

THERMAL CONDUCTIVITY GAS ANALYZER

(Type: ZAF-4)

Optimum for concentration measurement for H₂, Ar and He.



Flame-proof type
(NESPI Exd IIC T6Gb)



Standard type

- Operation facilitated with easy-to-read, large LCD panel.
- Free voltage on 100 to 240V AC, 50/60Hz.
- Flame-proof type available for explosive atmospheres.
- RS232C (MODBUS) communication. (option)
- Automatically calibrates zero/span. (option)
- Computes and corrects influence by other gases. (option)
- Gas concentration alarm output. (option)
- Two measuring range. (option)

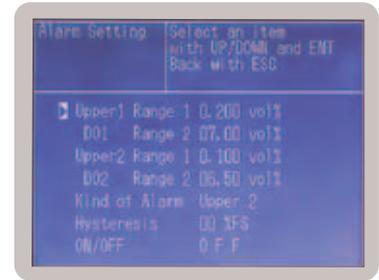
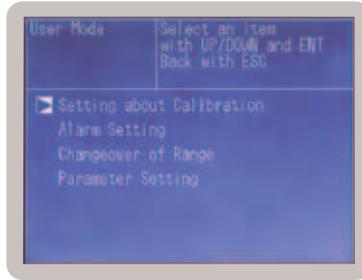
Renewed with fresh design

ZAF-4

Feature 1 Easy-to-read, large LCD.



● Operation is facilitated with the aid of guidance in English.



Feature 2 PC communication available.



Personal Computer

RS232C (MODBUS) for measurement value, setting range read/write, device status output.



Feature 3 Compact size mountable on panel.

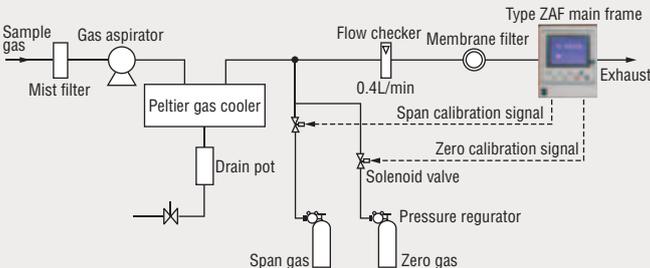
Mountable in same panel cutout as heretofore.



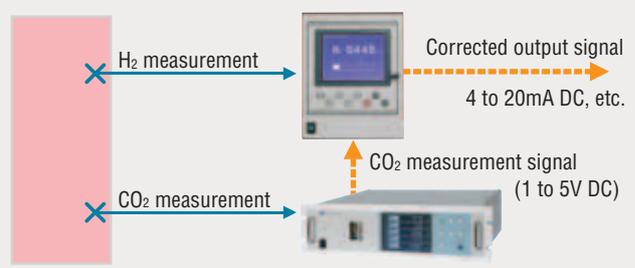
(Unit mm)

Mass 5kg.

Feature 4 Automatically calibrates zero/span. (option)



Feature 5 Computes and corrects influence by other gases. (option)



Feature 6 Gas concentration alarm output. (option)



Alarm output (1a relay contact) selectable for:

- High limit
- Low limit
- High-high limit
- Low-low limit

Feature 7 Two range. (option)

- A range selected by key on front panel or by external contact closure command.
- Range ratio Up to 1:10 for H₂ or He measurement, Up to 1:5 for Ar, CH₄ or CO₂ measurement.

Feature 8 Linear measurement output signal.

- Dispenses with external linearizer.

● Main applications

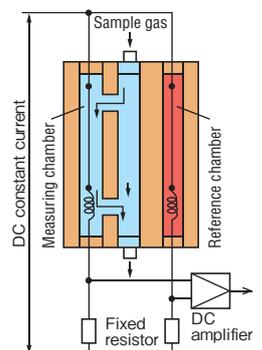
- H₂ concentration measurement for semiconductor equipment.
- H₂ concentration measurement for hydrogen generator.
- H₂ concentration measurement for kiln.
- Ar, He or CH₄ concentration measurement for gas generation plant.
- He concentration measurement for super-conducting equipment.
- Ar concentration measurement for air separation plant.

