CKD

Fine Level Switch

KML502 Series
MKML Series

INSTRUCTION MANUAL

SM-A84885-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **"KML502 Series/MKML Series" fine level switch**.
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic or water control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest edition of each standard), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.
The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air and fluid from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Design and Selection

⚠ WARNING

It is the customer's responsibility to check the specifications of this product and its compatibility with the customer's system before selecting and handling the equipment.

Incorrect equipment selection and handling may cause not only problems with this product but also problems with your system.

Set the temperature, pressure and other use conditions in accordance with the specification range of the product.

To prevent backflow of the detection liquid and false detection, observe the following precautions regarding the installation environment.

- Please install and use under atmospheric pressure environment.
  It cannot be used for detection in sealed liquid tanks or similar liquid tanks.
- Do not install the product in a chemical atmosphere or in an atmosphere that may damage the switch contacts.
  * Examples of hazardous atmospheres: dust, organic silicon materials, hydrofluoric acid, etc.
  *If the microswitch type is used in an atmosphere of siloxic acid generated from organic silicon, contact failure may occur.
- Install at a position higher than the upper limit of the liquid tank to be detected.
- Install with the micro switch/reed switch facing up.
- When using a reed switch type, do not bring magnetic components (magnets, solenoid valves, etc.) near the product.
- Install it in a location that is not easily affected by noise.

⚠ CAUTION

Cautions regarding signal processing

The ON-OFF signal may be repeatedly output (chattering) depending on the fluctuation of the liquid level and working conditions. Take countermeasures against chattering by using a timer on the control side, etc.

Precautions for switching water level

The switching water level listed in catalogs, etc. is the value for water, and changes depending on the specific gravity of the detection solution.

Precautions on Product Disposal

⚠ CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

CONTENTS

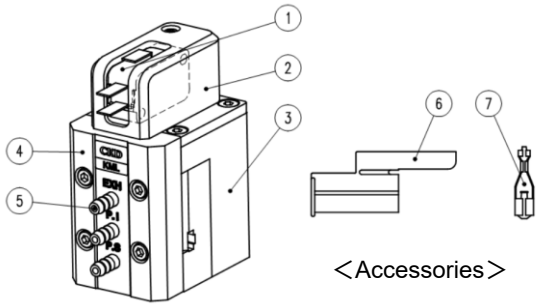
1. PRODUCT OVERVIEW

1.1 Product Overview

This product is a liquid level switch that detects the interface between air and liquid using compressed air or nitrogen gas as a medium and outputs the contact.

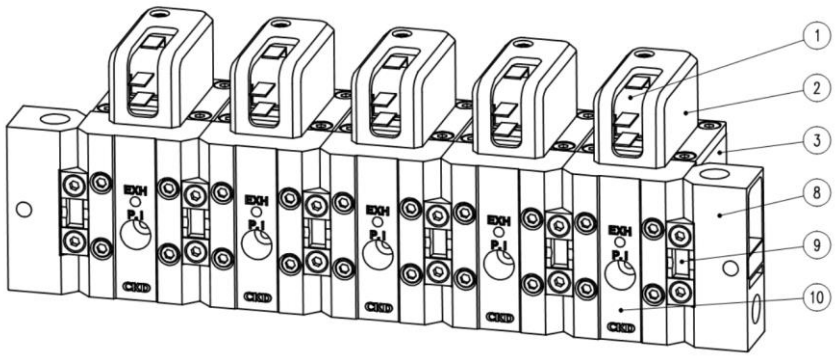
1.2 Part Name

■ Single unit



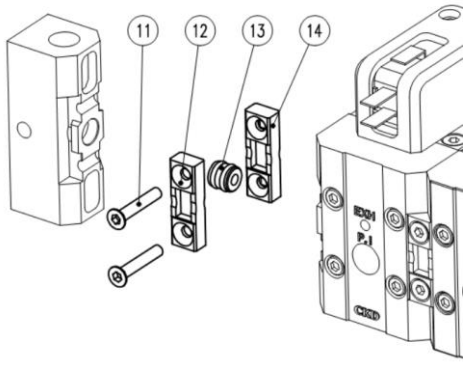
	Part name	Material
1	Switch	—
2	Switch cover	PPS
3	Body	PPS
4	Single plate	PPS
5	Fitting	Stainless steel
6	Housing	Nylon 66
7	Terminal	Brass, Tin plating
Internal parts	Diaphragm	FKM、FFKM

■ Manifold



	Part name	Material
8	Supply block	PPS
9	Joiner set	PPS、FKM、Stainless steel
10	Manifold plate	PPS

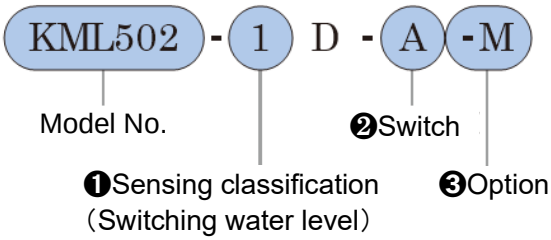
■ Joiner set



	Part name	Material
11	Hexagon socket head cap screw	Stainless steel
12	Joiner for front	PPS
13	Orifice collar	PPS、FKM
14	Joiner for rear (nut built-in)	PPS、Stainless steel

1.3 Model Number Indication

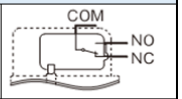
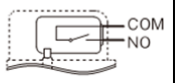
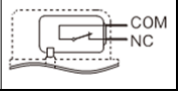
■ Single unit



