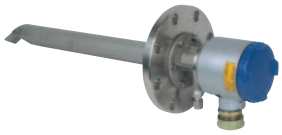
Fuji Electric

IN-SITU ZIRCONIA OXYGEN ANALYZER

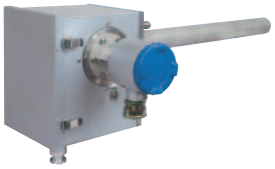
DATA SHEET

ZFK8, ZKM1/ZKM2, ZTA

This oxygen analyzer can continuously measure oxygen concentration in combustion exhaust gas of industrial boilers or furnaces, and is suited to combustion management and control.
The analyzer system is comprised of the detector and converter coupled together as a complete system. The detector includes the flow guide tube and the sensor. The flow guide tube inserted into the stack draws the process gas into the sensor. The converter has the sensor diagnosis function and the sensor recovery function, which ensure the long-term use and the stability of the sensor.



Detector with flow guide tube (ZFK8)



Detector with ejector (ZFK8, ZTA)

IP66 Converter (ZKM1)

IP67 Converter (ZKM2)

FEATURES

1. No gas sampling devices required
   Insertion type sensor delivers quick response.
2. Easy maintenance
   Modular design allows easy replacement of sensor, flow guide tube, and filter.
3. Reliability and long-term stability
   The converter diagnoses the sensor deterioration caused by components in sample gas, and electrically restores the sensor.
4. Improved safety
   The converter cuts off the power supply for the detector when detecting a burnout of thermocouple for heater control. The converter also cuts off the power supply at emergency, in response to an external contact input. These functions along with the key lock function are provided as standard to ensure improved safety.
5. Easy operation
   A user can operate the converter or make various settings on an interactive basis. Display language is available in English, Chinese, or Japanese.

SPECIFICATIONS

General Specifications

Measuring object: Oxygen in noncombustible gas

Measuring method:
Insertion type zirconia sensor

Measuring range: 0 to 2 ··· 50 vol%, two ranges, user configurable
(in 1 vol% O_2 steps)

Repeatability: Within ±0.5%FS

Linearity: Within ±2%FS

Response time: Within 4 to 7 sec, for 90% (from calibration gas inlet)

Warmup time: ≥ 10 min

Analog output: 4 to 20mA DC (allowable load resistance ≤ 500Ω) or 0 to 1V DC (output resistance ≥ 100Ω), linear, isolated

Power supply: Rated voltage;
100 to 120V AC (operating voltage 90 to 132V AC)
200 to 240V AC (operating voltage 190 to 264V AC)
Rated frequency; 50/60Hz

Power consumption:
Startup: 240VA (Detector: approx. 200VA, Converter: approx. 40VA)
During operation: 70VA (Detector: approx. 50VA, Converter: approx. 20VA)

Detector (ZFK)

Measured gas temperature:
Flow guide tube system; –10 to +600ºC (for general-use, corrosive gas)
Ejector system; –10 to +1500ºC (for high-temperature gas)
–10 to +800ºC (for general-use)

Measured gas pressure:
–3 to +3kPa

Flow guide tube:
- General-use, for corrosive gas, with blowdown nozzle:
  Flange: JIS 5K 65A FF
  Insertion length: 0.3, 0.5, 0.75, 1 m
- For high particulate:
  *The flow guide tube for high particulate gas comes with blowdown nozzle. You can select the one with or without the flow guide tube cover.
  Flange: JIS 5K 80A FF
  Insertion length: 0.3, 0.5, 0.75, 1 m

Ambient temperature:
Detector: -10 to +60°C
Detector flange surface: ≤ 125°C during the power is supplied
Ejector: -5 to +100°C
*When sample gas temperature is lower than 150°C and the outside temperature is lower than 0°C, cover the flow guide tube flange and the detector (the part that contact outside air) with thermal insulating material to prevent dew condensation.

Storage temperature:
Detector: –20 to +70ºC
Ejector: –10 to +100ºC

IP rating: Equivalent to IP66 excluding the filter
The heat-retaining cover (12th code) is required for the use in a cold area.

Filter: Alumina(filtering accuracy 50µm) and quartz paper

Main materials of gas-contacting parts:
Detector; Zirconia, SS316, platinum
Flow guide tube; SS304 or SS316
Ejector (general use); SS316, SS304
Ejector; (for high temperature) SiC, SS316, SS304

Pipe adapter for calibration gas inlet:
for 6 mm tube or 1/4 inch tube (as selected in the 6th code)

Pipe adapter for reference gas inlet (option):
for 6 mm tube or 1/4 inch tube (as selected in the 13th code)

Installation: Horizontal plane ±45º, ambient air should be clean.

Dimensions: (L × max. dia.) 194mm × 125.5mm (detector)

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

Finish color: Silver and SS metallic color

Calibration gas flow:
1.5 to 2 L/min

Blowdown air inlet pressure:
200 to 300kPa

Ejector: Probe for guiding measured gas to detector
Flange; JIS10K 65A RF
Insertion length; 0.5, 0.75, 1, 1.5m (according to customer's specification)

Ejector air inlet flow rate:
5 to 10 L/min

Ejector exhaust gas processing:
Returned to flue or furnace

Ejector heater temperature drop alarm output:
SPST-NO contact, 200 V AC, 2A
Mechanical thermostat
The contact is closed when the heater temperature is 100°C or lower.

Converter (ZKM)

Concentration value indication:
Digital indication in 4 digits

Contact output:
6 points, SPST-NO,
250 V AC, 3A or 30 V DC, 3A
Functions;
- Under maintenance
- Error[*1]
- Alarm[*2]
- Zero calibration gas
- Span calibration gas
- Blowdown[*3]

Notes
1. The contact is closed upon: open circuit of thermocouple line, open circuit of O_2 sensor line, temperature overrange, calibration error, zero/span error, output error.
2. The contact is closed upon the alarm you selected among: H, L, HL, HH, LL.
3. The contact is closed during blowdown. This function is available only on the version with blowdown nozzle.

Contact input:
3 points
ON; 0V (10mA or less), OFF; 5V
Functions;
- External hold
- Calculation reset
- Heater OFF
- Blow down (option)
- Inhibition of calibration
- Calibration start
- Range change

Calibration method:
(a) Manual calibration with key operation
(b) Auto. calibration (option)
Calibration cycle; 00 day 00 hour to 99 days 23 hours
(c) Batch calibration

Calibration gas:
- Setting range
  Zero gas; 0.010 to 25.00% O_2
  Span gas: 0.010 to 50.00% O_2
- Recommended calibration gas concentration
  Zero gas; 0.25 to 2.0% O_2
  Span gas; 20.6 to 21.0% O_2
  (oxygen concentration in the air)

Blowdown: (option)
A function for blowing out dust that has accumulated in the flow guide tube. Blowdown can be performed for a predetermined time and at predetermined intervals.
Blowdown cycle; 00 hour 00 minute to 99 hours 59 minutes
Blowdown time; 0 minute 00 second to 0 minutes 999 seconds

Output signal hold:
The converter holds the output signal during: calibration, blowdown, sensor recovery, sensor diagnosis, PID auto-tuning, and during the maintenance mode is set to "yes". You can cancel the output hold function during warm-up.

Selector valve and flowmeter (option):
The selector valve allows you to switch between the zero gas and the span gas when you carry out a calibration. The flowmeter is used for regulating the flow rate of the calibration gas.

Communication (option):
RS485 (MODBUS)

Combustion efficiency display (option):
When you select this display, "rich mode display" will be simultaneously displayed. This function calculates and displays combustion efficiency from oxygen concentration and measured gas temperature.
Thermocouple (R) is required for temperature measurement.

