



Operation Manual

PRODUCT NAME

Electro-pneumatic proportional valve

MODEL / Series / Product Number

VEP/VEF/VEA/VER Series

SMC Corporation

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Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots -Safety.

etc.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction(WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

**Design / Selection****Warning****1. Confirm the specifications.**

Products represented in this manual are designed only for use in compressed air systems.

Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Please contact SMC when using a fluid other than compressed air.

2. Actuator drive

When an actuator, such as a cylinder, is to be driven using an electro-pneumatic proportional valve, take appropriate measures (cover installation or approach prohibition) to prevent potential danger caused by actuator operation.

3. Intermediate stops

Since the electro-pneumatic proportional valve is a metal seal type, air leaks from the valve. Therefore, it is not possible to stop and hold for a long time an actuator.

4. Not suitable for use as an emergency shutoff electro-pneumatic proportional valve, etc.

The electro-pneumatic proportional valves are not designed for safety applications such as an emergency shutoff. If the electro-pneumatic proportional valves are used for the mentioned applications, additional safety measures should be adopted.

5. Release of residual pressure

For maintenance purposes install a system for releasing residual pressure.

Ensure that the residual pressure between the valve and the cylinder is released.

6. Ventilation

Provide ventilation when using an electro-pneumatic proportional valve in a confined area, such as in a closed control panel. For example, install a ventilation opening, etc. in order to prevent pressure from increasing inside of the confined area.

For applications such as mounting a electro-pneumatic proportional valve in a control panel, incorporate measure to radiate the heat so that the temperature will be not high.

7. Do not disassemble the product or make any modifications, including additional machining.

It may cause human injury and/or an accident.

Caution**1. Operation in a low temperature condition**

It is possible to operate a electro-pneumatic proportional valve in extreme temperature, as low as 0°C. Take appropriate measures to avoid freezing of drainage, moisture etc., in low temperature.

Mounting**Warning****1. Operation manual**

Install the products and operate them only after reading the operation manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.

2. Maintenance space

The installation should provide with sufficient space for maintenance activities (removal of valve, etc.).

3. Observe the tightening torque for screws

Tighten the screws to the recommended torque for mounting the product.

4. If air leakage increases or equipment does not operate properly, stop operation.

Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.

5. Painting and coating

Warnings or specifications printed or affixed on the product should not be erased, removed or covered up.

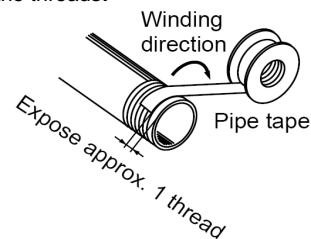
Please consult with SMC if paint is to be applied to resinous parts, as this may have an adverse effect due to the paint solvent.

Piping**Caution****1. Preparation before piping**

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

2. Wrapping of pipe tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads and sealing material do not get inside. Also, when pipe tape is used, leave 1 thread ridges exposed at the end of the threads.

**3. Preparation after piping**

Check the piping to prevent air leakage from the piping between the electro-pneumatic proportional valve and the actuator.

4. Connection of fittings**Rc types**

Tighten with the proper torque shown below.

Tightening Torque for Piping

Connection thread	Proper tightening torque (N·m)
Rc 1/4	8 to 12
Rc 3/8	15 to 20
Rc 1/2	20 to 25
Rc 3/4	28 to 30

Follow the procedure of the manufacture when fittings other than SMC is used.

5. Piping to products

When piping to a product, refer to the instruction manual to avoid mistakes regarding the supply port, etc.



Precautions for Electro-pneumatic proportional valve 2

Be sure to read before handling.

Lubrication

Warning

1. The electro-pneumatic proportional valve has been lubricated for life at manufacturer and does not require lubrication in service.
2. If a lubricant is used in the system, use turbine oil class 1 (no additive), ISO VG32. (Spindle oil, machine oil and grease are not applicable.)
Once a lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.
When turbine oil is used, refer to the Material Safety Data Sheet (MSDS) of the oil.

Air Supply

Warning

1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

2. When there is a large amount of drainage.

Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or drain catch should be installed before filters.

3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a filter with an auto drain is recommended.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

4. Use clean air

Do not use compressed air that contains chemicals, synthetic oils containing organic solvents, salt or corrosive gasses, etc., as it can cause damage or malfunction.

Caution

1. **When extremely dry air is used as the fluid, the inside lubrication decrease. As the result, the reliability (or reduced service life) is reduced. Please avoid using the extremely dry air.**

2. Install an air filter.

Install an air filter just before near the electro-pneumatic proportional valve. Select an air filter with a filtration size of 5 μ m or smaller.

3. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or drain catch.

Compressed air that contains a large amount of drainage can cause malfunction of pneumatic equipment such as electro-pneumatic proportional valves. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or drain catch.

Air Supply

Caution

4. **If excessive carbon powder is seen, install a mist separator on the upstream side of the electro-pneumatic proportional valve.**

If excessive carbon dust is generated by the compressor, it may adhere to the inside of a electro-pneumatic proportional valve and cause it to malfunction.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

Foreign particles on the spool and countermeasures

When the compressor lubricant at the air source is exposed to the high temperature compressed air, it will be oxidized and broken down to viscous brownish yellow or blackish brown particles. It is assumed that these particles have entered the electro-pneumatic proportional valve and got stuck to the spool.

These particles are different from dust, machining chips, rust or remnants of sealant tape that are left in the piping, and they have an extremely small particle diameter of a few μ m.

