

IN-SITU ZIRCONIA OXYGEN ANALYZER (ZIRCOMAT-P with built-in microcomputer)

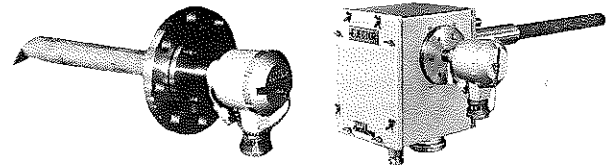
DATA SHEET

ZFK, ZFN

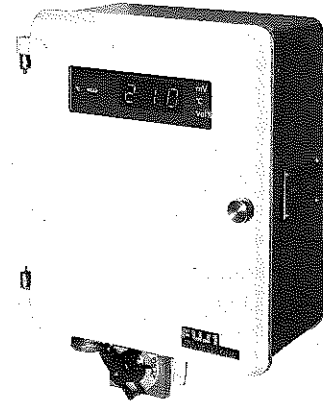
This zirconia oxygen analyzer has a detector directly inserted into a flue, heating furnace or the like so as to directly measure the oxygen concentration in gas. Two types of detectors are available, a general-use type for measured gas temperature of 600°C maximum and a high temperature type for 1590°C maximum, which may be selected according to the particular application.

The general-use type consists of a detector and transmitter, while the high temperature type is composed of a detector, ejector and transmitter. A sampling device is not necessary for either type.

Micro-processor based transmitter enables high performance and easy operation. It offers maintenance-free stable measurement.



(General-use detector) (High-temperature detector)



Transmitter

FEATURES

1. **Sampling device unnecessary**
Since the analyzer is an in-situ type, gas sampling devices such as a gas aspirator or dehumidifier are unnecessary, and stable measurements are possible free from maintenance.
2. **Fast response**
An exclusive flow guide tube and ejector which efficiently utilize the flow of measured gas are equipped enabling a fast response within 7 seconds.
3. **High temperature gas measurable**
Heat resistant material used for the ejector and insertion tube permit measurement of gas up to 1590°C.
4. **Measurement of corrosive gases of waste incinerator**
The adoption of hydrogen chloride detector made of corrosion-proof titanium assures optimum measurement of exhaust gas generating from waste incinerator.
5. **Possible for measurement in dusty atmosphere**
Automatic/manual blow-off (option) enables the measurement in dusty sample.
6. **Excellent stability**
A highly reliable heater with the heating element embedded in ceramic is used for heating the zirconia cell to facilitate uniform heating and provide a stable output.
7. **One-touch calibration**
Instrument can be calibrated by one-touch operation.
8. **Check function provided**
The condition of sensor/flow guide tube can be checked by one-touch operation (option).
9. **Self-diagnosis function**
Self diagnostics requires little maintenance.

SPECIFICATIONS

< General >

- Measuring gas:** Oxygen in non-combustible gas
Measuring method: In-situ type zirconia method
Measuring range: 0 to 5/0 to 10/0 to 25% O₂ (field selectable)
Oxygen concentration output signal:
 4 to 20mA DC
 (allowable load resistance 550Ω max.)
 0 to 1V DC
 (output resistance 0.1Ω max.)
 Simultaneous output with input/output isolated linear characteristic versus oxygen concentration
Repeatability: Within ±0.5% of maximum output signal
Linearity: ±2% FS
Response speed: Within 7 sec for 90% response (from calibration gas inlet)
Power supply: 100, 115 or 220V AC, 50/60Hz

Power consumption:

60W max. (general-use type), 210W max. (ejector type)
 220W max. at startup (general-use type), 370W max. (ejector type)

Warmup time: 10 minutes approx.