Ambient temperature:
–20 to +55°C

Ambient humidity:
95% RH or less, non condensing

Storage temperature:
–30 to +70°C

Storage humidity: 95% RH or less, non condensing

IP rating: Equivalent to IP66 or IP67, excluding the benchtop type

Case material: Aluminum case

Dimensions (H x W x D):
170 × 159 × 70mm (IP66)
220 × 230 × 95mm (IP67)
182 × 163.5 × 70.6mm (Bench type)

Weight: IP66 and benchtop:
Approx. 2kg (excluding cable and detector)
IP67: Approx. 4.5kg (excluding cable and detector)

Finish color: IP66: Case: Silver
Cover: Pantone Cool Gray 1C-F
IP67: Munsell 6PB 3.5/10.5 (blue)
Cover: Silver (case)

Installation: panel mounting, pipe mounting, or benchtop

CODE SYMBOLS

Detector

ZFK8 [5][6][7][8] - [9][10][11][12][13] - [14][15][16]

ZFK8 [R][ ][ ][5] - [ ][ ][ ][ ][ ] - [1][ ][ ]

Digit	Description			Note	Code
6	**Pipe adapter for calibration gas inlet**				
	For ø6mm tube (SS)				1
	For ø1/4 inch tube (SS)				2
	Ball valve				3
7	**Power supply**				
	100 to 120 V AC 50/60 Hz				1
	200 to 240 V AC 50/60 Hz				3
9	**Flow guide tube**				
10	<Flange>	<Application>	<Length>		
11	No tube				0 Y 0
	SS304	general use	300mm		5 A 3
	SS304	general use	500mm		5 A 5
	SS304	general use	750mm		5 A 7
	SS304	general use	1000mm		5 A 1
	SS316	for corrosive gas	300mm		5 B 3
	SS316	for corrosive gas	500mm		5 B 5
	SS316	for corrosive gas	750mm		5 B 7
	SS316	for corrosive gas	1000mm		5 B 1
	SS316	with blow-down nozzle	300mm		5 C 3
	SS316	with blow-down nozzle	500mm		5 C 5
	SS316	with blow-down nozzle	750mm		5 C 7
	SS316	with blow-down nozzle	1000mm		5 C 1
	SS316	for high particulate	300mm		6 D 3
	SS316	for high particulate	500mm		6 D 5
	SS316	for high particulate	750mm		6 D 7
	SS316	for high particulate	1000mm		6 D 1
	SS316	for high particulate with cover	300mm		6 E 3
	SS316	for high particulate with cover	500mm		6 E 5
	SS316	for high particulate with cover	750mm		6 E 7
	SS316	for high particulate with cover	1000mm		6 E 1
	Others				Z Z Z
12	**Heat-retaining cover**				
	Without				Y
	With				A
13	**Pipe adapter for reference gas inlet**				
	None				Y
	For ø6mm tube (SS)				A
	For ø1/4 inch tube (SS)				B
14	**Filter**				
	Standard				1
15	**Instruction manual**				
	Japanese				J
	English				E
	Chinese				C
16	**Specification name plate**				
	100 to 120V AC, 50/60Hz				1
	200 to 240V AC, 50/60Hz				2

Converter

ZKM [4][5][6][7][8] - [9][10][11][12]

ZKM [ ][ ][ ][ ][1] - [ ][ ][ ][1]

Digit	Description	Note	Code
4	**Construction**		
	IP66		1
	IP67		2
	Benchtop		3
5	**Output signal**		
	4 to 20mA DC		B
	0 to 1V DC		E
	Other		Z
6	**Communication**		
	None		Y
	RS-485		2
7	**Mounting bracket**		
	None (for benchtop type)		Y
	Panel mounting		1
	Pipe mounting		2
9	**Optional Functions**		
	None		Y
	Combustion efficiency display function	Note1	1
	Blowdown		2
	Auto calibration		3
	Combustion efficiency indication + Blowdown	Note1	4
	Combustion efficiency indication + Auto calibration	Note1	5
	Blowdown + Auto calibration		6
	Combustion efficiency indication + Blowdown + Auto calibration	Note1	7
10	**Display language**		
	Japanese		J
	English		E
	Chinese		C
11	**Option**		
	None	Note2	Y
	With valve		1
	With valve + flowmeter		2

Notes
1. On the versions with combustion efficiency display, the rich mode indicator is available as well.
2. If you select the benchtop type (4th code "3") or the versions with auto calibration (9th code "3", "5", "6", or "7"), select "Y" in the 11th code.

Dedicated cable

ZRZ [4][5][6][7][8] - [9]

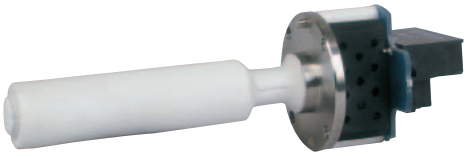
ZRZ [K][R][ ][ ][1] - [ ]

Digit	Description		Note	Code
4	**Connectable device**			
	ZKM			K
5	**Type**			
	For type R thermocouple			R
6	**Conduit length**	**Cable length**		
7	None	6 m		YA
	None	10 m		YB
	None	15 m		YC
	None	20 m		YD
	None	30 m		YE
	None	40 m		YF
	None	50 m		YG
	None	60 m		YH
	None	70 m		YJ
	None	80 m		YK
	None	90 m		YL
	None	100 m		YM
	6 m (Note 3)	6 m		AA
	10 m (Note 3)	10 m		BB
	15 m (Note 3)	15 m		CC
	20 m (Note 3)	20 m		DD
9	**Cable end treatment**			
	None			0
	One side (detector side)			1
	Both sides			2

Note 3) For connection between detector and converter, the conduit to be used should be rainproof flexible type.

Replacement detector element

Power supply	Code symbols
100 to 120V AC	ZFK8YY15-0Y0YY-0YY
200 to 240V AC	ZFK8YY35-0Y0YY-0YY



Ejector

	4	5	6	7	8
ZTA		1			1

Digit	Description	Note	Code
4	**Measured gas temperature**		
	For high temperatures (+1500°C max.)		1
	General-use (+800°C max.)		2
6	**Insertion length [mm]**		
	500		B
	750		C
	1000		D
	1500		E
7	**Power supply**		
	100V/115V AC 50/60Hz		1
	200V/220V AC 50/60Hz		3
	230VAC 50/60Hz		5

SCOPE OF DELIVERY

Detector: Detector × 1, Viton O ring × 1, mounting screw (M5 × 16) × 6, thermal sticker × 1, flow guide tube (as specified) × 1, ceramic filter × 1, heat-retaining cover (as specified) × 1, Instruction manual × 1

Converter: Converter × 1, mounting bracket set, (as specified) × 1
AC250V 500mA T fuse × 2, AC250V 2.5A T fuse × 2
Instruction manual × 1

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

Items to be prepared separately:

(1) Standard gas for calibration
Type ZBM□NSH4-01 (up to 5% O_2 range)
Type ZBM□NSJ4-01 (over 5% O_2 range)

(2) Pressure regulator for standard gas (type ZBD61003)

(3) Flowmeter
Type; ZBD42203, 0.2 to 2L/min (for calibrating gas)
Type; ZBD42403, 1 to 10L/min (for ejector)

IMPORTANT INFORMATION

- Combustible gases such as CO and H_2 in the measured gas cause measurement error.
- Corrosive gases, for example, Si vapor, alkaline metal, P, and Pb, may shorten the life of the sensor.
- If the gas temperature reaches 300°C or above, remote the detector flange from the furnace wall so that the surface temperature of the flange will not go higher than 125°C. Mount the flow guide tube in such a direction that less gas flows into the detector.
- When the dust contained in the process gas is high, install the flow guide tube inclined downward, and in such a direction that less gas flows into the detector.
- If you use the analyzer in a waste incinerator, do not use the automatic blowdown because it causes corrosion of the flow guide tube due to drain water. Carry out blowdown manually after the furnace is stopped and the change in readings is decreased.

DETECTOR SELECTION GUIDE

The device combination varies according to the conditions of the gas to be measured. Select the appropriate devices to be combined with reference to the following table.

