COMPACT TYPE GAS ANALYZER

DATA SHEET ZSVS

OVERVIEW

The compact type gas analyzer with built-in pump and filter is intended for heat treat furnace, plant cultivation, and research-purpose chemical analysis. With the gas extractor, either simplified measurement probe (non-fixed type) or continuous measurement probe (fixed type) is selectable at option. Since a high-sensitivity single-beam mass flow controller is adopted for the infrared sensor, long-term stability and maintainability are excellent.

FEATURES

1. Gas concentrations of 4 components measurable simultaneously and continuously (Note).Concentrations of max. 3 gas components among CO_2, CO and CH_4 are continuously measurable with the infrared sensor, and that of O_2 is continuously measurable with galvanic cell type oxygen sensor.
2. Standard with 3-range analyzer
   Measurement can be performed over a broad range using the range selector key.
3. Compact type small and easy to use.
   The compact body with built-in pump and membrane filter is easy to carry and install.
   Operation is easier because operation keys and display unit are all gathered in the analyzing block.
4. A rich variety of standard functions incorporated.
   Max. 8-channel outputs are allowed including instantaneous concentration value, O_2-corrected value, O_2-corrected moving average value and CP calculation value outputs.

(Note) For continuous measurement, the standard requirements for sample gas (shown on page 3) need to be met, and zero/span calibrations and membrane filter replacement are required periodically.

SPECIFICATIONS

Standard Specifications

- **Measuring system:**
  CO_2, CO and CH_4; Non-dispersive infrared absorption method with single light source and single beam (single beam method)
  O_2; Galvanic cell method
- **Measurable component and min./max. measuring range:**
  CO_2; 0 to 200 ppm / 0 to 100 %
  CO; 0 to 200 ppm / 0 to 100 %
  CH_4; 0 to 1000 ppm / 0 to 100 %
  O_2; 0 to 5 % / 0 to 25 %
  Max. 4 components measurable including O_2
- **Number of measuring ranges:**
  3 ranges
  - Max. range ratio 1:5
- **Warm-up time:** 30 min after power-on
  Provided with count-down timer indicating function.
- **Analog output:** In up to 8 channels.
  4 to 20 mA DC or 0 to 1 V DC (linear)
  Non-isolated output
  Allowable load; 4 to 20 mA DC, 550Ω or less
  0 to 1 V DC, 100 kΩ or more
  - Instantaneous value output of each gas component
  - Instantaneous value output after O_2 correction (when provided with O_2 analyzer)
  - Average value output after O_2 correction (when provided with O_2 analyzer)
  - CP calculation value output (when provided with CO_2 analyzer)

  * The channel numbers of indicated value and output value correspond to each other one by one.
  * An exclusive 25-pin cable is standard-equipped.
- **Communication output:**
  RS-232C Modbus protocol
  * Use a commercially available product (D-sub 9-pin cable).

This product is not explosion-proof. When handling dangerous gas, adequate attention shall be paid.

• Indicated values:
Digital 4-digit indication (by LCD with back light)
- Instantaneous values of respective gas components
- Instantaneous values after O_2 correction (when provided with O_2 analyzer)
- Average value after O_2 correction (when provided with O_2 analyzer)
- CP calculation value display (when provided with CO_2 analyzer)

* The channel numbers of indicated value and output value correspond to each other one by one.

• Power supply: Rated voltage;
100 to 115 V AC or 200 to 240 V AC
Working voltage;
85 to 132 V AC or 180 to 264 V AC
* Depending on customer's code selection.
Rated frequency; 50/60 Hz
Max. rated power; 150 VA
Inlet; Class 1 type conforming with EN60320

• Operating conditions:
Ambient temperature; 0 to 40˚C
Ambient humidity; 90% RH or less
* Condensation unallowable

• Storage conditions:
Ambient temperature; -20 to 60˚C
Ambient humidity; 95% RH or less
* Condensation unallowable.

• External dimensions (H × W × D mm):
211 × 365 × 527

• Weight: Approx. 12 kg

• Finish color: Cover; White pearl mica
Base; Medium gray metallic

• Enclosure design:
Casing made of steel plates for indoor installation.

• Gas-contacting part materials:
Gas inlet/outlet; Polypropylene
Sample cell; SUS304/neoprene rubber
Transparent window: CaF2
Internal pipes: Toalon tube/Teflon tube

• Gas inlet/outlet: φ6/φ3 hose end

• Purge gas flow rate:
1 L/min (to be purged as required)

Standard Functions

• Zero gas flow time:
Z180 to 999 sec (settable in 1-sec step)

• Auto indication off:
Indication automatically turns off when no key is operated for the determined period of time in the standby status.
Light off time; OFF/ON (1 to 30 min)
(settable in 1-min step)

• Output holding: At calibration during measurement, output holds the value just before the calibration according to hold setting. In the standby status, output will not be held. Indication will not be held either.
Hold setting; OFF/ON

• Key lock: None of the set values can be changed when key lock is turned ON.
This is helpful for reducing operation errors and wrong inputs.

