General Specifications

IR400
NDIR TYPE INFRARED GAS ANALYZER (5-COMPONENT ANALYZER)

GS 11G02N01-01E

The IR400 infrared gas analyzer is capable of measuring the concentrations of NO, SO_2, CO_2, CO, CH_4 and O_2 components in sample gas.

NO, SO_2, CO_2, CO and CH_4 are measured by non-dispersive infrared method (NDIR), while O_2 is measured by built-in paramagnetic sensor or external zirconia sensor. A maximum of 5 components including O_2 (up to 4 components except for O_2 measurement) are simultaneously measurable.

The mass flow type twin detector of high sensitivity and reliability adopted in the infrared ray method detection unit makes the measurement hardly affected by interfering components.

In addition, the IR400 includes a microprocessor and has a large-size liquid crystal display, iproviding easy operation, high accuracy and multiple functions.

Optimum as an analyzer unit of measurement system for combustion exhaust gas from refuse incinerator and boiler, or gas from different industrial furnaces.

■ FEATURES

1. Simultaneous and continuous measurement of up to 5 components including O_2
   O_2 and 4 components selected from among NO, SO_2, CO, CO_2, and CH_4.
2. Minimal interference from other gas components
   The mass flow type twin detector of high sensitivity and reliability minimizes interference from other gas components, ensuring excellent stability.
3. Extensive functions
   Incorporating O_2 correction, average value computing, automatic calibration, one touch calibration, upper/lower limit alarm, remote measurement range changeover, range identification signal output, etc., the analyzer accommodates different application requirements.
4. Easy-to-read, large LCD
   Large LCD provides clear indications of all measured components and computed values and easy interactive operation.
5. 19-inch rack mounting
   Unitized construction of the main body on the 19-inch rack and of the signal input/output terminal module allows easy configuration of a gas analyzer system.
6. Maximum measuring range ratio
   A maximum range ratio of 1:25 is achieved.

■ SPECIFICATIONS

Standard Specifications

Measurement principle:
NO, SO_2, CO_2, CO, CH_4: Non-dispersive infrared method
Single light source-double beams
O_2: Paramagnetic type (built-in), or zirconia type (external)

Measurable gas components and measuring ranges:

Component \ Range	Minimum range	Maximum range
NO	0 – 50 ppm	0 – 5000 ppm
SO_2	0 – 50 ppm	0 – 10 vol%
CO_2	0 – 20 ppm	0 – 100 vol%
CO	0 – 50 ppm	0 – 100 vol%
CH_4	0 – 200 ppm	0 – 100 vol%
O_2 (paramagnetic)	0 – 5 vol%	0 – 25 vol%
O_2 (zirconia)	0 – 5 vol%	0 – 25 vol%

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- Measurement of up to 5 components including O_2.
- 1 or 2 measuring range per component.
- Measuring range ratio ≦ 1:5 (O_2 analyzer)
  ≦ 1:25 (except O_2 analyzer)

For measurable components and possible combina tions of measuring ranges, refer to Tables 1-(1) to (7).

Display:
Digital indication in 4 digits (LCD with backlight)
- Instantaneous value of each component
- Instantaneous value after O_2 correction (only in NO, SO_2, CO with O_2 measurement)
- Average value after O_2 correction (only in NO, SO_2, CO with O_2 measurement)
- Average O_2 value

Analog output signal:
* Input/output of analog signals is available in combination with the input/output terminal module.
4 to 20 mA DC or 0 to 1 V DC, non-isolated, 12 points max.
Analog output corresponds one-to-one with measured value indication.

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Permissible load resistance;
550 Ω max. for 4 to 20 mA DC
100 kΩ min. for 0 to 1 V DC
* Refer to Table 2 for the channel numbers of displayed values and analog output signals.

Analog input signal:
For signal input from external O_2 analyzer.
Signal requirement;
(1) Signal from Yokogawa's zirconia O_2 sensor (Model ZX8D Style C)
(2) 0 to 1V DC from an O_2 sensor
Input section is not isolated. This feature is effective when built-in O_2 sensor is not used.
(An input signal triggers measured concentration indication and O_2 correction.)
* External O_2 sensor should be purchased separately.

Relay contact output:
1a contact (250 V AC/2 A, resistive load)
Instrument error, calibration error, range identification, auto calibration status, pump ON/OFF, peak alarm.
1c contact (250 V AC/2 A, resistive load)
Upper/lower alarm contact output. (for each channel)
Power disconnection alarm.
* All relay contacts are isolated mutually and from the internal circuit.

Contact input: Non-voltage contact (ON/0 V, OFF/ 5V DC, 5 mA flowing at ON)
Remote range changeover, auto calibration remote start, remote hold, average value reset, pump ON/OFF
Isolated from the internal circuit with photocoupler. Contact inputs are not isolated from one another.

Transmission output:
Solenoid valve drive signal for automatic calibration.
Transistor output (100 mA or less)
* For details, see External Connection Diagram on page 15.

Power supply:
Voltage rating; 100 to 240 V AC
Allowable range; 85 to 264 V AC
Frequency; 50/60 Hz
Power consumption; 250 VA max.
Inlet; Conform to EN60320 Protection Class 1

Operating conditions:
Ambient temperature; –5 to 45˚C
Ambient humidity; 90% RH max., non-condensing.

Storage conditions:
Ambient temperature; –20 to 60˚C
Ambient humidity; 90% RH max., non-condensing

Dimensions (H × W × D):
Analyzer main unit;
177 × 483 × 578 mm
Input/output terminal module;
164 × 316 × 55 mm

Weight: Approx. 22 kg (only analyzer)

Finish color: Front panel; Off-white (Munsell 10Y7.5/0.5 or equivalent)
Casing; Plating, Steel-blue (gray)

Enclosure: Steel casing, for indoor use

Material of gas-contacting parts:
Gas inlet/outlet; SUS304
Sample cell; SUS304/neoprene rubber
Infrared-ray transmitting window; CaF_2
O_2 sensor sampling cell: SUS316
Internal piping; Toaron tube, Teflon tube

Gas inlet/outlet: Rc1/4 or 1/4NPT internal thread

Purge gas flow rate: 1 L/min (when required)

Installation altitude: 2000 m or less

Safety and EMC conforming standards:
Safety; EN61010-1
Pollution degree; 2
Installation category; II
EMC; EN61326
EN61000-3-2
EN61000-3-3

Standard Functions

Output signal hold:
Output signals are held during manual and auto calibrations by activation of holding (turning "ON" its setting).
The values to be held are the ones just before start calibration mode.
Indication values will not be held.

Remote output hold:
Output signal is held at the latest value or setting value by short-circuiting the remote output holding input terminals.
Holding is maintained while the terminals are short-circuited. Indication values will not be held.

Range changeover:
The range changeover is available in manual, auto, and remote modes. Only preset changeover method is effective.

Manual: Allows range to switch by key operation.

Auto: Allows range to switch from low to high range when 90%FS or more is available in the low range.
Allows range to switch from high to low range when 80%FS or less is available in the low range.

Remote: Non-voltage contact input (for measurable components)
Allows range to switch via an external signal when remote range changeover input is received.

Range identification signal:
The present measuring range is identified by a contact signal.
The contact output terminals for each component are short-circuited when the first range is selected, and when the second range is selected, the terminals are open.

Auto calibration:
Auto calibration is carried out periodically at the preset cycle.
When a standard gas cylinder for calibration and a solenoid valve for opening/closing the gas flow line are prepared externally by the customer, calibration will be carried out with the solenoid valve drive contacts for zero calibration and each span calibration turned on/off sequentially at the set auto calibration timing.

Auto calibration cycle setting:
Auto calibration cycle is set.
Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day).

Gas flow time setting:
The time for flowing each calibration gas in auto calibration is set.
Settable within 60 to 900 seconds (in increments of 1 second)

Auto calibration remote start:
Auto calibration is carried out only once according to an external input signal.
Calibration sequence is settable in the same way as the general auto calibration.
Auto calibration is started by opening the auto calibration remote start input terminals after short-circuiting for 1.5 seconds or longer.

Auto zero calibration:
Auto zero calibration is carried out periodically at the preset cycle.
This cycle is independent of "Auto calibration" cycle.
When zero calibration gas and solenoid valve for opening/closing the calibration gas flow line are prepared externally by the customer, zero calibration will be carried out with the solenoid valve drive contact for zero calibration turned on/off at the set auto zero calibration timing.

Auto zero calibration cycle setting:
Auto zero calibration cycle is set.
Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day)

Gas flow time setting:
The time for flowing zero gas in auto zero calibration is set.
Settable 60 to 900 seconds (in increments of 1 second)

Upper/lower limit alarm:
Alarm contact output turns on when measurement value reachs the preset upper or lower limit alarm value.
Contacts close when the instantaneous value of each component becomes larger than the upper alarm limit value or smaller than the lower alarm limit value.

Instrument error contact output:
Contacts close at occurrence of analyzer error No. 1, 3 or 10.

Calibration error contact output:
Contacts close at occurrence of manual or auto calibration error (any of errors No. 4 to 9).

Auto calibration status contact output:
Contacts close during auto calibration.

Pump ON/OFF contact output:
During measurement, contacts close.
While calibration gas is flowing, contacts open. Contacts are connected in power supply of pump, and stop the sample gas while calibration gas is flowing.

Optional Functions

O_2 correction: Conversion of measured NO, SO_2 and CO gas concentrations into values at reference O_2 concentration.

