Resin Pressure Measuring System

CZ-100P (Resin Pressure Sensor)
PCT-300 (Output Converter)
Instruction Manual

IM100CZ04-E7

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of the instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

CONTENTS

SYMBOLS

WARNING : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

CAUTION : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

: This mark indicates that all precautions should be taken for safe usage.

: This mark indicates important information on installation, handling and operating procedures.

: This mark indicates supplemental information on installation, handling and operating procedures.

: This mark indicates where additional information may be located.

⚠ WARNING

- To prevent injury to persons, damage to the instrument and the equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to the instrument and the equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction may occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy plant.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock to operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dissipation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push the front panel with a hard object.
- The resin adhered to this instrument should be cleaned to dry cloth with a clean while the resin is still hardened, be careful of burns.
- Tools such as wire wheels or abrasive cloths should never be used to clean the process diaphragm.
- Do not apply impact to nor drop this product. If so, its damage or fault may result.
- As precise parts are incorporated, do not give any shock and handle carefully during transportation and installation. Take great care not to scratch the diaphragm.
- Do not wipe or rub the nameplate on the outer case of the resin pressure sensor with a cloth moistened with an organic solvent, or a glove. If so, the printed section may be erased.
- This product uses stainless steel, aluminum, and fluororesin (O-rings and leadwire covering materials). When disposing of each part used for this product, always follows the procedure for disposing of industrial wastes stipulated by the respective local community.
- If the output from the resin pressure sensor is found to be abnormal during the operation, immediately stop the operation and inspect for any distortion or damage of the diaphragm. If the diaphragm is damaged, the pressure of the measured media (e.g.resin) is applied to the inside of the resin pressure sensor.
  Continued use under such conditions may result in the damage of the screw which fixes the folder in the housing, and the folder in the housing may come off in the worst case.
- Do not use the pressure sensor in stead of a blind bolt.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for explanation purpose.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty, expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

1. OUTLINE

1.1 Principle of Operation

When pressure is applied to a diaphragm in the resin pressure sensor (CZ-100P), force acts upon a pressure sensing element through a metal rod located near the diaphragm.

The pressure sensing element used in CZ-100P has 4 gauges adhered to a metallic elastic body and connected to Wheatstone bridge. Each strain gauge made of metal resistance foil with small temperature coefficient slightly changes its gauge resistance due to strain occurring by the application of force to the elastic body. In this case, as shown in the attached diagram (Fig. 1), the elastic body is in such construction that by the application of force stretching strain occurs in R1 and R3, while shrinking strain in R2 and R4 to increase the gauge resistances of R1 and R3 and to decrease those of R2 and R4. These resistance changes are detected as bridge voltage change to generate the output proportional to the force applied. The output thus generated is input to the PCT-300 output converter which can finally output the DC voltages of 0 to 10 V, 0 to 10 mV, 1 to 5 V and 4 to 20 mA from its output terminals via a 3-stage amplifier circuit.

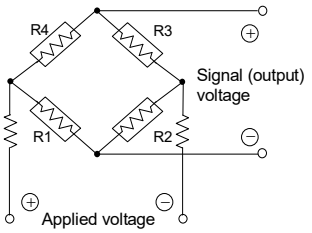


Fig. 1

1.2 Features

- The detection of strain caused by the deformation of an elastic metal body within its elasticity limit using the highly reliable strain gauge enables highly accurate pressure measurement.
- The dual construction of connecting pipe and pressure sensing element portions extremely lessens output indication change caused by external transient temperature change.
- Calibration normally performed to a strain gauge sensor becomes easy and accurate without monitoring the output due to the employment of the PCT-300 output converter.

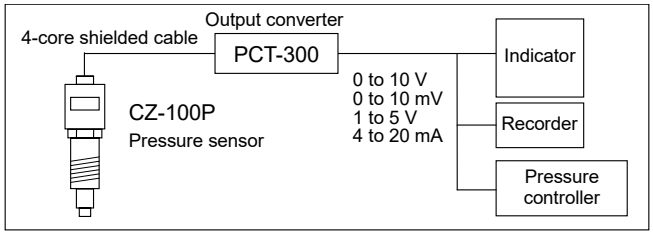


Fig. 2 Block diagram of resin pressure system

2. PRODUCT CHECK

Before using this product, check each of the following:

- Model code
- Check that all of the items delivered are complete.
- Check that there are no scratch or breakage in external appearance.

■ Resin pressure sensor

CZ-100P-□-□ □ □
(1) (2) (3) (4)

(1) Specification type

HB:	Fixed nut type	Standard	PF3/8 L = 150
HC:	Fixed nut type	Standard	PF3/8 L = 180
HZ:	Fixed nut type	Nonstandard size	PF3/8, 1/2-20UNF-2A etc.
HL:	Loose nut type	Standard	PF3/4 (20 to 100 MPa)
HLZ:	Loose nut type	Nonstandard size	PF3/4 (20 to 100 MPa)
LL:	Loose nut type	Standard	PF3/4 (5 to 10 MPa)
LLZ:	Loose nut type	Nonstandard size	PF3/4 (5 to 10 MPa)
LLA:	Loose nut type	Standard	PF3/4 (0.5 to 1 MPa)

(2) Diaphragm section material

S: SUS630 (Standard)
H: HASTELLOY C (Optional)

(3) Diaphragm surface treatment

N: Standard
K: CERAMIC Kanigin plate (Optional)

(4) Intrinsically safe

N: Standard (For non-explosionproof specification type)
G: Explosionproof specification type (For indoor use)
H: Explosionproof specification type (For outdoor use)

● Accessories

- Instruction Manual [IM100CZ04-E7]
- Copper Gasket
  (Included in only the Loose nut type [thickness: t = 2 mm])

If any of the products are missing, damaged, or if your manual is incomplete, please contact RKC sales office or the agent.

● Blind bolt (Sold separately)

This is a bolt to be used to fill the hole on the machine from which a pressure sensor has been removed. If a blind bolt is necessary, please contact with our sales staff or the nearest distributor.

