Fuji Electric

IN-SITU ZIRCONIA OXYGEN ANALYZER
<HART communication>

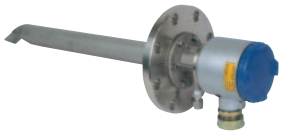
DATA SHEET

ZFK8, ZKM-2, ZTA

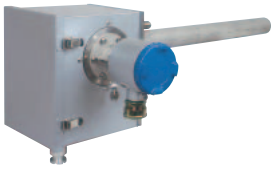
This oxygen analyzer is used to continuously measure oxygen concentration in combustion exhaust gas of industrial boilers or furnaces, and is ideally suited for combustion management and control.

The analyzer system is comprised of the detector and converter coupled together as a complete system. Detector setting configuration includes the detector flow guide tube and detector sensor. The flow guide tube is inserted directly into the gas and directs gas to the sensor for measurement. The converter (ZKM) is comprised of the signal processor, input/output and communications, display and system controls.

The converter provided with an unconventional sensor-diagnostic function ensures long-term stable detecting operation.



General-use detector (ZFK8)



High-temperature detector (ZTA)

<IP66> Converter (ZKMA)

<IP67> Converter (ZKMB)

FEATURES

1. No need for gas sampling devices
   Since the sensor unit is directly inserted into a flue, gas-sampling devices such as gas aspirator and dehumidifier are not required, which ensures fast response.
2. Easy maintenance
   The sensor in a unit structure mounted to the detector can be replaced easily. Since the detector and the flow guide tube are installed separately, you can easily replace the filter at the tip of the detector and can maintain the detector and the flow guide tube separately according to the degree of corrosion.
3. High reliability ensured by the sensor diagnostic function
   To check the degree of sensor depletion due to gas components in the target gas, the converter is equipped with the sensor diagnostic function, so that you know when to replace 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 equipped as standard to ensure improved safety.
5. Simple operation
   A user can operate the converter or make various settings on an interactive basis. Display language is available in English, Japanese, or Chinese.
6. HART communication is available as an option
   The HART communication enables remote control.
   *HART® is a registered trademark of the HART Communication Foundation.

SPECIFICATIONS

General Specifications

Measuring object: Oxygen in noncombustible gas

Measuring method:
Directly insert type zirconia system

Measuring range: 0 to 2 ··· 50 vol% O_2
(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: More than 10 min

Analog output: 4 to 20mA DC (allowable load resistance less than 500Ω) or 0 to 1V DC (output resistance more than 100Ω)

Digital input (option): RS-485 or HART communication

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:
During warm-up 255VA
During operation 70VA
[When the power supply voltage is 100 or 220 V AC]

Detector Specifications (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: With or without blow-down nozzle
Flange; JIS5K 65A FF
(JIS5K-80AFF for high particulate gas)
Insertion length; 0.3, 0.5, 0.75, 1m

Ejector (general-use):
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:
Into furnace, returned to flue

Ejector heater temperature drop alarm output:
Alarm output when below 100 ºC Mechanical thermostat
N.O. (1a) contact, 200V AC, 2A

Operating temperature:
−10 to +60ºC for Primary detecting element
−5 to +100ºC for ejector section
125ºC or less at detector flange surface with power applied

Storage temperature:
Sensing element: −20 to +70ºC
Ejector: −10 to +100ºC

Structure: Dust/rain-proof structure(IEC IP66 equivalent)

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

Main materials of gas-contacting parts:
Detector; Zirconia, SUS316, platinum
Flow guide tube; SUS304 or SUS316
Ejector (general use); SUS316, SUS304
Ejector; (for high temperature) SiC, SUS316, SUS304

Calibration gas inlet:
ϕ6mm tube join, ϕ1/4-inch tube join, or ball valbe (as specified)

Reference air inlet (option):
ϕ6mm tube join or ϕ1/4-inch tube join (as specified)

Detector mounting:
Horizontal plane ±45º, ambient surrounding air should be clean.

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

Mass (approx.) {weight}:
Detector; 1.6kg
Ejector; 15kg (insertion length 1m)
Flow guide tube (general-use, 1m); 5kg

Finish color: Silver and SUS metallic color

Calibration gas flow:
1.5 to 2 L/min

Blowdown air inlet pressure:
200 to 300kPa {2 to 3 kgf/cm^2}

Converter specification (ZKM)

Concentration value indication:
Digital indication in 4 digits

Contact output signal:
(1) Contact specification; 6 points, 1a 250V AC/3A or 30V DC/3A
(2) Contact function;
- Under maintenance
- Under blowdown Note3)
- Span calibration gas valve
- Zero calibration gas valve
- Instrument anomalies Note1)
- Alarm Note2)
- Range identification output Note4)

Note1) The following Instrument errors (1) Thermocouples break (2) Sensor break (3) Temperature fault (4) Calibration fault (5) Zero/span adjustment fault (6) Output error turn the contact-ON

Note2) Alarm selects just one as mentioned below (1) High (2) Low (3) Upper and Lower (4) High-high (5) Low-low, it turns ON while operating.

Note3) Under blow down is available in case of option, and it turns ON while operating.

Note4) It turns ON during range selection, and turns OFF when the range 1 is selected.

Contact input signal:
(1) Contact specification; 3points (the following option)
ON; 0V (10mA or less), OFF; 5V
(2) Contact function;
- 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) All calibration

Calibration gas:
- Available range settings
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 with compressed air dust that has deposited 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:
Output signal is held during calibration, processing diagnosis of sensor, warm-up, PID auto tuning, under set up maintenance mode "available" and blowdown. The hold function can also be released.

Valve and Flow meter (option):
Selects zero or span gas during manual zero or span calibration. Mounted on the side of the converter.

Communication function:
HART communication (option)
RS485 (MODBUS) (option)

Combustion efficiency display (option):
This function calculates and displays combustion efficiency from oxygen concentration and measured gas temperature.
Thermocouple (R) or thermocouple (K) is required for temperature measurement.
Range: 0 to 1000°C, Accuracy: ±5°C.
On the version with combustion efficiency display, an alarm function of "rich mode" indication is also available.

Operating temperature:
–20 to +55ºC

Operating humidity:
95% RH or less, non condensing

Storage temperature:
–30 to +70ºC

Storage humidity: 95% RH or less, non condensing

Enclosure: Dust-proof, rainproof
(corresponding to IP66 or IP67 of IEC)
*when the specified cable gland is attached.

Material: Aluminum case

Outer dimensions (H x W x D):
170 X 159 X 70mm (IP66, Bench type)
220 X 230 X 95mm (IP67)

Mass {weight}: IP66: Approx. 2kg (excluding cable and detector)
IP67: Approx. 4.5kg (excluding cable and detector)
Cable:Approx. 4kg/m (with rainproof flexible conduit)

Finish color: Case: Silver
Cover: Munsell 6PB 3.5/10.5 (blue)

Mounting method: Mounted flush on panel or on pipe

Electrical Safety:
Overvoltage category
; II power supply input
; I relay interfaces
(IEC1010-1)
External overcurrent protective device
; 10A
Equipment interfaces are safety separated (SELV)

EC Directive Compliance

The product conforms to the requirements of the Low Voltage Directive 2006/95/EC and EMC directive 89/336/EEC (as amended by Directive 92/31/EEC), both as amended by Direc-tive 93/68/EEC.
It conforms to following standards for product safety and electromagnetic compatibility:

EN61010-1 : 2010, EN62311: 2008
Safety requirements for electrical equipment for measurement, control and laboratory ese.
“Installation Category II”
“Pollution Degree 2”
“Altitude up to 2187 yard (2,000 m)”
EN61326-1 : 2006, EN61326-2-3: 2006
EN61000-3-2 : 2006, A1: 2009, A2: 2009
EN61000-3-3 : 2008
Electrical equipment for measurment, control and laboratory use. EMS requirements.

CE

ZFK, ZKM

CODE SYMBOLS

(Detector)

ZFK 8 R □ □ 5 - □ □ □ □ □ - □ □ □

Digit	Description			Note	Code
6	Calibration gas inlet	For ø 6mm tube (SUS)			1
		For ø 1/4 inch tube (SUS)			2
		With ball valve			3
7	Power supply	100 to 120 V AC 50/60 Hz			1
		200 to 240 V AC 50/60 Hz			3
8	Revision No.				5
9	Flow guide tube				
10	flange	application	length		
11	no tube				0Y0
	SUS304	general use	300 mm		5A3
	SUS304	general use	500 mm		5A5
	SUS304	general use	750 mm		5A7
	SUS304	general use	1000 mm		5A1
	SUS316	for corrosive gas	300 mm		5B3
	SUS316	for corrosive gas	500 mm		5B5
	SUS316	for corrosive gas	750 mm		5B7
	SUS316	for corrosive gas	1000 mm		5B1
	SUS316	with blowdown nozzle	300 mm		5C3
	SUS317	with blowdown nozzle	500 mm		5C5
	SUS318	with blowdown nozzle	750 mm		5C7
	SUS319	with blowdown nozzle	1000 mm		5C1
	SUS316	for high particulate	300 mm		6D3
	SUS317	for high particulate	500 mm		6D5
	SUS318	for high particulate	750 mm		6D7
	SUS319	for high particulate	1000 mm		6D1
	SUS316	for high particulate with cover	300 mm		6E3
	SUS317	for high particulate with cover	500 mm		6E5
	SUS318	for high particulate with cover	750 mm		6E7
	SUS319	for high particulate with cover	1000 mm		6E1
	Others				ZZZ
12	Heat-retaining cover	Without			Y
		With			A
13	Reference gas inlet	None			Y
		For ø 6 mm tube (SUS)			A
		For ø 1/4 inch tube (SUS)			B
14	Filter spec	Standard			1
15	Instruction manual language	Japanese			J
		English			E
		Chinese			C
16	Specification nameplate	Standard (100 to 120 V AC 50/60 Hz)			1
		Standard (200 to 240 V AC 50/60 Hz)			2

(Converter)

ZKM □ □ □ □ 2 - □ □ □ 1 □ - Y R □

Digit	Description		Note	Code
4	Enclosure	IP66		A
		IP67		B
5	Analog output signal	4 to 20 mA DC		B
		0 to 1 V DC		E
6	Communication function	None		Y
		RS-485		2
		HART		3
7	Mounting bracket	None		Y
		Mounting on panel surface		1
		Pipe mounting		2
8	Revision No.			2
9	Optional functions	None		Y
		Combustion efficiency display	Note 2	1
		Blowdown		2
		Auto calibration		3
		Combustion efficiency display + Blowdown	Note 2	4
		Combustion efficiency display + Auto calibration	Note 2	5
		Blowdown + Auto calibration		6
		Combustion efficiency display + Blowdown + Auto calibration	Note 2	7
10	Language	Japanese		J
		English		E
		Chinese		C
11	Selector valve/ flowmeter	None		Y
		With valve (For ø6 mm tube)		1
		With valve + flowmeter (For ø6 mm tube)		2
		With valve (For ø1/4 inch tube)		3
		With valve + flowmeter (For ø1/4 inch tube)		4
12	—	—		1
13	Cable gland	Without		Y
		With		A
14	—	—		Y
15	—	—		R
16	Thermocouple for combustion efficiency display	None		Y
		Type R thermocouple		R
		Type K thermocouple		K
	*Thermocouple is to be prepared separately.			

