

Intrinsically Safe Explosionproof Construction Safety Barrier

RZB-001 Instruction Manual


IMD01G01-E3


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


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

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and 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 can 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.)
- Take the necessary measures of not contacting this instrument with any high-voltage parts such as power supply terminals, etc.

- 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.
- 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.
- 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 will 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 front panel with a hard object.

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 purpose of illustration.
- 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.

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1. OUTLINE

The RZB-001 safety barrier has been explosionproof-verified in Japan as intrinsically safe explosionproof construction * when used together with the resin pressure sensor (the CZ-100P/CZ-200P) of the explosionproof specification for configuring a system.

(Equivalent to IEC standard: EEX ia IIB, T3)

In addition, its explosion class and ignition grade correspond to 2G3.

When using this safety barrier, always follow the instructions described on the nameplate attached.

* Intrinsically safe explosionproof construction is the construction approved by the public authorities concerned as a result of tests or any other means that electrical equipment and appliances with a safety barrier which can limit electrical energy installed in a hazardous area do not ignite their surrounding gas or vapor even if electric spark or high temperature may be generated in the area in either normal or abnormal condition.

2. HANDLING

2.1 Handling Caution



This product has passed the qualification test of intrinsically safe explosionproof when combined with our resin pressure sensor (CZ-100P/CZ-200P). Always combine and use this product with our resin pressure sensor.



To prevent accidents, grounding terminals must be grounded separately to secure intrinsic safe explosionproof.

Grounding condition:

- Resistance value: 10 Ω or less
- Grounding conductor: metal wire with tensile strength of 1.04 kN or more, or annealed copper wire of 2.6 mm or more in diameter



Conduct wiring work so that the sum of inductance and capacitance between cables used for connecting the resin pressure sensor and the RZB-001 and between thermocouple compensating leads is less than the following numeric value.

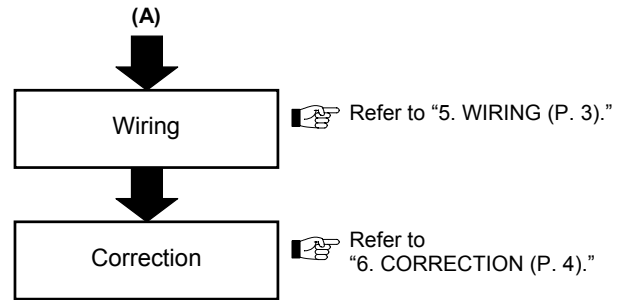
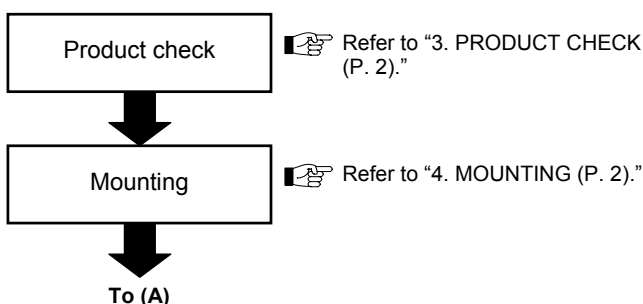
- Allowable inductance (Lw): 0.6 mH or less
- Allowable capacitance (Cw): 0.1 μ F or less



This product may deteriorate its characteristics when applied with a strong impact. Therefore, do not drop it or give any impact to it.

2.2 Handling Procedure

Conduct the necessary work by taking the following steps. In addition, conduct grounding, wiring and connection by referring to the instrument configuration diagram (P. 3).



3. PRODUCT CHECK

Check whether the delivered product is as specified by referring to the following model code.