• Instrument/calibration error indication:
When the instrument or calibration is abnormal, an error number is indicated to help analysis of the error.

• O_2 correction: Conversion of measured NOx, SO_2 and CO gas concentrations into values at standard O_2 concentration
Calculating equation;

$$C = \frac{21-On}{21-Os} \times Cs$$

C; Sample gas concentration after O_2 correction
Cs; Measured concentration of sample gas
Os; Measured O_2 concentration
On; Standard O_2 concentration for conversion (settable within 0 to 19%)
The result of conversion is indicated and output in a signal simultaneously.
* An Os value of 20% or more is taken as 20% for calculation.

• Averaging after O_2 correction;
The result of O_2 correction is subjected to moving average for the determined period of time. And the result of averaging is indicated and output in a signal simultaneously.
Average value will be taken at a cycle of 30 sec. (Indication and output are updated every 30 sec.)

• Resetting of output average value:
Indication and output of average value are cleared in response to resetting.
* Effective only when average value selection is specified in CODE SYMBOLS.

• CP calculation: The carbon potential of carburizing furnace and conversion furnace are calculated using furnace temperature (fixed input value) and CO concentration value (fixed or measured value) while referring to CO_2 measured value.

Calculation equation; $$CP = \frac{CPS \times (PCO)^2}{K1 \times PCO_2}$$

where,
CPS ; Saturated carbon concentration (partial pressure)
0.0028t–1.30 (800˚C ≦ 850˚C)
0.0030t–1.47 (850˚C ≦ 950˚C)
0.0034t–1.85 (950˚C ≦ 1000˚C)
t ; Furnace temperature
PCO ; CO concentration value (partial pressure)
PCO_2 ; CO_2 concentration value (partial pressure)
K1 ; Constant K1=10 (9.06–15966/T)
T ; Rankine temperature
(tx9/5+32+46˚)

Performance

- Repeatability: Within ±0.5% of full scale
- Linearity: Within ±2% of full scale
- Zero drift: Within ±1% of full scale/day
- Span drift: Within ±1% of full scale/day
- Response time: 90% response time: Within 50 sec Galvanic cell type O2 analyzer: Within 3 min
- Other gases' influence:

Interference component / Sample component/range		CO_2 analyzer		CO analyzer		O_2 analyzer	CH_4 analyzer
		200ppm max	500ppm min	200ppm max	500ppm min	All ranges	All ranges
NO	1000ppm	Within ±2%		Within ±2%		Within ±2%	Within ±2%
SO_2	1000ppm	Within ±2%		Within ±2%		Within ±2%	Within ±2%
CO_2	15%	–	–	Within ±3%	Within ±3%	Within ±2%	Within ±5%
CO	1000ppm	Within ±2%		–	–	Within ±2%	Within ±2%
CH_4	1000ppm	Within ±2%		Within ±2%		Within ±2%	–
NH_3	50ppm	Within ±2%		Within ±2%		Within ±2%	Within ±2%
H_2O 2°C saturatio		Within ±3%	Within ±2%	Within ±3%	Within ±2%	Within ±2%	Within ±2%

Standard Requirements for Sample Gas

- Flow rate: 0.5 L/min ±0.2 L/min
- Temperature: 0 to 40°C at inlet of sampling gas
  10 to 70°C at tip of non-fixed type probe (available at option)
  70 to 400°C at tip of fixed type probe (available at option)
- Pressure: 0 to 2 kPa (Gas shall be discharged into atmospheric air.)
- Dust: 10 mg/Nm^3 or less
- Mist: Unallowable
- Corrosive gas: HCl 10 ppm or less
  Others Unallowable
- Standard gas for calibration:
  Zero gas; N_2 or clean air
  However, clean air cannot be used if CO_2 and O_2 are included in sample gas components.
  Span gas; Concentration limited within 90 to 100% of the range of each sample gas component.
  Unusable at concentrations beyond 100%.

Options

- Gas extractor: Used for aspirating sample gas.
  Non-fixed type; Since this type is used for intermittent measurement, it cannot be fixed.
  Material;
  SUS304/polypropylene
  Fixed type; Used for continuous measurement. Flange 5K25A FF
  Sampling pipe length selectable among 300, 400, 600 and 800mm
  Material; SUS316
- Sample inlet tube:
  Used for delivering gas from the extractor to sampling block.
  Shape; $\phi 6/\phi 4 \times 5$ m or $\phi 6/\phi 4 \times 10$ m
  Material; Teflon

Installation Requirements

- Selection of a place which does not receive direct sunlight, rain, wind nor radiation from hot substances.
  If such a place cannot be found, a roof or cover should be prepared for protection.
- Avoidance of a place under heavy vibration
- Selection of a place where atmospheric air is clean
- Discharge of exhaust gas into atmospheric air at a safe location
- Avoidance of use in an explosion-proof area

