
**User's
Manual**

PK200

**PK200
CURRENT-TO-PNEUMATIC
CONVERTER
[Style:S2]**

IM 21B3D1-01E

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Model PK200 Current-to-Pneumatic Converter	CMPL 21B3D1-01E

Revision Record

◆ INTRODUCTION

Thank you for purchasing the Current-to-Pneumatic Converter.

The Current-to-Pneumatic Converter is correctly calibrated at the factory before shipment. To ensure correct and efficient use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

■ Regarding This Manual

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instrument.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.

■ Safety Precautions

- For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety.

- For the intrinsically safe equipment and explosionproof equipment, in case the instrument is not restored to its original condition after any repair or modification undertaken by the customer, intrinsically safe construction or explosionproof construction is damaged and may cause dangerous condition. Please contact Yokogawa for any repair or modification required to the instrument.
- The following safety symbol marks are used in this Manual:



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.



NOTE

Draws attention to information essential for understanding the operation and features.

WARRANTY

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
 - In case of problems, the customer should contact the Yokogawa representative from which the instrument was purchased, or the nearest Yokogawa office.
 - If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
 - Responsible party for repair cost for the problems shall be determined by Yokogawa based on our investigation.
-
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
 - Improper and/or inadequate maintenance by the Purchaser.
 - Failure or damage due to improper handling, use or storage which is out of design conditions.
 - Use of the product in question in a location not conforming to the standards specified by the Yokogawa, or due to improper maintenance of the installation location.
 - Failure or damage due to modification or repair by the party except Yokogawa or who is requested by Yokogawa.
 - Malfunction or damage from improper relocation of the product in question after delivery.
 - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

1. HANDLING PRECAUTIONS

IMPORTANT

For installation, wiring and maintenance in hazardous areas, please follow 1.5 Installation of Intrinsically Safe Type, 1.6 Installation of Flameproof Type and “Installation and Operating Precautions for Jis Flameproof Equipment” at the end of this manual

The PK200 current-to-pneumatic converter is fully factory inspected before shipment. When the instrument is delivered, visually check the instrument and accessories to ensure that they are not damaged. This chapter describes the handling precautions, read them carefully before using the instrument.

For items other than those described in this chapter, see the relevant items.

If you wish to make inquiry, contact the distributor where you purchased the instrument or the nearest YOKOGAWA service station.

1.1 Checking the Model Suffix Code and Specifications

The data plate on the side face of the instrument base shows the model suffix code and specifications. With reference to the model suffix code and specifications in section 2.3, confirm that the instrument is as specified by the order.

For inquiry, inform us of the model suffix code and instrument serial number.

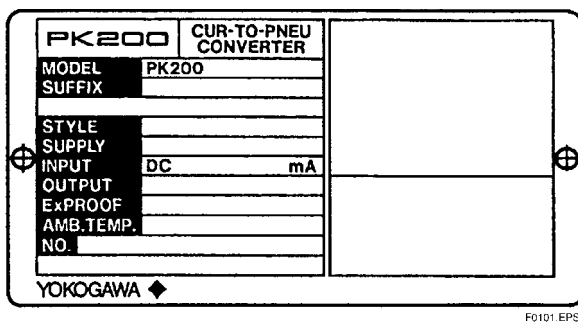


Figure 1.1 Data Plate for General-Use Type

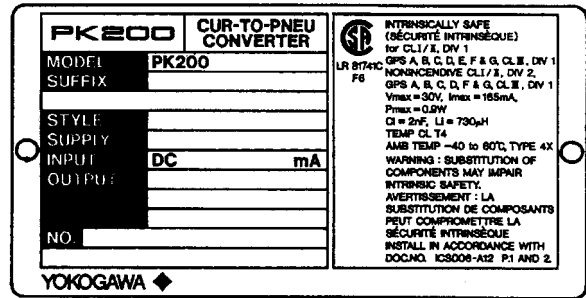


Figure 1.2 Data Plate for CSA Intrinsically Safe Type

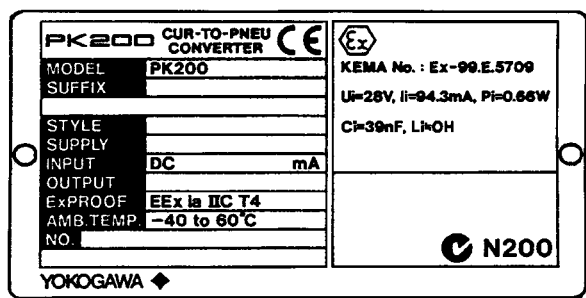


Figure 1.3 Data Plate for CENELEC Intrinsically Safe Type

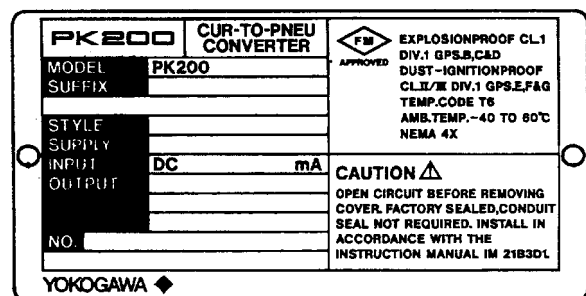


Figure 1.4 Data Plate for FM Explosionproof Type

1.2 Transportation Precautions

To prevent damage occurring during transportation, transport the converter in the original shipping container (box) with all packing items and equipment in its proper position.

1.3 Storage Precautions

- (1) Select a storage place :
 - Which is protected from rain and water.
 - Which is free from vibration and impact.
 - Whose temperature and humidity are as specified below. Room temperature and humidity (approx. 25°C and 65%) are more recommendable.
 - Temperature: -10 to 60°C
 - Humidity: Less than 80%
- (2) Store the converter in the packing condition of shipment from YOKOGAWA whenever possible.

1.4 Precautions for Installation Area

To use the converter stably for a long time, determine an installation place, taking into account the following.

(1) Ambient Temperature

Avoid installing the instrument in a place subject to a large temperature gradient and variations. If the instrument is subject to plant-generated heat radiation, take measures such as provision of heat protection and good ventilation.

(2) Atmospheric Conditions

Avoid installing the converter in corrosive atmosphere. Should it be used in corrosive atmosphere, make provision for maintaining good ventilation.

(3) Magnetic Field

Please contact us in the case this instrument is installed the strong Magnetic Field.

1.5 Installation of Intrinsically Safe Type

1.5.1 CSA Intrinsically Safe Type

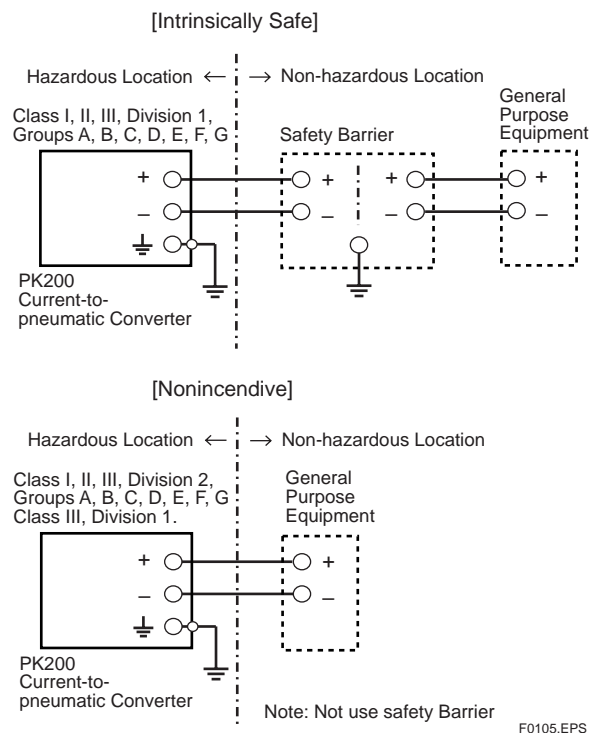


Figure 1.4 Installation of CSA Intrinsically Safe Type

1. PK200 current to pneumatic converter is applicable for use in hazardous locations:
 - Intrinsically Safe for Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations.
 - Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups F & G, and Class III, Division 1 Hazardous Locations.
 - Outdoor Hazardous Locations, Encl Type 4X.
 - Temperature Class: T4
 - Ambient Temperature: -40 to 60°C
2. Entity Parameters
 - Intrinsically safe apparatus parameters
 - $V_{max} = 30V$
 - $I_{max} = 165mA$
 - $P_{max} = 0.9W$
 - $C_i = 2nF$
 - $L_i = 730\mu H$
 - Associated apparatus parameters (CSA Certified Barriers)
 - $V_{oc} \leq 30V$
 - $I_{sc} \leq 165mA$
 - $P_{max} \leq 0.9W$

3. Installation

- Control equipment connected to barrier must not use or generate more than 250 Vrms or Vdc.
- The safety barrier must be CSA certified.
- Associated apparatus manufacturer’s installation drawing must be followed when installing this apparatus.
- The maximum power delivered from the barrier must not exceed 0.9 W.
- Note a warning label worded “SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY” and “INSTALL IN ACCORDANCE WITH DOC. NO. ICS006-A12 P.1 AND 2”.

1.5.2 CENELEC (KEMA) Intrinsically Safe Type

Caution for CENELEC (KEMA) Intrinsically safe type

1. The model PK200/KS1 for potentially explosive atmospheres:

- Type of Protection: EEx is IIC
- Temperature Class: T4
- Ambient Temperature: -40 to 60°C

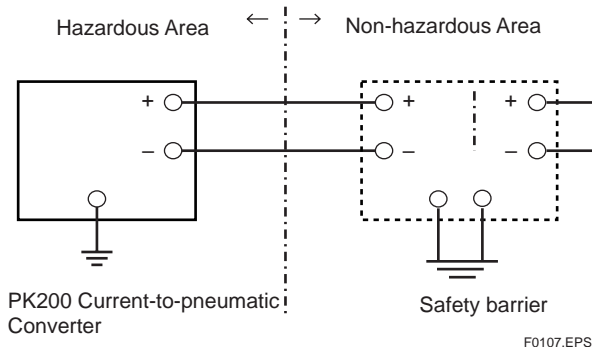
2. Electrical Data

Maximum Input Voltage U_i : 28V
 Maximum Input Current I_i : 94.3mA
 Maximum Input Power P_i : 0.66W
 Maximum Internal Capacitance C_i : 0.39nF
 Maximum Internal Inductance L_i : Negligibly Small

3. Installation

Refer to the installation diagram. All wiring shall comply with local installation requirements.

[Installation Diagram]



NOTE

In any safety barriers used, output current must be limited by a resistor 'R' such that $I_o = U_o/R$.

4. Maintenance and Repair

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void KEMA intrinsically safe Certification.

1.5.3 JIS Intrinsically Safe Type

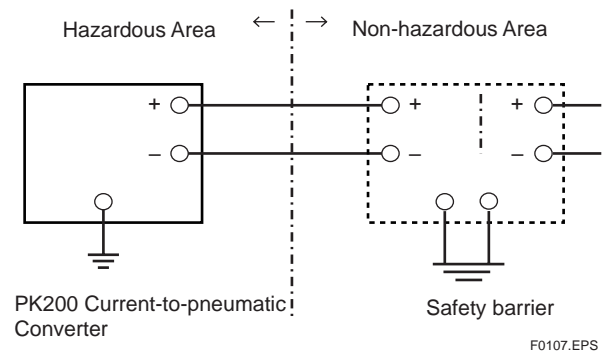
The model PK200/JS3 current-to-pneumatic converters, which have obtained certification according to technical criteria for explosion-protected construction of electric machinery and equipment (Standards Notification No.556 from the Japanese Ministry of Labor) conforming to IEC standards, is designed for hazardous areas where explosive gases and/or inflammable vapors may be present. (This allows installation in Division 0, 1 and 2 areas)

To preserve the safety of flameproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Users absolutely must read the following instructions and “Installation and Operating Precautions for JIS Intrinsically Safe Equipment (EX - A03E)” at the end of this manual.

1. Installation

The PK200 Current-to-Pneumatic Converter should be used in connection with the certified safety barrier as shown below. All wiring shall comply with local installation requirements.

[Installation Diagram]



2. Temperature

Install the PK200, So that any part of the instrument that may exposed to the inflammable gas or vapor would not exceed the temperature 60°C

3. Safety Barrier

Use the certified safety barrier that satisfies the following requirements.

- Safety Ratings
Maximum output voltage: 28V or less
Maximum output current: 94.3mA or less
Maximum output power: 0.66W or less
- Protection type and group
Protection type: ia Group: IIC
- Allowable inductance and capacitance
Maximum_external inductance: More than the external wiring inductance
Maximum_external capacitance: More than the sum of the external wiring capacitance and 39nF

Table 1.1 Recommended Safety Barrier
Contact each supplier for the details of the barrier.

Supplier	Type	Model
MTL	Isolated type	MTL5046
P+F	Isolated type	KFD2-SCD-Ex1.LK*

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- * To connect this barrier with PK200 converter, for the connection between the barrier and the controller, use the terminal #7 and #9 of the barrier.

1.6 Installation of Flameproof Type

1.6.1 JIS Flameproof Type

The model PK200/JF3 current-to-pneumatic converters, which have obtained certification according to technical criteria for explosion-protected construction of electric machinery and equipment (Standards Notification No.556 from the Japanese Ministry of Labor) conforming to IEC standards, is designed for hazardous areas where explosive gases and/or inflammable vapors may be present. (This allows installation in Division 1 and 2 areas)

To preserve the safety of flameproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Users absolutely must read “Installation and Operating Precautions for JIS Flameproof Equipment (EX - B03E)” at the end of this manual.

1.6.2 FM Explosionproof Type

Following items are described in the instruction documents of this instrument to ensure certified explosionproof properties.

1. PK200 Current to Pneumatic Converter is applicable for use in hazardous areas;
 - * Explosionproof for Class I, Division 1, Groups B, C and D.
 - * Dust ignitionproof for Class I/II, Division 1, Groups E, F and G.
 - * Outdoor hazardous locations, NEMA 4X.
2. Wiring
 - * All wiring shall comply with National Electrical Code ANSI/NEPA70 and Local Electrical Codes.
 - * When installed in Division 1, “FACTORY SEALED, CONDUIT SEAL NOT REQUIRED”. However, in case of installing a sealing fitting (option) for waterproof or other purposes, see 4.2.2(6).
3. Operation
 - * **WARNING: OPEN CIRCUIT BEFORE REMOVING COVER.**
FACTORY SEALED, CONDUIT SEAL NOT REQUIRED.
INSTALL IN ACCORDANCE WITH THE INSTRUCTION MANUAL IM 21B3D1-01E
 - * Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.
4. Maintenance and Repair
 - * The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Explosionproof Certification.

