

INSTRUCTION MANUAL
FOR
EXPLOSION-PROOF PRESSURE SWITCH
CD30

TYPES REGISTERED TO LABOR SAFETY LABORATORY
CD30; PRESSURE RANGES EXCLUDING 0.6 MPa(6 kgf/cm²)
AND 1 MPa(10kgf/cm²)
CD30-1: 1 MPa(10 kgf/cm²)
CD30-2: 0.6MPa(6 kgf/cm²)

NAGANO KEIKI CO., LTD.

CONTENTS

1. INTRODUCTION	3
2. APPLICATIONS	5
3. FEATURES	5
4. SPECIFICATIONS	6
5. INSTRUCTIONS FOR TRANSPORTATION, STORAGE AND UNPACKING	1 1
6. COMPONENTS	1 2
7. OPERATION PRINCIPLE	1 3
8. INSTALLATION	2 2
9. SETTING	2 2
10. MAINTENANCE AND INSPECTION	2 2
11. TROUBLESHOOTING	2 4
12. WHAT IS EXPLOSION-PROOF STRUCTURE?	2 5
13. OUTSIDE DIMENSIONS	2 7
14. DETAILS OF PRESSURE-PROOF PACKING AND CONDUIT TUBE PRESSURE-PROOF THREAD COUPLINGS	2 8
TABLE 1-1, 1-2 & 1-3 TROUBLESHOOTING	

Any employees of our company or our associated companies, our dealers and intermediary companies are strictly prohibited from making alterations in the descriptions of this manual without permission. It is possible, however, to put arrow marks in order to clarify the applicable product.

1. INTRODUCTION

The explosion-proof pressure switch CD30 employs a Bourdon tube type pressure element and covers a wider pressure range for its size. We also offer diaphragm type and dual-contact type pressure switches for a wide variety of applications.

This manual describes the handling procedures of the CD30 pressure switch. We recommend that the user should read through this manual carefully before using the CD30 for trouble-free operation.

Items which may potentially invoke injury or serious harm to the human bodies are marked with "DANGER". Observe the given instructions strictly.

(1) Warranty

Our explosion-proof pressure switch is manufactured under strict quality control. If quality defects should be caused by our pressure switch within a period of one year from the date of shipment, we will repair or replace the defective product without charge. We will not bear the responsibility for damages or losses of other machinery, devices or products.

Note that we will not compensate for any damages or losses caused by disassembly or remodeling of the product itself not conducted by us or our specified vendors, addition of the diaphragm seal or other functions, improper handling, misuse, or secular deterioration.

It is quite difficult to verify improper handling, misuse, etc. on the site. Note that we will consider whether our product has been used properly or not only if deformation, wear, burn-out or other clear traces are found in the parts or product, regardless of user's recognition.

(2) Exemptions

Note that we will not bear the responsibility for any inadequacies caused by a failure to observe the descriptions of this manual.

(3) Precautions

① It is prohibited to use this pressure switch in any life-support equipment or equipment without our permission.

② This pressure switch is manufactured to measure pressure applied to the pressure lead-in unit. It is prohibited to use it for any other applications.

③ Do not install this pressure switch in any unspecified conditions. For example, do not attempt to weld or solder it.

④ Use this pressure switch in the specified pressure range.

The withstand pressure means the pressure at which the instrument will not be broken even in the case of a trouble, misuse, handling errors, etc. Resetting may be needed in some cases.

⚠ WARNING

Do not select any ranges on the assumption that the pressure switch is used near the withstand pressure. Use the switch in the specified normal pressure range.

⑤ Damping

This switch is not equipped with a damping mechanism. Use an external dampener or snubber if pulsating pressure is applied to the switch.

⑥ Once the case is opened, do not touch any other parts than the adjusting shaft for deciding the set value. If you move a part which has been fixed with locking paint before shipment, the setting becomes improper and the setting function may be lost.

⑦ This pressure switch consists of precisely manufactured parts. Be careful not to push up the movable mechanism or microswitch pin with a screwdriver, etc. in circuit conduction test when starting operation. Pushing up the movable mechanism or microswitch pin may result in troubles or setting errors.

⑧ To measure oxygen or fluid containing much oxygen, use oil-free instrument.

Oil may be left inside a general-purpose instrument. Such residual oil may react with oxygen, resulting in a fire or explosion.

⚠ DANGER

Be sure to use an oil-free instrument to measure oxygen.

⑨ If a mass-marketed tester is used to check ON and OFF switching signals, the pointer may shake unstably due to minute current. This does not always mean defects of the switch.

The switch has the maximum and minimum ratings. A rating over 800 mW is required for a general-purpose instrument. (A rating over 40 mW is required for a gold-plated instrument.)

If unstable shaking of the pointer as shown above is found, check ON and OFF signals using the MY CHECKER (option) or an actual load.

⑩ Do not use this pressure switch to measure sulfide gas (H_2S or SO_2), ammonia gas (NO_2), nitric acid gas (HNO_3), chlorine gas (Cl_2) or other harmful gas, which may cause poor contact or corrosion of the micro-switch, resulting in contact failures.

⑪ If the atmosphere contains silicone gas, silicon dioxide (SiO_2) is collected on the contacts due to electric arc energy, resulting in contact failures in some cases. If there is silicone oil, silicone filler or another silicone product, install the pressure switch apart from such a silicone product or remove the silicone product.

⑫ The movable mechanism of this pressure switch requires no lubrication. Do not lubricate it.

⚠ DANGER

Before dismount this pressure switch, be sure to close the valve to prevent process fluid from spouting out. If no valve is used or it cannot be closed, open the process fluid to the atmosphere to make the process pressure quite the same as the atmospheric pressure, then dismount the switch with great care.

Even if the process fluid is opened to the atmosphere, the fluid may spout out due to the internal head pressure, resulting in burning or injury in the worst case.

⚠ DANGER

Before opening the case of this pressure switch, be sure to turn off the power. Wiring work with the power turned on may cause electrocution. Be sure to turn off the power on both sides.

⑬ Diaphragm seal type

- If fill liquid leaks from a diaphragm type switch, the performances of the switch will be lost. Never loosen the parts shown on the name plate.
- Handle the lead pipe with great care. If it is crushed, measurement is disabled.
- If the lead pipe is not fixed and suspended in the air, it may shake due to vibrations, resulting in fatigue breakage. Fix the lead pipe at several point to prevent shaking due to vibrations.
- Since the diaphragm is made of a thin plate, it may be torn or deformed if it is picked with a finger or any object. Never press the diaphragm with a finger or any object to check the change of indications. Use a soft brush to clean it. Touch it with great care.

2. APPLICATIONS

This pressure switch can be used as an explosion-proof electric appliance in compliance with the regulations and ordinances concerning the Labor Safety and Hygiene Law. Therefore, it meets the requirements for Class 1 and Class 2 dangerous places.

3. FEATURES

- (1) The explosion-proof container is made of aluminum die casting for light weight. Both the switch body and terminal box has screw type covers for easy uncovering.
- (2) Setting is enabled from outside using a screwdriver without dismantling the cover.
- (3) Like setting, setting locking is also enabled from outside using a screwdriver without dismantling the cover.
- (4) This switch has the following features, since it employs a Bourdon type pressure element:
 - ① All switches have the same outside dimensions, regardless of the applicable pressure ranges.
 - ② Diaphragm type switches are available.
 - ③ High response speed.

An especially durable Bourdon tube is employed.

(5) A highly sensitive pin plunger type micro-switch is employed. Any other micro-switches of different characteristics are also available upon requests. Single-contact type (SPDT) and dual-contact type (SPDT x 2) are available.

4. SPECIFICATIONS

(1) Scope of Application

Explosion-proof structure type: Explosion-proof structure (d)

Explosion classes: Class 1 and Class 2

Ignition temperature: G1, G2, G3 and G4

Applicable dangerous places: Class 1 and Class 2 places

Applicable industries: Industries related to petrochemistry, chemical fibers, synthetic fibers, ethylene, methanol, derivatives, liquefied gases, electric ovens, medicines, paints, soda, and other flammable or explosive substances or gases

(2) Outside dimensions

See page 27.

