Manual No.3156E R6

Operation Manual for DTF-201 Oxygen Analyzer (% Range)

RX-62230＊-A＊＊＊＊＊

ENERGY SUPPORT CORPORATION

Cautionary items for safety

Observe the following cautionary items for safe operation of the device.

Warning

1. When connecting wiring at the terminal of the analyzer, be careful to avoid electric shock. Be sure to turn the power off before connecting wiring.
2. Connect a grounding cable to avoid electric shock.

Caution

1. To avoid electric shock, check for correct power supply wiring and agreement between the supply voltage requirement of the device and the supplied voltage before turning on the power switch of the device.
2. Keep away from the sensor and its periphery during operation and shortly after operation stop to avoid burns caused by high temperatures. If maintenance is inevitably necessary, wear heat resistant gloves or the like and be careful to avoid burns.
3. An “electric shock” warning mark shown on the right is attached near the power supply where there is a danger of electric shock. If the wiring circuit is unknown, turn the power off even when no electric shock warning mark is attached.

4. If the sample gas includes toxic contents, there is a danger of gas intoxication. Be sure to shut off the source gas valve when performing maintenance of the piping system.
5. For safe and correct use of the device, observe the cautions and handling methods described in this operation manual. If the device is operated without observing description herein, there is a danger of electric shock, gas intoxication, oxygen deficiency and burns as well as damage to the device, deterioration of functions or possible damage to the final product (system, etc.).

Guarantee

1. Term

   The term of guarantee of a single piece of equipment shall be one year since the product is delivered. However, if the equipment is built in another unit, the term of guarantee shall be that of the unit. The single unit delivery meant that the receiver, sensor unit, cable are delivered as single unit whereas the equipment built in another unit meant the equipment by combining the sampling flow or to combine to another units are delivered as built-in delivery.

2. Conditions

   The delivered product shall be exchanged or repaired free of charge if it fails or any abnormality is generated due to poor workmanship in design, manufacture or material attributable to ENERGY SUPPORT CORP. in the above-mentioned term of guarantee though it is operated properly after it is stored and installed properly after it is delivered to the client.

   The proper operating method includes the following.

   ① The installation conditions and operation conditions described in the specifications of this measuring tool and this operation manual are satisfied.

   ② The analyzer is periodically calibrated and replacement of consumable parts is made.

   ③ Periodic maintenance and inspection are made according to the operating state of the analyzer.

   However, the following cases shall be excluded from the scope of guarantee even if they occur in the above-mentioned term of guarantee.

   1) Failure generated due to operation errors (erroneous operation not described in operation manual)
   2) Failure caused by repairs, remodeling, disassembly, cleaning and so on made by other than us
   3) Failure caused by fire or act of God (including inductive lightning surge)
   4) Failure caused by improper storage (storage in a hot and humid site, etc.) or lack of maintenance (generation of fungi, etc.)

   Note) Consumable parts and consumable components are excluded from the scope of guarantee.

3. Scope

   The scope of guarantee shall be limited to the range delivered by us.

4. Indemnity

   We will not assume responsibility for any accompanying losses caused by the failure of our product (losses, lost profits and so on caused by the controlled or recorded results made under the use of our product, or losses, lost profits and so on caused by the system in which our product is installed.). Safety units or the like shall be installed under the responsibility of the client.

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1. Introduction

1-1 Introduction

The DTF-201 Oxygen Analyzer is a product of the latest ceramics production technology, using a thick film sensor and digital signal processing technology. This Operation Manual explains how to operate the DTF-201 oxygen analyzer.

Please read this manual thoroughly to ensure long, successful operation of your Oxygen Analyzer.

1-2 Usage Caution Notices

- Do not install the analyzer in a location subjected to vibration.
- Do not apply water or volatile fluids to the analyzer.
- Do not use sample gas containing corrosive gases (F, HF, CL_2, HCL, SO_2, H_2S, etc.) or poisonous materials (Si, Pb, P, Zn, Sn, As, etc.). These can shorten the life of the sensor.
- Do not use sample gas containing inflammable gas. The inclusion of inflammable gas can cause deviation in the oxygen concentration measurement value.
- The major usage of this oxygen analyzer is for atmospheric oxygen measurement at boiler, Heating furnace.
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1-3 Product Outline

The DTF-201 oxygen analyzer has the following features.

- With one calibration of the air sample point is possible.
- Compact size.(Small installation space.)
- Easy maintenance.
- Low power consumption by the sensor.(About 13 W for normal use.)
- Short warm up time.
- No power switch.

Operating Principles of Zirconia Type Oxygen Analyzer

(1) Configuration and Functions (See diagram at right.)

① Heater: Heats the sensor to approximately 800℃.

② Sensing cell: Sets the oxygen concentration of the reference oxygen chamber to 100%, and measures the oxygen concentration of the gas detection chamber. (See below for detailed principles.)

③ Pumping cell: Sets the oxygen concentration of the gas detection chamber to 0%. (See below for detailed principles.)

④ Gas detection chamber: Inducts gas through the gas diffusion holes.

⑤ Reference oxygen chamber: The oxygen concentration is set at approximately 100% by the reference oxygen microcurrent.

(2) Detection characteristics resulting from high temperature heating of the sensor:

① When a gas with a different oxygen concentration is put between the electrodes, oxygen ion conductivity occurs and electromotive force is generated. (Oxygen concentration cell effect)

② When current is applied between the electrodes, oxygen ions flow in the opposite direction in proportion to the current. (Oxygen pumping effect)

The sensing cell uses characteristics ① and ② above, and the pumping cell uses characteristic ② above.

(3) Sensing Cell Principles

① Minute current flows between the electrodes of the sensing cell. When current is applied between the electrodes, the oxygen inside the gas detection chamber is transferred to the reference oxygen chamber so that the oxygen concentration in the reference oxygen chamber is approximately 100%.

Note: The quantity of oxygen transferred from the gas detection chamber to the reference oxygen chamber is extremely small, so it does not affect the oxygen concentration in the gas detection chamber.

② The electromotive force in the following equation is generated between the electrodes of the sensing cell by the difference between the oxygen concentration in the gas detection chamber and the reference oxygen chamber.

The sensing cell measures the electromotive force generated between its electrodes and sends signals to the pumping cell so that the electromotive force reaches 450 mV (oxygen concentration of 0% in the gas detection chamber).