2. OVERVIEW

2.1 Functional Description

The PK200 current-to-pneumatic converter is a signal converter that receives an electronic controller or DCS control signal and converts it into a pneumatic pressure signal.

2.2 Standard Specifications

Materials: Case: Aluminum die-cast
 Paint: Polyurethane resin-baked finish
 Paint color: Deep-sea moss-green (Munsell 0.6GY3.1/2.0 or equivalent)
 Pressure Gauge Case: Stainless steel JIS SUS304

Input Signals: 4 to 20mA DC or 10 to 50mA DC

Input Resistance: PK200 is not a constant resistor.

Equivalent circuit of PK200 is shown in Fig. 2.1

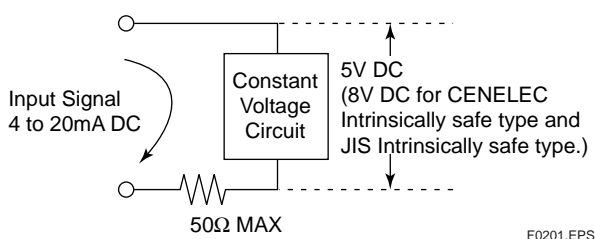


Fig. 2.1 Equivalent Circuit

Operating Voltage: Min. 5.1V DC (at 4mA)
 (Min 8.1V DC for CENELEC/JIS Intrinsically Safe type)
 Max. 6V DC (at 20mA)
 (Max. 9V DC for CENELEC/JIS Intrinsically Safe type)

Output Signals:

Output Signal	Standard Output		Doubled Output		Recommended Supply Air Pressure *1	Supply Air Pressure Gauge Scale *1
	Output Signal	Pressure Gauge Scale	Output Signal	Pressure Gauge Scale		
Pa calibration	20 to 100kPa	0 to 200kPa	40 to 200kPa	0 to 400kPa	130 to 150kPa	0 to 200kPa
					230 to 260kPa	0 to 400kPa
kgf/cm ² calibration	0.2 to 1.0 kgf/cm ²	0 to 2kgf/cm ²	0.4 to 2.0 kgf/cm ²	0 to 4kgf/cm ²	1.3 to 1.5kgf/cm ²	0 to 2kgf/cm ²
					2.3 to 2.6kgf/cm ²	0 to 4kgf/cm ²
Bar calibration	0.2 to 1.0bar	0 to 2bar	0.4 to 2.0bar	0 to 4bar	1.3 to 1.5bar	0 to 2bar
					2.3 to 2.6bar	0 to 4bar
P calibration	3 to 15psi	0 to 30psi	6 to 30psi 3 to 27psi	0 to 60psi	19 to 22psi	0 to 30psi
					33 to 37psi	0 to 60psi

*1: Set supply air pressure in the range given in the upper column for standard output and in the range given in the lower column for multiplied pressure output.

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I/O Action: Output pressure increases as input increases.

Manual Operation: Available using auto/manual (A/M) transfer switch (Optional)

Zero Point Adjusting Range: Within 0 to ±10% of span

Span Adjusting Range: Within 0 to 25% of span

Air Consumption: 4Nl/min maximum (for a supply air pressure of 140kPa)

Max. Air Delivery: 110Nl/min maximum (for a supply air pressure of 140kPa)

Minimum Load Capacity:
1m copper tube with 4mm I.D. +20cc

Ambient Temperature:
-40 to 80°C (for general use)
-20 to 60°C (JIS Explosionproof, JIS Intrinsically safe, CENELEC Intrinsically Safe type)
-40 to 60°C (for FM Explosionproof type)

Water Proof Construction: Complies with JIS C 0920 immersionproof type
IEC IP54
NEMA type 3

Intrinsically Safe Construction:
CSA Intrinsically Safe: Intrinsically Safe for Class I, Division 1, Groups A, B, C & D
Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations.
Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups F & G, and Class III, Division 1 Hazardous Locations.

Outdoor Hazardous Locations, Encl Type 4X.

Temperature Class: T4

CENELEC Intrinsically Safe:

Intrinsically Safe EEx ia IIC T4

JIS Intrinsically Safe:

Intrinsically Safe Ex ia IIC T4

Explosionproof Construction:

JIS Explosionproof: Flameproof Exd II B+H₂ T6X

FM Explosionproof: Explosionproof for Class I,

Division 1, Groups B, C and D.

Dust ignitionproof for Class II/III,

Division 1, Groups E, F and G.

Temperature Class: T6.

Outdoor hazardous locations, NEMA 4X.

Dustproof Construction: IEC IP54

Connections:

Air Connection: Rc1/4 or 1/4NPT female

Electrical Connection: G1/2, G3/4 female or

1/2NPT, 3/4NPT female

Mounting: Vertical or horizontal 50mm (2-

INCH) pipe mounting

Wall mounting

Mass (weight): 2.8kg (6.1lb)

Accuracy: ±0.5%

Linearity: ±0.2%

Hysteresis: Less than 0.2%

Repeatability: 0.1%

2.4 Options

- Option Code/JF3: JIS Flameproof
JIS flameproof Exd II B+H₂ T6X
- Option Code/G11: Packing adapter for JIS Flameproof
Electrical connection: G1/2 female, Applicable cable O.D.: 8 to 12mm
- Option Code/G21: Packing adapter for JIS Flameproof
Electrical connection: G3/4 female, Applicable cable O.D.: 10 to 16mm
- Option Code/FF1: FM Explosionproof
Explosionproof for Class I, Division 1, Groups B, C and D.
Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
Outdoor hazardous locations, NEMA 4X.
Temperature Class: T6
- Option Code/KS1: CENELEC (KEMA) Intrinsically safe
CENELEC Intrinsically safe EEx ia IIC T4
Applicable only with input signal code-A.
- Option Code/JS3: JIS Intrinsically Safe
JIS Intrinsically safe Ex ia IIC T4
Applicable only with input signal code-A.

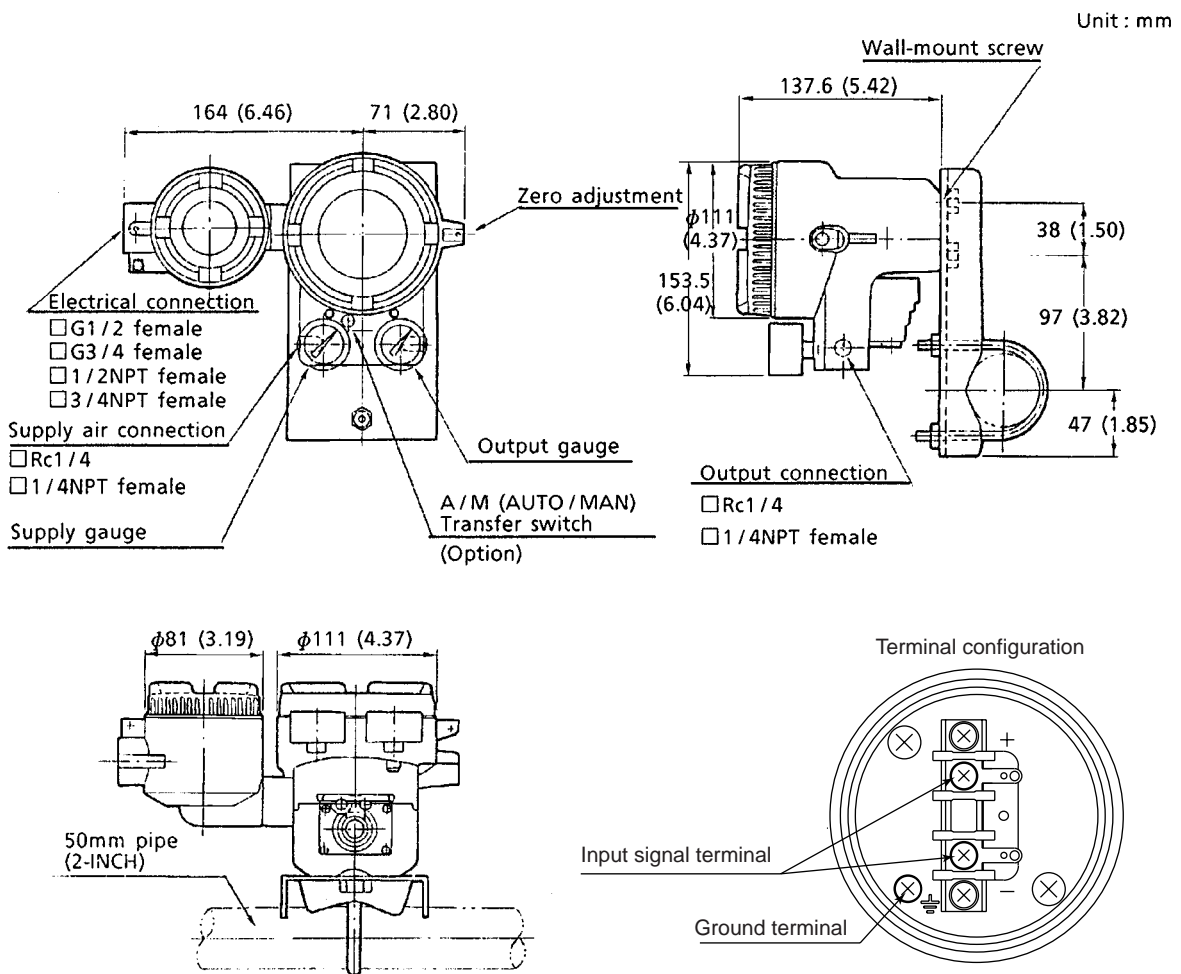
2.3 Model and Suffix Codes

Model	Suffix Code	Description
PK200	
Input Signal	-A -C	4 to 20mA DC 4 to 20mA/10 to 50mA DC selection type
Output Signal	1 2 3 4 5 6 7 8 9	Output signal Pa calibration 20 to 100kPa scale 0 to 200kPa Output signal Pa calibration 40 to 200kPa scale 0 to 400kPa Output signal kgf/cm ² calibration 0.2 to 1.0 kgf/cm ² scale 0 to 2kgf/cm ² Output signal kgf/cm ² calibration 0.4 to 2.0 kgf/cm ² scale 0 to 4kgf/cm ² Output signal bar calibration 0.2 to 1.0kPa scale 0 to 2bar Output signal bar calibration 0.4 to 2.0kPa scale 0 to 4bar Output signal P calibration 3 to 15psi scale 0 to 30Psi Output signal P calibration 6 to 30psi scale 0 to 60Psi Output signal P calibration 6 to 27psi scale 0 to 60Psi
Connections	1 2 3 4	Air connection: Rc 1/4, Electrical connection: G1/2 female Air connection: Rc 1/4, Electrical connection: G3/4 female Air connection: 1/4 NPT female, Electrical connection: 1/2NPT female Air connection: 1/4 NPT female, Electrical connection: 3/4NPT female
Option	/□	See section 2.4.

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- Option Code/CS1: CSA Intrinsically Safe Intrinsically Safe for Class I, Division 1, Groups A, B, C & D Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations. Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups F & G, and Class III, Division 1 Hazardous Locations. Outdoor Hazardous Locations, Encl Type 4X. Temperature Class: T4
- Option Code/SCF-□: Special Color Finished on converter cover
Allows the paint color of only a converter cover to be selectable by specifying the color in the specification item with reference to GS22D1F1.
- Option Code/X1: Epoxy Paint
Epoxy resin-baked coating.
- Option Code/L: Lighting Protector
Installed in the terminal box to protect internal circuitry from high voltage surges such as those caused by lighting induced.
- Option Code/AM: AUTO/MANUAL Switch
Mounted on front of housing, in manual mode, output signal is varied by adjusting the external supply pressure regulator.
- Option Code/GW: Double Scale Pressure Gauge
Double scales are Pa and kgf/cm².
- Option Code/SS: Stainless Steel Screw and Bracket
Screw and bracket, both are made of stainless steel.
- Option Code/RA: Reverse Action
Increasing of input signal to make output pressure decrease.

2.5 External Dimensions

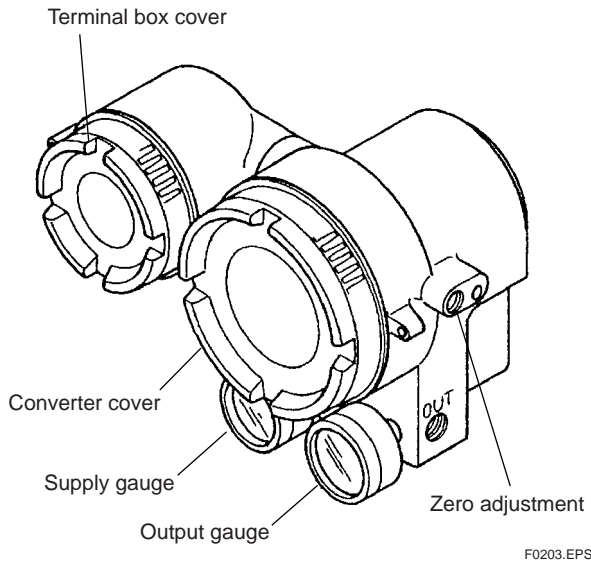


* Show INCH equivalents as (××.××)

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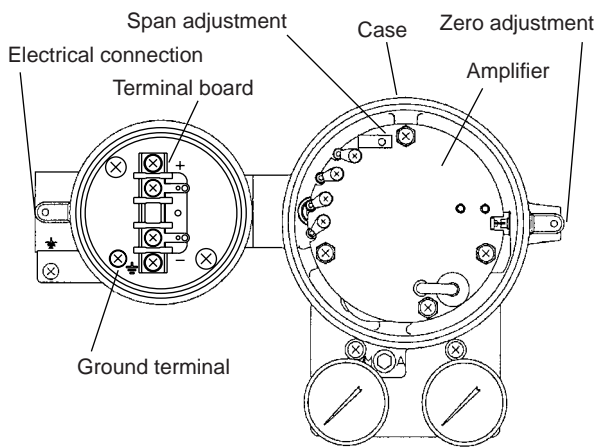
Figure 2.2 External Dimensions

2.6 Part Names



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Figure 2.3 Part Names (1)



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Figure 2.4 Part Names (2)

3. INSTALLATION

3.1 Overview

When installing the PK200 converter, see section 1.4 “Precautions for Installation Area.” For the ambient environmental conditions of an installation place, see section 2.2 “Standard Specifications.”