■ Output converter

PCT-300 □-□ □
(1) (2) (3)

(1) Intrinsically safe

N: Standard type (For non-explosionproof specification type)
E: Intrinsically safe explosionproof construction pass type

(2) Number of outputs

2: For two output points (0 to 10 V DC, 0 to 10 mV DC)
3: For three output points
(0 to 10 V DC, 0 to 10 mV DC, 1 to 5 V DC)
4: For four output points
(0 to 10 V DC, 0 to 10 mV DC, 1 to 5 V DC, 4 to 20 mA DC)

(3) Optional function

N: None
G: With gain selector switch
L: With linearizing function
(Linearity error for using this product with the CZ-100P becomes within ±0.5 % of span)

■ Sensor connection cable (Sold separately)

W-AB-N□*-PA-5000: Standard (For non–intrinsic safety)
[Cable length: 5 m]
W-AB-Y□*-PB-5000: Intrinsically safety (Hazardous side)
[Cable length: 5 m]
W-AB-N□*-DA-1000: Non-intrinsic safety (Non-hazardous side)
[Cable length: 1 m]

*□: Cable cover type
(G: Heat-resistant glass coated cable, V: Vinyl coated cable, S: Silicon coated cable)

3. MOUNTING

3.1 Pressure Sensors (CZ-100P)

3.1.1 Mounting cautions

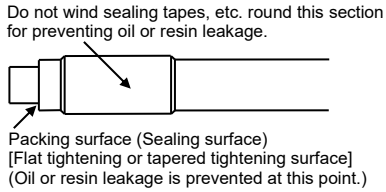
■ Mounting environment

- Ensure that no cooling pipes directly contact the pressure sensor or connector, since the pressure reading accuracy may be affected or the connector may be damaged.
- Do not locate any heat source near the pressure sensor or directly expose it to heat. Otherwise, high-temperature deterioration of the sensor block may occur. If the temperature could rise in the strain gauge block located within the housing, cover possible heat sources with insulation materials.
- Do not use the pressure sensor under any of the following environmental conditions:
  - Where the sensor is exposed directly to cold air, warm air or hot air.
  - Where temperature variations are large.
  - Where the sensor is exposed to direct sunlight.
  - Where the sensor is directly splashed with water or rain, or the humidity is high.
- Do not bring magnetic devices such as magnetic relays, etc. near the pressure indicator (including PCT-300). Also, keep power lines from the resin pressure sensor cable.

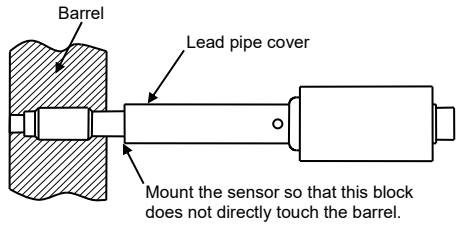
- If the pressure sensor is used for screen changer operation, it may suffer an impact during screen changer operation, causing sensor troubles. In such a case, carefully consider the position and direction when installing the sensor.

■ Mounting pressure sensors

- When the diaphragm at the end of CZ-100P and its surroundings completely touch with its mounting hole, large indication error may occur. In this case, temperature may exert a large influence especially upon the zero point. Therefore, much attention should be paid when a mounting hole is drilled.



- When using a lead pipe cover, pay attention that the lead pipe cover end does not directly touch the barrel. (See the "**■ Exposed length at the bottom of the sensor outer case**")



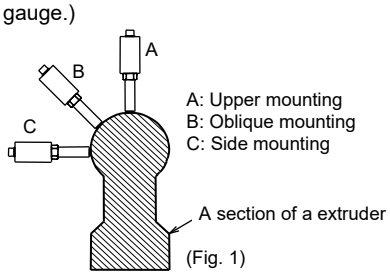
- Prior to mounting the pressure sensor, check the appearance of the diaphragm. If the diaphragm has a deformed or abnormal end, it needs to be repaired or re-calibrated. As there is a case where the diaphragm is already deformed by the application of overload when used previously, carefully check its condition before the pressure sensor is re-used.

■ Mounting hole

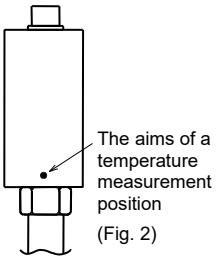
- When mounting the pressure sensor, check its mounting hole dimensions. (Do not overtighten its screw.)
- If resin or its carbide still remains in the mounting hole, this may damage the pressure sensor. Therefore, prior to mounting the sensor, always remove any residue from the mounting hole.
- Check that the diaphragm surface does not protrude from the inner wall of the barrel, since this may score the diaphragm surface with the screw, etc. If necessary, adjust the position between the diaphragm surface and the inner wall of the barrel using stainless steel gaskets, etc.
- For the loose nut type, resin leakage may occur more easily than the fixed nut type, as the pressure sealing surface becomes wider. If any resin leaks through the mounting gap of the sensor, use copper gaskets (thickness: t = 2 mm) or aluminum gaskets (thickness: t = 2 mm) by taking into account the position between the diaphragm surface and the inner wall of the barrel. (Copper Gasket: Included in only the Loose nut type)

■ Mounting direction

- If the sensor is installed in the upright direction (Fig.1-A), it may be affected directly by heat flow from heater or heat source (rising current of heated air). In such a case, the temperature of the strain gauge in the sensor may exceed an allowable maximum temperature of 150 °C. In order not to exceed this limit temperature, it is necessary to keep the sensor outer cylinder surface at a temperature of less than 134 °C (Fig.2). Conduct the following treatments.
  1. In order to avoid heat flow, wind a heat insulating material round such a heat source (heater, etc.).
  2. Further extend the length of the exposed lead pipe.
- In order to keep the specified sensor performance longer, it is recommended that the sensor outer cylinder surface temperature be keep at less than 134 °C.
- When the sensor is installed in the upright position, thermal effects on the sensor may not sufficiently lessen even if the length of the exposed lead pipe is further extended. In this case, take measures of *1*.
- The effect of heat flow lessens as the installing direction of the sensor changes from the slanting direction (Fig.1-B) to the horizontal direction (Fig.1-C) in this order. In this case, take measures of *1* and *2* if necessary by checking the sensor outer cylinder surface temperature. (To the relevant manufacturer: It is recommended that the sensor be installed in the horizontal or slanting direction in order to lessen the effect of heat on the strain gauge.)



(Fig. 1)



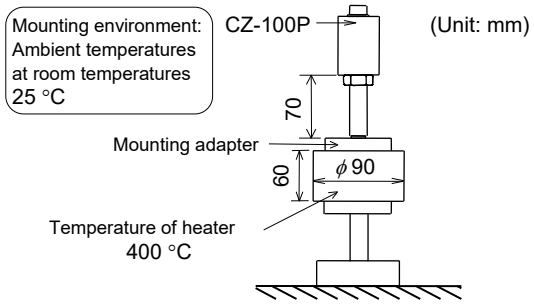
(Fig. 2)

■ Exposed length at the bottom of the sensor outer case

- Cases where the temperature of the strain gauge in the sensor become less than 150 °C is as follows:
  – The effect of heat flow is small.
  – The sensor is installed in the upright position.
  – The diaphragm is at a temperature of 400 °C.
  – The length of the exposed sensor outer cylinder is more than 70 mm. (See below)

  However, as the effect of heat flow from an actual extruder is serious, if there is no enough exposed section below the sensor outer cylinder even at a diaphragm temperature of less than 200 °C, the operating temperature of the sensor strain gauge may exceed its limit. Therefore, check the temperature environment where the sensor is installed (by indirectly checking the temperature of the sensor outer cylinder surface), and take necessary measures to lessen the temperature of the sensor strain gauge by using a heat insulating material, if necessary.