● Thermal Conductivity Ratio of Gases

Gases	Comparative thermal conductivity (0°C) when replacing thermal conductivity of air (2.41 x 10 ⁻² w/(m.k) with 1
Sulfur dioxide gas	SO ₂
Carbon dioxide gas	CO ₂
Argon	Ar
Carbon monoxide	CO
Steam (100°C)	H ₂ O
Air	
Nitrogen	N ₂
Oxygen	O ₂
Methane	CH ₄
Hydrogen	H ₂

● Measuring Principle

This thermal conductivity gas analyzer measures gas concentration by utilizing the different thermal conductivities of 2 gas components. In the detector, there are reference and measuring chambers in each of which a thin platinum wire is stretched. The reference chamber is filled with reference gas and through the measuring chamber, sample gas is flowed. Each platinum wire composes a bridge circuit in combination with an external fixed resistor, and it is heated by flowing a constant current. When there is a change in the concentration of the component under measurement, the thermal conductivity of sample gas will change to affect the temperature of the platinum wire in the measuring chamber. The resulting thermal change is taken out as a change in electric resistance, according to which the concentration of measured gas is calculated.



Specifications (Standard type)



Standard Specifications

Measuring principle	Measurement of thermal conductivity
Measurable component	He, Ar, H ₂ , CH ₄ , CO ₂
Measurable range	As specified for particular type.
Output signal	4 to 20mA DC, 0 to 1V DC, 0 to 10mV DC Non-isolated output (Any one-output signal specifiable in CODE SYMBOLS)
Allowable load resistance	550Ω max. (in 4 to 20mA DC output)
Output resistance	100kΩ (in 0 to 1V DC or 0 to 10mV DC output)
Display unit	LCD with backlight
Display of measured value	Max. 4 digits
Display language	English
Output signal holding	In both manual and automatic calibrations, output value just before calibration can be held.
Power supply	100 to 240V AC, 50/60Hz, Approx. 50VA
Warm-up time	At least 30min
Ambient temperature	-5 to 45°C
Ambient humidity	Less than 90% RH (condensation unallowable)
Storage conditions	-20~60°C, less than 95% RH (condensation unallowable)
Mounting	Flush mounting on panel
External dimensions (H×W×D)	240×192×213mm
Mass	Approx. 5kg
Finish color	Off-white (equivalent to 10Y7.5/0.5)
Housing	Steel-plate case, indoor type
Material of gas-contacting parts	JIS SUS304, platinum, platinum iridium, silver, fluororubber, epoxy resin, nickel, tin
Gas inlet/outlet, purge port	Rc1/4 or NPT1/4 (whichever specified)
Purge gas flow rate	Approx. 1L/min (as required)
Applied standard	CE mark (Option)

Performance

Repeatability	±1% of F.S.
Drift	Zero point : Within ±2% of full scale/week (H ₂ meter, reference gas N ₂) Span : Within ±2% of full scale/week (H ₂ meter, reference gas N ₂)
Response speed (90% response)	Standard within 60sec (at flow rate 0.4L/min) High speed within 10sec (at flow rate 1L/min), allowed only for H ₂ meter (reference gas N ₂)

Standard Gas Measurement Conditions

Temperature	0 to 50°C
Gas flow rate	Constant at 0.4±0.05 L/min
Dust	Less than 100μg/Nm ³ with a particle size of 0.3μm max.
Pressure	10kPa max.
Mist, Corrosive gas	Unallowable
Moisture	Below saturation at 2°C
Standard gases for calibration	Zero gas: same as reference gas Span gas: Concentration within 90 to 100% of measuring range Concentration beyond 100% is inapplicable.