(3) Available pressure ranges

Table 4-1

Pressure ranges MPa(kgf/cm ²)	Contact differences MPa(kgf/cm ²)		Withstand pressure MPa(kgf/cm ²)	Acceptance Nos. of Labor Safety Lab.
	Single-contact	Dual-contact		
* 0~0.2 (0~2)	0.014(0.14)or less	0.02 (0.2)or less	0.3 (3.0)	No. 20093
* 0.4 (4)	0.028(0.28) "	0.04 (0.4) "	0.6 (6.0)	No. 20094
* 0.6 (6)	0.042(0.42) "	0.06 (0.6) "	0.9 (9.0)	No. 20095
* 1 (10)	0.07 (0.7) "	0.10 (1.0) "	1.5 (15.0)	No. 19919
* 1.5 (15)	0.08 (0.8) "	0.12 (1.2) "	2.25 (22.5)	No. 20487
* 2 (20)	0.08 (0.8) "	0.14 (1.4) "	3.00 (30.0)	No. 19920
2.5 (25)	0.10 (1.0) "	0.18 (1.8) "	3.75 (37.5)	No. 20488
3.5 (35)	0.14 (1.4) "	0.25 (2.5) "	5.25 (52.5)	No. 19914
5 (50)	0.20 (2.0) "	0.35 (3.5) "	7.5 (75)	No. 20489
7 (70)	0.25 (2.5) "	0.40 (4.0) "	10.5 (105)	No. 19915
10 (100)	0.30 (3.0) "	0.50 (5.0) "	15.0 (150)	No. 19916
15 (150)	0.45 (4.5) "	0.75 (7.5) "	22.5 (225)	No. 20490
20 (200)	0.60 (6.0) "	1.10 (11.0) "	30.0 (300)	No. 19921
25 (250)	0.75 (7.5) "	1.25 (12.5) "	37.5 (375)	No. 20491
35 (350)	1.25 (12.5) "	1.75 (17.5) "	52.5 (525)	No. 19922

* Manifold type switches are available for the pressure ranges marked with asterisks.

(4) Material of liquid contacting parts

Bourdon tube, Socket: St.St. 316

(5) Leading external conductor into terminal box

Conduit screw connection: PF 1/2, PF 3/4 or PF 1

Pressure-proof packing type: For the cable dimension and other details, see page 28.

(6) Pressure connection screw: G1/2B

(7) Performances

Recommended pressure setting range: 15 to 90% of the pressure range (See Tables 4-3 and 4-4.)

Accuracy: 1% or less of the maximum pressure

Ambient temperature: -5 to +40°C

Table 4-2

Electrical performances				
Rating			Withstand voltage	Insulation resistance
	Resistive load	Inductive load		
125 VAC	15 A	15 A	50/60 Hz, 1 minute	Between each terminal and case 100 M Ω or more on 500 VDC
250 VAC	15 A	15 A	1500 VAC	
125 VAC	0.5 A	0.05 A	Between each terminal and case	
30 VDC	2 A	1 A	case	
Power factor and time constant for inductive load is 0.4 or more and 7 ms, respectively.			1000 VAC Between non-charged terminals	

If a micro-switch of electric ratings not shown above according to applications, see the electric rating plate.

Great rush current or long-duration current applied to an inductive load, etc. or quite slow pressure variance has great influences upon the service life of the switch. Reduce the value as far as possible.

(8) Weight

3.6 to 4.4 kg

(9) Switch type

JIS-rated industrial micro-switch

(10) Setting range

Table 4-3 Pressure Switch Setting Ranges

Model: CD30 Single-contact Unit: MPa

No.	Pressure range	Contact difference (MAX)	Setting range		Normal pressure range
			Upper limit type	Lower limit type	
1	0 ~ 0.2	0.014	0.034~0.18	0.02 ~ 0.166	0 ~ 0.13
2	0 ~ 0.4	0.028	0.068~0.36	0.04 ~ 0.332	0 ~ 0.26
3	0 ~ 0.6	0.042	0.102~0.54	0.06 ~ 0.498	0 ~ 0.39
4	0 ~ 1	0.07	0.17 ~0.9	0.1 ~ 0.83	0 ~ 0.65
5	0 ~ 1.5	0.08	0.23 ~1.35	0.15 ~ 1.27	0 ~ 0.975
6	0 ~ 2	0.08	0.28 ~1.8	0.2 ~ 1.72	0 ~ 1.3
7	0 ~ 2.5	0.1	0.35 ~2.25	0.25 ~ 2.15	0 ~ 1.625
8	0 ~ 3.5	0.14	0.49 ~3.15	0.35 ~ 3.01	0 ~ 2.275
9	0 ~ 5	0.2	0.7 ~4.5	0.5 ~ 4.3	0 ~ 3.25
10	0 ~ 7	0.25	0.95 ~6.3	0.7 ~ 6.05	0 ~ 4.55
11	0 ~ 10	0.3	1.3 ~9	1 ~ 8.7	0 ~ 6.5
12	0 ~ 15	0.45	1.95 ~13.5	1.5 ~ 8.7	0 ~ 9.75
13	0 ~ 20	0.6	2.6 ~18	2 ~17.4	0 ~ 13
14	0 ~ 25	0.75	3.25 ~22.5	2.5 ~ 21.75	0 ~ 16.25
15	0 ~ 35	1.25	4.75 ~31.5	3.5 ~ 30.25	0 ~ 22.75

Table 4-4 Pressure Switch Setting Ranges

Model: CD30 Double-contact Unit: MPa

No.	Pressure range	Contact difference (MAX)	Setting range		Normal pressure range
			Upper limit type	Lower limit type	
1	0 ~ 0.2	0.02	0.04 ~ 0.18	0.02 ~ 0.16	0 ~ 0.13
2	0 ~ 0.4	0.04	0.08 ~ 0.36	0.04 ~ 0.32	0 ~ 0.26
3	0 ~ 0.6	0.06	0.12 ~ 0.54	0.06 ~ 0.48	0 ~ 0.39
4	0 ~ 1	0.1	0.2 ~ 0.9	0.1 ~ 0.8	0 ~ 0.65
5	0 ~ 1.5	0.12	0.27 ~ 1.35	0.15 ~ 1.23	0 ~ 0.975
6	0 ~ 2	0.14	0.34 ~ 1.8	0.2 ~ 1.66	0 ~ 1.3
7	0 ~ 2.5	0.18	0.43 ~ 2.25	0.25 ~ 2.07	0 ~ 1.625
8	0 ~ 3.5	0.25	0.6 ~ 3.15	0.35 ~ 2.9	0 ~ 2.275
9	0 ~ 5	0.35	0.85 ~ 4.5	0.5 ~ 4.15	0 ~ 3.25
10	0 ~ 7	0.4	1.1 ~ 6.3	0.7 ~ 5.9	0 ~ 4.55
11	0 ~ 10	0.5	1.5 ~ 9	1 ~ 8.5	0 ~ 6.5
12	0 ~ 15	0.75	2.25 ~ 13.5	1.5 ~ 12.75	0 ~ 9.75
13	0 ~ 20	1.1	3.1 ~ 18	2 ~ 16.9	0 ~ 13
14	0 ~ 25	1.25	3.75 ~ 22.5	2.5 ~ 21.25	0 ~ 16.25
15	0 ~ 35	1.75	5.25 ~ 31.5	3.5 ~ 29.75	0 ~ 22.75

5. INSTRUCTIONS FOR TRANSPORTATION, STORAGE AND UNPACKING

(1) Instructions for Transportation

This product is a precision instrument. If it is dropped or a shock is applied to it, it may be damaged. Carry the product with great care.