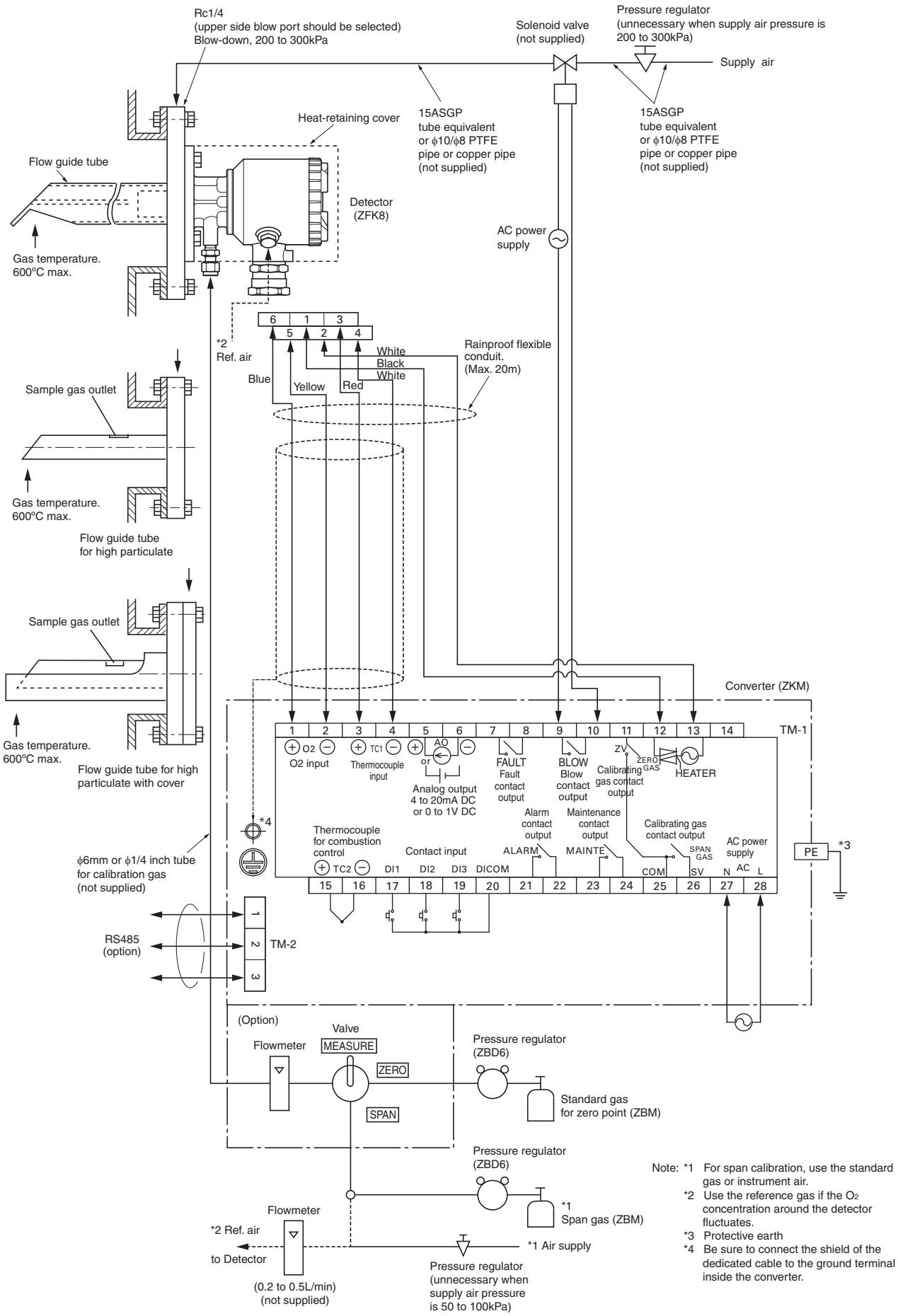
Application		Gas conditions				Detector			Converter	Ejector
		Temp.	Flow rate	Dust	Moisture	Flange material	Flow guide tube	9th–11th code		
Boilers	Gas, oil	≤ 600 °C	5–20 m/s	< 0.2 g/Nm^3	Low	SS 304	Standard	5A□	ZKM1 or ZKM2	—
	Coal			< 10 g/Nm^3	Low	SS 316	With blowdown nozzle	5C□		
Refuse incinerators		≤ 600 °C	5–20 m/s	< 1 g/Nm^3	Low		For corrosive gas	5B□		
				< 10 g/Nm^3	Low		With blowdown nozzle	5C□		
				< 25 g/Nm^3	Low		For high particulate	6D□		
				< 25 g/Nm^3	High		For high particulate, with cover	6E□		
Heating furnaces		≤ 800 °C	≤ 1 m/s	< 1 g/Nm^3	Low	—	No flow guide tube	0Y0		ZTA2
		≤ 1500 °C	≤ 1 m/s	< 1 g/Nm^3	Low	—	No flow guide tube	0Y0		ZTA1

Notes

- Dust volumes listed above are approximate value.
- If the oxygen concentration of ambient air fluctuates, select a detector with a pipe adapter for reference gas inlet (13th code A or B).
- Consult us for specifications not listed above.

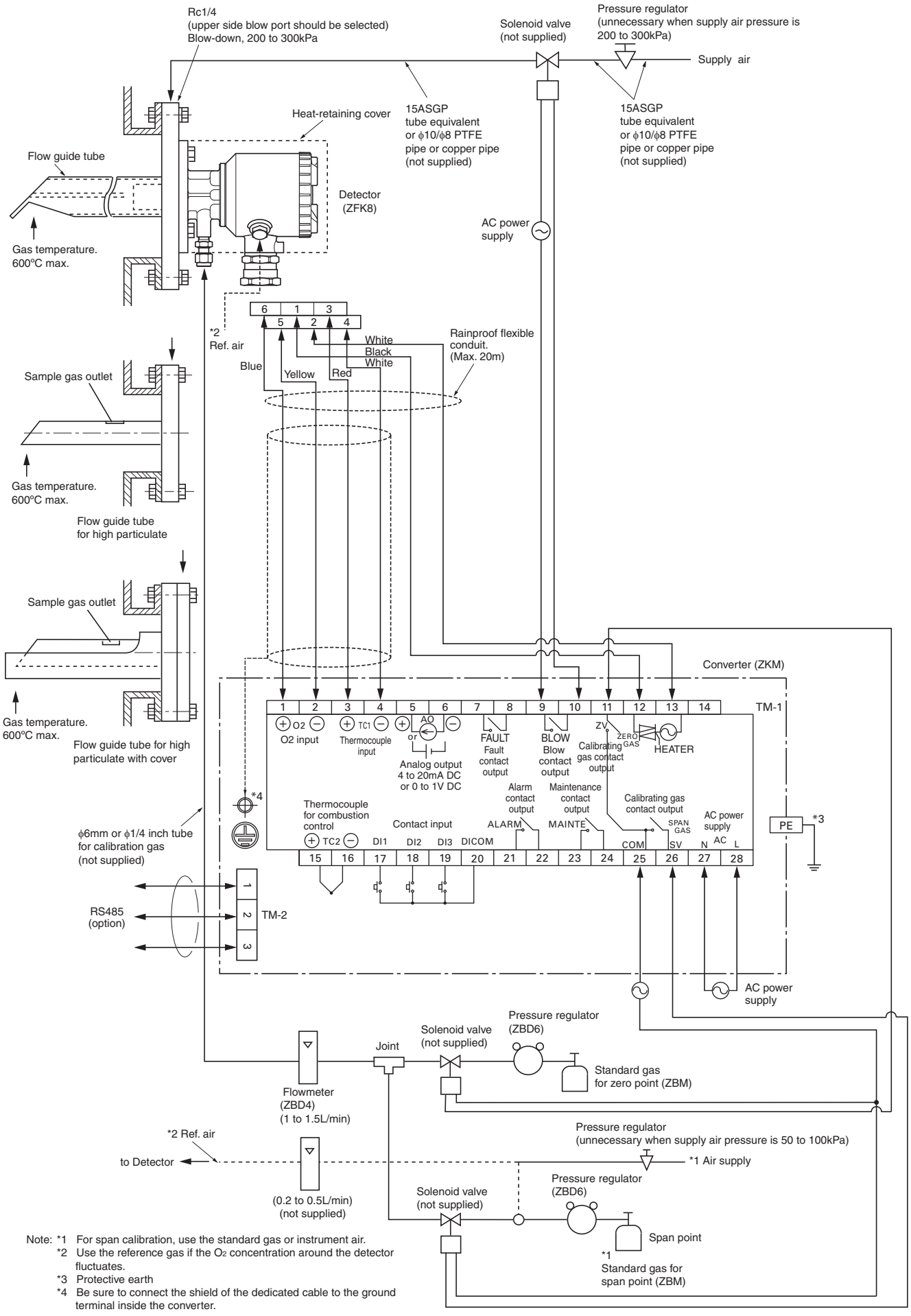
CONFIGURATION

Flow guide tube system (with valve)