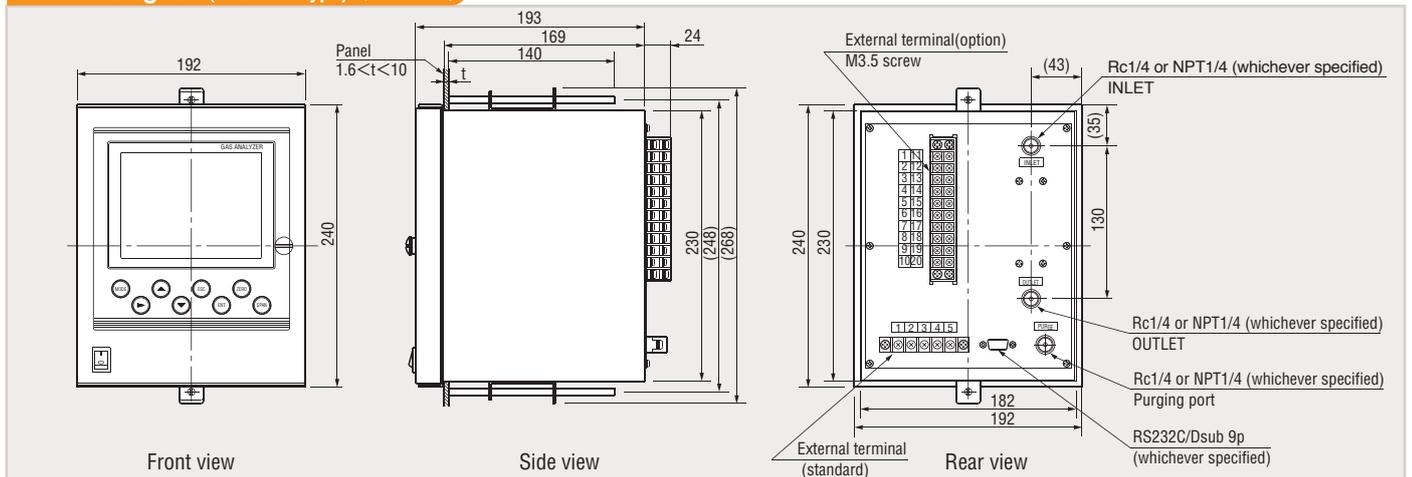
Optional Specifications

Relay contact output	5 SPST relay contact outputs Relay contact capacity: 220V AC/2A (resistive load) Isolated with relay between contacts, and between contacts and internal circuit. Max. 5 functions are selectable among those listed below. ① Zero-side solenoid valve drive output for automatic calibration ② Span-side solenoid valve drive output for automatic calibration ③ Suction pump OFF output in automatic calibration ④ Upper limit (1point) concentration alarm output ⑤ Lower limit (1point) concentration alarm output ⑥ Upper/lower limit (1point) concentration alarm output ⑦ Upper limit (1point) and lower limit (1point) concentration alarm output (Total 2 points) ⑧ 2-step upper limit (1point at each step) concentration alarm output (Total 2 points) ⑨ 2-step lower limit (1point at each step) concentration alarm output (Total 2 points) ⑩ Analyzer error or automatic calibration error alarm output ⑪ Calibrating status output ⑫ Range identification output (for 2 range type only)
Contact input	3 non-voltage contact inputs ON: 0 V, OFF: 5V DC, current at ON: 5mA Isolated with photo coupler between inputs and internal circuit. Not isolated between contact inputs. The following actions can be input. ① Remote holding of measured value output ② Remote range changeover (only with 2-range meter) ③ Remote start of automatic calibration
Interference gas measured value input	Analog input for H ₂ meter interference correction (1 to 5V DC) Either CO ₂ or CH ₄ component of an external gas analyzer is to be input. Adjustment is required at Fuji Electric's factory. Details of measurement gas will be checked when receiving an order.
Automatic calibration function	Zero and span calibrations are automatically carried out at the predetermined intervals. Calibration gases are flowed sequentially by driving the externally installed solenoid valves.
Communicating function	RS-232C (9-pin D-sub output) Half duplex, asynchronous MODBUS™ protocol, communication speed 9600 bps Contents of communication: Reading/writing of measured concentration values and various set values, and output of device status

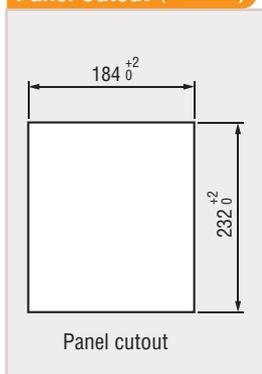
Installation Conditions

- The analyzer should not be exposed to direct sunlight or radiation from a hot object.
- A place subjected to heavy vibrations should be avoided. A location with clean atmosphere should be selected.
- Before measuring combustible gases, the existing gases should be purged from the analyzer using air or N₂.
- When the analyzer is installed outdoors, it should be sheltered with a housing or cover to protect it from rain and wind.