❶Sensing classification（Switching water level）

Symbol	Description
1	8～12mm
2	1～3mm

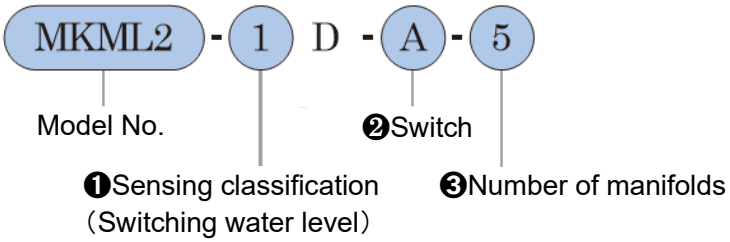
❷Switch

Symbol	Description	
A	Micro switch (C contact)	
B	Reed switch (A contact)	
C	Reed switch (B contact)	

❸Option

Symbol	Description
Blank	Single unit
-M	Single unit with manifold plate

■ Manifold



❶Sensing classification（Switching water level）

Symbol	Description
1	8～12mm
2	1～3mm

❷Switch

Symbol	Description
A	Micro switch (C contact)
B	Reed switch (A contact)
C	Reed switch (B contact)

❸Number of manifolds

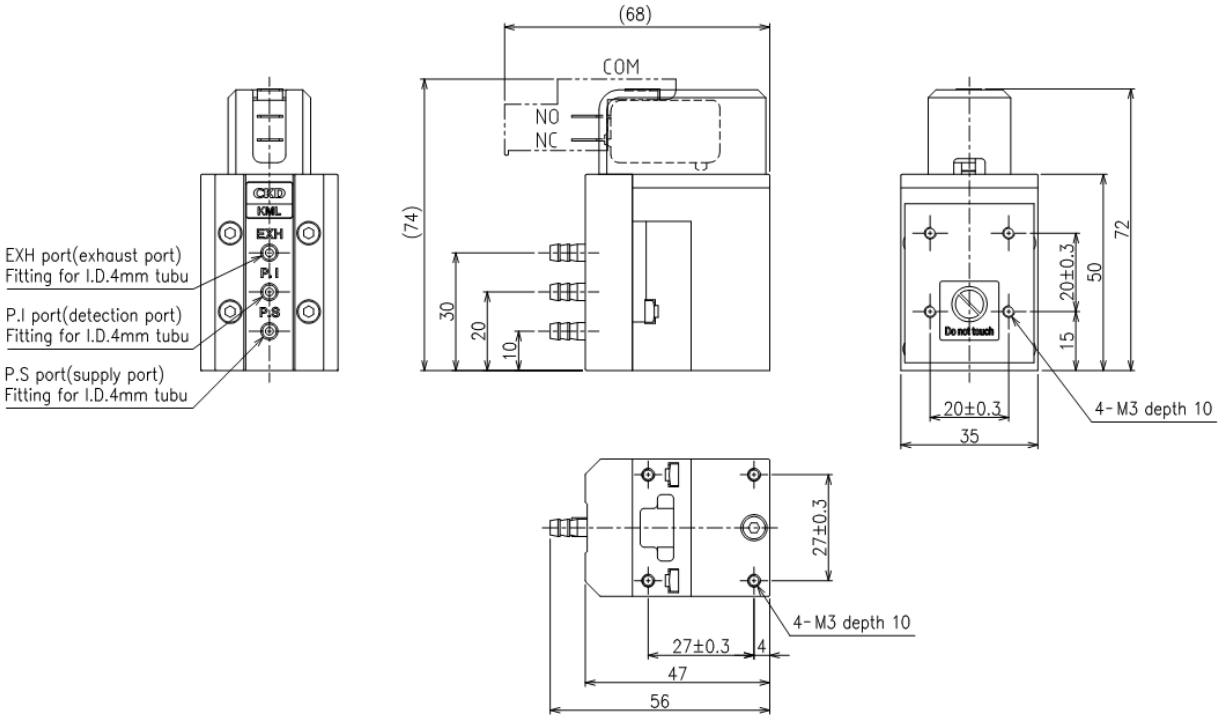
Symbol	Description
1	1 stations
2	2 stations
3	3 stations
4	4 stations
5	5 stations

■ Joiner set

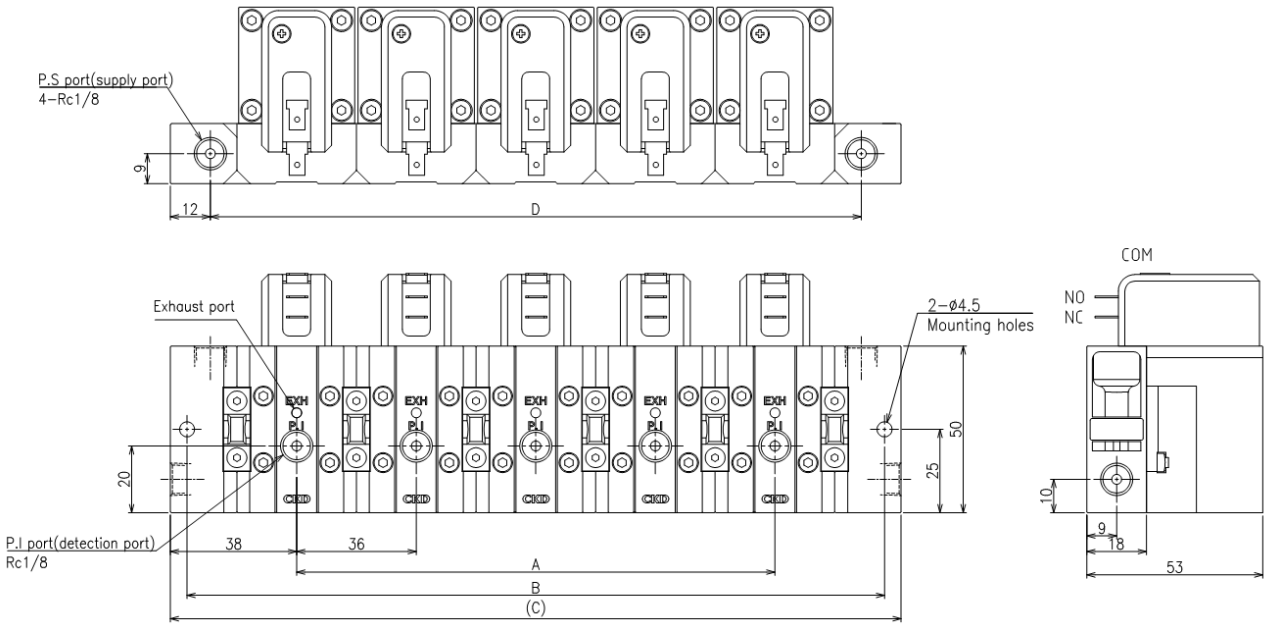
KML502-JC-SET

1.4 Dimensions

■ Single unit



■ Manifold



Station No.	A	B	C	D
1	—	66	76	52
2	36	102	112	88
3	72	138	148	124
4	108	174	184	160
5	144	270	220	196