Note 2) On the version with combustion efficiency display, an alarm function of "rich mode" indication is also available.

(Ejector)

ZTA □ □ 1 □ 1

Digit	Description		Note	Code
4	Measured gas temperature	For high temperature (+1500°C max.)		1
		General use (+800°C max.)		2
5	—	—		1
6	Insertion length [mm]	500		B
		750		C
		1000		D
		1500		E
7	Power supply voltage	100V/115 V AC 50/60Hz		1
		200V/220 V AC 50/60Hz		3
		230 V AC 50/60Hz		5
8	Revision No.	—		1

(Dedicated cable)

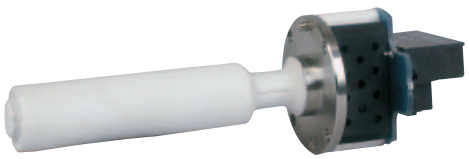
ZRZ K R □ □ 1 - □

Digit	Description			Note	Code
4	Connectable device	ZKM			K
5	Type	R thermocouple			R
6	Length	Rainproof flexible conduit	Cable		
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 1)	6 m	Note 1	AA
		10 m (Note 1)	10 m	Note 1	BB
		15 m (Note 1)	15 m	Note 1	CC
		20 m (Note 1)	25 m	Note 1	DD
8	Revision No.	—			1
9	Cable end treatment	None			0
		One side (detector side)			1
		Both sides			2

Note 1) For connection between detector and converter, use a rainproof flexible conduit.

(Replacement Detector element)

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



SCOPE OF DELIVERY

	Description		Q'ty
Detector (ZFK)	Detector main unit		1
	Viton O ring		1
	Mounting screw (M5 x 16)		6
	Thermal sticker		1
	Ceramic filter		1
	Instruction manual		1
	Flow guide tube (as specified)		1
	Heat-retaining cover (as specified)		1
	Reference gas inlet port (as specified)		2
Converter (ZKM)	Converter main unit		1
	Fuse (2.5A)		2
	Ferrite core		1
	Instruction manual		1
	Metal fittings	<For panel mounting> M8 sems screw (stainless steel)	4
		<For pipe mounting> U bolt (stainless steel)	2
		M8 nut and washer (stainless steel)	4
		Support (stainless steel)	2
Ejector (ZTA)	Ejector main unit		1
	Insertion tube		1
	Packing		1
	M16 nut and washer (stainless steel)		4
Dedicated cable (ZRZ)	Cable (of the specified length)		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)

CAUTIONS

- If combustible gas (CO, H_2 etc.) exists in the measured gas, error will occur due to burning at the sensor section. The inclusion of corrosive gas (Si vapor, alkaline metal, P, Pb etc.) will shorten the life of the sensor.
- When the measured gas temperature is high (+300°C or higher), the flange should be separated from the furnace wall in order to bring the detector flange surface temperature below the specified value +125°C). The flow guide should be attached in the direction in which the gas flow to the detector decreases.
- When much dust is included in the gas, the flow guide tube should be attached at an inclination so that the flow goes from below to above. And the flow guide tube should be attached in the direction in which the gas flow to the detector decreases.
- In the case of a refuse incinerator, automatic blow down of the flow guide should not be performed (to prevent corrosion of the flow guide tube due to drainage). Blow-down should be performed manually when change in the indication has become very little with the furnace stopped.

DEVICE CONFIGURATION

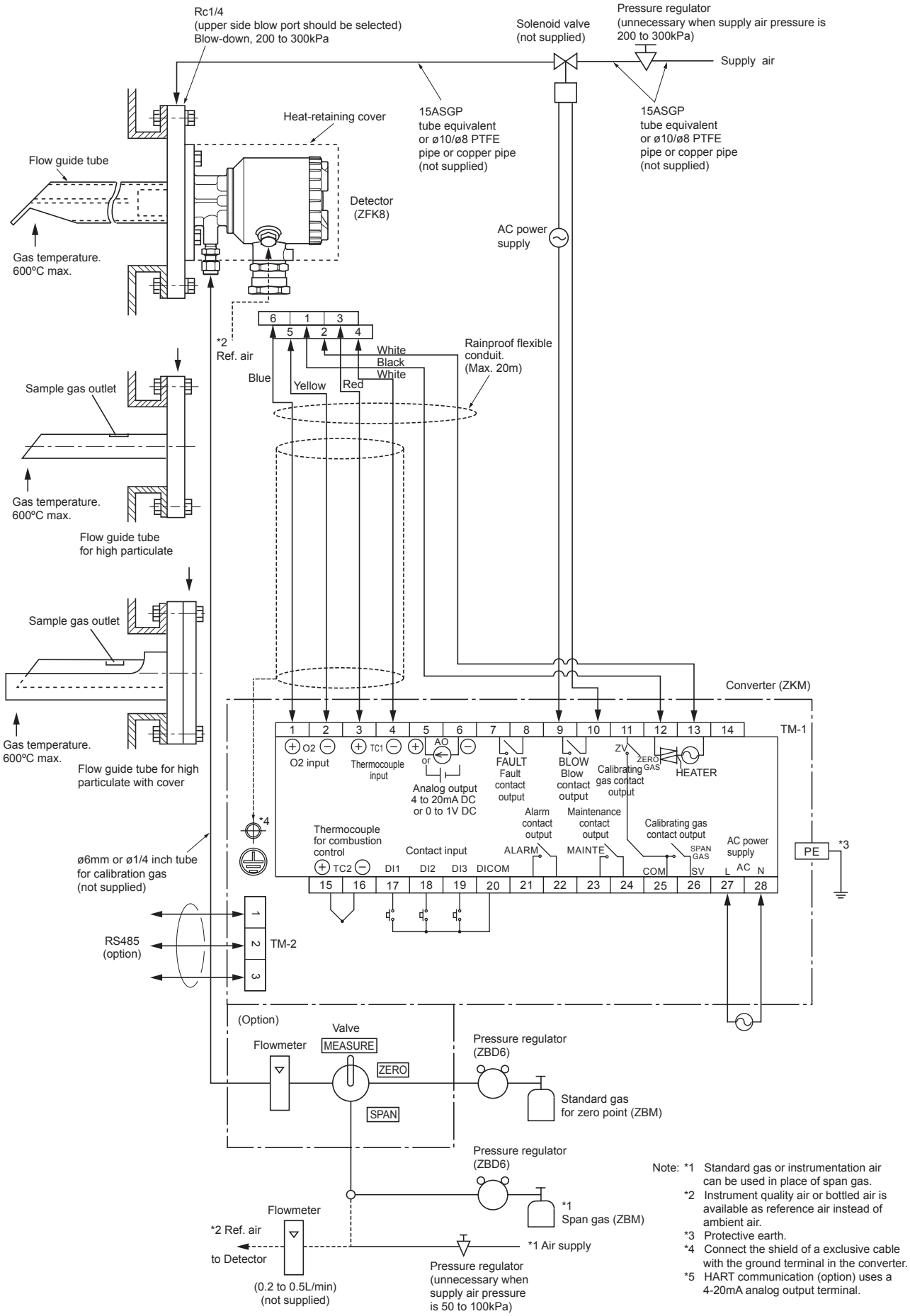
The device to be combined differ according to the conditions of the gas to be measured. Select the devices to be combined with reference to the following table.

Measured gas						Device configuration		
Application	Temperature	Gas Flow	DUST	Heat-retaining cover	Note	Detector type	Converter type	Ejector type
General-use (boiler)	600ºC or less	5 to 20m/s	Less than 0.2g/Nm^3	—	Fuel; gas, oil	ZFK8R□□5-□A5□□-1□	ZKM	—
			Less than 10g/Nm^3	—	Fuel: coal with blow down	ZFK8R□□5-□C5□□-1□	ZKM	—
For corrosive gas (refuse incinerator)	600ºC or less	5 to 20m/s	Less than 1g/Nm^3	—	Included low moisture	ZFK8R□□5-□B5□□-2□	ZKM	—
			Less than 10g/Nm^3	—	Included low moisture with blow down	ZFK8R□□5-□C5□□-2□	ZKM	—
			Less than 25g/Nm^3	no	Included low moisture with blow down	ZFK8R□□5-□D6□□-2□	ZKM	—
			Less than 25g/Nm^3	yes	Included high moisture with blow down	ZFK8R□□5-□E6□□-2□	ZKM	—
General-use (boiler)	800ºC or less	Less than 1m/s	Less than 1g/Nm^3	—	SUS316 tube with blow down	ZFK8R□□5-0Y0□□-1□	ZKM	ZTA2
	1500ºC or less	Less than 1m/s	Less than 1g/Nm^3	—	SIC tube with blow down	ZFK8R□□5-0Y0□□-1□	ZKM	ZTA1

Note (1) Dust volume is approximate value.
(2) Instrument quality air or bottled air is available as reference air by selecting detector with reference air inlet.