3.2 Installation

PK200 can be installed on a pipe using a mounting bracket provided or directly installed on the wall. Select either method, taking into account the installation space and service method.

3.2.1 Pipe Mounting

When this instrument is mounted on a pipe, use the mounting bracket and U-bolt provided. The pipe dia. available is 50mm (2-INCH) and the instrument can be installed on either a horizontal or vertical pipe.

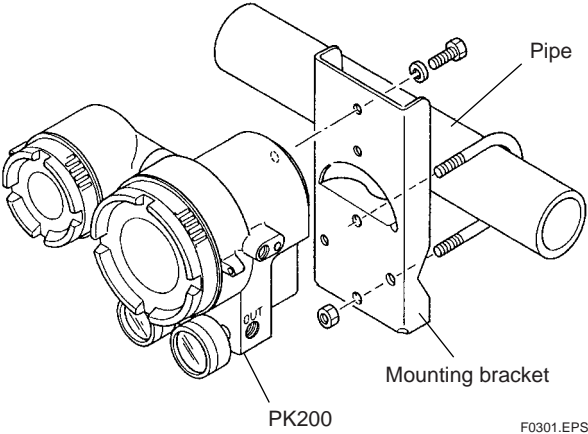


Figure 3.1 Pipe Mounting

3.2.2 Wall Mounting

When the instrument is installed on the wall, use the two M8 screws provided.

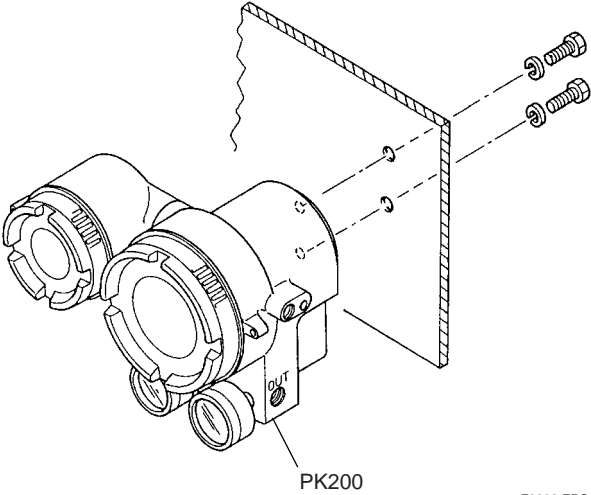


Figure 3.2 Wall Mounting

4. WIRING AND PIPING

4.1 Piping

4.1.1 Supply Air

For easy operation and maintenance, supply air must be clean and dry.



IMPORTANT

Thoroughly study selection of an air supply system, supply air suction point, installation of the header, and air supply piping so that no water, oil, or dust is carried into the current-to-pneumatic converter via the piping.

Table 4.1 shows the air supply pressure for this instrument.

For air consumption, see the standard specifications.

Table 4.1 Recommended Supply Air Pressure

Output Signal Code	Output Signal	Supply Air Pressure
1	20 to 100kPa	130 to 150kPa
2	40 to 200kPa	230 to 260kPa
3	0.2 to 1.0kgf/cm ²	1.3 to 1.5kgf/cm ²
4	0.4 to 2.0kgf/cm ²	2.3 to 2.6kgf/cm ²
5	0.2 to 1.0bar	1.3 to 1.5bar
6	0.4 to 2.0bar	2.3 to 2.6bar
7	3 to 15psi	19 to 22psi
8	6 to 30psi	34 to 37psi
9	3 to 27psi	34 to 36psi

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4.1.2 Air Supply Piping

Connect air supply piping to the supply pressure connection **[SUP]** of the converter.

Generally, use copper tubes of 6mm O.D. and 4mm I.D., air piping, and coupling to install air supply piping. After installing the piping, check for leakage.

4.1.3 Output Piping

Connect output air piping to the output connection **[OUT]** of the converter.

Generally, use copper tubes of 6mm O.D. and 4mm I.D., air piping, and coupling to install output air piping. After installing the piping, check for leakage.

4.2 General-Use and Flameproof Type Wiring

4.2.1 Cable Selection

- (1) Use twisted wires or cables with performance equal to or better than that of 600V vinyl-insulated cables (JIS C 3307) for wiring cables.
- (2) Use shielded cables for wiring in a place susceptible to noise influence.
- (3) For wiring in an area where high or low ambient temperatures exist, use wires or cables that meet service environment requirements.



IMPORTANT

If the PK200 is flameproof and the ambient temperature is 50°C or more, use an external cable having a maximum allowable heat resistance of at least 70°C in consideration of the instrument's generation of heat or the cable's self-heating.

- (4) For use in an atmosphere where harmful gas, liquid, oil, or solvent exists, use wires or cables with materials sufficiently durable to such substances.

4.2.2 Wiring

- (1) Install wiring away from noise sources such as a large capacity transformer, motor, or power supply.
- (2) Remove terminal box cover and wiring connection dustproof plugs, then connect wiring.
Using an Allen wrench (width 3mm), unscrew the locking setscrew and remove the flameproof cover. Then, connect the wiring and when installing the cover, do not neglect to fasten shrouding metal.
- (3) It is recommended that clip-on terminals R1.25-5 or R2-5 be used for wiring termination (JIS C 2805).
- (4) It is also recommended that wiring be installed in conduits and ducts to provide protection against water or external damage. For flameproof external wiring, see 1.6 Installation of Flameproof Type” and “INSTALLATION AND OPERATING PRECAUTIONS FOR JIS FLAMEPROOF EQUIPMENT” at the end of this manual.
- (5) When installing a flameproof gland packing adapter (option code: /G11 and /G21) for cable wiring, observe the following steps.
 - a. Release the shrouding metal and remove the terminal box cover.
 - b. Measure the outside dia. of the cables to be used in two directions in 0.1mm unit.
 - c. Obtain the average value of the measured values in two directions and select a gland packing whose inner dia. is nearest to the average value from among those in Table 4.1.
 - d. Screw the flameproof packing adapter into the terminal box until the O-ring touches the terminal box wiring port (at least 6 full turns), and tighten the lock nut.
 - e. Insert the cable through the union cover, the union coupling, the clamp nut, the clamp ring, the gland, one washer, the rubber packing, and the packing box, in that order.
 - f. Insert the end of the cable into the terminal box.
 - g. Tighten the grand to grip the cable. When tightening the union cover, tighten approximately one turn past the point where the cable will no longer move up and down.
Proper tightening is important. If it is too tight, a circuit break in the cable may occur; if not tight enough, the flameproof effectiveness will be compromised.



CAUTION

Tighten the grand approximately one turn after the point where you can no longer shift the cable up and down by hand.

Take great care in this step, since proper tightening is very important.

- h. Fasten the cable with tightening the clamp nut.
- i. Tighten the lock nut on the union cover.
- j. Connect the cable wires to each terminal.

Table 4.2 Type of Packing and Applicable Cable O.D.

Wiring port thread diameter	Appropriate cable outer diameter (mm)	Identifying mark	Part Number
G1 / 2	8-10 10.1-12	16 8-10 16 10-12	G9601AM
G3 / 4	10-12 12.1-14 14.1-16	22 10-12 22 12-14 22 14-16	G9601AN

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- (6) Install a sealing fitting (option) to be used for metal conduit lines, in the following order.
 - a. Assemble a sealing fitting into the instrument.
Apply sealing compound to the nipple provided and screw in the nipple by seven to eight turns, then fix it with a lock nut.
 - b. Install wiring using insulated wires and provide a compound filling chamber of inorganic material by using sealing dams. (See Figure 4.5.)
 - c. Fill sealing compound from the compound filling port until the fitting is filled with the compound.
Example of sealing compound
Shimada Electric (1kg can)
For FG5: Approx. 100g/P. filling
For FG6: Approx. 115g/P. filling
 - d. After the compound has been sufficiently softened, screw the plug into the filling port.
 - e. Connect a metal conduit for piping (JIS C 8305) or explosion-proof flexible fitting to the sealing fitting by engaging five or more threads.
 - f. For the details of sealing, see 3.3.2.3 in the “Recommended Practice of Explosion-Protected Electrical Installations in General Industries” published by the Industrial Safety Institute, Ministry of Labor (Japan).

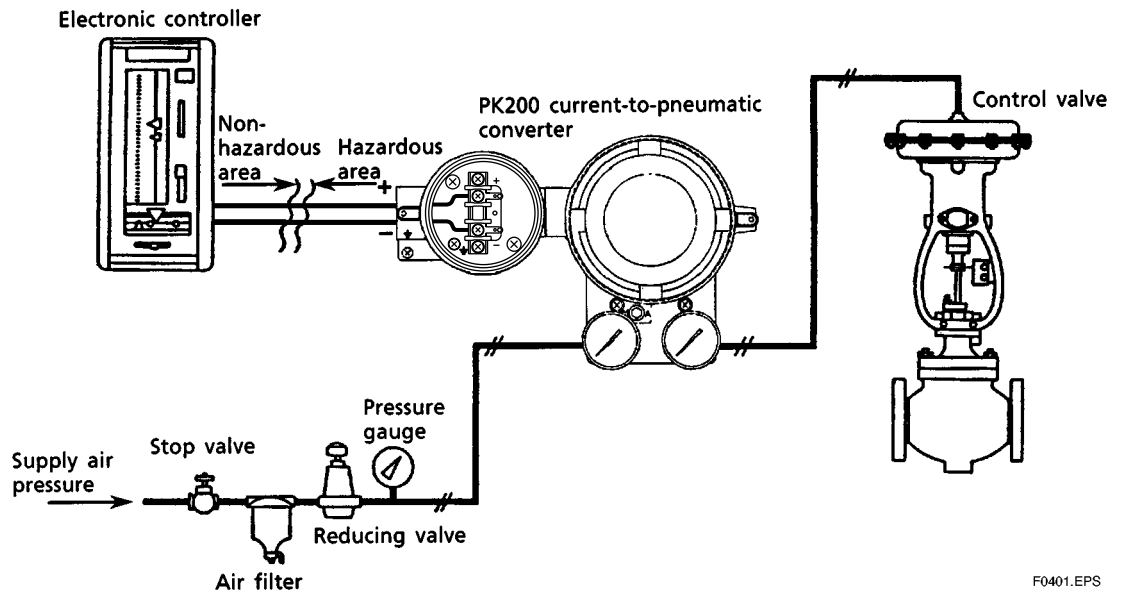


Figure 4.1 General-Use and Flameproof Type Wiring

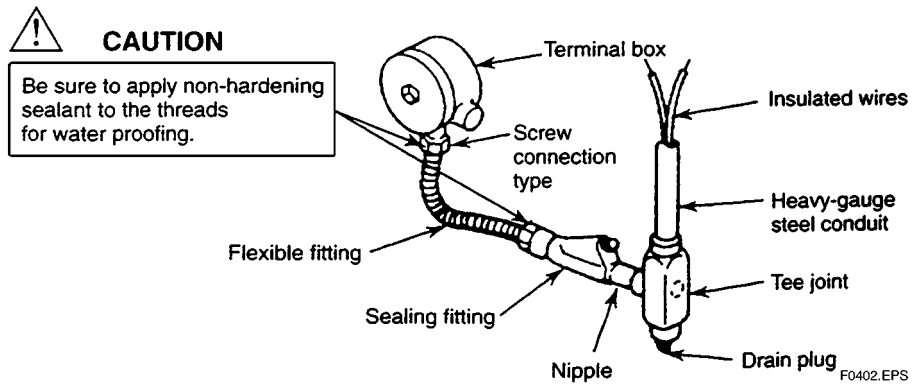


Figure 4.2 Flameproof Metal Conduit Wiring

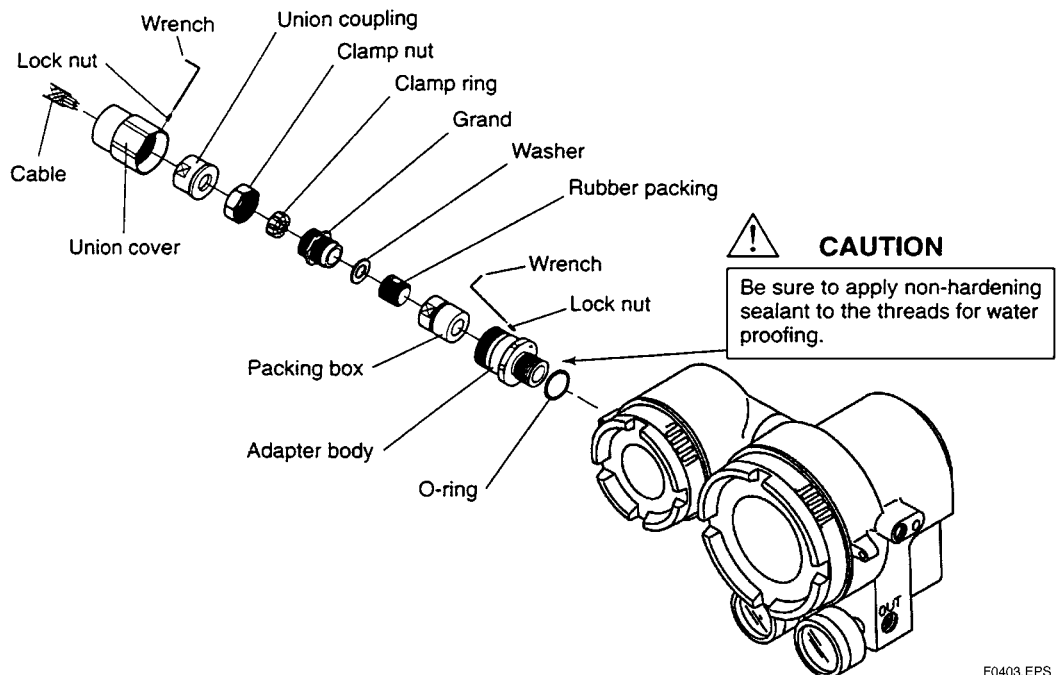


Figure 4.3 Flameproof Gland Packing Installation (Option code: /G11 and /G21)

4.2.3 Grounding

- (1) Provide grounding with a ground resistance of 100Ω.
- (2) Grounding terminals are provided inside and outside of the terminal box. Use either terminal.
- (3) Use 600V PVC insulated wire for grounding wiring.