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

Where:
C: Sample gas concentration after O_2 correction
Cs: Measured concentration of sample gas
Os: Measured O_2 concentration (limit setting: 1 to 20% O_2, default 17%)
On: Reference O_2 concentration (value changeable by setting: 0 to 19% O_2, default 4%)

Average value after O_2 correction and O_2 average value calculation:
The result of O_2 correction or instantaneous O_2 value can be outputted as an average value in the determined period of time.
Used for averaging is the moving average method in which sampling is carried out at intervals of 30 seconds.
(Output is updated every 30 seconds. It is the average value in the determined period of time just before the latest updating.)
Averaging time is settable within 1 to 59 minutes (in increments of 1 minute) or 1 to 4 hours (in increments of 1 hour).

Average value reset:
The above-mentioned output of average value is started from the initial state by opening the average value resetting input terminals after short-circuiting for 1.5 seconds or longer.
Output is reset by short-circuiting and restarted by opening.

CO concentration peak count alarm:
(available only for CO + O_2 measurement)
Alarm output turns on according to the preset concentration and count.
Whenever the instantaneous value of CO exceeds the preset concentration value, count increments. If the count exceeds the preset value in one hour, the alarm contacts close.

Communication function:
RS-232C (9 pins D-sub)
Half-duplex bit serial
Start-stop synchronization
Modbus™ protocol
Contents: Read/write parameters
Read measurement concentration and instrument status
Remark: When connecting via RS-485 interface, a RS-232C ⟷ RS-485 converter should be used.

Performance

Repeatability: ±0.5% of full scale (±1% of full scale for range less than 0-50 ppm)
Linearity: ±1% of full scale
Zero drift: ±1% of full scale/week
(±2% of full scale/week for range between 0-50 ppm and 0-200 ppm)
(±2% of full scale/day for range less than 0-50 ppm)
Span drift: ±2% of full scale/week
(±2% of full scale/day for range less than 0-50 ppm)
Response time (for 90%FS response) :
Within 60 seconds including replacement time of sample gas (when gas flow rate is 0.5 L/min)

Effects of interfering gases

When sample gas contains gas components listed below, the measurement accuracy may suffer. Consult Yokogawa for countermeasures or effect on accuracy.

Analyzer	Interference gas	Effect
SO_2 analyzer	NO_2	50 ppm of NO_2 is equivalent to -6 ppm of SO_2
CO analyzer	CO_2	15% of CO_2 is equivalent to 7 to 10 ppm of CO
	N_2O	1000 ppm of N_2O is equivalent to 80 ppm of CO
CH_4 analyzer	CO_2	15% of CO_2 is equivalent to approx. 3 ppm of CH_4

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Standard Requirements for Sample Gas

Flow rate: 0.5 ±0.2 L/min
Temperature: 0 to 50˚C
Pressure: 10 kPa or less (Gas outlet side should be open to the atmospheric air.)
Dust: 100 µg/Nm³ or less in particle size of 1 µm or less
Mist: Unallowable
Moisture: Below a level where saturation occurs at 2˚C (condensation unallowable).
Corrosive component: HCl 1 ppm or less
Standard gas for calibration:
Zero gas; Dry N_2
Span gas; Each sample gas having concentration 90 to 100% of its measuring range (recommended).
Gas beyond concentration 100%FS is unusable.

In case a zirconia O_2 analyzer is installed externally and calibration is carried out on the same calibration gas line:
Zero gas; Dry air or atmospheric air (provided without CO_2 sensor)
Span gas; For other than O_2 measurement, each sample gas having concentration 90 to 100% of its measuring range.
For O_2 measurement, O_2 gas of 1 to 2 vol%.

Installation Requirements

- Indoor use: Avoid exposure to direct sunlight, weather, and radiant heat from hot substances. Where exposure to such conditions are unavoidable, a protective hood or cover should be prepared.
- Minimal vibration
- A clean atmosphere

Diagram of measurement principle of infrared gas analyzer (NO, SO_2, CO_2, CO, CH_4)

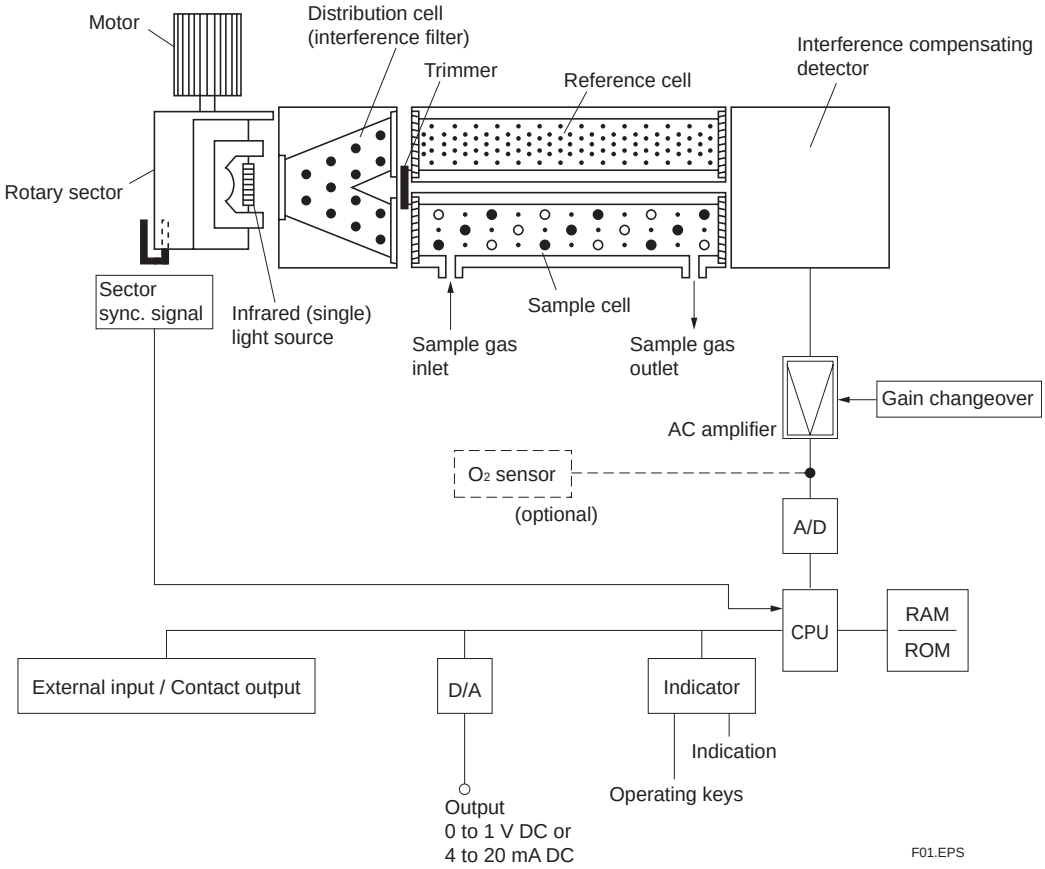
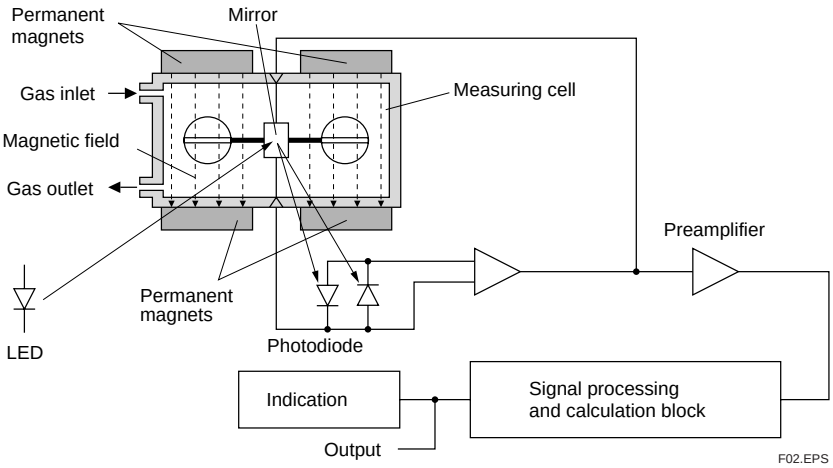
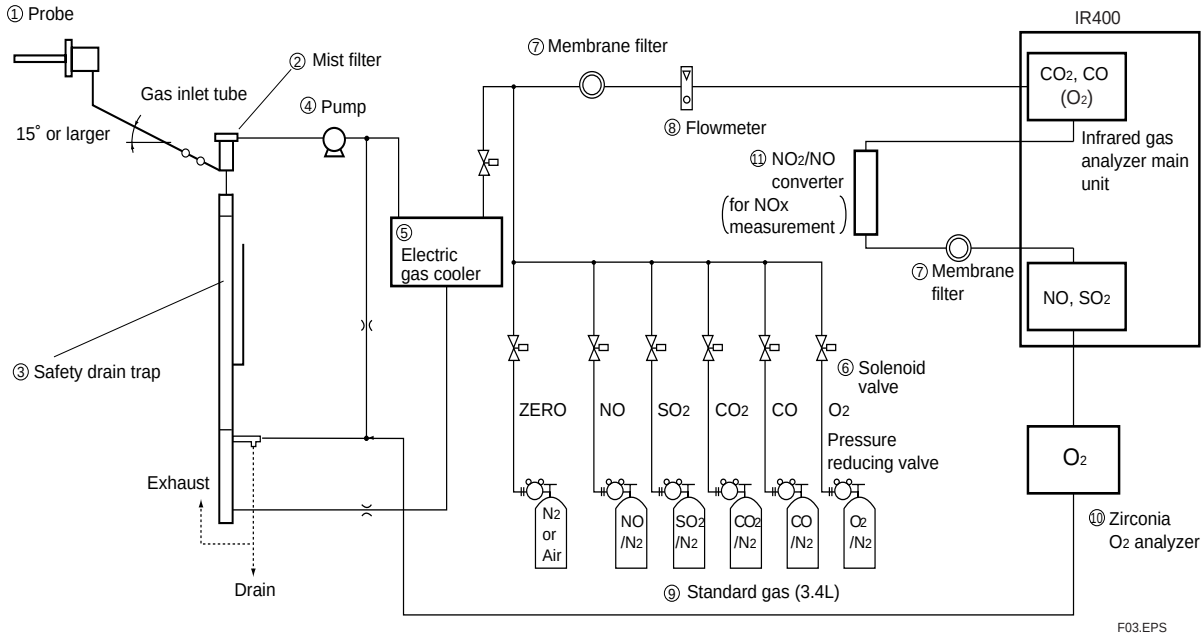


