

INSTRUCTION MANUAL

SWITCHING ELEMENT

APA1

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

For Safety Use

To use this product safely, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, read this operation manual carefully for proper operation.

Observe the cautions on handling described in this manual, as well as the following instructions :



Precautions

- Do not touch electric wiring connections (exposed live parts) : this will cause an electric shock. During wiring, keep the power off. Also, do not touch these live parts with wet hands.



1. PRODUCT

1-1. General Outline and Characteristic

- 1) Unrelated to the material of object
PEL is capable to censor out regardless the material of object whether resin or glass.
- 2) Non-contacting censor
Measuring is so achieved without contacting object that eliminates potential scratching the surface of valuable product.
- 3) Manifold block is adaptable
Unit is compact and the same manifold is serviceable to every model as the mounting dimensions are all the same throughout whole models, resulting easy alteration of the system.
- 4) Stable censoring with extreme low pressure.
- 5) Simple adjustment
- 6) Extensive service life
- 7) Superb confrontation against environmental hazard

1-2. Specifications

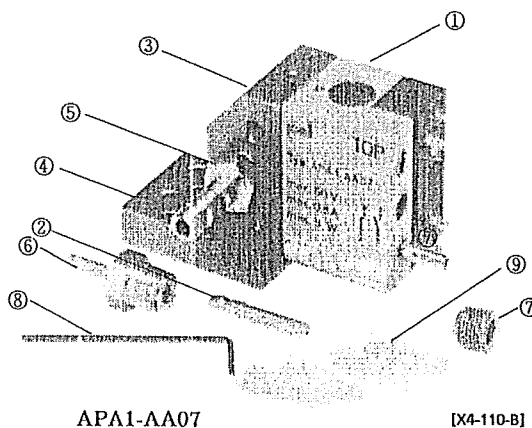
Specification of switching element

Model code	APA1
Item	
Working pressure	When pressure is used Standard 0.14MPa Practical range 0.005~0.3MPa When vacuum is used Standard 0.02MPa Practical range 0.005~0.1MPa
Air consumption	10~108 (varies depending on combination of nozzles on switching element.)
Out put	Contact signal using 2 ea. Contact type Reed switches Terminals 1,2 : NO Terminals 3,4 : NC
Capacity of contact points	Max. Voltage 50V AC/DC
	Max. Current 0.5A
	Max. power consumption 5W
	Rated 24V AC/DC 0.2A
Electrical service life	Over 10,000,000 times (with 24V, 0.2A)
Mechanical service life	Over 10,000,000 times
Responding time	Max. 20Hz (Gaging switch)
	Max. 50Hz (Differential pressure gaging switch)
Hysteresis	1.5~20 μ m (for Gaging purpose)
Repeatability	0.2~4 μ m (for Gaging purpose)
Connecting tube I.D.	ϕ 3~ ϕ 4
Ambient temperature	-10~+60 $^{\circ}$ C (Not to be frozen)

Technical drawing of the front view of the M5.P0.8 panel. The drawing shows a rectangular panel with various ports and mounting features. Key dimensions include a total width of 26 and 26.5, and a total height of 39. On the left, there are four circular ports labeled 1, 2, 3, and 4. A "Switching element" is located on the left side. The top right features a "G (PF) 1/8 Source of Pressure" and a "Connecting port of M6 Cascade". The bottom right has a "Base board" with "2 - M5 Panel mounting holes (Hole $\phi 5.6$ Depth of spot facing 5.5)". Various other dimensions like 10, 7, 12.5, 23, 40, 11, 28, 20, 9, 20, 31, 5, 10, and 7 are provided for specific components and sections.

