

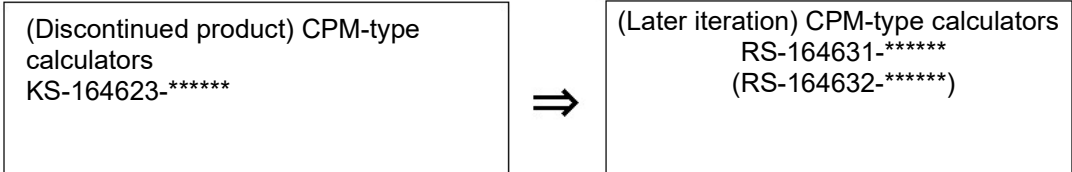
CP calculators  
**Instruction manual**




Be sure to read this instruction manual  
before handling the product.



To customers replacing the (discontinued) CP M-type calculators with the (later iteration) Be sure to check the instructions before assembly.





## Warning

Ignition, electric shock, or malfunction may occur.

The discontinued product differs with the later iteration in the terminal block number, wiring method, and terminal arrangement.

Perform wiring in accordance with the instruction manual after checking the terminal arrangement of the later iteration.

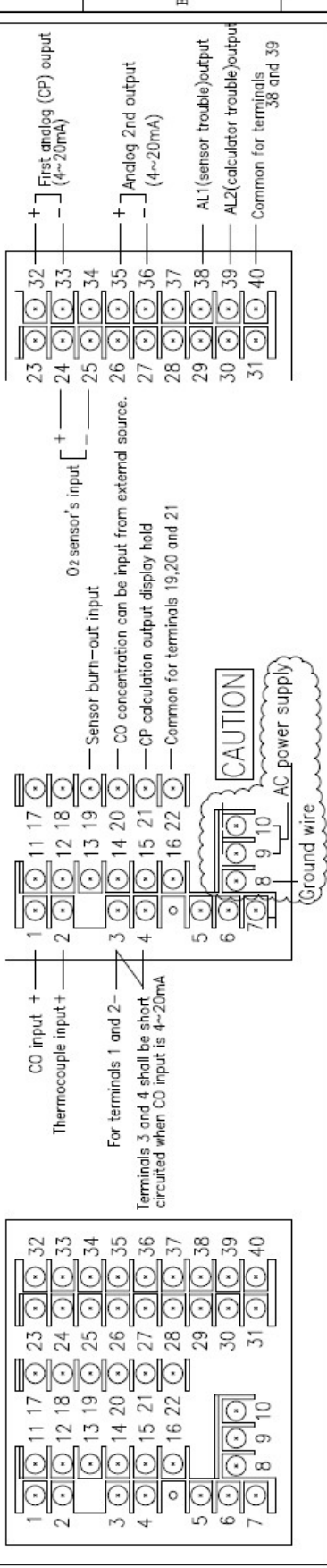
Differences with the (discontinued) CPM-type calculators

Part number	External dimension	Wiring connection	Mounting dimensions	Rated performance	Operation characteristics	Operation method
RS-164631-*****	×	×	△	⊙	⊙	○
(RS-164632-*****)	×	×	△	⊙	⊙	○

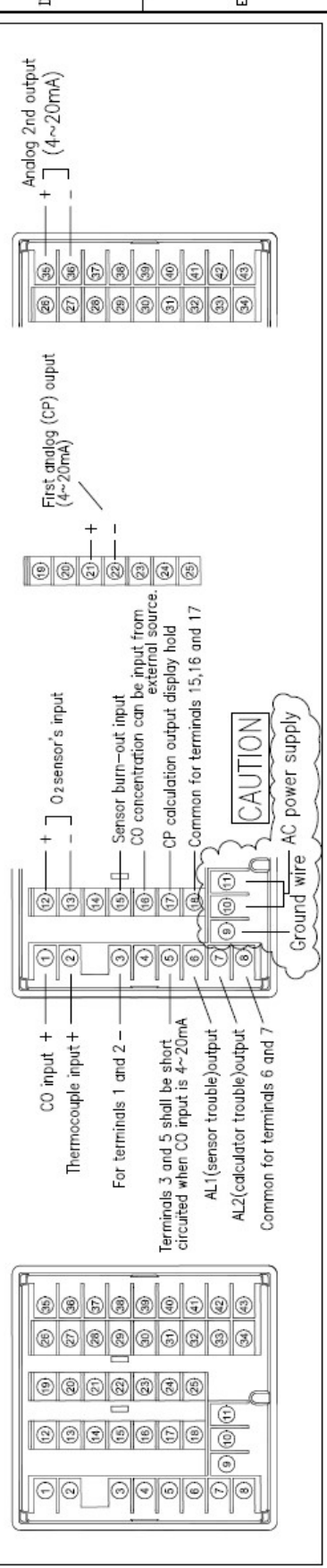
- ⊙: To be fully compatible
- : Almost no change
- △: To be fully compatible for single part mounting. No compatibility for CPC-IV
- ×: With change (For the wiring connection, see the terminal arrangement.)
- \* To prevent incorrect wiring, change the mark tube No. of the existing wiring.
- \* If the existing wiring is too short to be connected, add or change the wiring.

