Circuit of directional control valve and electro-pneumatic proportional valve (VEP type)

Simplifying circuit design
Space-saving and piping work eliminated

Automating pressure control

Power amplifier
VEA25
0 to 5 VDC

Electro-pneumatic proportional valve
VER2000 VER4000

Mist separator
Series AM

Application Example

Purpose
Electrode pressurization control for spot welding
Automatically varies the applied pressure in accordance with the material, thickness, and stacked quantity of the workpieces.

Auxiliary functions
Through the use of a power amplifier that is equipped with an abnormality detection circuit,
• Open circuit in the output wire
• Malfunction in the 24 VDC power supply can be detected by a programmable logic controller, thus preventing defective workpieces or equipment damage.
Series VER2000/V4000

Standard Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>Direct operated type VER2000</th>
<th>Internal pilot type VER4000</th>
<th>External pilot type VER4001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port size</td>
<td></td>
<td>( \frac{3}{4} ), ( \frac{1}{2} )</td>
<td>( \frac{3}{4} ), ( \frac{1}{2} )</td>
<td>( \frac{3}{4} ), ( \frac{1}{2} )</td>
</tr>
<tr>
<td>Fluid</td>
<td></td>
<td>Air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure</td>
<td></td>
<td>1.0 MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td></td>
<td>0 to 50°C (No condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A port setting pressure range</td>
<td></td>
<td>0.1 to 0.9 MPa</td>
<td>0.1 to 0.9 MPa(^{(1)})</td>
<td>0.1 to 0.9 MPa(^{(2)})</td>
</tr>
<tr>
<td>Max. effective area (Cv factor)</td>
<td></td>
<td>16 mm(^2) (0.9)</td>
<td>52 mm(^2) (2.9)</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td></td>
<td>0.04 s</td>
<td>0.06 s</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td></td>
<td>3% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td></td>
<td>3% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td></td>
<td>0.5% F.S.</td>
<td>1.5% F.S.</td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td></td>
<td>3% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubrication</td>
<td></td>
<td>Not required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
<td>1.24 kg</td>
<td>( \frac{3}{4} ): 2.20 kg</td>
<td>( \frac{3}{4} ): 2.81 kg</td>
</tr>
</tbody>
</table>

Note: 1) Set the inlet pressure by 0.05 MPa or larger than the required maximum set pressure.
2) Set the pilot pressure by 0.05 MPa or larger than the required maximum set pressure.
3) The non-lubricated specification is not applicable to these models.

Proportional Solenoid Specifications

<table>
<thead>
<tr>
<th>Applicable power amplifier</th>
<th>VEA25□</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. current</td>
<td>1 A</td>
</tr>
<tr>
<td>Coil resistance</td>
<td>13 ( \Omega ) (Ambient temperature 20°C)</td>
</tr>
<tr>
<td>Rated power consumption</td>
<td>13 W (Ambient temperature 20°C, with maximum current)</td>
</tr>
<tr>
<td>Coil insulation type</td>
<td>Class H or equivalent (180°C)</td>
</tr>
<tr>
<td>Max. temperature rise</td>
<td>140°C (Ambient temperature 50°C, with maximum current)</td>
</tr>
<tr>
<td>Electrical entry</td>
<td>DIN terminal</td>
</tr>
</tbody>
</table>

Accessory

<table>
<thead>
<tr>
<th>Model</th>
<th>VER2000</th>
<th>VER4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting screw (With washer)</td>
<td>M5 x 45</td>
<td>M6 x 53</td>
</tr>
<tr>
<td>Gasket</td>
<td>AXT500-13</td>
<td>AXT510-13, VER4-13</td>
</tr>
<tr>
<td>Feed back plate</td>
<td>—</td>
<td>VER4-3P</td>
</tr>
</tbody>
</table>

Option

<table>
<thead>
<tr>
<th>Model</th>
<th>VER2000</th>
<th>VER4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacer type regulator</td>
<td>ARB210-00-B</td>
<td>ARB310-00-B</td>
</tr>
<tr>
<td>(B port regulator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow control interface</td>
<td>AXT503-23A</td>
<td>AXT510-32A</td>
</tr>
<tr>
<td>Pressure gauge</td>
<td>G36-10-01</td>
<td>G36-10-01</td>
</tr>
</tbody>
</table>

Model Selection

- Applicable cylinder bore size: ø25 to ø125
- For model selection, refer to “Selecting Electro-pneumatic Proportional Valve” on page 706.
How to Order

Series VER2000

VER2000

Series VER4000

VER400

Pilot type

0 Internal pilot

1 External pilot

Thread type

Nil Rc

F NPT

G NPTF

Port size

Nil Without sub-plate

02 1/4

03 5/8

Port size

Nil Without sub-plate

03 3/4

04 1/2

06 3/4

Note: To order valve with interface regulator (B port regulation), flow control interface, or pressure gauge, indicate part number of the electro-pneumatic proportional valve and that of the option *. Refer to “Option” on page 704 for part number of option. Products will be in the same package and not assembled when delivered.