Diagram of measurement principle of paramagnetic oxygen analyzer



Example of gas sampling system configuration

The following illustrates a typical system configuration for five component gas measurement for monitoring combustion exhaust gas from boiler, refuse incinerator, etc. Contact Yokogawa for system configuration matching the particular use or further information.



Typical sampling system components

No.	Item	Description
①	Probe	With a heating type stainless steel filter. Standard pore size: 40 m
②	Mist filter	Separates drain and removes dust and mist.
③	Safety drain trap	Prevents drain from being sucked. Composite operation of constant-pressure bubbler.
④	Pump	Sucks in sample gas. Sample gas flow rate: approx. 2 L/min
⑤	Electric gas cooler	Dehumidifies sample gas.
⑥	Solenoid valve	Used for introducing calibration gas.
⑦	Membrane filter	Glass fiber or PTFE filter removes fine dust. Dust buildup conditions can be monitored through front panel of analyzer.
⑧	Flowmeter	Adjusts and monitors sample gas flow rate.
⑨	Standard gas	Used for zero/span calibration. Zero, NO, SO_2, CO, CO_2, and O_2 gas cylinders.
⑩	Zirconia O_2 analyzer	Not required when built-in type is used. Installed externally. Measures O_2 concentration (0 to 25%) of sample gas.
⑪	NO_2/NO converter	Required for NOx measurement. Converts NO_2 to NO gas efficiently using special catalyst.

For each sampling component, consult with Yokogawa.

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MODEL AND SUFFIX CODE

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Model	Suffix code	Option code	Description			
IR400			Infrared gas analyzer 19-inch rack mounting type with slide rail			
Measurable component (note 8)			1st	2nd	3rd	4th
	-A		NO			
	-B		SO_2			
	-C		CO_2			
	-D		CO			
	-F		CH_4			
	-G		NO	SO_2		
	-H		NO	CO		
	-J		CO_2	CO		
	-K		NO	SO_2	CO	
	-L		NO	SO_2	CO_2	CO
O_2 Analyzer						
	N		Without O_2 analyzer			
	1		External zirconia type O_2 sensor (purchase separately: ZX8D)			
	2		External O_2 analyzer (note 1)			
	3		Built-in paramagnetic type O_2 sensor			
1st Component 1st Range (note 2)						
	V		0-20 ppm (note 3)			
	A		0-50 ppm			
	B		0-100 ppm			
	C		0-200 ppm			
	D		0-250 ppm			
	E		0-500 ppm			
	F		0-1000 ppm			
	G		0-2000 ppm			
	H		0-5000 ppm			
	J		0-1%			
	K		0-2%			
	L		0-3%			
	M		0-5%			
	P		0-10%			
	Q		0-20%			
	R		0-40%			
	S		0-50%			
	T		0-70%			
	U		0-100%			
1st Component 2nd Range (note 2)						
	A		0-50 ppm			
	B		0-100 ppm			
	C		0-200 ppm			
	D		0-250 ppm			
	E		0-500 ppm			
	F		0-1000 ppm			
	G		0-2000 ppm			
	H		0-5000 ppm			
	J		0-1%			
	K		0-2%			
	L		0-3%			
	M		0-5%			
	P		0-10%			
	Q		0-20%			
	R		0-40%			
	S		0-50%			
	T		0-70%			
	U		0-100%			
	N		Not available			
2nd Component 1st Range (note 2)						
	A		0-50 ppm			
	B		0-100 ppm			
	C		0-200 ppm			
	D		0-250 ppm			
	E		0-500 ppm			
	F		0-1000 ppm			
	G		0-2000 ppm			
	H		0-5000 ppm			
	J		0-1%			
	K		0-2%			
	L		0-3%			
	M		0-5%			
	P		0-10%			
	Q		0-20%			
	R		0-40%			
	S		0-50%			
	T		0-70%			
	U		0-100%			
	N		Not available			

MODEL AND SUFFIX CODE

Model	Suffix code	Option code	Description
IR400			Infrared gas analyzer 19-inch rack mounting type with slide rail
2nd Component 2nd Range (note 2)	B		0-100 ppm
	C		0-200 ppm
	D		0-250 ppm
	E		0-500 ppm
	F		0-1000 ppm
	G		0-2000 ppm
	H		0-5000 ppm
	J		0-1%
	K		0-2%
	L		0-3%
	M		0-5%
	P		0-10%
	Q		0-20%
	R		0-40%
	S		0-50%
	T		0-70%
	U		0-100%
	N		Not Available
3rd Component 1st Range (note 2)	A		0-50 ppm
	B		0-100 ppm
	C		0-200 ppm
	D		0-250 ppm
	E		0-500 ppm
	F		0-1000 ppm
	G		0-2000 ppm
	H		0-5000 ppm
	J		0-1%
	K		0-2%
	L		0-3%
	M		0-5%
	P		0-10%
	Q		0-20%
	R		0-40%
	S		0-50%
	T		0-70%
	U		0-100%
	N		Not Available
3rd Component 2nd Range (note 2)	B		0-100 ppm
	C		0-200 ppm
	D		0-250 ppm
	E		0-500 ppm
	F		0-1000 ppm
	G		0-2000 ppm
	H		0-5000 ppm
	J		0-1%
	K		0-2%
	L		0-3%
	M		0-5%
	P		0-10%
	Q		0-20%
	R		0-40%
	S		0-50%
	T		0-70%
	U		0-100%
	N		Not Available
4th Component 1st Range (note 2)	A		0-50 ppm
	B		0-100 ppm
	C		0-200 ppm
	D		0-250 ppm
	E		0-500 ppm
	F		0-1000 ppm
	G		0-2000 ppm
	H		0-5000 ppm
	J		0-1%
	K		0-2%
	L		0-3%
	M		0-5%
	P		0-10%
	Q		0-20%
	R		0-40%
	S		0-50%
	T		0-70%
	U		0-100%
	N		Not Available

MODEL AND SUFFIX CODE

Model	Suffix code	Option code	Description
IR400			Infrared gas analyzer 19-inch rack mounting type with slide rail
4th Component 2nd Range (note 2)	B		0–100 ppm
	C		0–200 ppm
	D		0–250 ppm
	E		0–500 ppm
	F		0–1000 ppm
	G		0–2000 ppm
	H		0–5000 ppm
	J		0–1%
	K		0–2%
	L		0–3%
	M		0–5%
	P		0–10%
	Q		0–20%
	R		0–40%
	S		0–50%
	T		0–70%
	U		0–100%
	N		Not available
O_2 Analyzer 1st Range (note 2)	1		0–5%
	2		0–10%
	3		0–25%
	N		Not available
O_2 Analyzer 2nd Range (note 2)	2		0–10%
	3		0–25%
	N		Not available
Output	-4		4–20 mA DC, non-isolation
	-1		0–1 V DC, non-isolation
Piping	R		Rc 1/4
	T		1/4 NPT
Indication, Power Cable (note 7)	J		Japanese, Power Cable; rated voltage 125 V AC
	E		English, Power Cable; rated voltage 125 V AC (UL)
	U		English, Power Cable; rated voltage 250 V AC (CEE)
Option O_2 correction and O_2 avarage (note 4)		/K	With O_2 correction and O_2 average value
		/A	With peak count alarm (note 4)
Communication		/C	RS–232C (note 9)
Internal purge (note 5)		/P	Analyzer internal purging
Relay board (note 6)		/R	With dedicated cable

Footnotes:
1: A signal from the external O_2 analyzer should be 0-1 V DC linear to full scale.
2: Possible combinations of ranges are specified in separate tables.
3: Only available for CO_2 measurement. Option code "/P," Analyzer internal purging, must be specified.
4: O_2 correction is available only for NO, CO, and SO_2. Both average value output after O_2 correction and average O_2 value output are provided at the same time.
A peak count alarm can be provided only for CO measurement.
5: When internal purging is specified with 3- or 4-component analyzers, only one set of gas inlet/outlet can be used and thus NO_2/NO converter cannot be connected between two measurement sections.
6: Should be specified when using a solenoid valve for automatic calibration.
7: Suffix Codes "E" and "U" are power cables with different voltage rating and plug type. Select appropriate code according to the operating power supply voltage to be used in the field.
Suffix Code "E" is of the North American plug type and "U" of the European type.
8: For NOx measurement, a NO_2/NO converter (P/N K9350LE or K9350LF) should be purchased separately.
9: Should be specified when using Modbus™ communication.