Scope of Delivery

- Gas analyzer system
- Standard accessories (Refer to the table at top Following table.)
- Instruction manual

Items to be Prepared Separately

- Standard gas (ZBM) and pressure regulator (ZBD)
- Recorder (when necessary, Fuji's product type PHR)

Standard Accessories

Name	Quantity
Tubular fuse (2A)(for analyzing block)	2 pcs
Power cord (for domestic use, for 100/115V AC) (2m) × 2 Power cord (for North American use, for 100/115V AC) (2m) × 2 Power cord (for European use, for 200/220V AC) (2m) × 2	Either one pair * Depending on customer's code selection.
Grounding cable (5m)	1 cables
Output signal cable (1m)	1 cable
Filter paper (glass fiber) for membrane filter	5 sheets
Connection tube (5m)	1 tube
Instruction manual (in Japanese or English)	1 copy

Note) Standard accessories include consumables for 6 months.

Spare Parts for 1-Year Measurement

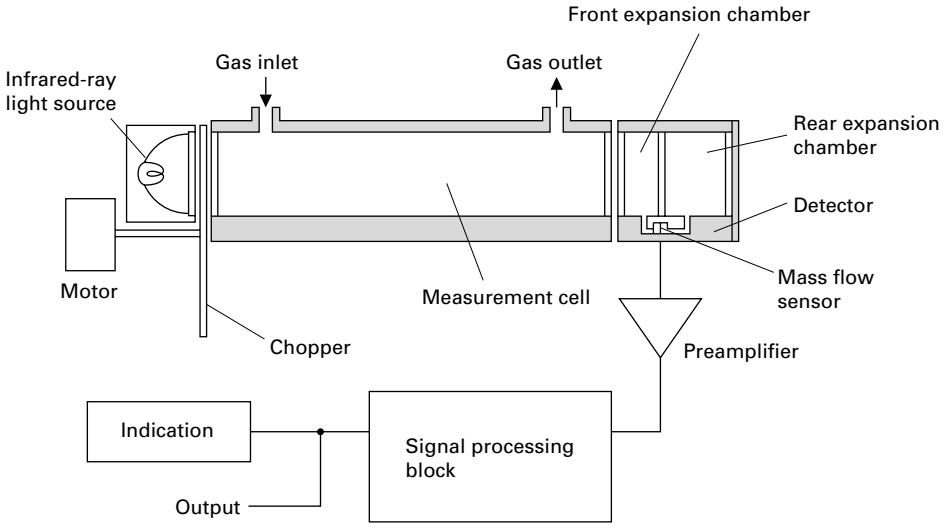
Name	Quantity	Ordering No.
Filter paper (glass fiber) for membrane filter	1 pc (25 sheets)	TK700735P2
Large O-ring for membrane filter	1 pc	8553765
Small O-ring for membrane filter	1 pc	TK733572P1
Diaphragm unit for pump	1 unit	TK713248P1

Specify the ordering No. and the quantity when placing an order.

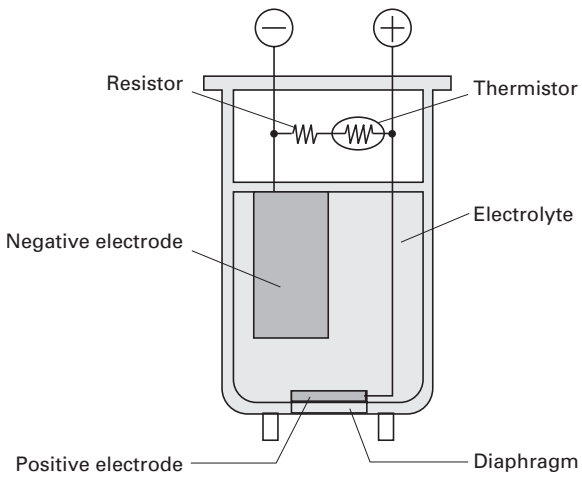
Other

- A galvanic cell type oxygen sensor has a service life of about 18 months from the date of its delivery. Periodic replacement is recommended.
  Replacement part ordering No. : TK7M3502C1

Principle Diagram of Infrared Type Measurement (CO_2, CO, CH_4)



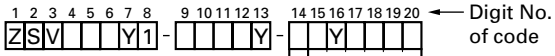
Principle Diagram of Galvanic Cell Type Measurement (O_2)



