



INSTRUCTION MANUAL

FOR

PRESSURE TRANSMITTER

MODEL KM31

 **NAGANO KEIKI CO., LTD.**

MANURAL FOR ACCURATE AND SAFE OPERATION

SAFTY CHAPTER

FOR

PRESSURE TRANSMITTER

PRESSURE TRANSDUCER

AND ELECTRONIC PRESSURE SWITCH

To use these devices accurately and safely, carefully read this manual and the operation manual. Incorrect usage may cause malfunction and result in human injury, accidents, etc. Be sure to keep this manual for reference after reading.

WARNING

1. Do not apply more than the maximum allowable pressure.
Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements.
2. Do not use these devices on measured objects which are corrosive to fluid or gas contacting areas.
Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.
3. Do not apply excessive weight, vibration or shock.
Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.
4. Use with the unspecified power supply may cause fire hazard or electric shock.
5. Use with the instrument temperature range.
Use outside of the instrument temperature range may cause human injury or damage to surroundings due to explosion or breakdown of the devices.
6. Connect wiring accurately according to the wiring diagrams or instructions in the operation manual.
Incorrect wiring may result in human injury or fire hazard.
7. Use devices with an explosion-proof construction when operating in place liability to have explosive gas.
Danger of ignition and explosion.
8. If the measured object is oxygen, use devices with "Use No Oil" treatment.
Standard devices may possibly contain remaining oil, and there is danger of combustion and explosion if oil acts on oxygen.
9. Accurately install these devices according to the installation instruction in the operation manual.
10. Never attempt to reconstruct the main body of devices nor add any new functions to the devices, etc. Contact us for repairs.

Note: Inform us in advance when using these devices in a way that may result in fatal or serious injury due to malfunction or incorrect operation.

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1. Preface

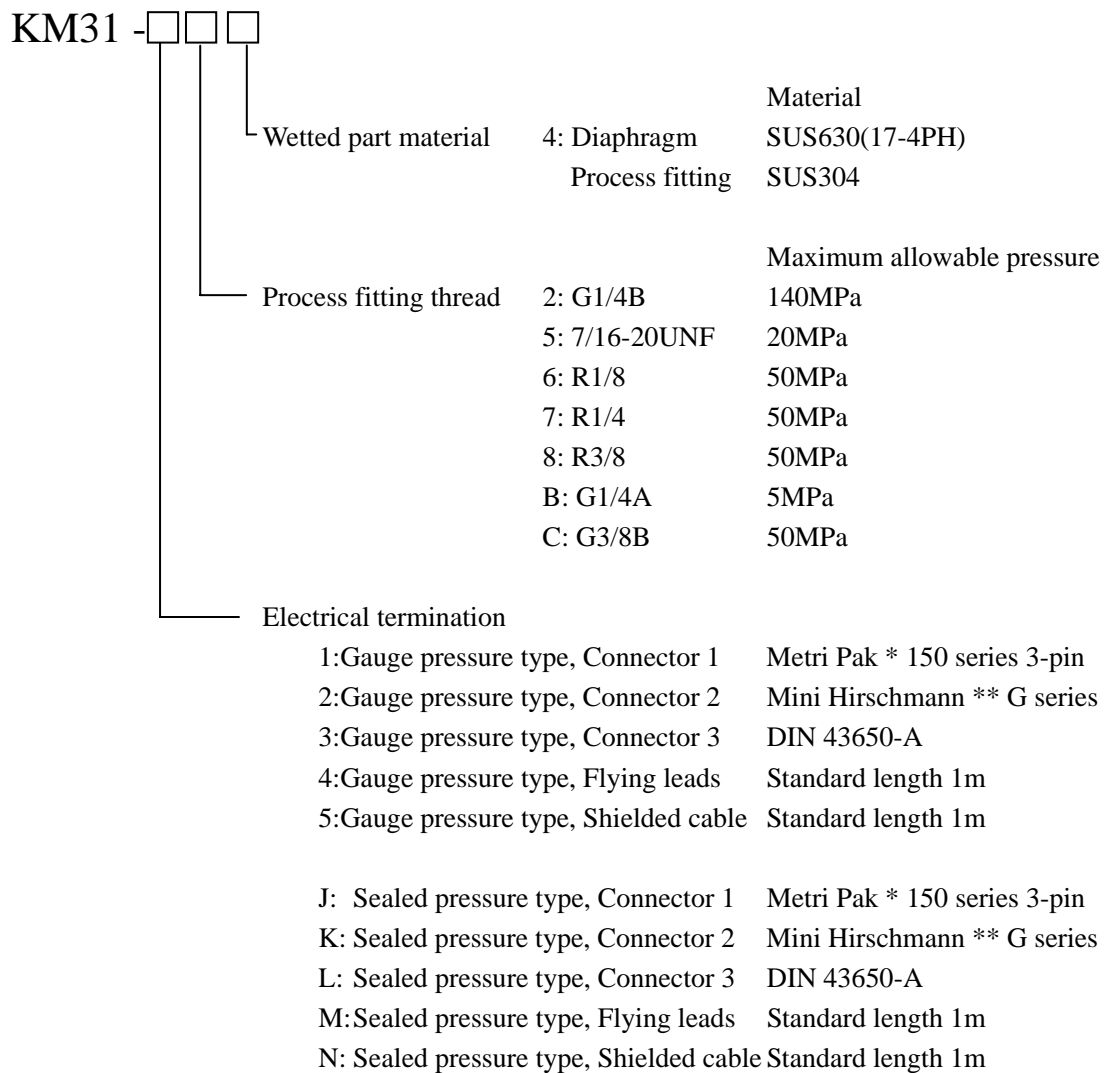
First, please confirm the specifications of the model delivered. If its pressure ranges, electrical power source, or output is incorrect, it may be a cause of accident. Please make sure to install and use a model of proper specification that meets to environment to be installed.

