

# COPAL ELECTRONICS

Pressure indicators

## PZ-200

Instruction Manual Ver. 1.1

Thank you for purchasing NIDEC COPAL ELECTRONICS CORP. product.

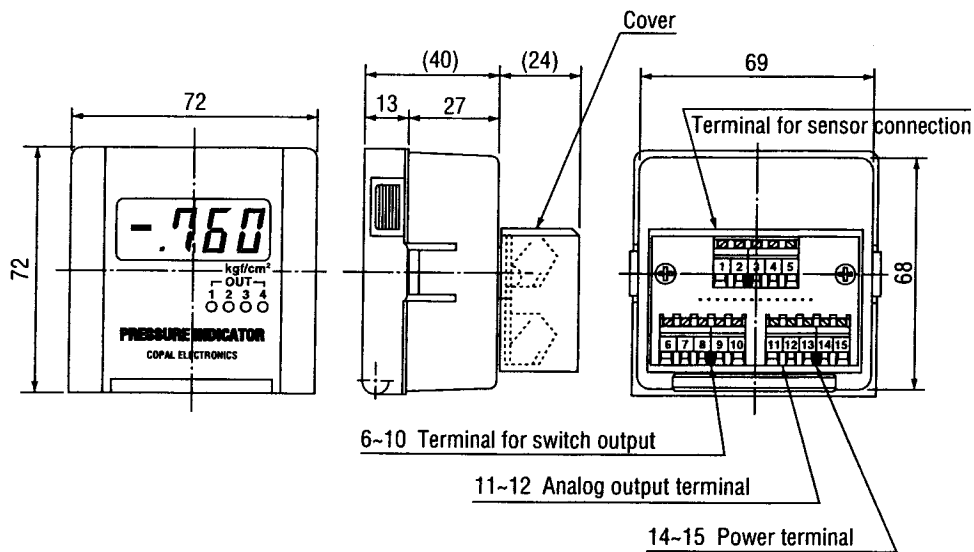
In order to use the product correctly and most appropriately, please completely read this manual before use and keep it for future reference.

### [Overview]

PZ-200 shall be used with Copal's pressure transducers with amplifier and other sensors whose output signals are 1 to 5VDC or 4 to 20mA.

### [Outline Dimensions]

Unless otherwise specified, tolerance :  $\pm 0.5$  (Unit: mm)



No.	Connection
1	Sensor signal IN (1 ~5 V)
2	Sensor signal IN (4 ~20 mA)
3	Sensor power out (+)
4	Sensor power out (Common)
5	Common
6	LL OUT
7	L OUT
8	H OUT
9	HH OUT
10	Switch out (Common)
11	Analog output (4 ~ 20 mA)
12	Analog output (Common)
13	Common
14	Power IN (+) (DC12 ~ 24 V)
15	Power IN (Common)

\* All the "Common" connections are made inside.

### \* Installation to the panel board

Make a hole in the panel board as (W)  $69.5^{+0.5/0}$  mm  $\times$  (H)  $68.5^{+0.5/0}$  mm  $\times$  (Thickness) 1 to 2.5 mm. And push the front panel into the hole until the hooks grip the panel.

## 【Specifications】

### (1) General

Item	Condition	Specification
Operating temp. range		0 to 50°C
Compensated temp. range		0 to 50°C
Current dissipation	Including analog output	80mA or less
Operating humidity		35 to 85%RH (No condensation)
Storage temp.		-20 to 70 °C (Atmospheric pressure, humidity 65%RH maximum)
Net weight		Approx. 150g
Power		12 to 24VDC±10%
Dimensions	72(W) × 72(H) DIN standard	Refer to the outline dimensions

### (2) Input

Input signal	(Internal selector switch provided)	1 to 5V / 4 to 20mA
Input method		Single ended (No isolation of com. for Power to Analog output)
Input impedance	(1 to 5V input mode)	Approx. 120kΩ
Internal resistance	(4 to 20mA input mode)	51Ω
Maximum input voltage	(1 to 5V input mode)	30V
Maximum input current	(4 to 20mA input mode)	70mA

