ10 series and 70°C for the PVQ30 series.
When the valve is mounted inside the enclosed control panel (in a state without convection of air), however, the above temperature may be exceeded due to the rise in coil temperature or the influence of other equipment. Take measures to release the heat, for example, to create a convection of the air around the valve or provide an air vent.

2. Do not touch the valve directly with hands.
The coil can be hot depending on the ambient temperature or energizing time.
Install a protective cover over the valve if it can be touched directly with hands.