2. Product Outline

KM31 Pressure Transmitter is a small but rugged pressure transmitter which has a semi-conductor strain gage on pressure detecting element.

KM31 has variety of output signal as standard for 0.5 to 4.5V ratiometric, 4-20mA DC, 0-5V DC, 0-10V DC, 1-5V DC, and 1-6V DC.

3. Model Number Construction



* : Metri Pak is a trademark of Delphi Packard Electric Systems.

** : Mini Hirschmann is a trademark of Richard Hirschmann of America, Inc.

4. Specifications

Pressure range:

Gauge Pressure	-0.1 to 0.2MPa, 0 to 0.2MPa, 0 to 3.5MPa, 0 to 5MPa, 0 to 70MPa,	-0.1 to 0.3MPa, 0 to 0.3MPa, 0 to 10MPa, 0 to 100MPa,	-0.1 to 0.5MPa, 0 to 0.5MPa, 0 to 20MPa, 0 to 140MPa	-0.1 to 1MPa, 0 to 1MPa, 0 to 35MPa,	-0.1 to 2MPa, -0 to 2MPa, 0 to 50MPa,
Sealed Pressure	0 to 5MPa, 0 to 70MPa,	0 to 10MPa, 0 to 100MPa,	0 to 20MPa, 0 to 140MPa	0 to 35MPa,	0 to 50MPa,

Maximum allowable pressure: 200%F.S. for 20MPa and bellow.
150%F.S. for 35MPa and 50MPa.
120% F.S. for 70MPa and above.

Accuracy: $\pm 1.0\%$ F.S. (-20 to 85°C) including linearity, hysteresis, & repeatability.
 $\pm 1.5\%$ F.S. (-40 to -20°C, 85 to 125°C) incl. linearity, hysteresis, & repeatability.
(DIN43650-A and Shielded cable -30 to -20°C, 85 to 105°C)

Output	1/10Vs to 9/10Vs (0.5 to 4.5V DC at Vs=5V DC) 3 wire system	0 to 5V DC 1 to 5V DC 1 to 6V DC 3 wire system	0 to 10V DC 3 wire system	4 to 20mA DC 2 wire system
Supply voltage	Vs=5.0±0.5V DC	9 to 36V DC	14 to 36V DC	9 to 36V DC
Supply current	3.5mA DC max.	15mA DC max.		
Over voltage	16V DC max.	36V DC max.		

Load resistance: 10k ohm minimum. (refer p 6 for 2 wire system)

Insulation resistance: 100M ohm minimum. (case to terminals tied together, 100V DC)

Withstand voltage: 100V AC (case to terminals tied together, 1 minute)

Temperature range

Compensated: -40 to 125°C (DIN43650-A and Shielded cable -30 to 105°C)

Operating: -40 to 125°C (DIN43650-A and Shielded cable -30 to 105°C)

Storage: -40 to 125°C (DIN43650-A and Shielded cable -30 to 105°C)

Vibration rating: 196.1 m/s² rms (random vibration, 20 to 2000Hz)

Shock rating: 981 m/s² (less than 6 ms)

Durability: 10 to 100%F.S. pressure cycle tested to 50 million cycles.

Response time: Less than 1 ms.

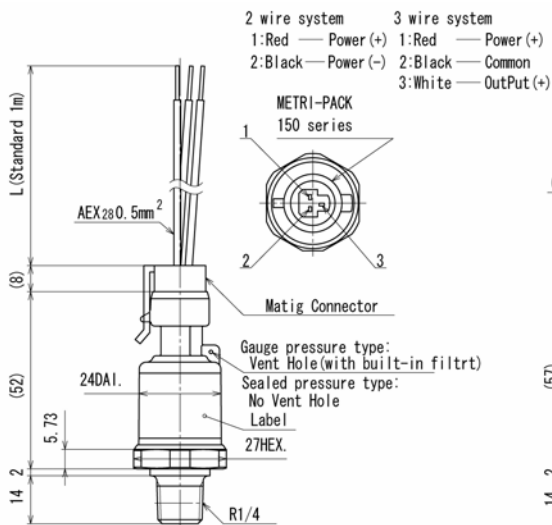
Circuit protection: Reverse polarity & miswire protected.

Enclosure protection: IP 65(Connector type has to connect with mating connector)

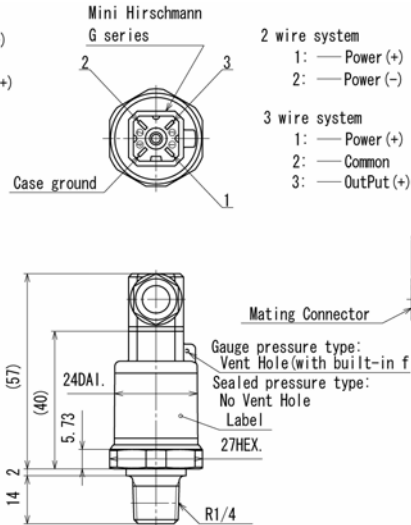
Weight: Approximately 98 g (In case of KM31-574, with 1 m cable length.)

