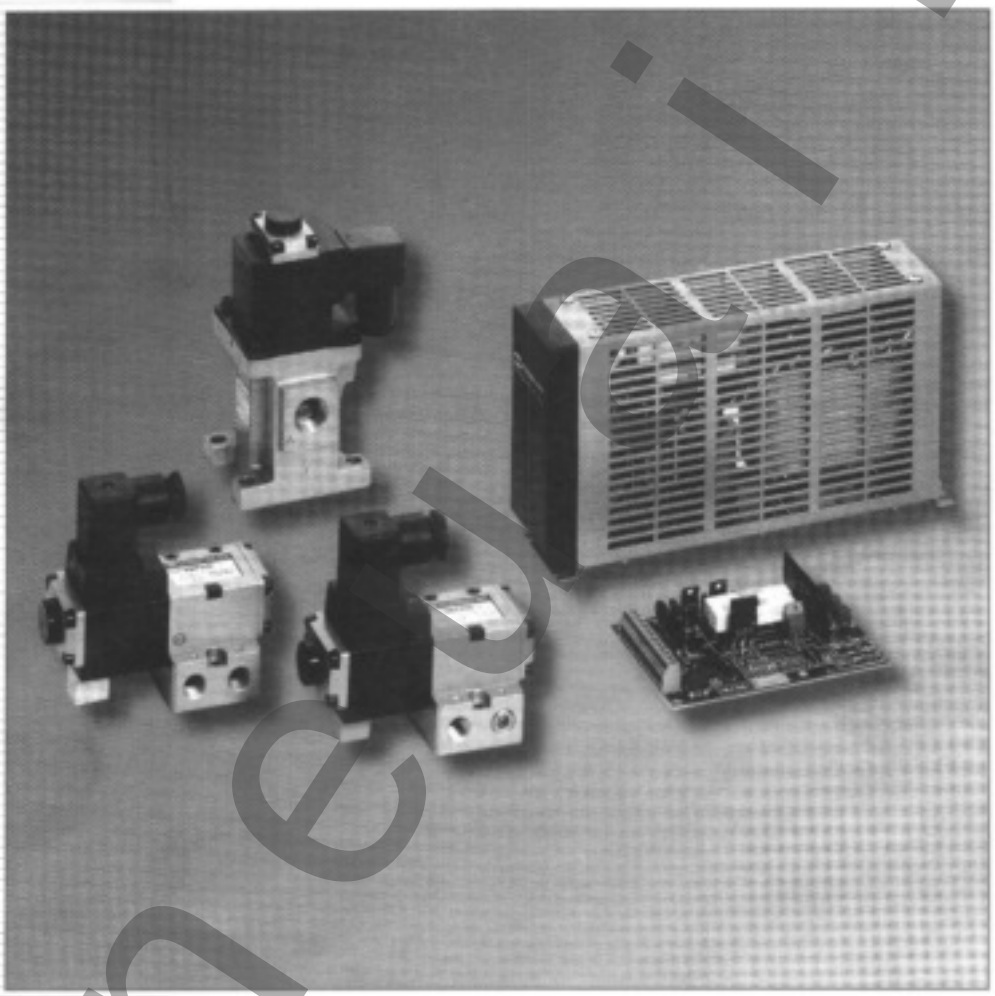
Electro-Pneumatic Valve

NVEP/NVEF Series



Output Pressure or Flow is Controlled By An Electrical Input Signal
Amplifier Supply Voltage is 115VAC or 24VDC
Operating Pressure Up To 150 psig
1/4" to 3/4" Port Sizes
Base Mount or Body Ported
Built-In PID Controller is Optional

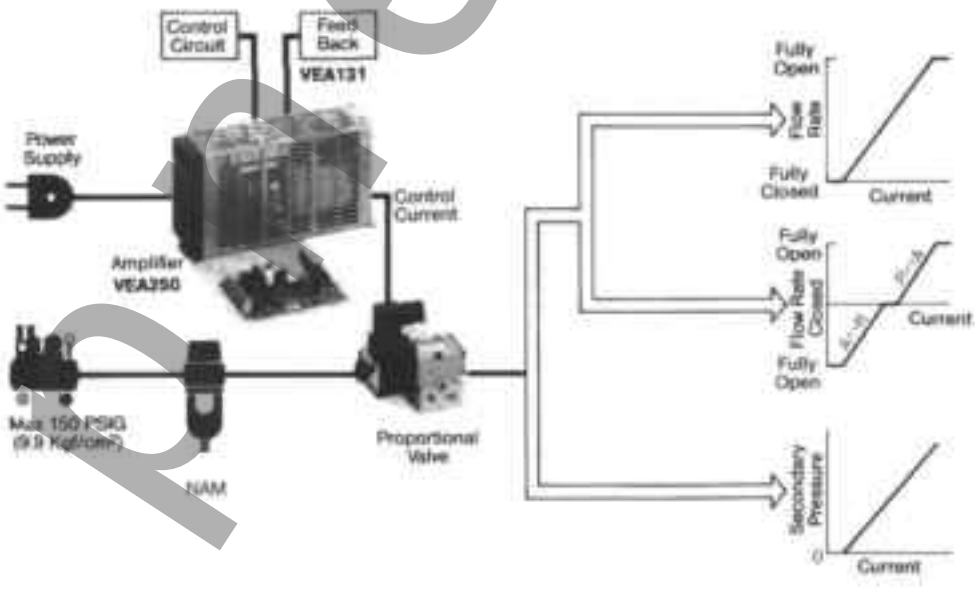
NVEF, NVEP

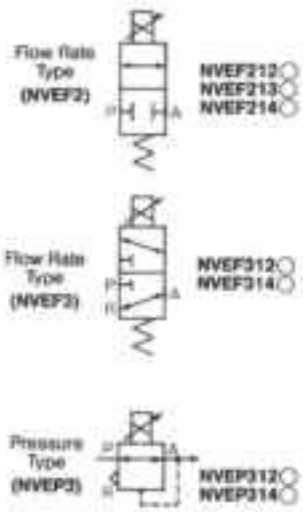
System Composition

The conventional pneumatic valve system consists of ON-OFF valves which are in a deenergized or energized position. A proportional control valve system provides the ability to infinitely control the position of the internal spool assembly which increases or decreases the amount of FLOW or PRESSURE being released from the valve.

To accomplish this, combine a low power INPUT signal with a high power OUTPUT signal through the use of the POWER AMPLIFIER. This amplifier becomes a very important part of the total system. Without this component it is not possible to provide the infinite control and use of a basic ON or OFF Directional Control Valve would have to be continued.

SMC offers two (2) types of Proportional control Valves:
1. A Pressure Type (NVEP) which controls secondary pressure by varying the current through the solenoid.
2. A Flow Rate Type (NVEF) which controls air flow by varying current through the solenoid.





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2•3 Port Electro-Pneumatic Proportional Valve

NVEF, NVEP

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2•3 Port Electro-Pneumatic Proportional Valve

NVEF, NVEP

STANDARD SPECIFICATIONS

Characteristics	Flow			Pressure	
	NVEF2120 NVEF3120 (Base Mount)	NVEF2130	NVEF2140 NVEF3140	NVEP3120 (Base Mount)	NVEP3140
Port Size	1/4", 3/8" NPTF	1/4", 3/8", 1/2" NPTF	1/2", 3/4" NPTF	1/4", 3/8" NPTF	1/2", 3/4" NPTF
Media	Air *				
Oper. Pressure	150 PSIG (9.9 Kgf/cm)				
Proof Pressure	225 PSIG (15 Kgf/cm)				
Ambient Temp.	40 ~ 120°F (5 ~ 50°C)				
Response Time	30 ms Max.		50 ms Max.	30 ms Max.	50 ms Max.
Hysteresis	3% F.S.				
Repeatability	3%				
Sensitivity	0.5%				
Linearity	–			3%	
Lubrication	Recommend ISO Specification VG32 (Turbine Oil #1)				
Weight Lbs.	1.98	2.20	3.09	1.98	3.09

* Lubricated or oil free and any non-flammable, non-toxic, non-corrosive gases, except oxygen.