Example) VER4000-03 ····················· 1 pc.

* ARB310-00-B ················· 1 pc.

* G36-10-01 ····················· 1 pc.

Working Principle

F1: The pulling force of the solenoid when a specified amperage is applied to the solenoid, or the force that is created by the pilot pressure.

F2: The force that is created by the port 4 pressure (P4) that passes through the feedback passage and acts on the spool surface, and the spring force.

OFF state

F1 < F2 condition: See figure 1.

| Port 4 (A) → Port 5 (R1) | Exhaust air |
| Port 1 (P) → Port 12 (B) | Supply air |

ON state

Immediately after turning on — F1 > F2: See figure 3.

Thereafter — F1 = F2: See figure 2.

[*In**, port 3(R) is half open.]

F1 = F2: See figure 2.

[Port 1 (P) → Port 14 (A) (Supply air)]
[Port 2 (B) → Port 13 (R2) (Exhaust air)]
[Port 4 (A) (P, Setting)]
[Port 2 (B) → Port 13 (R2) (Exhaust air)]
**Series VER2000/V4000**

**Current—Pressure Characteristics**

The horizontal axis of the characteristics represents the output amperage of the power amplifier VEA25 (if NULL and GAIN are in the shipping condition, 0 to 1 A can be viewed by substituting them with command signals 0 to 5 V.)

**Selecting Electro-pneumatic Proportional Valve**

The response behavior of an electro-pneumatic proportional valve is affected by the load capacity. Therefore, select an electro-pneumatic proportional valve in accordance with the bore and the stroke of the cylinder to be used.

(The diagram below is provided as a guide.)

**How to Use DIN Terminal**

**Wiring procedure**
1. Loosen the retaining screw and pull out the connector from the pin plug.
2. Make sure to remove the retaining screw, insert the tip of a flat head screwdriver into the groove below the terminal block and pry it up to separate the terminal cover from the terminal block.
3. Securely connect the wires to the specified terminals in accordance with the wiring procedure.

**Terminal block**

Connection 3 is not used for terminal 1 and 2.

**Note**) Coil has no polarity.

**Applicable cable (Cabtire cable)**
0.75 mm², 1.25 mm²/2 core, 3 core (O.D. ø6.8 to ø11.5) based on JIS C 3312 and C 3322.

**Outlet changing procedure**
To change the wire outlet, first separate the terminal cover from the terminal block. Then, reinstall the terminal cover in the desired direction (in 90° increments).

**How to Find the Flow Rate**

**Air temperature of 20°C**

Subsonic flow at \( P_1 + 0.1013 < 1.89 (P_2 + 0.1013) \)

\[
Q = 226S \sqrt{P (P_2 + 0.1013)}
\]

Sonic flow of \( P_1 + 0.1013 \geq 1.89 (P_2 + 0.1013) \)

\[
Q = 113S (P_1 + 0.1013)
\]

**Note**) Correction for varying air temperatures:
Square the coefficient indicated in the table below with the flow rate that has been obtained from the above formula.

**Q**: Air flow rate \([\text{l/min (ANR)}]\)

**S**: Effective area \([\text{mm}^2]\)

**P**: Amount of pressure drop \(P_1 – P_2\) \([\text{MPa}]\)

**P1**: Upstream pressure \([\text{MPa}]\)

**P2**: Downstream pressure \([\text{MPa}]\)

**Precautions**

Be sure to read before handling.

Refer to front matters 42 and 43 for Safety Precautions and pages 287 to 291 for Precautions on every series.

**Caution**

1. **Air supply**
   - Poor quality air could increase the spool's sliding resistance, while preventing it from attaining its specified characteristics. Use compressor oil with a minimal generation of oxidants and install a mist separator (SMC's AM series). Refer to pages 2 and 3.
   - Avoid using ultra-dry air since it may reduce the amount of lubricant and shorten the service life.

2. **Mounting**
   - Vibrations are transmitted to the valve by the proportional solenoid's dither. If it is necessary to prevent the transmission of vibrations, insert vibration isolating rubber material.
   - Thoroughly flush the pipe to completely eliminate any dust or scales from the pipe inside.
   - Install a silencer (AN series) on the exhaust port.
   - Be careful with the molded coil because it generates heat while current is applied to it.

3. **Lubrication**
   - This product can be used without lubrication. But if lubricated, use turbin oil Class 1, ISO VG32 (with no additive). It is impossible to use spindle oil, machine oil, or grease.