5. Outline Drawings and Wiring Diagram

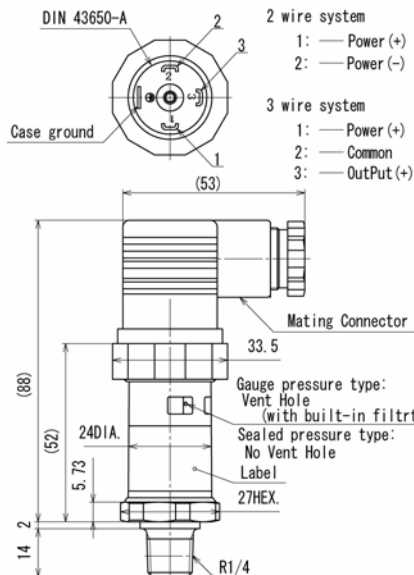
5-1 Outline Drawings and Wiring Diagram



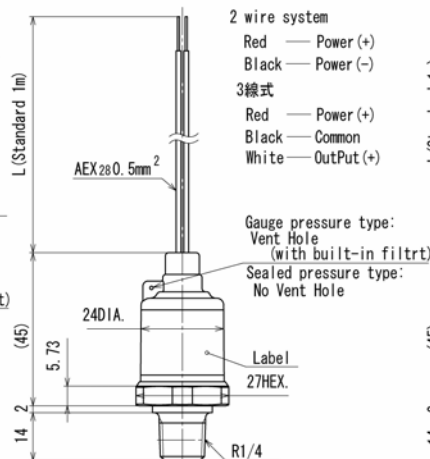
KM31-174:Gauge pressure type
KM31-J74:Sealed pressure type



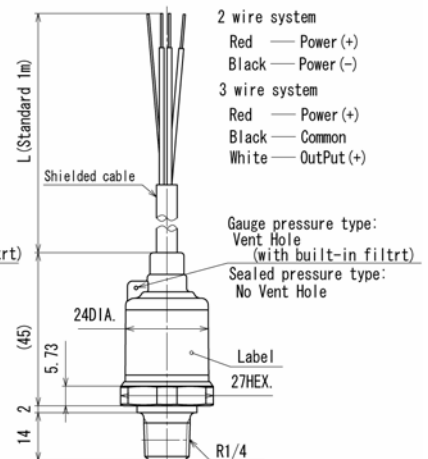
KM31-274:Gauge pressure type
KM31-K74:Sealed pressure type



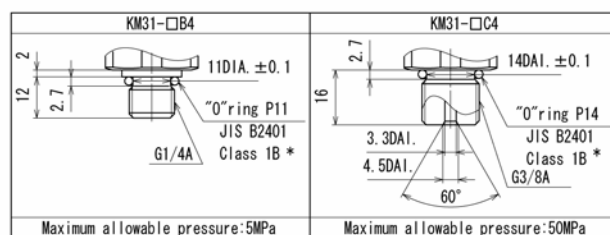
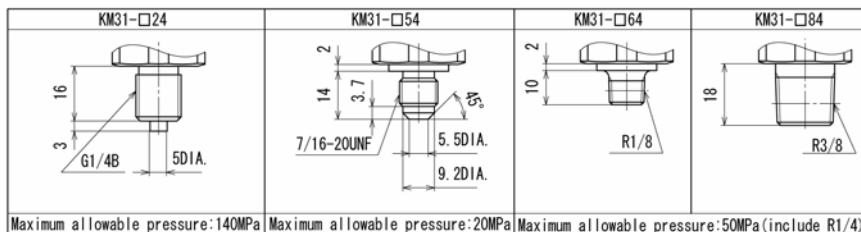
KM31-374:Gauge pressure type
KM31-L74:Sealed pressure type



KM31-474:Gauge pressure type
KM31-M74:Sealed pressure type



KM31-574:Gauge pressure type
KM31-N74:Sealed pressure type
Shield is not connected to case ground

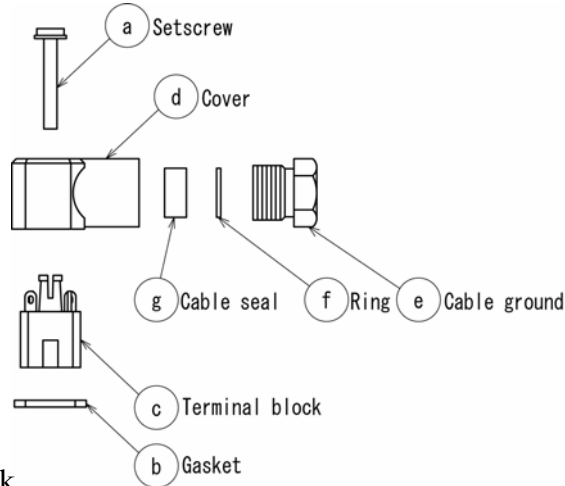


Please instruct the material of "O"ring according to the operation temperature etc.