Since the clearance between the spool and sleeve allows a small amount of leakage to achieve smooth sliding of the spool, these particles enter between the spool and sleeve with the leaked air, even when the valve is stopped, and cause sticking.

To prevent these particles from entering the valve, the following countermeasures can be considered.

1. Review the type of compressor lubricant and change it to a high quality specialized lubricant for compressor, which generates less oxidation products.
2. Enhance the filtration accuracy of the filter element (by using a main line filter AFF series).
3. Mount a mist separator (SMC AM series) with extremely high filtration accuracy after the filter with normal filtration accuracy.

However, with countermeasure 1, deteriorated particles may still be generated depending on the compressor's operating conditions (such as the appropriateness of the amount of lubricant, wearing of the piston ring, discharge pressure and temperature) or the drain exhausting condition, so it is preferable to apply countermeasure 1 with 2 or 3.

Since the lubricant is oxidized or broken down at different speeds depending on the compressor's operating conditions, and therefore the deteriorated foreign particles from the compressor vary in amount and diameter, some of the particles may even go through the filter described in countermeasure 2. Therefore, be sure to install a mist separator at the air source of the electro-pneumatic proportional valve.

Precautions

1. When a mist separator or main-line filter is installed, it is necessary to flush the piping (both the inlet and outlet sides of the valve) to completely eliminate all the residual foreign matter.
2. Regarding replacement of the cartridge of the mist separator or main-line filter, if the amount of oil deteriorated particles is large and the cartridge is used for a long time, the cartridge element will become clogged and pressure drop will become large. Therefore, the cartridge element should be replaced when the pressure difference becomes 0.1MPa or more, or when it has been used for over a year.



Precautions for

Electro-pneumatic proportional valve 3

Be sure to read before handling.

Operating Environment

Warning

1. Do not use in an atmosphere where the electro-pneumatic proportional valve is in direct contact corrosive gases, chemicals, salt water, water, steam.
2. Do not use in an environment where flammable gas or explosive gas exists. The products do not have an explosion proof construction.
3. Do not use in a place subject to heavy vibration and/or shock.
4. The electro-pneumatic proportional valve should not be exposed to prolonged sunlight. Use a protective cover.
5. Remove the emissive heat when there is a source of heat around there.
6. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.
7. When the electro-pneumatic proportional valve is mounted in a control panel or its energized for a long time, make sure ambient temperatures is within the specification of the electro-pneumatic proportional valve.

Maintenance

Warning

1. Perform maintenance inspection according to the procedures indicated in the operation manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Removal of equipment, and supply/exhaust of compressed air.

When equipment are removed, first confirm that measures are in place to prevent dropping of workpieces and run-away of equipment, etc. Then the cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.

For this electro-pneumatic proportional valve, exhaust the residual pressure between the electro-pneumatic proportional valve and the actuator.

Before remounting or replacement, confirm that the electro-pneumatic proportional valve and power amplifier have cooled sufficiently. If touched inadvertently, there is a danger of being burned. When the equipment is to be started again after remounting or replacement, first confirm that measures are in place to prevent lurching of actuators, etc., and then confirm that the equipment is operating normally.

3. Manual override operation

When the manual override is operated, connected equipment will be actuated.

Operate after safety is confirmed.

Maintenance

Caution

1. Drain flushing

Remove drainage from the air filters regularly.

2. Lubrication

Be sure to continue to supply lubricant once it has been started.

And, use turbine oil Class 1 (with no additive) ISO VG32 for lubrication.

If other lubricant oil is used, it may cause malfunction.



VEP/VEF/VEA/VER Series

Specific Product Precautions 1

Be sure to read before handling.

VEA250 Series

Model

VEA250	Basic style with driving function only
VEA251	A malfunction detection circuit is added to VEA250.
VEA252	A malfunction detection circuit and a feedback circuit are added to VEA250, utilizing a positive sensor to effect various functions of high precision controls.

Basic Style Specifications: VEA250

Power supply voltage	24 VDC (Including ripple from 22 to 26 VDC)
Power consumption	Approximately 26 W
Output current range	0 to 1 A
Impedance of electro-pneumatic proportional valve	13 to 18.5 Ω (1 A F.S.)
Externally set input impedance	100 k Ω or more
Externally set input voltage	0 to 5 V
External potentiometer	10 k Ω ($\frac{1}{8}$ W or more): not provided
Step response	0.06 s or less (1 A, 95%)
Dither frequency adjustable range (DITHER)	120 to 180 Hz (140 Hz when delivered)
Zero adjustable range (NULL)	0 to 500 mA (0 mA when delivered)
Gain adjustable range (GAIN)	500 mA to 1 A for input voltage 5 V (1 A when delivered)
Electric linearity	$\pm 1\%$ or less (1 A F.S.)
Fluctuation to impedance	1% or less for 13 to 18.5 Ω (1 A F.S.)
Fluctuation to power supply	$\pm 1\%$ or less for 22 to 26 VDC (1 A F.S.)
Fluctuation to temperature	$\pm 2\%$ or less for 25°C \pm 25°C (1 A F.S.)
Operating temperature range	0 to 50°C
Relative humidity range	25 to 85%
Vibration resistance	19.6m/s ² or less(50Hz)
Storage conditions	No condensation, Relative humidity: 25 to 85%
Weight	0.1 kg

With Malfunction Detection Circuit: VEA251 (Same main features as VEA250)

Detection capabilities	Breakage of output cable/power source cable
Output type	Open collector output/Turned off at breakage
Power source required for detecting circuit	24 VDC, 100 mA(MAX)
Weight	0.1 kg

With Feedback Circuit: VEA252 (Same main features as VEA250/251)

Sensor feedback voltage	Recommended range 0 to 5 V
Input impedance	100 k Ω or more
Pre-amplifier-gain	0.2 to 100(100 when delivered)
Integral action time (DELAY ADJ)	0 to 20 s
Derivative action time	0 to 2 s
Weight	0.1 kg



VEP/VEF/VEA/VER Series

Specific Product Precautions 2

Be sure to read before handling.