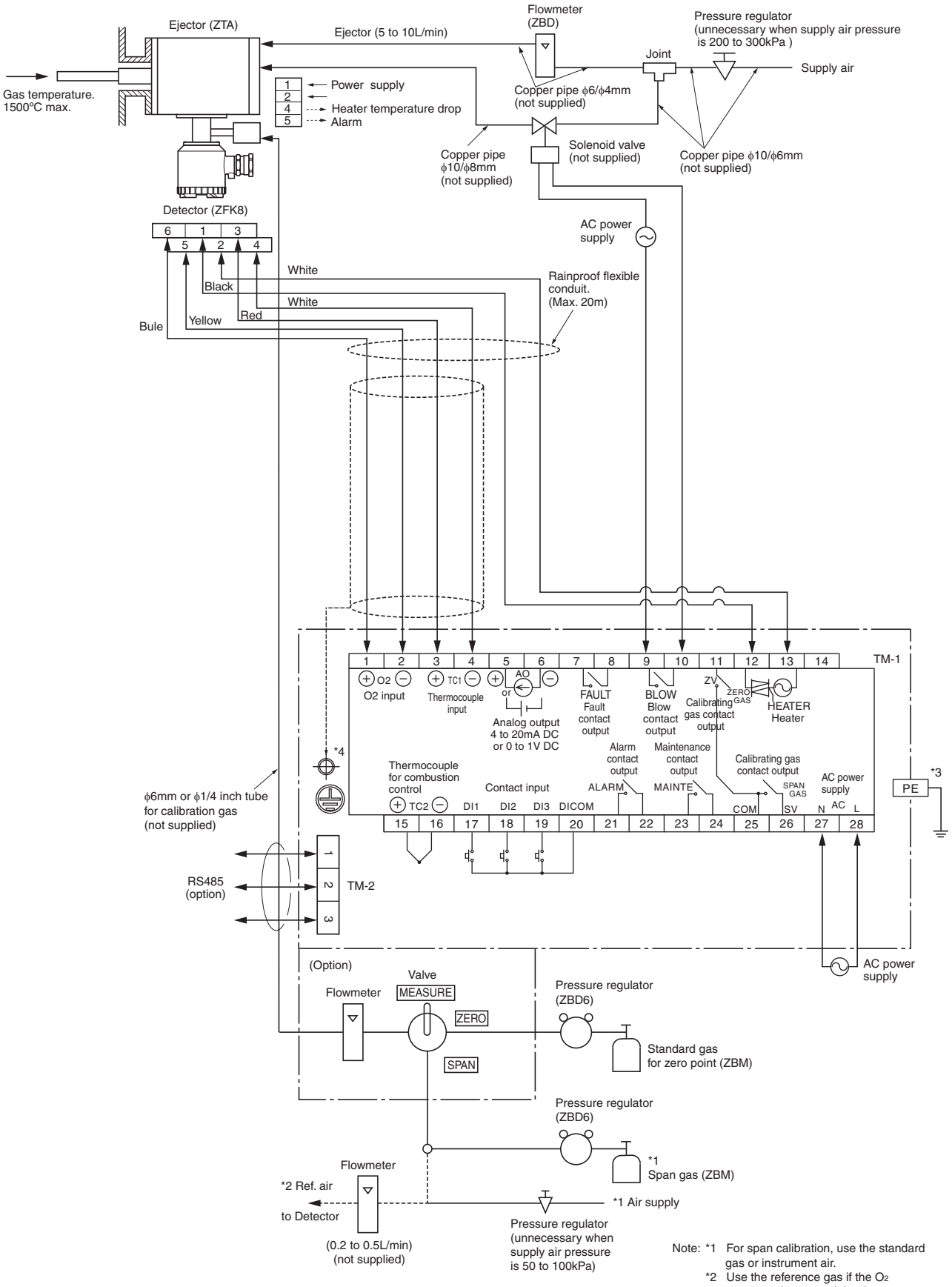
Note: *1 For span calibration, use the standard gas or instrument air.
*2 Use the reference gas if the O_2 concentration around the detector fluctuates.
*3 Protective earth
*4 Be sure to connect the shield of the dedicated cable to the ground terminal inside the converter.

Flow guide tube system



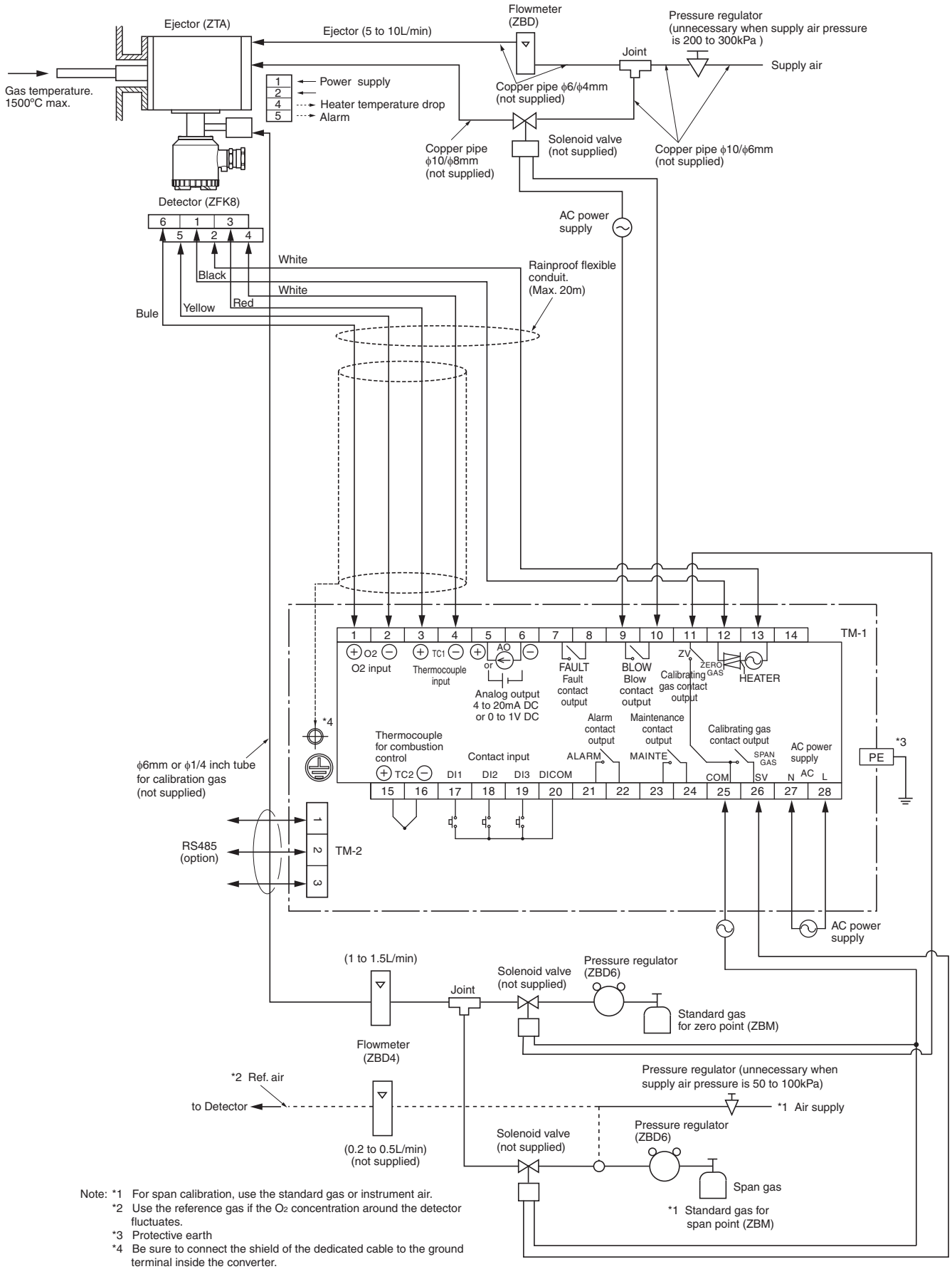
Note: *1 For span calibration, use the standard gas or instrument air.
*2 Use the reference gas if the O_2 concentration around the detector fluctuates.
*3 Protective earth
*4 Be sure to connect the shield of the dedicated cable to the ground terminal inside the converter.

Ejector system (with valve)



Note: *1 For span calibration, use the standard gas or instrument air.
*2 Use the reference gas if the O_2 concentration around the detector fluctuates.
*3 Protective earth
*4 Be sure to connect the shield of the dedicated cable to the ground terminal inside the converter.

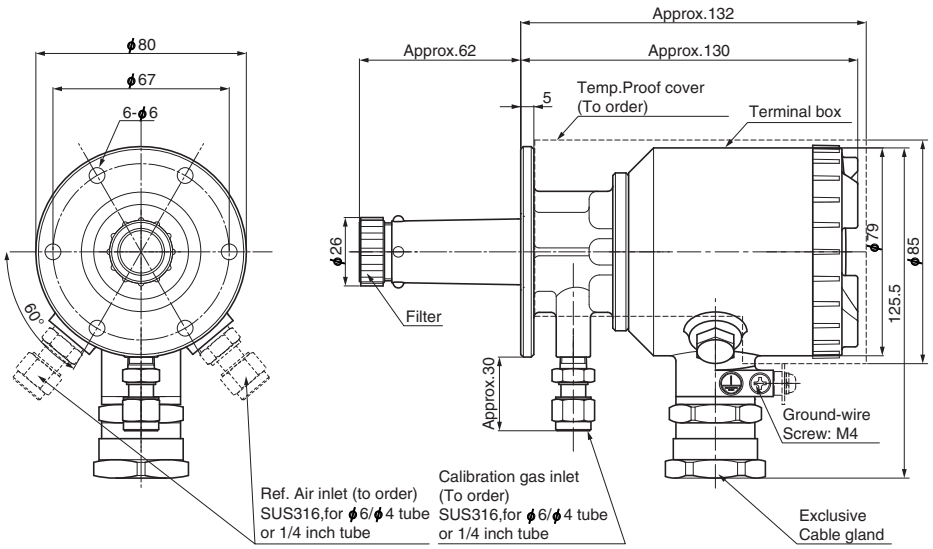
Ejector system



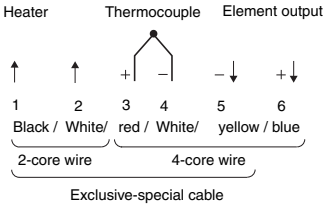
Note: *1 For span calibration, use the standard gas or instrument air.
*2 Use the reference gas if the O_2 concentration around the detector fluctuates.
*3 Protective earth
*4 Be sure to connect the shield of the dedicated cable to the ground terminal inside the converter.