5-2 Wiring Instruction of Mating Connector for KM31-2□4 and KM31-K□4(Mini Hirschmann)

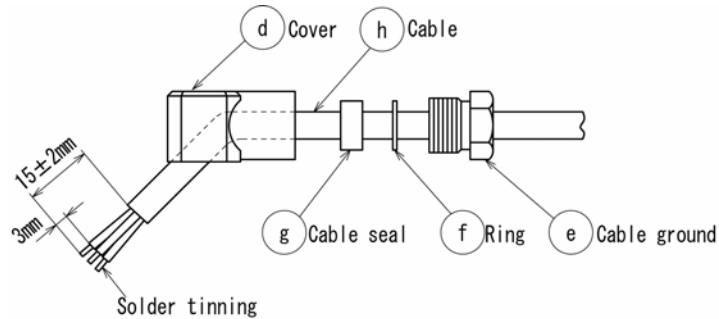
(1) Disassembly of the mating connector

The setscrew (a) is loosened and extracted, the cover (d) is pulled in the direction of the setscrew (a), the mating connector is drawn out from the plug attached to the KM31, and the gasket (b) is removed. The cable ground (e) is loosened and removed, and the ring (f) and the cable seal (g) are removed.



(2) Wiring of the terminal block

Adaptable cable size is from 4 mm DIA. to 7.5 mm DIA. Strip sheath 15mm from tip of the cable. Strip insulator 3mm from tip of leads, and solder tinning on the stripped conductors. Insert cable ground (e), ring (f), cable seal (g), and cover (d) on the cable (h).

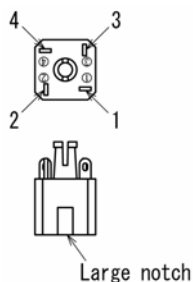


2 wire system:

Solder “power +” wire to “terminal 1”, and “power - ” wire to “terminal 2” on terminal block.

3 wire system:

Solder “power +” wire to “terminal 1”, “COM ” wire to “terminal 2”, and “output” wire to “terminal 3” on terminal block.



Terminal No.	2 wire system	3 wire system
1	Power +	Power +
2	Power -	COMMON
3	N.C.	Output +
4	*	*

* : In case of connecting shield line to case ground, use terminal 4.

(3) Assembly of the Terminal box

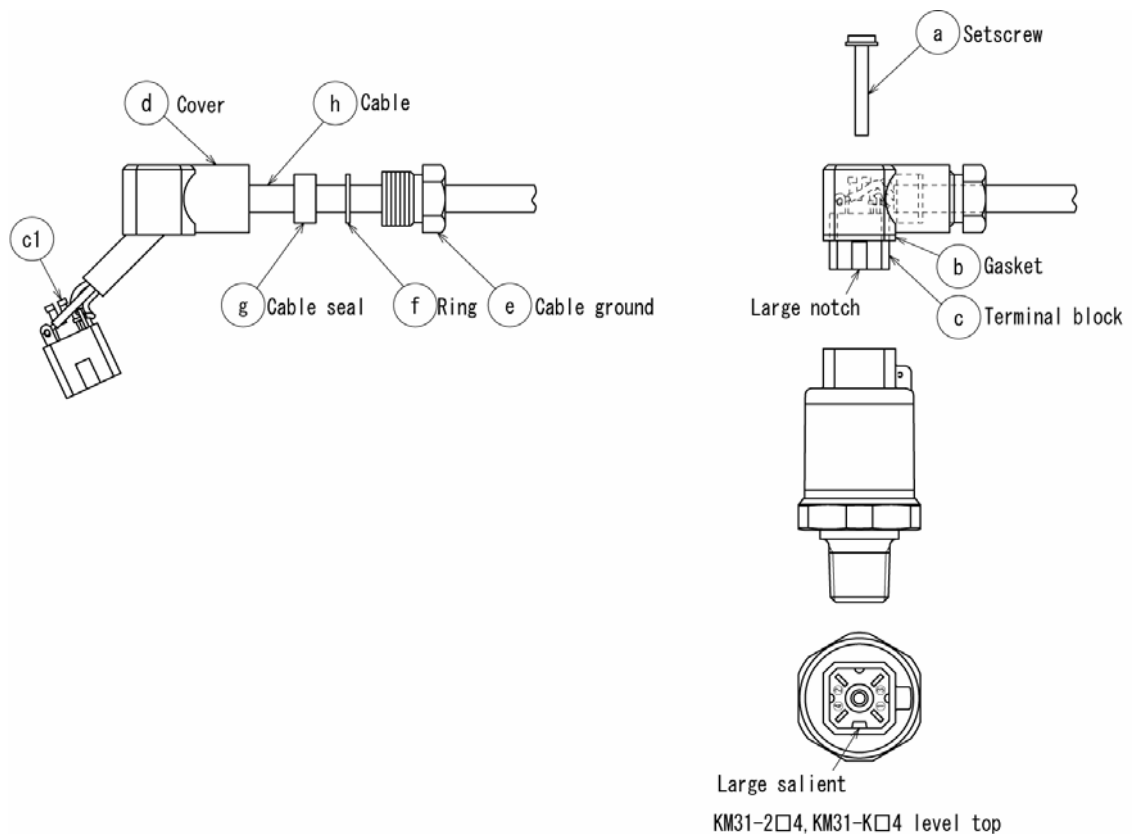
Push the terminal block (c) until it snaps to the cover (d).

Depending on how housing and connector are incorporated, the direction of the housing can be set at an arbitrary angle at 90-degree intervals.

Note : When returning the terminal block, insert the three center conductors carefully enough not to be caught between the protruding portion (c1) of the terminal block bottom and the cover (d) because the space which contains electric wire is narrow.

Put the cable seal (g) and the ring (f) into the cable inlet of the cover (d), and tighten the cable ground (e) firmly. Then, please push in the cable until the cable seal (g) sticks to the sheath. Fit the gasket (b) into the terminal block (c), insert the assembled mating connector into the device's plug, match the large notch of the terminal block with the large salient of KM31's plug, and put in the setscrew (a) for tightening.