### (3) Display

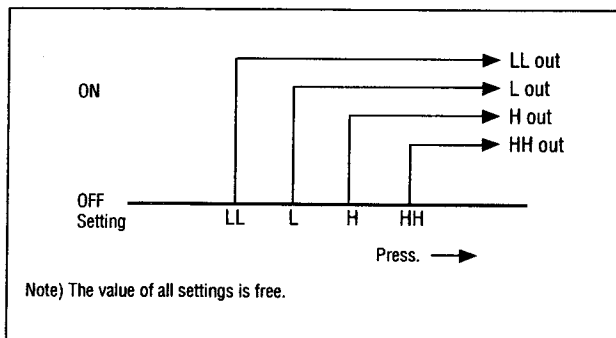
Sampling cycle		Approx. 4 times/sec.
Display accuracy	(After calibration)	±0.1% reading ±2digits
Thermal error	(Offset indication)	±3digit/10°C
	(Full scale indication)	±3digit/10°C
Display element		LCD (height=12mm)
Display digits	(000 to 1000)	3+1/2 digits
Resolution		1digit
Zero point variable range		±200 digits
Full scale variable range		±200 to 1000 digits
Decimal point location		10 <sup>2</sup> , 10 <sup>1</sup> , 10 <sup>0</sup> (Selected by panel switch)
Polarity indication		Negative “-“ indication
Over range indication	When input signal exceeds the maximum display capacity of ±1999	The display shows “1***” (***: No display)

#### (4) Switch output

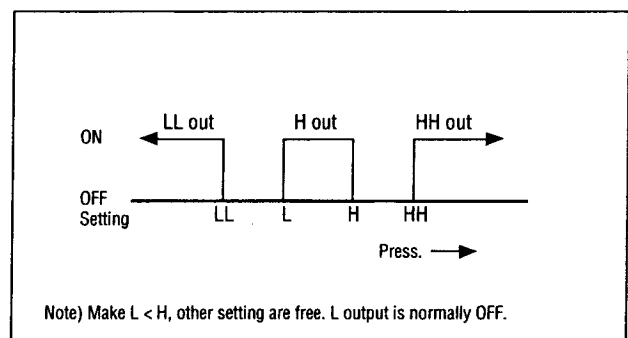
Pressure setting range		0 to 1000
Number of setting points	①(LL) ②(L) ③(H) ④(HH)	4points output
Switching capacity		30VDC, 100mA (NPN open collector)
Residual voltage		1.2VDC (at 100mA of inflow current) 0.4VDC (at 16mA of inflow current)
Output mode		3modes(Refer to the pressure switch output function)
Hysteresis	Fixed	Approx. 5 digits
Setting method	The desired switch channel is selected with SET SW	By setting trimmer
Response	Analog comparison method	Approx. 100ms

#### (5) Switch output schematics

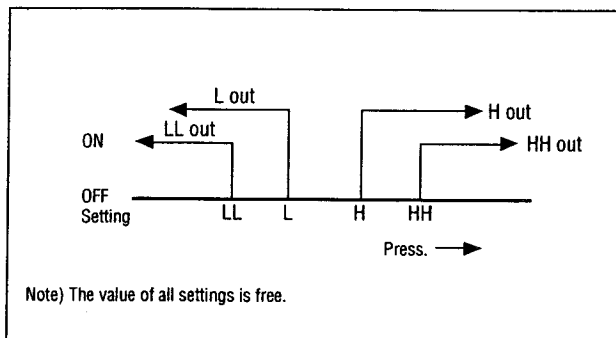
a) Upper limit mode



b) Window mode



c) Upper and lower limit mode



#### \*Handling notes:

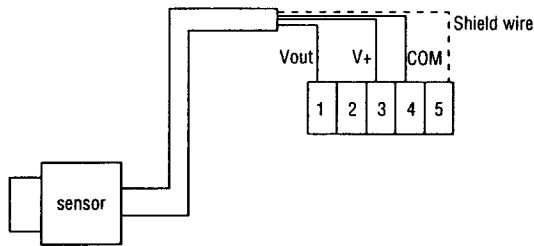
1. Never short-circuit the switch and analog output to the power input terminal. These conduct might damage the internal circuitry.
2. In case of window mode, be sure to set "H " setting value be greater than "L" setting value. Unless this condition was satisfied, the switch would not work properly.