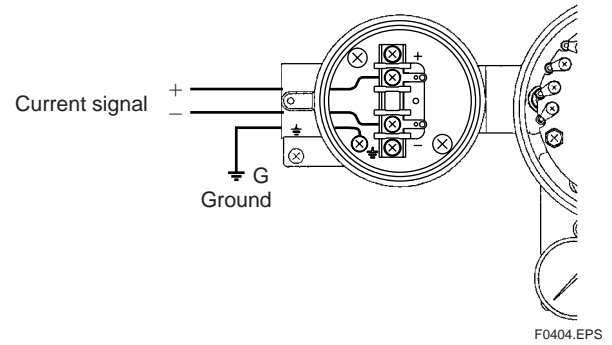


Figure 4.4 Wiring

4.3 Intrinsically Safe Type Wiring

The wiring of the intrinsically safe circuit between the converter and the safety barrier must be kept routed with sufficient physical separation from other circuits so as not to be affected by electromagnetic induction, etc., and should be implemented using metallic conduit or shielded cable.

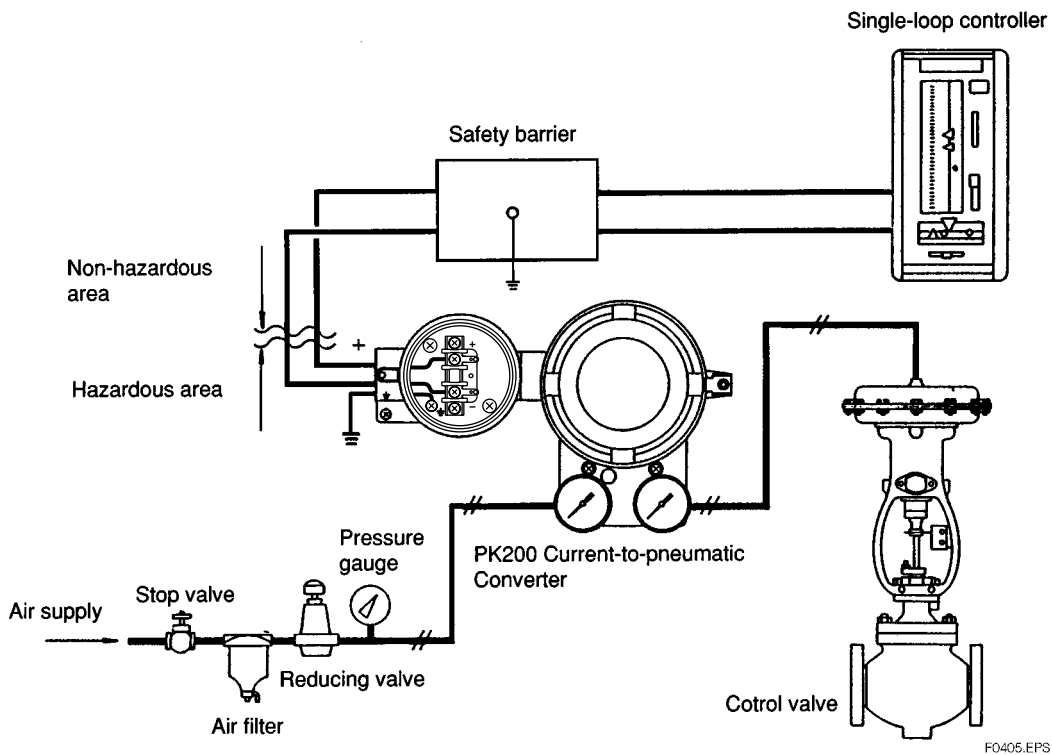


Figure 4.5 Intrinsically Safe Type Wiring

5. OPERATION

5.1 Auto/Manual (A/M) Transfer Mechanism

Please refer to following instruction for the model with A/M selector switch (optional code: /AM).

For the model without A/M selector switch, please go to section 5.2.

Use of A/M transfer mechanism requires that a supply pressure adjusting reducing valve be installed.

- (1) Set the A/M selector switch provided at the front (on the supply air pressure gauge side) of the converter to "M." (Turn the switch clockwise.)
- (2) This allows supply air pressure to be output, which is supplied to the control valve.
- (3) Output air pressure can be regulated using the supply air pressure reducing valve. (Output to the control valve can be read by the output pressure gauge attached to the converter. Pressure gauge minimum unit is 20kPa (0.2kgf/cm².)

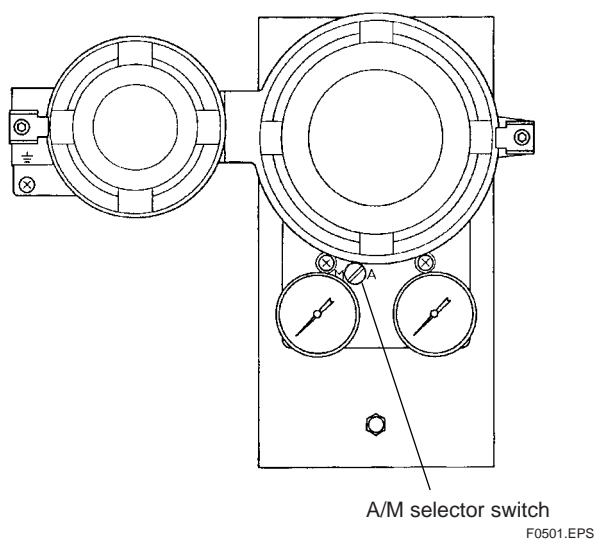


Figure 5.1 Auto/Manual Transfer Mechanism

5.2 Zero Point Adjustment

- (1) For the model with A/M selector switch, please set the A/M selector switch to A (Auto). (Turn the switch counterclockwise.)
- (2) Apply supply air pressure to the current-to-pneumatic converter.
For supply air pressure, see the data plate or Table 5.1 "Supply Air Pressure."
Standard output applies for model suffix output signal code "1, 3, 5, 7" and multiplied pressure output for model suffix output signal code "2, 4, 6, 8, 9."

Table 5.1 Recommended Supply Air Pressure

Output Signal Code	Output Signal	Supply Air Pressure
1	20 to 100kPa	130 to 150kPa
2	40 to 200kPa	230 to 260kPa
3	0.2 to 1.0kgf/cm ²	1.3 to 1.5kgf/cm ²
4	0.4 to 2.0kgf/cm ²	2.3 to 2.6kgf/cm ²
5	0.2 to 1.0bar	1.3 to 1.5bar
6	0.4 to 2.0bar	2.3 to 2.6bar
7	3 to 15psi	19 to 22psi
8	6 to 30psi	34 to 37psi
9	3 to 27psi	34 to 36psi

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- (3) Then input an input signal.
Input a 0% electric signal.
Apply 4mA for 4 to 20mA input or 10mA for 10 to 50mA input.
- (4) Make zero point adjustment so that the output air pressure reaches the specified pressure.
For output air pressure, see the data plate or Table 5.2 "Output Signals."
To increase output air pressure, turn the zero adjustment clockwise. To decrease the pressure, turn the zero adjustment counterclockwise. (See Figure 5.2.)
For the model with reverse action (/RA), please turn zero adjustment counterclockwise to increase output air pressure. To decrease output air pressure, please turn zero adjustment clockwise.

<Example: 20 to 100Pa output signal for 4 to 20mA input signal>

Adjust the zero adjustment so that an output signal of 20kPa is obtained when a 4mA input signal is applied.

Table 5.2 Output Signals

Output Signal Code	Output Signal
1	20 to 100kPa
2	40 to 200kPa
3	0.2 to 1.0kgf/cm ²
4	0.4 to 2.0kgf/cm ²
5	0.2 to 1.0bar
6	0.4 to 2.0bar
7	3 to 15psi
8	6 to 30psi
9	3 to 27psi

T0502.EPS

5.3 Calibration



CAUTION

Always perform calibration in a non-hazardous area.

- (1) For the model with A/M selector switch, please set the A/M selector switch to A (Auto). (Turn the switch counterclockwise.)
- (2) Remove the converter cover.



WARNING

For flameproof specifications or intrinsically safe explosion-proof specifications, first conduct a gas detector check to confirm that there is no explosive gas in the area.

- (3) Apply supply air pressure to the current-to-pneumatic converter.
For supply air pressure, see the data plate or Table 5.3 "Supply Air Pressure."
Standard output applies for model suffix output signal code "1, 3, 5, 7" and multiplied pressure output for model suffix output signal code "2, 4, 6, 8, 9."

Table 5.3 Recommended Supply Air Pressure

Output Signal Code	Output Signal	Supply Air Pressure
1	20 to 100kPa	130 to 150kPa
2	40 to 200kPa	230 to 260kPa
3	0.2 to 1.0kgf/cm ²	1.3 to 1.5kgf/cm ²
4	0.4 to 2.0kgf/cm ²	2.3 to 2.6kgf/cm ²
5	0.2 to 1.0bar	1.3 to 1.5bar
6	0.4 to 2.0bar	2.3 to 2.6bar
7	3 to 15psi	19 to 22psi
8	6 to 30psi	34 to 37psi
9	3 to 27psi	34 to 36psi

T0503.EPS

- (4) Then input a 0% input signal.
Apply 4 mA for 4 to 20mA input or 10mA for 10 to 50mA input.
Control the zero adjustment so that the output air pressure reaches the specified pressure.
For 0% output air pressure, see the data plate or Table 5.4 "Output Signals."
To increase output air pressure, turn the zero adjustment clockwise. To decrease the pressure, turn the zero adjustment counterclockwise.
For the model with reverse action (/RA), please turn zero adjustment counterclockwise to increase output air pressure. To decrease output air pressure, please turn zero adjustment clockwise.

Table 5.4 Output Signals

Output Signal Code	Output Signal
1	20 to 100kPa
2	40 to 200kPa
3	0.2 to 1.0kgf/cm ²
4	0.4 to 2.0kgf/cm ²
5	0.2 to 1.0bar
6	0.4 to 2.0bar
7	3 to 15psi
8	6 to 30psi
9	3 to 27psi

T0504.EPS

- (5) Input a 100% input signal.
Apply 20mA for 4 to 20mA input or 50mA for 10 to 50mA input.
Control the zero adjustment so that the output air pressure reaches a specified pressure.
For 100% output air pressure, see the data plate or Table 5.2 "Output Signals." (See Figure 5.3.)
To increase output air pressure, please turn span adjustment clockwise. To decrease output air pressure, please turn span adjustment counterclockwise. (See Figure 5.3.)

For the model with reverse action (/RA), please turn span adjustment counterclockwise to increase output air pressure. To decrease output pressure, please turn span adjustment clockwise.

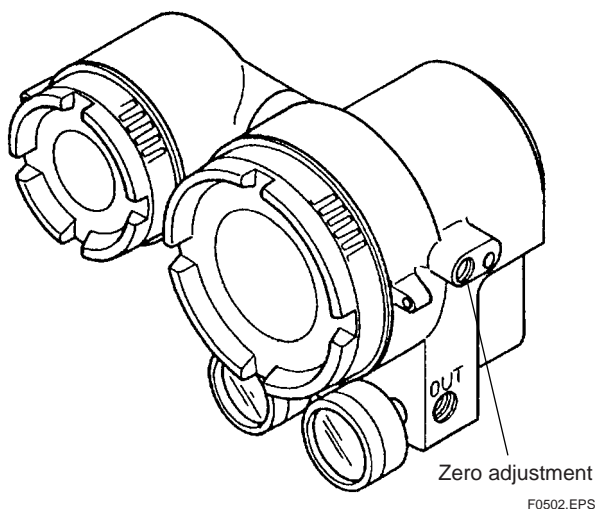


Figure 5.2 Zero Point Adjustment Mechanism

(9) After completing adjustments, change the input signal to 0%, 25%, 50%, 75%, and 100% and confirm if the specified output is reached at the relevant input.

Confirm the accuracy with reference to the input and output signal reference values given in Table 5.5 “Input and Output Signals.”

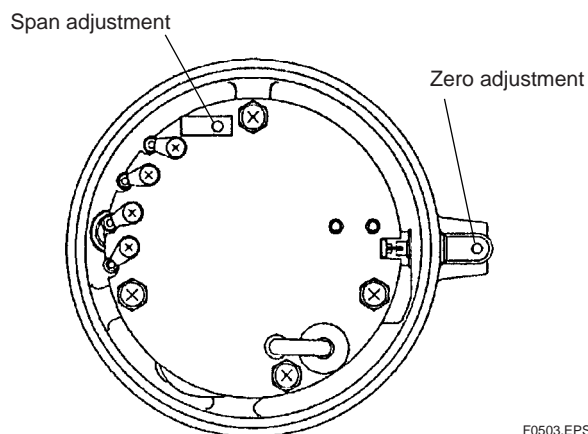


Figure 5.3 Span Adjustment Mechanism

- (6) Input a 0% input signal.
Confirm if 0% output air pressure reaches the specified pressure. If not, make zero point adjustment.
- (7) Input a 100% input signal
Confirm if 100% output air pressure reaches the specified pressure. If not, make span adjustment.
- (8) Repeat steps (6) and (7) two to three times to adjust the zero point and span.

<Example: For 20 to 100 kPa output signal at 4 to 20 mA input signal>

Calibrate the input and output signals with reference to Table 5.6. Accuracy should be within ±0.5% of span.

Table 5.6 Input and Output Signals

	Input Signal	Output Signal
0%	4mA	20kPa
25%	8mA	40kPa
50%	12mA	60kPa
75%	16mA	80kPa
100%	20mA	100kPa

T0506.EPS

Table 5.5 Input and Output Signals

Input Current of the model with / RA is shown in ().