Measurable components and ranges – availability check table –

Table 1. Single-component analyzer (NO, SO_2, CO_2, CO, CH_4)

1st range \ 2nd range		A	B	C	D	E	F	G	H	J	K
		0-50ppm	0-100ppm	0-200ppm	0-250ppm	0-500ppm	0-1000ppm	0-2000ppm	0-5000ppm	0-1%	0-2%
V	0-20ppm	◎	◎	◎	◎	◎	–	–	–	–	–
A	0-50ppm	–	☆□◎○	☆□◎○	☆□◎○	☆□◎○	☆□◎○	–	–	–	–
B	0-100ppm	–	–	☆□◎○	☆□◎○	☆□◎○	☆□◎○	☆□◎○	–	–	–
C	0-200ppm	–	–	–	☆□◎○△	☆□◎○△	☆□◎○△	☆□◎○△	☆□◎○△	–	–
D	0-250ppm	–	–	–	–	–	☆□◎○△	☆□◎○△	☆□◎○△	–	–
E	0-500ppm	–	–	–	–	–	☆□◎○△	☆□◎○△	☆□◎○△	□◎○△	–
F	0-1000ppm	–	–	–	–	–	–	☆□◎○△	☆□◎○△	□◎○△	□◎○△
G	0-2000ppm	–	–	–	–	–	–	–	☆□◎○△	□◎○△	□◎○△
H	0-5000ppm	–	–	–	–	–	–	–	–	□◎○△	□◎○△
J	0-1%	–	–	–	–	–	–	–	–	–	□◎○△
K	0-2%	–	–	–	–	–	–	–	–	–	–
L	0-3%	–	–	–	–	–	–	–	–	–	–
M	0-5%	–	–	–	–	–	–	–	–	–	–
P	0-10%	–	–	–	–	–	–	–	–	–	–
Q	0-20%	–	–	–	–	–	–	–	–	–	–
R	0-40%	–	–	–	–	–	–	–	–	–	–
S	0-50%	–	–	–	–	–	–	–	–	–	–
T	0-70%	–	–	–	–	–	–	–	–	–	–
U	0-100%	–	–	–	–	–	–	–	–	–	–

1st range \ 2nd range		L	M	P	Q	R	S	T	U
		0—3%	0—5%	0—10%	0—20%	0—40%	0—50%	0—70%	0—100%
V	0—20ppm	–	–	–	–	–	–	–	–
A	0—50ppm	–	–	–	–	–	–	–	–
B	0—100ppm	–	–	–	–	–	–	–	–
C	0—200ppm	–	–	–	–	–	–	–	–
D	0—250ppm	–	–	–	–	–	–	–	–
E	0—500ppm	–	–	–	–	–	–	–	–
F	0—1000ppm	–	–	–	–	–	–	–	–
G	0—2000ppm	□◎○△	–	–	–	–	–	–	–
H	0—5000ppm	□◎○△	□◎○△	□◎○△	–	–	–	–	–
J	0—1%	□◎○△	□◎○△	□◎○△	◎○△	–	–	–	–
K	0—2%	□◎○△	□◎○△	□◎○△	◎○△	◎○△	–	–	–
L	0—3%	–	□◎○△	□◎○△	◎○△	◎○△	◎○△	–	–
M	0—5%	–	–	□◎○△	◎○△	◎○△	◎○△	◎○△	◎○△
P	0—10%	–	–	–	◎○△	◎○△	◎○△	◎○△	◎○△
Q	0—20%	–	–	–	–	◎○△	◎○△	◎○△	◎○△
R	0—40%	–	–	–	–	–	◎○△	◎○△	◎○△
S	0—50%	–	–	–	–	–	–	◎○△	◎○△
T	0—70%	–	–	–	–	–	–	–	◎○△
U	0—100%	–	–	–	–	–	–	–	◎○△

◎:CO_2 analyzer measurable range ○:CO analyzer measurable range △:CH_4 analyzer measurable range
□:SO_2 analyzer measurable range ☆:NO analyzer measurable range

Table 2. Two-component analyzer (NO and SO_2)

		2nd component (SO_2), 1st range ⟶ SO_2							
↓ 1st component (NO),1st range		A	B	C	D	E	F	G	H
		0-50ppm	0-100ppm	0-200ppm	0-250ppm	0-500ppm	0-1000ppm	0-2000ppm	0-5000ppm
NO	A 0-50ppm	○	○	○	○	○	○	○	—
	B 0-100ppm	○	○	○	○	○	○	○	—
	C 0-200ppm	○	○	○	○	○	○	○	—
	D 0-250ppm	○	○	○	○	○	○	○	—
	E 0-500ppm	○	○	○	○	○	○	○	○
	F 0-1000ppm	○	○	○	○	○	○	○	○
	G 0-2000ppm	○	○	○	○	○	○	○	○
	H 0-5000ppm	—	—	—	—	○	○	○	○

○: Double components measurable range. 1st component ; NO, 2nd component ; SO_2.

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* 1st range (low range) must meet the combination in above table.
2nd range, both NO and SO_2 measurements are based on Table 1.

Table 3. Two-component analyzer (NO and CO)

Both NO and CO analyzer must meet the range in Table 1; Single component analyzer.

Table 4. Two-component analyzer (CO_2 and CO)

1st component ↓ (CO_2), 1st range		2nd component (CO), 1st range → CO: A 0-50ppm	B 0-100ppm	C 0-200ppm	D 0-250ppm	E 0-500ppm	F 0-1000ppm	G 0-2000ppm	H 0-5000ppm	J 0-1%
CO_2	A 0-50ppm	○	○	○						
	B 0-100ppm	○	○	○	○	○				
	C 0-200ppm	○	○	○	○	○				
	D 0-250ppm					○				
	E 0-500ppm					○	○			
	F 0-1000ppm						○			
	G 0-2000ppm		□×2.5	□×2.5	□×2.5	□×5	□×10	□×10	○	○
	H 0-5000ppm		□×1	□×1	□×1	□×2	□×4	□×4	○	○
	J 0-1%					□×1	□×2	□×2	□×10	○
	K 0-2%						□×1	□×1	□×5	□×10
	L 0-5%								□×2	□×5
	M 0-10%	□×2	□×2	□×2	□×2	□×2	△×2×10	△×2×5	□×2	□×5
	N 0-20%	□×1	□×1	□×1	□×1	□×1	△×1×10	△×1×5	□×1	□×2.5

○□△:Double components measurable. 1st component ; CO_2, 2nd component ; CO.

Note: 1st range (low range) must meet the combination in above table. (For 0-200 ppm range, measurement is available up to 25 times.)
2nd range, ○ is specified; both CO_2 and CO measurements are available up to 20 times of the 1st range.
□ is specified; CO measurement is available up to 20 times of the 1st range.
CO_2 measurement is available up to the ratio written after the □ mark.
△ is specified; both CO_2 and CO measurements are available up to ratio written after the △ mark.
The ratio, first value is for CO_2, second value is for CO.
example: △×2 ×5 means, 2nd range of CO_2 is available up to double of 1st range, 2nd range of CO is available up to 5 times of 1st range.
×1 means only 1st range.

Table 5. Three-component analyzer (NO + SO_2 + CO)

See Table 2 for NO + SO_2 measurement of three-component analyzer (NO + SO_2 + CO). See Table 1 for CO measurement.

Table 6. Four-component analyzer (NO + SO_2 + CO_2 + CO)

See Table 2 for NO + SO_2 measurement and Table 4 for CO_2 + CO measurement.