In the case of an indirect measuring diaphragm type switch, hold the whole switch. Do not hold the case, lead or pressure receiving unit only.

(2) Instructions for Storage

Store the product in a dry place free from vibrations or dust. If it is necessary to pile up the packages of the products, use care not to deform or drop the packages.

If the product should be stored after use, follow the instructions below:

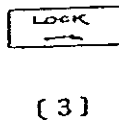
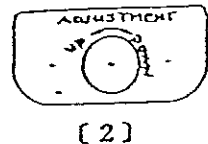
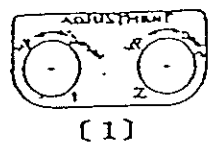
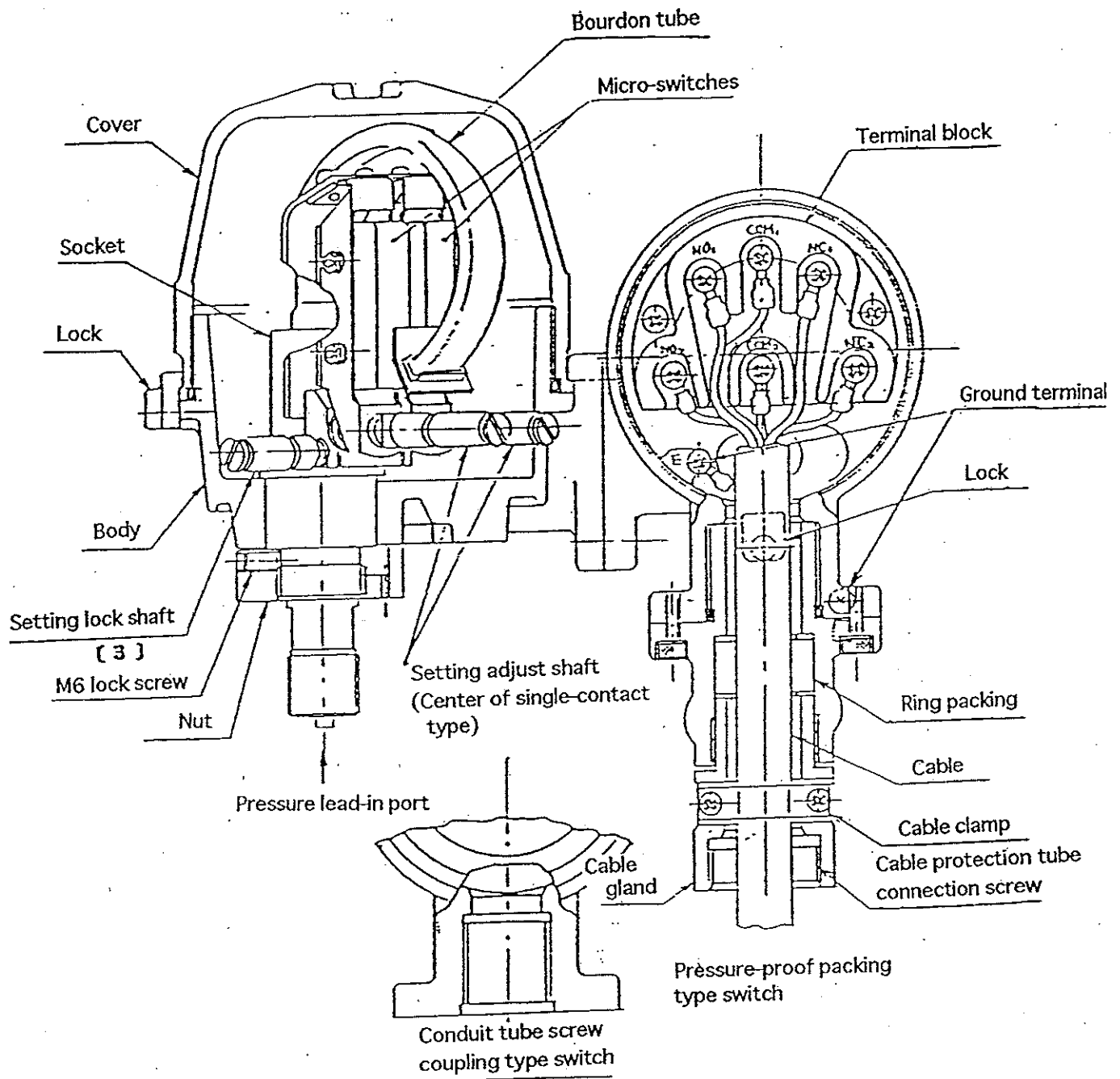
- ① Clean the liquid contacting parts to remove foreign matters and fluid, etc. Be careful not to damage or deform the diaphragm if a diaphragm type switch is used.
- ② Check the liquid contacting parts for corrosion. Do not use any corroded liquid contacting parts.
- ③ Check the contacts for proper functioning. If some contacts are defective, contact us for repair.
- ④ Check the appearance for defects or abnormalities.
- ⑤ If no abnormalities are found in the above-shown checks, write the sites of using the products, dates of replacements, etc. on the packages, and store the packages under strict control.
- ⑥ If there is a possibility of freezing in the winter, remove water completely, then store the product.
- ⑦ In the case of a diaphragm type product, wind the lead in a circle of approximately 300 mm in diameter for efficient storage and reusing. If it is wound in a small circle, it is difficult to unwind it when reusing the product.

(3) Instructions for Unpacking

Handle the product with great care when unpacking it.

Unpack the product in a wide place in order not to drop it when taking it out of the package. After unpacking, check if the supplied product meet the specifications required by you. Also check if the product is not damaged in transportation. If you find some problems, please contact the dealer from which you purchased the product or our office.

6. COMPONENTS



To change the setting,
loosen the setting lock shaft
by approximately half turn.

[4]

(Name plate)

Fig. 6-1

7. OPERATION PRINCIPLE

As shown on the right, the Bourdon tube directly drives the micro-switch to turn on and off the circuit. The set pressure can be adjusted by turning the setting adjust shaft (thread) to slide the micro-switch holder.

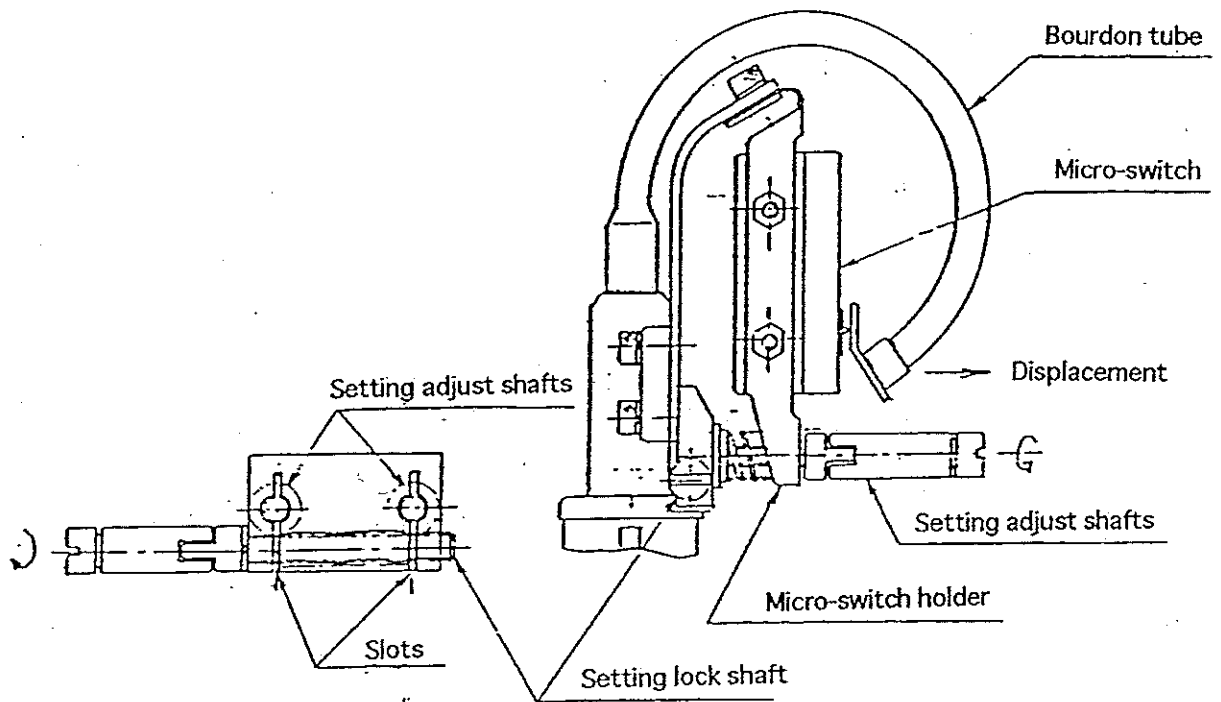


Fig. 7-1

The setting shafts can be locked securely by tightening the screws into the slots as shown above