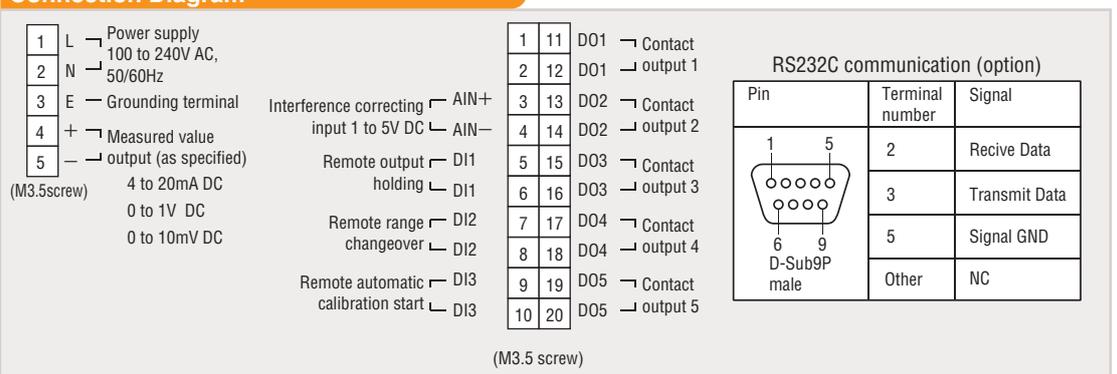
Outline Diagram (Standard type) (Unit: mm)



Panel Cutout (Unit: mm)



Connection Diagram



● Specifications (Flame-proof type)



Standard Specifications

Measuring principle	Measurement of thermal conductivity
Measurable component	He, Ar, H ₂ , CH ₄ , CO ₂
Measurable range	As specified for particular type.
Output signal	4 to 20mA DC, 0 to 1V DC, 0 to 10mV DC Non-isolated output(Any one-output signal specifiable in CODE SYMBOLS)
Allowable load resistance	550Ωmax. (in 4 to 20mA DC output)
Output resistance	100kΩ(in 0 to 1V DC or 0 to 10mV DC output)
Display unit	LCD with backlight
Display of measured value	Max. 4 digits
Display language	English, Japanese, Chinese
Output signal holding	In both manual and automatic calibrations, output value just before calibration can be held.
Power supply	100 to 240V AC, 50/60Hz, Approx. 50VA
Warm-up time	At least 30min
Ambient temperature	-5 to 45°C
Ambient humidity	Less than 90% RH (condensation unallowable)
Storage conditions	-20~60°C, less than 95% RH (condensation unallowable)
Mounting	Mounted flush on panel
External dimensions(H×W×D)	470×354×211mm
Mass	Approx. 22kg
Finish color	Off-white (equivalent to 10Y7.5/0.5)
Housing	Steel-plate case, indoor type
Material of gas-contacting parts	JIS SUS304, platinum, platinum iridium, silver, fluororubber, epoxy resin, nickel, tin
Gas inlet/outlet, purge port	Rc1/2 or NPT1/2 or G1/2
Ex. standard	NEPSI (Exd IIC T6Gb)

Performance

Repeatability	±1% of F.S.
Drift	Zero point : Within ±2% of full scale/week (H ₂ meter, reference gas N ₂) Span : Within ±2% of full scale/week (H ₂ meter, reference gas N ₂)
Response speed (90% response)	Standard within 60sec (at flow rate 0.4L/min) High speed within 10sec (at flow rate 1L/min), allowed only for H ₂ meter (reference gas N ₂)

Standard Gas Measurement Conditions

Temperature	0 to 50°C
Gas flow rate	Constant at 0.4±0.05 L/min
Dust	Less than 100μg/Nm ³ with a particle size of 0.3μm max.
Pressure	10kPa max.
Mist, Corrosive gas	Unallowable
Moisture	Below saturation at 2°C
Standard gases for calibration	Zero gas: same as reference gas Span gas: Concentration within 90 to 100% of measuring range Concentration beyond 100% is inapplicable.