VEF · VEP Series

Specifications

Item	Model	Flow type			Pressure type	
		VEF2121 VEF3121	VEF2131	VEF2141 VEF3141	VEP3121	VEP3141
Port size Rc		1/4, 3/8	1/4, 3/8, 1/2	3/8, 1/2, 3/4	1/4, 3/8	3/8, 1/2, 3/4
Fluid		Air				
Maximum operating pressure		1.0 MPa				
Ambient and fluid temperature		0 to 50°C (With no condensation)				
Response time		0.03 s or less		0.05 s or less	0.03 s or less	0.05 s or less
Hysteresis		3% F.S.				
Repeatability		3% F.S.				
Sensitivity		0.5% F.S.				
Linearity		—			3% F.S. or less	
Lubrication		Not required (Use turbine oil Class 1, ISO VG32, if lubricated.)				
Weight (kg)		0.9	1.0	1.4	0.9	1.4

Note) The non-lubricated specification is not applicable to these models.

Proportional Solenoid Specifications

Proportional solenoid recognition symbol	1 (Applicable power amplifier: VEA25□)
Applicable power amplifier	VEA25□
Max. current	1 A
Coil resistance	13 Ω (Ambient temperature 20°C)
Rated power consumption	13 W (Ambient temperature 20°C, with maximum current)
Coil insulation type	Class H or equivalent (180°C)
Max. temperature	140°C (Ambient temperature 50°C, with maximum current)
Electrical entry	DIN terminal

VER Series

Standard Specifications

Item	Model	Direct operated type	Internal pilot type	External pilot type
		VER2000	VER4000	VER4001
Port size		1/4, 3/8	3/8, 1/2, 3/4	
Fluid		Air		
Max. operating pressure		1.0 MPa		
Ambient and fluid temperature		0 to 50°C (No condensation)		
A port setting pressure range		0.1 to 0.9 MPa	0.1 to 0.9 MPa ⁽¹⁾	0.1 to 0.9 MPa ⁽²⁾
Max. effective area (Cv factor)		16 mm ² (0.9)	52 mm ² (2.9)	
Response time		0.04 s	0.06 s	
Hysteresis		3% F.S.		
Repeatability		3% F.S.		
Sensitivity		0.5% F.S.	1.5% F.S.	
Linearity		3% F.S.		
Lubrication		Not required (Use turbine oil Class 1, ISO VG32 if lubricated.)		
Weight		1.24 kg	3/8, 1/2: 2.20 kg, 3/4: 2.81 kg	

Note 1) Set the inlet pressure by 0.05 MPa or larger than the required maximum set pressure.

Note 2) Set the pilot pressure by 0.05 MPa or larger than the required maximum set pressure.

Note 3) The non-lubricated specification is not applicable to these models.

Proportional Solenoid Specifications

Applicable power amplifier	VEA25□
Max. current	1 A
Coil resistance	13 Ω (Ambient temperature 20°C)
Rated power consumption	13 W (Ambient temperature 20°C, with maximum current)
Coil insulation type	Class H or equivalent (180°C)
Max. temperature rise	140°C (Ambient temperature 50°C, with maximum current)
Electrical entry	DIN terminal



VEP / VEF / VEA / VER Series

Specific Product Precautions 3

Be sure to read before handling.

Mounting

⚠ Caution

1. Vibrations caused by proportional solenoid valve oscillation are transmitted to the EP proportional control valve. If the transmission of vibration is unacceptable, insert an isolating rubber material before installation.
2. Flush the piping to thoroughly remove any dust or scale from inside of the piping before connecting it.
3. Mount a silencer (AN series) on the exhaust port.
4. Handle the molded coil carefully because it generates heat while energized.
5. Mount the EP proportional control valve so that the spool is mounted horizontally.

Manual operation

⚠ Caution

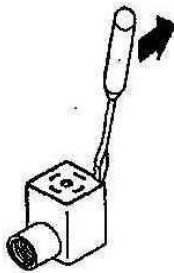
To check the operation of the EP proportional control valve without applying power, remove the rubber cap and press the tip of the core with a screwdriver. After checking the operation, reinstall the rubber cap in its original position.

How to Use DIN Terminal

⚠ Caution

Wiring procedure

1. Loosen the holding screw and pull the connector out of the pin plug.
2. Make sure to remove the holding screw, insert the tip of a flat head screwdriver into the groove on the bottom of the terminal block and pry it up to separate the terminal block cover from the terminal block.