8. INSTALLATION

(1) Pressure outlet

① Provide the pressure outlet in the tank or the like which has stable pressure as far as possible, not the electromagnetic valve, check valve and so forth which are subject to quick pressure changes.

If the outlet tube is equipped with a stop valve or cock, maintenance and inspection can be executed efficiently.

⚠ CAUTION

- If the outlet port is located in the lower part of the piping, drain enters the outlet tube, resulting in clogging. Provide the outlet port on the side or top of the piping.
- If errors due to air bubbles should be avoided when measuring liquid, install an air vent valve at the highest position of the outlet tube or take proper measures.

② Check if there is pulsating pressure or not. Pulsating pressure is very harmful to the pressure switch. If there is pulsating pressure, be sure to use a dampener, etc. to reduce the pulsating pressure.

A pressure gauge is effective for checking functioning of the dampener visually as shown below.

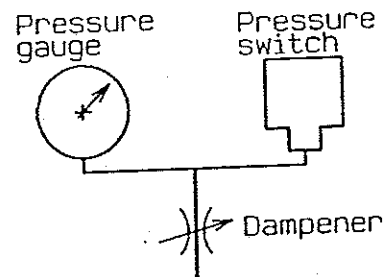


Fig. 8-1

⚠ CAUTION

- Be sure to check functioning of the dampener. Though a dampener is installed, the service life of the pressure switch may become shorter since the dampener is fully opened.
- In the early stage of liquid measurement, air remains in the pressure switch and the dampener functions efficiently. As the pressure switch is used, the air will be discharged from the inside of the pressure switch, which will be filled with liquid only, resulting in bad dampener efficiency. Thus, it is necessary to check the efficiency of the dampener for a while after starting operation.

- ③ If there may be surge pressure, connect a longer lead pipe to the pressure switch and use a dampener.

⚠ CAUTION

Note that surge pressure may easily be produced in a conduit handling liquid, resulting in over-pressure which may break the pressure element.

(2) Environments

Follow the instructions shown below to select the installation position of the pressure switch.

- Install the pressure switch in a place free from dust; corrosive gas, silicone gas source, etc.
- Do not install the pressure switch in a place exposed to the direct sunlight.
- Do not install the pressure switch in a place exposed to rain or dew.
- Do not install the pressure switch in a humid place.
- Do not install the pressure switch in a hot or cold place.

⚠ CAUTION

- In a hot place, be sure to install the pressure switch apart from the heat source.
 - If the pressure switch is exposed to a temperature below the specified ambient temperature in a cold place or the like, keep the instrument panel warm using heat insulation material.
 - Be very careful to prevent water in the piping from being frozen.
 - The inside of the pressure switch may be frosted when the ambient temperature changes quickly.
- Quick change of the ambient temperature should be avoided.

(3) Installation panel, etc.

The pressure switch is easily affected by vibrations. Install it in a place free from vibrations. Use a separate instrument panel from the operation panel in which solenoid valves and other devices generating shocks and vibrations are mounted. Prepare a rigid foundation and install the instrument panel on such a foundation in order to prevent external vibrations from being transmitted to the instrument panel.

Use flexible pipes for the pressure switch to prevent excessive force and main pipe vibrations from being applied to the pressure switch.

(4) Installation

① Installation methods

a. Two installation methods are available: Panel installation, and pipe installation. The product is supplied with either bracket as specified.

Fix the pressure switch on the panel or 2B pipe firmly.

b. In pressure piping work, do not hold the pressure switch. Be sure use a wrench.

② Piping

Select a proper pipe size according to the use conditions, applications, etc. Use larger pipes to measure liquid or if there is a possibility of clogging due to foreign matters. Install a gas vent valve at the highest position of the piping and a drain valve at the lowest position.

To measure the steam pressure, install the pressure switch at a position lower than the mains and sufficiently apart from the mains in order to cool down the switch and substitute with condensate.

To measure hot fluid, use long enough pipe between the pressure switch and mains (30 to 40 cm at least) to keep the temperature below 40°C.

If there is a possibility of too high viscosity or solidification of fluid when the temperature becomes low, use a seal pot to substitute with another liquid.

A union joint is convenient for connection with the pressure switch.

If sealing tape is wound around the tapered threads, leave one or two threads unwound to prevent scraps from being put into the piping.

If scraps of sealing tape may possibly cause serious interference or troubles to the instruments and devices, use parallel threads for all connections.

③ Wiring

Remove the locked M4 socket head bolt from the terminal box. Turn the cover with a screwdriver (or equivalent tool) in the direction of the arrow as shown on the right, and the cover is removed.

The terminal block is as shown on the right.

The terminal symbols are marked in relief.

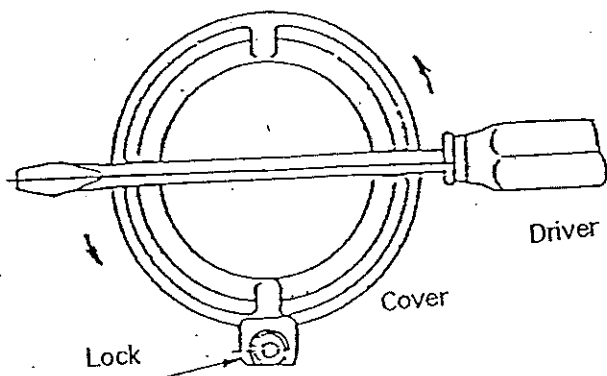


Fig. 8-2

The symbols mean the following.

NO: Normally open terminal

COM: Common terminal

NC: Normally closed terminal

1: Circuit 1

2: Circuit 2

Use vinyl coated wires, cabtyre cables, etc.
of the proper sizes for connection. (See page 28.)

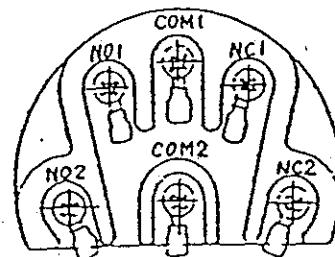


Fig. 8-3

When a conduit is used, be sure to use lock nuts and press the threads against the single side.

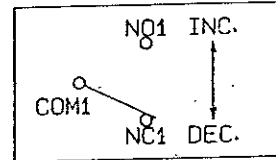
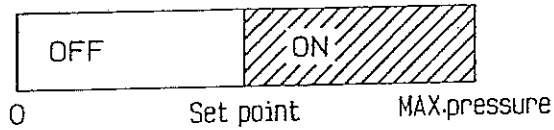
See the wiring plate (stuck on the inside of the terminal box cover) and terminal symbols for proper wiring.

⚠ CAUTION

The terms "normally open" and "normally closed" mean the conditions of the contacts when a pressure lower than the set pressure is applied.

a. Upper limit type (H)

A single-contact type switch. When the pressure exceeds the set pressure, the contacts function to turn on the circuit.