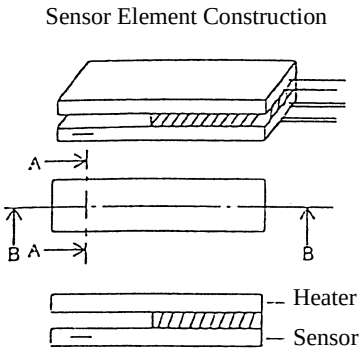
Electromotive force $E = -53.2 \times \log_{10} \frac{\text{oxygen concentration in gas detection chamber}}{\text{oxygen concentration in reference oxygen chamber (100)}}$

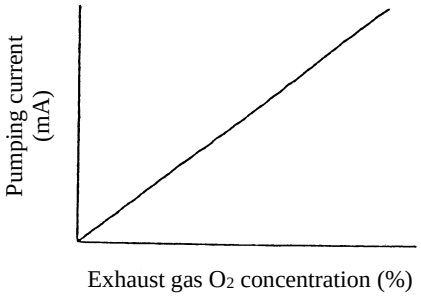
$$450 = -53.2 \times \log_{10} \frac{X}{100}$$

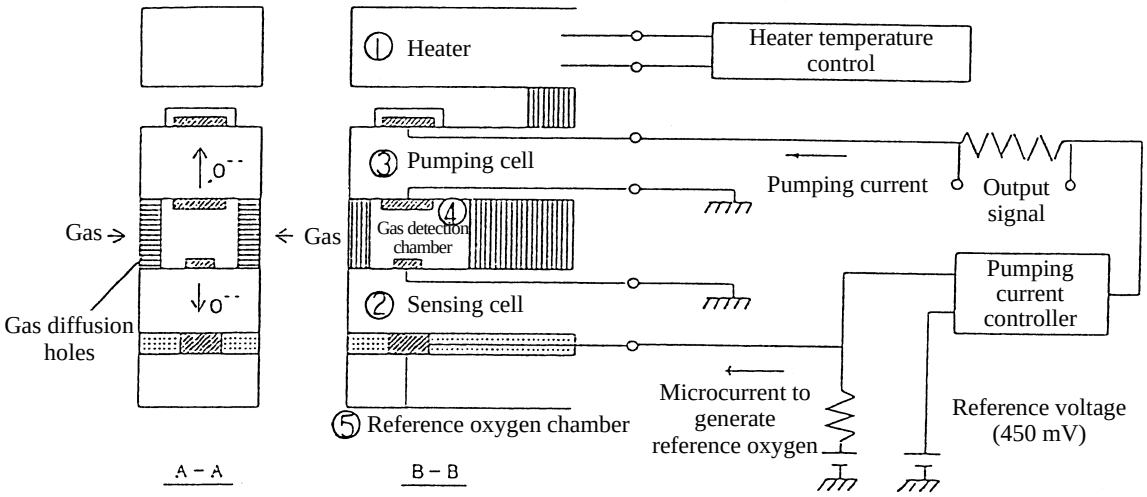
X = approx. 0.003 ppm ≒ 0%

(4) Pumping Cell Principle

The pumping cell receives the signal from the sensing cell and applies current to the electrodes so that the oxygen concentration in the gas detection chamber reaches 0%. The current applied and the oxygen concentration in the sample gas are proportional, so by measuring the current the oxygen concentration in the sample gas can be measured.

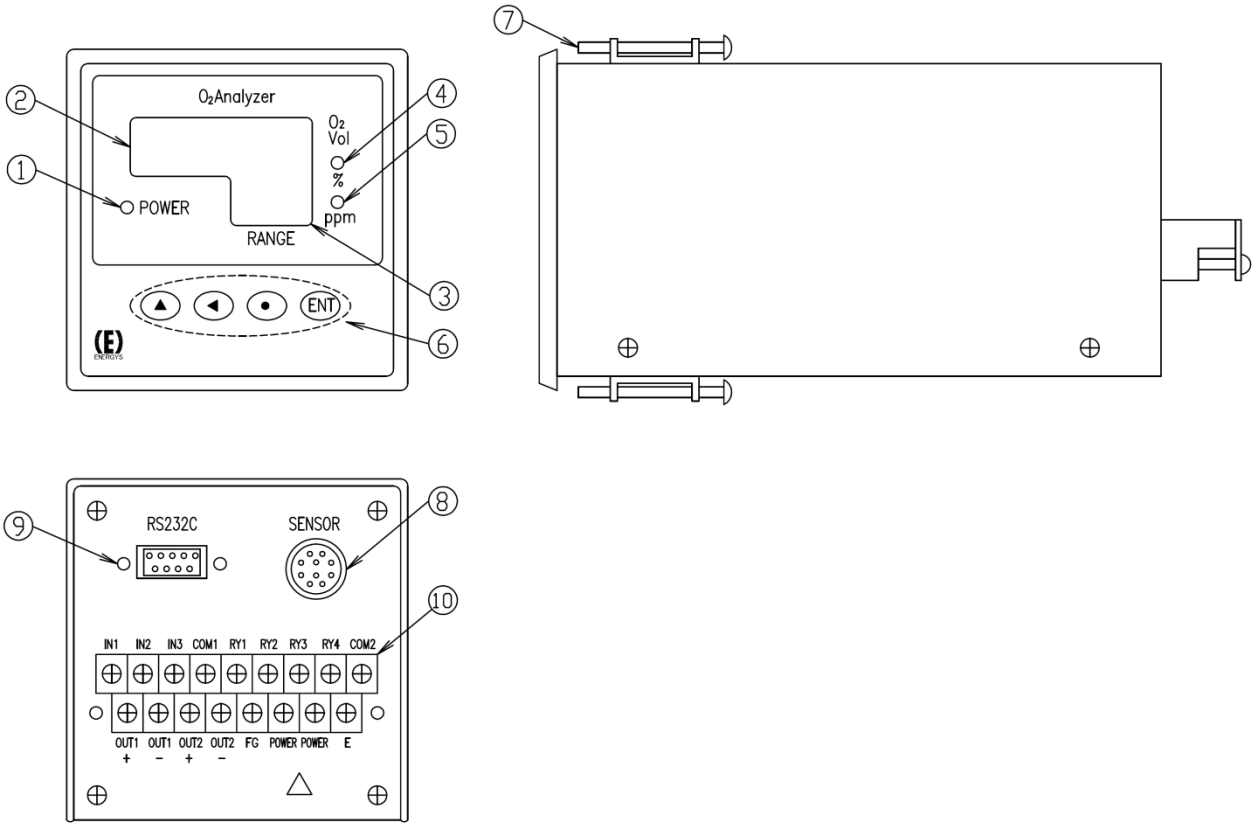






1-4 Name of each part

(1)DTF-201 receiver of oxygen analyzer



No.	Name (function)
①	POWER lamp (Lit after the power is turned on.)
②	Display 1 (5 digits, for display of concentration, data and error)
③	Display 2 (3 digits, for display of range, concentration alarm and channel)
④	% range lamp (Lit in % measurement mode.)
⑤	ppm range lamp (Lit in ppm measurement mode.)
⑥	Key (for calibration and data setting)
⑦	Installation fitting (for fixing the panel)
⑧	Connector 1 (for connecting the sensor unit)
⑨	Connector 2 (for RS232C connection; option)
⑩	Terminal block (for input/output wiring)

2. Unpacking

2-1 Checking the Components and Accessories

Part name	Part No.	Q'ty	Remarks
Oxygen analyzer	RX-62230＊-A＊	1	RX-622300:AC100-240V RX-622303:DC24V
Installation fitting	CA-1	2	Accessory

NOTE)

※refer to your specifications document. The probe, sensor, relay cables, and others are different depending on the specifications; check those parts off against the specifications document.