SOLENOID SPECIFICATIONS

Adder Number	0	1
Required Amplifier	VEA130, VEA131	VEA 250, 251, 252
Control Range	0-750mA	0-1A
Coil Resistance	26Ω (68°F (20°C))	13Ω (68°F (20°C))
Power Consumption	15W Max. Current (68°F (20°C))	13W Max. Current (68°F (20°C))
Insulation	Class H	
Max. Temperature Rise	284°F (140°C) at Full Current	
Electrical Connection	DIN Connector (½" PF)	

How To Order

NVEF 3 1 4 0 - 1 - 03

Flow Rate Type

Amplifier

#	Model
0	VEA130, 131
1	VEA250, 251, 252

Ports | Body Size | Orifice Area | Port Size

Ports	Body Size	Orifice Area Code	Max. Effective Orifice (mm²)	Port Size NPTF
2	(Base mount type) 2	1	13	02 = 1/4 03 = 3/8
		2	9	
		3	5	
	3	1	30	02 = 1/4 03 = 3/8 04 = 1/2
	4	1	45	03 = 3/8 04 = 1/2 06 = 3/4
3	(Base mount type) 2	1	12	02 = 1/4 03 = 3/8
		2	8	
		3	4.5	
		4	2.5	
	4	1	25	03 = 3/8 04 = 1/2 06 = 3/4

NVEP 31 4 0 - 1 - 03

Pressure Type

Amplifier

#	Model
0	VEA130, 131
1	VEA250, 251, 252

Body Size | Operating Pressure | Port Size

Body Size	Operating Pressure Code	PSIG (Kgf/cm²)	Port Size NPTF
(Base mount type) 2	1	7-90 (0.5-6.5)	02 = 1/4
	2	15-135 (1-9)	03 = 3/8
4	1	0.7-22.5 (0.05-1.5)	03 = 3/8 04 = 1/2 06 = 3/4

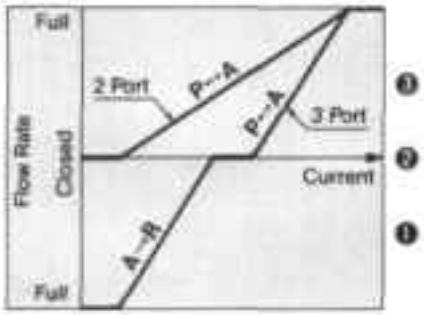
Subplates (NVEF212○; NVEF312○; NVEP312○)

Part No.	Porting	No. of Ports
DXT172-2-1NPTF	1/4" NPTF side ports	3
DXT172-2-2NPTF	3/8" NPTF side ports	3

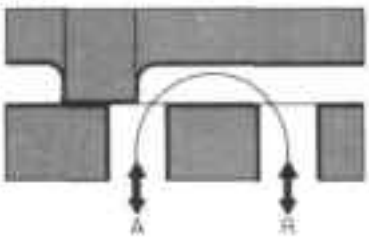
* Includes gasket and screws

OPERATING PRINCIPLES

The effective orifice size is controlled by the movement of the spool, which is balanced between the Solenoid Force (F1) and the Spring Force (F2). The Solenoid Force increases as the control current increases, pushing the spool to the right as shown below (❶→❷→❸).



❶



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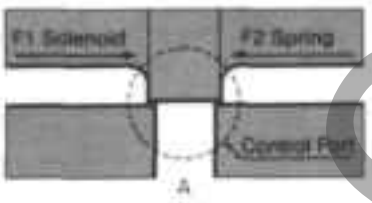
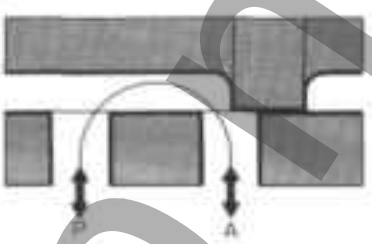
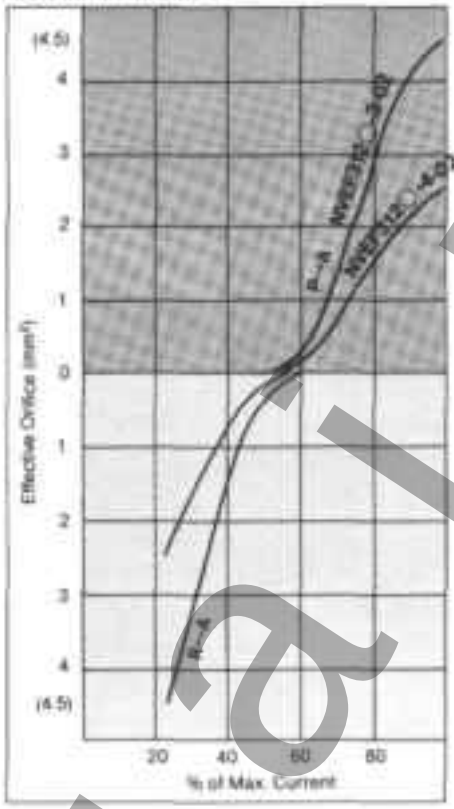
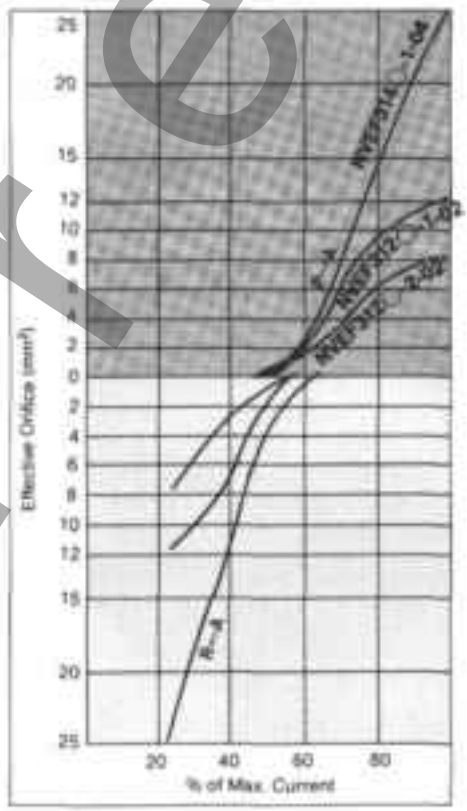