3. Put the cable 8 through the cable gland 5, washer 6 and rubber seal 7 in that order and insert it into the cover 4.

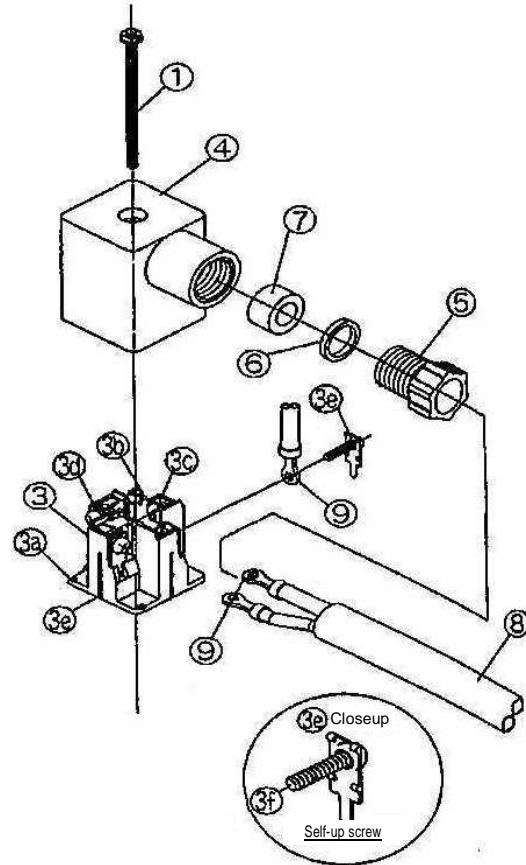
Strip the sheath of the cable 8 as shown below and crimp the crimped terminal 9 to the end of the cable.

Remove the self-up screw 3f from the bracket 3e (loosen it if using a Y shaped crimped terminal), mount the crimped terminal 3 as shown in the figure and fasten the self-up screw 3f again.

* The tightening torque should be within $0.5N \cdot m \pm 15\%$.

How to Use DIN Terminal

⚠ Caution



Remarks

- a) Wiring can be done with a bare wire. In that case, loosen the self-up screw 3f, insert the lead wire into the bracket 3d and screw in the screw again.
- b) The maximum size of the crimped terminal 9 is 1.25mm² to 3.5 for O terminal and 1.25mm² to 4 for Y terminal.
- c) Use a cable with outside diameter of $\phi 6$ to 12mm for the cable 8.
* When the outside diameter of the cable ranges from $\phi 9$ to 12mm, remove the internal part of the rubber seal 7.

Terminal block

Connect the terminal block to the terminal 1 and 2.

Terminal 3 is not used.

* **The coil does not have polarity.**

Applicable cable (Heavy-duty cord)

0.75mm² or 1.25mm² cord with 2 or 3-core defined in JIS C 3312. (Outside diameter $\phi 6.8$ to $\phi 11.5$)

Electrical entry changing procedure

After separating the terminal block and terminal cover, the electrical entry can be changed by assembling the terminal cover in the desired direction (90° intervals).



VEP / VEF / VEA / VER Series

Specific Product Precautions 4

Be sure to read before handling.

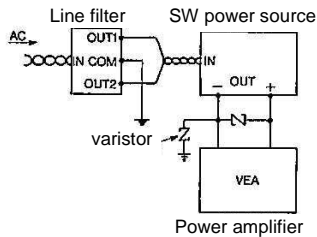
VEA25□ Wiring

Warning

Some elements (such as a 10W cement resistor) generate heat up to around 100°C as part of their function. Therefore, when installing the power amplifier, beware of the radiated heat. Also, never touch these parts directly while and after they are energized.

Caution

1. Twist and solder the end of a lead wire before connecting it.
2. Separate the wiring into the 24 VDC, OUTPUT, SIGNAL, SENSOR, and DETECT portions. In particular, shielded wires are recommended for the SIGNAL and SENSOR wires. Use lead wires that measure 0.75 mm² to 1.25 mm² in thickness for the 24 VDC, OUTPUT and 0.5 mm² for the remaining wires.
3. A fuse is mounted on the power supply to protect the equipment on the secondary side and the elements on the board. Be aware that it may be broken due to reverse connection of the 24 VDC wiring or over current.
4. When the wires are to be installed in the control panel along with those for other types of equipment, make sure to separate the AC and DC lines (to prevent the risk of damaging the elements in the circuit due to noise).
Twisting the AC lines together is an effective countermeasure against noise.
5. If there is a significant amount of noise (ripple) from the power supply, provide noise protection such as a line filter or a varistor.
Line filter: 250VAC, 3 to 5A class
varistor: for 39 to 47VDC operation



6. If the feedback circuit of the VEA252 is not used, remove the jumper pin J1 from "side 2" side and reinsert it into "side 1" on the board. Since this disables the feedback function, it will have the same function as the VEA251.
When the jumper pin J1 is inserted into "side 2", be sure to input the feedback signal from the sensor. If the feedback signal is not input, the EP proportional valve will not operate even when the externally set input voltage is changed, because 1A or more of current is output.

Outline

Two optional functions

1. Failure detection function [VEA251/252]

This function detects failure such as breakage of the output cable, short-circuit^(*) of the load circuit, power supply unit fault or breakage of the power supply cable, and informs a sequence controller of the failure in the form of open collector output.

This can prevent accidents before they happen.

When error occurs: OFF

The output is insulated from the internal circuit by a photocoupler.

(*) Detection only. If short-circuit occurs, remove the cause immediately.