DRG.NO.

KS-164623-\*\*\*\*\*



RS-164631-\*\*\*\*\*



JAPAN	ENERGY SUPPORT CORP.	UNIT	1/2
	CP calculators CPM	DATE	
	connecting diagram		

S164631 226

KS-164623-\*\*\*\*\*  
RS-164631-\*\*\*\*\*

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## 1. Introduction

Thank you for purchasing the CP calculators CPM.

This instrument is a carbon potential calculators with an indication accuracy of  $\pm 0.1\%$  FS, an operation period of about 2 seconds, and the front face measuring 96×96 mm.

This machine features the digital command with a large and eye-friendly LED display and the interactive mode with a high-resolution dot matrix LCD display for settings.

Be sure to read this instruction manual in advance to understand the product thoroughly and prevent troubles.

### Request

**- To instrumentation dealers, installation dealers, and sales dealers -**

Be sure to provide the users of the product with this instruction manual.

**- To users of the product -**

Keep this instruction manual for future reference until the product is discarded.  
Be sure to record and save the settings.

### Product warranty

This product is warranted for a year after purchase. If the product goes out of order during its guarantee period under normal use in compliance with the notices specified in the instruction manual and the product adhesive label, the defect will be fixed for free of charge. In that case, please contact the supplier or the sales office nearest you.

However, repairing is offered at cost despite the guarantee period in the following circumstances.

1. Failure and damage due to misuse, misconnection, unauthorized repair, or modification
2. Failure and damage due to fire disaster, earthquake, wind and flood damage, lightning strike, other extraordinary natural phenomenon, pollution, salt damage, hazardous gas damage, use of abnormal voltage and non-designated power supply
3. Replacement of restricted parts and accessories

### Reminders

1. This manual shall not be copied or reproduced in whole or in part without permission.
2. The information in this manual is subject to change without notice.
3. We take all possible measures to ensure the reliability of this manual. Should you find any points not being quite clear, errors, or omissions, contact the sales office nearest you.
4. We are not responsible for the result of operation.

## ■ Points to be checked before use

After opening the package, be sure to check the following points before use. Should you find any points not being quite clear, please contact the supplier or the sales office nearest you.

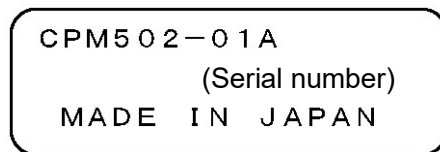
### 1. Checking of appearance

Check the external appearance of the product for damage.

### 2. Checking of format code

Check the format code of the product purchased for errors.

- ◆ Format code name plate and application place  
A name plate as shown below is applied to the upper surface of the product.



### 3. Checking of accessories

Check the following accessories supplied with the product.

Part name	Quantity	Remark
Mounting bracket	2 (complete set)	For panel mount
Instruction manual	1	This manual

When purchasing any accessories separately, these products may be supplied in some cases.

## Request

1. Be careful not to drop the product when unpacking it.
2. When transporting the product, place the product in a dedicated shipping carton and put the carton into a case lined with cushion.  
Thus, it is advisable to store dedicated shipping cartons.
3. When the product remains unused for a long period of time with the product detached from the final product (panel), place the product in a dedicated shipping carton and store it in a place less prone to dust generation in normal ambient temperature.
4. A protective sheet is applied to the display at the front of the product. Remove the protective sheet before using the product.



## 2. For your continued safety

For your continued safety, read and understand the following cautions.

### 2-1. Preconditions for use




This product is a component type unit installed to the indoor instrumentation panel. Do not use the product under other conditions.

Ensure the safety of the system by providing a fail-safe design and periodic inspection on the end product side before using the product. For the wire connection, adjustment, and operation of the product, ask a specialist having instrumentation knowledge.

In addition, the user must read this instruction manual to fully understand the cautions and basic operation of the product.

### 2-2. Symbol mark

Fully grasp the meaning of the following symbol marks indicated in the product body and this instruction manual.

Symbol mark	Meaning
 <b>Warning</b>	Explains about the cautions to avoid the possible danger of death or severe injury of the user.
 <b>Caution</b>	Explains about the cautions to avoid the possible danger of slight injury of the user or damage of the product or peripheral equipment.
	Ground terminal. Be sure to connect the ground terminal to the protective grounding.

## 2-3. Important instructions



### **Warning**

For preventing serious accident, be sure to read and understand the following instructions.