2-2 Temporary Product Storage

When storing the product temporarily prior to installation, observe the following conditions.

- It is preferable to store the product inside a box, protected by polystyrene, etc.

Store the product in a location with the following features:

- Away from direct sunlight.
- The ambient temperature is between -10℃ and 50 ℃, with little variation in temperature.
- There is little humidity and dust.
- The location is not exposed rainfall.
- There is little mechanical vibration.
- There are no corrosive gases or dangerous gases.

3. Installation

3-1 Installation Conditions

This oxygen analyzer must be installed indoors. For safe, correct use of your oxygen analyzer, install the analyzer in a location with the following conditions to provide the best possible installation conditions.

- There is little vibration.
- It is not affected by corrosive gases (F, HF, CL_2, HCL, SO_2, H_2S, etc.), and will not interfere with maintenance personnel.
- Condensation is not caused by sudden temperature fluctuations.
- It is not affected by direct heat radiation.
- It is affected little by noise.
- There is little humidity and dust.
- The ambient temperature is between 0℃ and 50℃. (not exposed to direct sunlight)

3-2 Installation Method

Installation Cautions

- This oxygen analyzer is a precision instrument. When installing it, avoid large shocks and applying a load upon it.
- Its terminal block and connector jut out from the panel, so they are easily damaged. Take care not to knock them during installation.

3-3 Piping and wiring Methods

(1) Piping Arrangement

Piping between the probe generator (sensor) and the air selector unit (for supplying calibration gas) must be connected.

Pipes consist of the following:

- Calibration gas pipe
- Ejector air pipe
- Purge air pipe

And others

Details differ depending on the specifications. Refer to your specifications document.

(2) Wiring Methods

①Wiring between the probe generator (sensor) and analyzer
Connect the sensor and analyzer with the special relay cable.

Details differ depending on the specifications. Refer to your specifications document.

② Wiring to receiver

Connect wiring to the receiver at the terminal block (M3 screws). Take care of the polarity when wiring.

Layout of terminal block and description

IN1	IN2	IN3	COM1	RY1	RY2	RY3	RY4	COM2

OUT1 ＋	OUT1 －	OUT2 ＋	OUT2 －	FG	POWER	POWER	E

IN1 :NO-voltage contact input terminal 1

IN2 :NO-voltage contact input terminal 2

IN3 :NO-voltage contact input terminal 3

COM1 :Common terminal for IN1 through 3

RY1 :Open co output terminal 1 (permissible rating DC25V, max.50 mA)

RY2 :Open co output terminal 2 (permissible rating DC25V, max.50 mA)

RY3 :Open co output terminal 3 (permissible rating DC25V, max.50 mA)

RY4 :Open co output terminal 4 (permissible rating DC25V, max.50 mA)

COM2 :Common terminal for RY1 through 4

OUT1+,- :4 to 20 ma DC output of oxygen concentration (corresponding to selected range). Non-insulated output, load resistance 600 Ω or less

OUT2+,- :0 to 5 VDC output of oxygen concentration (corresponding to selected range). Non-insulated output, load resistance 10 KΩ or above

FG :Terminal for connecting shields of OUT1 and 2

POWER :Power terminal (85 to 132 VAC, 50/60 Hz, max.50 VA)

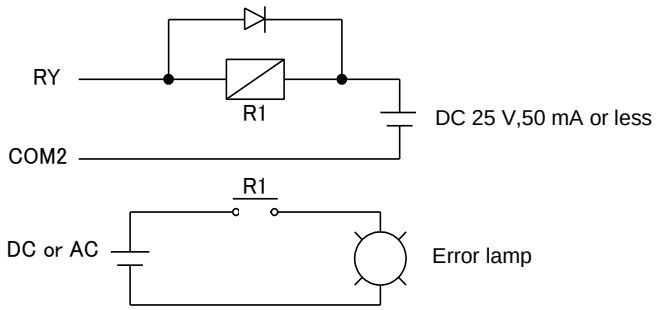
E :Grounding terminal

※1 IN1-3, RY1-4, and OUT2 are different depending on the specifications; check those parts off against the specifications document.

※2 OUT2 is either one of DC 0-1 V, DC 0-5 V, DC 0-10 V. Refer to your specifications document.

※3 POWER is either one of AC 100-240 V, DC 24 V. Refer to your specifications document.