2. Feedback function [VEA252]

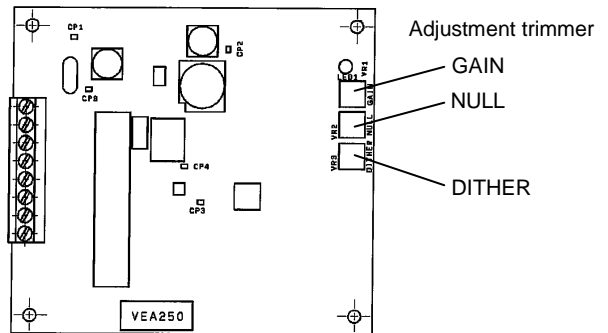
With this power amplifier, various processing data (pressure, cycles, flow rate etc.) can be fed back by sensors, enabling the system to perform highly precise control.

It is also possible to remove the feedback function by switching the jumper socket on the circuit board and to use it as VEA251. Note that VEA252 cannot be used for VER series. (Use it without feedback circuit*)

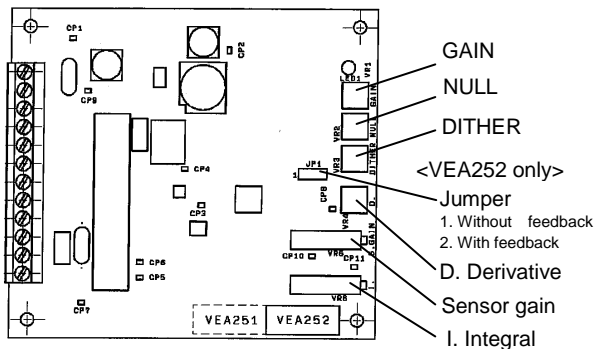
- See "Appearance".

VEA25□ Appearance

VEA250

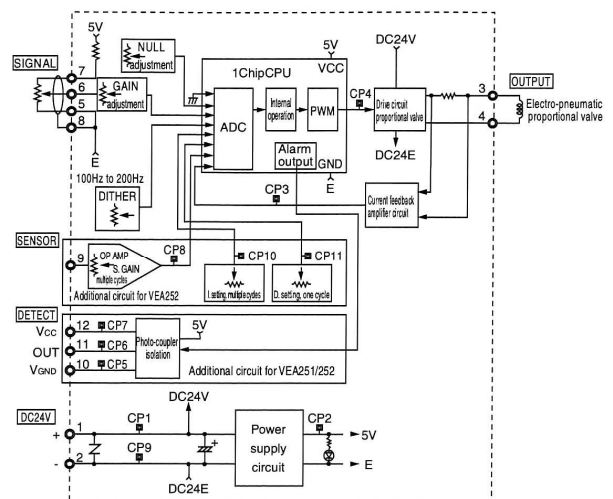


VEA251/2



In VEA252, when the jumper shown above is changed from "side 2" to "side 1", it is possible to use it without feedback circuit.

Circuit Diagram





VEP / VEF / VEA / VER Series

Specific Product Precautions 5

Be sure to read before handling.

VEA25□ Caution for Mounting

1. Installation location

Pay attention to the environmental conditions since this is an open type power amplifier.

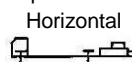
Operating temperature: 0 to 50°C (the smaller the temperature variation the better)

Operating relative humidity: 25 to 85% (avoid high humidity.)

Vibration: 20m/s²[2G] at the maximum (The electronic parts may be damaged.)

2. Mounting orientation

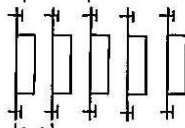
One amplifier



Vertical



Multiple amplifiers

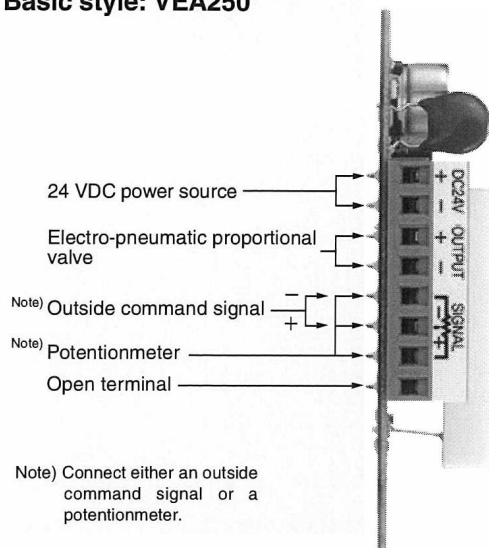


Vertical placement promotes air convection, resulting in improved heat dissipation.

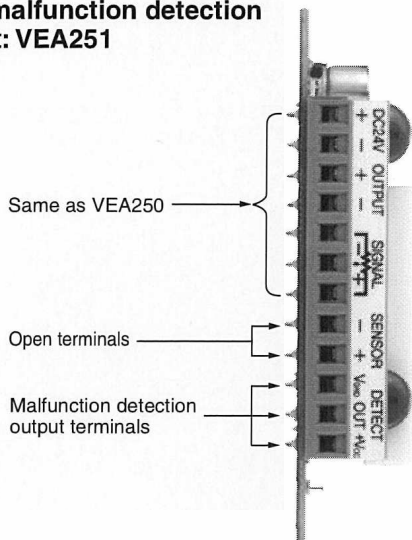
Mount at least 40mm apart

External Connection

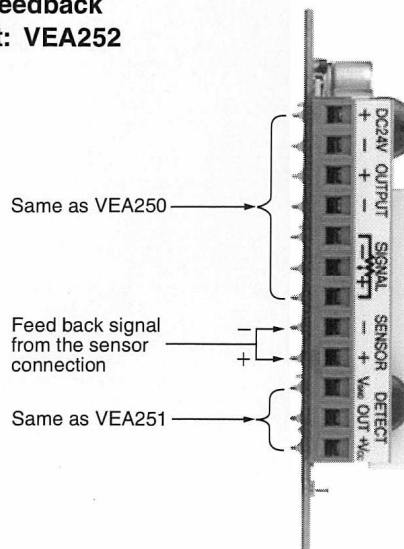
Basic style: VEA250



With malfunction detection circuit: VEA251



With feedback circuit: VEA252



Precautions for connection

We recommend peeling off 4 to 5mm of the tip of the lead wire and neatly soldering it before connecting.