If the temperature of the sensor outer cylinder surface exceeds 160 °C, the outer cylinder surface changes its color from black to dark brown and then brown in this order. If it exceeds 180 °C, the color may change to silver.



- A lead pipe cover is mainly for protecting the exposed section below the sensor outer cylinder from being exposed to cold wind. Therefore, do not install the sensor such that it is embedded in the heat source (such as in the barrel or heater) together with the lead pipe cover. This may heighten thermal conductivity from the heat source, resulting in a temperature increase in the sensor strain gauge.

3.1.2 Caution in removing pressure sensors

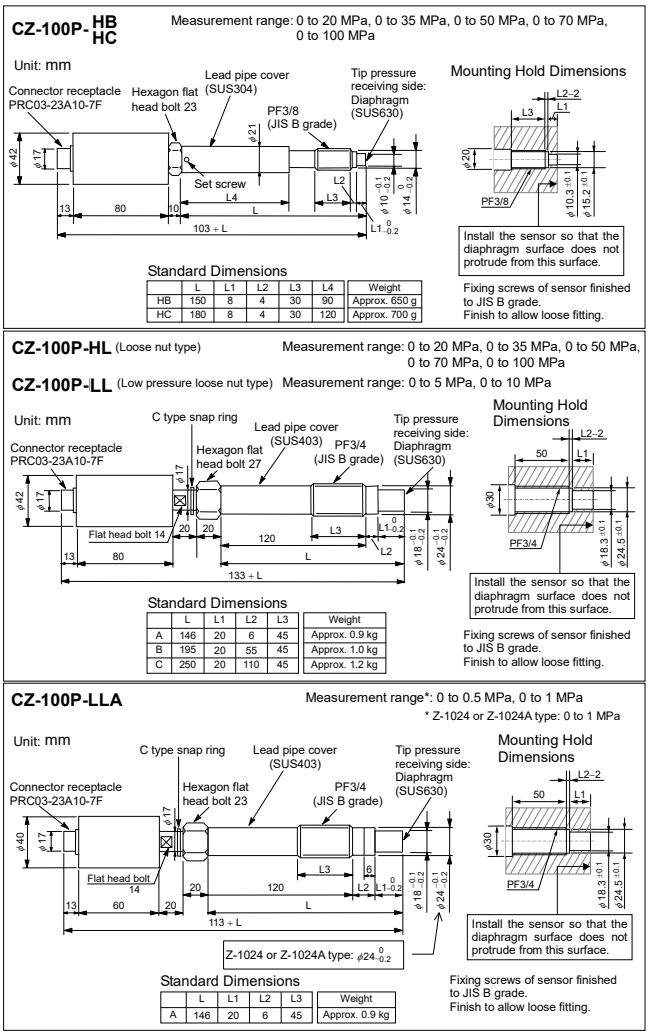
- **Always remove the sensor while resin is being melted**, since the diaphragm of the sensor may be damaged if the sensor is removed after the resin has hardened. If the sensor is re-mounted under this condition the repeatability may deteriorate.
- When removing the pressure sensor, remove it under the same temperature as that during installation. Removing the pressure sensor under the different temperature as that during installation cause irregular engagement of the thread.
- If resin flows into the gap between the lead pipe and the mounting hole, it may be impossible to remove the sensor even with the threads completely disengaged. In this case, if the sensor is forcibly removed using a puller, the sensor may be knocked when removed, damaging the diaphragm and reducing the accuracy. Slowly remove the sensor without knocking it.

- Remove the resin attached to the pressure sensing part (diaphragm and its surrounding section) after melting it by applying light heat to the side of the pressure sensing part using a burner (Do not let the temperature exceed 400 °C). In addition, care should be taken not to scratch the pressure sensing block.
  If not, diaphragm damage or resin leakage may result.

3.1.3 Cautions during extruder cooling down

If the temperature is decreased while resin remains in the extruder with the pressure sensor installed, the diaphragm may be depressed and deformed by resin contraction, etc. As a result, a measurement error or pressure dead-band may occur. If the extruder is cooled down, completely remove all the resin remaining in the barrel, or remove the sensor. Especially take care for the low pressure sensor, as this effect becomes serious.

3.1.4 Dimensions



3.1.5 Pressure sensor installation

1. Make sure the mounting hole is correctly machined. If installing the pressure sensor into a previously used hole, make sure the hole is thoroughly cleaned to remove any plastic residue.
2. Lubricate the threads with a high temperature anti-seize lubricant.
3. Tighten the hexagon nut part with a torque wrench. When tightening the pressure sensor, always tighten only the hexagon nut part.
   - Fixed nut type (PF3/8 thread: HB, HC type): 30.0 N·m [300 kgf·cm]
   - Loose nut type (PF3/4 thread: LL, HL, LLA type): 60.0 N·m [600 kgf·cm]

Tighten the pressure sensor to secure it after the temperature rises.

Do not tighten any block other than the hexagonal nuts, since this may damage the pressure sensor.

3.2. Output Converter (PCT-300)

3.2.1 Mounting cautions

WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

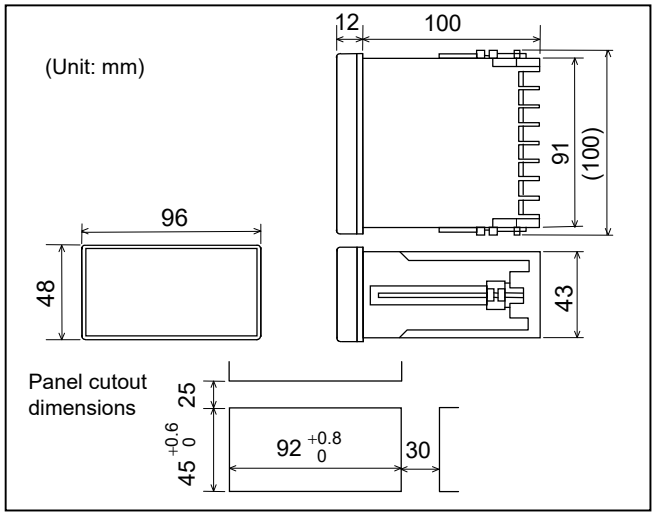
(1) This instrument is intended to be used under the following environmental conditions. **(IEC61010-1)**
[OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions:
- Allowable ambient temperature: 0 to 50 °C
- Allowable ambient humidity: 45 to 85 %RH
- Installation environment conditions: Indoor use, Altitude up to 2000 m

(3) Avoid the following when selecting the mounting location:
- Rapid changes in ambient temperature, which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Exposure to direct sunlight.
- Excessive heat accumulation.