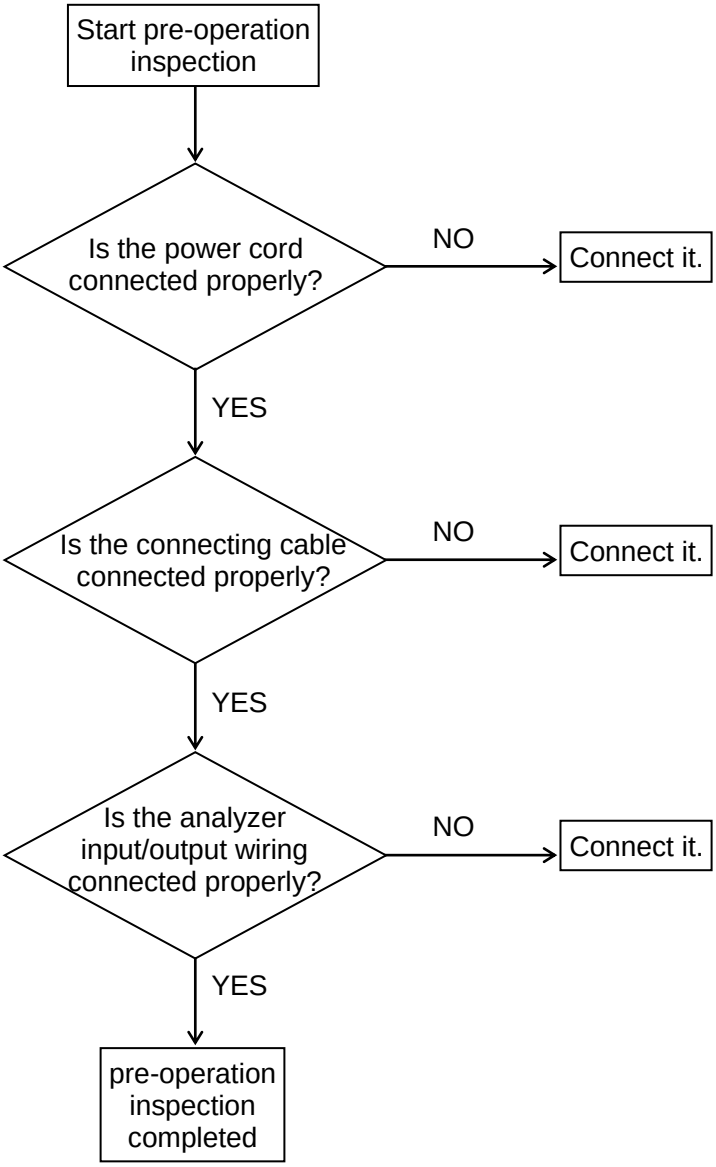
<u>Example of Wiring Circuit to RY</u>



4. Operation

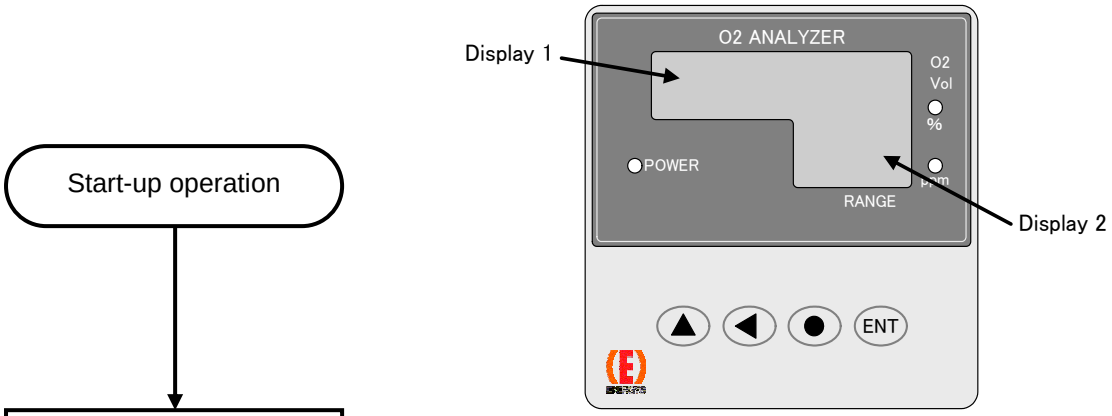
4-1 Operation Preparation

Before you turn the power ON, perform the following inspection.



4-2 Start-up

Perform the basic start-up operation as follows.



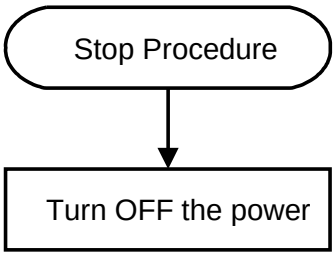
① When you turn ON the power to the analyzer, the POWER LED lights up and Display 1 starts the countdown. After 3 minutes, measurement can start.
Display 1 displays the countdown as follows.
3.00 -> 2.59 -> ... -> 0.01 -> 0.00 ->
Concentration display

The analyzer does not have a power switch, so provide one externally.

② Display 2 displays the output range No.
When range No. 1 is selected: 1
When range No. 2 is selected: 2
When range No. 3 is selected: 3
When range No. 4 is selected: 4
Checking and changing of each range is performed using the receiver setting data (CH030 - 037).
If the concentration warning is output, the range No. is not displayed, and AH (concentration high) or AL (concentration low) is displayed.
For details, see page 16, 4-4 Procedure During Operation, (2) Output Range Switching.

③ For gas calibration, see page 16, 4-4 Procedure During Operation, (4) Gas Calibration.

4-3 Stop Procedure



Turn OFF the power supply to the oxygen analyzer.
There is no power switch on the analyzer, so turn off the external power supply.

If operation is stopped for a short period such as 1 week or less, do not turn off the power.
If operation is stopped for a longer period, once the sample gas is replaced by ambient air, then turn off the power.

4-4 Procedure During Operation

(1) Key Operation Method

Key operation is required to change the range and perform gas calibration when starting up. This operation is very important, so be sure to read these instructions.

Key operation may change the oxygen analyzer output, so when using the oxygen analyzer output signals for control purposes, always apply the control release device before operating the keys.

Key Functions

◀ key ⋯ Press this key to shift from the O_2 Concentration display to the data setting mode, or to move toward the left digit of the setting data. The currently changeable digit flickers.

▲ key ⋯ Press this key to change the value of the set CH and the set data.

● key ⋯ Press this key in the following cases.

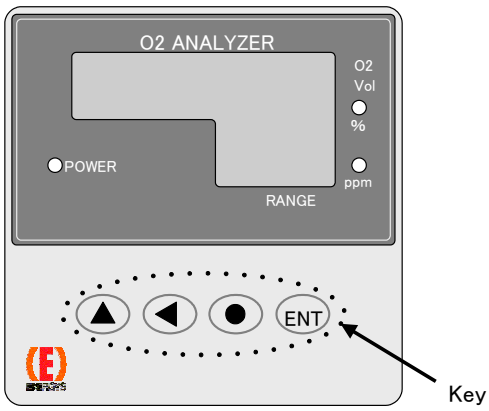
∗To insert a decimal point after the flickering digit.

∗To switch to the opposite sign when the set data has a plus or minus sign.