1.5 Specifications

item			KML502-1D-*	KML502-2D-*
Supply gas	Working fluid		Compressed air/nitrogen gas (*1)	
	Working pressure	kPa	15 to 35	10 to 35
	Operating fluid temp.	℃	5 to 60	
Ambient temperature		℃	5 to 60	
Pressure resistance	P.S port	kPa	100	
	P.I port	kPa	10 (1000mm for detection fluid water)	6(600mm for detection fluid water)
Contact capacitance	A-type		3A 125/250 VAC resistance load (micro switch)	
	B-type, C-type		0.25 A 100 VDC resistance load (reed switch)	
Switching water level		mm	8 to 12 (*2)	1 to 3(*2)
Hysteresis		mm	2 (*2)	
Repeatability		mm	±1 (*2)	
Response time		ms	200 or less (working pressure 20kPa, ambient temperature 24°C, detection tube inner diameter of ø4, length 5 m)	
Detection tube I.D.		Φmm	4	
Tube length		m	Within 5	
Consumption flow rate		cm^3/min（ANR）	750 or less (at working pressure 20 kPa)	
Detection flow rate		cm^3/min（ANR）	45±10 (at working pressure 20 kPa)	
Weight		Kg	0.14	

*1: Use fluid passed through a filter with a filtration degree of 0.3 μm or less.
*2: The above specifications are values obtained at working pressure 20 kPa (ambient temperature: 24±2°C).
Be sure to use working pressure with a high degree of cleanliness.

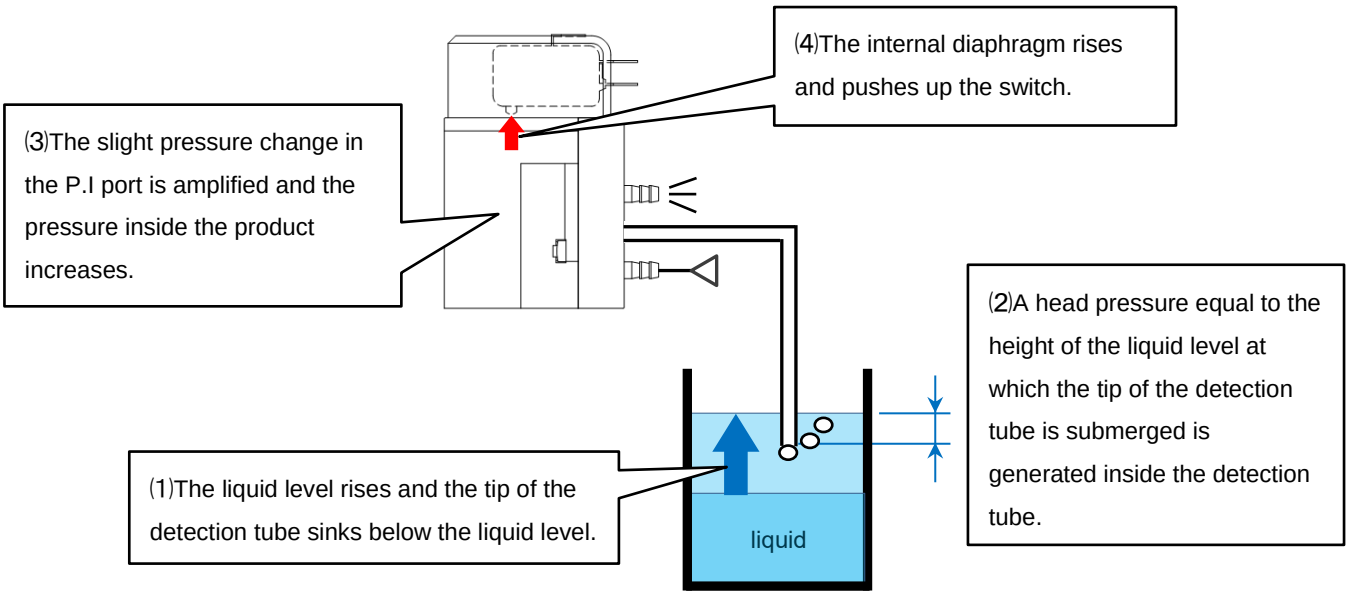
1.6 Description of Operation

1 The liquid level rises and the tip of the detection tube sinks below the liquid level.

2 A head pressure equal to the height of the liquid level at which the tip of the detection tube is submerged is generated inside the detection tube.

3 The slight pressure change in the P.I port is amplified and the pressure inside the product increases.

4 The internal diaphragm rises and pushes up the switch.



2. INSTALLATION

2.1 Piping

⚠ CAUTION

Make sure there are no leaks or restrictions in the piping.

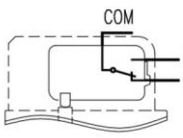
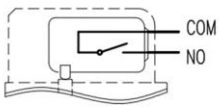
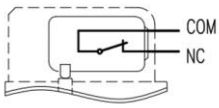
Four supply ports are provided on the manifold product supply block.

Please mask unused ports with the attached plugs.