Cable: 24mm dia. cable of 5m standard length between detector and transmitter installed in flexible conduit

[Oxygen detector (type ZFK2, 5), Ejector (type ZTA)]

Measuring instrument:

General use ZFK2
 Anti-corrosive type ZFK5

Measured gas temperature:

-20 to 1590°C
 -20 to 600°C for flow guide tube type (general use, anti-corrosive type)
 -20 to 800°C or 1590°C for ejector type

Measured gas pressure:

-3 to +3kPa
 { -300 to +300mmH₂O }

Flow guide tube: Two types available, general type and one with blow-off nozzle

Flange; JIS 5K 65A RF
 Insertion length (to be specified); 0.3, 0.5, 0.75, 1.0m (general type)
 0.3, 0.5, 0.75, 1.0, 1.5, 2.0m (one with blow-off nozzle)

Ejector: Probe for introducing measured gas into detector

Flange; JIS 10K 65A RF
 Insertion length; 0.5, 0.75, 1.0, 1.5m (to be specified)

Ambient temperature:

-20 to 60°C for cable section
 -5 to 100°C for ejector
 125°C max. for detector flange surface when energized

Structure: Drip-proof

Filter: Aluminum (filtration degree 50μm) and quartz paper

Material of gas-contacting parts:

General use detector; Zirconia, SUS316, SUS304, platinum

Anti-corrosive detector; Zirconia, titanium, platinum, SUS316 (flow guide tube)

Ejector; SiC, SUS316, SUS304

Detector mounting:

Horizontal ±45°C; surrounding air should be clean

Outer dimensions: (L × max. dia.) 210 × 100mm (detector)

Mass (Weight): Detector, about 1.6kg
 Ejector, about 15kg (insertion length 1m)
 Flow guide tube of 1m (general-use type), about 5kg

Finish color: Munsell N9.5 (silver) and SUS metallic color

Ejector air input: 5 to 10ℓ/min

Blow-off air input: 200 to 300kPa
 { 2 to 3kgf/cm² } { 0.2 to 0.3Nm³/min }

Ejector exhaust gas processing:

Returned to furnace or flue

Heater temperature drop alarm output (ejector type):

Alarm is output below 100°C, mechanical type thermostat, 1 NO contact of 200V AC, 2A

[Oxygen transmitter (type ZFN)]

Indication: 3-digit indication (LED)

Contact output for failure:
 1 PDT contact of 250V AC, 3A (broken wire in detector heater, thermocouple etc.)

Contact output during maintenance:
 1 NO contact of 250V AC, 3A

Calibration method:
 One-touch calibration with switch

Optional functions:
 Check of sensor failure/flow guide pipe clogging
 Manual/automatic blow-off function (Ref. to time chart)

Blow-off contact output:
 1 NO contact of 250V AC, 3A

Output signal hold:
 Output signal is held during maintenance, blow-off, and sensor/flow guide tube check (hold can be released)

Power supply: 100, 115 or 220V AC, 50/60Hz

Ambient temperature:
 -10 to 50°C

Structure: Rain-proof type

Material: Steel case, aluminum cover

Mounting method:
 Mounted on 2B pipe or wall (to be specified)

Outer dimensions (H × W × D):
 About 410 × 242 × 160mm

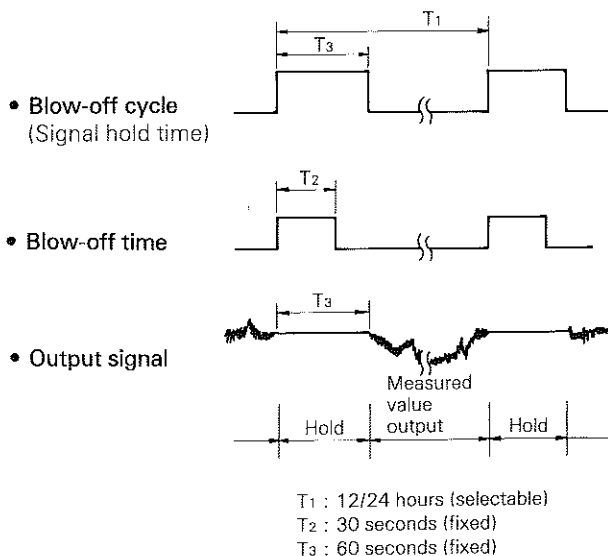
Mass (Weight): About 11kg (excluding cable)