#### **1. Checking the power supply voltage and wire connection**

Before supplying the power supply, check for correct wire connection and grounding and make sure that the power supply voltage is set to the rated voltage.

#### **2. Installing the overcurrent protection device**

This product has no power supply switch. Provide the power supply for the product with an overcurrent protection device (such as breaker) consistent with rated specifications.

#### **3. Protecting the terminal**

For preventing electric shock, take safety measures on the terminal area of the product on the end product side so that the user cannot touch the area directly.

#### **4. Installing the safety device**

If a failure of this product and its peripheral equipment may cause serious loss to the facility to be used, install a safety device and provide a failsafe design on the end product side to avoid such possible damage.

Do not attempt to use the product with important facilities related to human life, nuclear energy, aerospace or aircraft.

#### **5. Avoiding putting your hand in the product's enclosure**

Do not put your hand or tools in the product's enclosure. You may receive an electric shock or be injured.

#### **6. Cutting off the power supply in case of doubt**

If foreign odor, abnormal noise or smoke is developed or the temperature is abnormally high, it is very dangerous. Cut off the power supply immediately and contact the supplier or the sales office nearest you.

#### **7. Avoiding repair and modification by yourself**

When repair or modification is necessary, contact the supplier or the sales office nearest you. Repair or modification such as replacing parts must be performed only by our authorized service technician.

#### **8. Observing the instruction manual**

To use the product properly and safely, observe this instruction manual. Note that we are not responsible for any charges for injury, damage, or lost income caused by misuse.

### 3. Format code list

#### C P M 5 0 2 - 0 (1) A

##### (1) Analog 2nd output method

- 1: PWM output method
- 2: DAC output method (with open-circuit check function at CO DC 0 to 1 volt input)

##### (2) Power supply voltage

: 100 to 240 volts AC

Refer to the following part number code when ordering or making inquiries.

Part number

RS-16463- - - - -

2nd output, other function	Symbol
PWM method	1
DAC method, CO:DC0=1 volt Input open-circuit check function	2

Thermocouple type	CP range %C	Symbol
K	0.3~1.3	1
	0.5~1.5	2
	0 ~1.0	3
	0 ~1.2	4
	0 ~2.0	5
	0 ~2.5	6
	0.1~1.1	7
	Other	0
R	0.3~1.3	A
	0.5~1.5	B
	0 ~1.0	C
	0 ~1.2	D
	0 ~2.0	E
	0 ~2.5	F
	0.1~1.1	G
	Other 0.1~1.1	Z

Carrier gas	CO%	H <sub>2</sub> %	
Butane	23.5	29.4	1
Propane	23.1	30.8	2
13A	20.7	37.8	3
Methanol	33.3	66.7	4
Other			Z

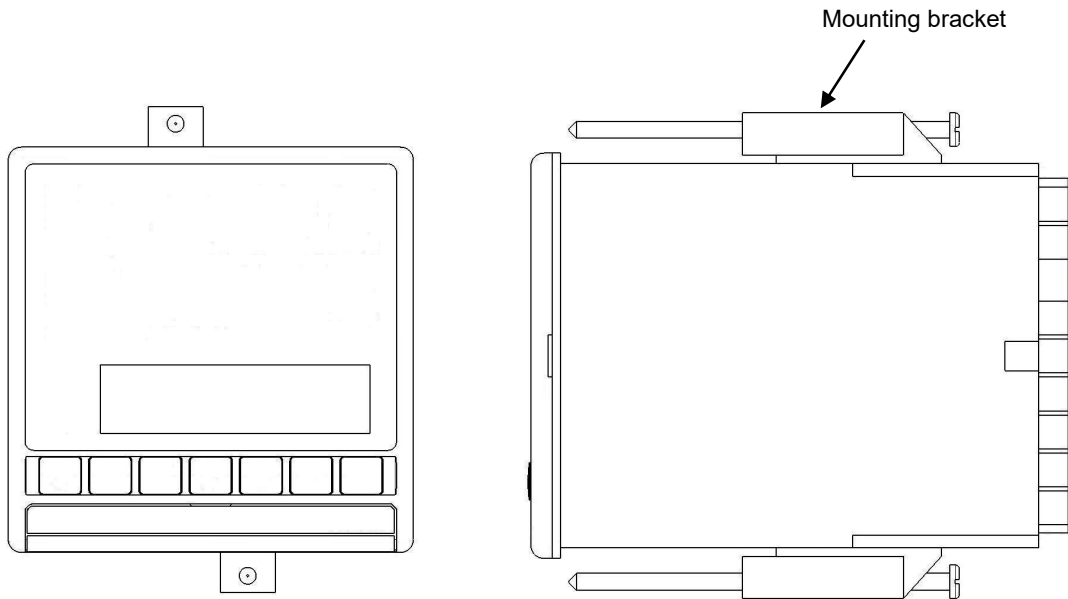
Detail of 2nd indicator display	Symbol
Temperature	1
CO concentration	2
Oxygen sensor electric power	3