As port cracking and screw damage may occur when constructing the manifold product supply port, tighten with a torque of 0.4 to 0.6N・m with the resin fitting.

2.2 Wiring

Check the type of switch for the product you are using and wire it with reference to the figure on the right. Please refer to the specification table on page 4 for the contact capacity.

KML502-*D-A Micro switch （C contact）	
KML502-*D-B Reed Switch (A contact)	
KML502-*D-C Reed Switch (B contact)	

⚠ CAUTION

Never perform wiring work while the power is energized (ON).

Check that there is no incorrect wiring before turning ON the power.

Use the supplied housing and terminals for wiring.

Do not solder the connection to the microswitch or reed switch.

Separate the wiring from the power lines of motors, heaters, etc.

3. USAGE

3.1 Safety Instructions

⚠ CAUTION

Precautions regarding supply gas

- Use a gas that has been filtered of dust and oil through a submicron filter/micro alescer.
- Use a low-pressure regulator with oil-free processing.
- Do not shut off the supply gas to prevent backflow of the chemical atmosphere or clogging of the flow path due to crystallization of the chemical.
- When one regulator regulating pressure is branched to multiple KML products, make sure that gas within the operating pressure range is supplied to each product.
- If pressure over 100 kPa is applied to the P.S port, the diaphragm may be damaged, and so gradually raise the supply pressure from 0kPa.

Precautions regarding detection tubes

- Use the detection tube with an inner diameter of ø4 mm and a length of 5 m or less.
- Do not install filters, solenoid valves, or anything else that will cause resistance in the middle of the sensing tube.
- The tip of the detection tube should be placed at least 2 mm above the bottom of the liquid tank so that the nozzle is not blocked.
- Do not block the P.I port, EXH port or detection tube with hands. Otherwise, failures may be caused.

Installation precautions of KML502-*D-*-M

- If increasing or replacing the number of stations using KML502-* D-*-M, perform as described in the instruction manual.

  When adding stations, prepare a separate joiner set (KML502-JC-SET).

Other precautions

- This product is adjusted at the time of shipment. If the Adjustment prohibited plate is removed and the product is readjusted by the customer, performance is not guaranteed.

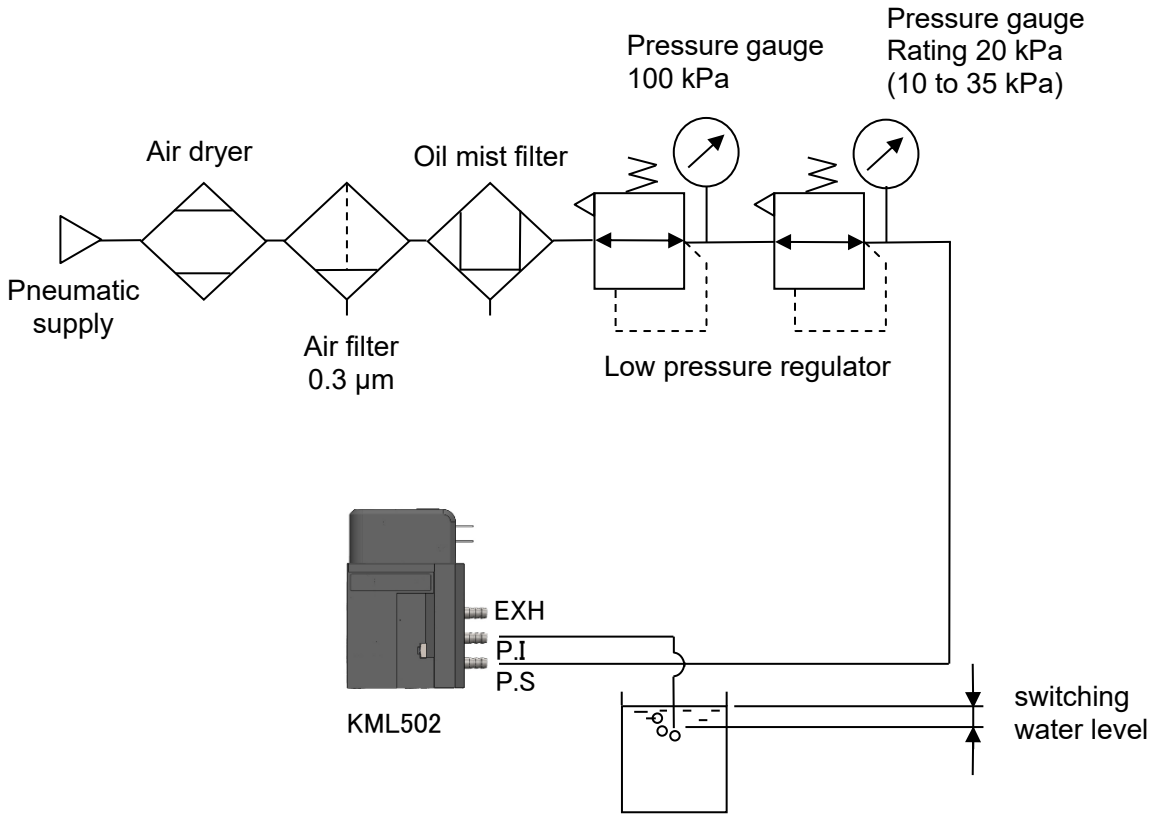
3.2 Supply pressure setting procedure

1 Please connect the piping using the air circuit shown below.
(Note) Before piping, adjust the set pressure of the two regulators to zero.

2 Adjust the regulator on the pressure source side so that the pressure displayed on the gauge is 100 kPa.

3 Next, use the regulator on the detector side to adjust the pressure just before the P.S port to the rated value of 20 kPa (pressure range 10 to 35 kPa).
(Note)
Be careful not to let the pressure exceed the pressure range.
Please do not seal the P.I port.
If the water level depth is 1000 mm, please use the working pressure at 15 kPa or more.