4. **Manual operation**
   - To check the operation of the valve without applying a current, remove the lock nut and use a screwdriver or the like to press the tip of the core. After checking the operation, reinstall the rubber cap in its original position.
5 Port Electro-Pneumatic Proportional Valve  Series VER2000/4000

Construction

VER2000

VER4000

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>Aluminum alloy</td>
<td>Metallic painted</td>
<td>9</td>
<td>O-ring</td>
<td>NBR</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Spool sleeve</td>
<td>Special stainless steel</td>
<td>--</td>
<td>10</td>
<td>O-ring</td>
<td>NBR</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>Feed back plate</td>
<td>Aluminum alloy</td>
<td>Metallic painted</td>
<td>11</td>
<td>Proportional solenoid</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Sub-plate</td>
<td>Aluminum alloy</td>
<td>--</td>
<td>12</td>
<td>Pilot valve assembly</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>Spring B</td>
<td>Stainless steel</td>
<td>--</td>
<td>13</td>
<td>Gasket</td>
<td>NBR</td>
<td>--</td>
</tr>
<tr>
<td>6</td>
<td>Gasket</td>
<td>NBR</td>
<td>--</td>
<td>14</td>
<td>Lock nut</td>
<td>NBR</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>Gasket</td>
<td>NBR</td>
<td>--</td>
<td>15</td>
<td>Filter</td>
<td>Stainless steel</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Gasket</td>
<td>NBR</td>
<td>--</td>
<td>16</td>
<td>Block packing</td>
<td>NBR</td>
<td>--</td>
</tr>
</tbody>
</table>

Note) Block packing: VER4001 (Outer pilot)
Series VER2000/4000

Dimensions

**VER2000:** With sub-plate

**VER4000**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sub-plate</th>
<th>Flow Control Interface</th>
<th>B Port Regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>VER2000</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>VER4000</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Dimensions**

- **VER2000:**
  - Flow control interface: 218.5 (Max. 228.5)
  - B port regulator: 198.5 (Max. 228.5)
- **VER4000**
  - Flow control interface: 233.5
  - B port regulator: 228.5

**With sub-plate**

- **VER2000**
  - Hex. socket head cap screw: M5 x 45 With SW
- **VER4000**
  - Hex. socket head cap screw: M6 x 45 With SW

**Flow control interface**

- **AXT503-23A**

**With B port regulator**

- Interface regulator: ARB210-00-B

**Breathing port**

- **VER2000/4000**
  - 5 x 3/8"-16 Port 1(P), 2(B), 3(R2), 4(A), 5(R1)

---

**Spiral**

- : Sub-plate
5 Port Electro-Pneumatic Proportional Valve

Related Products:

A solenoid valve for actuating a cylinder and an electro-pneumatic proportional valve for pressure control have been integrated into a single unit. High response has been achieved.

- The size and the direction of the pipe port can be selected.
- The size of the electro-pneumatic proportion can be selected.
- Solenoid valves for actuating a 2 stage stroke gun cylinder or a clamp cylinder can be mounted on an integrated manifold (maximum of 8 stations).

 Specifications

<table>
<thead>
<tr>
<th>Stations</th>
<th>Solenoid valves (8 stations at max.) can be added to the basic unit (2 stations).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port size</td>
<td>Rc 3/8, 1/2</td>
</tr>
</tbody>
</table>

Note) Composed of basic unit (VER2000-A, VS7-8-FG-S-3N)

Refer to Best Pneumatics No. 1 for details about solenoid valve.

VER2000-A
- Set pressure range of A port (max): 0.1 to 0.9 MPa
- Power amplifier: VEA250, VEA251
- Wiring: DIN terminal

Note) In the case of VER4000, set the inlet pressure by 0.05 MPa or higher than the required maximum set pressure.

VS7-8-FG-S-3N
- Rated voltage: 24 VDC (-15% to +10%)
- Wiring: DIN terminal

How to Order

DXT334-X711-04R-04U

Pressurization control unit

Size of 5 port electro-pneumatic proportional valve

1. VER2000-A
2. VER4000-A

Additional stations of solenoid valves

<table>
<thead>
<tr>
<th>Nil</th>
<th>0 station</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8 stations</td>
</tr>
</tbody>
</table>

Ordering example

DXT334-X711-04R-04U -------- 1 pc.
VS7-8-FG-D-3M -------- 1 pc.
(Third station of manifold where 1 piece of "VS7-8-FG-D-3M" is added to the basic unit of "VER2000-A" and "VS7-8-FG-S-3N").

Dimensions

DXT334-X72-04R-04U

Mounting section (For MB)