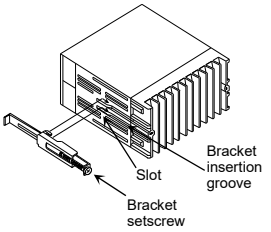
(4) Mount this instrument in the panel considering the following conditions:
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above the equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  High voltage equipment: Do not mount within the same panel.
  Power lines: Separate at least 200 mm.
  Rotating machinery: Separate as far as possible.
- For correct functioning mount this instrument in a horizontal position.
- In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

3.2.2 Dimensions



3.2.3 Mounting procedures

1. Prepare the panel cutout as specified in **3.2.2 Dimensions**.
2. Insert the instrument through the panel cutout.
3. Insert an upper mounting bracket along the bracket insertion groove from the back, and then engage a projection at the bracket end with a recess at the groove front and also insert metal fitting legs into slots.



4. Tighten a bracket setscrew from the rear of the bracket with Phillips screwdriver. Do not overtighten the bracket setscrew.
5. The other mounting bracket should be installed the same way as described in ***3***. and ***4***.

4. WIRING

⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

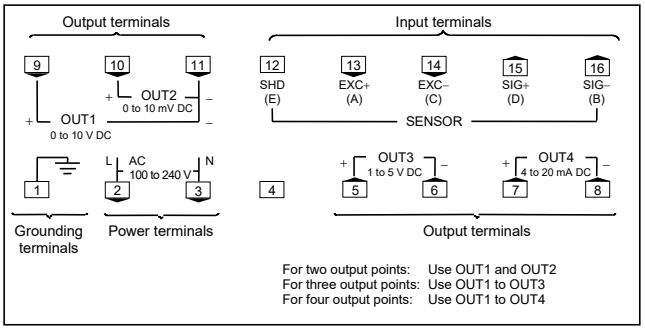
4.1 Wiring Cautions

- The CZ-100P (sensor) connect to the PCT-300 (output converter) using the 4-conductor shielded cable attached.
- The rated output of the CZ-100P (mV/V: Described on the nameplate adhered) is obtained when standard cable length is 5 m. If cable length has been extended, conduct rated output correction referring to **6. CORRECTION** (page 6).
- If the pressure sensor is used together with the output converter (PCT-300), always connect a grounding wire to the equipment side. (Ground the grounding terminal.)
- Connect a grounding wire to the extruder.
- For a heat-resistant glass covered cable, the cover is made of fibers. Therefore, the electrical insulation may deteriorate if the cable is exposed to high humidity or conductive liquid (water, etc.) and cause a pressure indication error. For this reason, avoid underground wiring or wiring within electric conduits passing through humid areas as much as possible.
- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate high breaking capacity close to the instrument.
  - Fuse type: Time-lag fuse (Approved fuse according IEC60127-2 and/or UL248-14)
  - Fuse rating: Rated current 0.5 A
- Use the solderless terminal appropriate to the screw size.
  Screw size: M3×6
  Recommended tightening torque: 0.4 N·m [4 kgf·cm]
  Specified solderless terminals: With isolation
  Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm^2

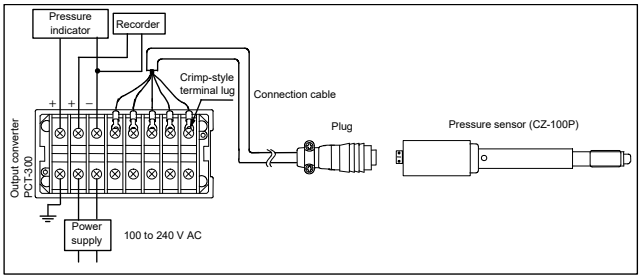
- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.

4.2 Wiring Method

■ Terminal configuration of output converter (PCT-300)



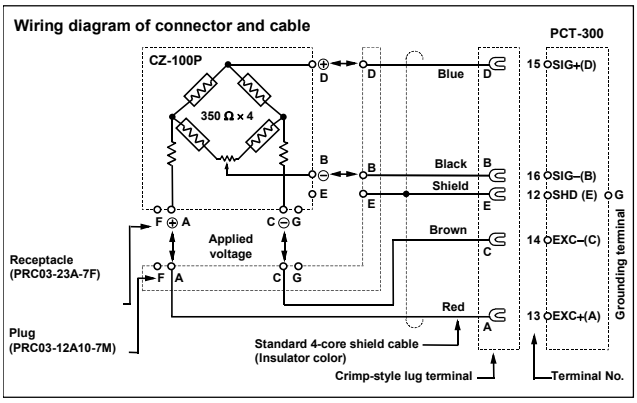
■ Wiring example



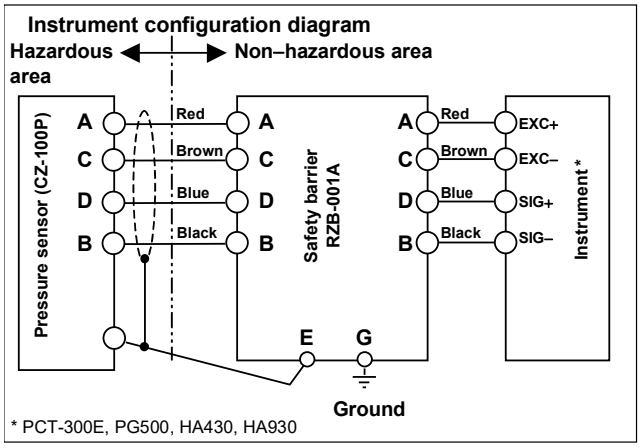
Do not place magnet relays or any other equipment which causes magnetic disturbance near the output converter. Install the power cable away from the 4-core shielded cable.

When connecting the sensor to a pressure indicator or recorder, check its polarity and output signal

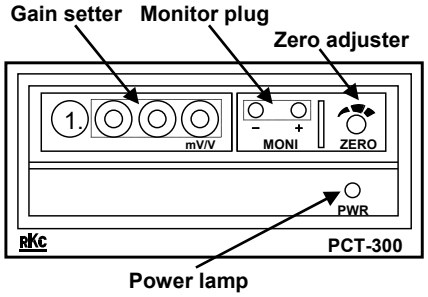
NDI standardized connector (plug, receptacle and jack) is used.