#### (6) Analog output

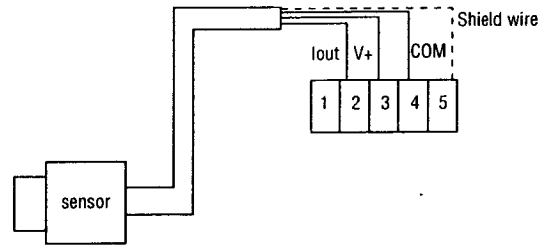
Output current	Constant current output	4 to 20mA (Non isolation)
Load resistance		0 to 250 $\Omega$
Accuracy	0 to 50°C	$\pm 0.5\%$ FS

## [Connection of pressure sensors]

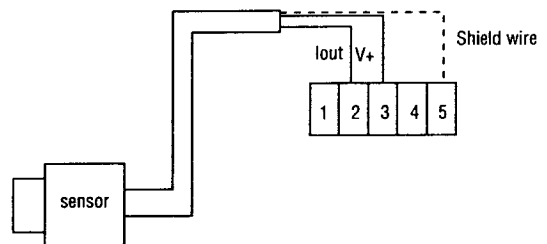
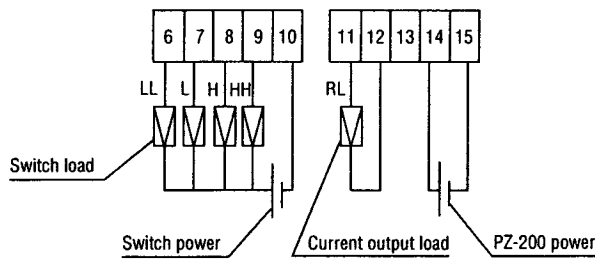
● Example) 1 ~ 5 V output sensor