PEL is built-up with the following components

No.	Parts	Qty
①	Switching element	1
②	Nozzle	1
③	Manifold	1
④	Base board	1
⑤	Hose nipple for $\phi 4$	1
⑥	Hose nipple for $\phi 3$	1
⑦	Plug Rc1/8	1
⑧	Hex. wrench 1.5HEX	1
⑨	Connector terminals	4



(Note) 1 ea. only of nozzle② (ID 1mm, APA-B-A10) is attached for gage nozzle.
Individually purchase when any other nozzle is required. Refer to page 10 as for kind of nozzle.

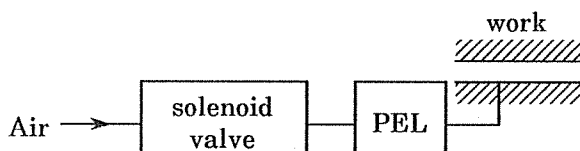


2. CAUTION

2-1. Wrong starting immediately opening air valve

With circuit such as posted below, PEL starts actuation instantaneously upon opening solenoid valve regardless with work load or without. It is due to the tentative actuation of reed switch caused by vertical vibration of float lifted by sudden rushing flow of air into PEL in a moment after of opening valve. Provide some measures to eliminate responding to the initial PEL signal for approx. 1 sec. after opening valve. The countermeasures for it are :

- Installation a timer to make delay the timing to start responding signals from PEL for a certain length of time since opening valve.
- Placing valve opening sequence ahead of operation program so as to have an initial PEL signal ignored from normal operation.