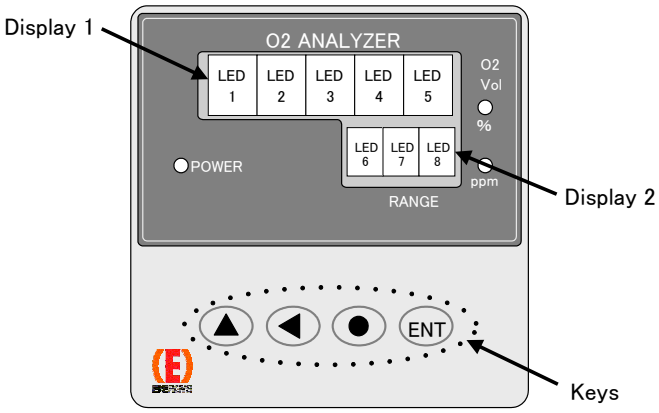
∗To return to the O_2 Concentration display mode from the setting mode

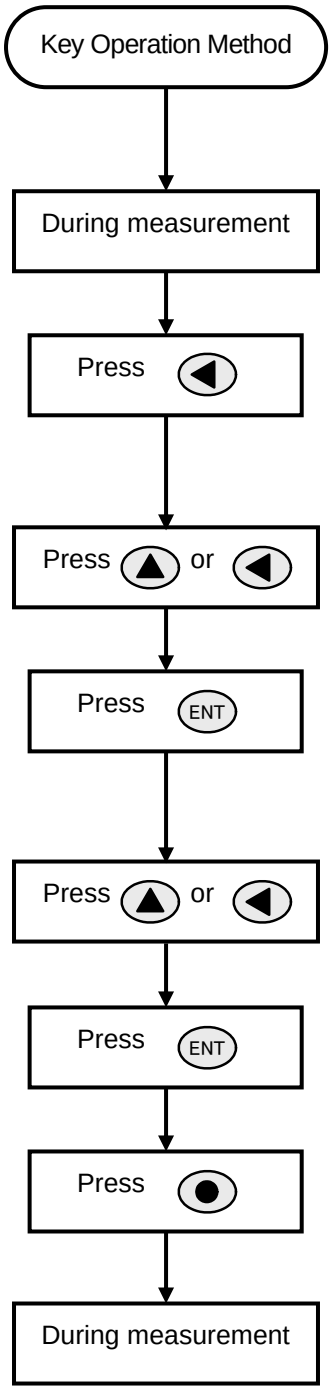
∗To clear an error when it has occurred.

ENT key ⋯ Press this key to save data in the receiver memory after changing the value of the set CH or set data.



Key Operation Method





Display 1 is the O_2 Concentration display.
Display 2 is the Range or Concentration warning display.

① First, press the ◀ key.
Display 2 will display the CH No. and LED 8 will flicker.
Display 1 display the data.

② Press ▲ or ◀ to set the CH No. of the data you wish to display on Display 2.

③ Press ENT .
LED5 on Display 1 will flicker.
Display 2 will continue to display the CH No.

④ Press ▲ or ◀ to change the data displayed on Display 1.

⑤ Press ENT to save the data in the receiver memory.

⑥ Press ● to return to the O_2 Concentration display.

Key operation is finished.
Using steps ① - ⑥ above, you can change the range and perform gas calibration.
The following page displays the System Data Table explaining which data is input to which CH.

System data Table

CH No.	Function	Setting Data	Default Data
000	Display selection	0: No display (— — — —) 1: Oxygen concentration 2: Icp 3: Vs 4: Ip1 5: Ip2 6: Vp 7: Vh 8: Ih 9: CPU Ih *2 – 9 are for checking use by we.	1
001	Sensor output VS monitor (μV)	—	Monitor value
002	Sensor output IP monitor (μA)	—	
003	Sensor output IP monitor (μA)	—	
004	Sensor output VP monitor (V)	—	
005	Sensor heater voltage monitor (V)	—	
006	Sensor heater current monitor (A)	—	
007	Sensor heater current monitor (A)	—	
008 | 015	Data for setting, checking by ENERGY SUPPORT CORP.		
016	Primary delay time (sec)	0 – 99	0
017	Data for setting, checking by ENERGY SUPPORT CORP.		
018	WET/DRY operation	0: WET 1: DRY(gas fuel) 2: DRY(solid and liquid fuel)	See Specifications Manual.
019			
020	Output range switching	1: No. 1 range 2: No. 2 range 3: No. 3 range 4: No. 4 range	Data is supplied for the current selected range
021 | 022	Data for setting, checking by ENERGY SUPPORT CORP.		
023	Output hold setting	0: No hold 1: Desired value 2: Value 5 sec. before error	See Specifications Manual.
024	Output hold value setting (%FS)	0 - 100	0
025 | 026	Data for setting, checking by ENERGY SUPPORT CORP.		
027	OUT1 output adjustment	When adjusting output ZERO or SPAN, sets to this CH.	—
028	OUT2 output adjustment		—
029	—	—	—

CH No.	Description	Setting data	Initial data
030	Output range No. 1 span value	1 - 99999 * Check the output range unit using CH034 - 037.	See Specifications Manual.
031	Output range No. 2 span value		
032	Output range No. 3 span value		
033	Output range No. 4 span value		
034	Output range No. 1 unit	0: Not in use 1: ppm 2: %	1
035	Output range No. 2 unit		1
036	Output range No. 3 unit		2
037	Output range No. 4 unit		2
038	—	—	—
039	—	—	—
040 | 119	Data for setting, checking by ENERGY SUPPORT CORP.		
120	Zero gas concentration (%)	0.00 - 99.90	See inspection data
121	Span gas concentration (%)		
122	-Span gas concentration (%)	-99.90 - 99.90	
123	Air point concentration	0.00 - 99.90	
125 to 142	Data for setting, checking by ENERGY SUPPORT CORP.		
143	Linearization table	Specific values for each sensor	See inspection data
144 | 179	Data for setting, checking by ENERGY SUPPORT CORP.		
180	Calibration point selection	5: Zero point 6: Span point 8: Air point	8
181	Calibration start	0: Default value 1: Calibration start	0
182 | 189	Data for setting, checking by ENERGY SUPPORT CORP.		
190	Heater control mode	0: Heater OFF 1: Constant voltage control 2: Constant resistance control 1 3: Constant resistance control 2	1 (Change not possible.)
191	Heater voltage setting value (V)	5.00 - 11.00	10.50 (Change not possible.)
192	Heater resistance at room temperature (Ω)	Specific values for each sensor	See inspection data
193	Resistance ratio	Specific values for each sensor	See inspection data
194 to 199	Data for setting, checking by ENERGY SUPPORT CORP.		