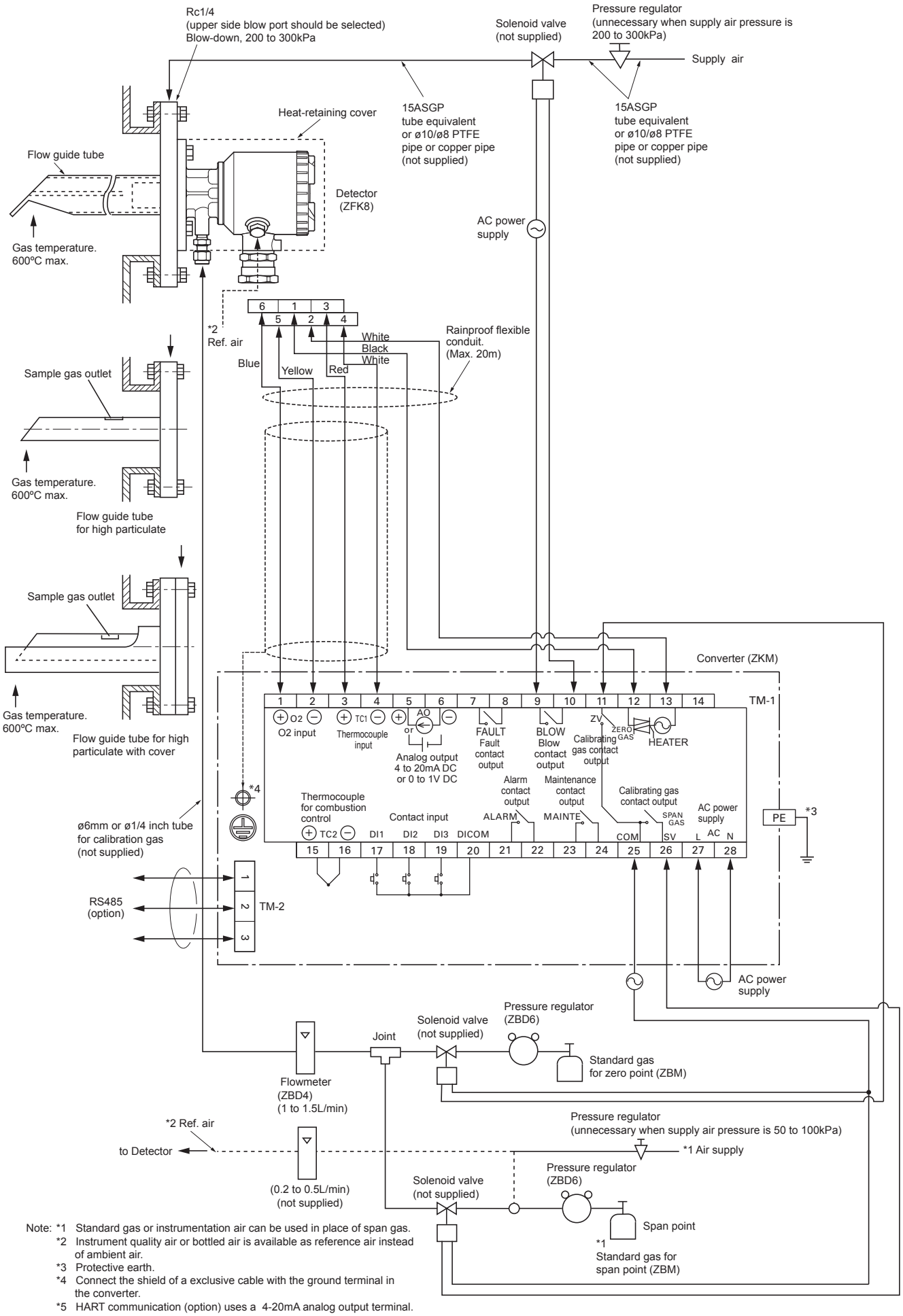
CONFIGURATION

Flow guide tube system (with valve)



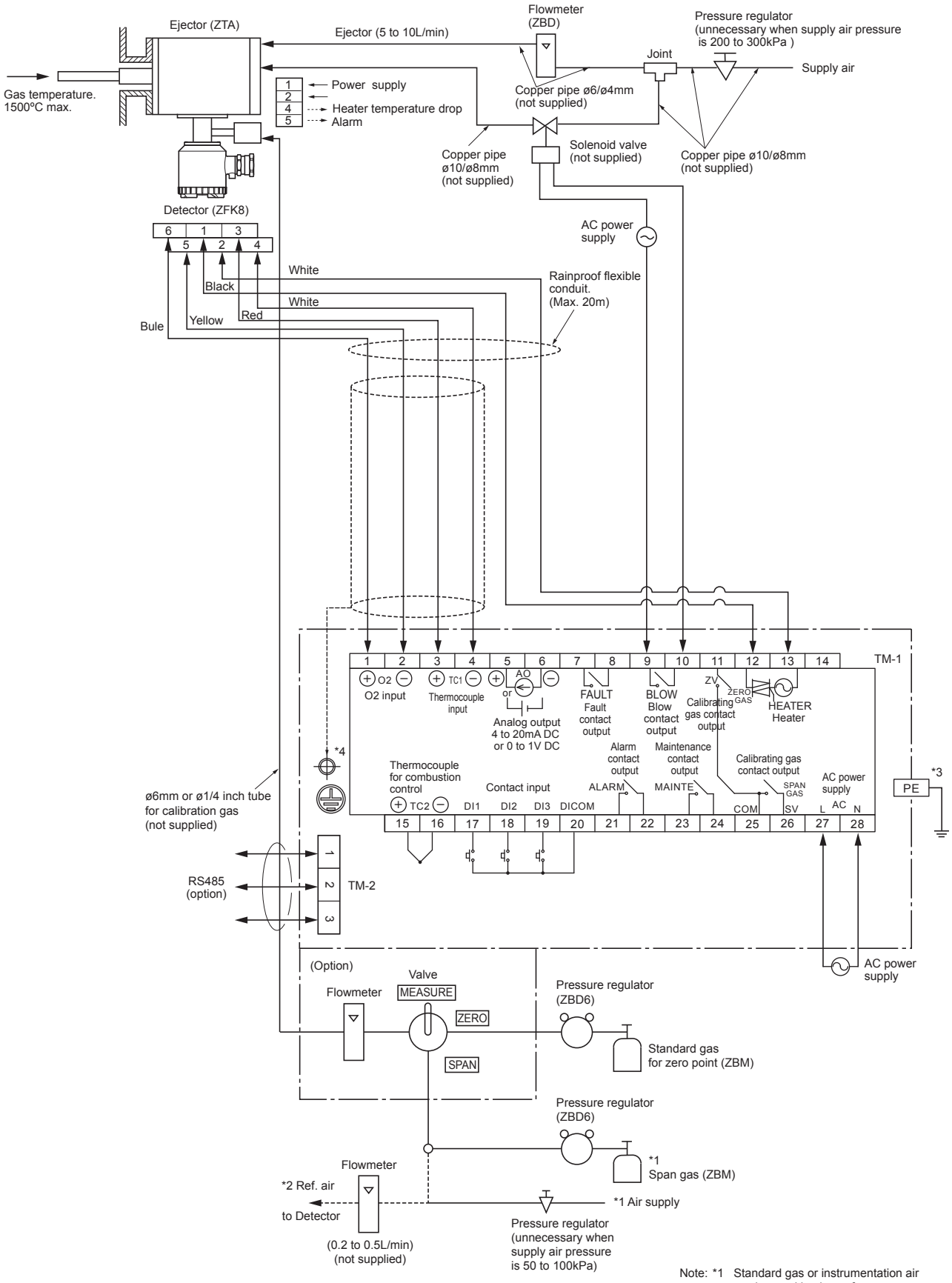
Note: *1 Standard gas or instrumentation air can be used in place of span gas.
*2 Instrument quality air or bottled air is available as reference air instead of ambient air.
*3 Protective earth.
*4 Connect the shield of a exclusive cable with the ground terminal in the converter.
*5 HART communication (option) uses a 4-20mA analog output terminal.