CODE SYMBOLS

Digit	Description	note	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 ← Digit No. of code Z S V S Y 1 - Y - Y
4	< Specification > Analyzing block		S
5	< Sample components (CO_2, CO, CH_4) > 1-component analyzer CO CO_2 CH_4 2-component analyzer (1st component + 2nd component) CO_2+CO CH_4+CO CO_2+CH_4 3-component analyzer (1st component + 2nd component + 3rd component) CH_4+(CO_2+CO) With out Other	 note 2	 B D E G H J S Y Z
6	< Sample component (O_2) and measuring range > Galvanic cell type oxygen analyzer/0 to 5%/10%/25% With out		1 Y
8	< Revision code >		1
9	< Power supply > For domestic use 100 to 115V AC, 50/60Hz For European use 200 to 240V AC, 50/60Hz For North American use 100 to 115V AC, 50/60Hz	note 3	1 2 3
10	< Measuring range (1st component) > 0 to 200ppm/500ppm/1000ppm 0 to 500ppm/1000ppm/2000ppm 0 to 1000ppm/2000ppm/5000ppm 0 to 2000ppm/5000ppm/1% 0 to 5000ppm/1%/2% 0 to 1%/2%/5% 0 to 2%/5%/10% 0 to 5%/10%/20% 0 to 10%/20%/50% 0 to 20%/50%/100% With out	note 4 note 2	A B C D E F G H J K Y
11	< Measuring range (2nd component) > 0 to 200ppm/500ppm/1000ppm 0 to 500ppm/1000ppm/2000ppm 0 to 1000ppm/2000ppm/5000ppm 0 to 2000ppm/5000ppm/1% 0 to 5000ppm/1%/2% 0 to 1%/2%/5% 0 to 2%/5%/10% 0 to 5%/10%/20% 0 to 10%/20%/50% 0 to 20%/50%/100% With out	note 4 note 2	A B C D E F G H J K Y
12	< Measuring range (3rd component) > 0 to 200ppm/500ppm/1000ppm 0 to 500ppm/1000ppm/2000ppm 0 to 1000ppm/2000ppm/5000ppm 0 to 2000ppm/5000ppm/1% 0 to 5000ppm/1%/2% 0 to 1%/2%/5% 0 to 2%/5%/10% 0 to 5%/10%/20% 0 to 10%/20%/50% 0 to 20%/50%/100% With out	note 4 note 2	A B C D E F G H J K Y

Digit	Description	note
14	< Output >	
	0 to 1 V DC, non-isolated	
	4 to 20 mA DC, non-isolated	
15	< Output type >	note 5,7
	Instantaneous value after O_2 correction	
	Average value after O_2 correction	
	CP calculation value	note 10
	With out	note 6
17	< Language >	
	Japanese	
	English	
18	< Gas extractor >	
	Non-fixed type (for intermittent measurement)	
	Fixed type (for continuous measurement), flange 5K25A, L = 300 mm	
	Fixed type (for continuous measurement), flange 5K25A, L = 400 mm	
	Fixed type (for continuous measurement), flange 5K25A, L = 600 mm	
	Fixed type (for continuous measurement), flange 5K25A, L = 800 mm	
	With out	
19	< Sample inlet tube >	note 8
	5m×ϕ6/ϕ4, Teflon	
	10m×ϕ6/ϕ4, Teflon	
	20m×ϕ6/ϕ4, Teflon	
	With out	
20	< Adjustment >	note 9
	Standard adjustment	
	Adjustment for heat treatment furnace	
	Other	



Note 1) A parenthesized sample component stands for the 2nd optical system.

Note 2) Specify code Y when only O_2 analyzer is needed.

Note 3) Between "1", "2" and "3" of the 9th digit, the rated voltage and plug shape of the attached power cord are different.
"1": For domestic use, rated voltage 125V AC (PSE), plug shape North American type
"2": For European use, rated voltage 250V AC (ECC), plug shape European type
"3": For North American use, rated voltage 125V AC (UL), plug shape North American type

Note 4) For possible combinations of sample component and measuring range, refer to the following tables (on pages 8 and 9).

Note 5) Specify this code when "1" or "2" is specified at the 6th digit.

Note 6) When "Y" is specified at the 6th digit, "Y" should also be specified at the 15th digit.

Note 7) The kind of output after O_2 correction will be added to all target components only when an analyzer for NOx, SO_2 and CO is specified.

Note 8) Sample inlet tube should be connected within 20 m.

Note 9) Calibration curve varies with gas components contained in sample gas.
"A ; standard adjustment" stands for adjustment in N_2 balance.
"B ; adjustment for heat treatment furnace" is applied to CO analyzer and CO_2 analyzer.
CO_2 analyzer: CO_2 range gas + 25% CO + 31% H_2/N_2
CO analyzer: CO range gas + 5% CO_2 + 31% H_2/N_2
When "Z; other" is specified, a gas composition table should be attached.

Note 10) Can be manufactured only when " CO_2 analyzer" is selected for the 5th digit.