Table 7. O_2 analyzer

1st range \ 2nd range		2	3
		0−10%	0−25%
1	0−5%	○△	○△
2	0−10%	—	○△
3	0−25%	—	○△

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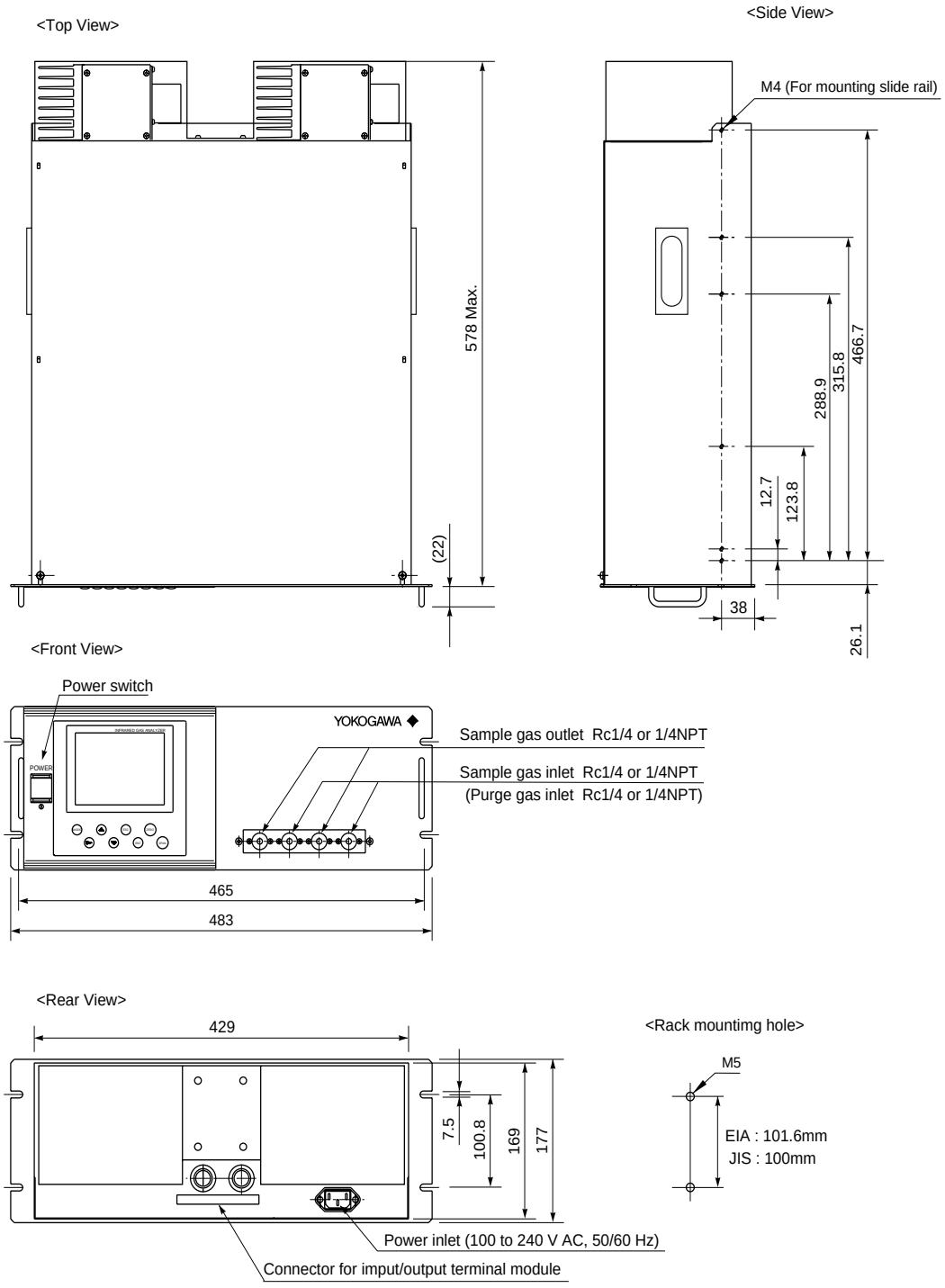
○ : Built-in O_2 analyzer measurable range
△ : External zirconia type O_2 analyzer (in this case, Yokogawa's ZX8D Style C) measurable range

*O_2 analyzer is selectable independently of combination with other components.

EXTERNAL DIMENSIONS

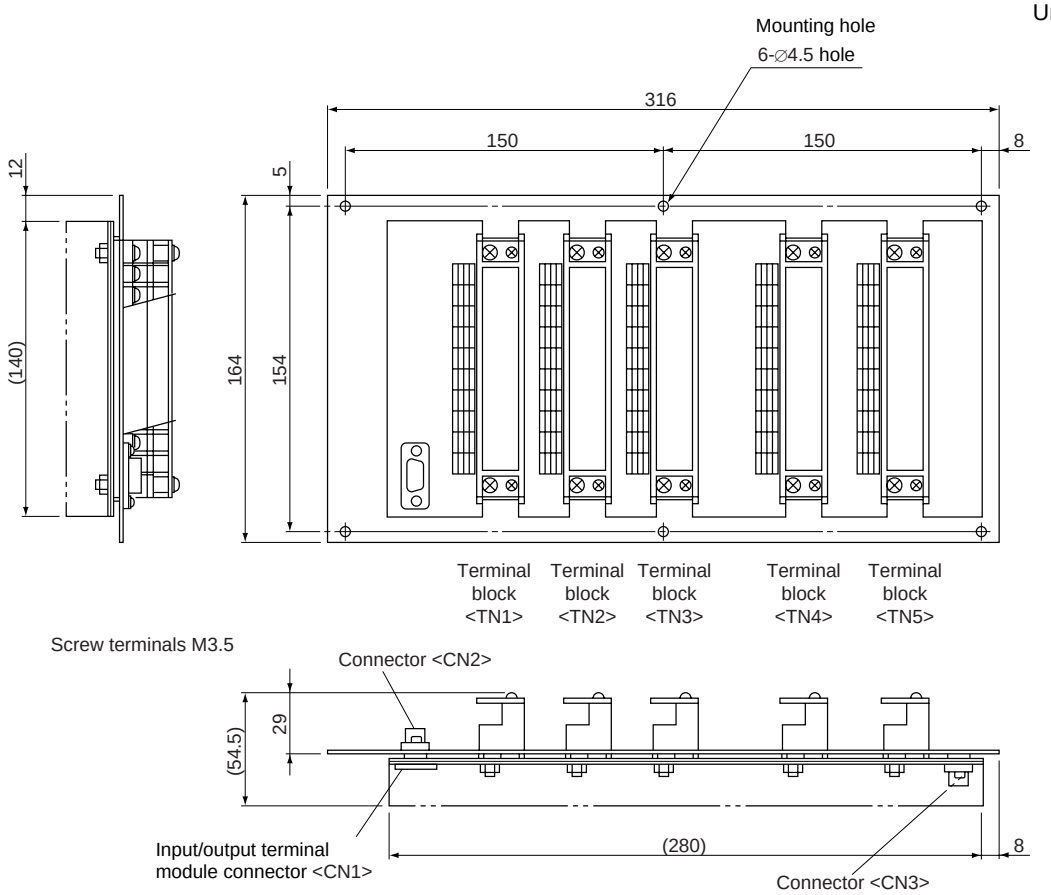
Analyzer Main Unit

Unit:mm

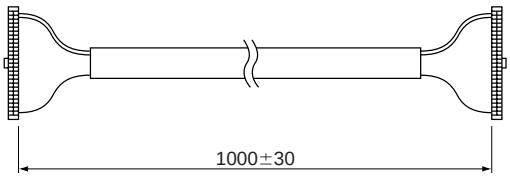


Input/Output Terminal Module: K9218SC (Accessory)

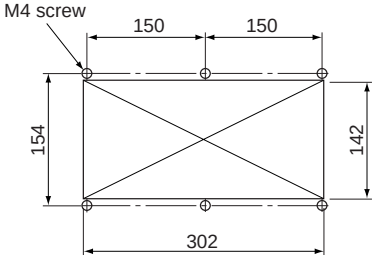
Unit: mm



Cable for Connecting Input / Output Terminal: K9218SD (Accessory)



Dimensions for Mounting Input/Output Terminal Module



Cut M4 screw holes at 6 positions.
Drill a rectangular hole of 302 × 142 mm or more in the center.

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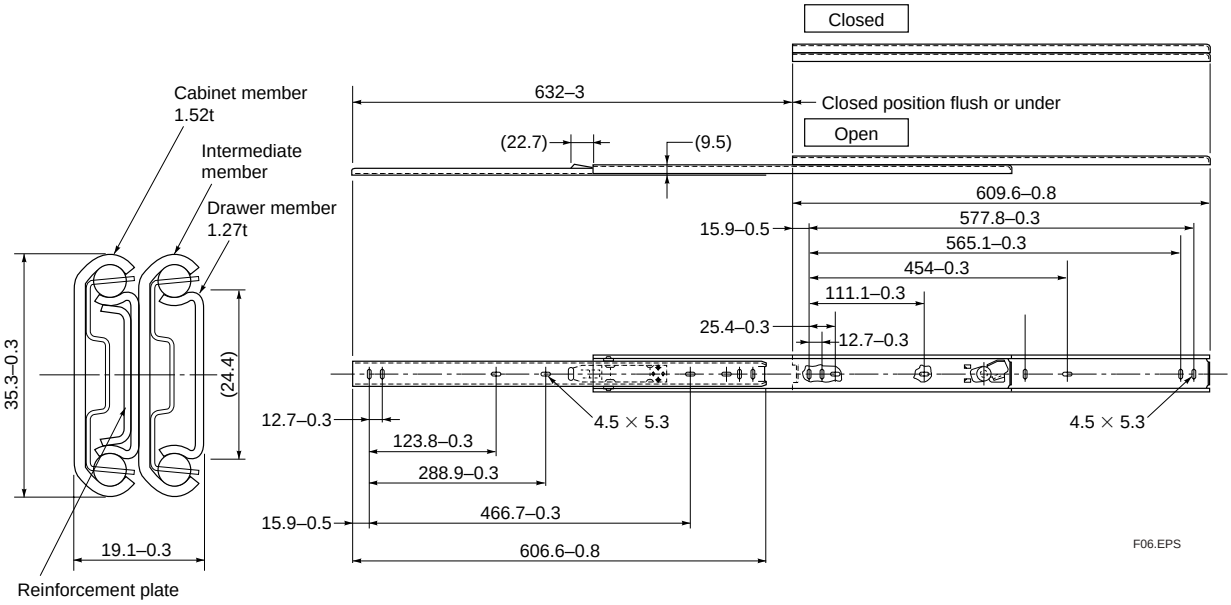
EXTERNAL DIMENSIONS OF ACCESSORY SLIDE RAIL