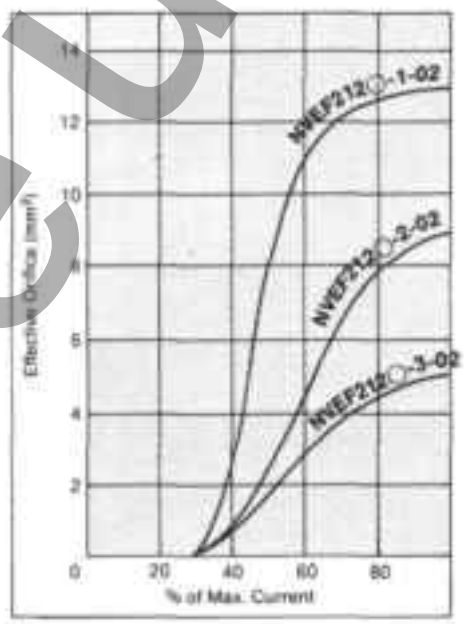
❸

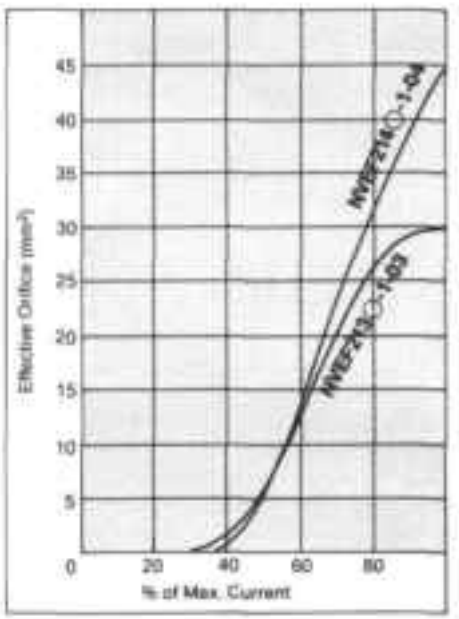


% Current/Flow Rate





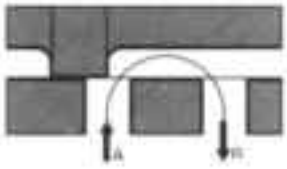




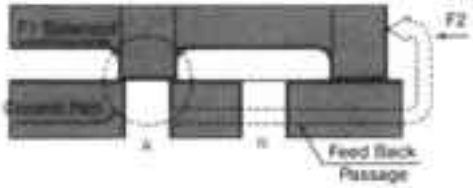
OPERATING PRINCIPLES

The secondary pressure is controlled by the movement of the spool which is balanced between the Solenoid Force (F1) and F2. F2 results from the secondary pressure (P2) acting on the end face of the spool.

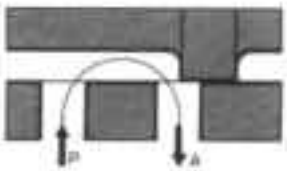
❶ $F_1 < F_2$



❷ $F_1 = F_2$

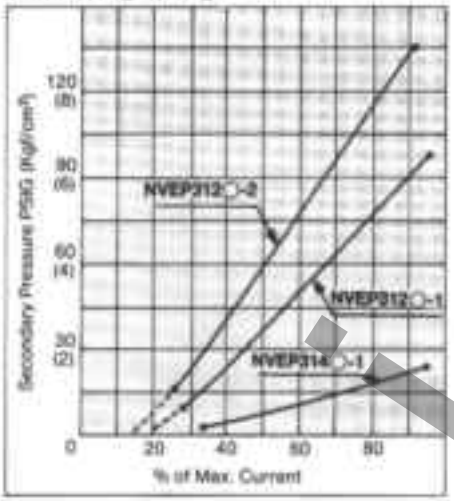


❸ $F_1 > F_2$

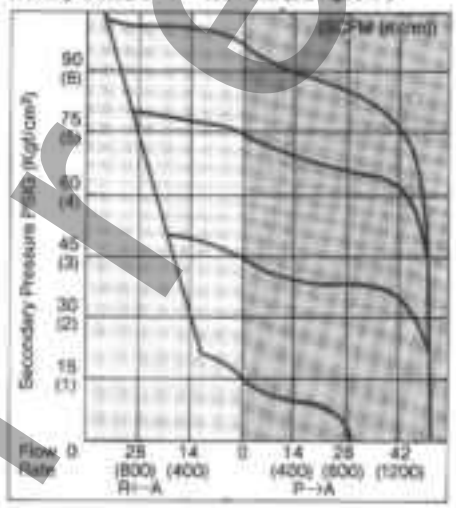


(P1=Primary Pressure) (P2=Secondary Pressure)

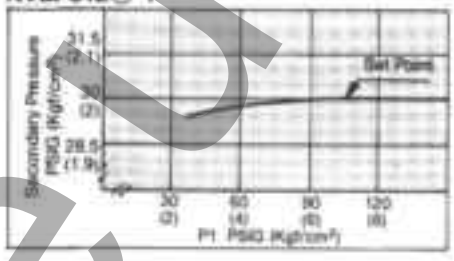
% Current/Pressure
NVEP312○/314○



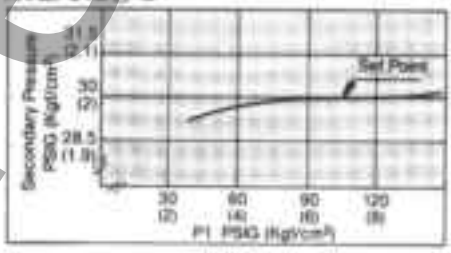
Flow Rates
NVEP312○-1-02
Primary Pressure P1 = 150 PSIG (9.9 Kgf/cm²)



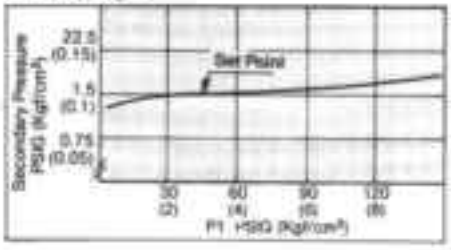
Pressure Rates
NVEP312○-1



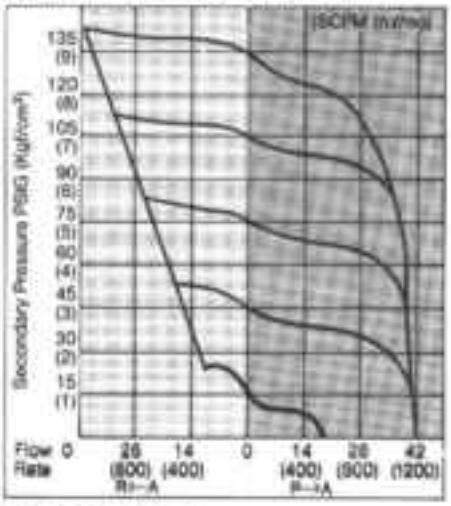
NVEP312○-2



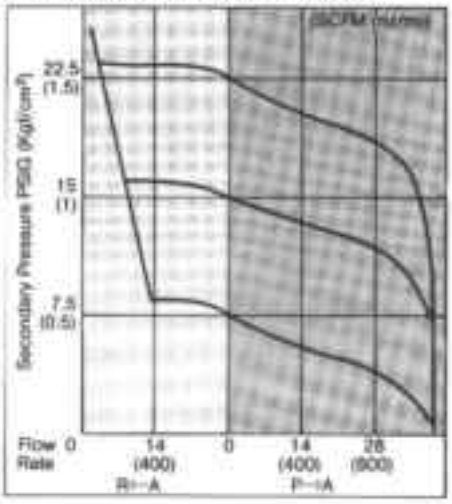
NVEP314○-1



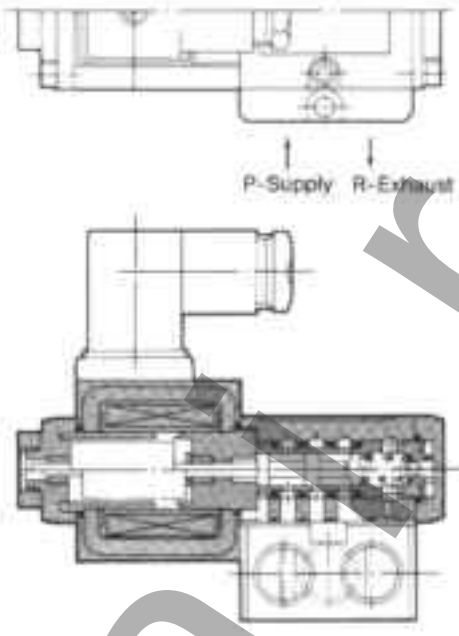
NVEP312○-2-02
Primary Pressure P1 = 150 PSIG (9.9 Kgf/cm²)