3. OPERATION

3-1. Description of Actuation

Internal structure · Principle

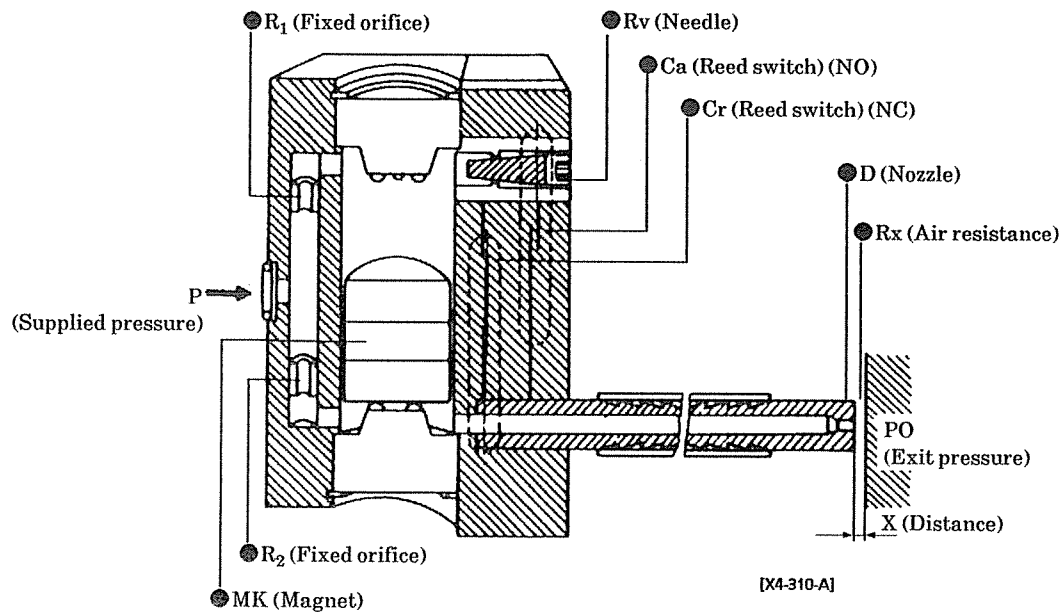


Fig. 1

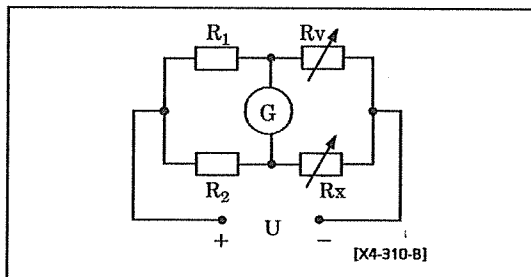


Fig. 2

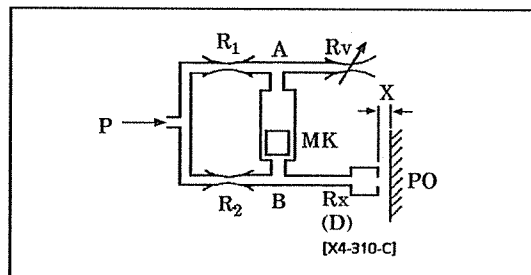


Fig. 3

- 1) PEL forms air circuit which corresponds to wheat-stone bridge electric circuit.
- 2) As it is seen among Fig. 1, Fig. 2 and Fig. 3,
Resisters R_1 and R_2 of electric circuit correspond to Orifices R_1 and R_2 of air circuit, respectively.
Variable resistances R_v & R_x of electric circuit correspond to variable Orifice R_v and Air flow resistance R_x which varies depending on distance X between nozzle and test piece.



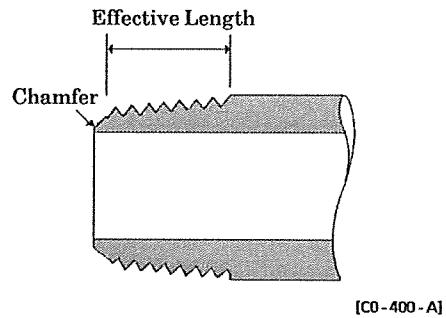
- 3) As air resistance R_x varies depending on variation of distance X , the back pressure at nozzle varies then pressure difference between A and B occurs. Making use of this difference, make a float MK which has built-in permanent magnet move up or down thus the motion of float shifts each contact point of two reed switch contacts (C_a is NO contact and C_r is NC contact as well).
- 4) It actuates with $15\text{mmH}_2\text{O}$ for use as pressure differential switch and it does with $50\text{mmH}_2\text{O}$ for use as a normal pressure switch.



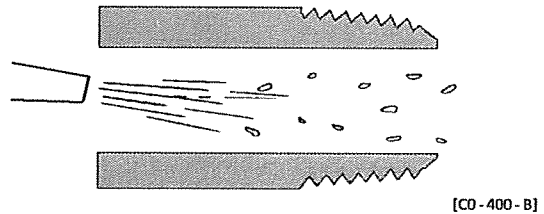
4. INSTALLATION

4-1. Piping

- 1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc.
- 2) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

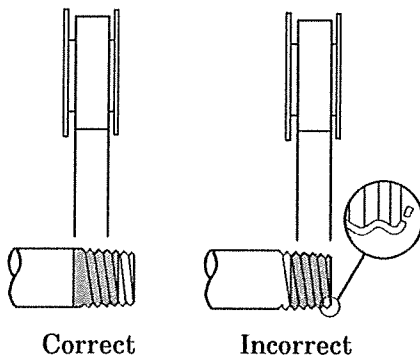


- 3) Flush air into the pipe to blow out foreign substances and chips before piping.

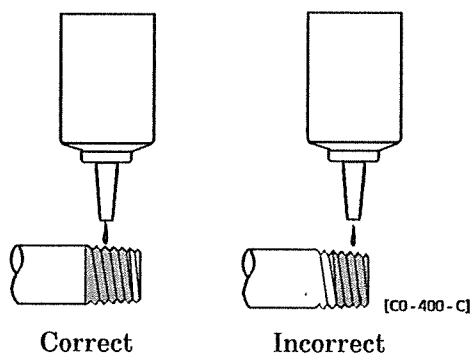


- 4) Refrain applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

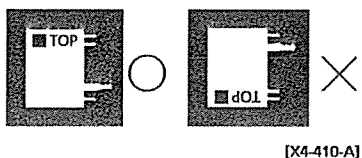
● Seal Tape



● Sealant (Paste or liquid)



- 5) Installation of PEL



Install it while holding top mark up right as illustrated right. Constant injection as for supplying air is preferred. Lay air supply port higher than nozzle port if injection is not available.