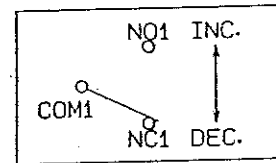
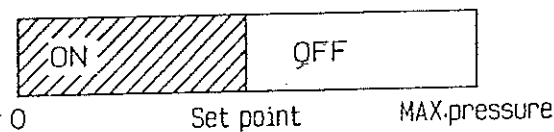


• NO1 and COM1 are used.

Fig. 8-4

b. Lower limit type (L)

A single-contact type switch. When the pressure lowers below the set pressure, the contacts function to turn on the circuit.



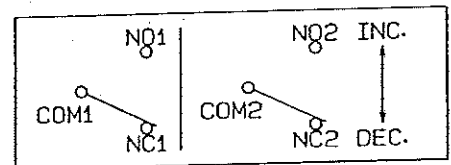
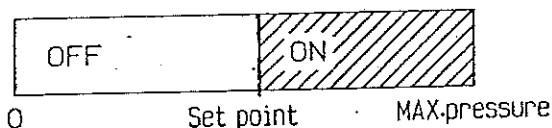
• NC1 and COM1 are used.

Fig. 8-5

c. Upper and lower limit type (HL)

A dual-contact type switch. It is a combination of the upper limit and lower limit type switches shown above, which function independently.

Upper limit type



Lower limit type

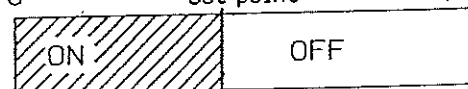


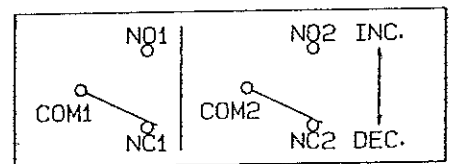
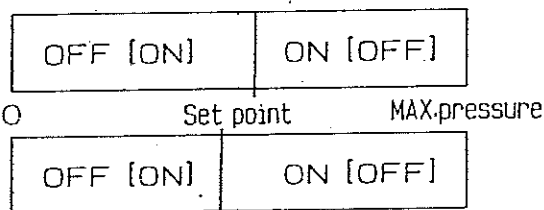
Fig. 8-5

• NO1 and COM1 (or NO2 and COM2) of the upper limit type and NC2 and COM2 (or NO1 and COM1) of the lower limit type used.

d. Dual-contact upper limit (lower limit) type switch (2H (2L))

A dual-contact type switch. It is a combination of the upper limit and lower limit type switches shown above which function independently.

Upper limit (lower limit) type



Upper limit (lower limit) type

Fig. 8-6

• NO1, COM1, NO2 and COM2 of the upper limit type and NC2, COM2, NC1 and COM1 of the lower limit type are used.

On completion of setting, tighten the lock firmly. The set value may lower slightly when the lock is tightened. In such a case, increase the setting by the degree of lowering, then tighten the lock. Note that the withstand pressure is 150% F.S.

⚠ CAUTION

Decide the electrical specifications of a switch with the greatest care. The allowable current depends on the voltage, load and power supply types. In general, it is recommended that a switch be used at 1/2 to 1/3 of its rating.

⚠ CAUTION

If the contact circuit contains an inductive load, remarkably high counter electromotive force is produced when the circuit is turned off, damaging the contacts. Please note this.

Be very careful to the direct current since the control capacity is reduced remarkably. This is because the direct current, different from the alternating current, has no zero cross point and electric arc, once it occurs, will not easily disappear, resulting in longer arc time. In addition, the current flows in one direction, resulting in transition of the contacts and accordingly wear-out of the contacts.

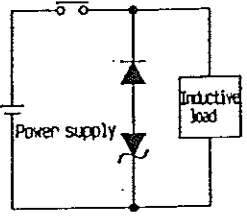
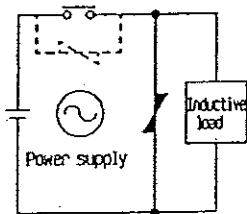
The rush current may increase according to loads, and the contacts may fail to open due to contact deposition or transition. Use an arc killer as shown below to increase the service life of the contacts, prevent noises and reduce carbide and nitric acid produced by electric arc.

Table 8-1

Typical examples of arc killers

Circuit example		Application		Features, etc.	Element selection
		AC	DC		
CR		*	○	<p>* For operation on AC voltage</p> <p>Load impedance should be much lower than the CR impedance.</p>	<p>Standard C and R values are as shown below.</p> <p>C: 0.5 to 1 μ F for 1 A contact current</p> <p>R: 0.5 to 1 Ω for 1 V contact voltage</p> <p>These values differ with variations of characteristics. Determine the values after repeated trial and error on the assumption that C has discharging suppression effects when the contacts open and R restricts the current when the circuit is turned on next time. Use C whose withstand voltage is 200 to 300 V. Use an AC capacitor (non-polar type) for an AC circuit.</p>
		○	○	<p>Reset time is longer when a relay, solenoid or the like is used as the load. It is recommended to connect the arc killer in parallel with the load on source voltage of 24 or 48 V or in parallel with the contacts on source voltage of 100 to 200 V.</p>	<p>C whose withstand voltage is 200 to 300 V. Use an AC capacitor (non-polar type) for an AC circuit.</p>
*1		×	○	<p>Reset time of this type is longer than the CR type.</p>	<p>Use a diode whose reverse withstand voltage is 10 times as high as circuit voltage and forward current is more than load current. In an electronic circuit carrying not so high circuit voltage, a diode whose reverse withstand voltage is a couple of times as high as circuit voltage can be used.</p>

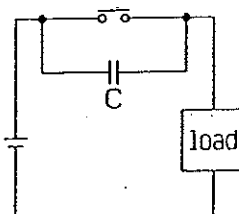
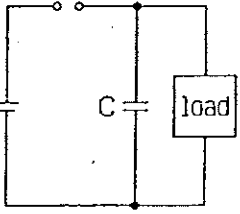
*1 DIODE TYPE

Circuit example	Application		Features, etc.	Element selection
	AC	DC		
<p>*1</p> 	×	○	<p>This type is effective for the case where the reset time of the diode type is too long.</p>	<p>Zener voltage of the Zener diode should be almost the same as the source voltage.</p>
<p>*2</p> 	○	○	<p>This type makes use of the constant-voltage characteristics of the varistor to prevent high voltage from being applied between the contacts. Reset time of this type is also rather longer. It is recommended to connect the arc killer between the loads on source voltage of 24 to 48 V or between the contacts on source voltage of 100 to 200 V.</p>	

*1 Diode + Zener diode type

*2 Varistor type

Do not use the arc killer in either of the following manners.

	<p>Though this arc killer quite efficiently extinguishes electric arc when turning off, C short-circuit current flows when the contacts are closed and the contacts easily stick to each other, since C is charged when the contact are open.</p>
	<p>Though this arc killer quite efficiently extinguishes electric arc when turning off, C charging current flows when the contacts are closed and the contacts easily stick to each other.</p>

9. SETTING

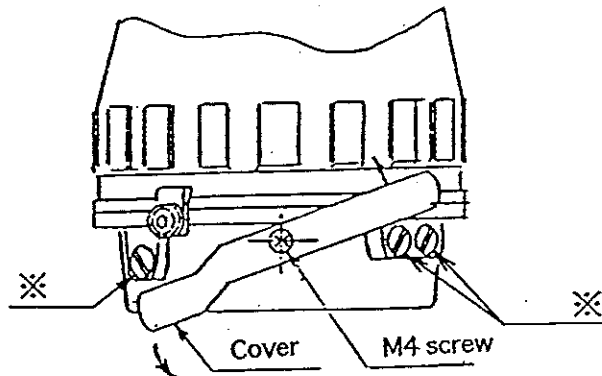


Fig. 9-1

Loosen the M4 screw and turn the cover in the direction of the arrow as shown on the right. The setting adjust shaft and setting lock shaft are exposed.