Unit: mm

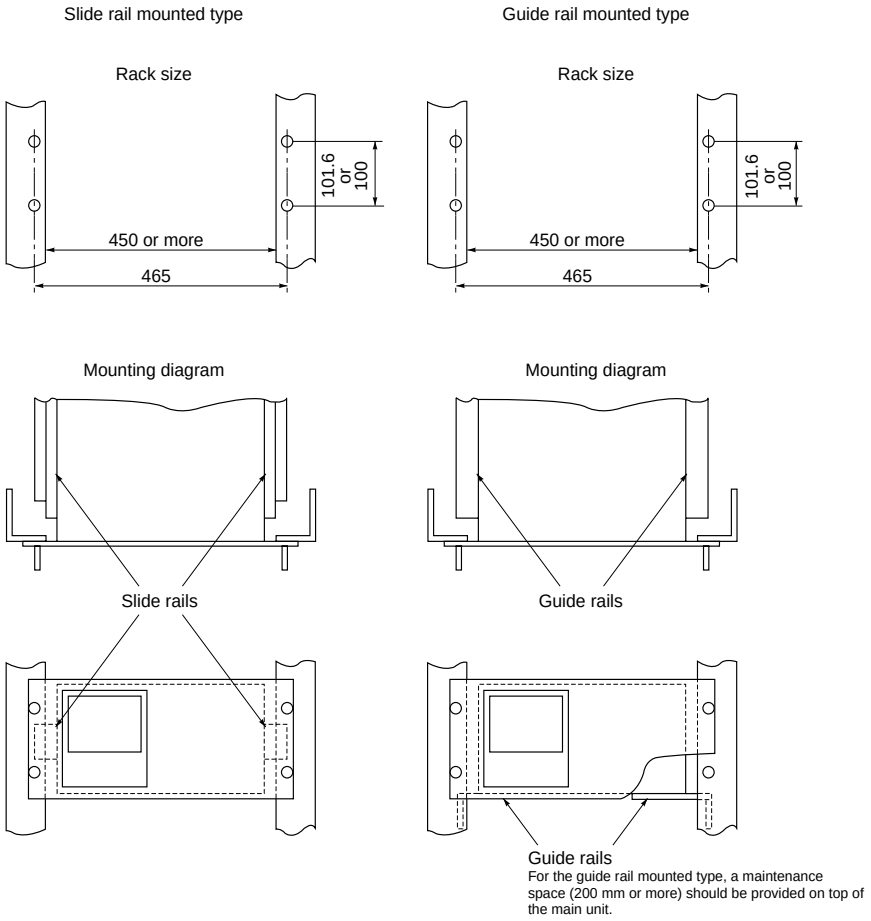
Model: 305A-24/Accuride International Inc.



19-inch rack mounting method:

The instrument weight should be supported at the bottom of the unit (or the side of the unit when mounted with the slide rails).

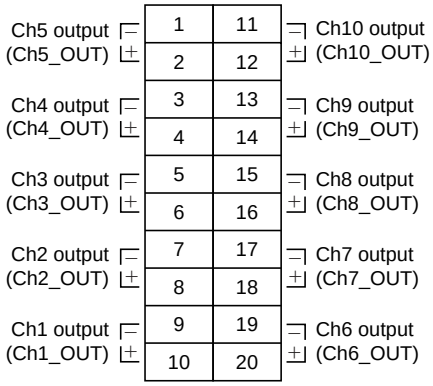
For easy maintenance, it is recommended to select the method to allow withdrawing along the slide rail.



For the guide rail mounted type, a maintenance space (200 mm or more) should be provided on top of the main unit.

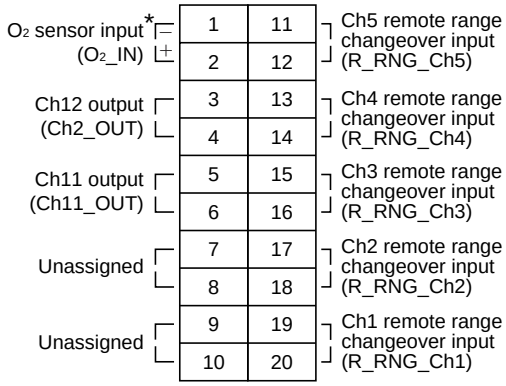
EXTERNAL CONNECTION DIAGRAM

Terminal block 1
<TN1>



(M3.5 screw)

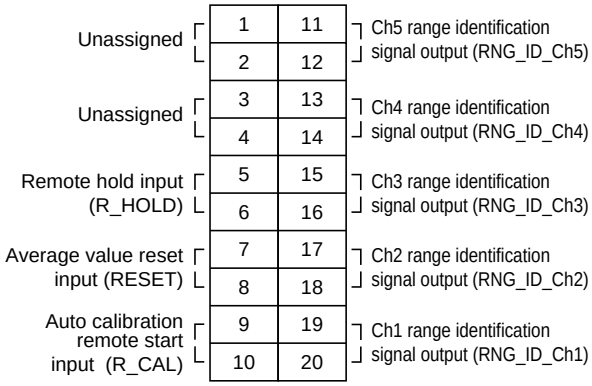
Terminal block 2
<TN2>



(M3.5 screw)

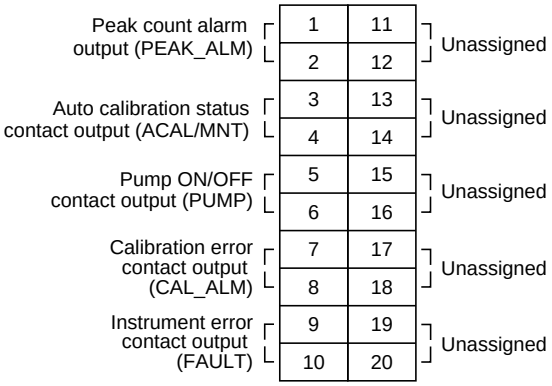
*For external O_2 sensor input.

Terminal block 3
<TN3>



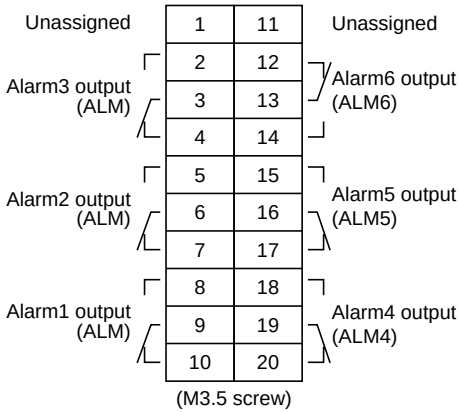
(M3.5 screw)

Terminal block 4
<TN4>



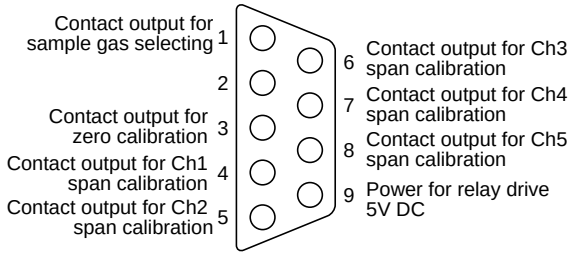
(M3.5 screw)

Terminal block 5
<TN5>



(M3.5 screw)

Connector
<CN3>
Solenoid valve drive signal output for calibration



<D-sub 9P>

Note 1: Unassigned terminals are used for internal connection.
So they should not be used as repeating terminals either.

Note 2: The allocation of each channel (Ch1 to Ch12) depends on measured gas components. Refer to the table on the next page.

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Table 8. Measurable Components and Their Corresponding Channel Numbers

Suffix/Option Code			Output and Corresponding Channel											
Measurable component	O_2 analyzer	O_2 correction	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
-A	N	Not specified	NO											
-B	N	Not specified	SO_2											
-C	N	Not specified	CO_2											
-D	N	Not specified	CO											
-F	N	Not specified	CH_4											
-G	N	Not specified	NO	SO_2										
-H	N	Not specified	NO	CO										
-J	N	Not specified	CO_2	CO										
-K	N	Not specified	NO	SO_2	CO									
-L	N	Not specified	NO	SO_2	CO_2	CO								
-A	1, 2, 3	/K	NOx	O_2	Correct NOx	Correct NOx av.	O_2 av.							
-B	1, 2, 3	/K	SO_2	O_2	Correct SO_2	Correct SO_2 av.	O_2 av.							
-D	1, 2, 3	/K	CO	O_2	Correct CO	Correct CO av.	O_2 av.							
-F	1, 2, 3	/K	CH_4	O_2	O_2 av.									
-G	1, 2, 3	/K	NOx	SO_2	O_2	Correct NOx av.	Correct SO_2	Correct NOx av.	Correct SO_2 av.	O_2 av.				
-H	1, 2, 3	/K	NOx	CO	O_2	Correct NOx	Correct CO	Correct NOx av.	Correct CO av.	O_2 av.				
-J	1, 2, 3	/K	CO_2	CO	O_2	Correct CO	Correct CO av.	O_2 av.						
-K	1, 2, 3	/K	NOx	SO_2	CO	O_2	Correct NOx	Correct SO_2	Correct CO	Correct NOx av.	Correct SO_2 av.	Correct CO av.	O_2 av.	
-L	1, 2, 3	/K	NOx	SO_2	CO_2	CO	O_2	Correct NOx	Correct SO_2	Correct CO	Correct NOx av.	Correct SO_2 av.	Correct CO av.	O_2 av.
-D	1, 2, 3	except /K	CO	O_2										
-H	1, 2, 3	except /K	NO	CO	O_2									
-J	1, 2, 3	except /K	CO_2	CO	O_2									
-K	1, 2, 3	except /K	NO	SO_2	CO	O_2								
-L	1, 2, 3	except /K	NO	SO_2	CO_2	CO	O_2							

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: No measurement in this area is displayed as NOx.
Notes: Peak count alarm is a contact out put.
"Correct XX" means an instantaneous XX value after O_2 correction, "Correct XX av." an average XX value after O_2 correction, and O_2 av." an average O_2 value.