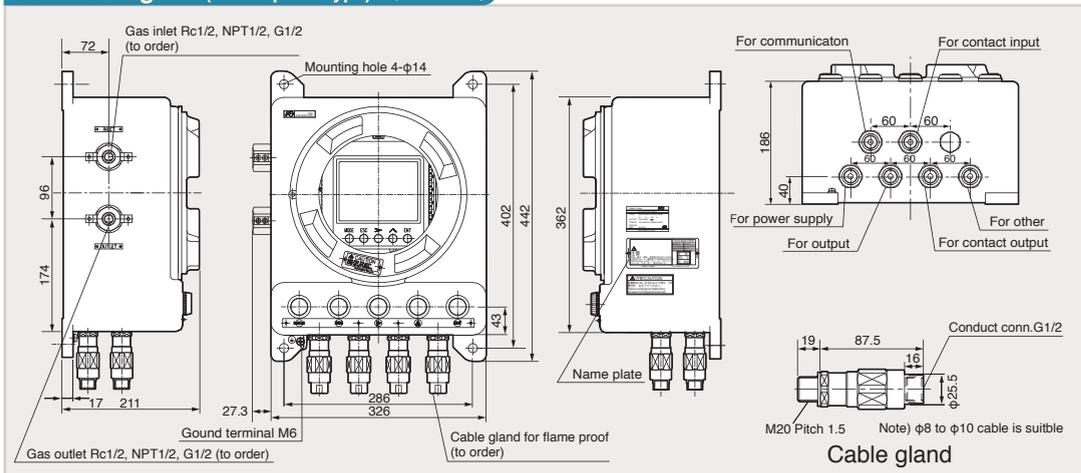
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Contact input	3 non-voltage contact inputs ON: 0 V, OFF: 5V DC, current at ON; 5mA Isolated with photo coupler between inputs and internal circuit. Not isolated between contact inputs. The following actions can be input. ①Remote holding of measured value output ②Remote range changeover (only with 2-range meter) ③Remote start of automatic calibration
Interference gas measured value input	Analog input for H ₂ meter interference correction (1 to 5V DC) Either CO ₂ or CH ₄ component of an external gas analyzer is to be input. Adjustment is required at Fuji Electric's factory. Details of measurement gas will be checked when receiving an order.
Automatic calibration function	Zero and span calibrations are automatically carried out at the predetermined intervals. Calibration gases are flowed sequentially by driving the externally installed solenoid valves.
Communicating function	RS-232C (9-pin D-sub output) Half duplex, asynchronous MODBUS™ protocol, communication speed 9600 bps Contents of communication: Reading/writing of measured concentration values and various set values, and output of device status

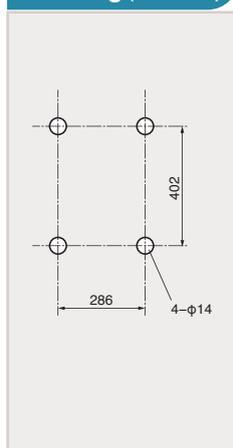
Installation Conditions

- The analyzer should not be exposed to direct sunlight or radiation from a hot object.
- A place subjected to heavy vibrations should be avoided. A location with clean atmosphere should be selected.
- When the analyzer is installed outdoors, it should be sheltered with a housing or cover to protect it from rain and wind.

Outline Diagram (Flame-proof type) (Unit: mm)



Dimensions of mounting (Unit: mm)



Connection Diagram

(Standard)	(Option) 13th digit A and 14th digit A, C, E																	
			<p>RS232C communication (option)</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Terminal number</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> <td>Recive Data</td> </tr> <tr> <td>5</td> <td>3</td> <td>Transmit Data</td> </tr> <tr> <td>6</td> <td>5</td> <td>Signal GND</td> </tr> <tr> <td>9</td> <td>Other</td> <td>NC</td> </tr> </tbody> </table>	Pin	Terminal number	Signal	1	2	Recive Data	5	3	Transmit Data	6	5	Signal GND	9	Other	NC
Pin	Terminal number	Signal																
1	2	Recive Data																
5	3	Transmit Data																
6	5	Signal GND																
9	Other	NC																
(M3.5 screw)	(M3.5 screw)																	