Tables of Sample Component and Measuring Range - Availability Check Tables -

Table 1: 1-Component Analyzer (CO_2, CO, CH_4)

Sample component / Range		CO_2 analyzer	CO analyzer	CH_4 analyzer
		D	B	E
A	0 to 200/500/1000ppm	○	○	—
B	0 to 500/1000/2000ppm	○	○	—
C	0 to 1000/2000/5000ppm	○	○	○
D	0 to 2000/5000ppm/1%	○	○	○
E	0 to 5000ppm/1/2%	○	○	○
F	0 to 1/2/5%	○	○	○
G	0 to 2/5/10%	○	○	○
H	0 to 5/10/20%	○	○	○
J	0 to 10/20/50%	○	○	○
K	0 to 20/50/100%	○	○	○

○ : Product available

Table 2: 2-Component Analyzer (CO_2 analyzer + CO analyzer)

CO_2 analyzer range \ CO analyzer range		Range values are the same as those of CO2 analyzer.									
		A	B	C	D	E	F	G	H	J	K
A	0 to 200/500/1000ppm	○	○	—	—	—	—	—	—	—	—
B	0 to 500/1000/2000ppm	○	○	○	—	—	—	—	—	—	—
C	0 to 1000/2000/5000ppm	—	—	○	○	—	—	—	—	—	—
D	0 to 2000/5000ppm/1%	—	○	○	○	○	—	—	—	—	—
E	0 to 5000ppm/1/2%	—	○	○	○	○	○	○	○	—	—
F	0 to 1/2/5%	○	○	○	○	○	○	○	○	○	—
G	0 to 2/5/10%	○	○	○	○	○	○	○	○	○	○
H	0 to 5/10/20%	○	○	○	○	○	○	○	○	○	○
J	0 to 10/20/50%	—	○	○	○	○	○	○	○	○	○
K	0 to 20/50/100%	—	○	○	○	○	○	○	○	○	○

○ : Product available

Table 3: 2-Component Analyzer (CH_4 analyzer + CO analyzer)

CH_4 analyzer range \ CO analyzer range		Range values are the same as those of CH_4 analyzer.									
		A	B	C	D	E	F	G	H	J	K
A	0 to 200/500/1000ppm	—	—	—	—	—	—	—	—	—	—
B	0 to 500/1000/2000ppm	—	—	—	—	—	—	—	—	—	—
C	0 to 1000/2000/5000ppm	—	—	—	—	—	—	—	—	—	—
D	0 to 2000/5000ppm/1%	—	—	—	—	—	—	—	—	—	—
E	0 to 5000ppm/1/2%	—	—	○	○	○	○	—	—	—	—
F	0 to 1/2/5%	—	—	○	○	○	○	○	○	—	—
G	0 to 2/5/10%	—	○	○	○	○	○	○	○	○	○
H	0 to 5/10/20%	—	○	○	○	○	○	○	○	○	○
J	0 to 10/20/50%	—	○	○	○	○	○	○	○	○	○
K	0 to 20/50/100%	—	○	○	○	○	○	○	○	○	○

○ : Product available

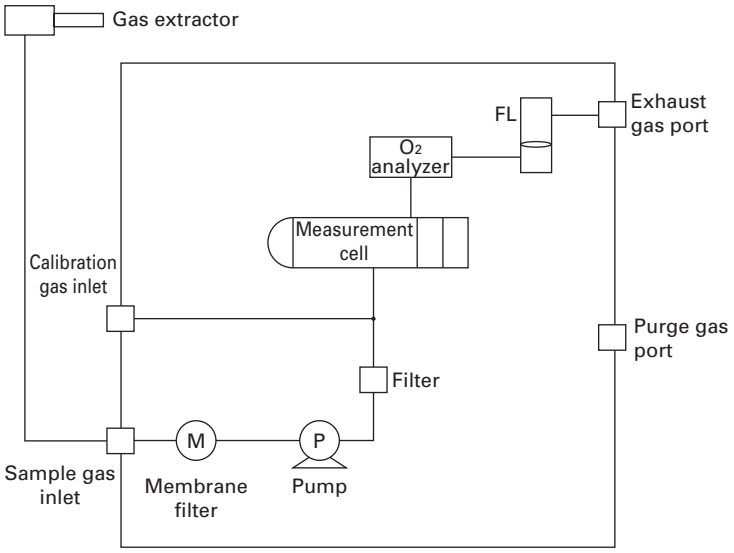
Table 4: 2-Component Analyzer (CO_2 analyzer + CH_4 analyzer)

CO_2 analyzer range \ CH_4 analyzer range		Range values are the same as those of CO_2 analyzer.									
		A	B	C	D	E	F	G	H	J	K
A	0～200/500/1000ppm	—	—	—	—	—	—	—	—	—	—
B	0～500/1000/2000ppm	—	—	—	—	—	—	—	—	—	—
C	0～1000/2000/5000ppm	—	—	—	—	○	—	—	—	—	—
D	0～2000/5000ppm/1%	—	—	—	○	○	○	—	—	—	—
E	0～5000ppm/1/2%	—	—	—	○	○	○	○	—	—	—
F	0～1/2/5%	—	—	—	○	○	○	○	○	—	—
G	0～2/5/10%	—	—	—	○	○	○	○	○	○	—
H	0～5/10/20%	—	—	—	○	○	○	○	○	○	○
J	0～10/20/50%	—	—	—	○	○	○	○	○	○	○
K	0～20/50/100%	—	—	—	○	○	○	○	○	○	○