RZB - 001 ☐ ☐
(1) (2) (3)

(1) Model name

(2) N: Built-in power circuit, signal circuit and thermocouple circuit

A: Built-in power circuit and signal circuit

(3) 1: For indoor use 2: For outdoor use

■ ACCESSORIES

Instruction manual (IMD01G01-E3): 1 copy

Special clamp: One set (Cramp \times 1, Screw \times 2, Nut \times 2)

■ PERIPHERAL ACCESSORIES (Sold separately)

Connection cable (manufactured by RKC)

Cable for intrinsically safe circuit side (With connector):

CZ-100P, 200P \leftrightarrow RZB-001

For pressure sensor: W-AB-Y \square -PB- $\square\square\square\square\square\square$ ^{1,2}

For thermocouple compensating leads:

W-BL- \square F-DB- $\square\square\square\square\square\square$ ²

Cable for non-intrinsically safe circuit side:

RZB-001 \leftrightarrow Pressure indicator or converter

For pressure sensor: W-AB-N \square -D \square - $\square\square\square\square\square\square$ ²

For thermocouple compensating leads:

W-BL- $\square\square$ -B \square - $\square\square\square\square\square\square$ ²

¹ When the cable direct-coupled type:

Specify the cable end treatment when ordering.

² $\square\square\square\square\square\square$: Cable length (unit: mm)

4. MOUNTING



WARNING

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

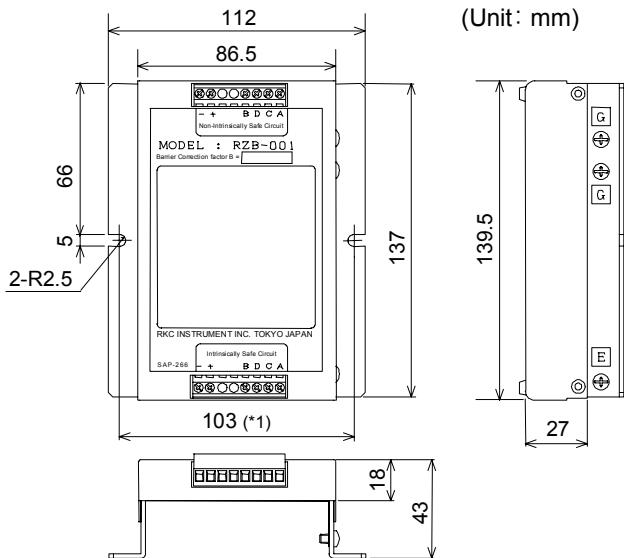
4.1 Mounting Environment

Avoid the following conditions when selecting the mounting location:

- Ambient temperature of less than -10°C or more than $+40^{\circ}\text{C}$.
- Ambient humidity of less than 45 % or more than 85 %RH.
- Rapid changes in ambient temperature which may cause condensation.

- Locations where corrosive, inflammable or explosive gases, vapor or dust exist.
- 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.

4.2 Dimensions



4.3 Mounting Method

- Make sure the mounting panel is grounded before mounting RZB-001. If the mounting panel and RZB-001 do not share the same ground, isolate them electrically by inserting an insulation board.

Grounding condition:

- Resistance value: 10 Ω or less
- Grounding conductor: metal wire with tensile strength of 1.04 kN or more, or annealed copper wire of 2.6 mm or more in diameter

- Firmly fix the safety barrier on a mounting plate located in the hazardous area with M4 or M5 locking washer screws (at two locations) so as to meet the dimensions described in the dimensional outline drawing (*1). Customer must provide the set of screws.

Recommended tightening torque:

- M4 screw 0.8 N·m (8 kgf·cm)
- M5 screw 2.1 N·m (21 kgf·cm)