● Example) 4 ~ 20 mA output sensor

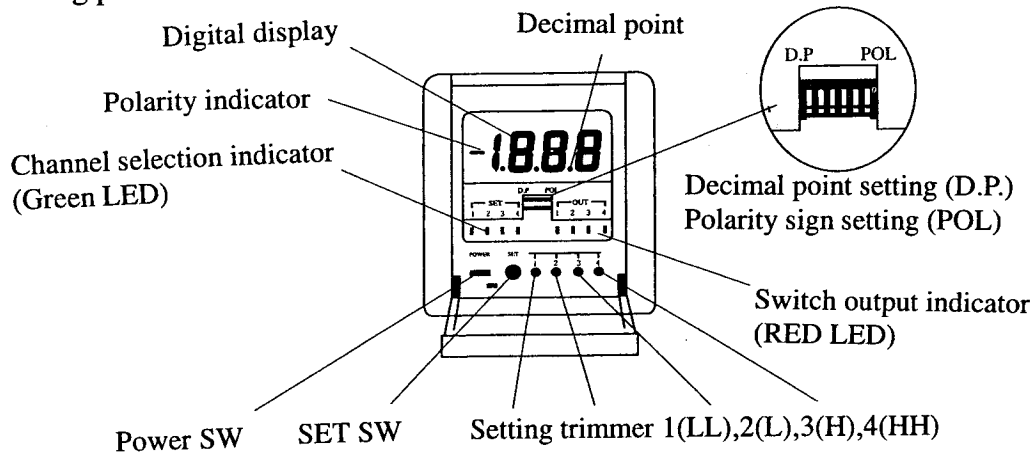


● Example) 4 ~ 20 mA output sensor

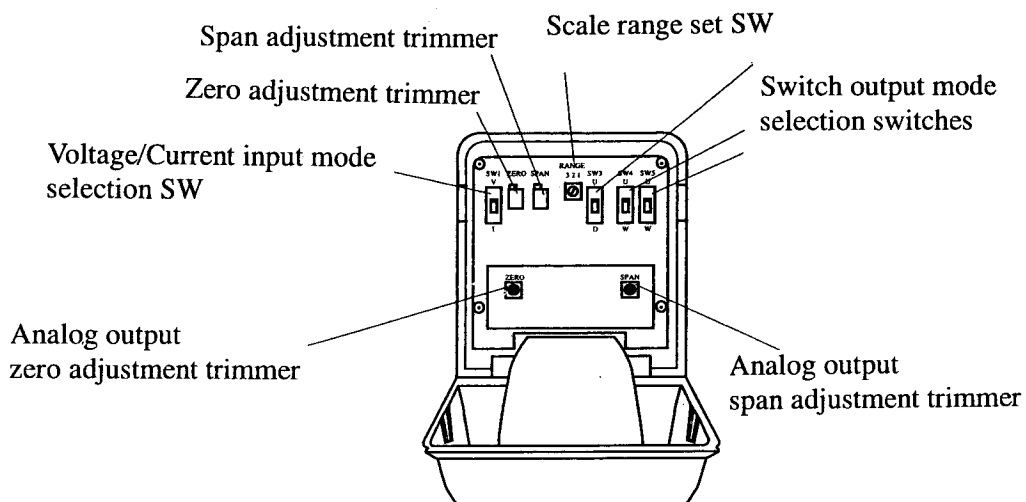


## [Operations]

### 1. Front setting panel



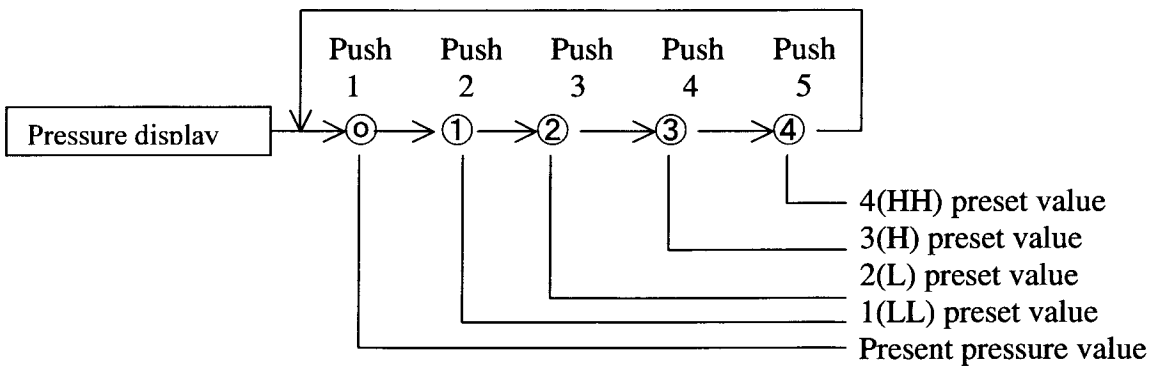
### 2. Inside setting panel



**[Explanations on internal part / setting instructions]**

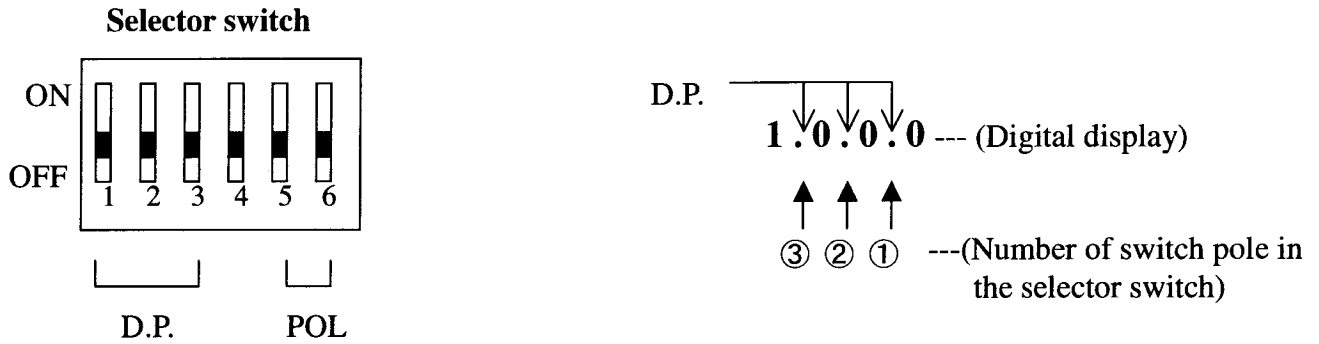
**( Front setting panel )**

- 1) Power SW --- This is the power switch to turn on or off the product. When switched on, the product starts working and the power is provided to the sensor.
- 2) Digital display --- In proportion to the input signal (1 to 5V / 4 to 20mA), the pressure is displayed in a digital value. When the SET SW is operated, the preset values of setting trimmers (1 to 4) will appear in the display.
- 3) Polarity indication --- The polarity indication is determined by presetting the POL switch. It is set as to display nothing for positive pressure and minus(-) for negative pressure at our factory prior to the shipment.
- 4) SET SW --- This switch is to show the preset values of the each pressure switch. Preset value will appear in sequence every time the switch is pushed on.



A LED lamp (green) indicating which pressure switch channel is being selected blinks when the SET SW pushed on.

- 5) Setting trimmers 1 to 4 --- Select the desired pressure switch channel is being selected blinks when the SET SW is pushed on. Adjust the corresponding setting trimmer to the requested value.
- 6) Channel selection indicators (Green LED) --- The indicator shows, which switch channel, is being selected when the SET SW is pushed on.
- 7) Switch output indicators (Red LED) --- When the pressure switches turn on the corresponding indicators light up.
- 8) Decimal point setting and polarity sign setting (D.P./POL) --- Decimal point setting and polarity sign setting.