Input	4 to 20mA	4mA (20mA)	8mA (16mA)	12mA (12mA)	16mA (8mA)	20mA (4mA)
	10 to 50mA	10mA (50mA)	20mA (40mA)	30mA (30mA)	40mA (20mA)	50mA (10mA)
Output Signal		0%	25%	50%	75%	100%
Output Signal	1	20kPa	40kPa	60kPa	80kPa	100kPa
	2	40kPa	80kPa	120kPa	160kPa	200kPa
	3	0.2kgf/cm ²	0.4kgf/cm ²	0.6kgf/cm ²	0.8kgf/cm ²	1.0kgf/cm ²
	4	0.4kgf/cm ²	0.8kgf/cm ²	1.2kgf/cm ²	1.6kgf/cm ²	2.0kgf/cm ²
	5	0.2bar	0.4bar	0.6bar	0.8bar	1.0bar
	6	0.4bar	0.8bar	1.2bar	1.6bar	2.0bar
	7	3psi	6psi	9psi	12psi	15psi
	8	6psi	12psi	18psi	24psi	30psi
	9	3psi	9psi	15psi	21psi	27psi

T0505.EPS

5.4 Range Adjustment

Perform the following to change to an output signal other than those specified in Table 5.4 “Output Signals.”

Zero point adjustable range is $\pm 10\%$ of span and the span adjustable range is from 100 to 125%.

An output signal can be flexibly regulated within these ranges using the zero and span adjustments.

Table 5.7 Zero and Span Adjustable Ranges

Output Signal Code	Output Signal	Supply Air Pressure
1	12 to 28kPa	80 to 100kPa
2 *1	24 to 56kPa	160 to 200kPa
3	0.12 to 0.28kgf/cm ²	0.8 to 1.0kgf/cm ²
4 *2	0.24 to 0.56kgf/cm ²	1.6 to 2.0kgf/cm ²
5	0.12 to 0.28bar	0.8 to 1.0bar
6 *3	0.24 to 0.56bar	1.6 to 2.0bar
7	1.8 to 4.2psi	12 to 15psi
8 *4	3.6 to 8.4psi	24 to 30psi
9 *5	0.6 to 5.4psi	24 to 30psi

*1 Please set the supply air pressure at the maximum working pressure plus 30 to 6kPa.

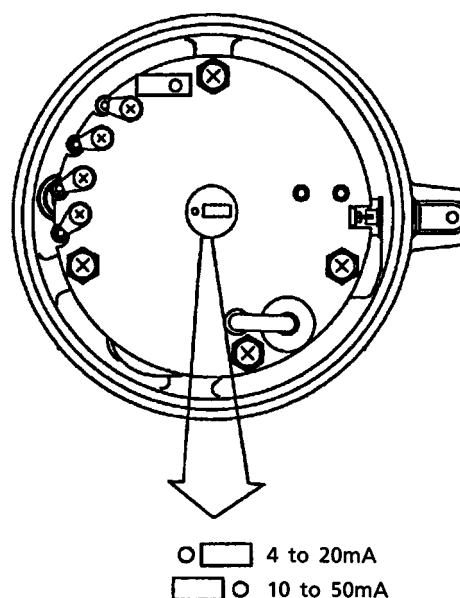
*2 Please set the supply air pressure at the maximum working pressure plus 0.3 to 0.6kgf/cm².

*3 Please set the supply air pressure at the maximum working pressure plus 0.3 to 0.6bar.

*4 Please set the supply air pressure at the maximum working pressure plus 4 to 7psi.

*5 Please set the supply air pressure at the maximum working pressure plus 7 to 9psi.

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Figure 5.4 4 to 20mA/10 to 50mA Selection

5.5 4 to 20mA/10 to 50mA Selection

Take the following steps to select an input signal by using 4 to 20mA/10 to 50mA selecting function.

4 to 20mA or 10 to 50mA can be selected by changing the SOCKET switch on the amplifier shown in Figure 5.4. (Input signal is calibrated at 4 to 20mA at the time of delivery.)

For 4 to 20mA input, insert the SOCKET switch to the two right pins. For 10 to 50mA input, insert the SOCKET switch to the two left pins.



NOTE

Before switching the SOCKET switch, always cut off the input signal.

6. MAINTENANCE

6.1 Overview

The PK200 converter components are structured as units to allow easy maintenance.

This chapter describes cleaning of each component and part replacement to be conducted for PK200 maintenance.

This converter is a high-precision instrument and thus, read the following description carefully before performing maintenance.

For maintenance, also see the operation items in Chapter 5.

6.2 Periodic Inspection

Periodic inspection is required for maintaining normal plant operations. During periodic inspection, pay special attention to the following.

- (1) Is the appearance normal?
- (2) Is there pressure leakage from the converter or its peripheral piping?
- (3) Is drainage present, or is there adhesion of dust or oil, in the air supply system?

Periodically clean the restrictor and nozzle flapper, which are easily subject to contamination. The following describes their cleaning.

6.2.1 Cleaning the Restrictor

Remove the restrictor shown in Figure 6.1 using a screw driver and thread a wire with 0.3mm dia. into the restrictor for cleaning.

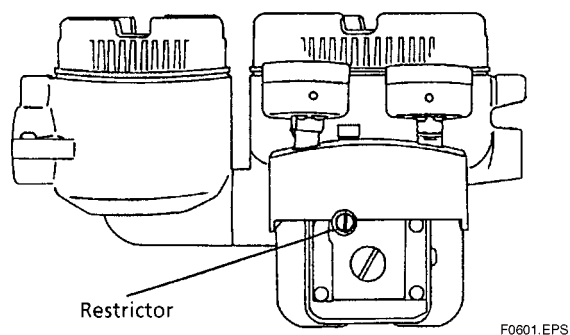
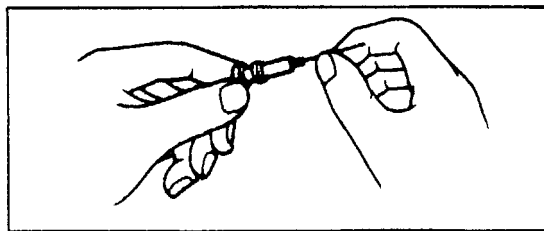


Figure 6.1 Restrictor Removal



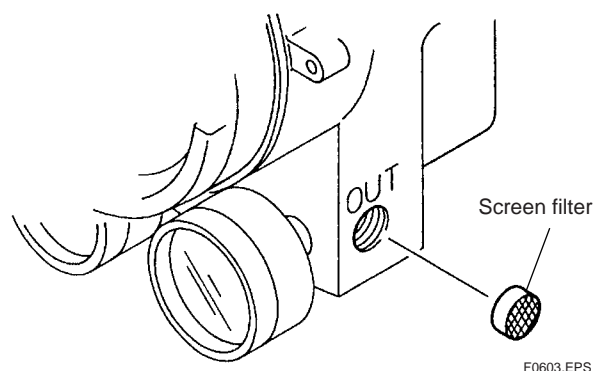
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Figure 6.2 Cleaning the Restrictor

6.3 Parts Replacement

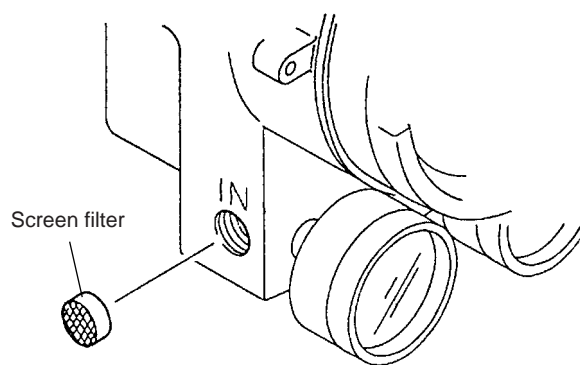
6.3.1 Replacing the Screen Filter

If the mesh filter located at the rear of the supply pressure connection and output air pressure connection is clogged, use a sharp-edged tool such as tweezers to remove the filter and replace it with a new one.



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Figure 6.3 Removing the Screen Filter (OUT Side)



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Figure 6.4 Removing the Screen Filter (IN Side)

6.3.2 Replacing the Controller Relay

- (1) Set the supply air pressure to zero.
- (2) Remove the controller relay from the bottom of the converter.
Unscrew the two mounting screws on the lower front face of the converter main body (see Figure 6.5) using a Phillips screwdriver. The relay can be removed downward.
- (3) When installing a new relay, attach the relay to the bottom of the converter, then fasten the relay using the two mounting screws at the front face of the converter.

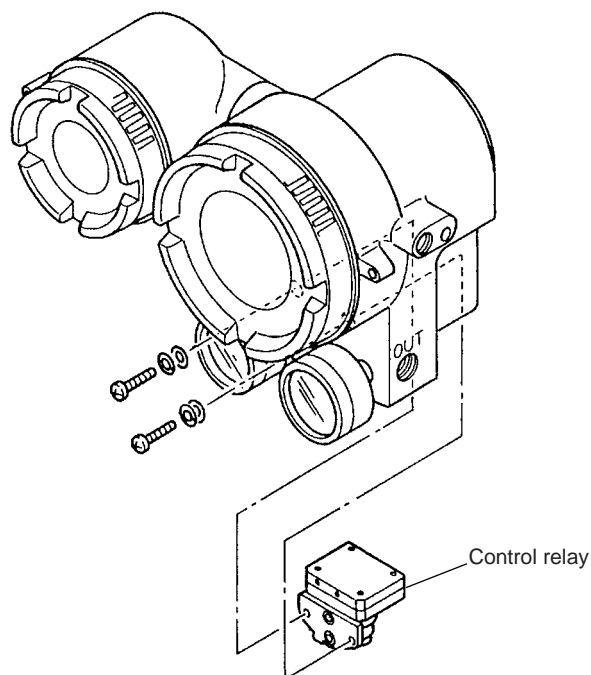


Figure 6.5 Removing the Control Relay

7. TROUBLESHOOTING

7.1 Overview

If the PK200 converter does not operate normally, check the condition carefully and solve any problem in accordance with section 7.3 Troubleshooting Flow.

If problem appears difficult to correct, consult YOKOGAWA service personnel.

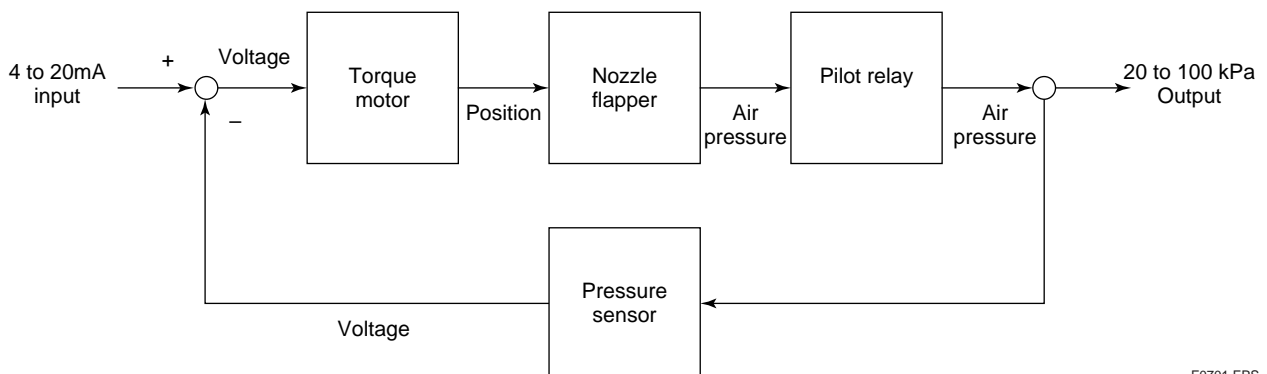
7.2 Operation Principle

The PK200 current-to-pneumatic converter accepts a 4 to 20mA or 10 to 50mA current signal from an electronic controller as an operating signal. This signal is input to a torque motor via an electric circuit, generating a torque proportional to the current signal.

An increase in the input signal causes the flapper at the end of the torque motor moving piece to move in the nozzle closing direction. When the nozzle is closed, back pressure increases, displacing the input diaphragm inside the control relay. This causes the control relay output air pressure to increase.

This output air pressure is output as PK200 converter output pressure and is also input to a feedback pressure sensor. The sensor then converts the pressure input into an electric signal, which is fed back to the electric circuit. The signal is then compared with the manipulated output signal, the result of which activates modification action until an output air pressure balanced with the input signal is obtained.

In this way, an output air pressure proportional to the input signal, which is a manipulated output signal, is obtained.



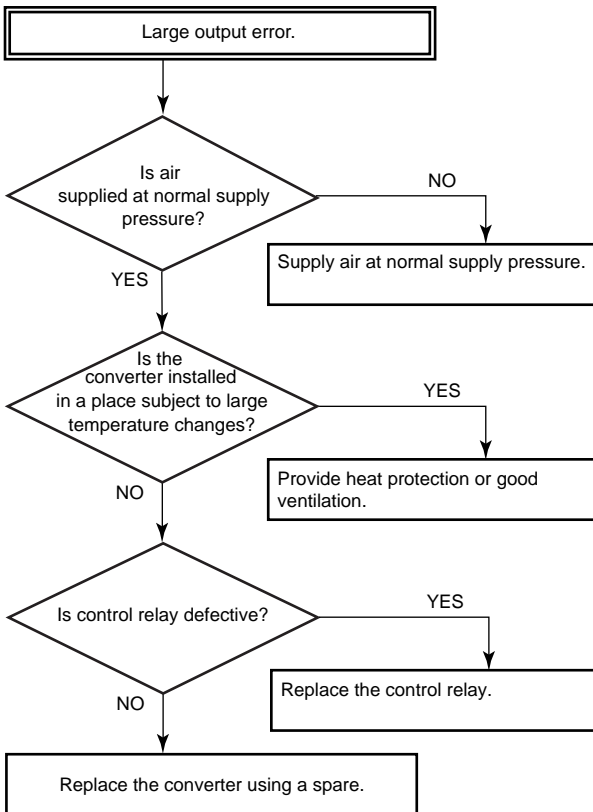
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Figure 7.1 PK200 Current-to-Pneumatic Converter Operation Principle Diagram

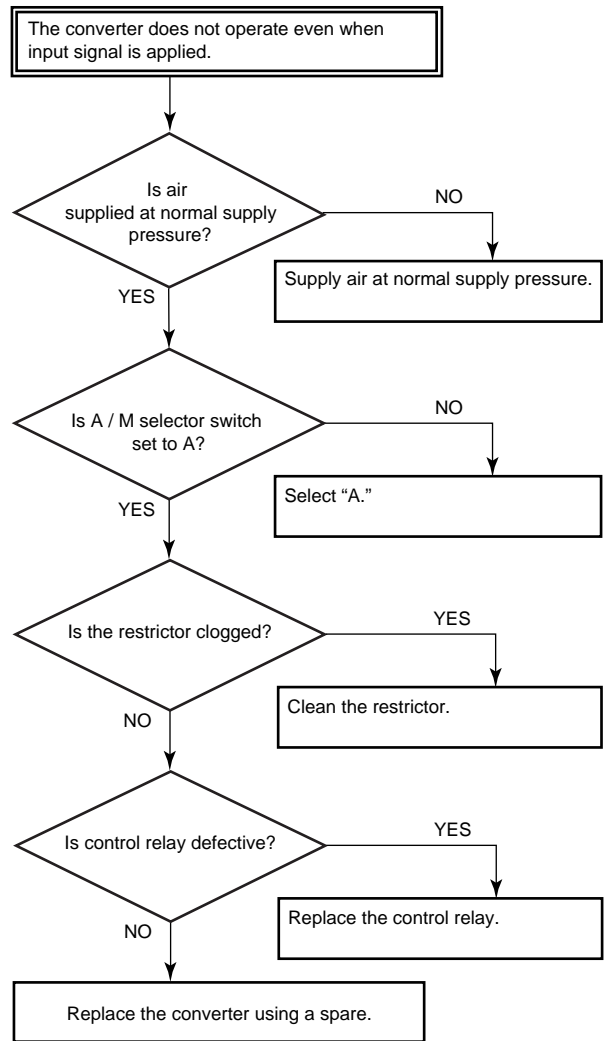
7.3 Troubleshooting Flow

The PK200 current-to-pneumatic converter causes relatively few problems as long as it is used correctly. However, inadequate preparation such as in mounting or service conditions may result in a problem.