5. WIRING



WARNING

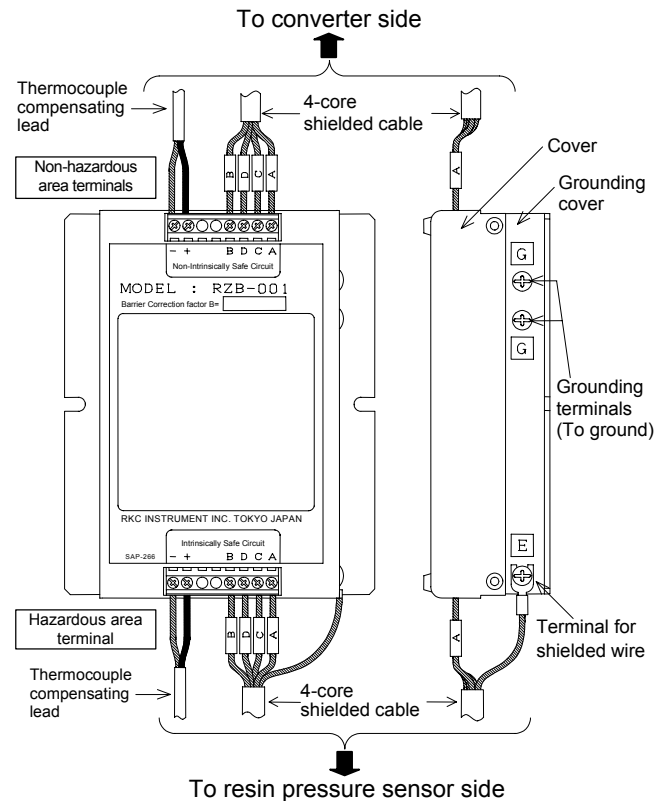
To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

5.1 Wiring Precautions

- Conduct wiring so that the safety barrier may not be affected by noise from high-voltage lines.
- Conduct wiring work such that the high performance of explosionproof is not lost.

- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- In order to prevent the instrument from malfunctioning, firmly connect each connector.

5.2 Terminal Configuration



■ Intrinsically safe circuit side terminals (terminals color: blue)

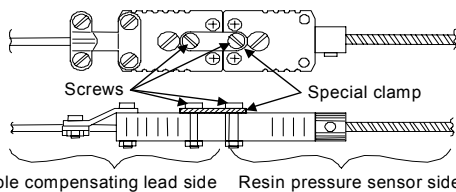
- A: Power supply circuit (Polarity +, color of lead covering material: red)
- C: Power supply circuit (Polarity –, color of lead covering material: brown)
- D: Signal circuit (Polarity +, color of lead covering material: blue)
- B: Signal circuit (Polarity –, color of lead covering material: black)
- +: Thermocouple circuit (Polarity +, color of lead covering material: red)
- : Thermocouple circuit (Polarity –, color of lead covering material: white)
- E: Shielded grounding terminal

■ Non-intrinsically safe circuit side terminals (terminals color: green)

- A: Power supply circuit (Polarity +, color of lead covering material: red)
- C: Power circuit (Polarity –, color of lead covering material: brown)
- D: Signal circuit (Polarity +, color of lead covering material: blue)
- B: Signal circuit (Polarity –, color of lead covering material: black)
- +: Thermocouple circuit (Polarity +, color of lead covering material: red)
- : Thermocouple circuit (Polarity –, color of lead covering material: white)

5.3 Wiring Method

- Grounding terminals (screw terminals denoted with "G") must be grounding separately.
[Recommended tightening torque: 0.8 N·m (8 kgf·cm)]
Grounding condition:
 - Resistance value: 10 Ω or less
 - Grounding conductor: metal wire with tensile strength of 1.04 kN or more, or annealed copper wire of 2.6 mm or more in diameter
- Firmly connect the A, B, C and D conductors extended from the cable (4-core shielded cable) on the resin pressure sensor side to the respective terminals on the intrinsically safe circuit side and also the A, B, C and D conductors extended from the cable (4-core shielded cable) on the converter side to the respective terminals on the non-intrinsically safe circuit side.
[Recommended tightening torque: 0.3 N·m (3 kgf·cm)]
- Firmly connect the shielding wire (screw terminals denoted with "E") to the shield of the resin pressure sensor cable on the intrinsically safe circuit side.
[Recommended tightening torque: 0.8 N·m (8 kgf·cm)]
- For the RZB-001N□ type, connect the thermocouple connector on the resin pressure sensor side and that on the compensating lead side with a special clamp as shown in the following Fig. and then firmly fix them with set screws.
[Recommended tightening torque: 0.3 N·m (3 kgf·cm)]



When connecting both thermocouple connectors, firmly fix them always with a special clamp. Otherwise the high performance of explosion-proof may not be displayed, thus resulting in an accident.