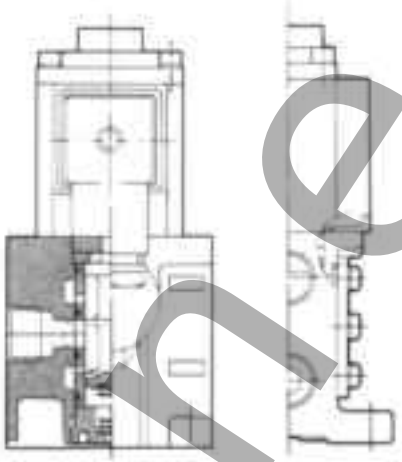
NVEP314○-1-04
Primary Pressure P1 = 45 PSIG (3 Kgf/cm²)



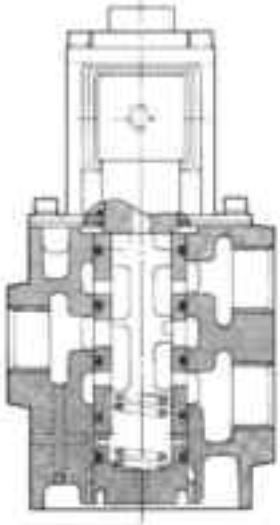
Flow Rate Type: NVEF212○ (2 Ports)
NVEF312○ (3 Ports)
Pressure Type: NVEP312○ (3 Ports)



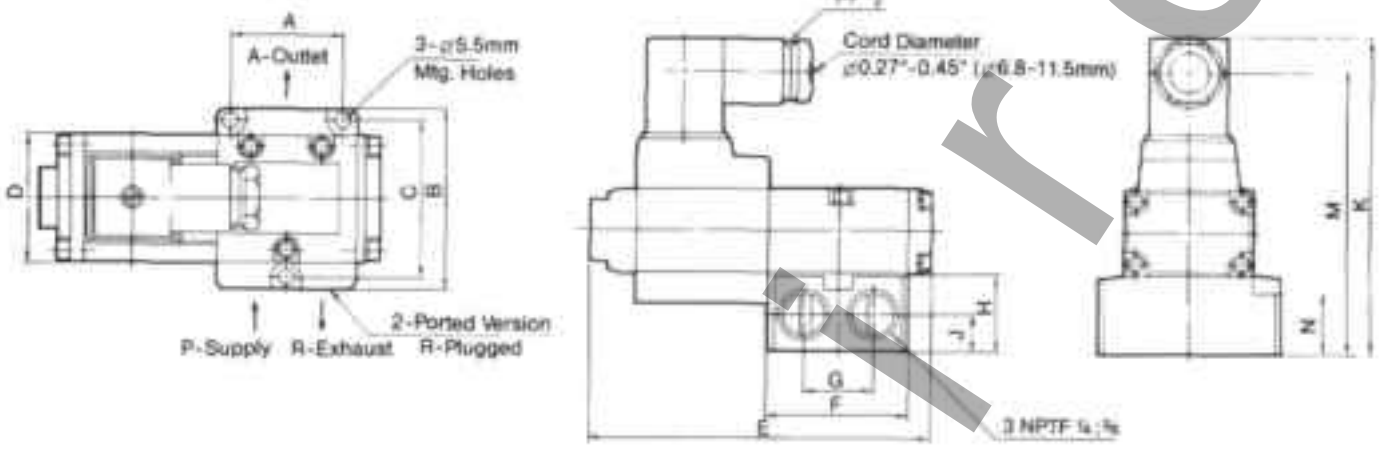
Flow Rate Type: NVEF213○ (2 Ports)



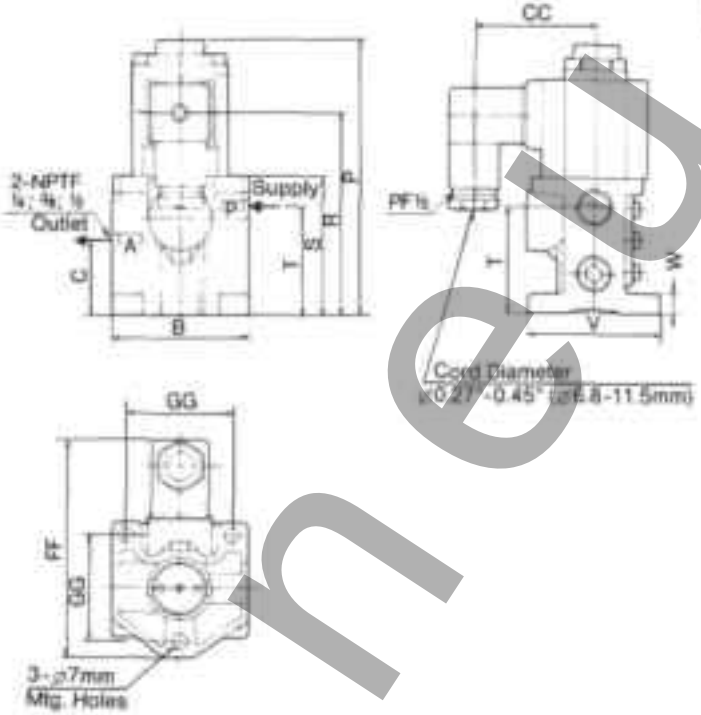
Flow Rate Type: NVEF214○ (2 Ports)
NVEF314○ (3 Ports)
Pressure Type: NVEP314○ (3 Ports)



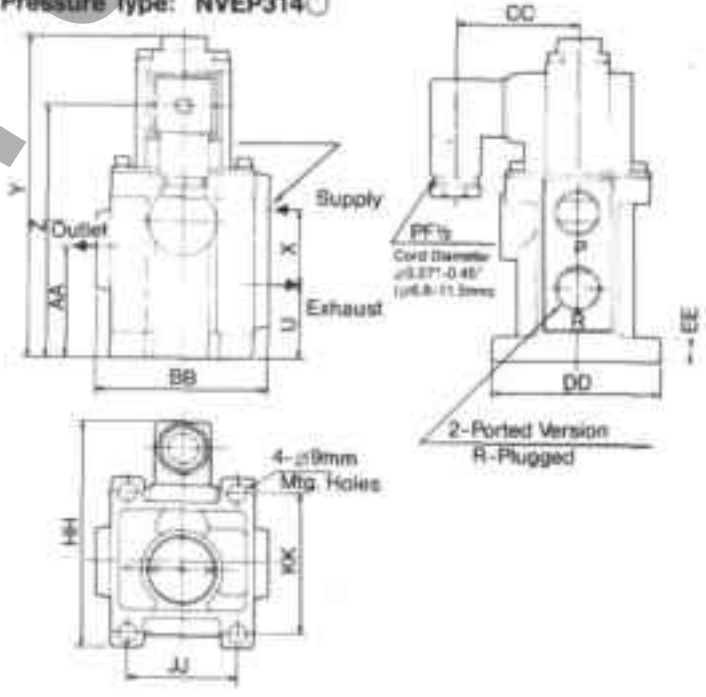
Flow Rate Type: NVEF212○, NVEF312○
Pressure Type: NVEP312○