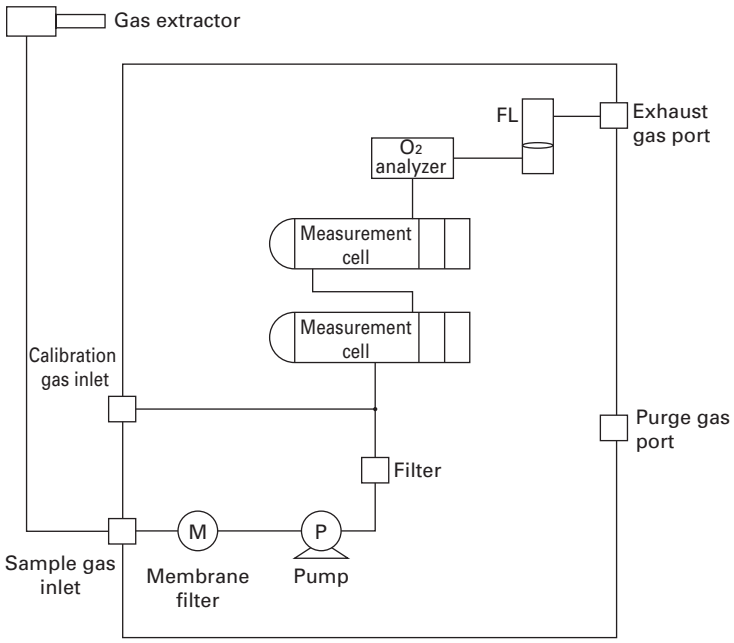
○ : Product available

• 3-component analyzer (CH_4 analyzer + CO_2 analyzer + CO analyzer);
Possible range in combination of Table 1 (CH_4 analyzer) and Table 2 (CO_2 analyzer + CO analyzer)