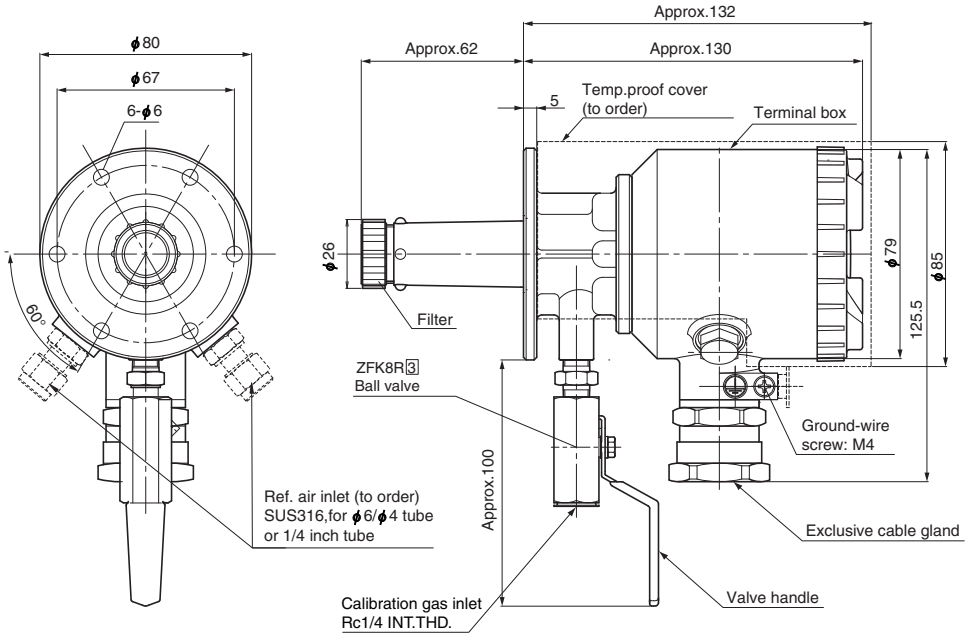
OUTLINE DIAGRAM (Unit:mm)

Detector (ZFK8)

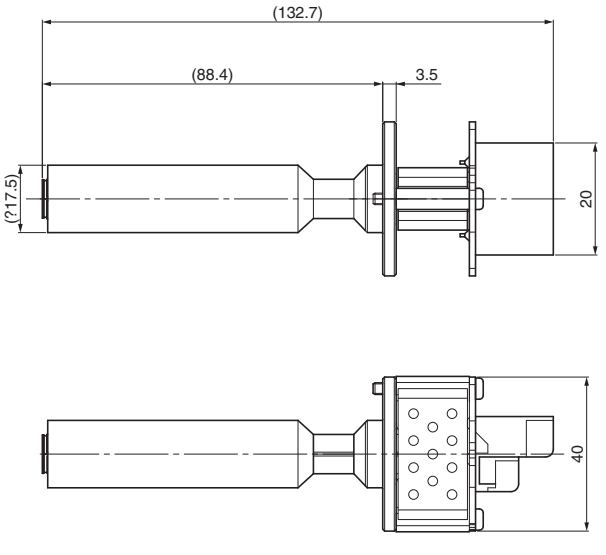


EXTERNAL CONNECTION DIAGRAM

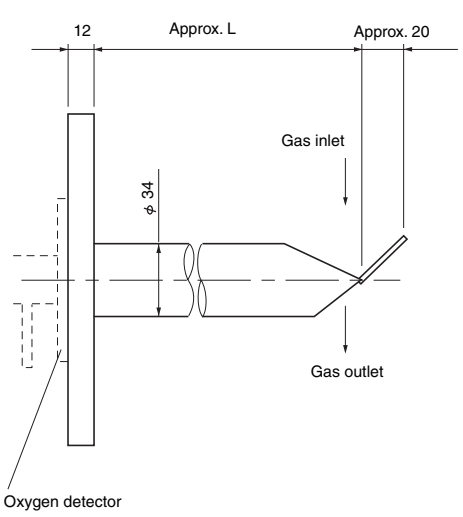


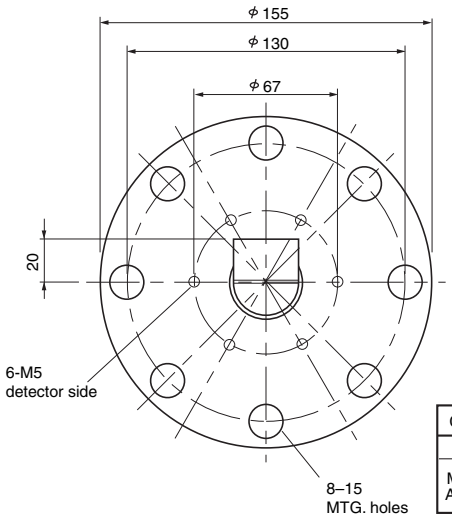


Sensor unit (ZFK8YY)



Flow guide tube

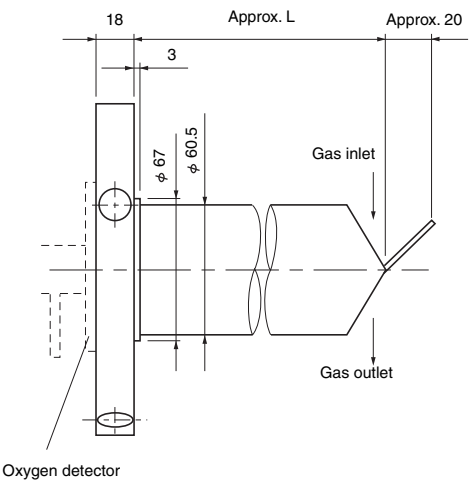


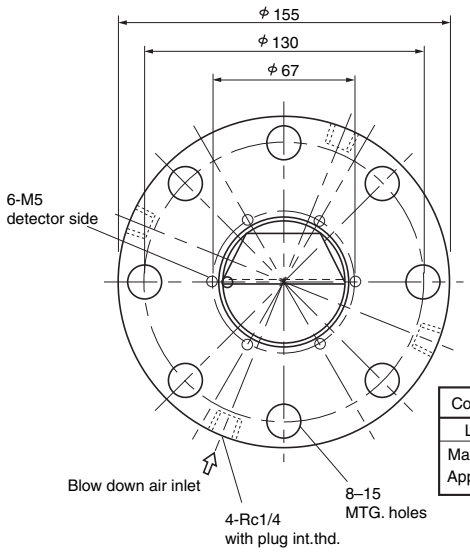


Z F K 8 R□ □5 - 5 A [3/5/7/1] □

Code 11th	3	5	7	1	Z
L (m)	0.3	0.5	0.75	1.0	L= (to order)
MASS Approx.(kg)	2.7	3.3	4.1	4.8	

Flow guide tube (with blow-down nozzle)

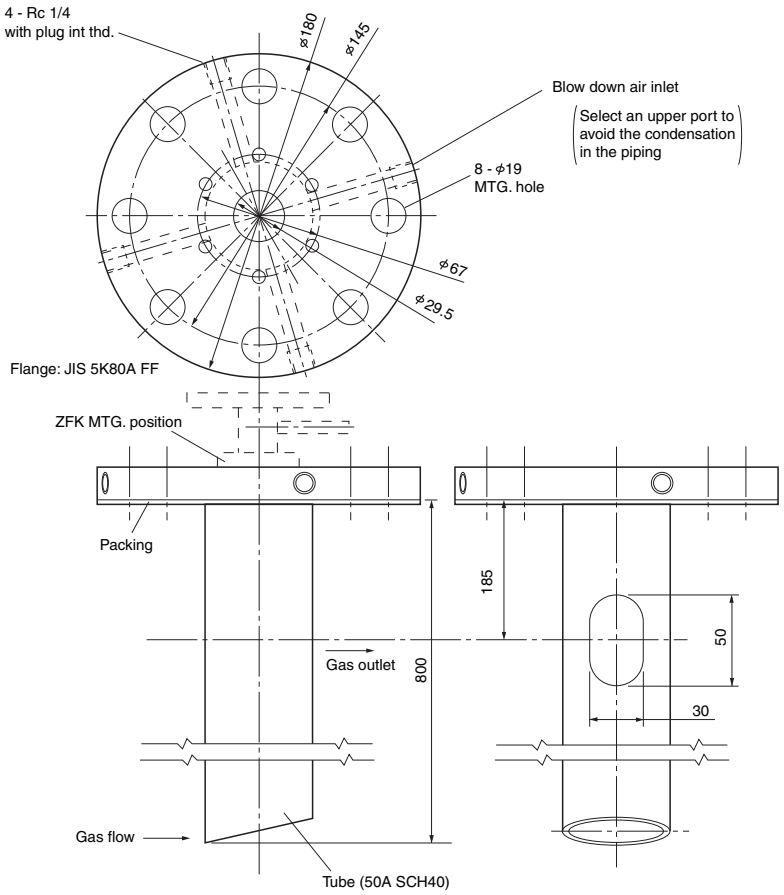




Z F K 8 R□ □5 - 5 C [3/5/7/1] □

Code 11th	3	5	7	1	Z
L (m)	0.3	0.5	0.75	1.0	L= (to order)
Mass Approx.(kg)	3.0	3.8	4.8	5.7	