Flow guide tube system



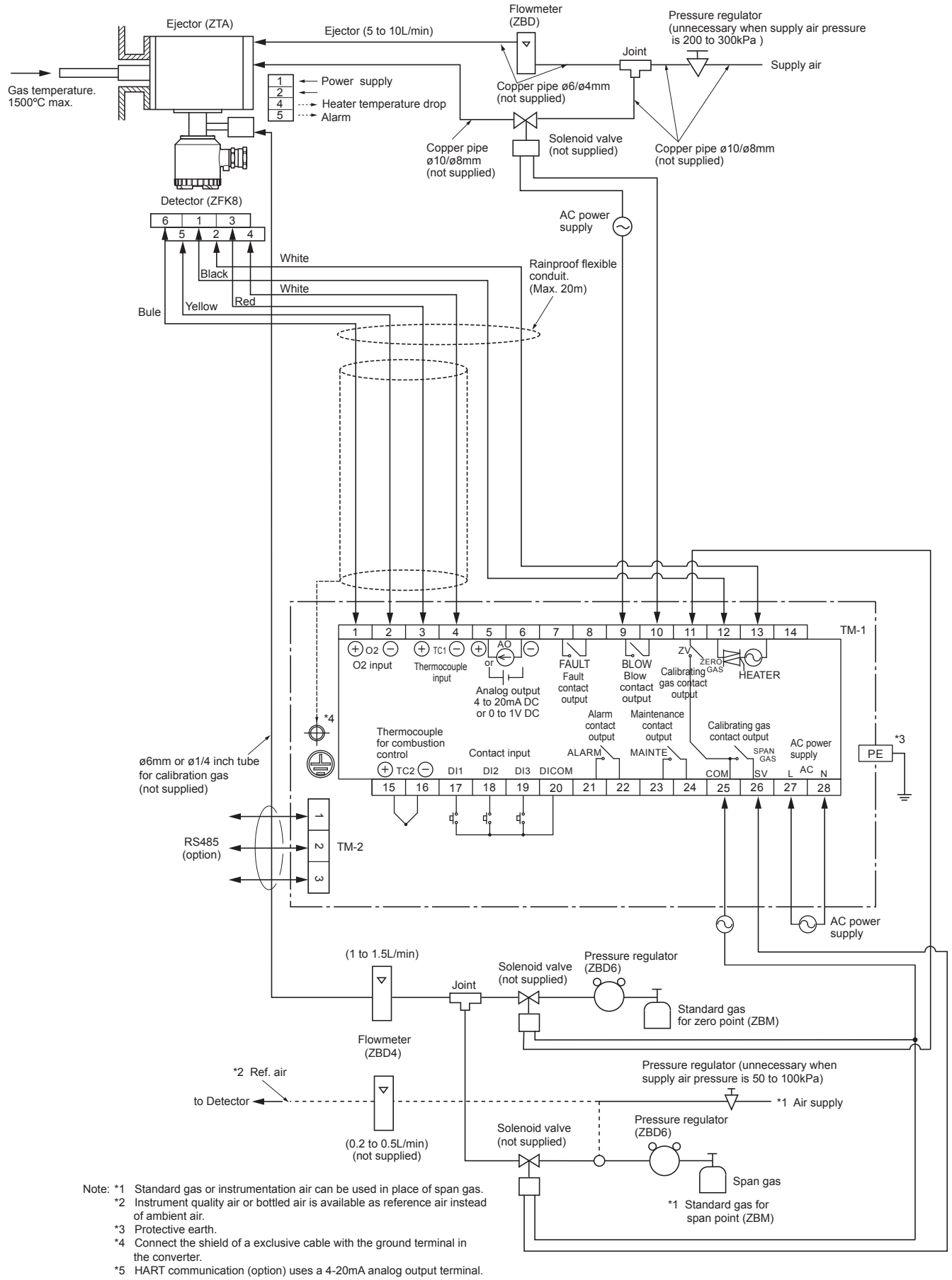
Note: *1 Standard gas or instrumentation air can be used in place of span gas.
*2 Instrument quality air or bottled air is available as reference air instead of ambient air.
*3 Protective earth.
*4 Connect the shield of a exclusive cable with the ground terminal in the converter.
*5 HART communication (option) uses a 4-20mA analog output terminal.

Ejector system (with valve)



Note: *1 Standard gas or instrumentation air can be used in place of span gas.
*2 Instrument quality air or bottled air is available as reference air instead of ambient air.
*3 Protective earth.
*4 Connect the shield of a exclusive cable with the ground terminal in the converter.
*5 HART communication (option) uses a 4-20mA analog output terminal.

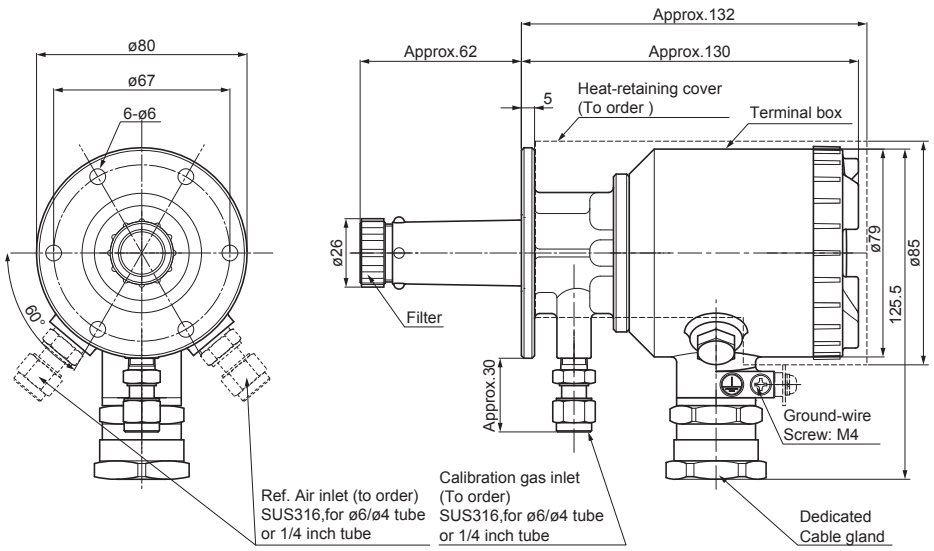
Ejector system



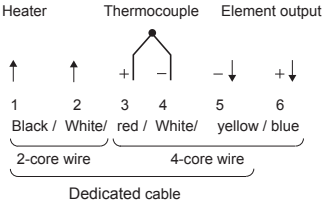
Note: *1 Standard gas or instrumentation air can be used in place of span gas.
*2 Instrument quality air or bottled air is available as reference air instead of ambient air.
*3 Protective earth.
*4 Connect the shield of a exclusive cable with the ground terminal in the converter.
*5 HART communication (option) uses a 4-20mA analog output terminal.

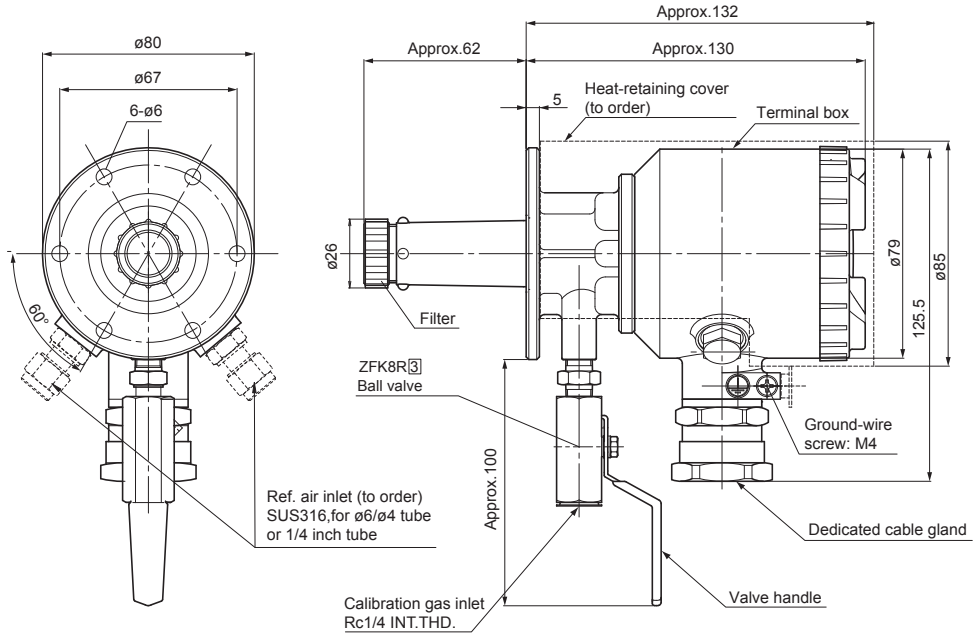
OUTLINE DIAGRAM (Unit:mm)

Detector (ZFK8)

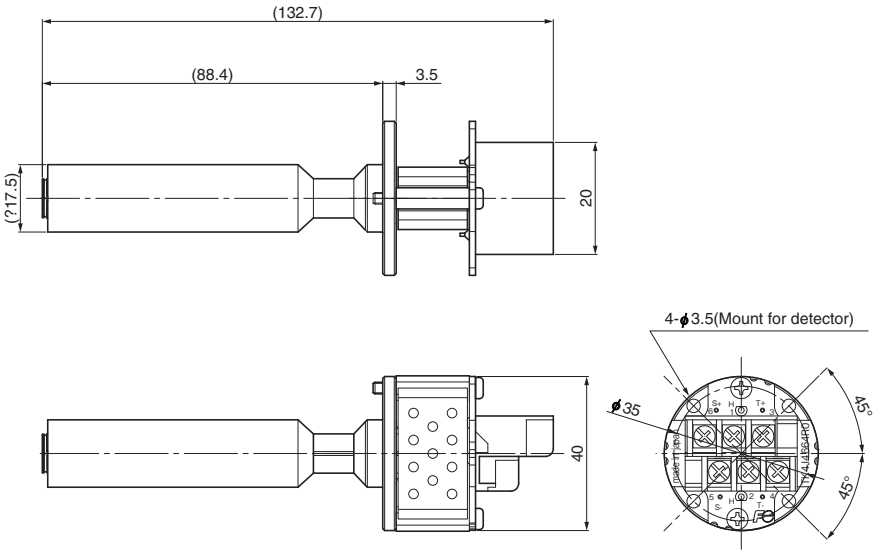


EXTERNAL CONNECTION DIAGRAM

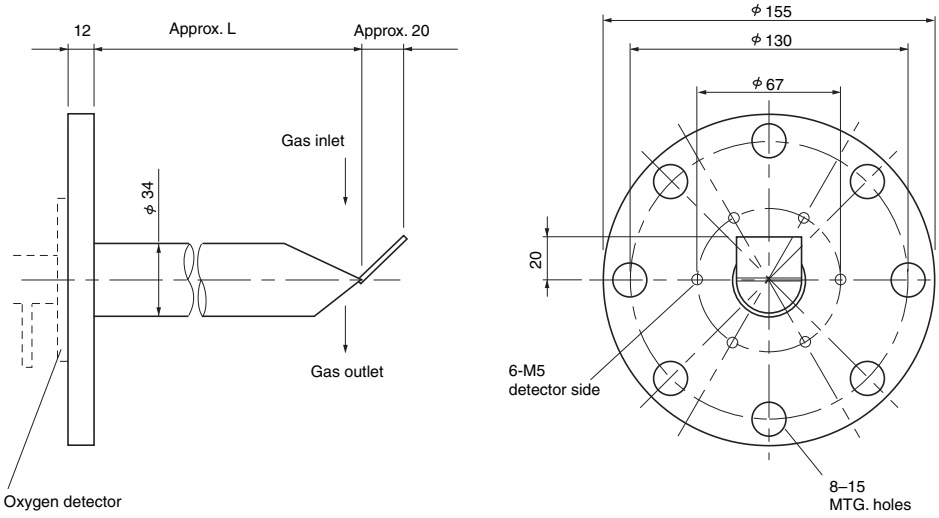




Sensor unit (ZFK8YY)