One optical line (1 to 3-component gas sampling system diagram): Type ZSVS

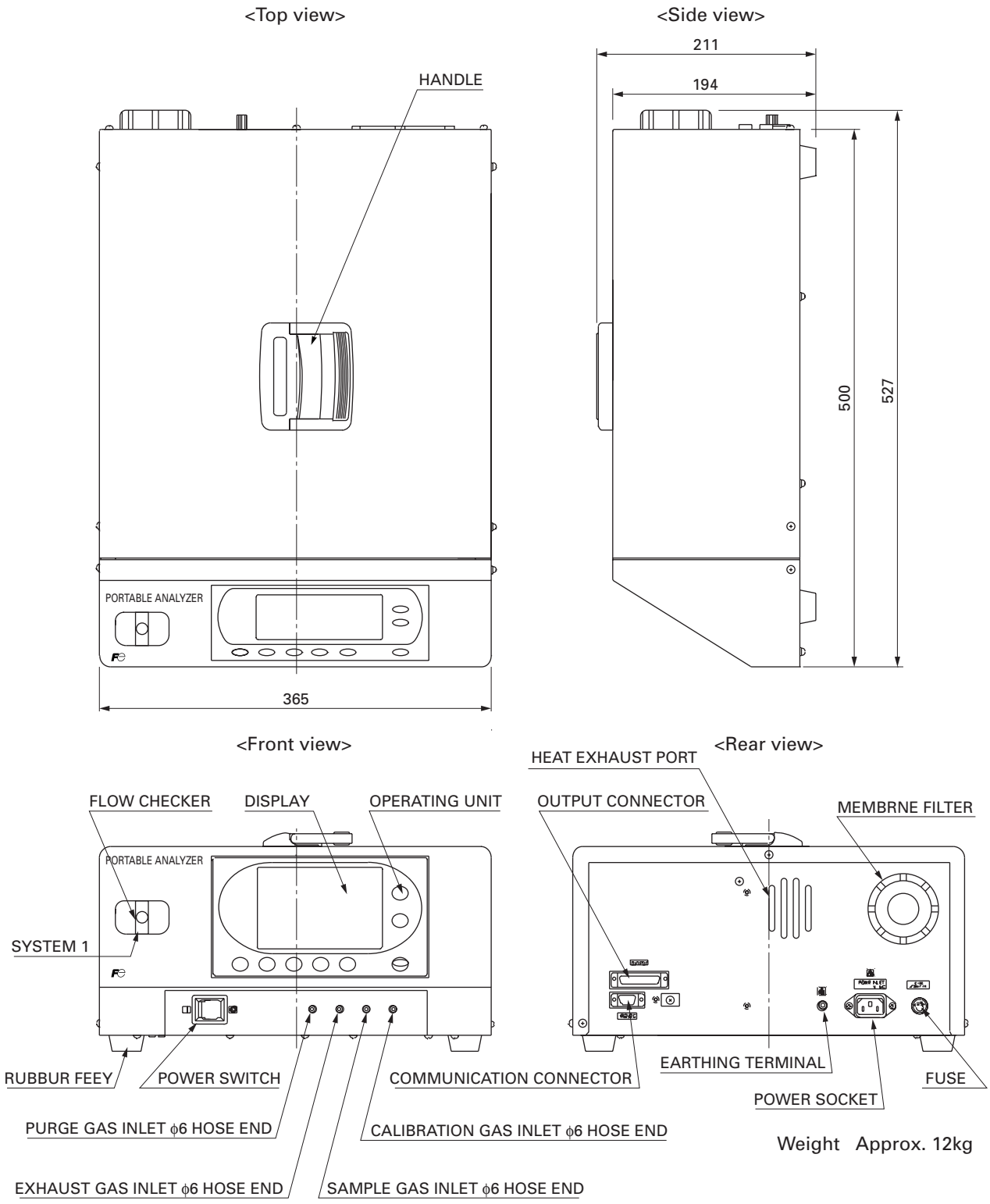


Two optical lines (3 to 4-component gas sampling system diagram): Type ZSVS



OUTLINE DIAGRAM (Unit : mm)

(1) Analyzing block



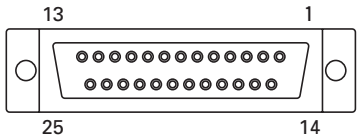
Weight Approx. 12kg

(2) External connection diagrams

Caution) Between male (P) and female (S) connectors, pin numbers are different.
Connect them properly with utmost care.

<Analog output>

On the analyzer side, a female connector (DB-25S-T-NR made by Japan Aviation Electronics Industry) is attached. For connection, the furnished cables (1 m)(DB-25P) should be used.

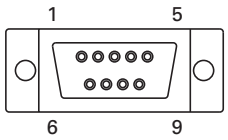


Color of furnished cable	Orange	Red	Brown	Black	White	Gray	Purple	Blue	Green	Yellow	Orange	Red	Brown
Pin name	CH7+	−CH6+		−CH5+		−CH4+		−CH3+		−CH2+		−CH1+	
Pin No.	13	12	11	10	9	8	7	6	5	4	3	2	1

Pin No.	25	24	23	22	21	20	19	18	17	16	15	14
Pin name	NC									−CH8+		−CH7
Color of furnished cable										Blue	Green	Yellow

<Communication output>

On the analyzer side, a male connector (DE-9P-T-NR made by Japan Aviation Electronics Industry) is attached. For connection, commercially available cross cables (DE-9S) should be used.



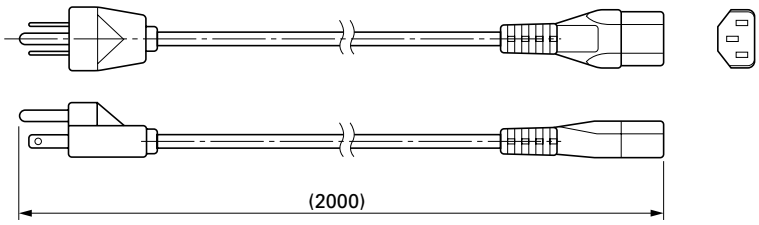
Pin name	NC	RXD	TXD	NC	GND
Pin No.	1	2	3	4	5

Pin No.	6	7	8	9
Pin name	NC	NC	NC	NC

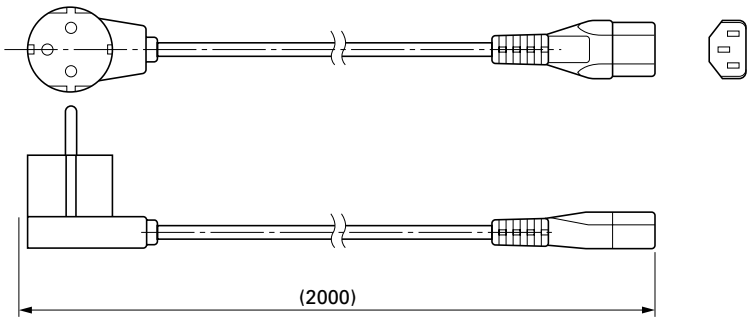
OUTLINE DIAGRAM (Unit : mm)

(3) Power cord and signal cable

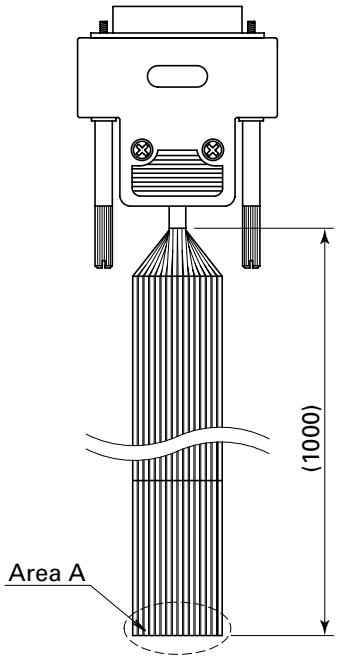
• Power cord for domestic and North American use (North American type), rated voltage 125V AC.
Note: The standards for domestic and North American use are different, but the shape is the same.