■ Wiring example of explosionproof specification sensor



5. ADJUSTMENT

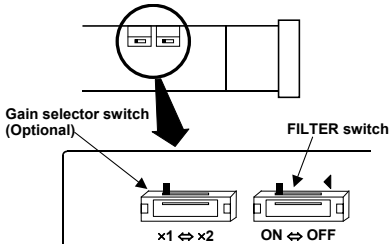


■ Adjustment procedures

1. Check the rated output (mV/V) described on the nameplate of the CZ-100P (This output should be corrected when the cable is extended.) and then set that value on the rotary switch which is gain setter of the PCT-300.

2. The pressure reading zero point is adjusted by the zero adjuster in PCT-300. Perform this zero adjustment after the position installed with CZ-100P on the extruder reaches the desired temperature and is in the steady state after the lapse of a certain time. If an indicator is not available, adjust the zero point on the monitoring terminals using a circuit tester. In addition, perform the above adjustment after warming up for 20 minutes or more with the power switch of PCT-300 turned ON (power lamp lights) after wiring has been finished.

- When the gain setter and zero adjuster are set using small screwdriver.
- When the sensor is provided with the gain selection function (optional), the output value is doubled if the function is set to "×2," which is effective for increasing the reading at low-pressure. The valid range is within the output range of PCT-300, which corresponds to half of full-scale pressure.
- Turn the FILTER switch to the OFF side (100 Hz, −3 dB) when quick response is required. The FILTER switch is turned to the ON side (10 Hz, −3 dB) prior to shipment.



When the following types of resin pressure sensors are used, connectable instruments (output converter, indicator, etc) and gain setting procedure are different.

Sensor types and connectable instruments:

Sensor type	Connectable instruments
CZ-100P-LLA Z-1024	PCT-300
CZ-100P-LLA Z-1024A	PG500, HA430, HA930
CZ-100P-LLA (0.5 MPa range)	PCT-300, PG500, HA430, HA930

See page 6 for Gain setting adjustment of each sensor type.

Gain setting for CZ-100P-LLA Z-1024 type:

1. Make sure your PCT-300 has a selectable gain function (optional) with a gain selector switch.

2. Read off the rated output value (Rated output: mV/V) from the label on the pressure sensor, and set the value with the Gain setter (rotary switch) on the PCT-300.
   To make indication error compensation due to operating temperature, cable length, or safety barrier, set the compensated value on the PCT-300.

For more details of indication error, see **6. CORRECTION** in this manual.

3. Then, set the selector switch (on the side of PCT-300, see drawing on page 6) to "×2."

Gain setting for CZ-100P-LLA Z-1024A type:

Set the RATED OUTPUT (Rated output: mV/V) value specified on the label of the pressure sensor
at Gain setting in the Setup setting mode for PG500, and
at Gain setting in the Function block F21 in the Engineering mode for HA430 and HA930.
To make indication error compensation due to operating temperature, cable length, or safety barrier, set the compensated value.

For more details of indication error, see **6. CORRECTION** in this manual

Gain setting for CZ-100P-LLA (0.5 MPa range) type:

When a PCT-300 is used, the Gain setting procedure is the same as that for CZ-100P-LLA Z-1024 type. See "Gain setting for CZ-100P-LLA Z-1024 type."

When PG500, HA430 or HA930 is used, enter a half value of the RATED OUTPUT (Rated output: mV/V) specified on the label of the pressure sensor
at Gain setting [1] in the Setup setting mode for PG500, or
at Gain setting [2] in the Function block F21 in the Engineering mode for HA430 and HA930.
To make indication error compensation due to operating temperature, cable length or safety barrier, set a half of the compensated value.

For more details of indication error, see **6. CORRECTION** in this manual

[1] For Gain setting in Setup setting mode, refer to the PG500 Operation Manual (IMR02F02-E□).
[2] For Gain setting in F21 in the Engineering mode, refer to the HA430/HA930 Quick Operation Manual (IMR01N16-E□).

6. CORRECTION

6.1 Correcting Indication Error due to the Operating Temperature

The pressure indication error caused by the difference between the pressure sensor's calibration temperature and the operating temperature can be adjusted using the instrument's gain setting. The pressure indicator error [pressure sensor output (sensitivity) temperature affect] is within a "±0.2 % of span/10 ºC," but the temperature affect can be corrected if necessary.

■ Correction procedure

1. The rated output after the correction is calculated from the following correction equation and correction factor.

$$e_1 = [1 + \text{Correction factor} \times (T - \text{Calibration temp.})] \times e_0$$

e_0: Rated output of the resin pressure sensor
e_1: Rated output after the correction
T: Operating temperature
Correction factor: See below
(The correction factor is the actual value and not the warranted value.)

Correction factor:

Diaphragm material	Calibration temperature (°C)	Correction factor
SUS630	150	$+0.13\times10^{-3}$
SUS630 + Kanigen plate	150	$+0.13\times10^{-3}$
HASTELLOY C	150	Please contact RKC sales office or the agent.
HASTELLOY C + Kanigen plate	250	

2. Set the value obtained in 1 above in the Gain setting section of the instrument*.

Example: When the $e_0 = 1.500$ SUS630 diaphragm material's pressure sensor is used at 230 °C.

$e_1 = [1 + 0.13 \times 10^{-3} \times (230-150)] \times 1.500$

$e_1 = 1.516$

Set 1.516 to the gain setting portion of the instrument.

* For PCT-300, use the Gain Setter.
For PG500, refer to Gain setting in the Setup setting mode in the PG500 Operation Manual (IMR02F02-E□).
For HA430/HA930, refer to the Gain setting in Function block F21 in the Engineering mode in the HA430/HA930 Quick Operation Manual (IMR01N16-E□).

6.2 Correcting Indication Error due to the Connection Cable Length

RKC Instrument's resin pressure sensor is calibrated for the standard cable length (5 m). Therefore, if the total length of the pressure sensor connection cable connected to the intrinsically safe circuit and non-intrinsically safe circuit side is other than 5 m, the resin pressure sensor indication value can be corrected using the instrument's gain setting.

■ Correction procedure

1. The rated output after the correction is calculated from the following correction equation and correction factor.

$$e_1' = e_0'/[1 + K \times (L - 5)]$$

e_0': Rated output of the resin pressure sensor
e_1': Rated output after the correction
K (Correction factor):
1.96×10^{-4}/m (Standard specification type)
1.40×10^{-4}/m (Explosionproof specification type)
L: Cable total length (m)
[However, when using RKC Instrument's standard cable.]