**Decimal point** --- The user can be selecting the optimum decimal point. The decimal point appears when the switch is on.

**POL** --- The user can be selecting the polarity sign depending on the positively or the negativity of the applied pressure. Preset positions at our factory prior to shipment is as shown below.

Number of switch pole	⑤	⑥
Positive pressure	ON	OFF
Negative pressure	OFF	ON

Note) Preset position when we shipped the product, ⑤ is ON and ⑥ is OFF.

Do not both switch poles ⑤ and ⑥ be “ON” or “OFF” at the same time.

**( Inside setting panel )**

- 1) Voltage / Current input mode selection switch --- This is the switch to select the input signal in either 1 to 5V or 4 to 20mA.

**SW1**  
V

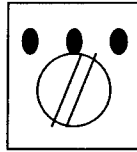


V --- 1 to 5V voltage input  
I --- 4 to 20mA current input

I \*The switch has been preset to 1 to 5V at our factory prior to shipment

- 2) Zero point adjustment trimmer --- This is the trimmer to adjust the zero point of the digital reading. Adjust it so that the digital reading to be “000” when the applied pressure to the pressure sensor is zero. It has been adjusted at our factory so as the digital reading to be “000” against input voltage 1V.
- 3) Span adjustment trimmer --- This is the trimmer to adjust the full scale of the digital display. Adjust it so that the digital reading to be the rated pressure when the rated pressure is applied to the pressure sensor. It has been adjust at the factory so as the digital reading to be “1000” against input voltage 5V.
- 4) Scaling setting switch --- This switch determine the coarse full scale value of digital reading. In conjunction with span adjustment trimmer, the full scale can be set somewhere between 200 through 1000 against 1 to 5V or 4 to 20mA input signal.

**Range**  
3 2 1



(Range) (Full scale digital reading)

- ① ---- 1200 to 560
- ② ---- 600 to 280
- ③ ---- 300 to 140

This switch is preset ① at position at our factory. Make zero point adjustment whenever the selection changed.

5) Setting of switch working mode

--- Three working modes are selectable, normal OFF mode, normal OFF/ normal ON mode and window mode.  
(Please refer to the switch output schematics (page#3))  
The mode can be selected by setting SW3, SW4 and SW5. Normal OFF mode has been chosen at our factory.

(Normal OFF mode)

SW3	SW4	SW5
U	U	U

All switches LL,L,H and HH work as normal OFF mode.

(Normal OFF/ Normal ON mode)

SW3	SW4	SW5
D	U	U

LL and L work as normal ON mode and H and HH work as normal OFF mode.

(Window mode)

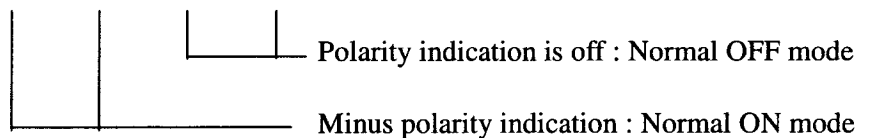
SW3	SW4	SW5
D	W	W

LL work as normal ON mode and HH work as normal OFF mode and L and H work as window mode. The sum of L setting value and Hysteresis (5counts) must be always less than H setting value in absolute value. L output is always OFF.

(Example)

Digital reading example when normal ON / normal OFF mode is chosen.

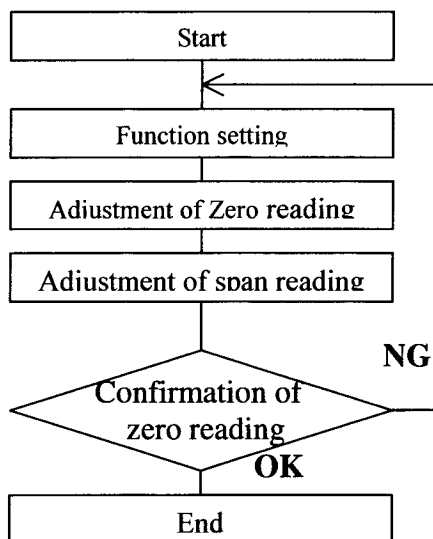
LL L H HH  
-100 -200 300 400



- 6) 4 to 20mA analog current output --- a) Zero point adjustment trimmer  
 This is trimmer to adjust the zero point of the analog output. Adjust it so that analog output becomes “4mA” when the applied pressure to the pressure sensor is zero. It has been pre-adjusted at our factory so as the output to be “4mA” against input voltage “1V”.
- b) Span adjustment trimmer  
 This is the trimmer to adjust the full scale of the analog output. Adjust it so that the analog output become “20mA” when the rated pressure is applied to the pressure sensor. It has been pre-adjusted at our factory so as the output to be “20mA” against input voltage “5V”.