4 With the above steps, the adjustment is complete and the specifications are satisfied.

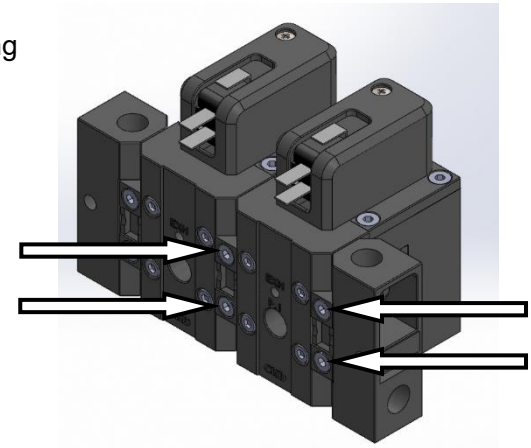


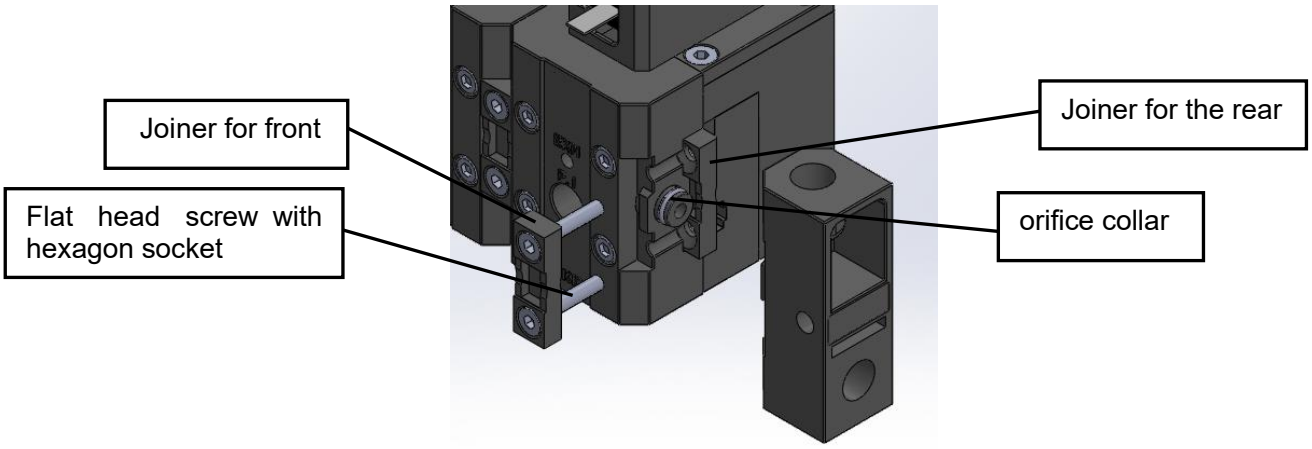
3.3 Manifold station addition/replacement procedure

1 Remove the hexagon socket set screws from the joiner between the sensors and supply blocks that you want to replace or add.
*Hex wrench size used: 2 mm (5/64: inch)
This is a replacement procedure for adding or replacing [KML502-*D-*-M].

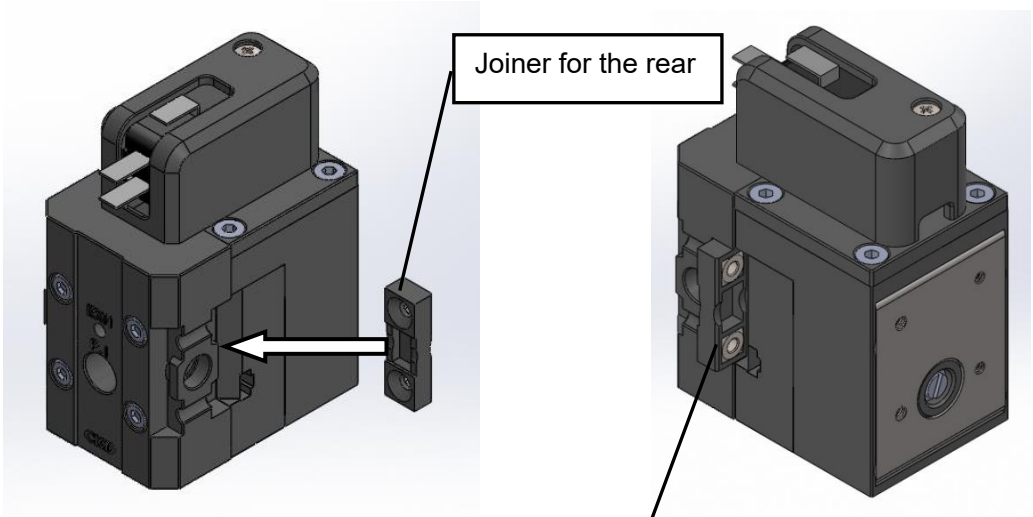
When increasing the number of stations, remove the joiner screws between the sections to be increased.

When replacing a sensor, remove the joiner screws on both sides of the sensor to be replaced.
Select the side for the joiner
(2 flat head hexagon socket head cap screws)
and the side for the joiner back.
An orifice collar is inserted inside.