CH No.	Description	Setting data	Initial data
200	Contact output RY1 function setting	0: No contact output 1: Analyzer error 2: Range echo (2 range discrimination) 3: Range echo (discrimination of 3 ranges or more)) 4: READY 5: Concentration max. alarm 6: Concentration min. alarm 7: Range echo (3 contacts)	See Specifications Manual.
201	Contact output RY2 function setting		
202	Contact output RY3 function setting		
203	Contact output RY4 function setting		
204	Contact output RY1 movement setting	0: NO 1: NC	See Specifications Manual.
205	Contact output RY2 movement setting		
206	Contact output RY3 movement setting		
207	Contact output RY4 movement setting		
208	Contact input IN1 movement setting	0: Not in use 1: Air 1 point calibration start	See Specifications Manual.
209	Contact input IN2,3 movement setting	0: Local range switching 1: Remote range switching	
210 | 219	Data for setting, checking by ENERGY SUPPORT CORP.		
220	O2 concentration max. alarm setting value	0.0 - 9990.0	If 5 and 6 are set for CH200 – 203, set your desired limit
221	O2 concentration min. alarm setting value	0.0 - 9990.0	
222	Oxygen max. alarm unit	0: Not used 1: ppm 2: %	
223	Oxygen min. alarm unit		
224	Simulation output selection	0: Measurement value output 1: Simulation output	0
225	OUT1 Current simulation output value	0.0 – 100.0	0.0
226	OUT2 Voltage Simulation output value	0.0 – 100.0	0.0
227 | 229	Data for setting, checking by ENERGY SUPPORT CORP.		
230	Gas fuel CO2 concentration	0.00 – 100.00	0.00
231	Gas fuel CO concentration		0.00
232	Gas fuel H2 concentration		0.00
233	Gas fuel CH4 concentration		0.00
234	Gas fuel C2H6 concentration		0.00
235	Gas fuel C3H8 concentration		0.00
236	Gas fuel C4H10 concentration		0.00
237	Gas fuel C5H12 concentration		0.00
238	Gas fuel N2 concentration		0.00
239	Gas fuel H2O concentration		0.00
240	Gas fuel CO2 concentration		0.00
241	Solid and Liquid fuel C concentration		0.00

CH No.	Description	Setting data	Initial data
242	Solid and Liquid fuel H concentration	0.00 – 100.00	0.00
243	Solid and Liquid fuel S concentration		0.00
244	Solid and Liquid fuel N2 concentration		0.00
245	Solid and Liquid fuel H2O concentration		0.00
246	Solid and Liquid fuel O2 concentration		0.00
247 | 269	—	—	—
270	How to calibration	0: Manual 1:Semi Auto 2: Auto	
276	Calibration mode	0: Air 1 point calibration 1: Air,Zero 2 point calibration 2: Air,Span 2 point calibration 3: Air,Zero,Span 3 point calibration	See Specifications Manual.
271 | 289	Data for setting, checking by ENERGY SUPPORT CORP.		
290	Communication setting	0: Maker setting 1: Maker setting 2: RS-232C 3: Maker setting	Option
291	Bit rate setting	0: 1200 1: 2400 2: 4800 3: 9600	
292	Data length setting	0: 8 bit 1: 7 bit	
293	Parity mode setting	0: Even parity 1: Odd parity	
294	Parity setting	0: No check 1: Check used	
295	Stop bit length setting	0: 1 bit 1: 2 bit	
296 | 309	—	—	—
310	Data setting change password	0: Data change prohibited 201: Data change possible	201

Caution notices when changing data settings.

Do not make changes to CH190 – 191. It will change the heater voltage supplied to the sensor, which could damage the sensor.

(2) Output Range Switching

The output range switching method can be made from 2 methods: range switching by key operation, by Contact input.

①Range switching by key operation (Local range switching)

By inputting 0 for CH026 and 0 for CH209, you can change output range 1 - 4 for CH020. You can select the same range No. as the input data, e.g. if you input "1", you get range 1, and if you input "2", you get range 2.

②Range switching using contact input (Remote range switching)

By inputting 0 for CH026 and 1 for CH209, the output range is switched in accordance with the no-voltage contact input that is input to IN2 and IN3 of the analyzer terminal block. The Contact input and selected range are related as shown below.

Contact Input		Selected Range
IN2-COM1	IN3-COM1	
ON	ON	No.1
OFF	ON	No.2
ON	OFF	No.3
OFF	OFF	No.4

(3) Output Range setting

The output range can be set as desired up to 4 ranges, setting the range span value for CH030 - 033, and setting the unit for CH034 - 037.

For output range No. 1, range span value setting is CH030, unit setting is CH034.
For output range No. 2, range span value setting is CH031, unit setting is CH035.
For output range No. 3, range span value setting is CH032, unit setting is CH036.
For output range No. 4, range span value setting is CH033, unit setting is CH037.

When setting the unit, inputting 0 is “Not in use”, 1 is ppm, and 2 is %.

Example

To set 0 - 25 % for output range No. 1, input 25 for CH030 and 2 for CH034.

The span value for the output range is a minimum of 5 %.
A unit isn't to set up ppm.

(4) Gas Calibration

This analyzer can be used with air 1 point calibration. It doesn’t need to carry out calibration ②,③,④ standardly.

① Air 1 point calibration

(a) Send the Air to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication.
(b) Input 0 to CH276 to set the calibration mode to air 1 point calibration.
(c) Input the Air point concentration to CH123.
20.6 % is inputted when the atmosphere air is used 20.9 % when the instrument air is used for calibration.
(d) Input 8 to CH180 to set the calibration point to air point.
(e) Input 1 to CH181 to start calibration.
This procedure performs calibration. As long as the setting data is not changed, steps (b),(c) and (d) are not required.
By inputting 1 to CH208, steps (d) – (e) are automatically performed by temporarily shorting between IN1 – COM on the analyzer terminal board.

② Air, Zero 2 point calibration

This analyzer doesn't need to carry out zero point calibration standardly. How to zero point (0.0%O2point) calibration is shown in the following for the reference.

(a) Input 1 to CH276 to set the calibration mode to air and zero 2 point calibration.

(b) Send the Air to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication. Air point is calibrated in a method to show in (c)-(e) of ①.

(c) Input 0.0 to CH120 for zero gas concentration. Zero gas is to use 10%CO2/N2 gas or 100%N2 gas.
Combustibility gas such as CO and H2 isn't to be contained in zero gas.

(d) Send the zero gas to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication.

(e) Input 5 to CH180 to set calibration point to zero point.

(f) Input 1 to CH181 to start calibration.
This procedure performs calibration. As long as the setting data is not changed, steps (a)and (c) are not required.

③ Air, Span 2 point calibration

(a) Input 2 to CH276 to set the calibration mode to air and span 2 point calibration.

(b) Send the Air to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication. Air point is calibrated in a method to show in (c)-(e) of ①.

(c) Input to CH121 for span gas concentration. The concentration of span gas is to use the gas of the 90% in F.S. range.

(d) Send the span gas to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication.

(e) Input 6 to CH180 to set calibration point to span point.

(f) Input 1 to CH181 to start calibration.
This procedure performs calibration. As long as the setting data is not changed, steps (a)and (c) are not required. Input the concentration after the change by the operation of (c) when you change the concentration of span gas.