The setting adjust shaft is locked before shipment. Loosen it by approximately half turn with a flathead screwdriver as shown on the name plate.

The set pressure can be changed with a flathead screwdriver. Clockwise rotation decreases the set pressure. Counterclockwise rotation increases it. When circuit 1 of a dual-contact type switch is set, circuit 2 is set, then circuit 1 is checked, the set pressure lowers slightly. This is inevitable. Repeat setting a couple of times.

⚠ CAUTION

If the pressure switch is used in a bad conditions such as near the sea and it is exposed to rain, the aluminum case in the setting adjust shaft and setting lock shaft positions (marked with asterisks above) may be corroded, resulting in a failure to rotate the shafts. To avoid corrosion, apply grease to the positions marked with asterisks above on a site near the sea.

10. MAINTENANCE AND INSPECTION

(1) Check the pressure switch once a year or more. The check points are as shown below.

- Check the appearance for defects and abnormalities.
- Check the set value.
- Measure the contact resistance.

We recommend to prepare a check list of the instruments and to make calibration and work records for effective instrument control. Check long-term changes of the instrument such as the total errors with respect to the initial values, abnormal contact errors, etc. If abnormal change takes place, it is necessary to locate the cause, no matter how it can be eliminated by means of readjustment. In the case of slight change, readjust it as the drift of the instrument.

(2) The contacts of a micro-switch are oxidized or chemically affected by the atmosphere. The contact resistance increases as time passes. If the load is relatively great, oxide film, etc. are blown out by electric arc energy when the contact function and poor contact rarely occurs. However, such a

phenomenon does not occur with a minor load, resulting in poor contact in many cases. In general, the user is liable to use a tester to check the contact resistance. However, a tester may indicate a higher resistance than the actual resistance or show unstable indication, since a tester uses quite a low current for measurement. Such a trouble does not mean defects of the switch. A switch has the maximum and minimum ratings. A rating over 800 mW is required for a general-purpose switch. (A rating over 40 mW is required for a gold-plated switch.)

If the phenomenon shown above takes place, check the ON and OFF signals by means of the voltage drop method or using the actual load.

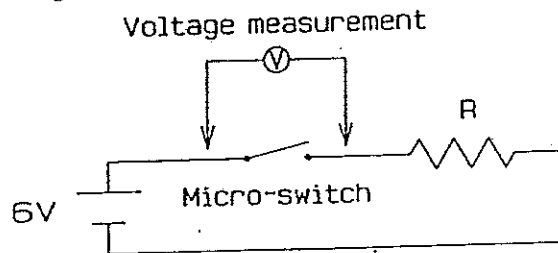


Fig. 10-1

Table 10-1

Minimum contact rating	contact R	Criteria contact resistance	Voltage at criteria contact resistance (For reference)
40mW	825 Ω	75 Ω	0.5 V
800mW	41.2 Ω	3.8 Ω	0.5 V

Connect a 6 V power supply and resistor R, measure the voltage when the micro-switch is turned on, and find the contact resistance. The above table shows the values of R when the criteria resistances for judging whether the contacts are non-defective or not. It also shows the voltages when the contact resistance reaches the criteria resistance for reference. Note that the value of R is different when criteria resistance not shown above is used. The above table only shows the standard criteria resistances, and values not shown above do not always cause poor contact. It is recommended that the optimum criteria resistance be determined according to the use site and conditions, taking account of the actual use conditions.

- (3) Apply grease to the setting lock shaft and setting adjust shaft to prevent corrosion. (See page 22.)
- (4) We have no legal regulations about the period of durability of explosion-proof instruments. However, the explosion-proof performance of this product depends on rubber and plastic to some extent. Therefore, we recommend that this product should be replaced earlier.
- (5) Other precautions for operation
 - ① The normal pressure of the switch should be 1/2 or 2/3 or less of the maximum deviation.
 - ② Do not apply any pressure over the maximum pressure.
 - ③ Do not pressurize or depressurize the switch quickly.
 - ④ Provide the switch with a protector in applications subject to excessive pressure variance.

11. TROUBLESHOOTING

(1) When some trouble occurs, see Attached Table 1 TROUBLESHOOTING and take proper countermeasures. If the trouble cannot be eliminated by taking proper countermeasures, contact the dealer or our office.

(2) If the micro-switch is broken, it can be replaced as shown below.

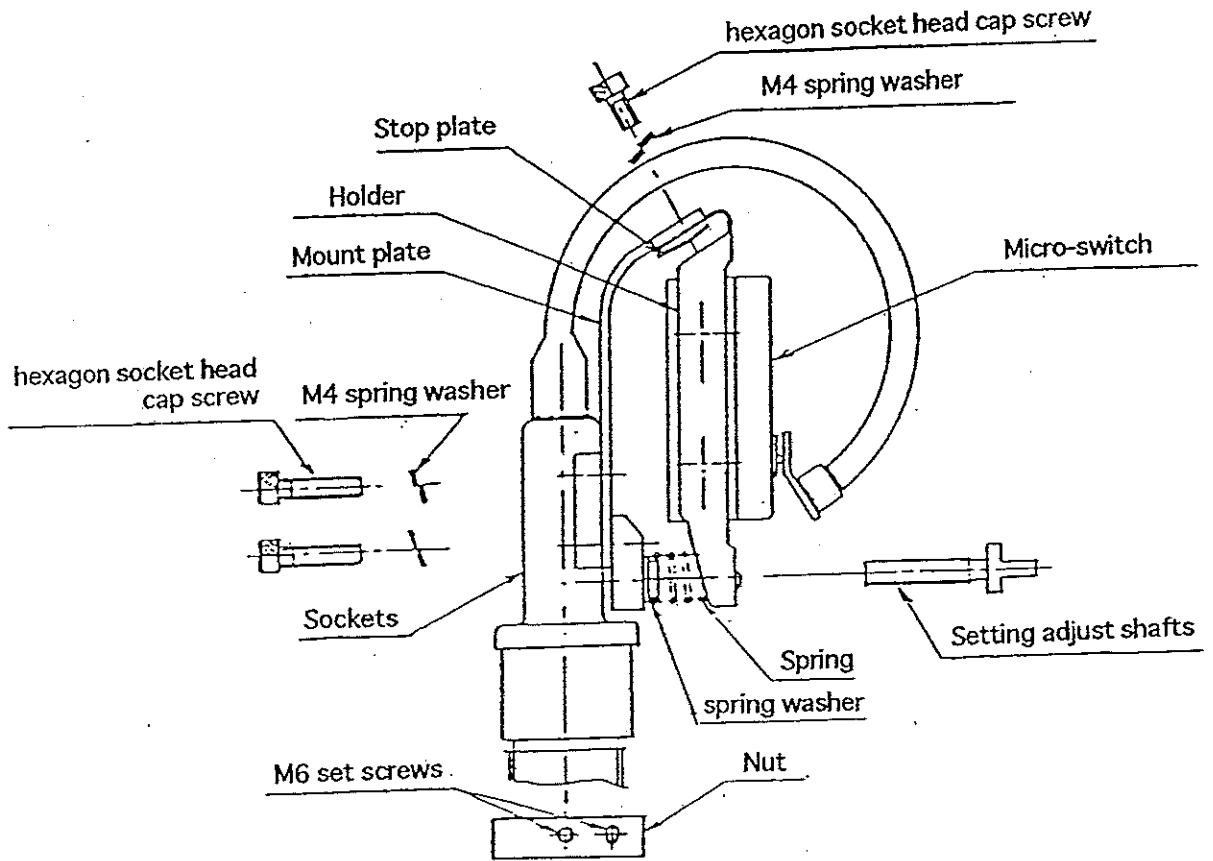


Fig. 11-1

- ① Remove the M6 set screws. Remove the nut from the case body and sockets assembly using a vise or wrench.
- ② Draw out the sockets to the extent that the wires are pulled.
- ③ Remove the setting adjust screw. Remove the spring and spring washer.
- ④ Remove the hexagon socket head bolts from the sockets and mount plate. The micro-switch can be detached together with the mount plate.
- ⑤ Detach the holder from the mount plate. Disconnect the wires from the micro-switch terminals. The wire colors are as shown below.