### 【Calibration】

<Calibration procedure flow>



The product has been calibrated at our factory so as the display to show 0 to 1000 against input voltage 1 to 5V. Because of this, the reading gotten from the rated pressure of 100kPa, 1MPa directly express the pressure unit of kPa or MPa. When assigning the current mode of 4 to 20mA as input or applying the other pressure unit, such as mmHg in medical equipment, however, calibration is necessary prior to actual use.

It must be noted that the accuracy ( deviation from the true value ) of the measured pressure value is the sum of the connected pressure sensor’s accuracy and PZ-200’s. For this reason, it is important to calibrate the PZ-200 with the matching pressure sensor when more accurate measurement is required. Calibration is also necessary when the pressure unit other than kPa or MPa is applied. In a long time usage, regular calibration after certain time span is recommended to keep the initial accuracy.



## 1) Calibration by voltage or current input (Simple calibration)

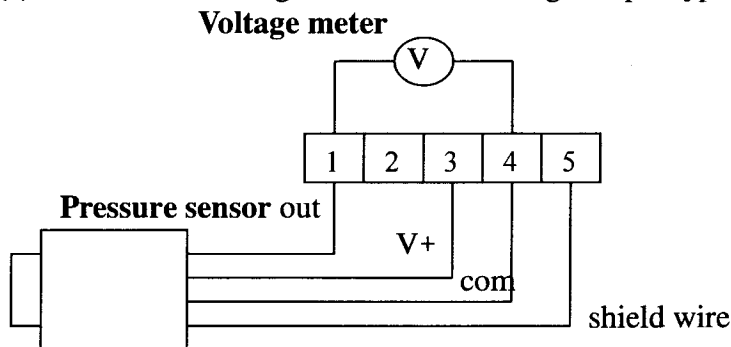
This method is effective only when the sensor output voltage (current) has already been calibrated. Since minute calibration is not possible with this method, other calibration method, which uses the pressure standard as described in 2), should be taken when more accurate calibration is necessary.

### ① Function setting

Prior to calibration, necessary function setting shall be completed by referring **【Explanations on internal part / setting instructions】**. (Page 4 to 8)

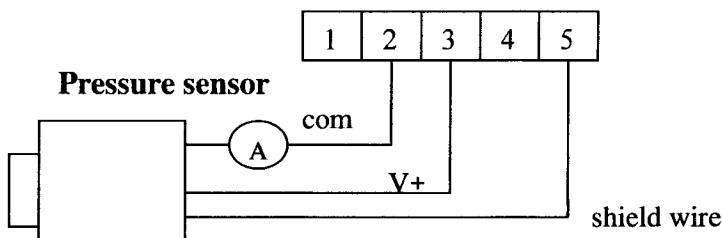
### ② Preparation

(a) When a 1 to 5V signal fed from a voltage output type pressure sensor;



Connect the voltage meter in parallel between the input terminals 1. and 4. of PZ-200 in order to read the sensor output.

(b) When a 4 to 20mA signal fed from a current output type pressure sensor;



Connect the current meter in serial between the input terminals 2. of PZ-200 and the com. terminal of the sensor in order to read the sensor output.

### ③ Power on

Turn on the power after checking the wiring connection. The digital display will show near "000" when no pressure is applied to the sensor.

### ④ Adjustment of zero reading

Read the voltage meter or current meter connected to the input terminal after confirming no pressure is applied to the sensor. In case the digital display does not show "000", adjust the display value to "000" with zero adjustment trimmer.

⑤ Adjustment of reading

- (a) Apply the pressure close to full scale to the sensor. If this applied pressure can be measured precisely, the calibration can be possible based on the measured pressure. However, presuming that the accurate pressure measurement is not possible, the calibration can be made by doing the following scaling on condition that the 1 to 5V sensor output voltage has been calibrated.

Suppose the output voltage of the pressure sensor was 4.56V, the span voltage could be derived by deducting zero voltage, say, 1V.

$$4.56 - 1.00 = 3.56V$$

Next presume the sensor's span voltage were 4V at its rated pressure 100kPa, the applied pressure could be obtained from the calculation below.

$$3.56 \times 1.00 / 4 = 89kPa$$

Make the digital reading of the PZ-200 as 89kPa by adjusting the span adjustment trimmer.