Finish color: Munsell E4/N8 (cover), Munsell E2/N4 (case)

Pump: Can be built in for air point adjustment (option)

Gas changeover cock (option):
 For air and zero adjustment, for standard gas changeover; connection port size Rc1/8 internal thread (union for φ6/φ4 teflon tube)

Blow-off time chart (option)



CODE SYMBOLS

Detector

1	2	3	4	5	6	7	8	9	Description
Z	F	K						3-0	
	2								Application
									General use
	5								Anti-corrosive (for waste incinerator)
									Rain-proof cover
				Y					Without
				A					With
									Flow guide tube
				Y					Without
				A					With L = 300mm
				B					With L = 500mm
				C					With L = 750mm
				D					With L = 1000mm
				U					With L = 300mm
				V					With L = 500mm
				W					With L = 750mm
				X					With L = 1000mm
				J					With L = 300mm
				K					With L = 500mm
				L					With L = 750mm
				M					With L = 1000mm
				N					With L = 1500mm
				P					With L = 2000mm
				Z					Other (consult Fuji)
									Power supply
								1	100/115V AC 50/60Hz
								3	200/220V AC 50/60Hz
									Specifications
								0	Standard

Transmitter

1	2	3	4	5	6	7	8	9	10	11	Description
Z	F	N									
											Specifications
											General use
											Anti-corrosive
											Measuring range
											0 to 5/10/25 vol.%O ₂
											Optional function
											Without
											With (sensor/flow guide check, manual/automatic blow-off)
											Calibration device
											Without
											With changeover cock
											With changeover cock and pump (must be specified B with A in 6th digit)
											Power supply
											100V AC 50/60Hz
											115V AC 50/60Hz
											220V AC 50/60Hz
											Exclusive cable (Power and signal cables are wired using flexible conduit.)
											Without
											5m
											Other (max. 20m)
											Mounting method
											1 Panel mounting
											2 Pipe mounting

Note: When cable length is more than 20m (Max. 100m), power cable (2mm² or larger) and 4-core special cable (sensor signal and thermocouple compensation wire, Code TK745326P1) should be wired.

Replacement detector

1	2	3	4	5	6	7	8	9	Description
Z	F	K		Y	Y			3-0	
									Application
									General use
									Anti-corrosive
									Power supply
								1	100/115V AC 50/60Hz
								3	200/220V AC 50/60Hz

Ejector

1	2	3	4	5	6	7	8	Description
Z	T	A		1	1	1		
								Measured gas temperature
								1 For high temperature (max. 1590°C)
								2 For general use (max. 800°C)
								Insertion length [mm]
							B	500
							C	750
							D	1000
							E	1500
								Power supply
								1 100/115V AC 50/60Hz
								3 200/220V AC 50/60Hz

SCOPE OF DELIVERY

Detector related: Detector × 1, Viton O-ring × 2, mounting screws (M5 × 16) × 6, thermal sticker × 1, flow guide tube (as specified), ceramic filter × 1, rain-proof cover (as specified) × 1

Transmitter related:

Transmitter and mounting brackets (1 set, specify mounting method)

Exclusive cable in flexible conduit, accessories (power fuse × 2)

Changeover cock half union × 3

Ejector related: Ejector × 1, insertion tube × 1, M16 nut, washer × 4, packing × 1

Items prepared separately:

Zero point calibrating standard gas, reduction valve

0 to 5% range; 0.8 to 1.3% O₂/N₂

0 to 10%, 0 to 25% range; 1.5 to 2.0% O₂/N₂

- Pressure regulator with standard gas flowmeter (Type: WR11FS) (2ry pressure 50kPa {0.5kgf/cm²}, flow 0 to 2ℓ/min)

- φ6/φ4 teflon tube, piping

Recommended devices:

- 2-way solenoid valve
(Supplier: CKD Co. Japan)
ADK11-15A-02C-AC V
(for blow back)
- : AC voltage
Connector size: Rc1/2
- Flowmeter
ZBD42203 (0.2 to 2ℓ/min)
(for calibration)
- ZBD42403 (1 to 10ℓ/min)
(for ejector)
- Connector size: Rc1/4
- Reducing valve
(Supplier: SMC Co. Japan)
AR400-04-BG
(for ejector and blow back)
- Connector size: Rc1/2

Cautions

- If combustible gas (CO, H₂, etc.) is contained in measured gas, it is burned in the sensor which results in error in measurement. If corrosive gas (Si vapor, alkali metal, P, Pb, etc.) is contained, the life of the sensor is shortened.
- When the measured gas temperature is high (300°C or more), relocate the flange away from the wall so that the temperature on the detector flange surface lowers below the specified level.
Mount the flow guide in the direction of reducing the flow of gas.
- When installing the instrument in a place with much dust, mount the flow guide tube aslant. Mount the flow guide in the direction of reducing the flow of gas into the detector.
- When using a waste incinerator, automatic blow off with flow guide is prohibited (to protect the flow guide tube from corrosion due to draining). It should be done manually when the incinerator has stopped and the indication is stabilized.

CONFIGURATION OF DEVICES

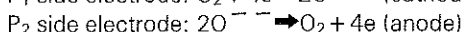
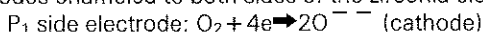
The configuration of devices differs according to the conditions of the gas to be measured. Select a suitable combination using the following table for reference.

Measured gas				Component devices					
Temperature	Application	Dust	Gas flow	Detector type	Transmitter type	Ejector type	Solenoid valve	Flowmeter ZBD422	Flowmeter ZBD424
600°C max.	General use	Little	With	ZFK2□A to D	ZFN11□	—	—	○	—
		Much	With	ZFK2□J to P	ZFN11A	—	○	○	—
		Little	Without	ZFK2□Y	ZFN11□	ZTA2	—	○	○
		Much	Without	ZFK2□Y	ZFN11A	ZTA2	○	○	○
	For anti-corrosive (for waste incinerator)	Little	With	ZFK5□U to X	ZFN31□	—	—	○	—
		Much*	With	ZFK5□J to P	ZFN31A	—	○	○	—
800°C max.	General use	Little	With / Without	ZFK2□Y	ZFN11□	ZTA2	—	○	○
		Much	With / Without	ZFK2□Y	ZFN11A	ZTA2	○	○	○
1590°C max.	General use	Little	With / Without	ZFK2□Y	ZFN11□	ZTA1	—	○	○
		Much	With / Without	ZFK2□Y	ZFN11A	ZTA1	○	○	○

Note: Automatic blow off is prohibited (to protect flow guide tube from corrosion).

MEASURING PRINCIPLE

When zirconia ceramic stabilized with yttrium is heated to a high temperature, it becomes a solid electrolyte in which only oxygen ions can move. An electrode action shown by the following equation occurs with regard to the oxygen concentration P₁, P₂ (P₁ > P₂) at the sides of the platinum electrodes enameled to both sides of the zirconia element.



This means that the oxygen ions move from side P₁ during high oxygen concentration to side P₂ during low concentration. The force used for moving these ions is an electromotive force (E) shown by the following equation.