If it is not soldered, the lead wire may come loose when inserted into the terminal block, causing short-circuit with adjacent terminals. Therefore, careful handling is required.

1. Power supply [24VDC]

Use a constant voltage switching power supply with 1.3A or more of 24+/-2VDC current capacity.

2. Command signal [SIGNAL]

The signal is controlled by manual potentiometer or external command signal (0 to 5VDC). The signal is controlled by manual potentiometer or external command signal (0 to 5VDC).

Since input impedance is 100kΩ, the current required for external command signal is not more than 0.05mA.

In case of external command signal, use in an isolated condition (not common grounded) by separating the power for signal from that of power amplifier drive.

3. Output [OUTPUT]

Use the output cable (connecting to the electro-pneumatic proportional valve) with a conductor sectional area of 0.75mm² or 1.25mm² and keep the length so that the impedance of the output cable only (2Ω in total of plus and minus sides) does not exceed 1Ω.

For example, if using JIS C 3306 1.25mm², the 60m long output cable (120m long in total of plus and minus sides) is applicable.

4. Failure detection output [DETECT]

(VEA251 and 252 only)

The failure detection circuit is an open collector circuit in which failure such as cable breakage, short-circuit or power supply shut-off in the output circuit is isolated by a photocoupler, which then informs the PC and control equipment of the failure.

However, the failure detection circuit itself is not a protective circuit. Therefore, if failure is detected, interlock the system to prevent accidents and shut off the power supply for the power amplifier.

Restart after checking and removing the cause of the failure.

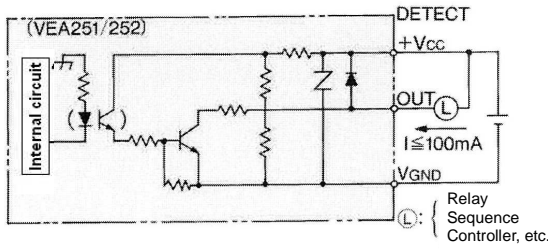


Specific Product Precautions 6

Be sure to read before handling.

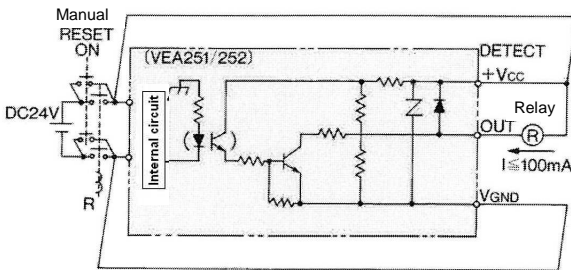
Examples of Failure Detection Circuit

[Safety circuit]



A safety circuit for the entire system is provided through the use of relays and sequence controllers as a safety measure in case the electro-pneumatic proportional valve does not operate due to an open circuit.

[Example for short-circuit protection circuit]



If short-circuit occurs at the current output terminal side, the power supply is shut off immediately to prevent damage to the output circuit of the power amplifier. It can be restarted by pressing the manual ^{RESET} ON switch.

Adjustment

Refer to "Appearance" for the position of adjustment trimmers [NULL, GAIN, DITHER, S.GAIN, I., D.].

1. Adjustment of input/output (NULL, GAIN)

The relationship between the input (command signal) and output (current) can be adjusted to suit the control conditions. The trimmer position is different between new type and old type. Please check the indication of trimmer when adjusting trimmer.

NULL ··· This function biases the size of current to the command signal. The range of current (0 to 500mA) can be adjusted to 0V of the command signal. (5mA or less when shipped)