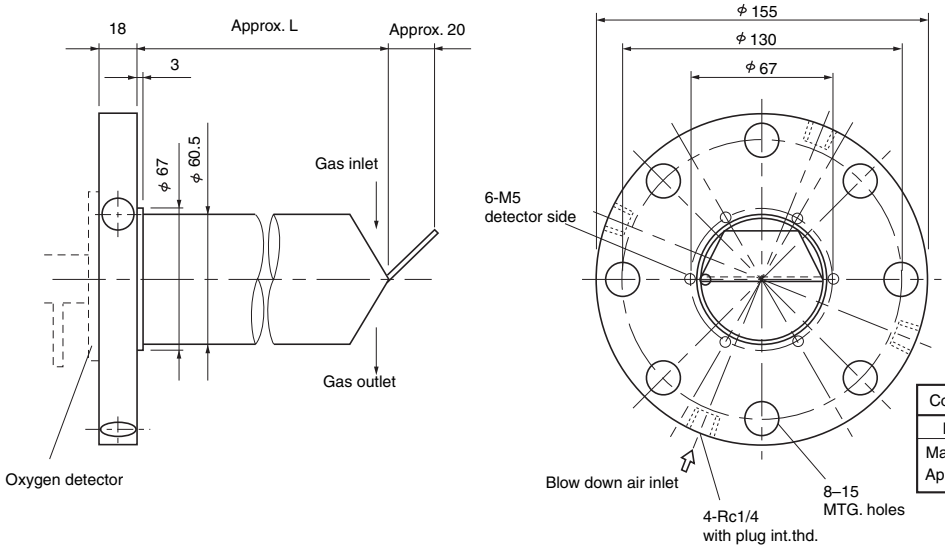
Flow guide tube



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	

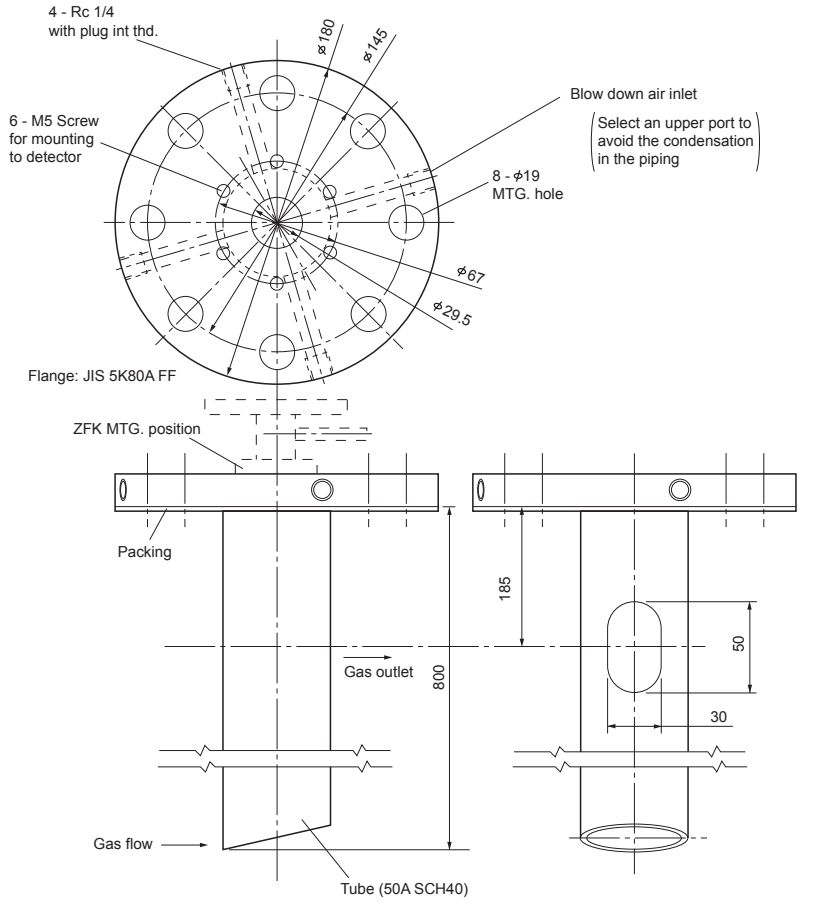
Flow guide tube (with blow-down nozzle)



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	

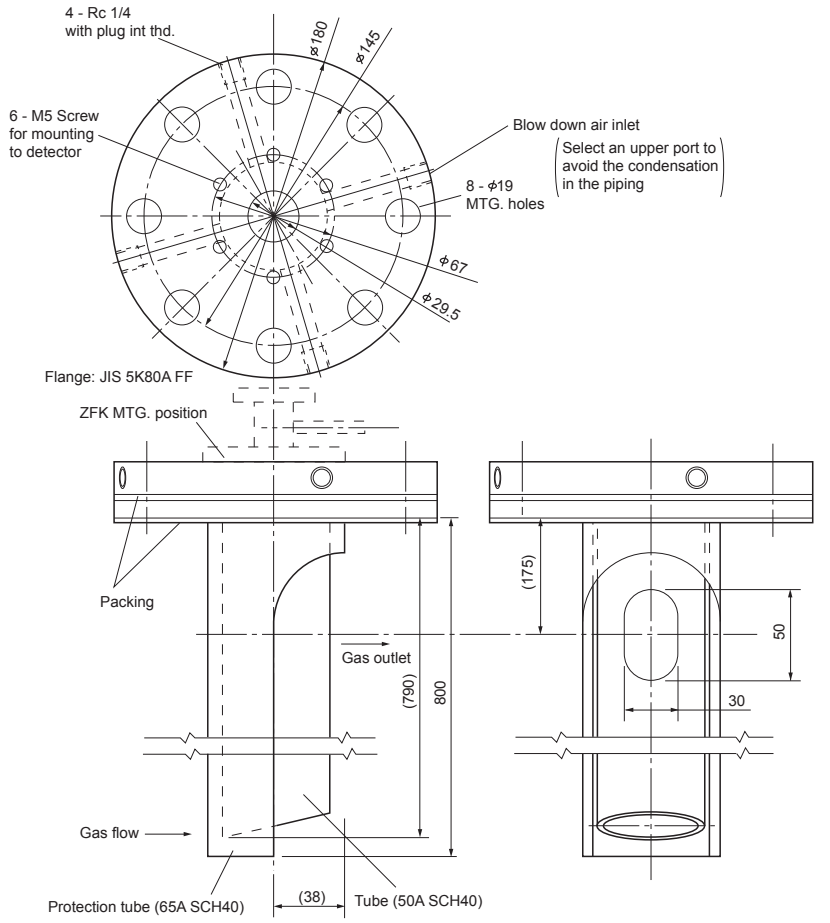
Flow guide tube (for high particulate)



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	

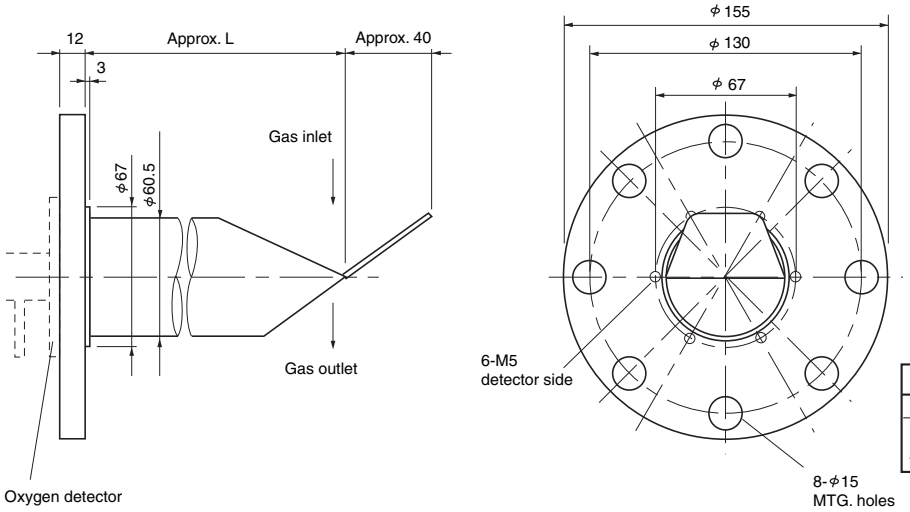
Flow guide tube (for high particulate with cover)



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	

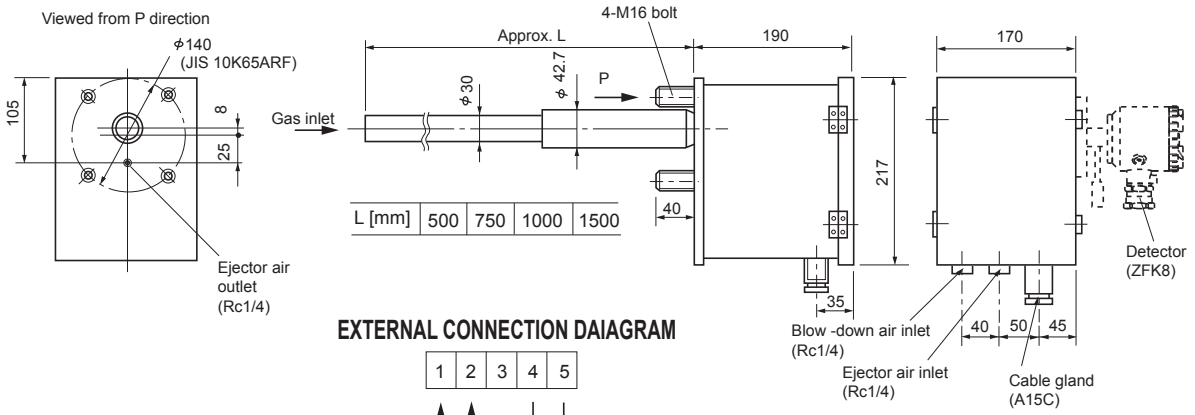
Flow guide tube (for corrosive gas)