STANDARD ACCESSORIES

Name	Part Number	Description	Qty
Power cable	K9218SA	standard inlet type (2.5 m)	1
Fuse	K9218SB	replacement fuse (250 V AC, 3 A, delay type) ×1	2
Input/output terminal module	K9218SC	External terminal module	1
Cable	K9218SD	Connection cable between main unit and input/output terminal module (1 m)	1
Slide rail	K9218SE	Slide rail	2

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Note: Quantity in this is number of accessories supplied as standard. For instance, two K9218SE parts, i.e., two slide rails, are supplied as standard. When ordering separately, the required number of should be considered.

Dedicated Zirconia O_2 Sensor (to be purchased separately)

For O_2 correction, the IR400 can accept linealized 0 to 1 V DC signal coming from an analyzer calibrated to 0 to 25% O_2 of full scale. Dedicated zirconia O_2 sensor , Model ZX8D, is available from Yokogawa.

Measuring method:Zirconia system
Measurable component and measuring range:

Measurable component	Minimum range	Maximum range
Oxygen (O_2)	0−5 vol%	0−25 vol%

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Repeatability: Within ± 0.5% of full scale
Linearity: Within ± 1% of full scale
Zero drift: Within ± 1% of full scale/week
Span drift: Within ± 2% of full scale/week
Response time: Approx. 20 seconds (for 90% response)
Measured gas flow rate: 0.5 ± 0.25 L / min
Remark: The Zirconia system, due to its principle, may produce a measuring error due to relative concentration versus the combustible O_2 gas concentration. Also, a corrosive gas (SO_2 of 250 ppm or more, etc.) may affect the life of the sensor.
Gas inlet/outlet size: Rc1/4
Power supply: 90 to 126 V AC or 200 to 240 V AC, 50/60 Hz
Enclosure: Steel casing, for indoor application
Indication: Temperature indication (LED)
Temperature alarm output:
Contact output 1a contact,
Contact capacity 220 V AC, 1 A (resistive load)
Safety and EMC conforming standards:
Safety; EN61010-1
Pollution degree; 2
Installation category; II
EMC; EN61326
EN61000-3-2
EN61000-3-3
Dimensions (H × W × D):
140 × 170 × 190 mm
Weight: Approx. 3 kg
Finish color: Munsell 5Y 7/1

Model	Suffix code	Option code	Description
ZX8D	--------	--------	Dedicated zirconia O_2 sensor
Power supply	−5	--------	90−126 V AC, 50/60 Hz
	−3	--------	200−240 V AC, 50/60 Hz
Style code	*C	--------	Style C (Non-CE conformity)
	*D	--------	Style D (CE conformity)

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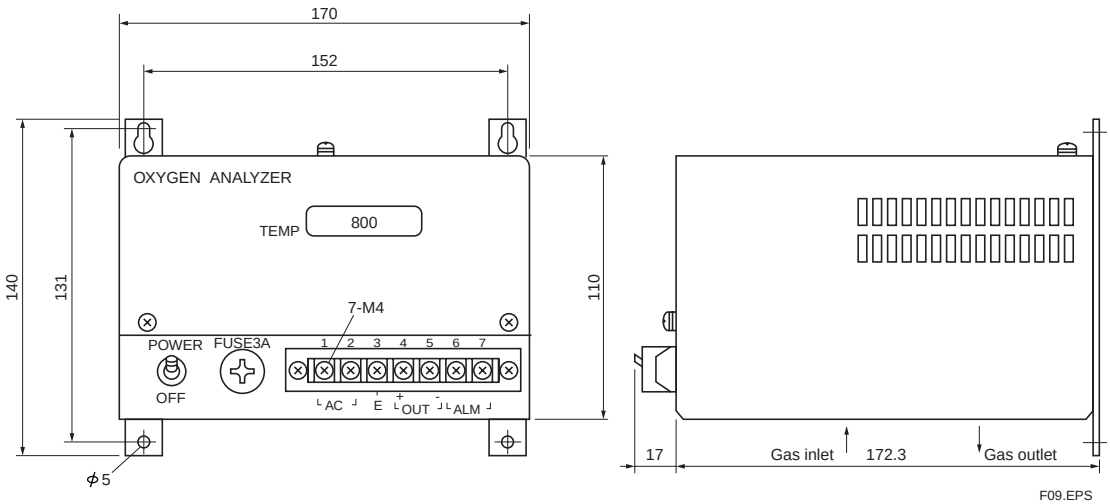
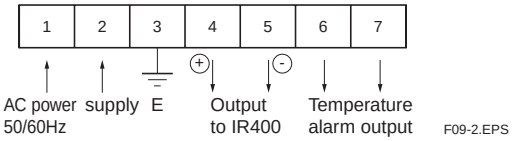
External Dimensions of ZX8D

Unit: mm



F09.EPS

External Connection Diagram



F09-2.EPS

Dedicated relay board (Option code: /R)

This relay board receives signals from connector CN3 of the IR400 I/O terminal module and activates the calibration solenoid valve directly.

- Relay contact : 1 normally closed contact
  Contact capacity; 250 V AC/2 A
  (resistive load)

Part Numbers

Item	Part No.	Description	Qty
Relay board	K9218SF	For external contact point	1
Cable	K9218SG	For relay board	1

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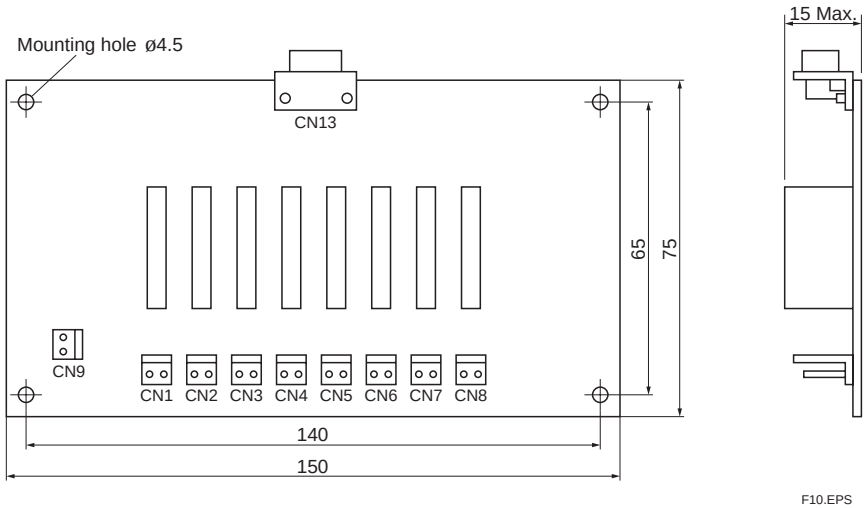
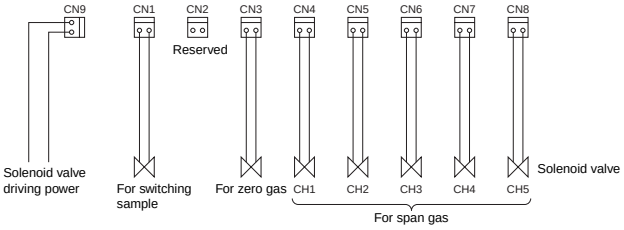
External Dimensions

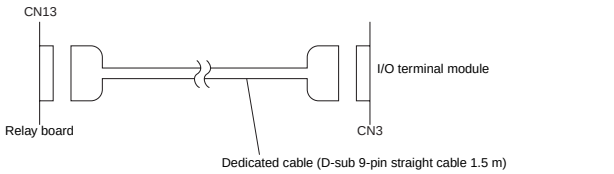
Unit: mm



F10.EPS

Connections





Contact action

- During measurement: CN1; ON
  Others; OFF
- During calibration: CN1; OFF
  Others; Contact corresponding to calibration timing is ON

Recommended Connector

- CN1 to CN9: Housing; VHR-2N
  (Japan Solderless Terminals (JST))
  Contact; SVH-21T-1.1
  (Japan Solderless Terminals (JST))

NO_2/NO Converter

Part number: K9350LE (Non-CE conformity)
K9350LF (Non-CE conformity)
Mounting: Indoor surface mounting
Target Gases: General boiler exhaust gas, atmosphere
Catalyst: Amount; 2 cm^3
Replacement cycle; Approx. 12 months (at flow rate of 0.3 L/min with 5% O_2, 10 ppm NO)
Temperature setpoint; 210 ±10°C (Sensing tip: K thermocouple)
Wetted materials: Ceramic, Viton, glass filter, SUS316
Conversion efficiency: 90% or higher, conforms to JIS
Gas Flow Rate: 0.5 L/min
Ambient Temperature: -5 to +45°C
Power Supply: 100 VAC, 50/60 Hz (K9350LE)
100 to 240 VAC, 50/60 Hz (K9350LF)
Safety conforming standards:
Safety; EN61010-1
Pollution degree; 2
Installation category; II
Weight: Approx. 1.1 kg (K9350LE)
Approx. 1.2 kg (K9350LF)
Sample gas requirements:
Dust/drain removed, gas temperature at 150°C or less