④ Air, Zero, Span 3 point calibration

(a) Input 3 to CH276 to set the calibration mode to air, zero and span 3 point calibration.

(b) Send the Air to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication. Air point is calibrated in a method to show in (c)-(e) of ①.

(c) Input 0.0 to CH120 for zero gas concentration. Zero gas is to use 10%CO2/N2 gas or 100%N2 gas.
Combustibility gas such as CO and H2 isn't to be contained in zero gas.

(d) Send the zero gas to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication. Zero point is calibrated in a method to show in (e),(f) of ②.

(e) Input to CH121 for span gas concentration. The concentration of span gas is to use the gas of the 90% in F.S. range.

(f) Send the span gas to the Probe transmitter (sensor unit) at 1-3L/min ,and it stabilizes indication. Air point is calibrated in a method to show in (e),(f) of ③.

This procedure performs calibration. As long as the setting data is not changed, steps (a), (c) and (e) are not required. Input the concentration after the change by the operation of (c) when you change the concentration of span gas.

4-5 Operation for when an Error Occurs

If an error code occurs, the error code is displayed on Display 1, and the O_2 Vol display stops displaying the normal value. If this occurs, follow the steps explained in 5-2 Troubleshooting on page 23. After you clear the error contents, press the  key or turn OFF the analyzer power supply (power supply reset) to restore the measurement condition.

4-6 Applied operations

(1) Primary delay time setting

With the data value input to CH016 (unit: seconds), primary delay can be applied to the concentration output signal. The setting range is 0 - 99 seconds.

(2) WET/DRY

The output of oxygen concentration when 0 is inputted to CH18 is WET output.

When fuel to use is gas fuel, each element concentration (vol %) in the fuel is inputted to CH230 - 239, and 1 is inputted to CH018. Oxygen concentration output becomes DRY output by the above.

When fuel to use is solid fuel or liquid fuel, each element concentration (vol %) in the fuel is inputted to CH241 - 246, and 2 is inputted to CH018. Oxygen concentration output becomes DRY output by the above.

(3) Output hold setting

If an error occurs for the sensor or receiver while CH023 is selected, this sets how the concentration output signal is to be held. The relationship between the input data and hold contents is shown in the table below.

Input Data	Hold Function
0	Hold not applied when error occurs in sensor or receiver.
1	Hold applied using the value set for CH024 when sensor or receiver error occurs.
2	Hold applied using the value 5 seconds before the error occurred in the sensor or receiver.

(4) Output hold value setting

If a sensor or receiver error occurs during warming up (receiver countdown display) or when 1 is input to CH023, hold is applied to the concentration output signal using the data set for CH024 (unit:% FS). For example, to hold current output of 4 - 20 mA at 12mA, the setting is 50% FS.

(5) Current output adjustment

① Connect an ammeter to check OUT1+ and OUT1- on the analyzer terminal board.

② When CH027 is called up, the display shows "cAL 1".

③ When you press the ENT key, 0 is displayed on display 1. Each time you press the ● key, display 1 can be switched to 0 and 100. When 0 is displayed, output ZERO adjustment is possible, and when 100 is displayed, output SPAN adjustment is possible using the following procedure.

④ The output value can be increased using the ▲ key when display 1 indicates 0 or 100, and reduced using the ◀ key. Perform adjustment while using the ammeter to check the output.

⑤ When you have finished ZERO and SPAN adjustment in steps ④, press the ENT key to return to the CH setting mode.

(6) Voltage output adjustment

① Connect a voltmeter to check OUT2+ and OUT2- on the analyzer terminal board.

② When CH028 is called up, the display shows "cAL 2".

③ When you press the ENT key, 0 is displayed on display 1. Each time you press the ● key, display 1 can be switched to 0 and 100. When 0 is displayed, output ZERO adjustment is possible, and when 100 is displayed, output SPAN adjustment is possible using the following procedure.

④ The output value can be increased using the ▲ key when display 1 indicates 0 or 100, and reduced using the ◀ key. Perform adjustment while using the voltmeter to check the output.

⑤ When you have finished ZERO and SPAN adjustment in steps ④, press the ENT key to return to the CH setting mode.

(7) Concentration alarm setting

Set the concentration max. alarm on CH220, and set the setting value unit on CH222.
Set the concentration min. alarm on CH221, and set the setting value unit on CH223.
When setting the unit, inputting 0 is "Not in use", 1 is ppm, and 2 is %. A unit isn't to use ppm.

To output the concentration alarm contact output, set the concentration warning for RY1 - 4 in 4 - 6 Applied Operations (8) on page 21.

(8) Contact output (RY1 – 4) setting

The contact output contents are set using CH200 - 203, and the contact output movement settings are set using CH204 - 207.

RY1 contact output functions are set at CH200, and the contact output operation settings are set using CH204.

RY2 contact output functions are set at CH201, and the contact output operation settings are set using CH205.

RY3 contact output functions are set at CH202, and the contact output operation settings are set using CH206.

RY4 contact output functions are set at CH203, and the contact output operation settings are set using CH207.

When 0 is input for the movement setting, the NO. is set, and when 1 is set, NC is set. See the table below for the difference between the contact output functions and the contact operation NO. and NC settings.

<table>
<tr><td rowspan="2">CH
200 – 203
input data</td><td colspan="2" rowspan="2">Contact output functions</td><td colspan="4">Contact output operation
CH 204 – 207 input data</td></tr>
<tr><td colspan="2">0 (NO)setting</td><td colspan="2">1 (NC)setting</td></tr>
<tr><td>0</td><td colspan="2">No contact output</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Analyzer error</td><td>During warming up,
measurement</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td>Upon analyzer error</td><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Range echo
(2 range
discrimination)</td><td>When No.1(No.3)
range is selected.</td><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
<tr><td>When No.2(No.4)
range is selected.</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Range echo
(discrimination of
3 range or more)</td><td></td><td>RY
(N)</td><td>RY
(N+1)</td><td>RY
(N)</td><td>RY
(N+1)</td></tr>
<tr><td>No.1 range is selected</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>No.2 range is selected</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>No.3 range is selected</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>No.4 range is selected</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">READY</td><td>During warming up</td><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
<tr><td>After warming up</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Concentration
max. alarm</td><td>During warming up</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td>Concentration higher
than set value</td><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
<tr><td>Concentration lower
than set value</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Concentration
min. alarm</td><td>During warming up</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td>Concentration higher
than set value</td><td colspan="2">OFF</td><td colspan="2">ON</td></tr>
<tr><td>Concentration lower
than set value</td><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
</table>

When using range echo with discrimination of 3 ranges or more, it is necessary to use 2 adjacent contact outputs, e.g. RY1, RY2.