Table 11-1

NO1	COM1	NC1	NO2	COM2	NC2
Red	White	Black	Yellow	Blue	Green

⑥ Replace the micro-switch with a new micro-switch with a holder. Assemble parts in the order of ⑤,④,③,② and ①.

⚠ CAUTION

Before screwing in the cover, make sure that no dust or foreign matters adhere to the threads. If you feel abnormal resistance when screwing in the cover, unscrew the cover immediately with great care, remove dust or foreign matters to prevent galling of the threads.

12. WHAT IS EXPLOSION-PROOF STRUCTURE?

The explosion-proof structure means a fully closed structure which withstands the pressure and has no risk of ignition of explosive gas outside the container even if explosive gas explodes inside the container.

- General matters concerning explosion-proof structure

The shaded portions apply to this product.

Table 12-1 Classification of Dangerous Places

Dangerous places	Descriptions
Class 0 place	A place where explosive gas of dangerous concentration always resides
Class 1 place	A place where explosive gas of dangerous concentration sometimes resides
Class 2 place	A place where the concentration of explosive gas may become dangerous in abnormal conditions though proper measures for preventing the explosive gas from being collected

Table 12-2 Classification of Explosion Grades

Explosion grades	Values of gaps subject to flame running at depth of 25 mm
1	Over 0.6 mm
2	Over 0.4 mm, not more than 0.6 mm
3	0.4 mm or less

Table 12-3 Classification of Ignition Classes

Ignition classes	Ignition point	Temperature rise on container outer surface (deg.)
G1	Over 450°C	320
G2	Over 300°C, not more than 450°C	200
G3	Over 200°C, not more than 300°C	120
G4	Over 135°C, not more than 200°C	70
G5	Over 100°C, not more than 135°C	40

The limit of the standard ambient temperature is 40°C in the operating conditions.

Table 12-4

Ignition class / Explosion grades	G1	G2	G3	G4	G5
1	Acetone Ammonia Carbon monoxide Ethane Acetic acid Ethyl acetate Toluene Propane Benzene Methanol Methane	Ethanol Isoamyl acetate 1-butanol Butane Acetic anhydride	Gasoline Hexane	Acetaldehyde Ethyl ether	
2	Coal gas	Ethylene Ethylene oxide			
3	Water gas Hydrogen	Acetylene			Carbon disulfide

The above are cited from the explosion-proof guideline for factory use electrical appliances.

13. OUTSIDE DIMENSIONS

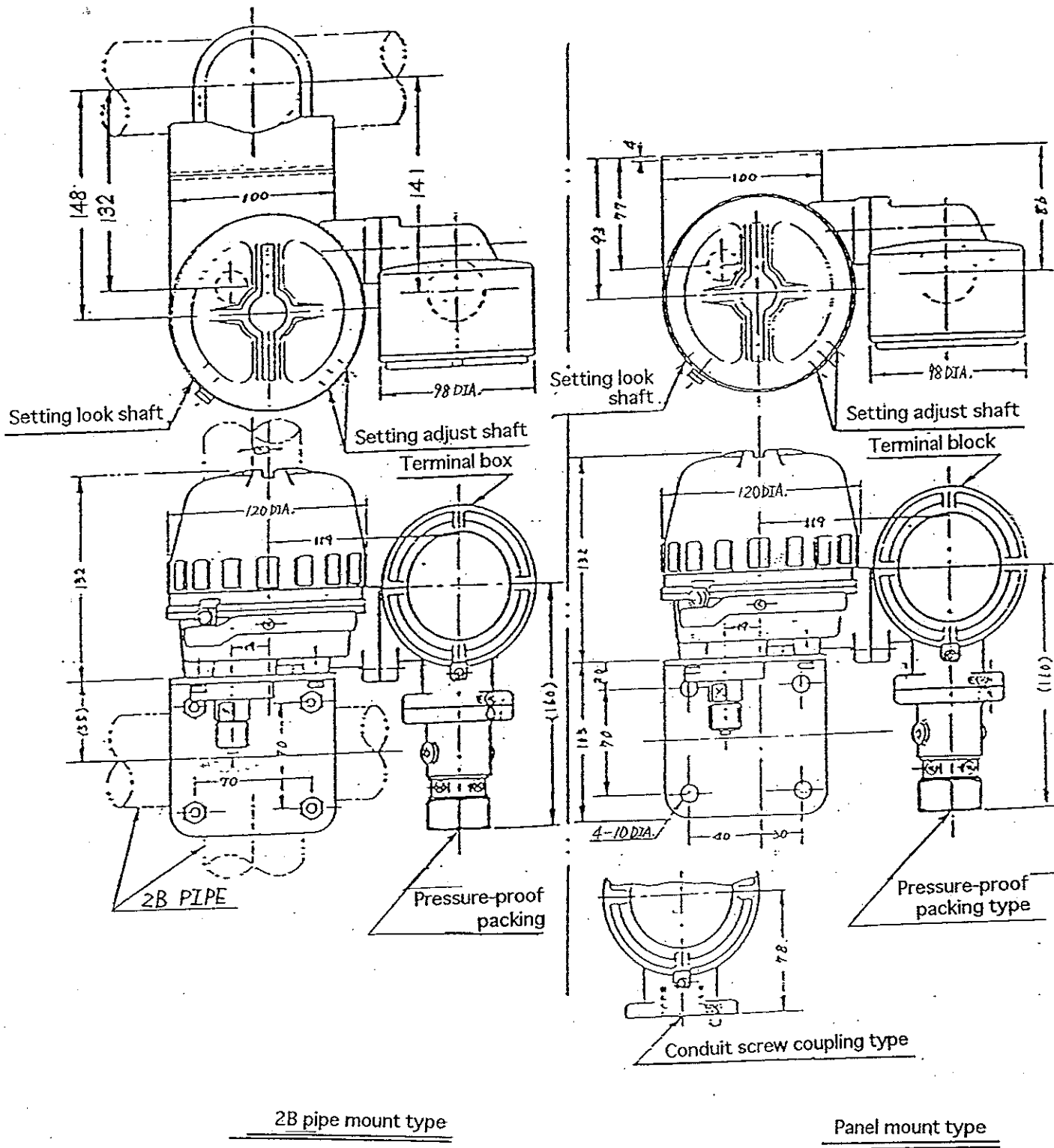


Fig. 13-1

14. DETAILS OF PRESSURE-PROOF PACKING AND CONDUIT TUBE PRESSURE-PROOF THREAD COUPLINGS

Ring packing		Cable outer diameter	
Outer diameter	Inner diameter		
23	10.5	9.4	
		9.9	
		10.1	
	12	10.5	
		11.0	
		11.4	
29.5	14	11.9	
		12.0	
		12.5	
		12.6	
	15.5	13.1	
		13.5	
		13.6	
		14.5	
		16.5	15.6