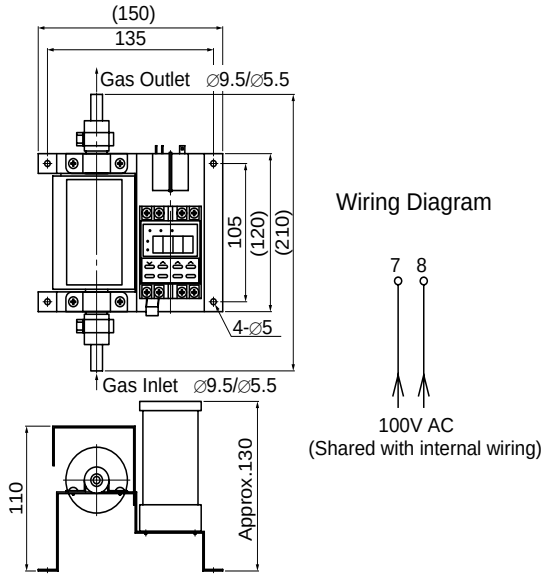
One-year-Use Spare Parts

Item	Part No.	Qty
Catalyst for NO_2/NO converter	K9350LP	2
Glass wool for NO_2/NO converter	K9350LQ	2
Fitting for NO_2/NO converter	K9350LV	2

T15.eps

External Dimensions

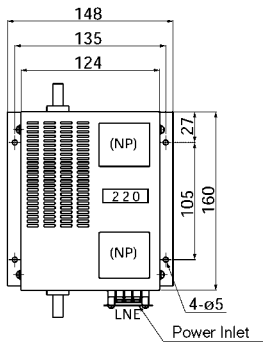
Unit: mm



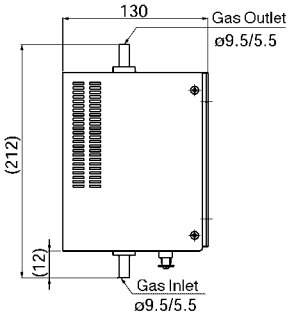
Wiring Diagram

100V AC
(Shared with internal wiring)

K9350LE



Front View



Side View

K9350LF

Inquiry Sheet for IR400 NDIR Type Infrared Gas Analyzer

Place a checkmark ✔ in the appropriate box and fill in the specific information in the blanks for your reference.

1. General Information

Company: _____ Delivery destination: _____

Responsible person: _____ Section: _____ (Phone No.)

Plant name: _____ Measurement location: _____

Purpose: ☐ Indication reading, ☐ Recording, ☐ Alarm, ☐ Control

2. Requirements

Measurable component:

	1st	2nd	3rd	4th
☐	NO			
☐	SO_2			
☐	CO_2			
☐	CO			
☐	CH_4			
☐	NO	SO_2		
☐	NO	CO		
☐	CO_2	CO		
☐	NO	SO_2	CO	
☐	NO	SO_2	CO_2	CO

O_2 Analyzer:

☐ Without O_2 analyzer
☐ External zirconia type sensor (purchase separately: ZX8D Style C)
☐ External O_2 analyzer
☐ Built-in paramagnetic type O_2 sensor

NO_2/NO Converter

☐ With NO_2/NO converter
☐ Without NO_2/NO converter

Range:

1st component, 1st range	1st component, 2nd range	2nd component, 1st range	2nd component, 2nd range
☐ 0 – 20 ppm	☐ 0 – 50 ppm	☐ 0 – 50 ppm	☐ 0 – 100 ppm
☐ 0 – 50 ppm	☐ 0 – 100 ppm	☐ 0 – 100ppm	☐ 0 – 200 ppm
☐ 0 – 100 ppm	☐ 0 – 200 ppm	☐ 0 – 200 ppm	☐ 0 – 250 ppm
☐ 0 – 200 ppm	☐ 0 – 250 ppm	☐ 0 – 250 ppm	☐ 0 – 500 ppm
☐ 0 – 250 ppm	☐ 0 – 500 ppm	☐ 0 – 500 ppm	☐ 0 – 1000 ppm
☐ 0 – 500 ppm	☐ 0 – 1000 ppm	☐ 0 – 1000 ppm	☐ 0 – 2000 ppm
☐ 0 – 1000 ppm	☐ 0 – 2000 ppm	☐ 0 – 2000 ppm	☐ 0 – 5000 ppm
☐ 0 – 2000 ppm	☐ 0 – 5000 ppm	☐ 0 – 5000 ppm	☐ 0 – 1%
☐ 0 – 5000 ppm	☐ 0 – 1%	☐ 0 – 1%	☐ 0 – 2%
☐ 0 – 1%	☐ 0 – 2%	☐ 0 – 2%	☐ 0 – 3%
☐ 0 – 2%	☐ 0 – 3%	☐ 0 – 3%	☐ 0 – 5%
☐ 0 – 3%	☐ 0 – 5%	☐ 0 – 5%	☐ 0 – 10%
☐ 0 – 5%	☐ 0 – 10%	☐ 0 – 10%	☐ 0 – 20%
☐ 0 – 10%	☐ 0 – 20%	☐ 0 – 20%	☐ 0 – 40%
☐ 0 – 20%	☐ 0 – 40%	☐ 0 – 40%	☐ 0 – 50%
☐ 0 – 40%	☐ 0 – 50%	☐ 0 – 50%	☐ 0 – 70%
☐ 0 – 50%	☐ 0 – 70%	☐ 0 – 70%	☐ 0 – 100%
☐ 0 – 70%	☐ 0 – 100%	☐ 0 – 100%	☐ Not available
☐ 0 – 100%	☐ Not available	☐ Not available	

3rd component, 1st range	3rd component, 2nd range	4th component, 1st range	4th component, 2nd range
☐ 0 – 50 ppm	☐ 0 – 100 ppm	☐ 0 – 50 ppm	☐ 0 – 100 ppm
☐ 0 – 100 ppm	☐ 0 – 200 ppm	☐ 0 – 100 ppm	☐ 0 – 200 ppm
☐ 0 – 200 ppm	☐ 0 – 250 ppm	☐ 0 – 200 ppm	☐ 0 – 250 ppm
☐ 0 – 250 ppm	☐ 0 – 500 ppm	☐ 0 – 250 ppm	☐ 0 – 500 ppm
☐ 0 – 500 ppm	☐ 0 – 1000 ppm	☐ 0 – 500 ppm	☐ 0 – 1000 ppm
☐ 0 – 1000 ppm	☐ 0 – 2000 ppm	☐ 0 – 1000 ppm	☐ 0 – 2000 ppm
☐ 0 – 2000 ppm	☐ 0 – 5000 ppm	☐ 0 – 2000 ppm	☐ 0 – 5000 ppm
☐ 0 – 5000 ppm	☐ 0 – 1%	☐ 0 – 5000 ppm	☐ 0 – 1%
☐ 0 – 1%	☐ 0 – 2%	☐ 0 – 1%	☐ 0 – 2%
☐ 0 – 2%	☐ 0 – 3%	☐ 0 – 2%	☐ 0 – 3%
☐ 0 – 3%	☐ 0 – 5%	☐ 0 – 3%	☐ 0 – 5%
☐ 0 – 5%	☐ 0 – 10%	☐ 0 – 5%	☐ 0 – 10%
☐ 0 – 10%	☐ 0 – 20%	☐ 0 – 10%	☐ 0 – 20%
☐ 0 – 20%	☐ 0 – 40%	☐ 0 – 20%	☐ 0 – 40%
☐ 0 – 40%	☐ 0 – 50%	☐ 0 – 40%	☐ 0 – 50%
☐ 0 – 50%	☐ 0 – 70%	☐ 0 – 50%	☐ 0 – 70%
☐ 0 – 70%	☐ 0 – 100%	☐ 0 – 70%	☐ 0 – 100%
☐ 0 – 100%	☐ Not available	☐ 0 – 100%	☐ Not available
☐ Not available		☐ Not available	

O_2 Analyzer, 1st range	O_2 Analyzer, 2nd range
☐ 0 – 5%	☐ 0 – 10%
☐ 0 – 10%	☐ 0 – 25%
☐ 0 – 25%	☐ Not available
☐ Not available	

Output:	☐ 4 – 20 mA DC	☐ 0 – 1 V DC	☐ RS-232C
O_2 correction and O_2 average:	☐ Yes	☐ No	
Peak count alarm:	☐ Yes	☐ No	
Relay board:	☐ Yes	☐ No	

3. Sample gas conditions

Fuel: ☐ Gas, ☐ Oil, ☐ Coal, ☐ Refuse, ☐ Other fuel_____

(1) Temperature: _____ to _____, Normal temperature _____ [°C]

(2) Pressure: _____ to _____, Normal pressure _____ [MPa]

(3) Humidity: _____ [vol%]

(4) Dust: _____ [mg/Nm^3]

(5) Corrosive gas: ☐ Yes _____ ☐ No

Composition (Detailed composition of sample gas should be provided. This is important for the purpose of knowing the effect of interference gases)

Contents	Concentration range		
CO	to	☐ %	☐ ppm
CO_2	to	☐ %	☐ ppm
CH_4	to	☐ %	☐ ppm
H_2	to	☐ %	☐ ppm
O_2	to	☐ %	☐ ppm
N_2	to	☐ %	☐ ppm
SO_2	to	☐ %	☐ ppm
NOx	to	☐ %	☐ ppm
H_2O	to	☐ %	☐ ppm
	to	☐ %	☐ ppm