Flow Rate Type: NVEF213○



Flow Rate Type: NVEF214○, NVEF314○
Pressure Type: NVEP314○



DIMENSIONS

A	B	C	D	E	F	G	H	J	K	M	N	P	R	S	T
1.57 (40)	2.52 (64)	2.20 (56)	1.77 (45)	4.80 (122)	1.97 (50)	0.98 (25)	1.10 (28)	0.51 (13)	4.45 (113)	3.98 (101)	0.83 (21)	5.08 (129)	3.74 (95)	2.56 (65)	2.01 (51)
U	**V**	**W**	**X**	**Y**	**Z**	**AA**	**BB**	**CC**	**DD**	**EE**	**FF**	**GG**	**HH**	**JJ**	**KK**
1.38 (35)	2.52 (64)	0.35 (9)	1.42 (36)	6.08 (154.5)	4.74 (120.5)	2.09 (53)	3.23 (82)	2.28 (58)	3.19 (81)	0.47 (12)	4.02 (102)	1.97 (50)	4.35 (110.5)	2.05 (52)	2.60 (66)

Millimeters in parentheses

Valve Installation

FILTRATION

To insure that proper operation is maintained it is very important that the air is properly filtered with COALESCED type filter, SMC offers a SERIES NAM coalescing filter and with the help of a SERIES NAF standard airline filter, which would be used to pre-filter the supply pressure, will provide you with a clean air supply.

LUBRICATION

This valve may be operated with or without lubrication. When lubrication is used it is very important that a high grade of oil be used. An oil with a specification of ISO VG 32 is recommended (Turbine Oil #1) EXCESSIVE LUBRICATION CAN CAUSE THE VALVE TO OPERATE ERRATICALLY.

MOUNTING

It is very important to mount the valve so that the spool is on a horizontal plane. It is recommended that a rubber vibration pad be placed underneath the valve to reduce the amount of noise created by the solenoid during operation.

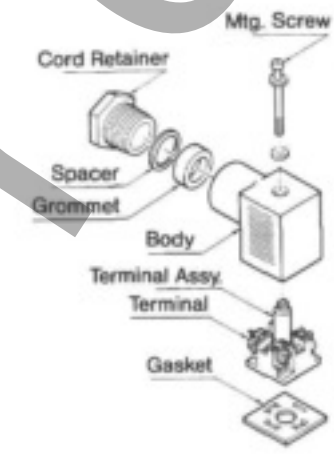
PLUMBING

Be sure that the supply lines are thoroughly cleaned out before connecting to the valve. Any metal chips or other types of contamination should be removed before operation.

MANUAL OPERATION

This valve may be manually operated. However, a great deal of force will be needed to manually operation this valve in order to overcome the mechanical spring as well as the air pressure assisting the spring.

Wiring Procedure for DIN



1. Remove DIN top from solenoid assembly.
2. Connect cable to correct terminals.
3. Use compression grommets for strain relief.

CAUTION:
If using ground terminal, remove spring washer. When removing DIN connector, lift perpendicular to valve body.

1-2 = Solenoid Connection
3 = Ground

Power amp.: Series VEA

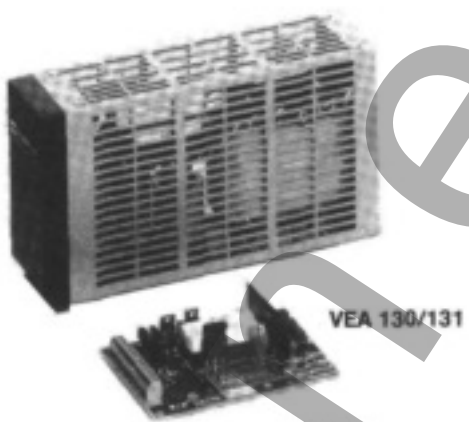
Used Exclusively For Electropneumatic Proportional Valve

Series VEA amplifiers are exclusively used for driving electropneumatic proportional valves, and have 3 important functions.

1. Command Signal
A low power DC voltage controls the output current.

2. High Dither-effect
Effective dither is obtained through P.W.M. (Pulse Width Modulation), thus minimizing the hysteresis of the electropneumatic proportional valve.

3. Stabilization of the Electropneumatic Proportional Valve's Performance
The adoption of a constant current system enables a stabilized performance even with a change in impedance or voltage at the power source. The repeatability is also improved.



VEA 130/131

VEA 250
VEA 251
VEA 252

Model

VEA 250/130	Basic type having driving function only
VEA 251	As a system safety measure, an abnormality detecting circuit is added to VEA 250.
VEA 252	An abnormality detecting circuit and a feedback circuit are added to VEA 250, Use of a sensor gives a wider control range and more precise control.
VEA 131	A feedback circuit is added to the VEA 130. Use of a sensor gives a wider control range.

Specifications

Characteristics		VEA130	VEA250
Supply Power		110/220V + 10% (50/60Hz)	DC24V +2V
Power Consumption		50VA	29W
Output Current Range		0–0.75A	0–1A
Impedance of E/P Proportional Valve		26–36Ω (0.75AF.S.)	13–18.5Ω (1A F.S.)
Amplifier Impedance		100KΩ	
Signal Voltage Range		0–10 VDC	0–5VDC
Applicable Potentiometer		10KΩ (1/8W or above) not provided	
Step Response		60ms (0.75A, 95%)	
Dither Frequency Adjustable Range		100–200 Hz (Factory adjusted @ 125Hz)	120–180Hz (Factory adjusted @ 140Hz)
Null Adjustable Range		0–0.5A (Factory adjusted @ 0A	
Gain Adjustable Range		500-750mA at an input voltage of 10V	500mA-1A at an input voltage of 5V
Electrical Linearity		±1% F.S.	
Current Stability	for Impedance Chg.	Max. 1% 26-36 (1A F.S.)	Max. 1% 13-18.5 (1A F.S.)
	for Voltage Fluct.	Max. +10% (1A F.S.)	Max. +1% against DC22-26V (1A F.S.)
	for Temp. Fluct.	Max. +1% @ 79°F (25°C) (1A F.S.)	Max. +2% @ 79°F (25°C) (1A F.S.)
Operating Temp. Range		32 - 122°F (0-50°C)	
Vibration Resistance		2G (amplitude of 0.4mm, 50Hz)	
Environment		Free from dew formation, relative humidity of 25-85%	
Weight Lb.		7.05	0.20

Specification of Abnormality Dectection Circuit /VEA251 (Main features as VEA250)

Detection capabilities	Broken output cable, broken power source cable
Output system / Type	Open collector output / Off when disconnected
Power source required for detection circuit	24VDC, 100mA
Weight	.26 (.12)