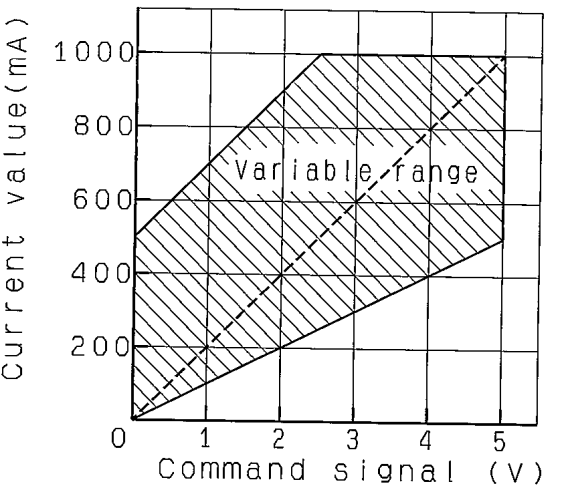
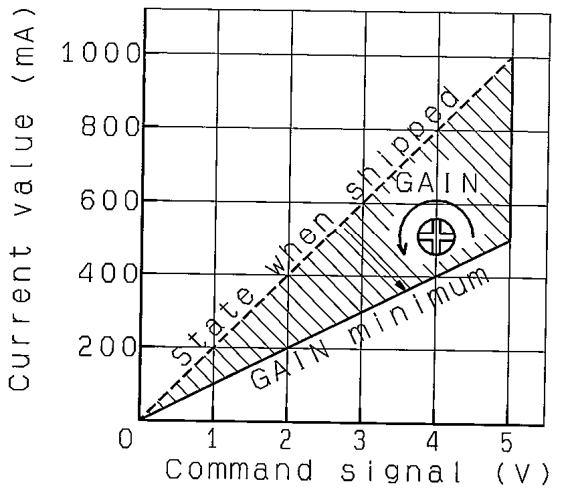
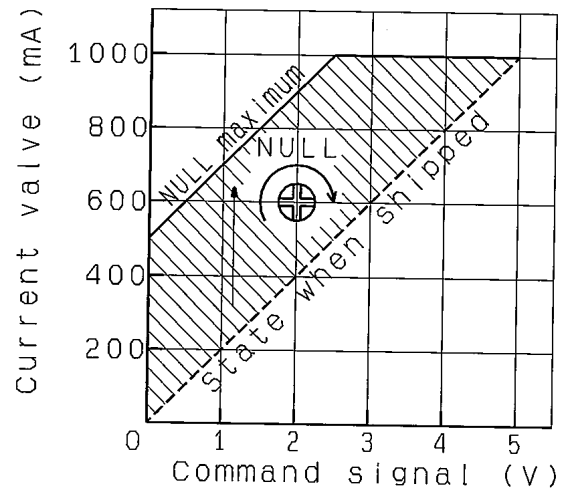
GAIN ··· This function changes the ratio of current (tilt) to the command signal

$$\frac{\text{Current}}{\text{Command signal}} = \frac{500\text{mA}}{5\text{V}} \text{ MIN}$$

$$\frac{1000\text{mA}}{5\text{V}} \text{ MAX}$$

Adjustable within a 100-200 $\frac{\text{mA}}{\text{V}}$ range

(200 $\frac{\text{mA}}{\text{V}}$ when shipped)



The variable range of input/output when NULL and GAIN are combined with the electro-pneumatic proportional valve is shown on the next page, using an example of the pressure type (VEP, VER).

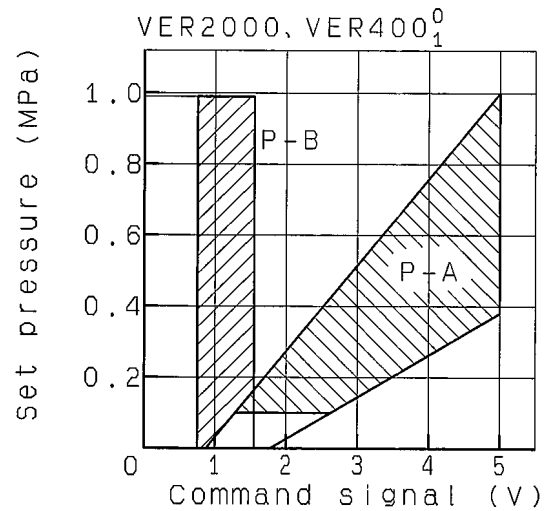
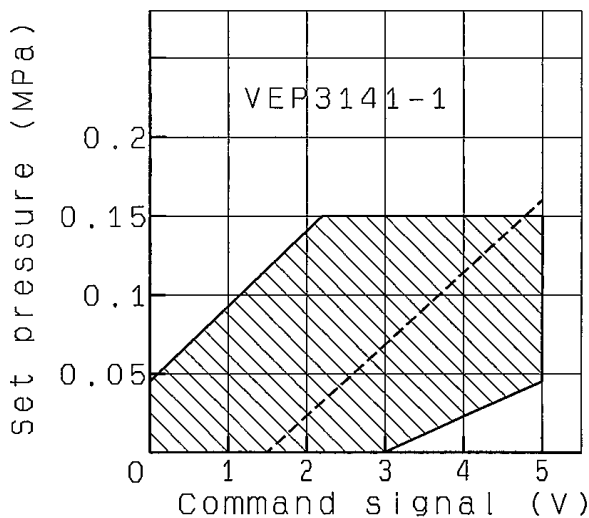
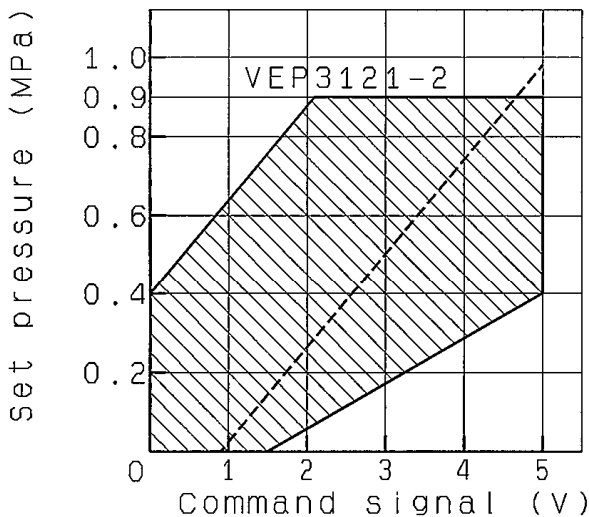
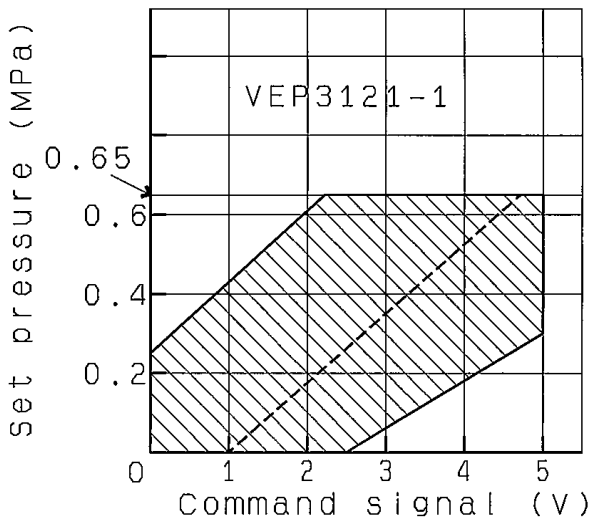