Code Symbols (Standard type)

Digit	Description	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4	<Construction> Standard type CE mark					3										
5	<Measured component> H ₂ Ar He CH ₄ CO ₂ (reference gas Ar unallowable) Other		K L M E A Z													
6	<Reference gas> (Note 1) N ₂ Air (incompatible with H ₂ /CH ₄ measurement) O ₂ (incompatible with H ₂ /CH ₄ measurement) Other			4	5	6										
7	<Connection port size> Rc1/4 NPT1/4				0	1										
8	<Revision No.>					4										
9	<Measuring range (1st range)> 0 to 3% (H ₂) 0 to 5% (H ₂ , He) 0 to 10% (H ₂ , He, Ar, CO ₂) 0 to 20% 0 to 30% 0 to 50% 0 to 80% 0 to 100% 100 to 90% (H ₂ , He, Ar) 100 to 80% (H ₂ , He, Ar, CH ₂) Other						Q L M N V P T J 9 8 Z									
10	<Measuring range (2nd range)> (Note 2) None 0 to 5% (H ₂ , He) 0 to 10% (H ₂ , He, Ar) 0 to 20% (H ₂ , He, Ar, CO ₂) 0 to 30% 0 to 50% 0 to 80% 0 to 100% Other						Y L M N V P T J Z									
11	<Measured value output> DC4 to 20 mA DC0 to 1V DC4 to 20 mA + RS-232C communication DC 0 to 1 V + RS-232C communication DC0 to 10mV						A B C D E									
12	— (Note 3)						A									
13	<Hz meter interference corrective calculation> (Note 4) None Provided						Y A									
14	<Input/output contacts> None Automatic calibration Concentration alarm Contact output selection							Y A C E								
15	<Indication> Japanese English								J E							
16	<Response speed> Standard response High-speed response (Note 5)									A B						
17	—												Y			
18	—															Y

Note 1 Reference gas refers to gas other than the component to be measured in sample gas.
("Z" must be specified when interference gas is to be contained.)

Note 2 The ratio of maximum range to the first range is as given below.
For CO₂, Ar or CH₄ measurement : 1st range x 5 (times)
For He or H₂ measurement : 1st range x 10 (times) A range from 0 to ...% cannot be combined with that from 100 to ...%.

1st range < 2nd range

Note 3 Specify Y if linearization in the 12th digit is not required.

Note 4 A CO₂ or CH₄ meter needs to be prepared separately.

A reverse range such as 100 to 0% cannot be specified.

Input signal is 1 to 5 V DC.

Adjustment is required at Fuji Electric's factory.

Details of measurement gas will be checked when receiving an order.

Reverse range such as 100% to 0% cannot be specified.

Cannot be specified if high-speed response is selected.

Note 5 High-speed response is for H₂ meter used for reference gas N₂ only.



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 Directive 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 use.

"Installation Category II"

"Pollution Degree 2"

"Altitude up to 2187 yard [2,000m]"

EN61326-1:2006, EN61326-2-3:2006,

EN61000-3-2:2006, A1:2009, A2:2009

EN61000-3-3:2008

Electrical equipment for measurement, control and laboratory use — EMC requirements.

Input/output contact specifications		14th digit:A	14th digit:C	14th digit:E	
		Automatic calibration related	Concentration alarm related	Contact output selection (Note 7)	
Contact output	Automatic calibration related	Zero gas valve drive Span gas valve drive Suction pump OFF in automatic calibration	○(D01) ○(D02) ●(D03)	— — —	○ ○ ●
	Concentration alarm related	Upper limit (1 point) concentration alarm	—	Any one alarm settable on screen (D01, 2)	Any one alarm settable on screen 2 Point (NO) contact
		Lower limit (1 point) concentration alarm	—		
		Upper/lower limit (1 point as a set) concentration alarm	—		
		Upper limit (1 point) and lower limit (1 point) concentration alarm	—		
	Other	2-step upper limit (1 point each) concentration alarm	—	2 Point (NO) contact	
2-step lower limit (1 point each) concentration alarm		—			
Contact input	Other	Calibration status Range information (2-range meter)(Note3) Analyzer error or automatic calibration error	○(D04) — ○(D05)	○(D04) ○(D03) ○(D05)	○ ○ ○
	Remote automatic calibration start (Note4)	○(D13)	○(D13)	○(D13)	
	Remote range changeover (2-range meter)(Note5)	○(D12)	○(D12)	○(D12)	
	Remote measured value output holding (Note6)	○(D11)	○(D11)	○(D11)	