If the converter does not operate normally, take correct measures by following the flow chart below. Some problems include a complex cause which may not be uncovered by the following flow chart. If a problem appears difficult to correct, contact our service personnel.



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Appendix A. AIR SUPPLY SYSTEM

1. Overview

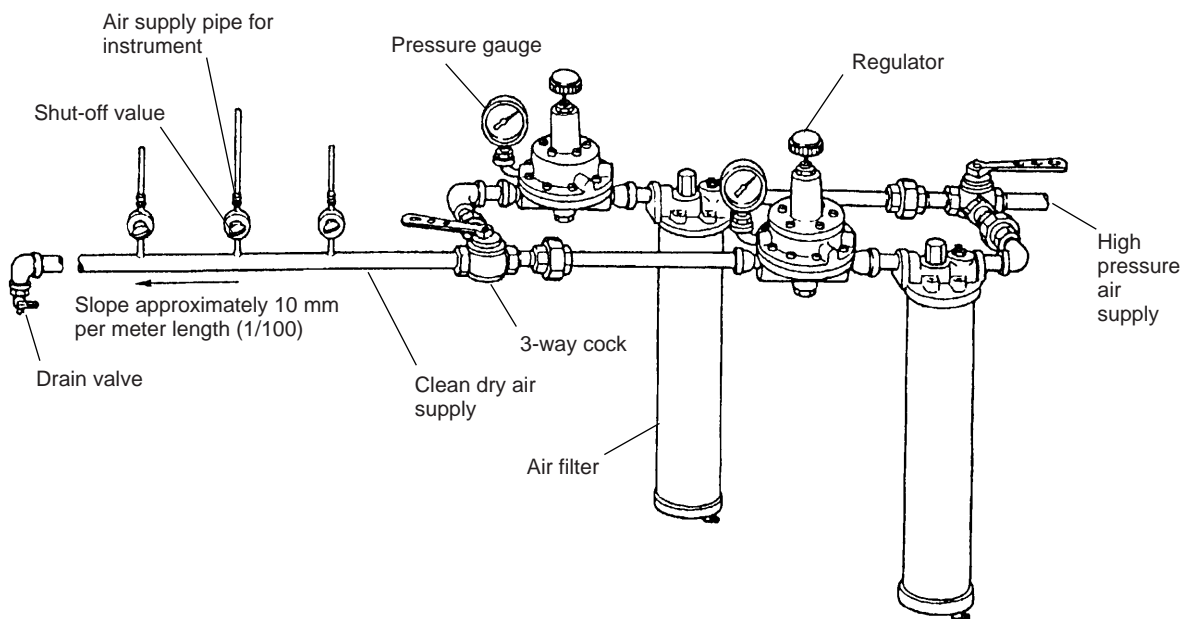
Pneumatic industrial instruments are one of the most maintenance-free, highly reliable industrial instrument systems and are in wide use. Such features are fully demonstrated only when suitable service conditions where the characteristics of pneumatic instruments are sufficiently taken into account are established.

One of such service conditions includes an air supply system. Pneumatic instruments require clean, dry air and thus, an aftercooler, filter, and air drier are installed after a compressor to prevent water, oil, and other contaminants from entering into the instruments. Also, care should be exercised as described below at service points.

2. Air Supply System

(1) Example of Panel-Mounting Instrument

When air is to be supplied to multiple instruments it is recommended that two reducing valves are used in parallel as shown in Figure 1. Parallel arrangement protects instruments from interference even if one reducing valve is suspended due to clogging. Also, use of a three-way cock as shown in Figure 1 allows any of air supply systems to be separated for maintenance. Generally, both air supply systems are used in parallel for operation. To supply clean and dry air to instruments, considerations should be made, such as provision of water drain, filter, and downward pitch (1/100 or more) for piping.



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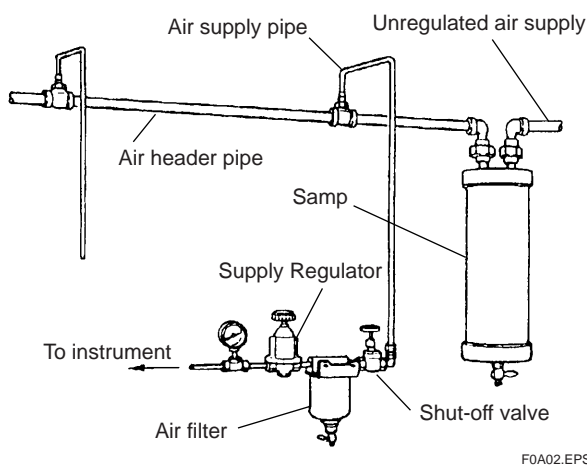
Figure 1 Example of Air Supply System (for Panel-Mounting Instrument)

(2) Example for Field-Mounting Instruments

Figure 2 shows an air-supply system for service point with respect to field-mounting instruments (individually installed instruments).

Securely install a filter and reducing valve in air supply piping that is nearest to an instrument. (These devices are not required if the instrument has a filter and reducing valve.)

Also, it is recommended that a shut-off valve be installed in the air supply pipe to allow removal of individual instruments without cutting off the entire air supply system.



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Figure 2 Example of Air Supply System (for Field-Mounting Instruments)

(3) Air supply System for Field-Mounted Instruments

- **Supply Air**

Clean, dry air is required. An aftercooler, filter, air drier are used to eliminate water, oil, and other contaminants.

- **Air Supply Header (Air Header)**

The air header that supplies air to a series of instruments is installed with a minimum downward pitch of 10 mm/m (1/100) so that moisture and oil entrapped in the header can be discharged.

- **Air Supply Piping**

An air supply pipe connected to an instrument is branched from the upper part of an air header to prevent moisture entry. Even if this is not possible, an air supply pipe should be branched from the side of the air header, i.e., it must not be branched from the bottom part of the header.

It is recommended that an air supply pipe be provided with a shut-off valve so that individual instruments can be removed.

- **Air Filter**

A filter removes moisture, oil, and other contaminants that cannot be removed by the main air supply system. In general a cock installed at the bottom of a filter is opened to discharge moisture, oil, and other contaminants. If the amount of moisture and oil is large, increase the number of draining times.

The above-noted methods and units are an example and there are other various methods and units. Use a method and units suitable for the process type to supply clean, dry air to instruments.

INSTALLATION AND OPERATING PRECAUTIONS FOR JIS INTRINSICALLY SAFE EQUIPMENT

Apparatus Certified Under Technical Criteria (IEC-compatible Standards) and from “RECOMMENDED PRACTICES for Explosion-Protected Electrical Installations in General Industries,” published in 1979

1. General

The following describes precautions on electrical apparatus of intrinsically safe construction (hereinafter referred to as intrinsically safe apparatus).

Following the Labor Safety and Health Laws of Japan, an intrinsically safe apparatus must undergo type tests in order to be certified by the Technical Institute of Industrial Safety, Inc. These tests are required to satisfy either the technical criteria for electrical machinery and equipment in compliance with explosionproof standards involving inflammable gases or vapors and for machinery and equipment having explosionproof performance (standards notification no. 556 from the Japanese Ministry of Labor) (hereinafter referred to as technical criteria), in conformity with IEC Standards, or the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries,” published in 1979. Such a certified apparatus can be used in hazardous locations where inflammable gases or vapors may be present.

Certified apparatus includes a certification label and an equipment nameplate with the specifications necessary for explosion requirements as well as precautions on explosion protection. Please confirm these precautionary items and use them to meet specification requirements.

For electrical wiring and maintenance servicing, please refer to “Internal Wiring Rules” in the Electrical Installation Technical Standards as well as “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.

To meet intrinsically safe requirements, equipment that can be termed an “intrinsically safe apparatus” must:

- (1) be certified by the Technical Institute of Industrial Safety, Inc. in accordance with the Labor Safety and Health Laws of Japan and have the appropriate mark of certification labeled on its case, and
- (2) be used in compliance with the specifications marked on its certification label, equipment nameplate and precautionary information furnished.

Note: Intrinsically safe apparatus satisfy their performance under specific conditions. They are not always absolutely safe under every operational and environmental condition. In other

words, they are not safe products involved with factors such as chemical reactions, geographical changes or the like other than affected by electric energy from the equipment itself.

2. Electrical Apparatus of Intrinsic Safety Type of Explosion-Protected Construction

The intrinsic safety type of explosion-protected construction is a method of protection applicable to a circuit or part of a circuit in which, under prescribed test conditions, no spark or thermal effect, whether produced normally or accidentally, is capable of causing a prescribed explosive gas to ignite. In other words, electrical apparatus of this construction is intended to suppress electrical energy thereby preventing ignition of a given explosive gas atmosphere even though spark or high thermal effect occurs in the electric circuitry.

Intrinsically safe electrical apparatus generally comprise intrinsically safe apparatus installed in a hazardous location and a safety barrier (associated apparatus), installed in a non-hazardous location, aimed at preventing electrical energy from flowing into the electric circuitry of intrinsically safe apparatus.

However, battery-operated, portable intrinsically safe apparatus or the like may be used alone.

3. Terminology

- (1) Intrinsically safe apparatus: Electrical apparatus in which all the circuits are intrinsically safe circuits.
- (2) Associated apparatus: Electrical apparatus in which there are both intrinsically safe circuits and non-intrinsically safe circuits that can affect the safety of intrinsically safe circuits.
- (3) Safety barrier: A specific type of associated apparatus, which consists mainly of safety barrier elements, and serves to limit the flow of excessive electrical energy, which is capable of causing ignition of a given explosive gas or vapour of a non-intrinsically safe circuit into concerned intrinsically safe circuits.
- (4) Apparatus of category “ia”: Intrinsically safe electrical apparatus and associated apparatus which are incapable of causing ignition of a given explosive gas or vapour with the appropriate safety factors such as:

- when up to two countable faults are applied and, in addition,
 - when non-countable faults produce an onerous condition.
- (5) Apparatus of category “ib”: Intrinsically safe electrical apparatus and associated apparatus which are incapable of causing ignition of a given explosive gas or vapour, with the appropriate safety factors such as:
- when up to one countable fault is applied and, in addition,
 - when non-countable faults produce an onerous condition.
- (6) Safety rating: A rating to be designated to intrinsically safe apparatus as well as associated apparatus and is the maximum rating allowable for maintaining intrinsic safety of concerned intrinsically safe circuits.

- (2) For pressure transmitters, pH transmitters, temperature detectors and the like, safety barriers that can be combined are already specified. Other safety barriers cannot be used.

Note 2: Testing Intrinsically Safe System

An assembly (as a system) in which intrinsically safe apparatus and safety barriers are combined is assessed to ensure that its safety requirements are satisfied. A tested and certified system incorporates a certification number (intrinsically safe apparatus and safety barriers have the same certification number).

Note 3: Impossible Combinations of Apparatus Certified Under Different Standards

Intrinsically safe apparatus certified under technical criteria and safety barriers certified under the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries” (1979) and vice versa cannot be combined even if their combination requirements are satisfied.

4. Caution on Combining Intrinsically Safe Apparatus and Safety Barriers

- (1) A combination of certified intrinsically safe apparatus and safety barriers needs to satisfy combination requirements. If intrinsically safe apparatus specify safety barriers for combination, safety barriers other than specified cannot be used (see Note 1 for more details).
- (2) Certified intrinsically safe systems specify specific safety barriers in combination with intrinsically safe apparatus. So safety barriers other than specified cannot be used (see Note 2 for more details).
- (3) Other than limitations of combining intrinsically safe apparatus and safety barriers as given in (1) and (2) above, two or more pieces of apparatus certified under different standards cannot be combined with each other (see Note 3 for more details). In addition, bear in mind that classifications of explosion protection such as “IIA,” “IIB” and “IIC” and category “ia” and “ib” limit a combination of intrinsically safe apparatus and safety barriers.
- For more details, see the “Type Certificate Guide for Explosion-Protected Construction for Electrical Machinery and Equipment,” issued by the Japanese Ministry of Labour, the Research Institute of Industrial Safety.

Note 1: Testing Apparatus

Intrinsically safe apparatus and safety barriers are assessed individually to ensure that their safety requirements are satisfied. Tested and certified intrinsically safe apparatus and safety barriers incorporate individual certification numbers. A combination of intrinsically safe apparatus and safety barriers involves the following two limitations:

- (1) A safety barrier which meets the combination requirements by referring to its safety rating and combination parameters shall be selected.

5. Installation of Intrinsically Safe Apparatus and Safety Barriers

(1) Classification of installation location

Intrinsically safe apparatus may be installed, depending upon applicable gases, in a hazardous area in Zone 0, 1 or 2 (Note 4 below), where the specified gases are present. However, note that apparatus certified under Technical Criteria, in category “ib” shall be installed only in Zone 1 or 2. Safety barriers (associated apparatus) that are combined with these intrinsically safe apparatus shall be installed only in a non-hazardous area. In cases where safety barriers are installed in a hazardous area, they shall be enclosed, for example, in a flameproof enclosure.