$$E = \frac{RT}{4F} \ln \frac{P_1(O_2)}{P_2(O_2)}$$

$$= 50.7 \log \frac{P_1(O_2)}{P_2(O_2)} \text{ mV (at } 800^\circ\text{C)}$$

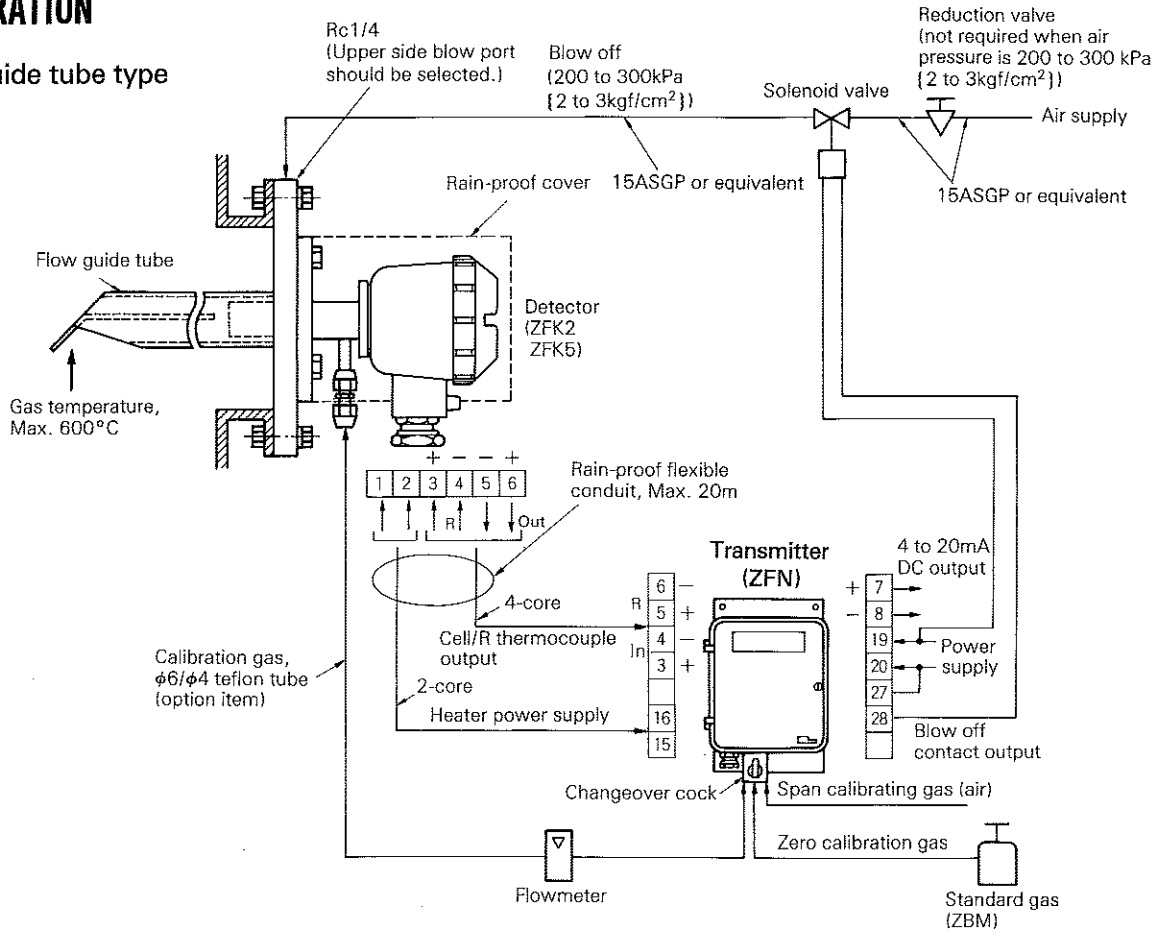
P₁ (O₂): Reference (atmospheric) oxygen concentration 20.6%