- Polarity exists in compensating leads (thermocouple circuit) on the intrinsically safe circuit and non-intrinsically safe circuit sides. Therefore, always check the polarity first, and then firmly connect the compensating leads to the safety barrier terminals on the intrinsically safe circuit and non-intrinsically safe circuit sides.

[Recommended tightening torque: 0.3 N·m (3 kgf·cm)]



For the RZB-001A□ type, as there is no built-in thermocouple circuit, no wiring of thermocouple compensating leads is required.

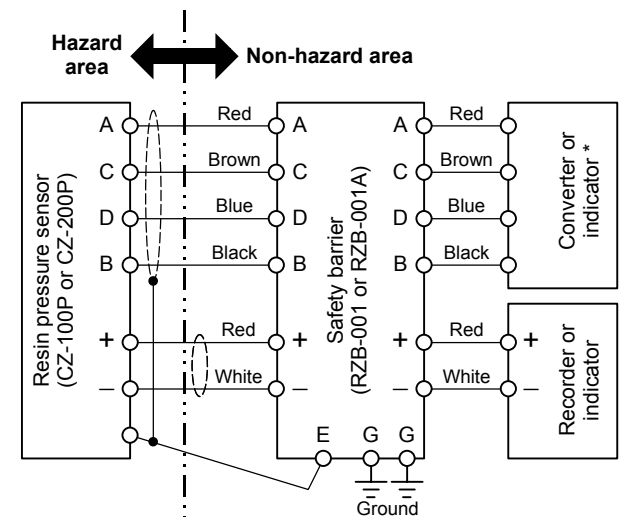
- Conduct wiring work so that the sum of inductance and capacitance between cables used for connecting the resin pressure sensor and the RZB-001 and between thermocouple compensating leads is less than the following numeric value.

Allowable inductance (Lw): 0.6 mH or less
Allowable capacitance (Cw): 0.1 μF or less



When a 4-core shielded cable specified by RKC (conductor cross-section: 0.5 cm²) is extended as long as 300 m, the inductance becomes about 0.6 mH. The inductance may exceed 0.6 mH with the cable bundled. Therefore, always use the cable without bundling it. In addition, the cable on the non-intrinsically safe circuit side (between the safety barrier and converter) has no limits on its length, allowable inductance and allowable capacitance.

Configuration diagram



*CT-300E, PCT-300E, REX-PG410 or REX-PG500

6. CORRECTION

For the RZB-001, its pressure indication error is corrected as follows. The following correction is made when the converter manufactured by RKC (the CT-300E, PCT-300E, REX-PG410 or REX-PG500) is used.

For the converter whose gain is adjusted using a variable resistor by connecting a resistor temporarily to the sensor bridge circuit, make the correction by multiplying the calibration voltage value by the reciprocal of the barrier correction factor B.

6.1 Correction of indication errors caused by safety barrier connection

A pressure indication error caused by the dispersion of RZB-001 internal resistance value is within about 1 % of span. However, when this error needs to be lessened further, make the correction, it 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

- The rated output after the correction is calculated from the following correction equation.

Barrier correction equation: $E_1 = B \times E_0$

B: Value of barrier correction factor B
E₀: Rated output of the resin pressure sensor
E₁: Rated output after the correction

- Set the value calculated in "1." to the gain setting portion of the converter *.

* Gain setting portion of the converter:

Converter	Gain setting portion
CT-300E	Rated Output Setter
PCT-300E	Gain Setter
REX-PG410	Gain setting
REX-PG500	Gain setting

Example:

Value of barrier correction factor B = 1.001
 Rated output of the resin pressure sensor = 1.234 mV/V

$$\begin{aligned} E_1 &= B \times E_0 \\ &= 1.001 \times 1.234 \\ &= 1.235 \end{aligned}$$

Rated output after the correction 1.235

Set 1.235 to the gain setting portion of the converter.

6.2 Correction of indication errors caused by extension of connection cable

Our resin pressure sensor is calibrated in a cable length of 5 m. Therefore, if the total extension length of the pressure sensor cables on the intrinsically safe circuit and non-intrinsically safe circuit sides exceeds 5 m, make the correction, if necessary.