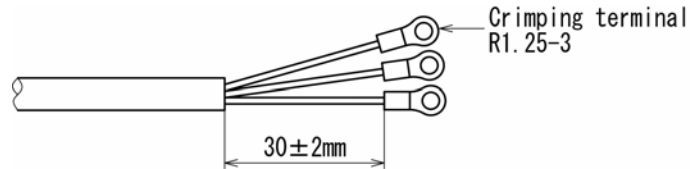
Note : Please tighten the setscrew (a) within a torque of $0.5 \text{ N} \cdot \text{m} \pm 15\%$.



5-3 Wiring Instruction of Mating Connector for KM31-3□4 and KM31-L□4(DIN 43650-A)

(1) Processing of cable

Adaptable cable size is from 6 mm DIA. to 10 mm DIA. and connecting wire of cross-sectional area of 1.5mm^2 (AWG16) or less. Strip sheath 30mm from tip of the cable. A crimping terminal is attached to tip of the wire. In addition, the round non-insulated terminal R1.25-3 should be used as suitable crimping terminal.

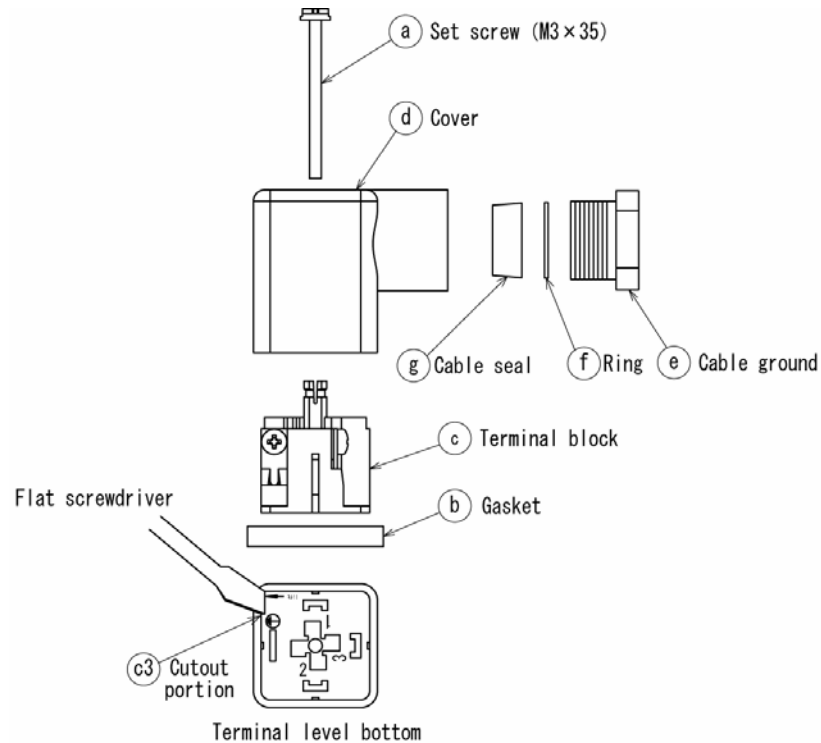


(2) Disassembly of the mating connector

The setscrew (a) is loosened and extracted, the cover (d) is pulled in the direction of the setscrew (a), the mating connector is drawn out from the plug attached to the KM31, and the gasket (b) is removed.

Insert a small flat-blade screwdriver etc. in the notch (marked by →) of the bottom of the terminal block (c) and twist it to remove the terminal block (c) from the cover (d).

The cable ground (e) is loosened and removed, and the ring (f) and the cable seal (g) are removed.



(3) Wiring of the terminal block

After running the cable (h) through the cable ground (e), the ring (f), and the cable seal (g) in this order, insert it in the cover (d).

2 wire system:

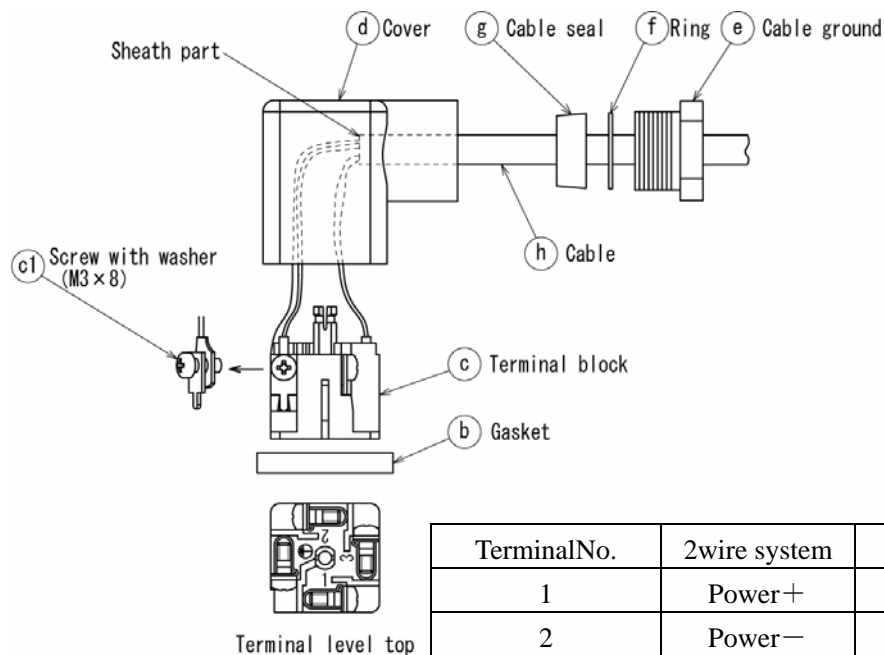
Fasten and connect the crimping terminal of “power +” into “terminal 1” of the terminal block (c) using the screw with washer (M3x8) (c1). Similarly, fasten and connect the crimping terminal of “power -” into “terminal 2”.