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)



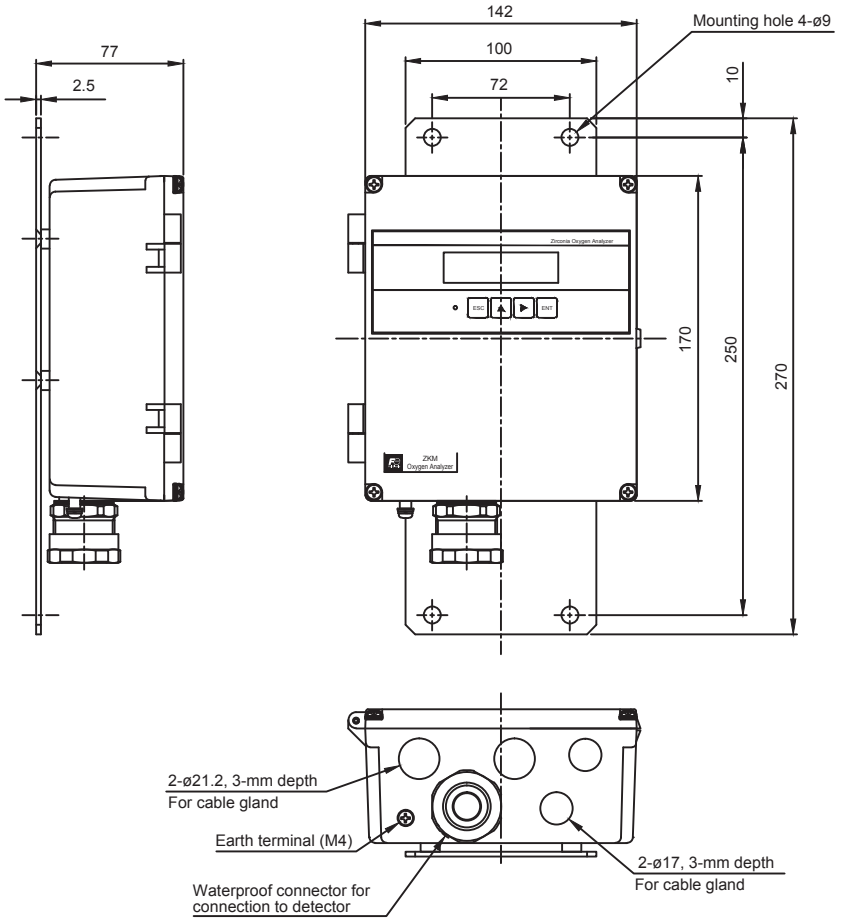
EXTERNAL CONNECTION DAIAGRAM

1	2	3	4	5

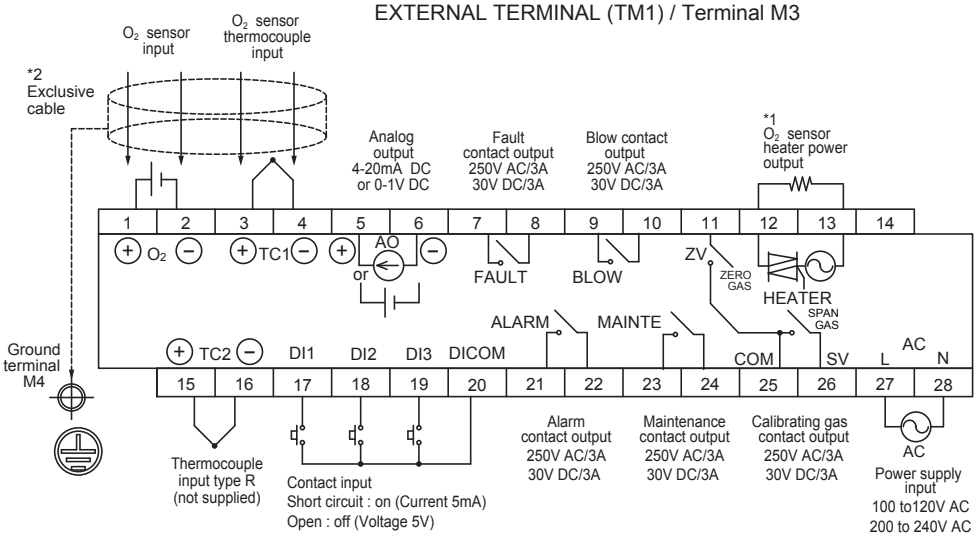
AC power supply
AC100/110V
AC200/220V
AC230V
Power consumption: 150 W