• Power cord for European use (European type), rated voltage 250 V AC

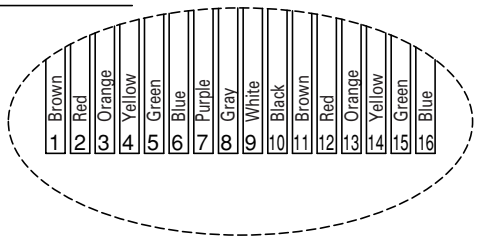


• Output cable



Output channel	+CH1-		+CH2-		+CH3-		+CH4-		+CH5-		+CH6-		+CH7-		+CH8-	
Connector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cable color	Brown	Red	Orange	Yellow	Green	Blue	Purple	Gray	White	Black	Brown	Red	Orange	Yellow	Green	Blue

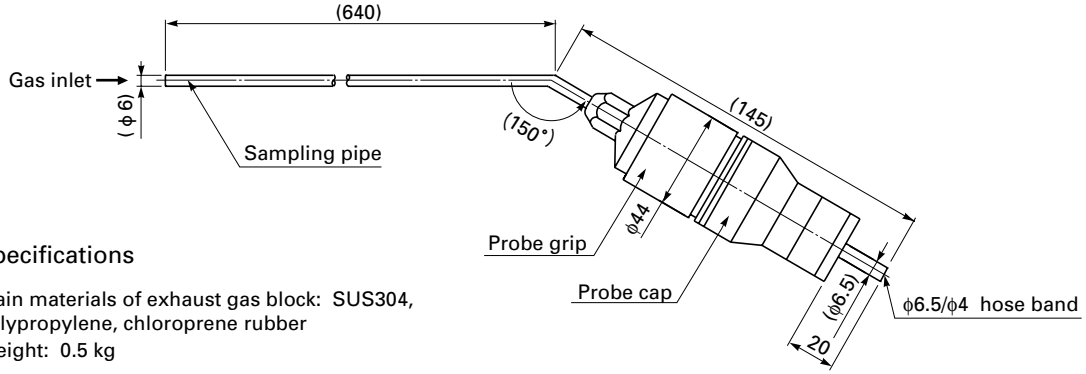
Details of area A



• Control input/output cable

OUTLINE DIAGRAM (Unit : mm)

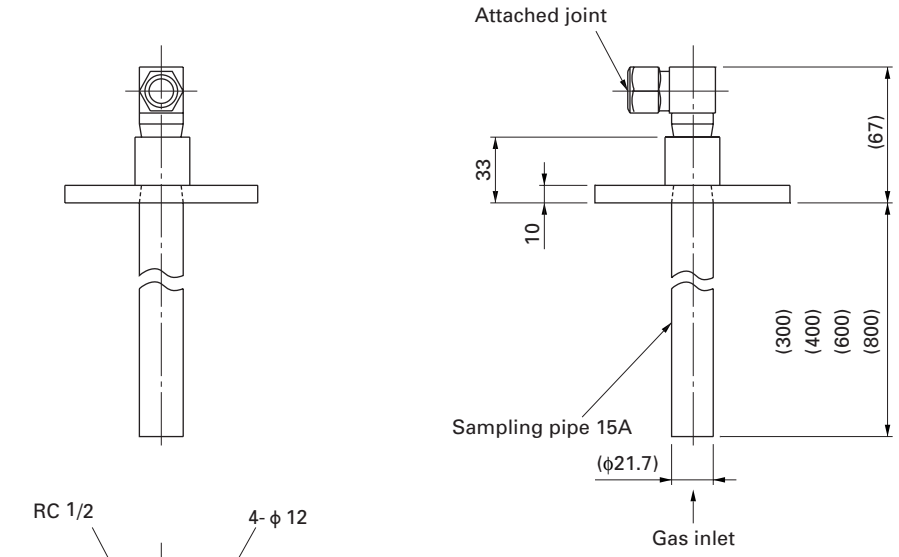
(4) Non-fixed type gas extractor



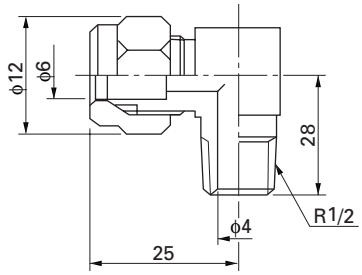
Specifications

Main materials of exhaust gas block: SUS304, polypropylene, chloroprene rubber
Weight: 0.5 kg

(5) Fixed type gas extractor



Attached joint (for φ6 pipe connection)



Material : Teflon

Specifications

Main materials of gas-contacting parts: SUS316, Teflon
Weight: 1 kg

⚠ Caution on Safety

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

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