3 wire system:

Fasten and connect the crimping terminal of “power +” into “terminal 1” of the terminal block (c) using the screw with washer (M3x8) (c1). Similarly, fasten and connect the crimping terminal of “power -” into “terminal 2” and fasten and connect the crimping terminal of “COM” into “terminal 3”

The crimping terminal should be a round non-insulated terminal that is unremovable. A Y-shaped terminal, which is easy to remove, or bare wire, which is easy to protrude, should not be connected.

Please tighten the screw with washer (c1) of the crimping terminal within a torque of $0.5 \text{ N} \cdot \text{m} \pm 15\%$.



* : In case of connecting shield line to case ground, use terminal ⊕.

(4) Assembly of the Terminal box

Push the terminal block (c) until it snaps to the cover (d).

Depending on how housing and connector are incorporated, the direction of the housing can be set at an arbitrary angle at 90-degree intervals.

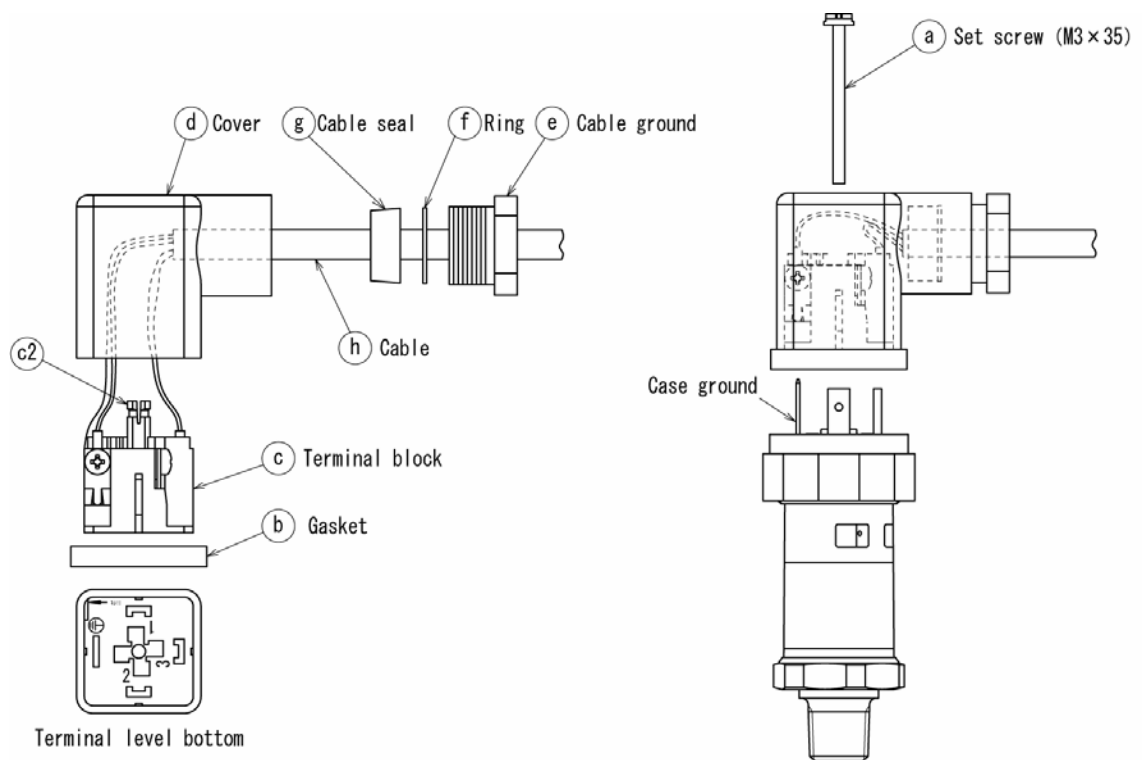
Note : When returning the terminal block, insert the three center conductors carefully enough not to be caught between the protruding portion (c2) of the terminal block bottom and the cover (d) because the space which contains electric wire is narrow.

Put the cable seal (g) and the ring (f) into the cable inlet of the cover (d), and tighten the cable ground (e) firmly.

Then, please push in the cable until the cable seal (g) sticks to the sheath.