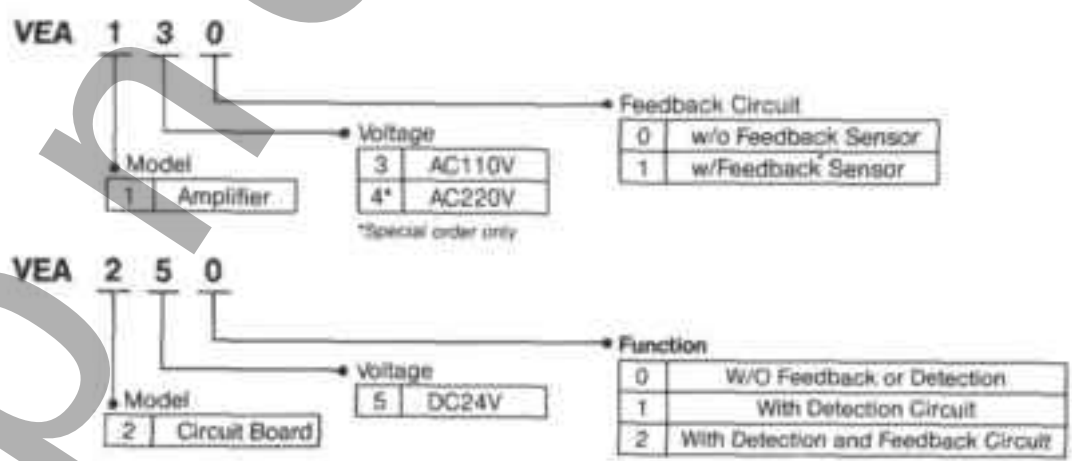
Specification of Feedback Circuit /VEA252 (Main features as VEA250, 251)

Sensor feedback voltage	Recommend range 0~5V (DETECT AMP GAIN×0.1~×10)
Input impedance	100kΩ or more
Pre Amp. gain	Fixed at×100
Integral action time (DELAY ADJ)	0~20s
Derivative action time	0~2s
Weight	.29 (.13)

Specification of Feedback Circuit/VEA131 (Main features as VEA130)

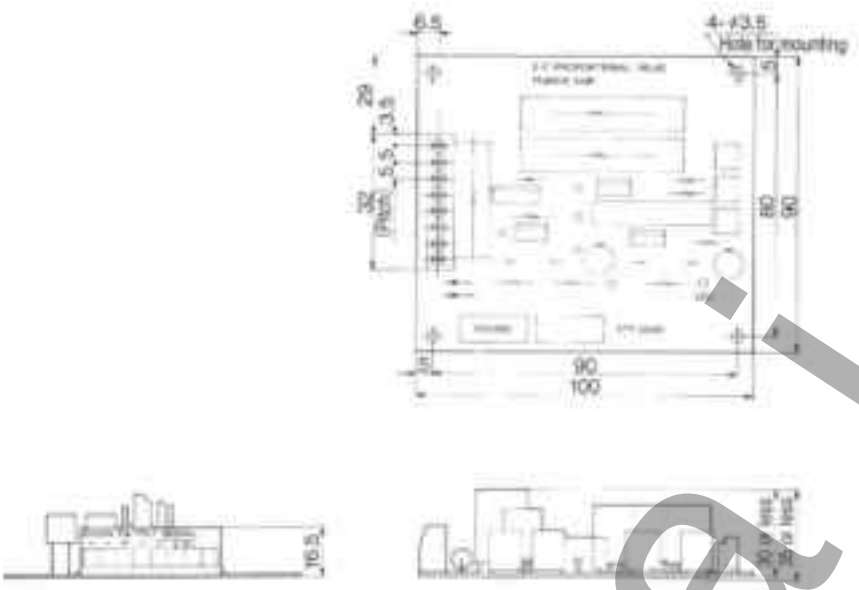
Sensor feedback voltage	0-1V (Detect Amp Gain X1~X20)
Input impedance	100KΩ
Pre Amp. gain	Fixed at X100
Integral action time (DELAY ADJ)	0.01~1s
Weight	7.05 (3.2)

How To Order

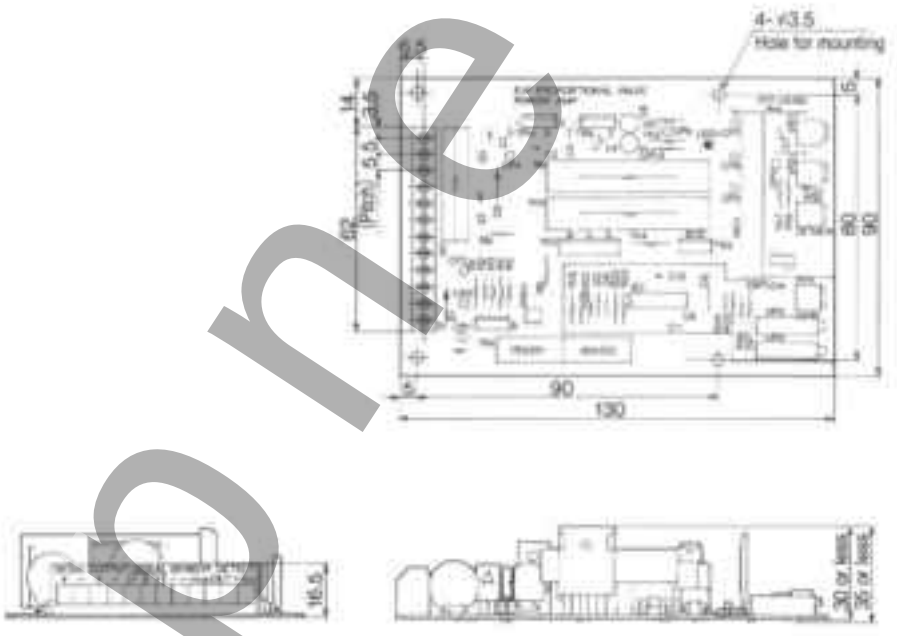


Dimensions (mm)

VEA250



VEA251/252



Handling Instructions

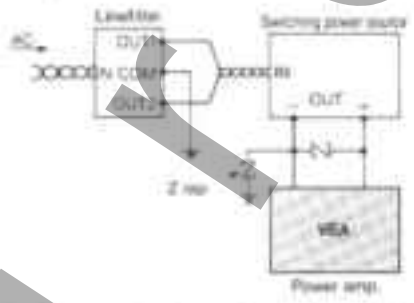
❶ Connect lead wire after twisting and soldering.

❷ Connect to 24VDC, output, signal, sensor and detect terminals. Shielded wires are recommended for connections to signal and sensor terminals.

NOTE: The 24VDC and the 0-5VDC signal voltage must have separate isolated grounds.

❸ Keep the AC line remote from the DC line when mounting together with other apparatus within a control box. (Noise can cause damage to circuit elements.) Twisting the wire of the AC line is an effective counter measure against noise.

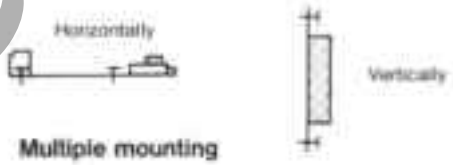
❹ If noise (ripple) from the power source is high, then noise protection measures such as a linefilter, are necessary.
Linefilter ; 250VAC, 3~5A rating
Z lap ; 38~47VDC



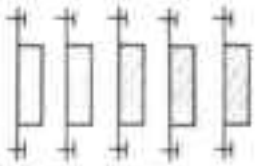
❺ Some of the elements will generate heat when operating, therefore care should be taken with respect to radiant heat.