Note 4: Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:

- Zone 0: An area in which an explosive gas atmosphere is present continuously or is present for long periods.
- Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.
- Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

(2) Ambient temperature limits for intrinsically safe apparatus

Intrinsically safe apparatus shall be installed in a location where the ambient temperature ranges from -20° to $+40^{\circ}\text{C}$ (for those certified under Technical Criteria) or -10° to $+40^{\circ}\text{C}$ (for those certified under the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries” (1979)). However, some field-mounted

intrinsically safe apparatus may be used at an ambient temperature up to 60°C. So, specifications should be checked before installing intrinsically safe apparatus.

If the intrinsically safe apparatus are exposed to direct sunshine or radiant heat from plant facilities, appropriate thermal protection measures shall be taken.

6. Wiring for Intrinsically Safe Circuits

In intrinsically safe construction, safety shall be maintained as an intrinsically safe system involving intrinsically safe apparatus and safety barriers connected thereto, and electrical wiring (through intrinsically safe circuits) interconnected between them. In other words, even when safety requirements are maintained individually by intrinsically safe apparatus and safety barriers, they shall not be affected by electrical or magnetic energy caused by electrical wiring.

To make electrical wiring for intrinsically safe circuits, you must:

- (a) refer to the equipment configuration diagram and make electrical wiring properly;
- (b) prevent intrinsically safe wiring from being contacted with non-intrinsically safe wiring, and separate the intrinsically safe circuit from other electrical circuits;
- (c) prevent intrinsically safe wiring from being electrostatically and magnetically affected by non-intrinsically safe wiring;
- (d) reduce wiring inductance and capacitance produced between the intrinsically safe apparatus and safety barrier where possible, and use a shorter cable between the intrinsically safe apparatus and safety barrier than specified if the maximum permissible inductance of the cable is specified as operating conditions;
- (e) conform to conditions of installation such as wiring method, earthing or the like, if any; and
- (f) protect the outer sheath of cables from damage with appropriate measures.

7. Maintenance and Inspection of Intrinsically Safe Apparatus and Safety Barriers

Maintenance and inspection of intrinsically safe apparatus and safety barriers shall be limited to within the instructions described in applicable instruction manuals. If other than this is required, contact the manufacturers. For more information, refer to the “USER’S GUIDELINES for Electrical

Installations for Explosive Gas Atmospheres in General Industry” issued in 1994 by the Japanese Ministry of Labour, the Research Institute of Industrial Safety.

(1) Requirements for maintenance personnel

Maintenance and inspection of intrinsically safe apparatus and safety barriers shall be conducted by maintenance personnel skilled in intrinsically safe construction and installation of electrical devices as well as capable of applying associated rules.

(2) Maintenance and Inspection

- (a) Visual inspection
Visually inspect the external connections of intrinsically safe apparatus and safety barriers, and cables for damage or corrosion as well as other mechanical and structural defects.
- (b) Adjustments
Zero, span and sensitivity adjustments shall be made with applicable adjusting potentiometers and mechanical adjustment screws.
These maintenance adjustments shall be made in a non-hazardous location.



CAUTION

If intrinsically safe apparatus and safety barriers require maintenance service and checking, a gas detector shall be used to ensure that there is no explosive gas in the location (maintenance servicing shall be conducted in a non-hazardous location).

(3) Repair

Intrinsically safe apparatus and safety barriers shall be repaired by manufacturers.

(4) Prohibition of modifications and specification changes

Do not attempt to make modifications or change specifications which may affect safety.

INSTALLATION AND OPERATING PRECAUTIONS FOR JIS FLAMEPROOF EQUIPMENT

Apparatus Certified Under Technical Criteria (IEC-compatible Standards)

1. General

The following describes precautions on electrical apparatus of flameproof construction (hereinafter referred to as flameproof apparatus) in explosion-protected apparatus.

Following the Labour Safety and Health Laws of Japan, flameproof apparatus is subjected to type tests to meet either the technical criteria for explosionproof electrical machinery and equipment (standards notification no. 556 from the Japanese Ministry of Labour) (hereinafter referred to as technical criteria), in conformity with the IEC Standards, or the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries,” published in 1979. These certified apparatus can be used in hazardous locations where explosive or inflammable gases or vapours may be present.

Certified apparatus includes a certification label and an equipment nameplate with the specifications necessary for explosion requirements as well as precautions on explosion protection. Please confirm these precautionary items and use them to meet specification requirements.

For electrical wiring and maintenance servicing, please refer to “Internal Wiring Rules” in the Electrical Installation Technical Standards as well as “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.

To meet flameproof requirements, equipment that can be termed “flameproof” must:

- (1) Be certified by a Japanese public authority in accordance with the Labour Safety and Health Laws of Japan and have a certification label in an appropriate location on its case, and
- (2) Be used in compliance with the specifications marked on its certification label, equipment nameplate and precautionary information furnished.

2. Electrical Apparatus of Flameproof Type of Explosion-Protected Construction

Electrical apparatus which is of flameproof construction is subjected to a type test and certified by the Japanese Ministry of Labour aiming at preventing explosion caused by electrical apparatus in a factory or any location where inflammable gases or vapours may be present. The flameproof

construction is of completely enclosed type and its enclosure shall endure explosive pressures in cases where explosive gases or vapours entering the enclosure cause explosion. In addition, the enclosure construction shall be such that flame caused by explosion does not ignite gases or vapours outside the enclosure.

In this manual, the word “flameproof” is applied to the flameproof equipment combined with the types of protection “e”, “o”, “i”, and “d” as well as flameproof equipment.

3. Terminology

(1) Enclosure

An outer shell of an electrical apparatus, which encloses live parts and thus is needed to configure explosion-protected construction.

(2) Shroud

A component part which is so designed that the fastening of joint surfaces cannot be loosened unless a special tool is used.

(3) Enclosure internal volume

This is indicated by:— the total internal volume of the flameproof enclosure minus the volume of the internal components essential to equipment functions.

(4) Path length of joint surface

On a joint surface, the length of the shortest path through which flame flows from the inside to outside of the flameproof enclosure. This definition cannot be applied to threaded joints.

(5) Gaps between joint surfaces

The physical distance between two mating surfaces, or differences in diameters if the mating surfaces are cylindrical.

Note: The permissible sizes of gaps between joint surfaces, the path length of a joint surface and the number of joint threads are determined by such factors as the enclosure’s internal volume, joint and mating surface construction, and the explosion classification of the specified gases and vapours.

4. Installation of Flameproof Apparatus

(1) Installation Area

Flameproof apparatus may be installed, in accordance with applicable gases, in a hazardous area in Zone 1 or 2, where the specified gases are present. Those apparatus shall not be installed in a hazardous area in Zone 0.

Note: Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:

Zone 0: An area in which an explosive gas atmosphere is present continuously or is present for long periods.

Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.

Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

(2) Environmental Conditions

The standard environmental condition for the installation of flameproof apparatus is limited to an ambient temperature range from -20°C to $+40^{\circ}\text{C}$ (for products certified under Technical Criteria). However, some field-mounted instruments may be certified at an ambient temperature up to $+60^{\circ}\text{C}$ as indicated on the instrument nameplates. If the flameproof apparatus are exposed to direct sunshine or radiant heat from plant facilities, appropriate thermal protection measures shall be taken.

5. External Wiring for Flameproof Apparatus

Flameproof apparatus require cable wiring or flameproof metal conduits for their electrical connections. For cable wiring, cable glands (cable entry devices for flameproof type) to wiring connections shall be attached. For metal conduits, attach sealing fittings as close to wiring connections as possible and completely seal the apparatus. All non-live metal parts such as the enclosure shall be securely grounded. For details, see the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.

(1) Cable Wiring

- Specific cables shall be used as recommended by the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.
- In necessary, appropriate protective pipes (conduit or flexible pipes), ducts or trays shall be used for preventing the cable run (outside the cable glands) from damage.
- To prevent explosive atmosphere from being propagated from Zone 1 or 2 hazardous location to any different location or non-hazardous location through the protective pipe or duct, apply sealing of the protective pipes in the vicinity of individual boundaries, or fill the ducts with sand appropriately.
- When branch connections of cables, or cable connections with insulated cables inside the conduit pipes are made, a flameproof or increased-safety connection box shall be used. In this case, flameproof or increased-safety cable glands meeting the type of connection box must be used for cable connections to the box.

(2) Flameproof Metal Conduit Wiring

- For the flameproof metal conduit wiring or insulated wires shall be used as recommended by the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry, published in 1994.
- For conduit pipes, heavy-gauge steel conduits conforming to JIS C 8305 Standard shall be used.
- Flameproof sealing fittings shall be used in the vicinity of the wiring connections, and those fittings shall be filled with sealing compounds to complete sealing of the apparatus. In addition, to prevent explosive gases, moisture, or flame caused by explosion from being propagated through the conduit, always provide sealing fittings to complete sealing of the conduit in the following locations:
 - (a) In the boundaries between the hazardous and non-hazardous locations.
 - (b) In the boundaries where there is a different classification of hazardous location.
- For the connections of the apparatus with a conduit pipe or its associated accessories, G-type parallel pipe threads (JIS B 0202) shall be used to provide a minimum of five-thread engagement to complete tightness. In addition, since these parallel threads do not have sealing property, nonhardening sealant such as liquid gaskets shall thus be applied to those threads for ensuring waterproofness.
- If metal conduits need flexibility, use flameproof flexible fittings.

6. Maintenance of Flameproof Apparatus

To maintain the flameproof apparatus, do the following. (For details, see Chapter 10 “MAINTENANCE OF EXPLOSION-PROTECTED ELECTRICAL INSTALLATION” in the USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry.)

(1) Maintenance servicing with the power on.

Flameproof apparatus shall not be maintenance-serviced with its power turned on. However, in cases where maintenance servicing is to be conducted with the power turned on, with the equipment cover removed, always use a gas detector to check that there is no explosive gas in that location. If it cannot be checked whether an explosive gas is present or not, maintenance servicing shall be limited to the following two items:

- (a) Visual inspection
Visually inspect the flameproof apparatus, metal conduits, and cables for damage or corrosion, and other mechanical and structural defects.
- (b) Zero and span adjustments
These adjustments should be made only to the extent that they can be conducted from the outside without opening the equipment cover. In doing this, great care must be taken not to cause mechanical sparks with tools.

(2) Repair

If the flameproof apparatus requires repair, turn off the power and transport it to a safety (non-hazardous) location. Observe the following points before attempting to repair the apparatus.

- (a) Make only such electrical and mechanical repairs as will restore the apparatus to its original condition. For the flameproof apparatus, the gaps and path lengths of joints and mating surfaces, and mechanical strength of enclosures are critical factors in explosion protection. Exercise great care not to damage the joints or shock the enclosure.
- (b) If any damage occurs in threads, joints or mating surfaces, inspection windows, connections between the transmitter and terminal box, shrouds or clamps, or external wiring connections which are essential in flameproofness, contact Yokogawa Electric Corporation.



CAUTION

Do not attempt to re-process threaded connections or refinish joints or mating surfaces.

- (c) Unless otherwise specified, the electrical circuitry and internal mechanisms may be repaired by component replacement, as this will not directly affect the

requirements for flameproof apparatus (however, bear in mind that the apparatus must always be restored to its original condition). If you attempt to repair the flameproof apparatus, company-specified components shall be used.

- (d) Before starting to service the apparatus, be sure to check all parts necessary for retaining the requirements for flameproof apparatus. For this, check that all screws, bolts, nuts, and threaded connections have properly been tightened.

(3) Prohibition of specification changes and modifications

Do not attempt to change specifications or make modifications involving addition of or changes in external wiring connections.

7. Selection of Cable Entry Devices for Flameproof Type



IMPORTANT

The cable glands (cable entry devices for flameproof type) conforming to IEC Standards are certified in combination with the flameproof apparatus. So, Yokogawa-specified cable entry devices for flameproof type shall be used to meet this demand.

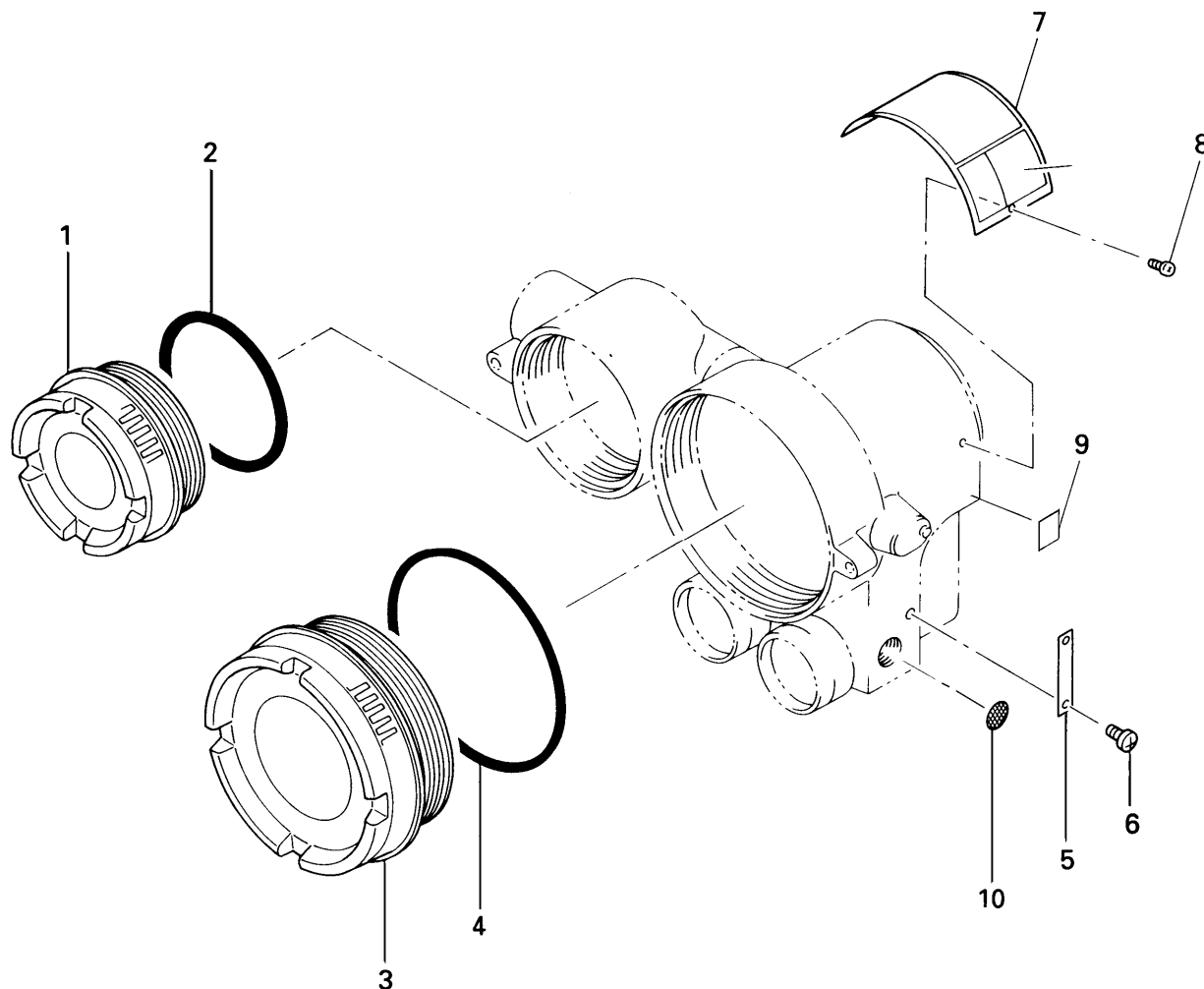
References:

- (1) Type Certificate Guide for Explosion-Protected Construction Electrical Machinery and Equipment (relating to Technical Standards Conforming to International Standards), issued by the Technical Institution of Industrial Safety, Japan
- (2) USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry (1994), issued by the Japanese Ministry of Labour, the Research Institute of Industrial Safet

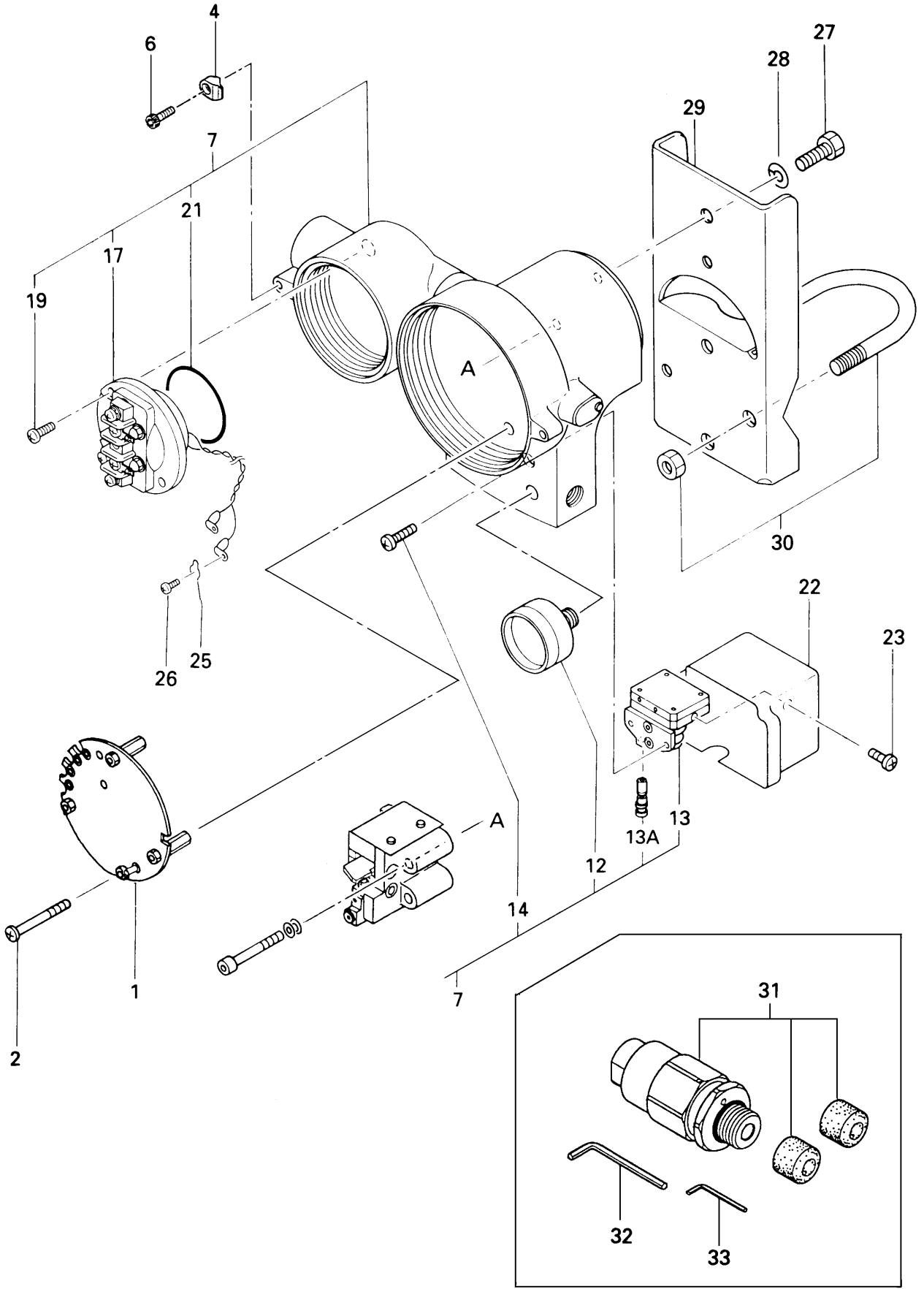
Customer Maintenance Parts List

Model PK200 Current-to-Pneumatic Converter

PK200



Item	Part No.	Qty	Description
1	F9172BS	1	Cover
2	Y9210XA	1	O-Ring
3	F9301DQ	1	Cover
4	G9303LK	1	O-Ring
5	F9515AZ	1	Tag Plate
6	F9270SA	2	Self-tapping Screw
7	—	1	Nameplate (Dataplate)
8	F9270SA	2	Self-tapping Screw
9	—	1	Nameplate (for JIS Flameproof option code: /JF3)
10	U0103FP	2	Screen



Item	Part No.	Qty							Description
		PK200-A□□1□□ ³	PK200-C□□1□□ ³	PK200-A□□2□□ ³	PK200-C□□2□□ ³	PK200-A□□1□□ ³ /RA	PK200-C□□1□□ ³ /RA	PK200-A□□2□□ ³ /RA	
1	See Table 1	1	1	1	1	1	1	1	Amplifier Assembly
2	Y9430JB	4	4	4	4	4	4	4	Machine Screw, M4×30
4	G9339AA	2	2	2	2	2	2	2	Bracket ^{*7}
6	Y9408ZU	2	2	2	2	2	2	2	Hex soc. H.Cap Screw, M4×8 ^{*7}
7	—	1	1	1	1	1	1	1	Case Assembly
12	See Table 2	2	2	2	2	2	2	2	Pressure Gauge (see page 4)
13	F9174HA	1	1			1	1		Pilot Relay Assembly
	F9174HB			1	1			1	Pilot Relay Assembly
13A	F9172FB	1	1	1	1	1	1	1	Screw Assembly
14	Y9425JY	2	2	2	2	2	2	2	Pan H.Screw, M4×25
17	F9172ST	1	1	1	1	1	1	1	Terminal Assembly ^{*4}
	F9172TC	1	1	1	1	1	1	1	Terminal Assembly (For /FF1) ^{*5}
	F9172TE	1	1	1	1	1	1	1	Terminal Assembly (For /CS1) ^{*6}
19	Y9512JU	2	2	2	2	2	2	2	Pan H.Screw, M5×12
21	F9172DK	1	1	1	1	1	1	1	O-Ring
22	F9174HL	1	1	1	1	1	1	1	Cover
23	G9307MQ	2	2	2	2	2	2	2	Pan H.Screw, M4×8
25	F9275MK	2	2	2	2	2	2	2	Clip
26	Y9306JU	2	2	2	2	2	2	2	Pan H.Screw
27	Y9820NS	2	2	2	2	2	2	2	Bolt
	Y9820NU	2	2	2	2	2	2	2	Bolt (When option code is /SS)
28	Y9800SS	2	2	2	2	2	2	2	Spring Washer
	Y9800SU	2	2	2	2	2	2	2	Spring Washer (When option code is /SS)
29	F9174HM	1	1	1	1	1	1	1	Bracket
	F9174FW	1	1	1	1	1	1	1	Bracket (When option code is /SS)
30	D0177XL-A	1	1	1	1	1	1	1	U-Bolt/Nut Assembly
31	Below	1	1	1	1	1	1	1	Cable Grand Assembly ^{*7}
	G9601AM								For Electrical connection: G1/2 female (option code: /G11)
	G9601AN								For Electrical connection: G3/4 female (option code: /G21)
32	E9135GY	1	1	1	1	1	1	1	Wrench (M4) ^{*7}
33	G9625BA	1	1	1	1	1	1	1	Wrench (M3) ^{*7}

*1: Suffix code of output signal: 1, 3, 5, A

*2: Suffix code of output signal: 2, 4, 6, B, C

*3: For suffix code details (indicated by □), refer to YOKOGAWA GS sheet.

*4: When optional code is /L, Part No. is F9172SU.

*5: When optional code is /L, Part No. is F9172TD.

*6: When optional code is /L, Part No. is F9172TF.

*7: For JIS Flameproof (option code: /JF3)

Table 1. Amplifier Assembly Part No. (Item 1)

Part No.	Model
F9174MA	PK200-A□ ^{*1} □ ^{*3}
F9174MG	PK200-C□ ^{*1} □ ^{*3}
F9174MH	PK200-A□ ^{*2} □ ^{*3}
F9174MJ	PK200-C□ ^{*2} □ ^{*3}
F9174MK	PK200-A□ ^{*1} □ ^{*3} /RA
F9174ML	PK200-C□ ^{*1} □ ^{*3} /RA
F9174MM	PK200-A□ ^{*2} □ ^{*3} /RA
F9174MN	PK200-C□ ^{*2} □ ^{*3} /RA
F9172UA	PK200-A□ ^{*1} □ ^{*3} /CS1
F9172UH	PK200-A□ ^{*2} □ ^{*3} /CS1
F9172UK	PK200-A□ ^{*1} □ ^{*3} /RA/CS1
F9172UM	PK200-A□ ^{*2} □ ^{*3} /RA/CS1
F9174LA	PK200-A□ ^{*1} □ ^{*3} /JS3
F9174LB	PK200-A□ ^{*2} □ ^{*3} /JS3
F9174LC	PK200-A□ ^{*1} □ ^{*3} /RA/JS3
F9174LD	PK200-A□ ^{*2} □ ^{*3} /RA/JS3
F9174LL	PK200-A□ ^{*1} □ ^{*3} /KS1
F9174LM	PK200-A□ ^{*2} □ ^{*3} /KS1
F9174LN	PK200-A□ ^{*1} □ ^{*3} /RA/KS1
F9174LP	PK200-A□ ^{*2} □ ^{*3} /RA/KS1

*1: Suffix code of output signal: 1, 3, 5, A

*2: Suffix code of output signal: 2, 4, 6, B, C

*3: For suffix code details, refer to GS sheet.

Table 2. Pressure Gauge Part No. (Item 12)

Part No.	Scale Units	Air Connection
G9615AT	0 to 2 kgf/cm ²	R 1/8
G9615AR	0 to 4 kgf/cm ²	R 1/8
G9615EA	0 to 200 kPa	R 1/8
G9615ED	0 to 400 kPa	R 1/8
G9615EC	0 to 2 bar	R 1/8
G9615EF	0 to 4 bar	R 1/8

Revision Record

● Manual No.: PK200 CURRENT - TO - PNEUMATIC CONVERTER

● Title: IM 21B3D1-01E

Edition	Date	Revision(s)
4th	Feb. 1996	Style change (Style: S1→Style: S2) other correction. Note CMPL 21B3D1-01E Amplifier Assembly of S2 is not compatible with S1.
5th	Sep. 1996	Installation and Operating Precautions for JIS Flameproof Equipment (B0006) updated and moved to the end of the manual. Due to Terminal box shape modification, Figure 2.2, 2.4, 4.1, 4.4 are changed. 1.1 Data plates for FM Explosionproof Type and CSA Intrinsically Safe Type added. 1.5 Installation of Intrinsically Safe Type added. 1.5.1 CSA Intrinsically Safe (/CS1) added. 1.6 Installation of Flameproof Type added. 1.6.1 JIS Flameproof Type added. 1.6.2 FM Explosionproof Type revised. NEMA 4 → NEMA 4X CMPL Figure of terminal box changed. Item 17, 19 revised. Item 18, 20 deleted. Note *4 revised. *5, *6 added.
6th	July 1997	2.4 Option Code/B added.s CMPL Option Code/B added. Item 1 revised.
7th	Mar. 1998	1.1 Add precaution for safety 4.1 Add precaution for safety 4.4 Add precaution for safety 5.4 Add precaution for safety 5.8 Add precaution for safety
8th	June 1999	Format change Add 'INTRODUCTION' Update Installation and Operating Precautions for JIS Flameproof Equipment (Ex-B02) 2.2 Change 'Exd II B+H ₂ T6' to 'Exd II B+H ₂ T6X' 2.4 Add optional code /JF3, /G11, and /G21 and delete /JF1 and /JF2 4.2 Add warning Change part number in Table 4.2 and Figure 4.3 CMPL Update CMPL 21B3D1-01E
9th	Jan. 2000	1.2 Add Figure 1.3 Add 1.5.2 CENELEC (KEMA) Intrinsically Safe Type Add 1.5.3 JIS Intrinsically Safe Type 2.2 Add information for /KS1 and /JS3 2.4 Add codes /KS1 and /JS3, and delete code /B Add 4.3 Intrinsically Safe Type Wiring Add Ex-A03E Ex-B03E: Change name (from EX-B02E) and format CMPL Update CMPL 21B3D1-01E
10th	Apr. 2001	1.5.3 Move Table from page 4.6. 2.5 Correct terminal configuration diagram. CMPL Table.1 Change parts number.