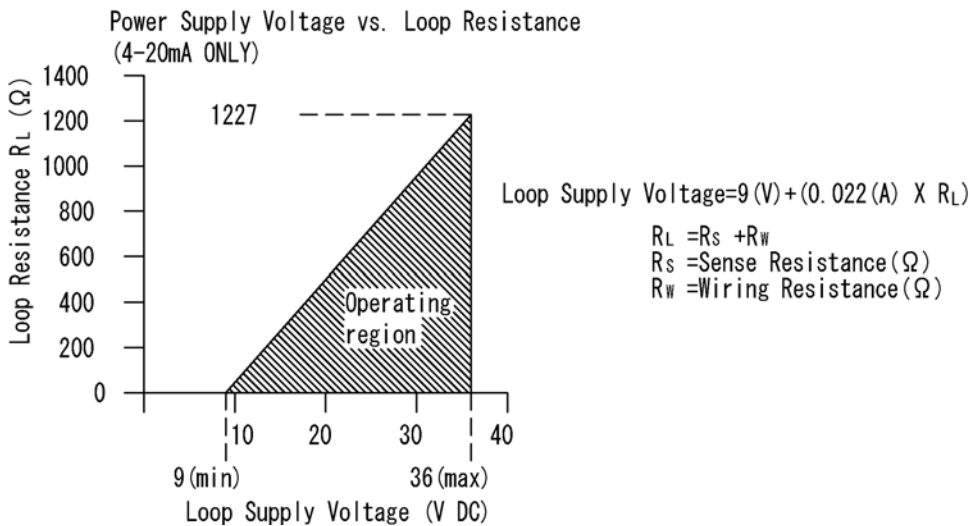
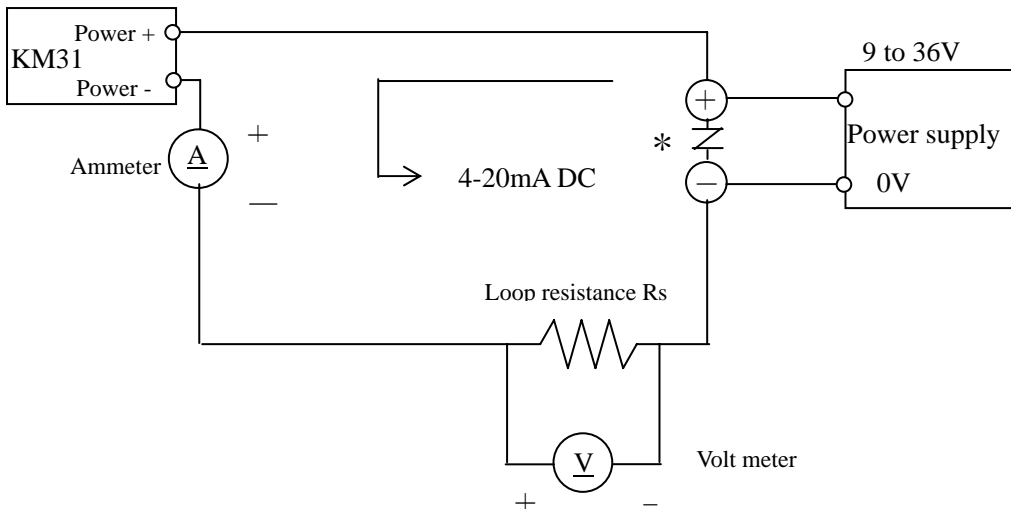
Fit the gasket (b) into the cover (d), insert the assembled mating connector into the KM31's plug, insert the \ominus terminal into the mark, and put in the setscrew (a) for tightening.

Note : Please tighten the setscrew (a) within a torque of $0.5 \text{ N} \cdot \text{m} \pm 15\%$.