For the wiring to RY, see the wiring circuit example on page 7.

(9) RS232C Communication function setting

The measurement status, error codes, range and measurement values can be transmitted.

The formats include condition = measurement status (6 bytes), E = error code (2 bytes), RANGE = range No. (1 byte), ppm = measured value (maximum 11 bytes), CR + LF. The communication specifications (bit rate, data length, parity check, stop bit, etc.) are set by ENERGY SUPPORT CORP.

(10) Setting the data setting change password

By setting 0 for CH310, changing the setting data can be prohibited. Setting 201 for CH310 makes it possible to change the data.

(11) Simulation output

By setting 1 for CH224, it is possible to output the simulation output value set to CH225 and CH226.

CH225:OUT1 Current simulation output value (0.0-100.0 (%))

CH226:OUT2 Voltage simulation output value (0.0-100.0 (%))

5. Maintenance

The following maintenance and inspection procedures are important in order to maintain normal functioning and accurate measurement. Make sure you thoroughly understand the procedure before performing maintenance.

Sensor replacement and pump maintenance cautions .

- To prevent gas intoxication or oxygen deficiency, before you replace the sensor or service the pump, always stop the supply of sample gas.
- There is a danger of getting burned, so before you replace the sensor or service the pump, turn off the power and allow the analyzer to cool down first. If you must work while the analyzer is still hot, wear heat resistant gloves and work carefully to avoid burns.

5-1 Daily and Periodic Inspection

Gas calibration	Frequency	Once or more per month. (Periodic calibration is recommended to suit the operating conditions.)
	Method	Perform as calibration in accordance with section 4-4 (4) .
Inspection of Sensor	Frequency	1 month
	Method	The amount of drift toward the last time calibration value is confirmed. (When it exceeds ± 2 % F.S./month, it thinks with the deterioration tendency of the sensor.)
Sensor replacement	Frequency	2 years
	Method	Replace when necessary. (See 5-2 Troubleshooting.) See the manual of TF type transmitter for the replacement method.

5-2 Troubleshooting

Phenomenon	Cause	Countermeasure	Remarks
Unable to change data.	0 is input for CH310.	Input 201 for CH310.	
	Receiver problem	Request repair by ENERGY SUPPORT CORP.	
Analyzer output, display value does not change.	Analyzer error occurring	Turn power OFF, then ON again after 10 seconds. Or push ◉ key to reset.	Take countermeasures in accordance with error code.
	Receiver problem	Request repair by ENERGY SUPPORT CORP.	
Analyzer output, display value error	Wiring problem	Check for wiring.	Adjust flow meter O-ring to within range.
	Leak of the sensor installation part.	Check for leaks.	
	Condensation of the sensor installation part.	Heating heat is carried out.	
	Gas calibration error	Perform gas calibration	
	Sensor deterioration	Replace the sensor	
Analyzer output, display value is zero	Flammable gas included in sample gas	Eliminate flammable gas from sample gas	
	Sensor deterioration	Replace the sensor	
Analyzer output and display value do not match	Output adjustment is inaccurate	Perform output adjustment for CH027, 028	
	Output range is different.	Change output range (CH020). Check output range setting (CH030 - 037) and reset.	
	Receiver problem	Request repair by ENERGY SUPPORT CORP.	
Slow response	Sample gas flow rate is insufficient.	Readjust sample gas flow rate	In the case of sampling.
	Blockage of sample gas pipe	Clean pipe or install new pipe	
	Primary delay time setting value is too large (CH016)	Check CH016 data, set it to 0 sec	
	Sensor deterioration	Replace the sensor	

Phenomenon	Cause	Countermeasure	Remarks
E-01 displayed E-02 displayed E-03 displayed (ROM, RAM, EEROM error)	Receiver problem	Turn power OFF, then ON again after 10 sec. If operation is not restored, request repair by ENERGY SUPPORT CORP.	
E-04 displayed E-05 displayed E-06 displayed E-07 displayed E-20 displayed (Heater failure)	Sensor heater failure	Replace sensor.	With the error cause cleared (e.g. sensor replaced), press the ● key to clear the error display.
	Receiver problem	Request repair by ENERGY SUPPORT CORP.	
E-08 displayed E-09 displayed E-10 displayed E-11 displayed E-12 displayed E-13 displayed	Sensor failure	Replace sensor.	
	Receiver problem	Request repair by ENERGY SUPPORT CORP.	
E-14 displayed	Heater terminal (S+,S-) release	Check for wiring.	
E-21 displayed	Data is input outside possible input range	Input correct data inside input range.	
E-35,36,38, 45,46,47 display	Calibration error E-35:Zero Cal error E-36:Span Cal error E-38:Air Cal error E-45:Zero Cal error E-46:Air Cal error	Check calibration gas flow rate, and recalibrate.	
		Check that standard gas concentration setting is not incorrect, and recalibrate.	
		Replace sensor.	
E-60 displayed	Output ranges are all "Not in use"	Change setting of output range No.1 – 4 to other than "Not in use"	
E-63 displayed	"Not in use" range selected by range switching	Select range other than "Not in use" range.	

6. Reference Material

6-1 Standard Specifications

Model	DTF-201		
Measurement Principle	Zirconia limiting current method		
Measuring range	0 - 5, 10, 25% O_2		
Output	DC4 - 20 mA (non-insulated output, load resistance 600 Ω or less)		
	DC0 - 1 V (non-insulated output, load resistance 100 kΩ or more)		
Repeatability	±0.5% FS (0 – 5% O_2 : ±1% FS or less)		
Linearity	±1% FS (0 – 5% O_2 : ±1% FS or less)		
Response Time	10 sec. or less (90% response for calibration gas switching)		
Warming-up time	Approx.3 min		
Ambient temperature	0 - 50℃		
Humidity	90% RH or less		
Power	AC100-240V±10% 50/60Hz		
Conditions of Sample gas	O_2	%	-15 - 25
	CO_2	%	0 - 20
	H_2	%	$CO+H_2$: 15% or less
	CO	%	$H_2O > CO+H_2$ Besides, the thing which doesn't have combustible gas. It is heated when it has condensation.
	H_2O	%	
	SOx	ppm	500 or less
	NOx	ppm	500 or less
	HCl	ppm	1 or less
	NH_3	ppm	1 or less
	HF	ppm	1 or less
	Cl_2	ppm	1 or less
	Others		-
	N_2	%	Bal.

The contents of this manual are subject to change without notice for improvement.

ENERGY SUPPORT

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Inquiry form URL：https://www.energys.co.jp/english/inq/all.php
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