2. Set the value obtained in 1 above in the Gain setting section of the instrument*.

Example:
Cable total length (L) = 10 m
Rated output of the resin pressure sensor (e_0') = 1.500

$e_1' = 1.500/[1 + 1.96 \times 10^{-4} \times (10-5)]$

$e_1' = 1.499$

Set 1.499 to the gain setting portion of the instrument.

* For PCT-300, use the Gain Setter.
For PG500, refer to Gain setting in the Setup setting mode in the PG500 Operation Manual (IMR02F02-E□).
For HA430/HA930, refer to the Gain setting in Function block F21 in the Engineering mode in the HA430/HA930 Quick Operation Manual (IMR01N16-E□).

6.3 Correcting Indication Error when the Cable of Another Company is Used

The nominal cross-sectional area of our cable conductor is 0.5 mm^2. If using a cable from another company, the resin pressure sensor's indication value can be corrected by correcting the gain setting of the instrument.

■ Correction procedure

1. The rated output after the correction is calculated from the following correction equation and correction factor.

$$e_1' = e_0'/[1 + 0.5/S \times K \times (L - 5)]$$

e_0': Rated output of the resin pressure sensor
e_1': Rated output after the correction
S: Conductor nominal cross-sectional area (mm^2)
K (Correction factor):
1.96×10^{-4}/m (Standard specification type)
1.40×10^{-4}/m (Explosionproof specification type)
L: Cable total length (m)

2. Set the value obtained in 1 above in the Gain setting section of the instrument*.

Example:
Cable total length (L) = 10 m
Conductor nominal cross-sectional area (S) = 0.75 mm^2
Rated output of the resin pressure sensor (e_0') = 1.500 mV/V

$e_1' = 1.500/[1 + 0.5/0.75 \times 1.96 \times 10^{-4} \times (10-5)]$

$e_1' = 1.499$

Set 1.499 to the gain setting portion of the instrument.

* For PCT-300, use the Gain Setter.
For PG500, refer to Gain setting in the Setup setting mode in the PG500 Operation Manual (IMR02F02-E□).
For HA430/HA930, refer to the Gain setting in Function block F21 in the Engineering mode in the HA430/HA930 Quick Operation Manual (IMR01N16-E□).

When anti-explosion specifications are required, use a cable with an allowable capacitance between the cable wires of 0.1μF or less and an allowable inductance of 0.6 mH or less.

The allowable inductance could be exceeded if the cable is wound, so do not wind the cable when using it.

6.4 Correcting Indication Error due to the Safety Barrier

A pressure indication error caused by the dispersion of our RZB-001 internal resistance value is within about 1 % of span. However, when this error needs to be lessened further, make the correction, if necessary. For this correction, the barrier correction factor B is used. No correction is required when the barrier correction factor B is "1.000."

The barrier correction factor B is described on the nameplate of the RZB-001.

■ Correction procedure

1. The rated output after the correction is calculated from the following correction equation and correction factor.

$$e_1'' = B \times e_0''$$

e_0'': Rated output of the resin pressure sensor
e_1'': Rated output after the correction
B: Barrier correction factor

2. Set the value obtained in 1 above in the Gain setting section of the instrument*.

Example:
Barrier correction factor (B) = 1.001
Rated output of the resin pressure sensor (e_0'') = 1.500 mV/V
Rated output after the correction = e_1''

$e_1'' = 1.001 \times 1.500$

$e_1'' = 1.502$

Set 1.502 to the gain setting portion of the instrument.

* For PCT-300, use the Gain Setter.
For PG500, refer to Gain setting in the Setup setting mode in the PG500 Operation Manual (IMR02F02-E□).
For HA430/HA930, refer to the Gain setting in Function block F21 in the Engineering mode in the HA430/HA930 Quick Operation Manual (IMR01N16-E□).

7. LINEARIZING FUNCTION SETTING

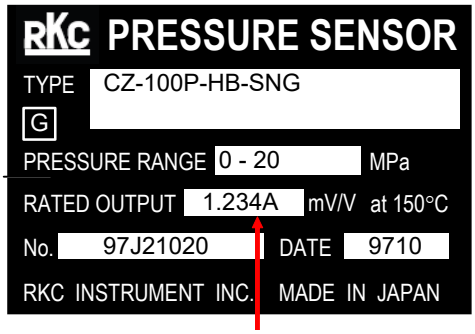
WARNING

- To prevent electric shock and instrument failure, always turn off the power supply before pulling out the internal chassis.
- To prevent injury or instrument failure, do not touch the internal printed circuit board.

■ Linearizing switch changing

1. First check the output characteristic type (A, N or B) engraved at the end of the figure showing the rated output value on the rating nameplate attached to the outer chamber of the pressure sensor.

Example: Rating nameplate

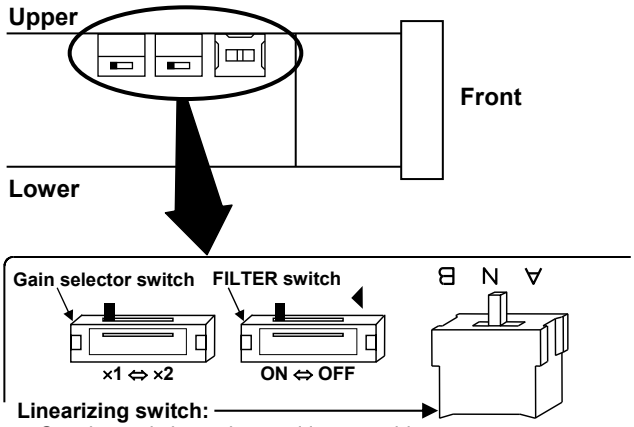


A, N or B is engraved in this section.
For products other than corresponding to the linearizing function, the output characteristic type (A, N or B) is not engraved in this section.

2. Next, check that the power to the PCT-300 output converter is turned off, then remove the internal assembly from the case.

3. Set the linearizing switch on the side of the internal assembly of the PCT-300 to the position matching the output characteristic type of the pressure sensor to be connected.

Internal assembly of PCT-300



Set the switch to the position matching the output characteristic type of the pressure sensor.

The gain selector switch or linearizing switch is optional.
The above figure shows all the optional switches to simplify the explanation.