P₂ (O₂): Oxygen concentration in measured gas

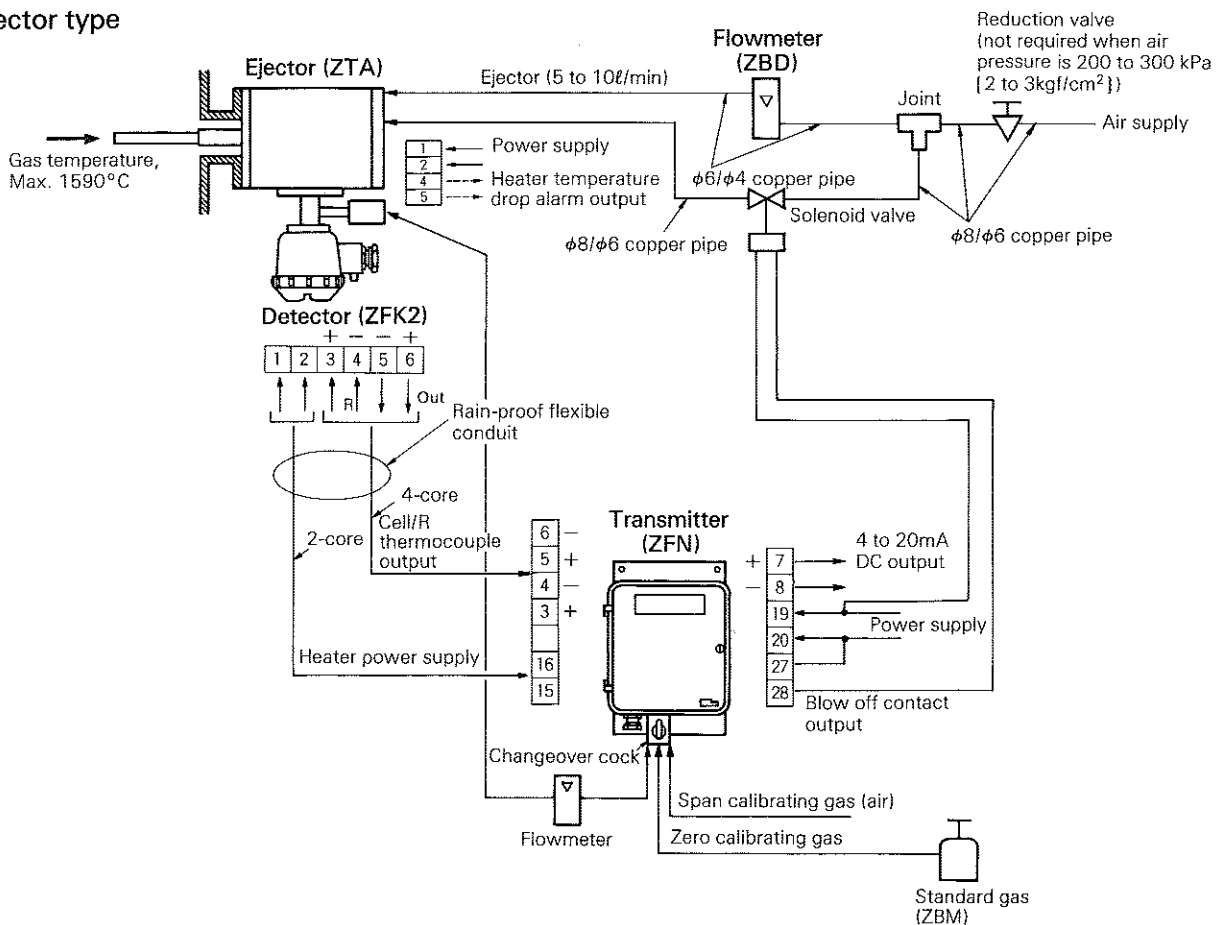
Therefore the unknown oxygen concentration P₂ (O₂) can be determined from the electromotive force (E).