Mounting Amplifier

Single mounting

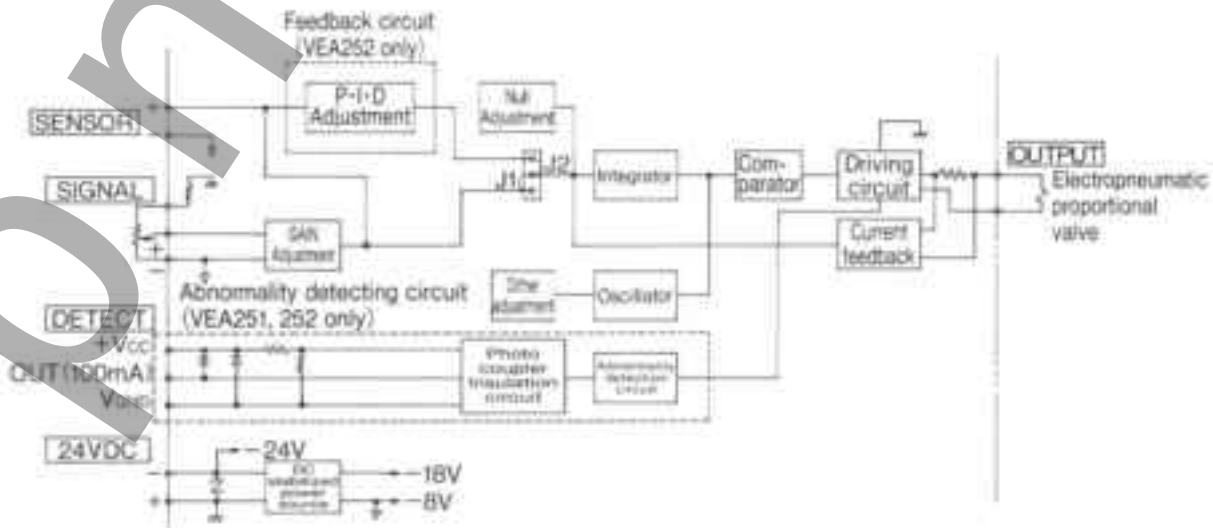


Multiple mounting

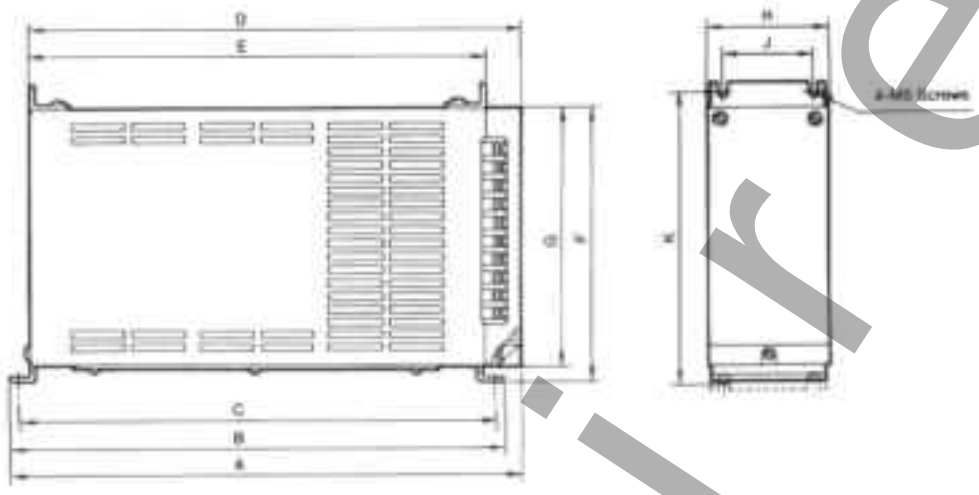


Vertical mounting aids heat radiation due to improved air flow.

Composition of Circuit



VEA130/131

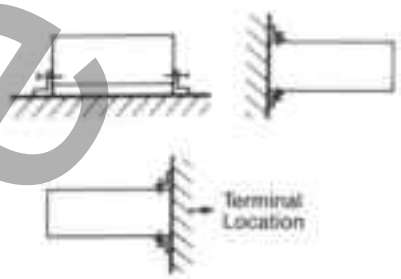


Dimensions

Model	A	B	C	D	E	F	G	H	J	K
VEA130/131	10.04 (255)	9.72 (247)	9.33 (237)	9.61 (244)	8.90 (226)	5.35 (136)	5.08 (129)	2.36 (60)	1.57 (40)	5.71 (145)

Mounting Amplifier

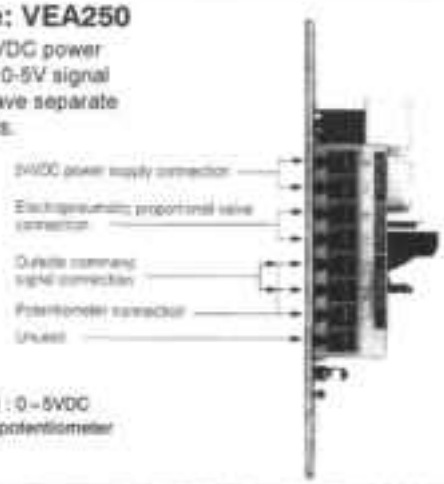
The VEA 130/131 Amplifier includes two (2) mounting brackets which may be moved to fit any of the following mounting configurations.



External Connections

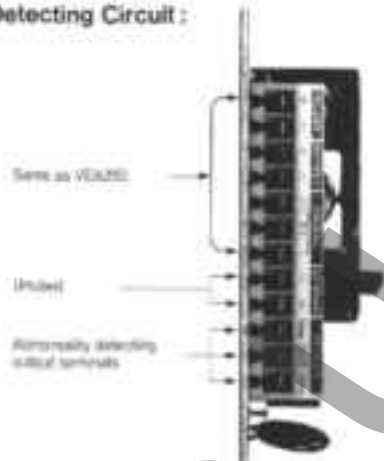
Basic Type: VEA250

NOTE) The 24VDC power source and the 0-5V signal voltage must have separate isolated grounds.

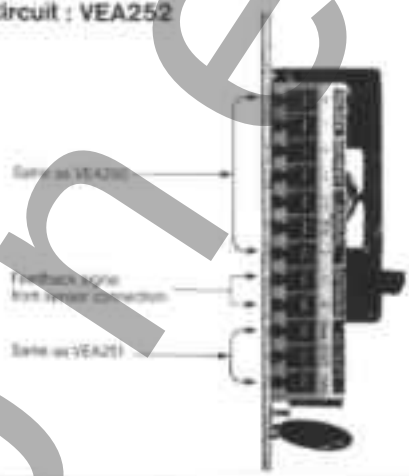


Command Signal : 0 – 5VDC
or (10 [KΩ] ¼W) potentiometer

With Abnormality Detecting Circuit : VEA251

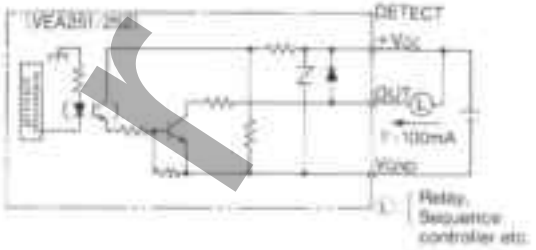


With Feedback Circuit : VEA252



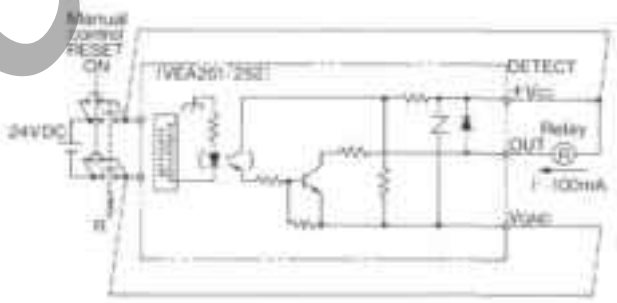
Specification Of Circuit With Abnormality Detection Function

Example of a Safety Circuit



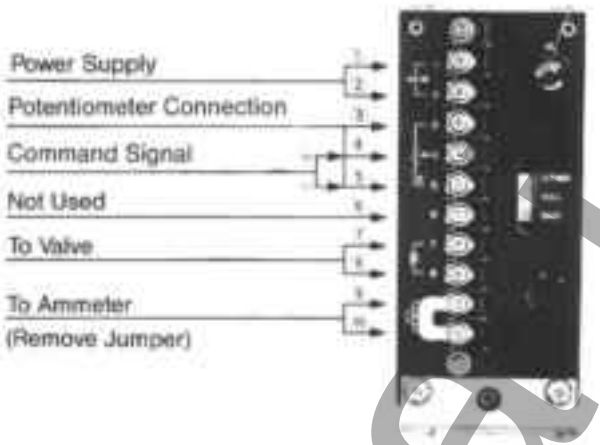
When the electropneumatic proportional valve malfunctions due to cable disconnection or breakage, a safety circuit for the entire system can be obtained by the use of a relay or sequence controller.