4. House the internal assembly in the case.
This completes the setting.

8. TROUBLES AND CAUSE

Problem	Possible cause
Indication pointer completely defects to the left or right.	• No indicator input circuit connected. • No 4-conductor shielded cable connected. • The defective connector used (standard or water resistant connector).
Digital display over-scale or underscale.	• Wires disconnected or shorted. • No internal sensor wiring connected. • The fiberglass coated cable immersed into water or exposed to high temperature, resulting in deteriorated insulation resistance. • No rated output set to the PCT-300 (different gain). • The double gain selector switch turned ON. • The strain gauge deteriorated due to exposure to high temperature. • No zero adjuster adjusted.
No pressure is indicated under pressurized condition.	• Irregularly tapped hole for installing the CZ-100P. (The sensor tip strongly contacting with the tapped hole.) • The diaphragm deteriorated, deformed or damaged. * • Mechanical Lead pipe deformation by external force.
Pointer or indication fluctuates during relay actuation.	• No measures for relay spark killing taken. • No 4-conductor cable shield perfectly wired or grounded. • The PCT-300 located near magnetically operated relays.
Pressure indication is fluctuated.	• Value different from the sensor rated output set to the rated output setter for the PCT-300. • The diaphragm deteriorated, deformed or damaged. * • The sensor exposed to hot or cold wind. • Some potential against the earth generated (2-point grounding, etc.).
Normal operation was performed, but no reading was received after a while or the reading varied and was unstable.	• Imperfect connecter contact. • The lead pipe deformed by external force. • The diaphragm deteriorated, deformed or damaged. * • The fiberglass coated cable immersed into water or exposed to high temperature, resulting in deteriorated insulation resistance. • The sensor exposed to hot or cold wind. • The extruder now in unstable operation or temperature rise.
Indication fluctuates from the beginning.	• The sensor tip forcibly tightened due to the small tapped hole. • The lead pipe cover contacting with the barrel, etc.
Resin leakage.	• The sealed surface deformed or scratched. • Foreign material (carbide, etc.) attached on the sealed surface. • Low sealed surface accuracy (parallelism, axis, etc.). • No screw threaded down to the extreme end. • Tightened at less than appropriate torque or not tightened.
No threads regularly engaged (no screw removed).	• No screw threaded down to the extreme end. • Not threaded as conforming to the standard. • The screw with burrs used. • Tightened with excessive torque. • Tightened at temperature different from the initial tightening temperature. • Foreign material attached on the threaded section, or stained.

For taking measures, also see "**3.1 PRESSURE SENSOR (CZ-100P)**." The converter is described on a basis of the PCT-300.

* For the cause of diaphragm deterioration, deformation or damage, see the following "■ **Main causes**" (P. 9).

Continued on the next page.

■ Main causes

These causes may arise independently or in mutual relations.

• Generative cause in operation

Overpressure	Load pressure exceeding its limit applied.
Irregular thread engagement	The metal pressure sensing surface mechanically scratched or chipped off.
Metal fatigue	The metal sensing surface fatigued by the application of changing or repeating pressure.
Corrosion	The pressure sensing surface corroded due to its contact with corroding material.
Abrasion	The pressure sensing surface worn away due to the mixture of fillers, etc.
Shrinkage	The pressure sensing surface deformed due to the shrinkage of resin adhered to its surface as a result of extruder cooling down.
Separation	The pressure sensing surface deformed or damaged by resin adhered to its surface due to the removal of the sensor while the resin is not yet melted or its melted condition is imperfect.
Protrusion	The pressure sensing surface deformed or damaged due to the protrusion of the push rod from the lead pipe as a result of an external force applied by the screen changer, etc.
Contact	The pressure sensing surface deformed due to the forced contact of the sensor outer side with the hole inner surface as a result of the finish of the hole inner surface.

• Generative cause in mounting and removing

Impact	The pressure sensing surface deformed due to its strong strike with solid material.
Dropping	The pressure sensing surface or its circumference scratched or deformed due to sensor dropping.
Handling	After the resin attached to the sensor tip is heated by a gas burner, etc. for its removal at the time of inspection, the pressure sensing surface scratched with a metal brush, etc.
Excessive tightening	The diaphragm deformed or damaged as the push rod pushes the diaphragm from the inside as a result of the deformation of the sensor flange by excessive tightening torque.

9. EXPLANATION OF EACH TERMS

Term	Explanation
Rated pressure	The maximum pressure which satisfies the specification. There are stipulated pressure ranges.
Rated output	Value obtained by subtracting the output at no-load from that at the rated pressure load. Electrically, it is output voltage per Volt in DC (mV/V) obtained through the bridge circuit when rated pressure is applied. At an application voltage of 10 V from the converter, a voltage of mV × 10 is output.
Accuracy	The maximum error including linearity and hysteresis.
Linearity	The maximum error from a reference line (straight line without error) when pressure-loaded in the pressure rise direction continuously from no-load to the rated pressure.
Hysteresis	The maximum difference between pressures at the same point in the rise and fall directions when the same pressure is loaded.
Repeatability	The difference between measured values obtained each time when pressure-loaded three times repeatedly from no-load to the rated pressure within a short period of time*.
Temperature effect on zero point	Zero-point output variation when the diaphragm temperature changes by 10 °C.
Temperature effect on output (sensitivity)	Output sensitivity (span) variation when the diaphragm temperature changes by 10 °C.
Allowable overpressure	The high limit of overpressure within a short period of time* at which the accuracy can be guaranteed even after the pressure returns to the rated pressure when overpressure-loaded.
Limit overpressure	The high limit of overpressure within a short period of time* at which no diaphragm is damaged when overpressure-loaded. However, no accuracy is guaranteed after the pressure returns to the rated pressure.

* Short period of time: From several seconds to several minutes.

10. SPECIFICATIONS

10.1 Resin Pressure Sensor (CZ-100P)

● Specification

Sensing block construction:
4-side adhesion-type strain gauge, wheatstone bridge

Rated pressure:
Fixed nut type: 20 MPa, 35 MPa, 50 MPa, 70 MPa, 100 MPa
Loose nut type (LL type): 5 MPa, 10 MPa
Loose nut type (HL type): 20 MPa, 35 MPa, 50 MPa, 70 MPa, 100 MPa
Loose nut type (LLA type): 0.5 MPa *, 1 MPa
* Available in combination use with PCT-300, PG500, HA430, or HA930.

Loose nut type (LLA Z-1024 type): 1 MPa *
* Available in combination use with PCT-300.

Loose nut type (LLA Z-1024A type): 1 MPa *
* Available in combination use with PG500, HA430, or HA930.

Rated output
[Calibration temperature: At diaphragm temperature of 150 °C]:
1.0 to 1.8 mV/V

LLA type (0 to 1 MPa): 1.0 to 1.6 mV/V
LLA type (0 to 0.5 MPa): 0.5 to 0.8 mV/V *
* Value 1.0 to 1.6 mV/V is specified on the sensor label.

LLA Z-1024 type: 0.5 to 0.8 mV/V *
* Value 1.0 to 1.6 mV/V is specified on the sensor label.