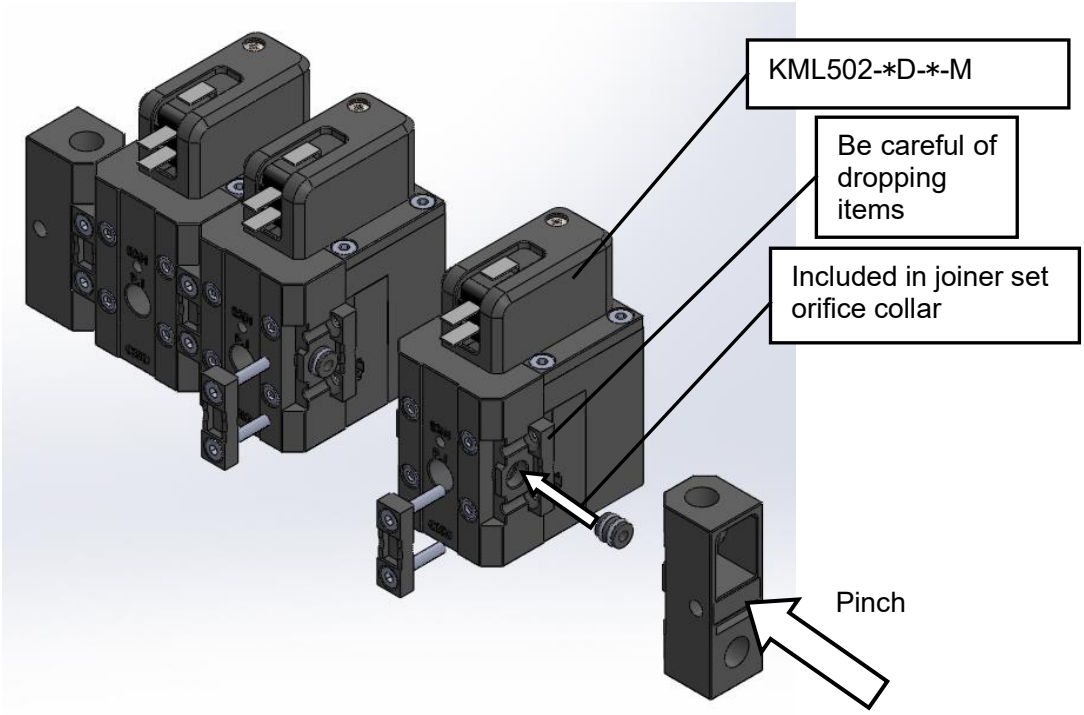




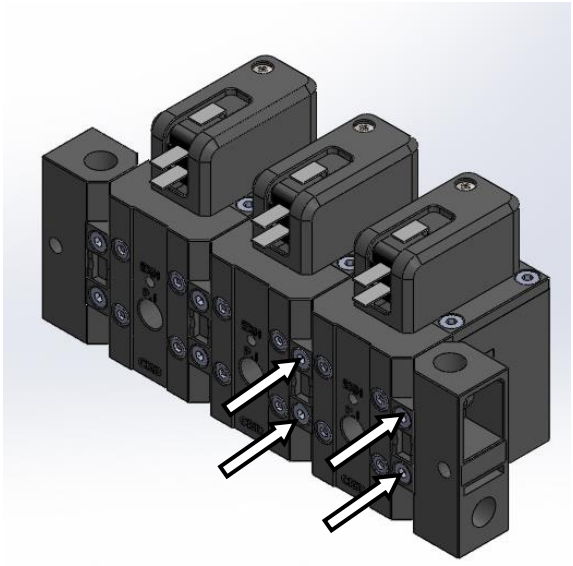
2 To add more units, fit the joiner set [[KML502-JC-SET] rear side of the joiner into the manifold of the sensor for expansion.
When replacing, insert the joiner rear, which is removed from both sides, into the grooves on both sides.



3 When expanding stations, install the orifice guard on the manifold side surface where the orifice guard is not installed. (Applying alcohol to the O-ring will make it easier to install.)
Be sure to insert the orifice collars on both sides.
Pinch the joiner so that the back side does not fall off.

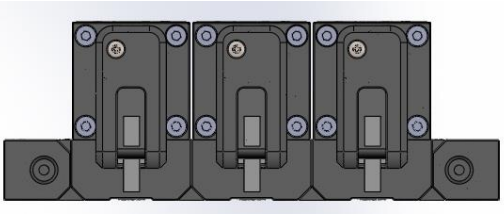


4 When the temporary assembly is completed, tighten with the countersunk screws mounted for the joiner surface.
(Recommended tightening torque: 0.5±0.05 N·m) * Tightening too strongly may cause damage.



5 After assembly, check that the manifold is assembled straight before use.

*If it is bent due to improper assembly, it may cause leakage.



Check that it is straight.

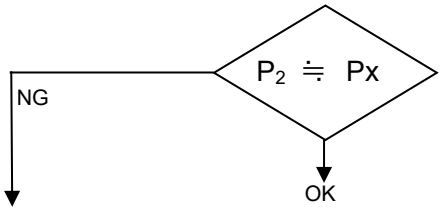
4. TROUBLESHOOTING

4.1 Problems, Causes, and Solutions

If this product does not operate as intended, check the piping and wiring before inspecting the product a s per the table below.

Malfunctioning phenomenon	Cause	confir-mation	Counter-measures
The switch does not turn off the output	When connecting or closing with a small inner diameter tube to the EXH port. →Difficult to exhaust.	A	a
	If the pressure on the tank side is higher than the pressure at the location where the switch body is installed. →Pressure difference is higher than the switching pressure.	B	b
	If there is piping resistance between the P.I port and the detection nozzle. →No bubbles are generated from the detection nozzle.	G	g
Does not output	When connecting a vacuum source to the EXH port. →The switch does not work due to the structure.	A	a
	When pressure is supplied exceeding the proof pressure. →The diaphragm is damaged.	C	c
	When clean supply gas is not supplied. →The internal orifice is clogged with debris.	D	d
	Loose piping/connections. →Leakage occurs.	F	f
No electrical signal is output	If the contact capacity is exceeded. →The switch is damaged.	E	e
flowed back	Pressure within the operating range is not supplied to each switch.	F	f
	No air bubbles come out of the detection nozzle.	G	g
	The set position of the switch is below the tank.	H	h

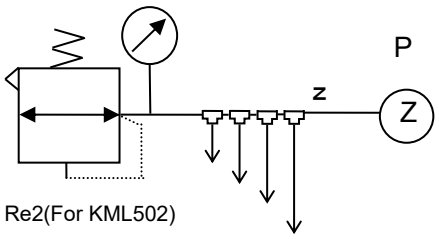
If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