(Note 1) Mark○: Normally Open (NO) contact

(Note 2) Mark●: Normally Closed (NC) contact, after turning on power supply

(Note 3) Low range: Contacts close, High range: Contacts open

(Note 4) When contacts open 1.5 sec after their closure, automatic calibration starts.

(Note 5) Contacts closed: Low range, Contacts open: High range

(Note 6) Contacts closed: Holding, Contacts open: Holding canceled

(Note 7) Up to 5 contact outputs can be set.

SCOPE OF DELIVERY

Analyzer main unit
Panel mounting brackets (1 set)
2 power fuses (250 V AC, 1 A)
Instruction Manual

ITEMS TO BE PREPARED SEPARATELY

Gas sampling equipment, standard gas, receiving instrument, etc.
With interference corrective calculation: CO or CO₂ gas analyzer

ORDERING INFORMATION

1. Analyzer type
2. Gas component to be measured
3. Measuring range
4. Gas component other than measured

Digit	Description	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
4	<Construction> Hazardous location	E														
5	<Measured component> H ₂ Ar He CH ₄ CO ₂ (reference gas Ar unallowable) Other	K L M E A Z														
6	<Reference gas> (Note 1) N ₂ Air (incompatible with H ₂ /CH ₄ measurement) O ₂ (incompatible with H ₂ /CH ₄ measurement) Other		4	5	6											
7	<Connection port size> G1/2 Rc1/2 NPT1/2		A	B	C											
8	<Revision No.>		4													
9	<Measuring range (1st range)> 0 to 3% (H ₂) 0 to 5% (H ₂ , He) 0 to 10% (H ₂ , He, Ar, CO ₂) 0 to 20% 0 to 30% 0 to 50% 0 to 80% 0 to 100% 100 to 90% (H ₂ , He, Ar) 100 to 80% (H ₂ , He, Ar, CH ₂) Other						Q L M N V P T J 9 8 Z									
10	<Measuring range (2nd range)> (Note 2) None 0 to 5% (H ₂ , He) 0 to 10% (H ₂ , He, Ar) 0 to 20% (H ₂ , He, Ar, CO ₂) 0 to 30% 0 to 50% 0 to 80% 0 to 100% Other						Y L M N V P T J Z									
11	<Measured value output> DC4 to 20 mA DC0 to 1V DC4 to 20 mA + RS-232C communication DC0 to 1 V + RS-232C communication DC0 to 10mV		A B C D E													
12	—		A													
13	<H ₂ meter interference corrective calculation> (Note 3) None Provided						Y A									
14	<Input/output contacts> None Automatic calibration Concentration alarm Contact output selection							Y A C E								
15	<Indication> Japanese English Chinese								J E C							
16	<Response speed> Standard response High-speed response (Note 4)									A B						
17	<Number of cable glands> None 3 4 5 6 7 8															0 3 4 5 6 7 Z
18	<Ex. Standard> NEPSI															N