Heater temp.drop alarm

Converter (ZKMA)
<IP66 enclosure>



EXTERNAL TERMINAL (TM1) / Terminal M3

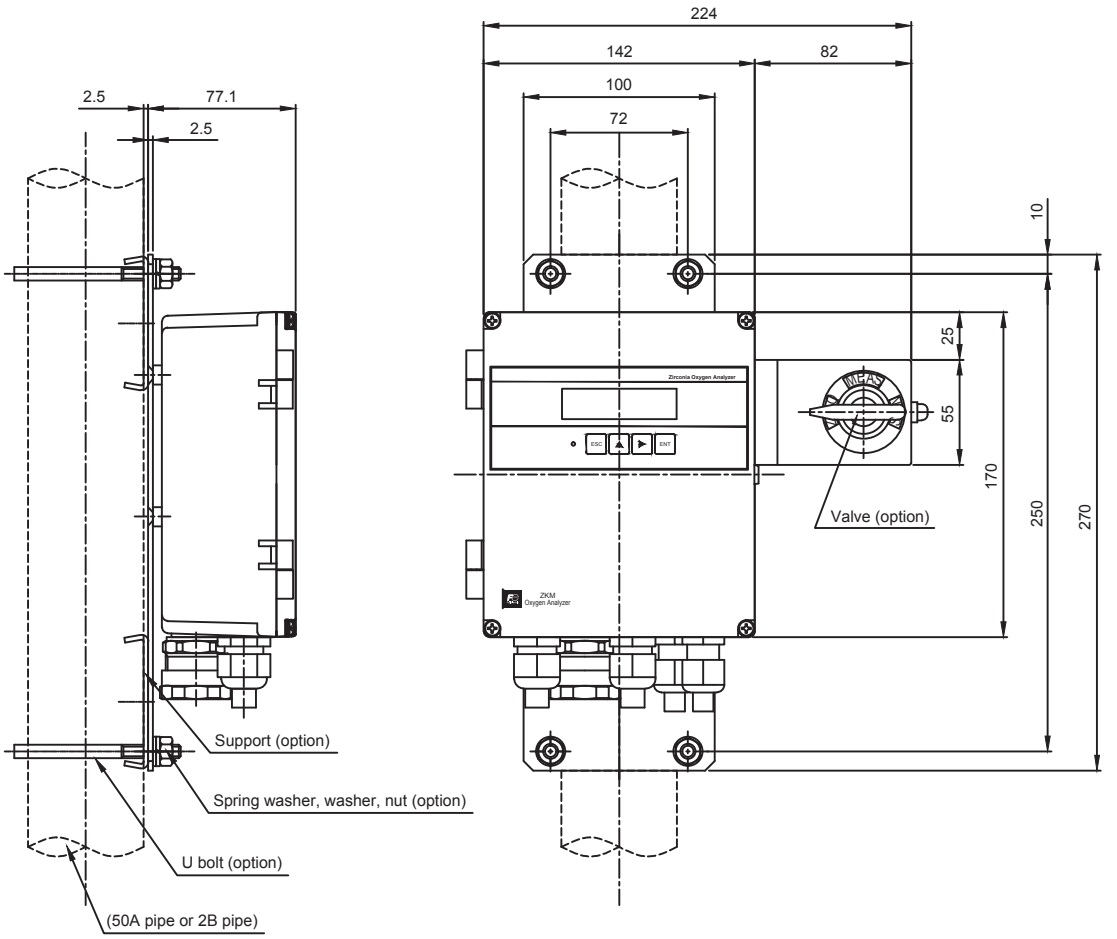


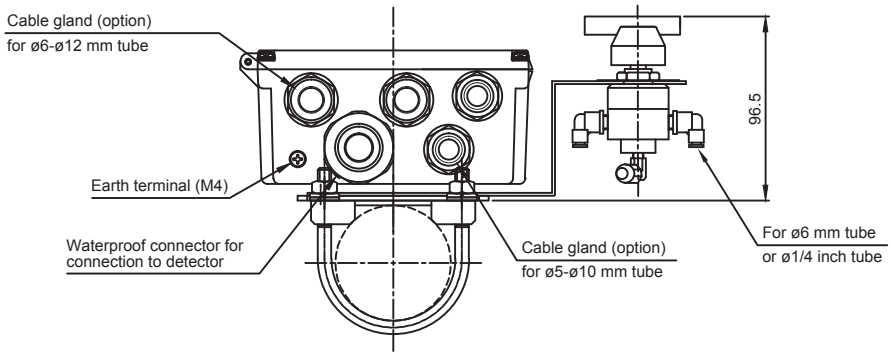
RS485 communication (option) terminal

1	2	3
GND	TRX+	TRX-

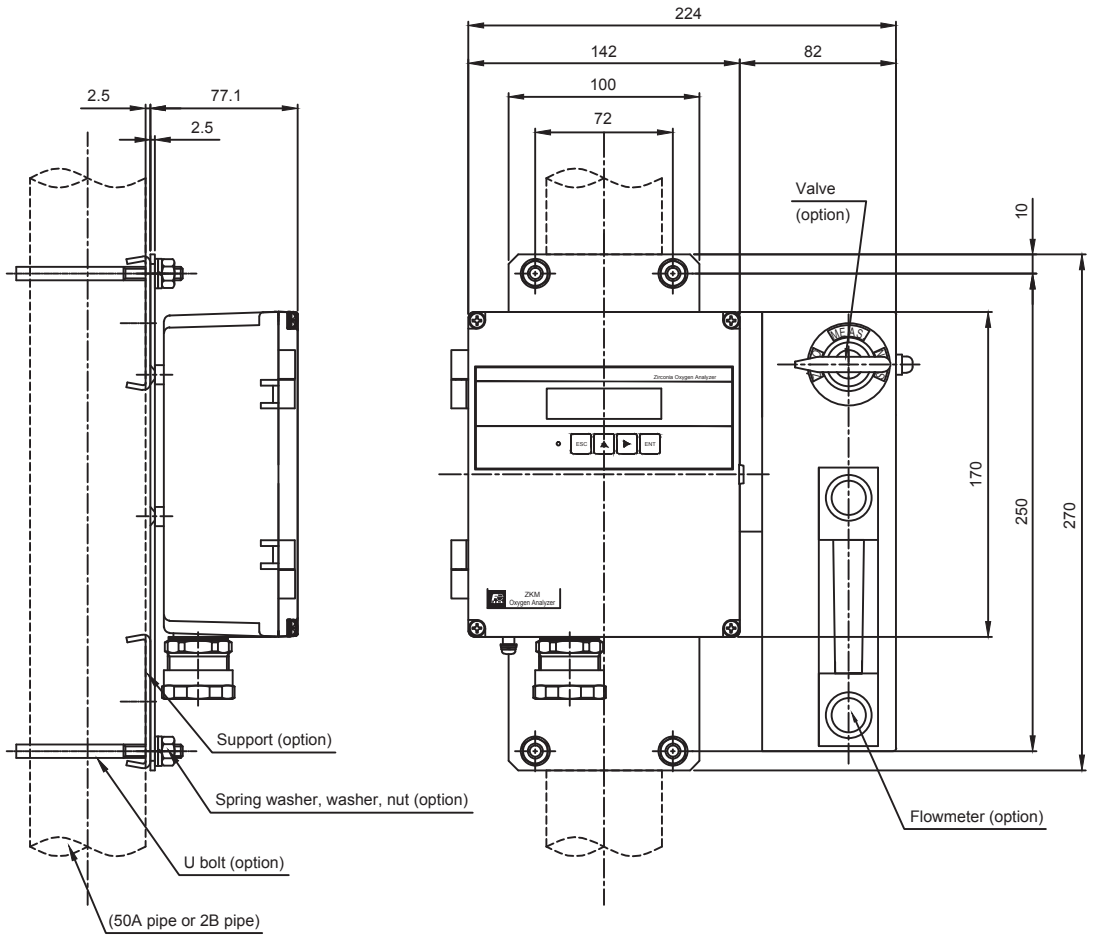
Note 1) The heater power supply is the same as the converter power supply.
Note 2) Be sure to connect the shield of the cable to the ground in the main body.
Note 3) HART communication (option) uses a 4-20 mA analog output.

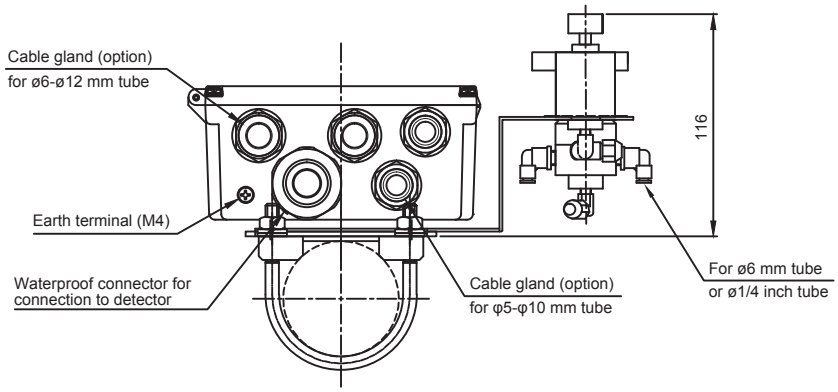
Converter (ZKMA)
<IP66 enclosure> with selector valve



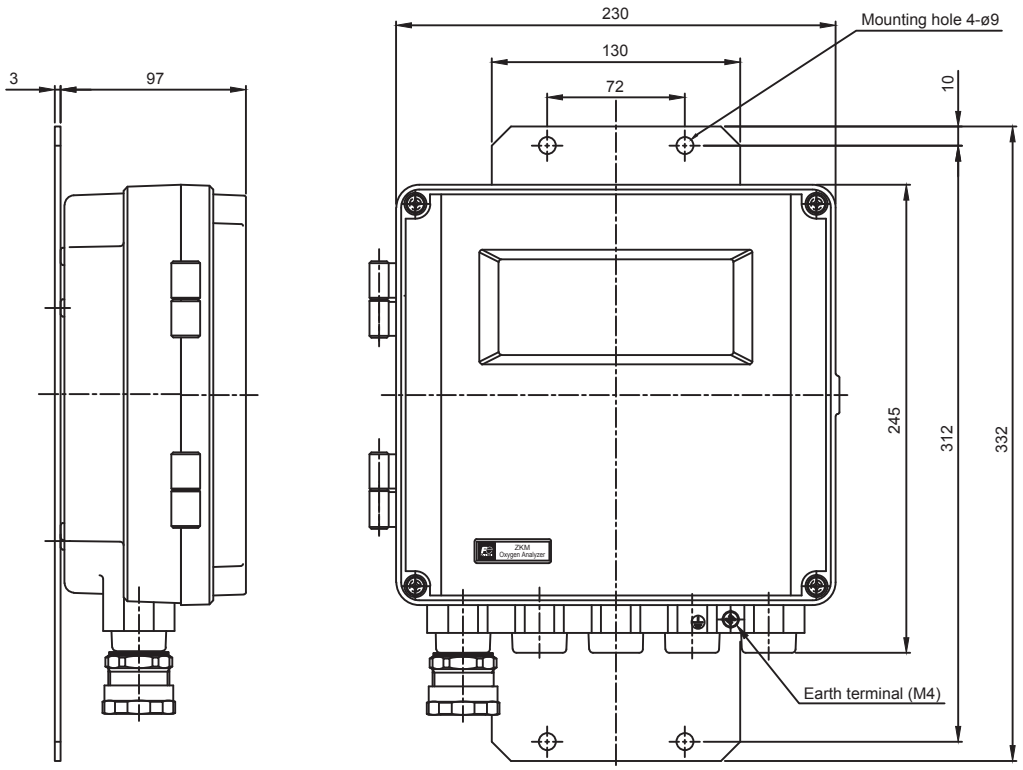


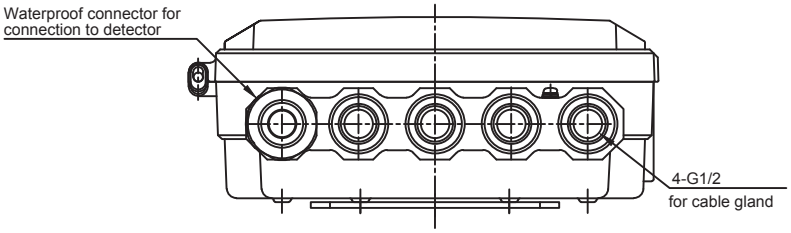
Converter (ZKMA)
<IP66 enclosure> with selector valve and flowmeter