CONFIGURATION

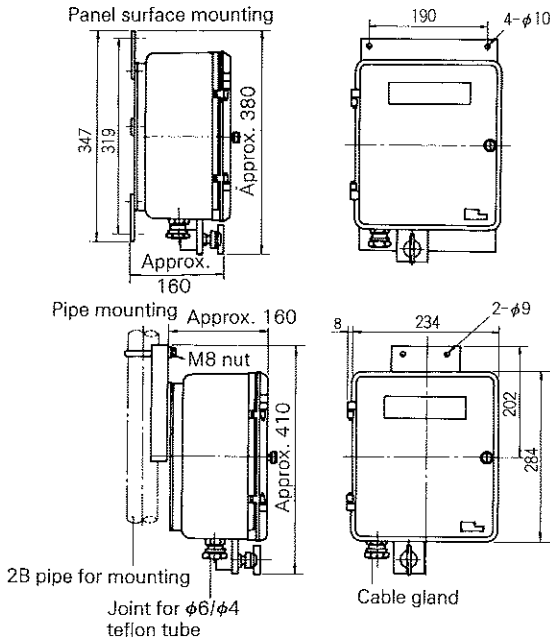
Flow guide tube type



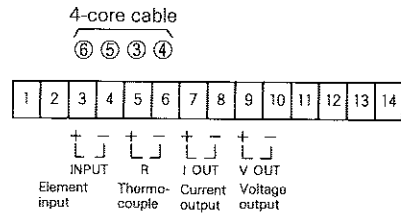
Ejector type



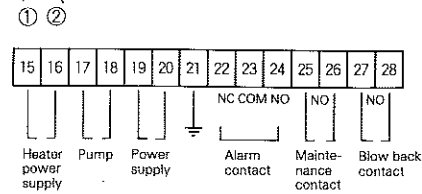
Transmitter (ZFN)



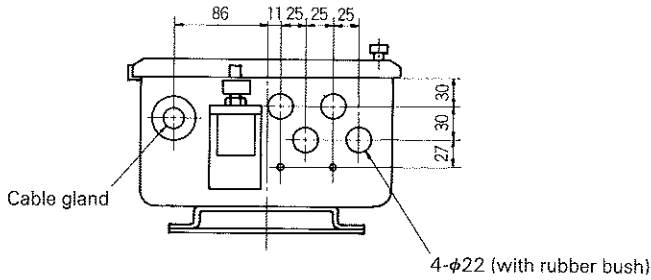
External connection diagram



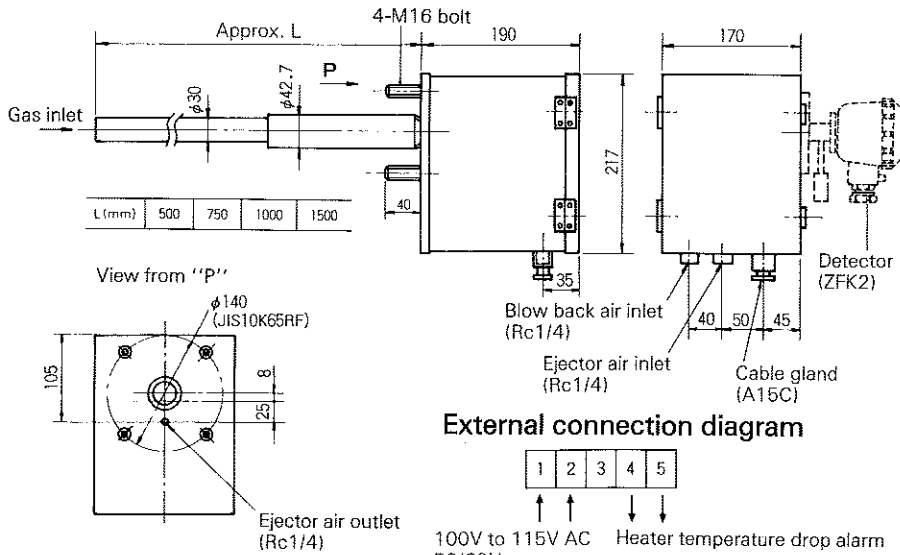
2-core cable



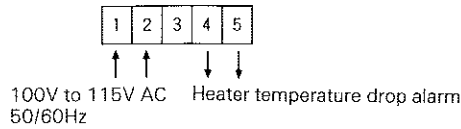
Notes: (1) ① to ⑥ are detector terminal numbers for cable.
 (2) Terminals 17 and 18 are option or for power supply of external pump.



Ejector (ZTA)



External connection diagram



Fuji Electric Co., Ltd.

12-1 Yurakucho 1-chome, Chiyoda-ku, Tokyo, 100 Japan
 Phone: Tokyo 3211-7111
 Telex: J22331 FUJIELEA or FUJIELEB