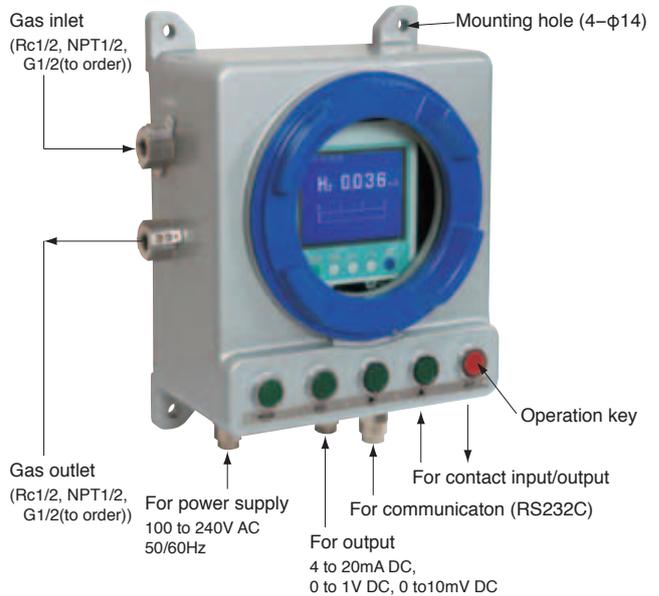
Note 1 Reference gas refers to gas other than the component to be measured in sample gas. ("Z" must be specified when interference gas is to be contained.)

Note 2 The ratio of maximum range to the first range is as given below.
For CO₂, Ar or CH₄ measurement : 1st range x 5 (times)
For He or H₂ measurement : 1st range x 10 (times) A range from 0 to ...% cannot be combined with that from 100 to ...%.

1st range < 2nd range

Note 3 A CO₂ or CH₄ meter needs to be prepared separately.
A reverse range such as 100 to 0% cannot be specified.
Input signal is 1 to 5 V DC.
Adjustment is required at Fuji Electric's factory.
Details of measurement gas will be checked when receiving an order.
Reverse range such as 100% to 0% cannot be specified.
Cannot be specified if high-speed response is selected.

Note 4 High-speed response is for H₂ meter used for reference gas N₂ only.



Input/output contact specifications		14th digit:A	14th digit:C	14th digit:E	
		Automatic calibration related	Concentration alarm related	Contact output selection (Note 7)	
Output	Automatic calibration related	Zero gas valve drive Span gas valve drive Suction pump OFF in automatic calibration	○(D01) ○(D02) ●(D03)	— — —	○ ○ ●
	Concentration alarm related	Upper limit (1 point) concentration alarm	—	—	—
		Lower limit (1 point) concentration alarm	—	Any one alarm settable on screen (D01, 2)	Any one alarm settable on screen 2 Point (NO) contact
		Upper/lower limit (1 point as a set) concentration alarm	—	—	—
		Upper limit (1 point) and lower limit (1 point) concentration alarm	—	—	—
	Other	2-step upper limit (1 point each) concentration alarm	—	—	—
2-step lower limit (1 point each) concentration alarm		—	—	—	
Contact input	Calibration status	○(D04)	○(D04)	○	
	Range information (2-range meter)(Note3) Analyzer error or automatic calibration error	— ○(D05)	○(D03) ○(D05)	○ ○	
	Remote automatic calibration start (Note4)	○(D13)	○(D13)	○(D13)	
Contact output	Remote range changeover (2-range meter)(Note5)	○(D12)	○(D12)	○(D12)	
	Remote measured value output holding (Note6)	○(D11)	○(D11)	○(D11)	

(Note 1) Mark○: Normally Open (NO) contact
(Note 2) Mark●: Normally Closed (NC) contact, after turning on power supply
(Note 3) Low range: Contacts close, High range: Contacts open
(Note 4) When contacts open 1.5 sec after their closure, automatic calibration starts.
(Note 5) Contacts closed: Low range, Contacts open: High range
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(Note 7) Up to 5 contact outputs can be set.

SCOPE OF DELIVERY

Analyzer main unit
Panel mounting brackets (1 set)
2 power fuses (250 V AC, 1 A)
Opner x 1
Wrench x 1
Instruction Manual

ITEMS TO BE PREPARED SEPARATELY

Gas sampling equipment, standard gas, receiving instrument, etc.
With interference corrective calculation: CO or CO₂ gas analyzer

ORDERING INFORMATION

1. Analyzer type
2. Gas component to be measured
3. Measuring range
4. Gas component other than measured

Fuji Electric Co., Ltd.

International Sales Div.

Sales Group

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Shinagawa-ku, Tokyo 141-0032, Japan

http://www.fujielectric.com

Phone: 81-3-5435-7280, 7281 Fax: 81-3-5435-7425

http://www.fujielectric.com/products/instruments/