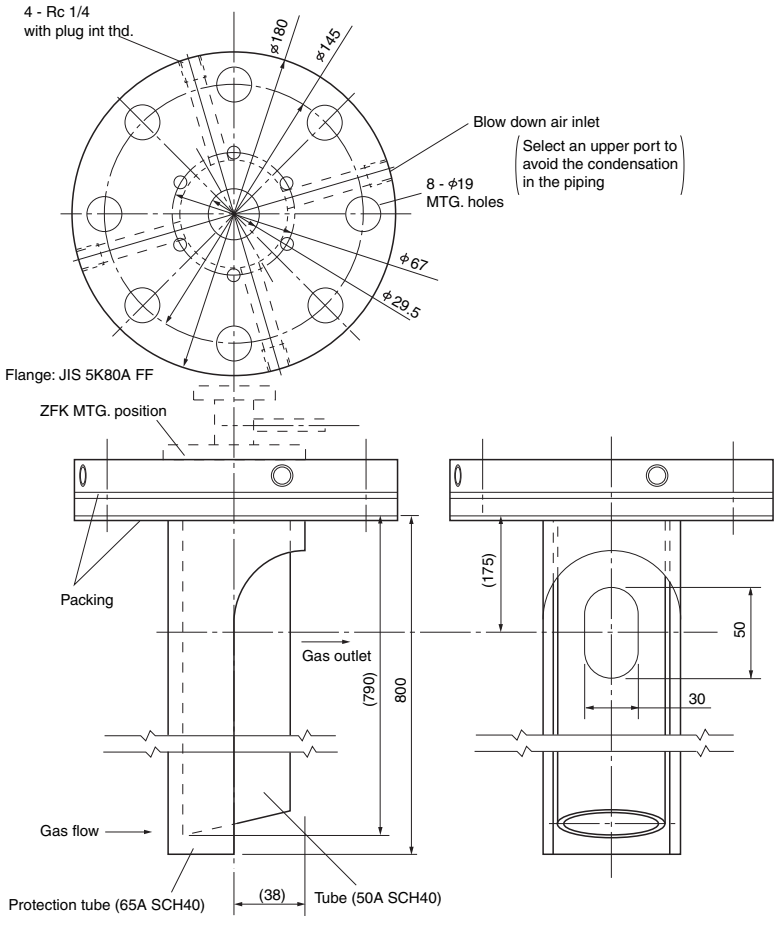
Flow guide tube (for high particulate)



Z F K 8 R□□5 - 6 D 3 5 7 1 □

Code 11th	3	5	7	1	Z
L (m)	0.3	0.5	0.75	1.0	L= (to order)
Mass Approx.(kg)	4.5	5.6	7.0	8.3	

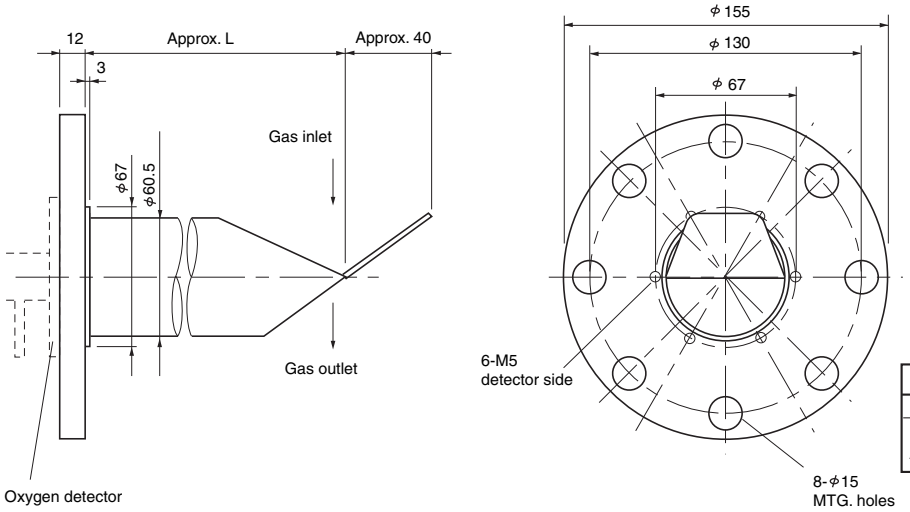
Flow guide tube (for high particulate with cover)



Z F K 8 R□□5 - 6 E 3 5 7 1 □

Code 11th	3	5	7	1	Z
L (m)	0.3	0.5	0.75	1.0	L= (to order)
Mass Approx.(kg)	7.1	9.0	11.4	13.6	

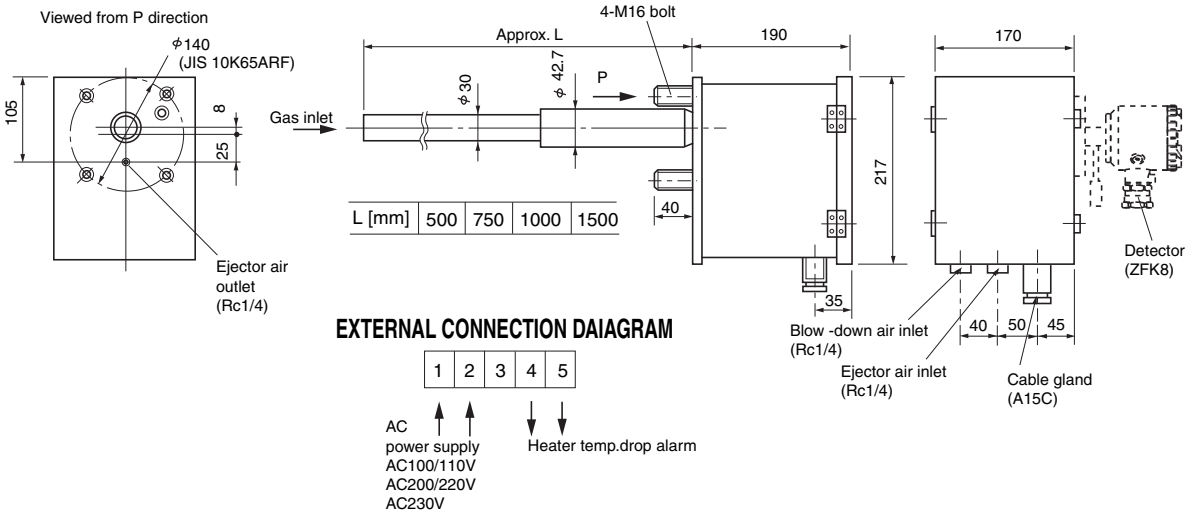
Flow guide tube (for corrosive gas)



Z F K 8 R□□5 - 5 B [3/5/7/1] □

Code 11th	3	5	7	1	Z
L (m)	0.3	0.5	0.75	1.0	L= (to order)
MASS Approx.(kg)	3.3	4.5	6.1	7.6	

Ejector (ZTA)