- (b) When a 4 to 20mA signal fed from a voltage output type pressure sensor.

Similarly, if the output current were 18.24mA at the pressure of almost full scale reading, the span current can be derived by deducting zero current, say, 4mA.

$$18.24 - 4.00 = 14.24mA$$

Next presume the span current were 16mA at its rated pressure 100kPa, the applied pressure could be obtained from the calculation below.

$$14.24 \times 1.00 / 16 = 89kPa$$

Make the digital reading of the PZ-200 as 89kPa by adjusting the span adjustment trimmer.

⑥ Change of the pressure unit

By making use of scaling function of PZ-200, different pressure unit is selectable. After first make calibration as previously described is ④ to ⑤. When calibrating the above exemplified pressure of 89kPa into mmHg, note the conversion constant below.

$$100kPa = 750.1mmHg$$

$$(89 / 100) \times 750.1 = 667.6mmHg$$

Therefore make the digital reading of the PZ-200 to be "668" by adjusting the span adjustment trimmer. In case the value were out of adjustment range by the trimmer, step down the scaling setting switch and then adjust the trimmer. Next the digital reading "000" by adjusting the zero adjustment trimmer at no applied pressure. This procedure is indispensable because the zero point shifts a little bit when span adjustment is made. Repeat span adjustment and zero adjustment in turn several times and get desired reading.

- ⑦ Completion  
Simple calibration completes with the procedures described above.
- Check the position of decimal point.
  - If the indicator did not appear at the anticipated position, adjust it by referring **【Explanations on internal part / setting instructions】**, ( **Front setting panel** ), 8).
  - Select the appropriate pressure unit sticker out of an large sheet attached and put it on the display panel.

## 2) Calibration by pressure measurement

If the applied pressure could be measured accurately, calibration including the pressure sensor would be possible. In this case the accuracy of pressure measurement should be high enough to get the necessary accuracy of the PZ-200's reading.

- ① Preparation  
Complete the adjustment of zero reading with the procedures ① to ④ mentioned above.
- ② Adjustment of span reading  
Generate the pressure close to rated value from the pressure generator and measure it with the standard pressure gauge. The calibration of the PZ-200 shall be done against this measured value. If the generated pressure were measured as 98.1kPa, adjust the span adjustment trimmer so as the display to show "98.1". Next, confirm the zero reading to be "000" at zero pressure.
- ③ Adjustment of span reading (Digital reading in other pressure units)  
Generate the pressure close to rated value form the pressure generator and measure it with standard pressure gauge. If the pressure unit of the gauge were the same unit to be appointed, adjust the reading of the PZ-200 to the same value. That it to say, were the generated pressure measured as 726mmHg, adjust the reading to be "726". Unit conversion is necessary when the pressure was measured in the different unit. For example the measured pressure 98.1kPa should be 726mmHg form the conversion equation  $100\text{kPa} = 750.1\text{mmHg}$ .

$$(98.1 / 100) \times 750.1 = 735.8\text{mmHg}$$

In this case make the digital reading of the PZ-200 to be "726" by adjusting the span adjustment trimmer. If the value were out of adjustable range by the trimmer, step down the scaling setting switch and then adjust the trimmer. Next make the digital reading "000" by adjusting the zero adjustment trimmer at no applied pressure. This procedure is indispensable because the zero point shifts a little bit when span adjustment is made. Repeat span adjustment and zero adjustment in turn several times and get desired reading.

- ④ Completion  
Calibration with pressure measurement completes with the procedures described above.
- Check the position of decimal point
  - If the indicator did not appear at the anticipated position, adjust it by referring **【Explanations on internal part / setting instructions】**, ( **Front setting panel** ), 8).
  - Select the appropriate pressure unit sticker out of an large sheet attached and put it on the display panel.