Example of Short-circuit Protection



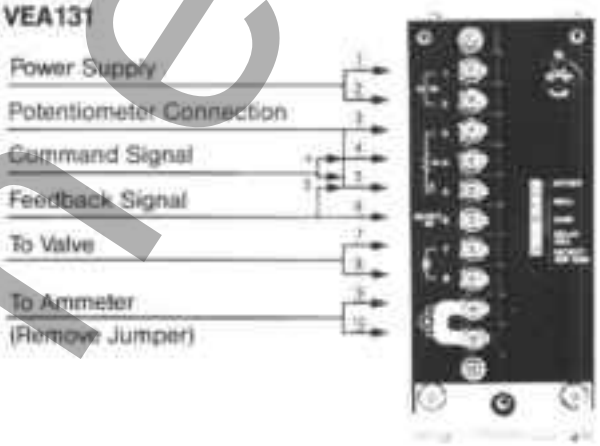
If a short-circuit occurs on the current output terminal side, the power source is cut immediately, preventing damage to the power amp. output circuit.
Starting and restarting is achieved by a manually controlled reset-on switch.

Basic Type: VEA130



NOTE: The command signal can be 0 - 10VDC or a (10 [KΩ] ¼W) potentiometer.

With Feedback Circuit: VEA131



Features and Functions of Power Amplifier

GAIN

This adjustment is used to change the upper limit of the signal range when the current of the valve is 100%.

NULL ("ZERO ADJUSTMENT")

This is used to adjust the minimum level of current which is received from the Power Amplifier. This is factory preset at 0 mA. This "minimum level" may be adjusted to any point between zero and 500 mA allowing changes in total current scale. (The "Zero" adjustment may be INCREASED by turning the NULL adjustment screw clockwise (to the right). (*See figure* **6-2**)

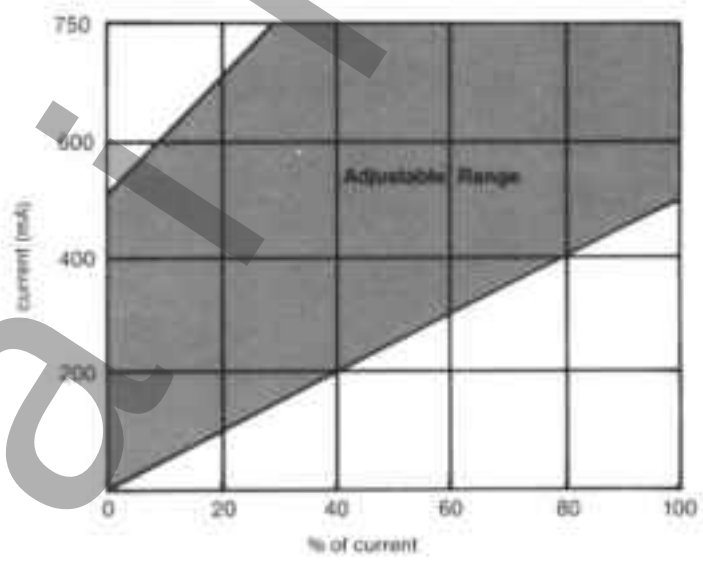


Fig. 6-2

DITHER

The dither frequency may be adjusted to minimize hysteresis. The dither may generate vibrations in the valve which produces a growling noise and may be adjusted within a range of 100 to 200 Hz by turning the DITHER adjustment screw. When the screw is turned clockwise (to the right) the frequency is increased and when turned counterclockwise (to the left) the frequency is decreased. (The DITHER has been preset at the factory at 125 Hz, and changing this setting is not normally required).

DELAY ADJUSTMENT

(Built-in feedback circuit type-VEA131/252 only)
This control is used to adjust the delay time constant of the sensor feedback signal. The delay will increase when the adjustment knob is turned clockwise (to the right). (*See figure* **6-3**)

DETECT AMP GAIN

(Built-in feedback circuit type-VEA131/252 only)
This control is used to change the amplification of the sensor signal. When the Detect AMP. GAIN adjustment knob is turned clockwise (to the right) the amplification will increase. (*See figure* **6-3**)

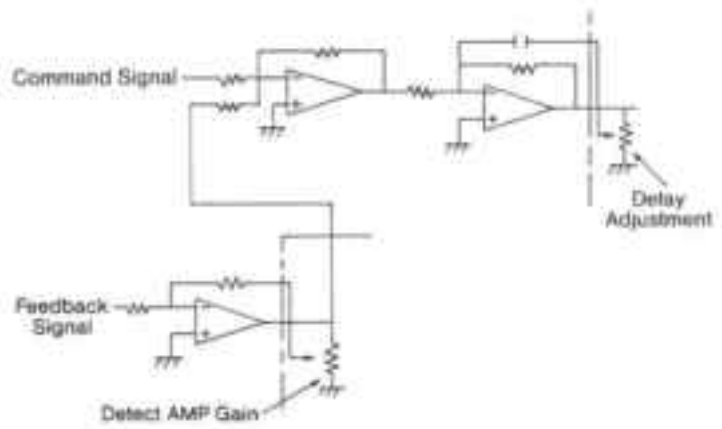
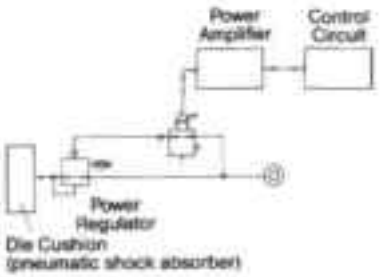


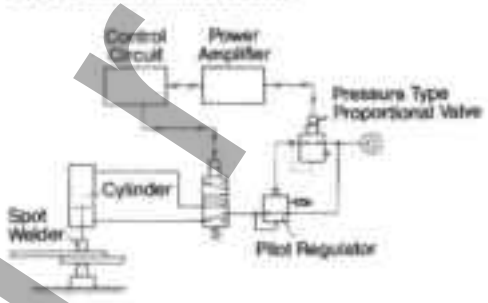
Fig. 6-3

Sample Applications Using Electro-Pneumatic Proportional Valves

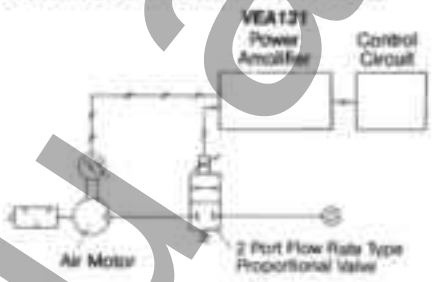
PRESSURE CONTROL OF DIE CUSHION



PRESSURE CONTROL OF WELDING MACHINE



AIR MOTOR SPEED CONTROL



PRESSURE CONTROL OF WATER PRESSURE VALVE

CYLINDER MULTI-STAGE SPEED CONTROL