PF 1/2
PF 3/4
PF 1

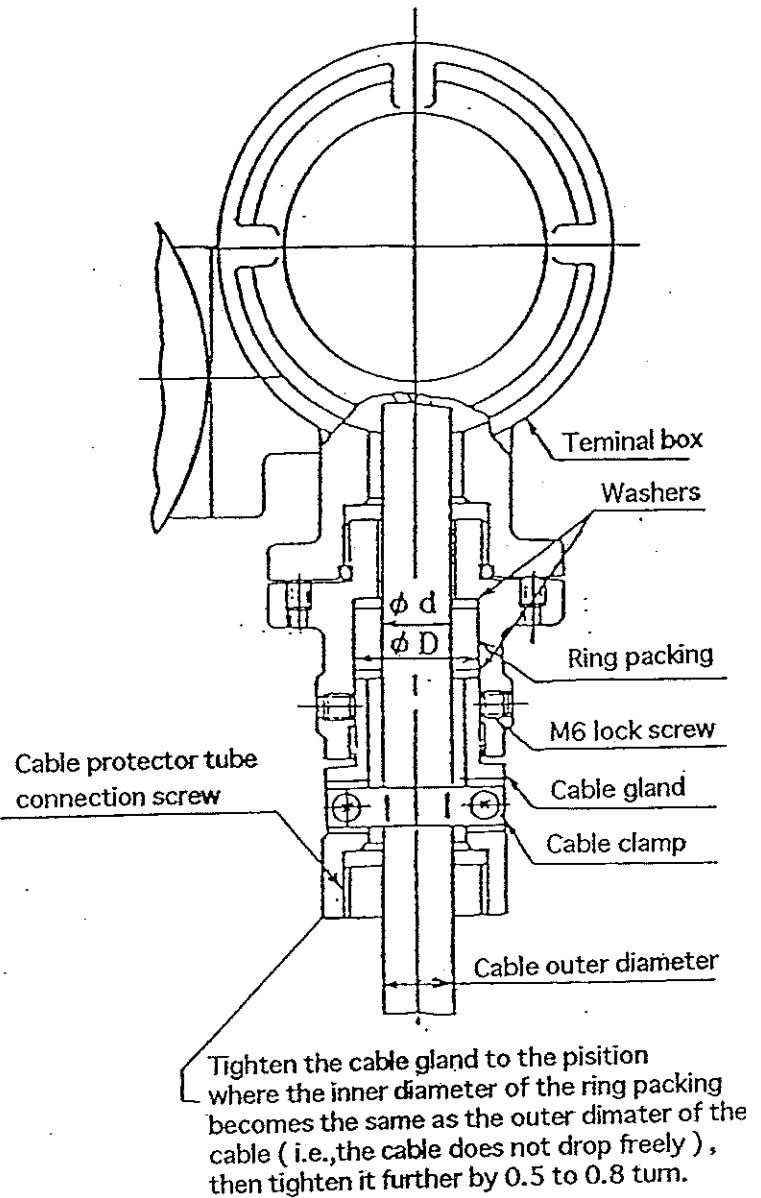


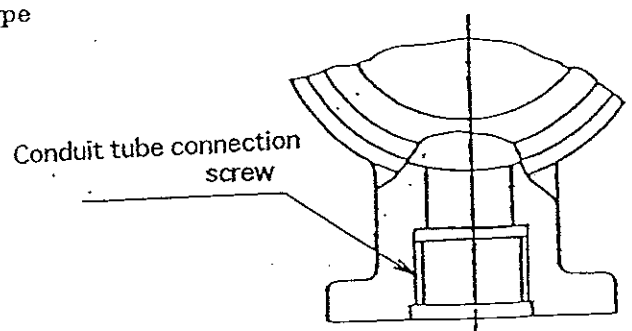
Fig. 14-1

The inner diameter of the ring packing and connection screw should be specified.

(2) Conduit Tube Pressure-Proof Screw Coupling Type

The connection screw should be specified.

PF 1/2
PF 3/4
PF 1



ATTACHED TABLE I-1 TROUBLESHOOTING

Troubles	Check points	Possible causes	Countermeasures	Remarks
Failure to operate at specified pressure	<ol style="list-style-type: none"> 1. Check the set range. 2. Check the operation point using a proper gauge. 3. Check the pressure circuit system. 4. Check if process fluid is suitable to St.St. 316. 5. Check the surge pressure. 6. Check leakage from the pressure switch. 7. Check the maximum voltage and current applied to the switch. 	<ol style="list-style-type: none"> 1. Pressure switch of an improper set range 2. Defects of the calibration gauge 3. Clogging of the pressure lead pipe, etc. 4. Corrosion by process fluid 5. Element breakage by surge pressure. 6. Element breakage by over-pressure 7. Voltage and current over the switch rating 	<ol style="list-style-type: none"> 1. Replace the switch with one of the proper set range. 2. Replace the calibration gauge. 3. Use a proper filter. 4. Replace the switch with a diaphragm seal type switch, etc. 5. Replace the element with one for higher pressure range. 6. Replace the element with one for higher pressure range. 7. Use a protection circuit. 	<ol style="list-style-type: none"> 1. Refer to the catalog, manual, etc. 5. Check the PROOF value (withstand pressure) shown on the name plate. 6. Check the withstand pressure shown on the name plate. 7. We recommend to use a mass-marketed relay with a built-in protection circuit.
Failure to reset at set pressure	<ol style="list-style-type: none"> 1. Check the set range and contact difference of the pressure switch. 2. Check if the contact resistance is greater or not. 	<ol style="list-style-type: none"> 1. The set range and contact difference are improper. 2. Poor contact due to minute load 	<ol style="list-style-type: none"> 1. Replace the switch with one of proper set range and contact difference. 2. Replace the micro-switch with one for minute loads. 	<ol style="list-style-type: none"> 1. Refer to the catalog, manual, etc. 2. Gold-plated type switch is also available. (Switch may be reset by turning it on and off several times.)

TABLE 1-2

Troubles	Check points	Possible causes	Countermeasures	Remarks
Operation and resetting at lower pressure than set pressure, or improper operation	<ol style="list-style-type: none"> 1. Check pulse pressure (abrupt pressure variance) in the pressure circuit. 2. Mechanical vibrations in installation position. 	<ol style="list-style-type: none"> 1. Excessive pulse pressure 2. Improper operation due to excessive vibrations 	<ol style="list-style-type: none"> 1. Use a dampener. 2. Change the installation position or use insulation rubber. 	<ol style="list-style-type: none"> 1. Use the type FD 10 dampener.
Operation point differs with temperature.	<ol style="list-style-type: none"> 1. Check the operation temperature. 	<ol style="list-style-type: none"> 1. Operation temperature range is exceeded. 2. Temperature coefficient is not taken into account. 	<ol style="list-style-type: none"> 1. Change the installation position, or radiate heat using pipes. 2. Take account of the temperature coefficient when deciding the accuracy. 	<ol style="list-style-type: none"> 1. When measuring hot fluid, apart the switch by 30 to 40 cm or more at least to reduce the temperature below 40°C. 2. Temperature coefficient: $\pm 0.05\%$ max. P./°C.
No current flows through switch in operation or when resetting.	<ol style="list-style-type: none"> 1. Check if electric power is supplied to the switch. 2. Check the maximum voltage and current of the switch. 3. Check the wiring condition. 4. Check the electric circuits. 	<ol style="list-style-type: none"> 1. No power is supplied. 2. Voltage and current exceed the switch capacities. 3. Improper wiring 4. Inadequate electrical circuits 	<ol style="list-style-type: none"> 1. Supply power to the switch. 2. Use a protector circuit. 3. Improve the wiring method. 4. Review the electrical circuits. 	<ol style="list-style-type: none"> 2. We recommend to use a mass-marketed relay with a built-in protection circuit.

TABLE 1-3

Troubles	Check points	Possible causes	Countermeasures	Remarks
Operation point greatly changes in long period.	<ol style="list-style-type: none"> Number of switch operations Check the contact resistance. Water in the pressure switch Check the periodical check data. (Check the drift values.) 	<ol style="list-style-type: none"> Service life of the switch is expired. Too great contact resistance due to contacts Corrosion of parts Drift in the elements or movable mechanism 	<ol style="list-style-type: none"> Readjust or replace the pressure switch. Replace the pressure switch. Use a rain-proof cover, etc. Readjust, or change the operation point in a generous range. 	<ol style="list-style-type: none"> Standard service life of the micro-switch is 500 thousand times. If oxidation or chemical change is caused by minute load, replace the micro-switch with a gold-plated type switch. Be careful when the value exceeds a couple of times as large as the switch accuracy $\pm 1\%$ max.P.