For the cable in a total extension length of 50 m, a pressure indication fall of about 0.6 % of span may occur.

■ Correction procedure

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

Cable correction equation:

$$E_1 = \frac{1}{1 + 1.4 \times 10^{-4} (L - 5)} E_0$$

E_0 : Rated output of the resin pressure sensor

E_1 : Rated output after the correction

L: Cable length (m)

[However, when using our standard cable]

2. Set the value calculated in "1." to the gain setting portion of the converter*.

* Gain setting portion of the converter:

Converter	Gain setting portion
CT-300E	Rated Output Setter
PCT-300E	Gain Setter
REX-PG410	Gain setting
REX-PG500	Gain setting

Example:

Cable length (m) = 10 m
 Rated output of the resin pressure sensor = 1.234 mV/V

$$E_1 = \frac{1}{1 + 1.4 \times 10^{-4} (L - 5)} E_0$$

$$E_1 = \frac{1}{1 + 1.4 \times 10^{-4} (10 - 5)} \times 1.234$$

$$= 1.233$$

Rated output after the correction 1.233

Set 1.233 to the gain setting portion of the converter.



If the correction due to the dispersion of the safety barrier internal resistance (hereafter called the "barrier correction") and that due to the extension of the connection cable (hereafter called the "cable correction") need to be both made, take the following steps.



For the correction equation, refer to **6.1 Correction of indication errors caused by dispersion of safety barrier internal resistance values** and **6.2 Correction of indication errors caused by extension of connection cable**.

● When making the cable correction after the barrier correction

1. The rated output after the correction (E_1) is calculated from the barrier correction equation.
2. Calculate the rated output after the correction (E_1) by substituting the value calculated in "1." (E_1) for the rated output of the resin pressure sensor (E_0) in the cable correction equation.
3. Set the value calculated in "2." (E_1) to the gain setting portion of the converter.

● When making the barrier correction after the cable correction

1. The rated output after the correction (E_1) is calculated from the cable correction equation.
2. Calculate the rated output after the correction (E_1) by substituting the value calculated in "1." (E_1) for the rated output of the resin pressure sensor (E_0) in the barrier correction equation.
3. Set the value calculated in "2." (E_1) to the gain setting portion of the converter.

7. SPECIFICATIONS

Explosionproof construction:

Intrinsically safe explosionproof construction (i2G3)

Use rated *:

Power supply circuit	9 V	50 mA
Signal circuit	6 V	50 mA
Thermocouple circuit	6 V	50 mA

* This indicates the rating of a non-intrinsically safe circuit.

The intrinsically safe circuit rating becomes as follows when the intrinsically safe device (resin pressure sensor) is combined with the intrinsically safe related device (safety barrier).

Power supply circuit	3.0 V DC	16 mA
Signal circuit	±11 V DC	1 mA or less
Thermocouple circuit	−8 to +28 mV	3 mA or less

Rating for maintaining safety:

250 V AC 50/60 Hz, 250 V DC

Allowable inductance:

Wiring between the resin pressure sensor and safety barrier: 0.6 mH or less

Allowable capacitance:

Wiring between the resin pressure sensor and safety barrier: 0.1 μF or less

Allowable ambient temperature:

−10 to +40 °C

Allowable ambient humidity:

45 to 85 %RH (non-condensing)

Cover:

Iron (Coating)

Grounding cover:

Brass (Nickel plating)

Grounding condition:

Resistance value:

10 Ω or less

Grounding conductor:

metal wire with tensile strength of 1.04 kN or more,
or annealed copper wire of 2.6 mm or more in
diameter

Combined system:

The resin pressure sensor (the CZ-100P/CZ-200P) is combined with the safety barrier of intrinsically safe explosionproof construction (the RZB-001).

Corresponding converter:

CT-300E
PCT-300E
REX-PG410 (explosionproof type)
REX-PG500 (explosionproof type)

Dimensions:

112 (W) × 139.5 (H) × 43 (D) mm

Weight:

Approx. 850 g

The first edition: DEC. 2002 [IMQ00]
The third edition: NOV. 2009 [IMQ01]