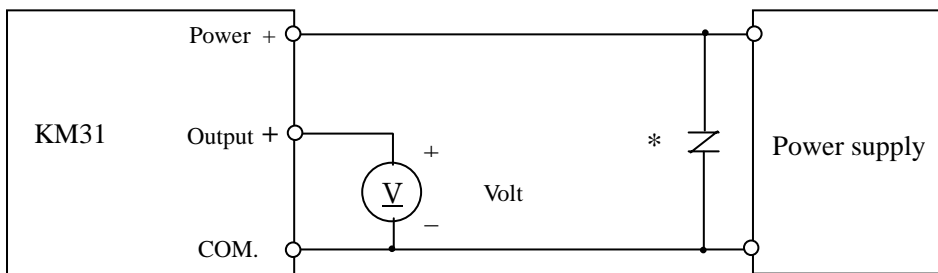
6. External connection

(Example 1) 2 wire system, 4-20mA DC output



(Example 2) 3 wire system

0.5-4.5V DC ratiometric, 0-5V DC, 0-10V DC, 1-5V DC, 1-6V DC output



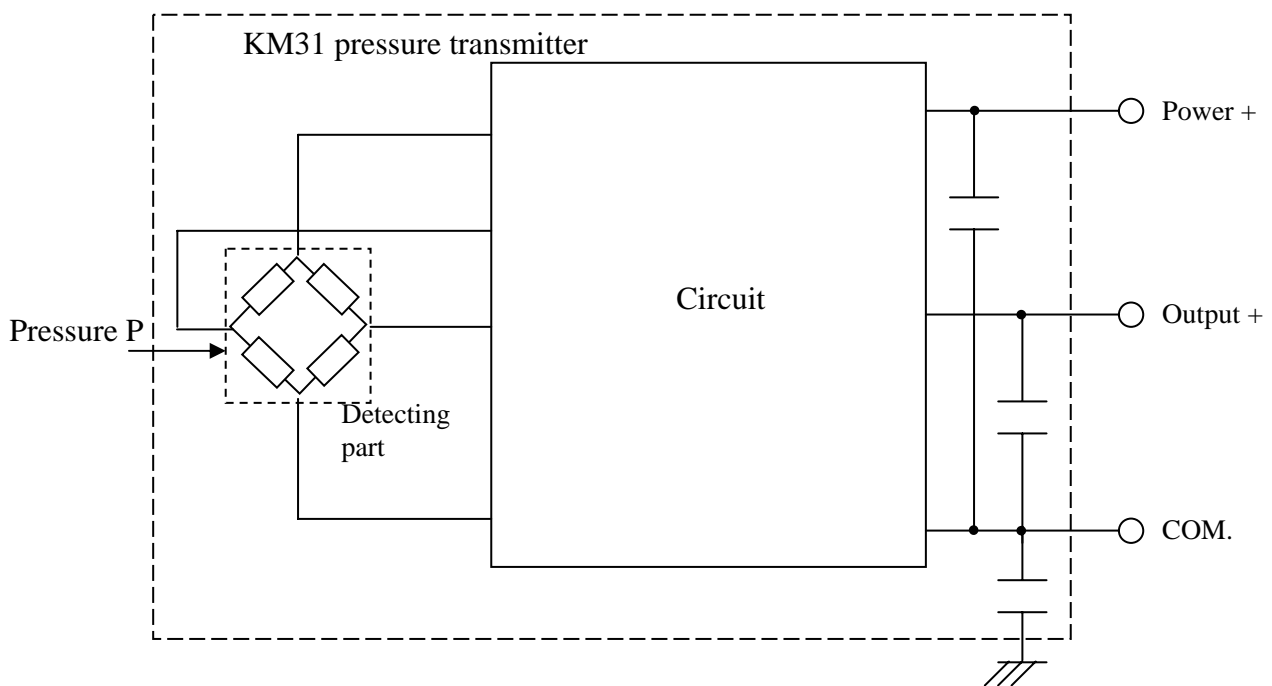
* When the other equipment that may generates surge is connected to same power supply, then add varistor or equivalent device to protect the transmitter.

7. Function Principle

This pressure transmitter has a diaphragm as pressure receiving part which converts pressure to strain, and the strain is detected by semi-conductor strain gage.

The detecting part has full bridge system which consists of four semi-conductor strain gages. Electrical signal is obtained from the bridge circuit that is proportional to the strain. The signal is converted to direct current output or DC voltage output by signal conversion circuit at next stage.

7-1. Block Diagram (0.5-4.5V DC ratiometric output)



8. Cautions for Installation, Transportation, and Storage

8-1. Installation

- 1) When connecting to process line, don't tighten the case itself with pipe-wrench etc. Surely use the hex part of the fitting with spanner or box wrench in the installation.
- 2) Do not install the transmitter while liquid fills up the process line. High pressure will be generated if the fitting screws tighten up, because liquid is incompressible. The generated high pressure may be a cause of failure. To avoid this kind of accident at installation, draw out the liquid in the process line, keep aside air for 15 to 20 mm, and tighten up the fitting.
- 3) This model has substantial vibration resistance, but to play safe, pay a good care not to provide severe vibration.

8-2. Cautions for transportation

As it is minutely processed instrument, it may become unusable, if it is dropped or if applied a shock that exceeds specification. Please transport it carefully.

8-3. Cautions for storage

Please store it at a place of less moisture, vibration and dust, etc.

9. Operation

- 1) Confirm once again that there is no error in wiring before turning the power source on.
- 2) After turning the power source on, make a test running for approximately 5 minutes and start the operation.
- 3) Do not connect/disconnect connector, nor rewire while the power is turning on.
- 4) Please avoid intermittent operation turning the power on and off in less than 5 minutes. Please consult to manufacturer if short period of intermittent operation is required.
- 5) The output may reach maximum signal within 0.1 second after turning the power on.

10. Maintenance and Adjustment

10-1. Installation

KM31 Pressure Transmitter has no movable part in the structure, so it almost doesn't require maintenance work.

Depending on operational situation, an adequate maintenance may be needed. In general, half-yearly periodical inspection is recommended. Please refer following check list for the periodical inspection.

List for Periodical Inspection

- External appearance
- Corrosion status for pressure inlet port
- Insulation between each terminal and case (100M ohm or greater, at 100V DC)
- Retightning of fitting screw
- Output inspection with standard pressure

10-2. Countermeasure against noise

KM31 Pressure Transmitter is partially tested for immunity to noise in compliance with IEC61000-4. Noise trouble is so complicated and many trouble are not easily solved theoretically. So, there is not perfect and complete solution. When measured values sometimes change, vary or show very different values, it may be caused by a noise effect. When noise comes on power supply line, it is a principle to determine the noise source and countermeasure against the source.

If the noise is obtained constantly, noise filter or similar device may be effective as a countermeasure. In addition, it may also be effective to use the other power source than one that has influence of noise.

Sometimes, noise is induced in the signal line by outside induction. In this case, keeping the noise source away, changing direction of equipments, applying magnetic shield, or applying static electric shield might be effective. Those countermeasures can be used for surge, too.

11. CE Marking

KM31 Pressure Transmitter adapted to CE marking with following standards.

Standard number: EN61326:1997, A1:1998, A2:2001

This pressure transmitter should be used with assumption of installing in protected environment from lightning surge (EN61000-4-5:1995, Annex B, B.3, Class 0). Therefore, please don't use the pressure transmitter in environment where may have chance to receive lightning surge.

Please do not use the pressure transmitter to intend to keep safety.

12. Others

This manual cannot cover all details of the instrument or other model variation. This also cannot stipulate all details of installation, maintenance, and other matters. Therefore, please contact if further detailed information is necessary or this manual doesn't meet intended requirements fully.

In case of there is chance to have pressure spike, please install throttle joint or consult to the manufacturer.