<table>
<tr><th colspan="2">Confirmation</th><th colspan="2">Countermeasures</th></tr>
<tr><td>A</td><td>To ensure common exhaust to the EXH port, check whether a tube is connected or whether a vacuum source is connected.</td><td>a</td><td>Do not connect a central exhaust tube to the EXH port as this may cause structural problems.</td></tr>
<tr><td>B</td><td>Check the differential pressure between the pressure at the location where the switch body is installed (Pα) and the pressure on the tank side (Pβ).</td><td>b</td><td>(When Pβ-Pα is 50 to 20 Pa)
KML502-2D-A, B, C cannot be used.
Please use another model.</td></tr>
<tr><td>C</td><td>If a pressure higher than 0.1 MPa (proof pressure) is supplied to KML502 and malfunction occurs, check whether there is any damage to the internal diaphragm.</td><td>c</td><td>Install the regulator in two stages.
(See confirmation I, countermeasure i)</td></tr>
<tr><td>D</td><td>If an operation failure occurs when clean liquid is not supplied, check whether contaminants are clogged on the internal orifice.</td><td>d</td><td>Supply clean fluid by inserting a dryer, submicron air filter , and micro alescer.</td></tr>
<tr><td>E</td><td>Check with a tester whether the contacts of the micro switch and reed switch turn ON/OFF.</td><td>e</td><td>Reconsider the circuit so as not to exceed the contact capacity.</td></tr>
<tr><td>F
注)</td><td>Attach a pressure gauge with a range of 0 to 0.1 MPa to the x part (Ⓧ), add a pressure range of 10 to 35 kPa to P2, and check whether the following formula is satisfied.
(The reading with this pressure gauge is Px)
 
①Check whether there are any objects in the piping that would cause R1 and R2 restrictions.

a) Presence or absence of bends in the piping.
(In some cases, pipes are bundled with bundling bands)
b) Presence or absence of a flow rate meter.
(During flow rate adjustment in some cases)

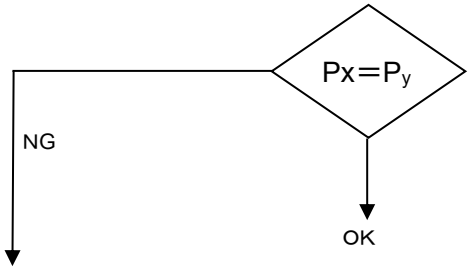
②Check whether the fitting is somewhere along the piping.

c) Check that there are no leaks due to insufficient tightening of the fittings.
d) Check the minimum bore size (fitting bore ød4).
e) How many (n) branches to KML502.

③Check the piping length (L1, L2) and inner diameter (ød1, ød2).</td><td>f</td><td>① Do not insert anything that will cause restrictions R1 and R2 in the piping.
②The inner diameter of the joint should be ød4≧ø2, and there should be no further constrictions.
③ Supply tube length: L1+L2≦5m
Supply bore size: ød1 ≧ ø4
Flow meter and fittings are connected part way in the piping, number n ≧ 5,
Supply tube length L1+L2≧5m
In this case, please install a pressure gauge with a range of 0 to 0.1 MPa (the reading is Pz) at section z, add a pressure range of 10 to 35 kPa to P2, and adjust as shown below.
 
Re2(For KML502)

Adjust with regulator Re2 so that Pz becomes the value shown in the table below.
However, in this case, P2=Pz may not be assumed.
<table><tr><th>Model</th><th>Pz pressure range (kPa)</th></tr><tr><td>KML502-1D- A, B, C
KML502-2D- A, B, C</td><td>10 to 35</td></tr></table></td></tr>
</table>

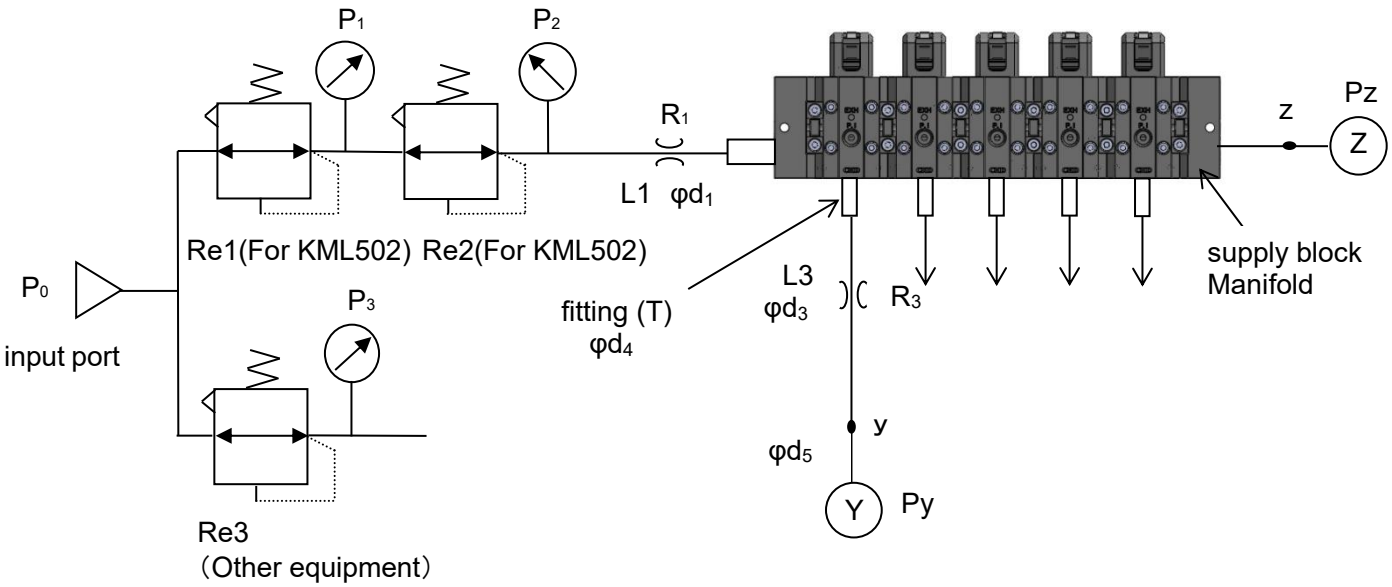
Note) Please refer to the circuit diagram used on page 13.