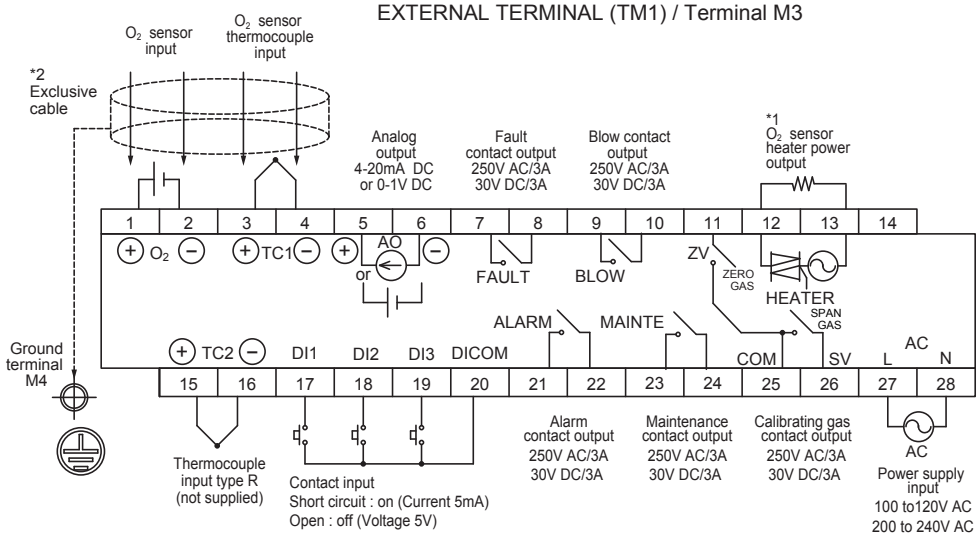


Converter (ZKMB)
<IP67 enclosure>





EXTERNAL TERMINAL (TM1) / Terminal M3

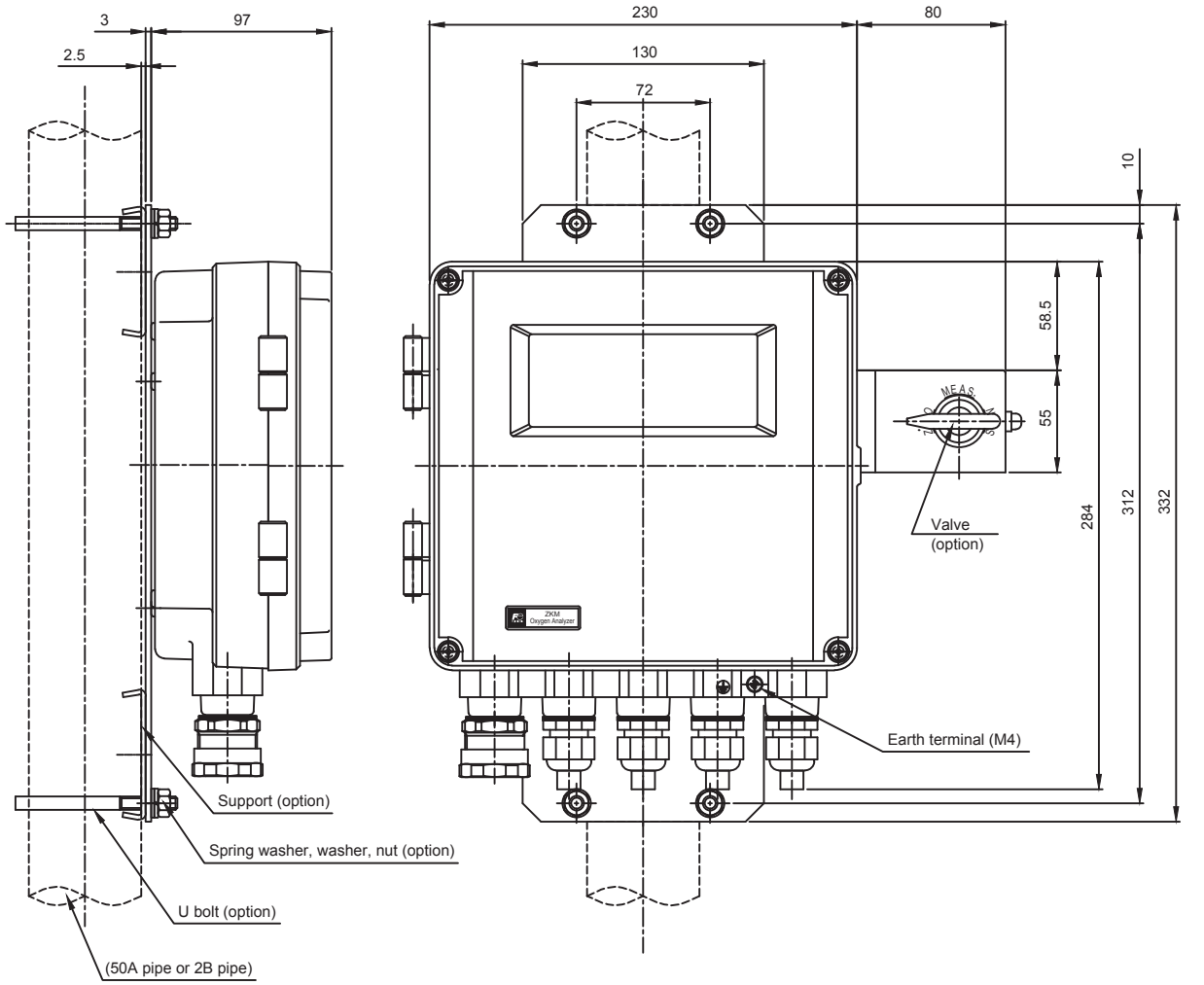


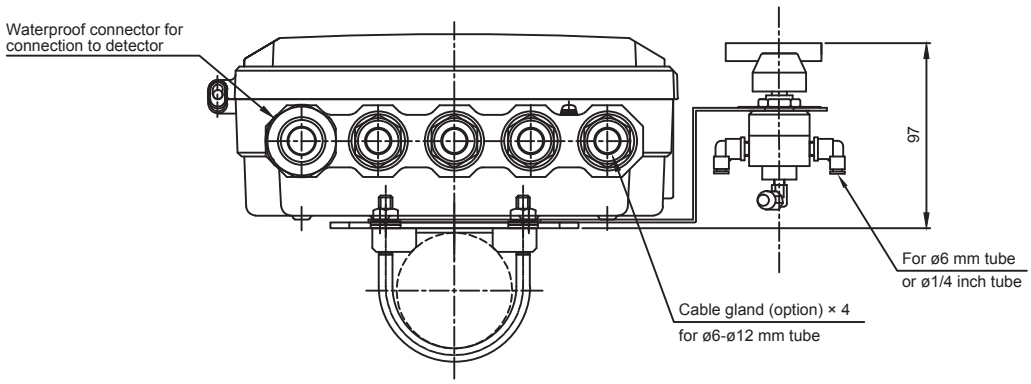
RS485 communication (option) terminal

1	2	3
GND	TRX+	TRX-

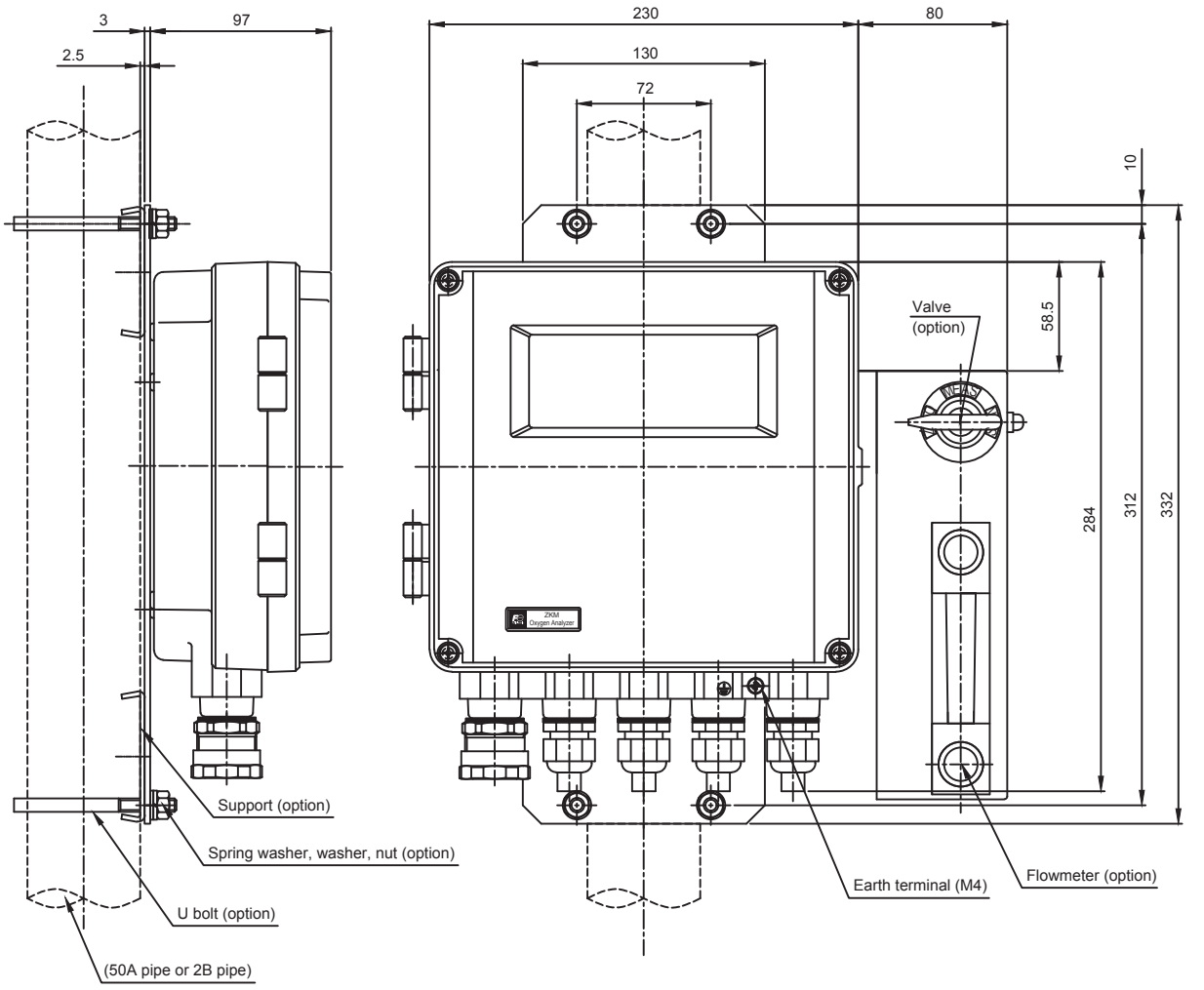
Note 1) The heater power supply is the same as the converter power supply.
Note 2) Be sure to connect the shield of the cable to the ground in the main body.
Note 3) HART communication (option) uses a 4-20 mA analog output.

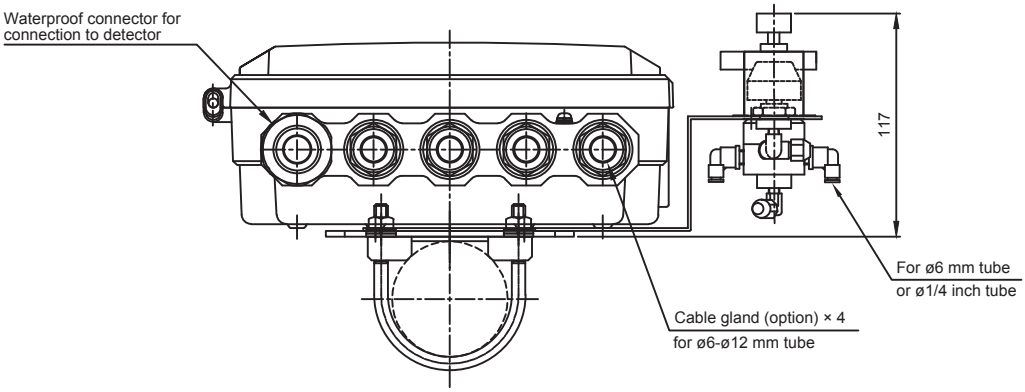
Converter (ZKMB)
<IP67 enclosure> with selector valve





Converter (ZKMB)
<IP67 enclosure> with selector valve and flowmeter





⚠ Caution on Safety

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

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Printed in Japan