VEP/VEF/VEA/VER Series

Specific Product Precautions 7

Be sure to read before handling.

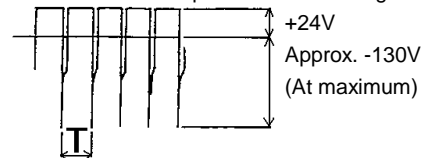
Variable range of set pressure adjustment of electro-pneumatic proportional valves VEP and VER



Adjustment of dither frequency (DITHER)

Dither is fine shaking of the movable part of the electro-pneumatic proportional valve caused by pulsation of the magnetizing current to maintain its proper operation (to keep hysteresis smaller). The dither frequency is adjusted to 140Hz at the time of shipment. However, if the buzzing sound caused by dither is too loud or the mounting board resonates, adjust it within a range of 140 to 170Hz. Adjust the DITHER frequency of the adjusting trimmer while measuring its value, keeping the EP proportional valve connected and operating.

<When an oscilloscope is used> DC range



Period: $T \cong 7.1\text{ms}$ When the frequency is 140Hz

$T \cong 5.9\text{ms}$ When the frequency is 170Hz

<When a frequency counter is used>

The frequency can be read directly.



Adjustment of feedback (S.GAIN, I. D.) VEA252 only

More highly-accurate control is possible by feeding back the state of load (pressure, force, speed, etc.) with a sensor.

At this time, the feedback needs to be adjusted to match with the control state.

S.GAIN···This adjusts the amplitude of the feedback signal from the sensor. The variable range is X0.1 to X10. The larger the magnification, the higher the control precision will be, but if the magnification is too large, the sensor will become too sensitive to fluctuation of the load or changes in of the command signal, causing oscillation.

I (Integral control action) ··· This function amplifies small deviations (by time integration) and precisely corrects them. The variable range of time integration is 0 to 20sec. The shorter the integration time, the faster the correcting action will be, but if the time is too short, the sensor will become too sensitive to fluctuation of the load or changes in of the command signal, causing oscillation.

D (Derivative action)···This function detects the changing speed (time derivative) of command signal and load, thereby improving the quick responding performance of the control and correction. The variable range of derivative action time is 0 to 2sec. The shorter the derivative action time, the better the quick responsiveness will be, but if the time is too short, the sensor will become too sensitive to noise, causing oscillation.

After obtaining a good control state by adjusting these three items, work on the GAIN adjustment to obtain matching between the command signal and output (pressure, force etc. of the object of control).

Power Amplifier

Use a purpose-designed power amplifier (VEA25*) to drive the EP proportional valve. The specifications indicated in the manual are applicable to the use of a purpose-designed power amplifier. Note that if another amplifier is used, the specifications will not be met. As a general rule, one power amplifier is used per EP proportional valve, however this is not an absolute requirement provided that the EP proportional valves are not used simultaneously.

Troubleshooting

Check the following list depending on the failure and take countermeasures.

Content of failure	Item to check	Countermeasures
Operation failure	Are wires properly connected?	Connect wires properly. Also check that there is no error on the power amp. side. Especially when a feedback circuit is used for VEA252, the valve supplies maximum pressure and flow rate (fully open) if the feedback signal is not input. Input the feedback signal or use it without the feedback circuit (See page 8).
	Is the inlet pressure within the specified range?	Keep it within the specified pressure range.
	Is manual operation possible?	Foreign matter might be caught in the spool. Replace the electro-pneumatic proportional valve.
	Is drainage accumulated?	Exhaust drainage from the filter and lubricate.
Oscillation	-	See "adjustment" (on page 10) for adjustment.
Air leakage	-	The spool might be worn out. Replace the electro-pneumatic proportional valve.

If it is not possible to solve the problems even with the above-mentioned countermeasures, the valve may have other errors. In that case, please stop using the valve immediately.

In the following cases, the valve may have internal problems. If so, please stop using the valve immediately.

1. The valve has been lubricated with oil other than the specified type.
2. Lubrication has been stopped partway through, or temporarily stopped.
3. Water has splashed directly onto the valve.
4. Intense vibration has been applied.
5. Foreign matter such as drainage or dust has got inside.
6. The valve has been used in some other way corresponding to the precautions in the operation manual.

If the electric-pneumatic valve is thought to have an error, please return it as it is.

Revision history

A	Safety Instructions	Po
B	Renewal	QR
C	Renewal	TY

1st printing:NP

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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