## Reference

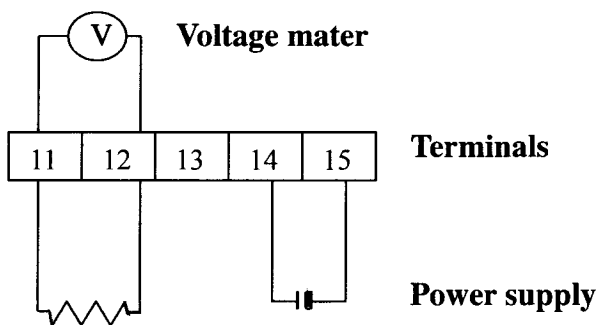
### Pressure unit conversion table

kPa	1
psi	0.145
mmHg	7.501
mmH <sub>2</sub> O	102
kgf/cm <sup>2</sup>	0.0102
bar	0.01

### 3) Calibration of analog current output of 4 to 20mA

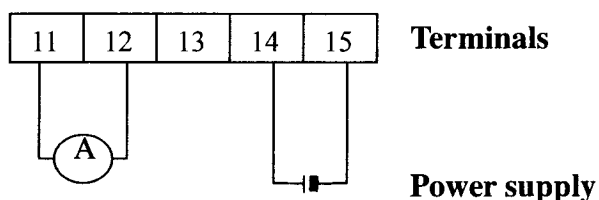
#### ① Preparation

a) When calibrated with voltage reading;



Connect the load resistor, 250ohm (as precise as possible) to the analog output terminals and connect the DC voltage meter to the analog output terminals.

b) When calibrated with current reading;



Connect the current meter to the analog output terminals.

Complete the calibration of zero reading adjustment and span reading adjustment as described in **【Calibration】**, 1) or 2) prior to the following procedures.

#### ② Zero adjustment of analog output

When a voltage meter is connected, adjust the analog zero adjustment trimmer so as the voltage to be 1.00V ( $4\text{mA} \times 250\text{ohm}$ ) at the time of no pressure application. When a current meter is connected adjust it so as the current to be 4.00mA.

#### ③ Span adjustment

When a voltage meter is connected, adjust the analog span adjustment trimmer so as the rated pressure application. When a current meter is connected, adjust it so as the current to be 20.00mA.

## [Notes on Handling]

### 1) Power

If the noise comes in the power line, it may alter the digital reading and cause the malfunction of the products. So pay attention to the wiring of the power line. Separation from the noise source and the protection with electro-magnetic shield and electrostatic shield should be prepared in case there are inducting noise source outside.

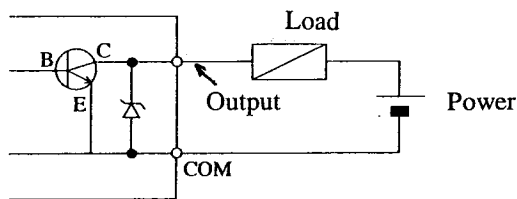
### 2) Connection with an pressure sensor

- a) Wirings with a pressure sensor must be as short as possible, and separate them from signal and power cables.
- b) Use a shield cable for wiring. Connect the shield wire end to **No.5** (COM) of the PZ-200.  
(Refer to the **[Connection of pressure sensors]**, page 4.)

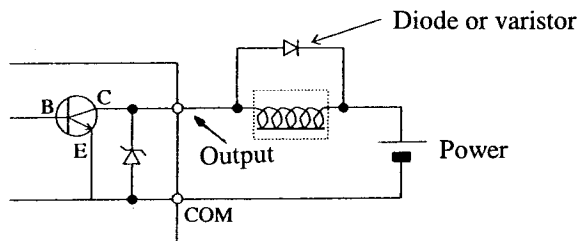
### 3) Setting of pressure switches

The following condition must be met in the relationship between the setting values of L (2) and H (3). (H) must be always greater than the sum of L + Hysteresis (5counts) in absolute value.

### 4) Switch output and load connection



- a) If the power were directly connected to the output terminal of PZ-200 without load, an over current would flow in and an output transistor would be damaged. The same result would be expected if output terminal and COM were connected reversibly.
- b) The maximum rating of the switch output is specified as DC30V, 100mA. Do not apply the voltage over 30V and not let the current flow over 100mA through output terminal.
- c) Never forget to connect the surge voltage absorption circuit when an inductance load such as a relay a solenoid is used as a load.



## **[Warranty]**

This product is covered by a warranty for a period of one year from the date of delivery. This warranty covers free-of-charge repair and replacement for defects occurring through design or manufacturing inadequacy of NIDEC COPAL ELECTRONICS CORP. Even during the warranty period, the following failures will be handled on a fee basis.

- 1) Failures or damages occurring through misuse or disoperation performed not following the instruction manual.
- 2) Failures or damages occurring through improper modification, adjustment, or repair.
- 3) Failures or damages occurring through natural calamities, fires or other inevitable accidents.
- 4) Replacement of accessories (e.g. O-ring rubber, etc).

For more detailed information, please ask for the nearest distributor or the following sales center.

### **COPAL ELECTRONICS**

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