	Confirmation		Countermeasures
G Note)	Install a pressure gage with a range of 0 to 0.1MPa on the y section (Ⓨ) and apply a pressure of 10kPa to P2 to check whether the following formula is satisfied. (The reading with this pressure gauge is Py)  ① Inspection whether or not restriction R3 is present in the piping. a) Presence or absence of bends in the piping. b) Presence of fittings (fitting bore ød5) ② Check the detection tube length (L3) and detection tube bore size (ød3).	g	① Do not insert anything that will cause restriction R3. d5≧ø4 ②Detection tube length: L3≦5m Detection tube I.D.: ød3≧ø4
H	If there is backflow, check the following 5 items. ①Check whether the pressure within the working range is supplied to each KML502. ②Check whether air bubbles are being released from the detection nozzle. ③Check whether the installation position of the KML502 main unit is above the tank. ④Check whether only the detection nozzle is in a completely closed container. ⑤If the pressure supply is stopped, check whether the detection nozzle is in the liquid.	h	①②Refer to Confirmation F･G, and Countermeasures f･g. ③Be sure to install the KML502 above the tank, as it will flow back easily if the MEVT is below the tank. ④A completely closed container is structurally unusable. ⑤If the detection nozzle is submerged in liquid when pressure supply is stopped, there is a risk of backflow if there is some pressure in the tank, so make sure that the detection nozzle is not submerged in liquid before stopping the pressure supply.
I Note)	Check the input pressure (P0) and whether that pressure is branched within the device. OK →①、② NG →① ① Confirm whether the regulator is installed in two stages on the sensor line. Pressure P1 at the first stage regulator (Re1). Pressure P2 at the second stage regulator (Re2). ② Check the pressure P3 at the regulator (Re3) using a line other than the sensor line.	i	①If the regulator is not turned on in two stages, the fluctuations in P0 (primary pressure fluctuations) and the effects of a sudden drop to the low pressure region in one stage will directly affect the sensor itself, causing problems, so be sure to turn on the regulator in two stages. P1=0.1 MPa Adjust P2 to the value shown in the table below. Model / P2 pressure range (kPa) KML502-1D- A, B, C / 10 to 35 KML502-2D- A, B, C Note: However, if it is necessary to perform confirmation F and make adjustments such as countermeasure f, follow that procedure. ②If the pressure of P3 and the flow consumption are high, check the P1 and P2 pressure values.

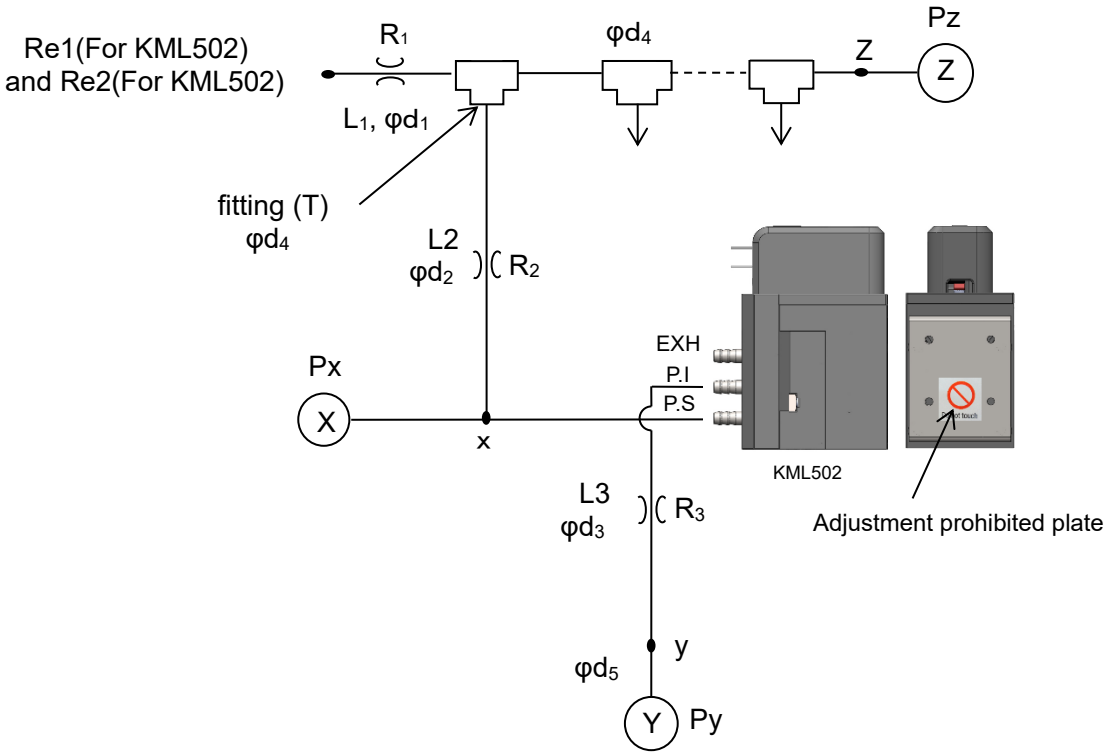
Note) Please refer to the circuit diagram used on page 13.

■ Circuit diagram used

For MKML2 and MXKML2 (maximum n=5)



For KML502 single unit



5. WARRANTY PROVISIONS

5.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

5.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.

5.3 Remarks

As an exception to 5.2 above, the product is warranted for one and a half (1.5) years from the date of delivery to the location specified by the customer.