4-2. Environmental conditions

1) Circumstances

- (1) Within the area of much dust or floating foreign particles, provide some protective measures to keep dusts from falling into unit.
- (2) Instead of leaving water dripping over the solenoid, either provide a cover or install the solenoid within a panel box.

2) Installation of peripheral equipment

(1) Filter

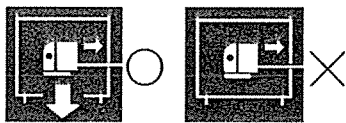
Select Submicron filter + Oil mist separator to install

(2) Countermeasure against sludge

There are much sludge (condensed humidity, oxide oil, tarry substance, foreign particles etc.) contained within compressed air. These substances deteriorate reliability of pneumatic equipment substantially. Take some measures to improve the air quality as follows.

- Improve the quality of compressed by purging drain (sludge) as follows;
 - Dehumidify compressed air by after cooler air dryer
 - Removal foreign particles by filter
 - Removal tarry substance by tar removing filter

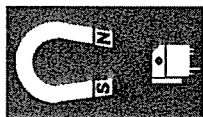
3) Placing within enclosure (PEL, SEPEL)



[X4-410-B]

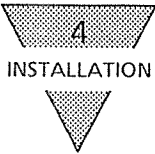
Be sure to provide an exhaust opening as illustrated to right so as to keep the pressure within the enclosure close enough to open air.

4) Magnetic field (PEL)

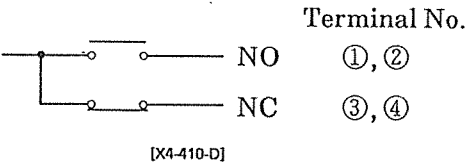


[X4-410-C]

PEL utilizes permanent magnet and reed switches within sensor mechanism of air type bridge circuit. Eliminate such as allowing magnetizing material come close (10mm or so) to the unit or avoid to give strong influence of external magnetic field to reed switches.



4-3. Wiring



Contact points consist of two reed switches, NO and NC contacts.