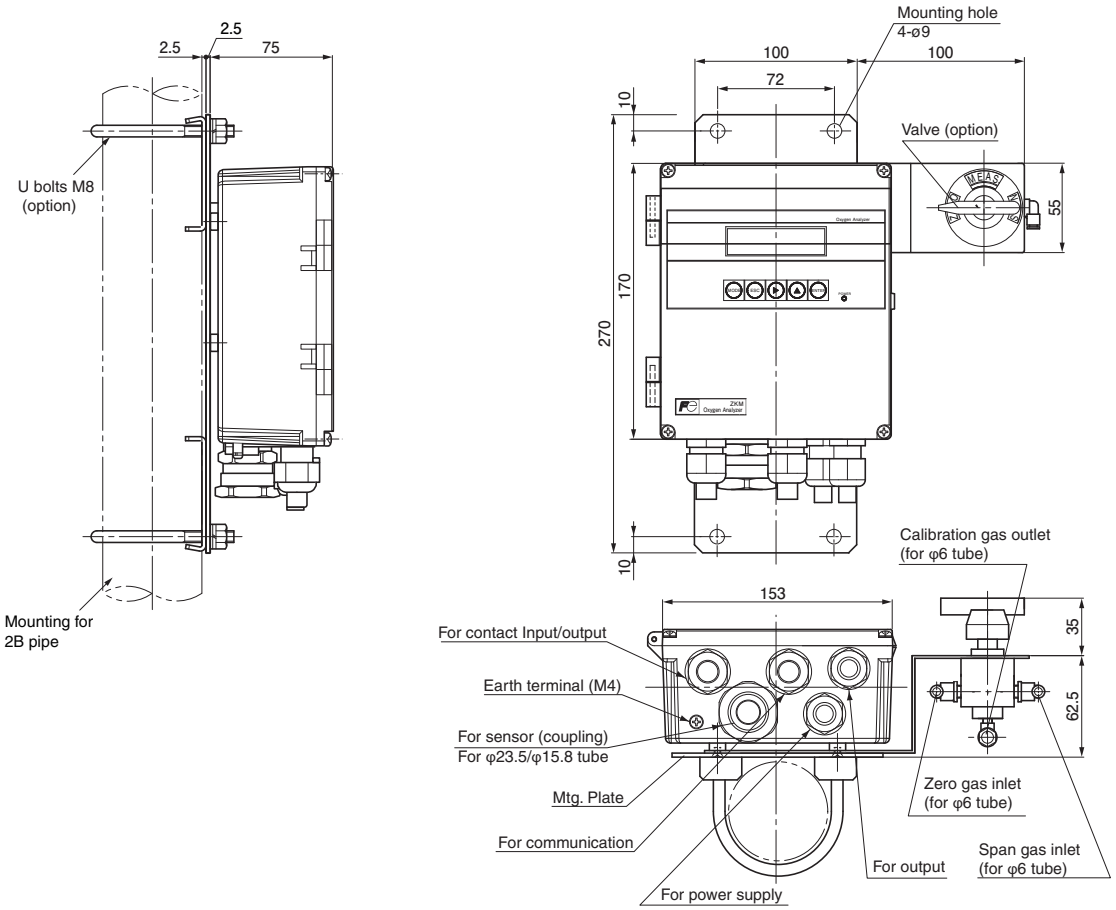
EXTERNAL CONNECTION DAIAGRAM

1	2	3	4	5

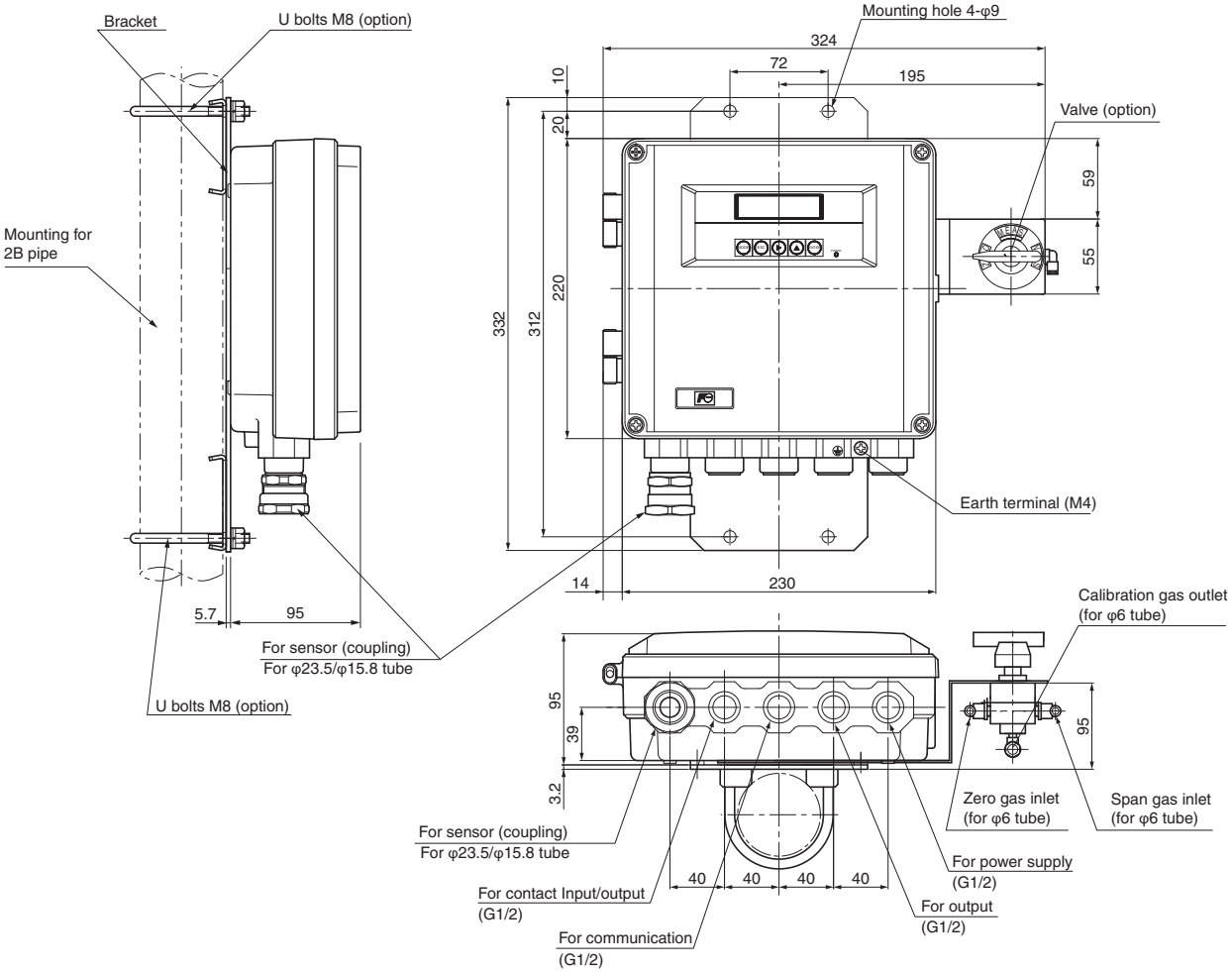
AC power supply
AC100/110V
AC200/220V
AC230V