LLA Z-1024A type: 0.5 to 0.8 mV/V *
* Value 0.5 to 0.8 mV/V is specified on the sensor label.

The output of each sensor becomes a specific value within the range of 1.0 to 1.8 mV/V.

Bridge impressed voltage:
10 V DC (When using PCT-300)
7.7 V DC (When using PG500)
8 V DC (When using HA430 or HA930)

Accuracy [At diaphragm temperature of 150 °C]:
SUS630 diaphragm specification type:
±1.0 % of span (For type exceeding 70 MPa: ±2.0 % of span)
HASTELLOY C diaphragm specification type:
±1.0 % of span (For type exceeding 50 MPa: ±2.0 % of span)

Linearity [At diaphragm temperature of 150 °C]:
SUS630 diaphragm specification type:
±1.0 % of span (For type exceeding 70 MPa: ±2.0 % of span)
HASTELLOY C diaphragm specification type:
±1.0 % of span (For type exceeding 50 MPa: ±2.0 % of span)

Hysteresis [At diaphragm temperature of 150 °C]:
SUS630 diaphragm specification type: ±1.0 % of span

For type exceeding 70 MPa:	±2.0 % of span
LLA type:	±0.2 % of span
LLA Z-1024 type:	±1.0 % of span
LLA Z-1024A type:	±1.0 % of span

HASTELLOY C diaphragm specification type: ±1.0 % of span
(For type exceeding 50 MPa: ±2.0 % of span)

Repeatability [At diaphragm temperature of 150 °C]:
SUS630 diaphragm specification type: ±0.2 % of span
HASTELLOY C diaphragm specification type: ±0.4 % of span

Zero balance: ±0.6 mV/V (±40 % of span)

Bridge resistance:
Input side: 350±5 Ω, Output side: 350±5 Ω

● Temperature characteristics

Maximum diaphragm temperature: 400 °C

Maximum strain gauge temperature: 150 °C

When the temperature at the bottom of outer tube (nut side) is more than 134 °C, the temperature at the strain gauge exceed 150 °C. *

* If the temperature at the strain gauge exceed 150 °C, the performance cannot be assured. Therefore, cover the heat source with a heat insulating material so that the above temperature does not exceed 150 °C.
The temperature at the strain gauge can be expected not to rise when:
• the long type of sensor is used or
• the sensor is installed aslant or transversely.
If any of the above measures can be taken, take it.

Zero shift due to temperature change [As to diaphragm temperature]:
SUS630 diaphragm specification type: 0.2 % of span/10 °C
HASTELLOY C diaphragm specification type: 0.3 % of span/10 °C

LLA type 0.5 MPa:	0.4 % of span /10 °C
LLA Z-1024 type, LLA Z-1024A type:	0.3 % of span /10 °C

Output (sensitivity) shift due to temperature change:
Same as **Zero shift due to temperature change**

● Mechanical characteristics

Allowable over pressure: 120 % of span

LLA type 0.5 MPa:	1000 % of span
LLA type 1 MPa:	500 % of span
LLA Z-1024 type, LLA Z-1024A type:	500 % of span

Limited over pressure: 150 % of span

LLA type 0.5 MPa:	2000 % of span
LLA type 1 MPa:	1000 % of span
LLA Z-1024 type, LLA Z-1024A type:	1000 % of span

Diaphragm material: SUS630 (Standard)
HASTELLOY C (Optional)

Diaphragm surface treatment:
Non surface treatment (Standard)
CERAMIC Kanigen plate (Optional)

Fixing screw section material: SUS403

Lead pipe cover material: SUS304 (Fixed nut type only)

Recommended tightening torque:
30 N·m (300 kgf·cm) [Fixed nut type, PF3/8]
60 N·m (600 kgf·cm) [Loose nut type, PF3/4]

10.2 Output Converter (PCT-300)

● Input

Input sensor: Strain gauge type sensor
[Resin pressure sensor (CZ-100P: RKC product)]

Input range:
Standard specification: 0 to 19.9 mV *
Explosion-proof construction specification: 0 to 11.6 mV *
* Excluding bias portion that allows zero adjustment

Input impedance:
1 MΩ or more

Action at input break:
Upscale (The sensor power supply break is the same)

● Sensor power supply

Applied voltage:
Standard specification: 10 V DC (Normal current 28 mA)
Explosion-proof construction specification:
8.2 V DC (Normal current 16 mA)

Accuracy: Within +0.1 %, Within −0.4 %

Temperature drift: 30 ppm/°C or less

● Zero point

Adjustment range:

Standard specification: ±7 mV (Input conversion)

Explosion-proof construction specification:
±6 mV (Input conversion)

Temperature drift: Within ±0.02 % of span/°C

● Gain

Adjustment range:

Standard specification:
Input range “10.00 to 19.99 mV” can be used as rating (10 V etc.).

Explosion-proof construction specification:
Input range “5.80 to 11.60 mV” can be used as rating (10 V etc.).

Setting accuracy:

Within ±0.2 % of span/°C

Temperature drift:

100 ppm/°C or less

Optional functions:

Gain selector switch provided (Selection 1× ⇔ 2×)

● Output

Output type:

0 to 10 V DC (Load resistance: 2 kΩ or more)
0 to 10 mV DC (Load resistance: 10 kΩ or more)
1 to 5 V DC (Load resistance: 1 kΩ or more)
4 to 20 mA DC (Load resistance: 600 Ω or less)

Monitor voltage:

0 to 10 V DC (Pin size of tester conforming: ϕ2.0)

● General specifications

Linearity: Within ±0.01 % of span

Noise: Within ±0.1 % p-p of span (0.1 to 10 Hz)

Response: 10 Hz/100 Hz transfer type (Factory shipment: 10 Hz)

Power supply: 90 to 264 V AC (Including power supply voltage variation), 50/60 Hz
Rating: 100 to 240 V AC

Power consumption:

12.5 VA max. (at 240 V AC)
7.5 VA max. (at 100 V AC)

Insulation resistance:

Between input/output terminal and grounding:
20 MΩ or more at 500 V DC
Between power terminal and grounding:
20 MΩ or more at 500 V DC

Withstand voltage:

Between input/output terminal and grounding:
1 minute at 1000 V AC
Between power terminal and grounding:
1 minute at 1500 V AC

Weight: Approx. 290 g

● Operating environment

Allowable ambient temperature:

0 to 50 °C

Allowable ambient humidity:

45 to 85 %RH (Non condensing)

Ambient operating atmosphere:

There should be neither corrosive gases nor much dust.

The first edition: APR. 1995
The seventh edition: NOV. 2022 [IMQ00]

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