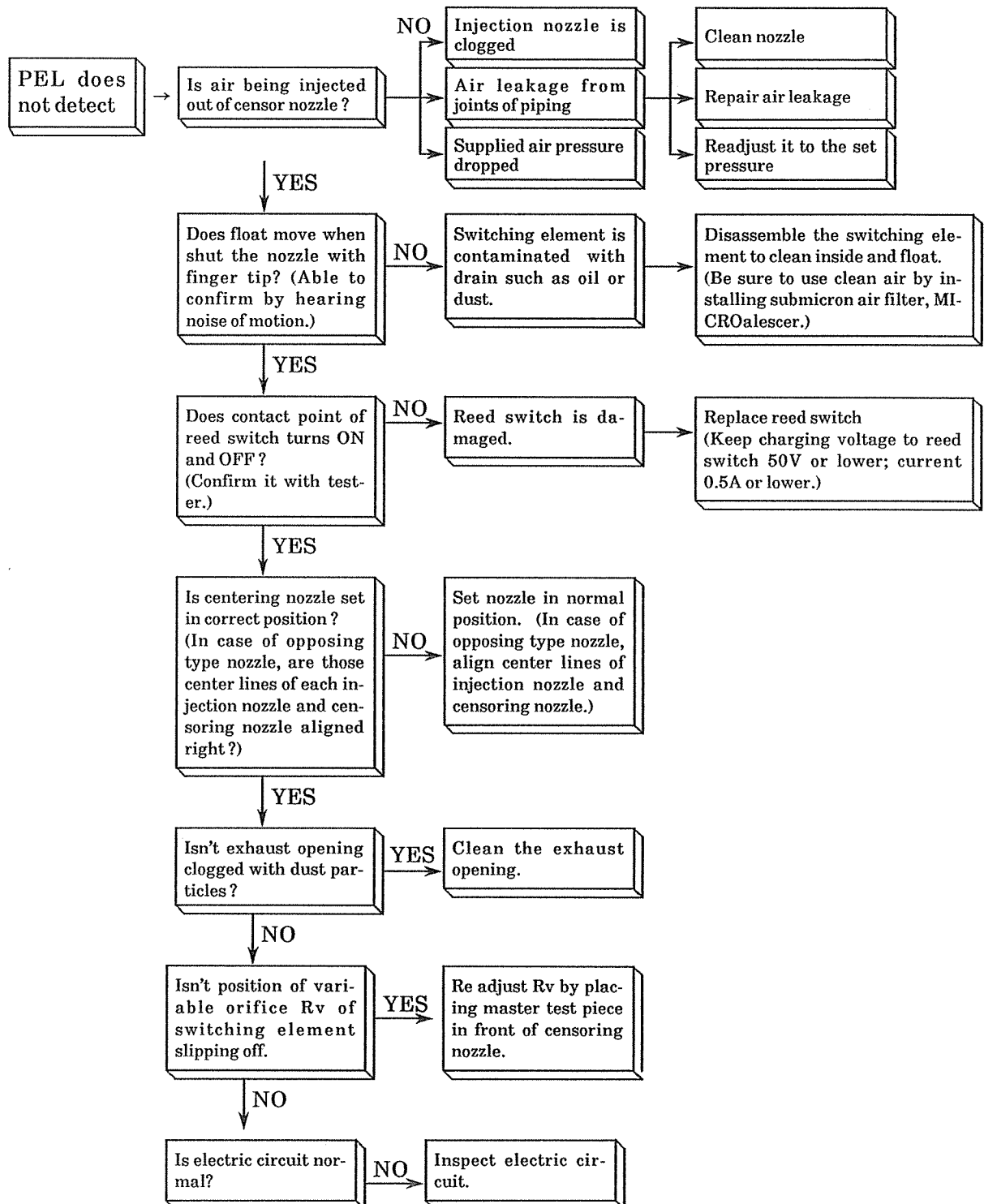
To use it as NO, connect to ① & ②

To use it as NC, connect to ③ & ④

Capacity of Contact point	Max. voltage	50V	AC/DC
	Max. current	0.5A	
	Max. power consumption	5W	
	Rated	24V	AC/DC 0.2A

5. MAINTENANCE

Trouble shooting



6

MODEL CODING

▼

6. MODEL CODE

PEL system is coded by a combination of switching element and censoring nozzle.

● Switching element

(A) Type	(B) Fixed orifice dia.	(C) Number of blocks
AA for Conventional application	03 0.3mm	No mark Single piece
AK for Vacuum application	05 0.5mm	2 2 blocks
AC for Dimension difference censoring	07 0.7mm	3 3 blocks
BL for Vacuum, pressure switching	10 1.0mm	4 4 blocks
		5 5 blocks

AA Type

- This is a conventional type of element with a broad application either for gaging (selection by dimensions) or for control (confirmation of existence or non-existence of subject). This type alone is a fundamental type of PEL itself and forms an air bridge circuit with one variable orifice and one censoring nozzle.

AK Type

- This element is normally used with a combination of an additive external variable orifice without having a built-in variable orifice. This model becomes handy to the place where control range is beyond that of AA type or where it is hard to adjust with an internal orifice.

AC Type

- Multiple numbers of AC type are assembled on manifold for collective assembly of censoring nozzle with single circuit. This concept is applied where there are 2 or more censoring nozzle for instance measuring dimensions.

BL Type

- This element is incapable to form air type bridge circuit by itself due to lack of fixed orifice as well as variable orifice. This type is, therefore, used simply as a normal pressure switch or used combined together with externally built air bridge circuit. It is, also, used pressure differential switch for leak tester.