Heater temp.drop alarm

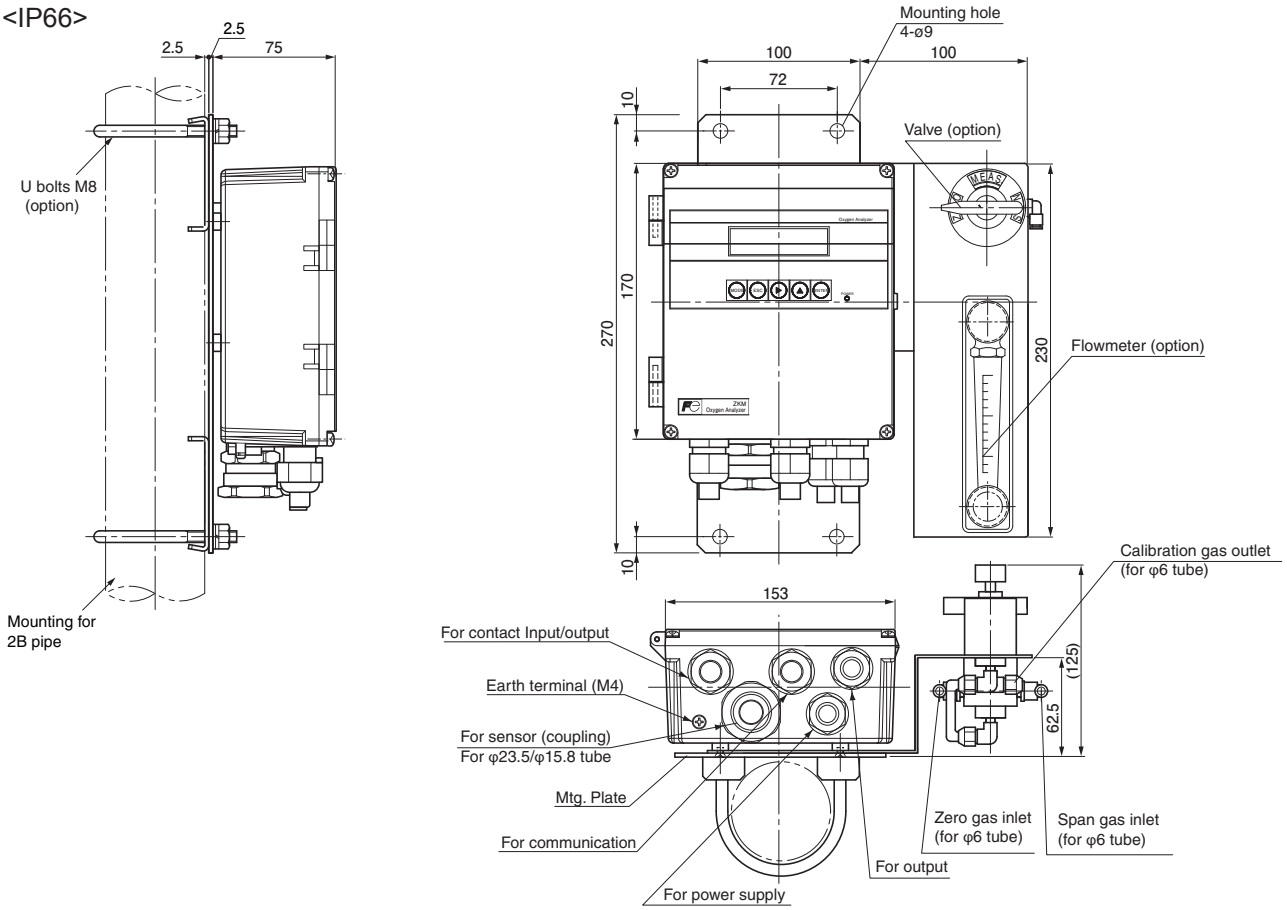
Converter (ZKM1)
<IP66>



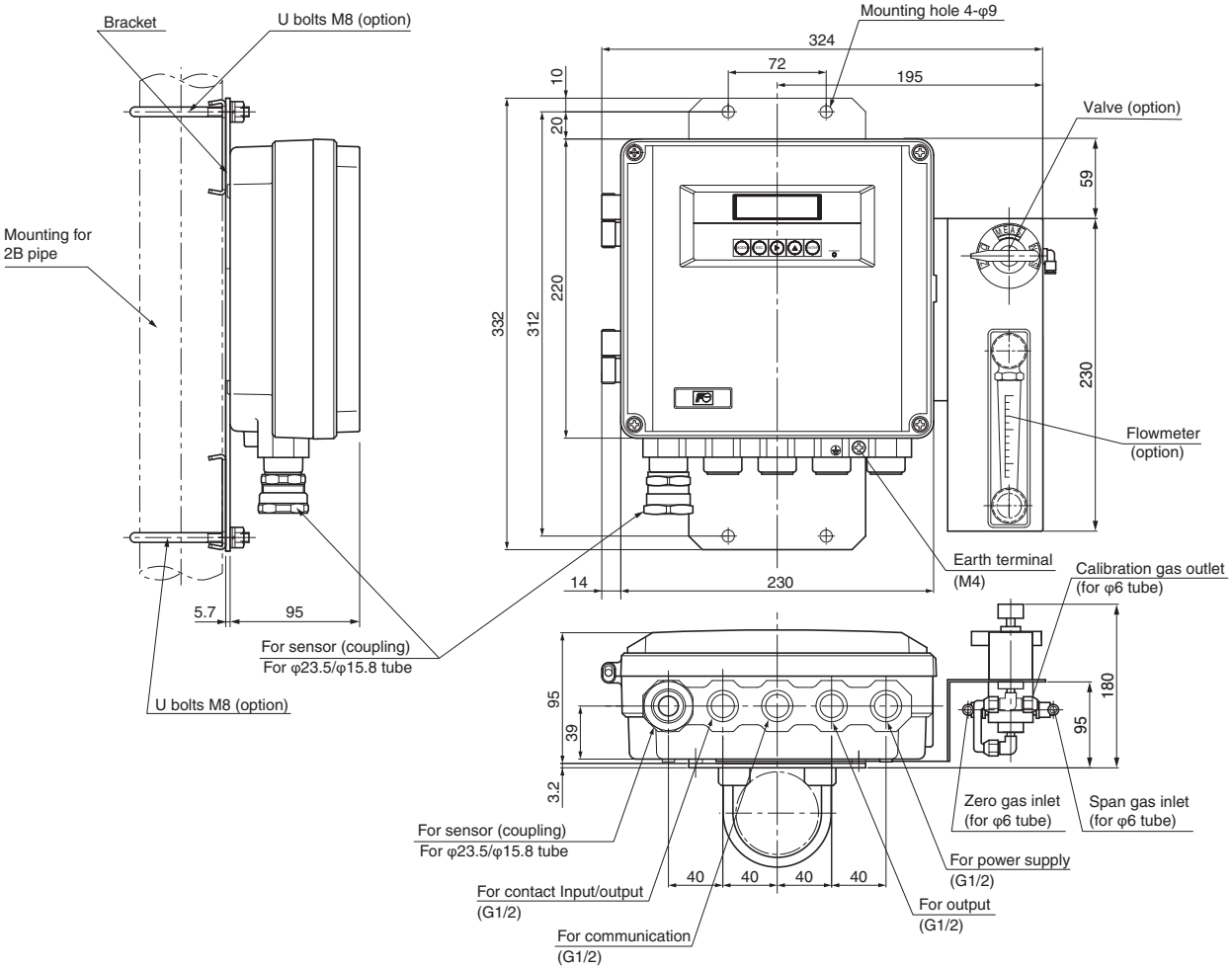
Converter (ZKM2)
<IP67>



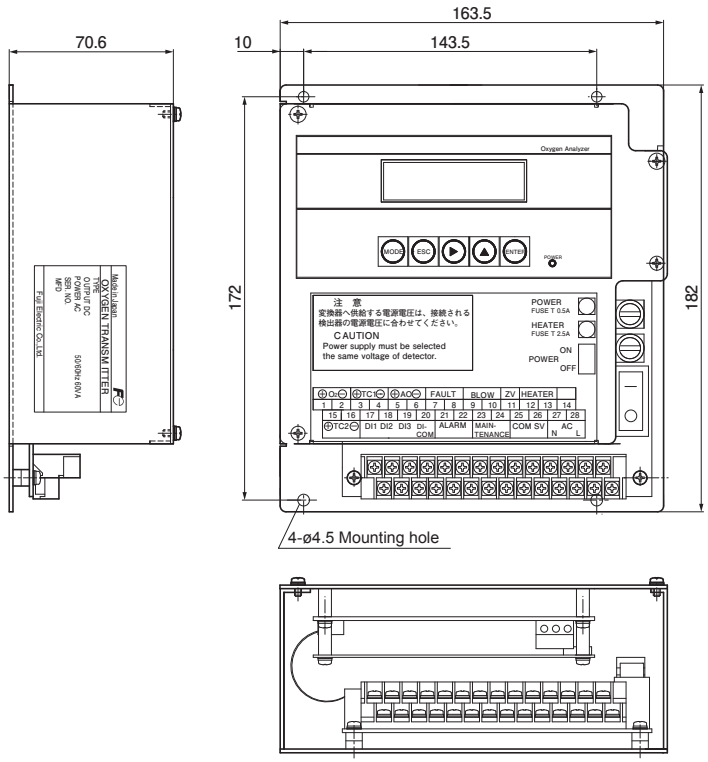
Converter (ZKM1)
<IP66>



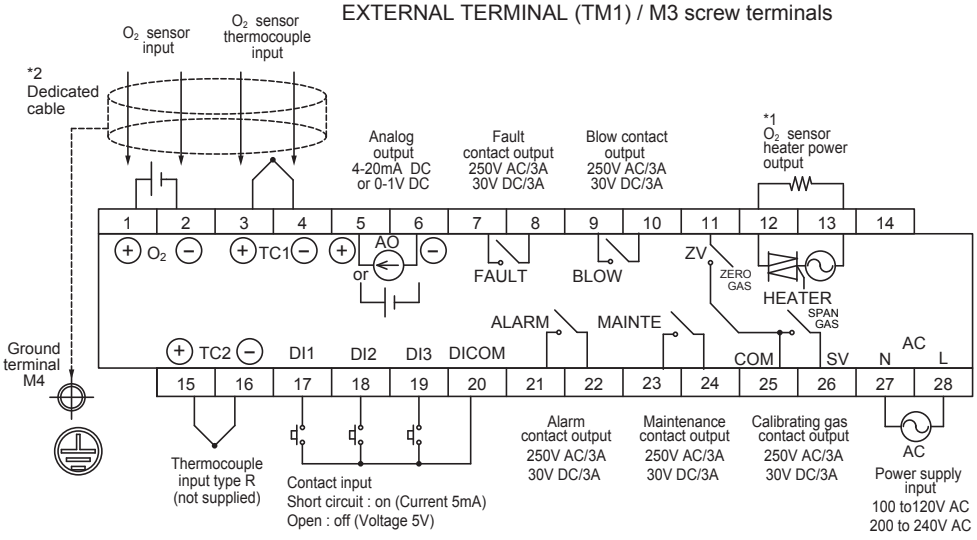
Converter (ZKM2)
<IP67>



Converter (ZKM3)
<Bench type>



EXTERNAL TERMINAL (TM1) / M3 screw terminals



RS-485 communication terminal (TM2, option) /
Euro-style terminals

1	2	3
GND	TRX–	TRX+

Notes:
*1. The heater uses the same power source as the converter.
*2. Connect the shield of the dedicated cable to the ground terminal inside the converter.

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual.

Fuji Electric Co., Ltd.

Instrumentation & Sensors Planning Dept.
1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan
http://www.fujielectric.com
Phone: +81-42-514-8930 Fax: +81-42-583-8275
http://www.fujielectric.com/products/instruments/

Information in this catalog is subject to change without notice.

Printed in Japan