2nd output range		Symbol
Temperature	0~1000°C	1
	0~1200°C	2
	200~1200°C	3
	その他	0
CO concentration	0~50%	4
	0~30%	5
	その他	Z
Oxygen sensor electric power	1000~1200mV	6
	0 ~1200mV	7
	その他	Y
CO <sub>2</sub> concentration	0~5%	A
	その他	C
DP value	-15~35°C	D
	Other	F

Input	CO external input range	
No	0~50%	1
4~20 mA	0~30%	2
	0~50%	3
	Other	0
0~1 V	0~30%	A
	0~50%	B
	Other	Z

## 4. Mounting and wire connection

### 4-1. External dimension



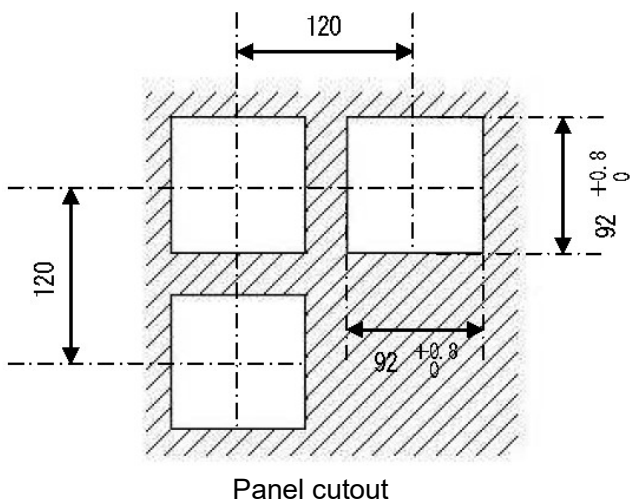
Unit: mm

### 4-2. Mounting

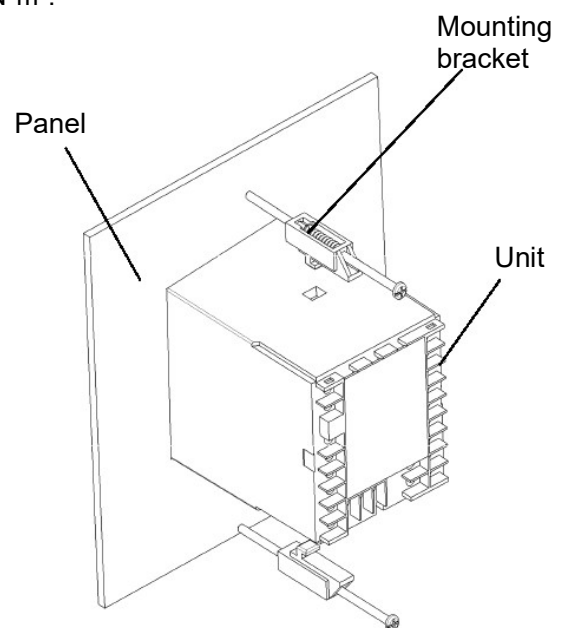
#### 4-2-1. Panel mounting dimensions and mounting method

##### 1. Normal mounting method

- (1) Insert the product into the panel cutout.
  - (2) Fit the supplied mounting brackets above and below and fasten the screws using a screwdriver to fix the product.
- The tightening torque of the screw is "0.6 - 0.8 N·m".



Unit: mm



## 4-2-2. Installation conditions



### Caution

For preventing accident, be sure to read and understand the following instructions.

#### 1. Environment

- (1) Interior
- (2) Out of direct sunlight
- (3) Away from high temperature
- (4) Free from vibration or impact
- (5) Away from liquid (such as water)
- (6) Free from dew formation
- (7) Under condition of "over voltage category II, pollution degree 2" based on the EN standard

#### 2. Ambience

- (1) Free from strong noise, static electricity, electric field, or magnetic field
- (2) Within an ambient temperature of -10 to 50°C (within 40°C during fit instrumentation), within an ambient humidity of 10 to 90% RH
- (3) Small temperature fluctuations
- (4) Free from corrosive gas, explosive gas, flammable gas, or combustible gas
- (5) Free from salt, iron, or conductive materials (such as carbon, iron)
- (6) Free from vapor, oil, chemicals
- (7) Free from dirt or dust
- (8) Away from high heat generating object
- (9) Not filled with heat
- (10) Wide space above the product
- (11) Free from wind

#### 3. Mounting position

- (1) The installation elevation shall be 2000 m or lower above sea level.
- (2) The mounting position shall be approx. 1.5 meters (around the eye level).
- (3) The mounting posture shall be  $\pm 10^\circ$  or less in front-back direction, and  $\pm 10^\circ$  or less in longitudinal direction.

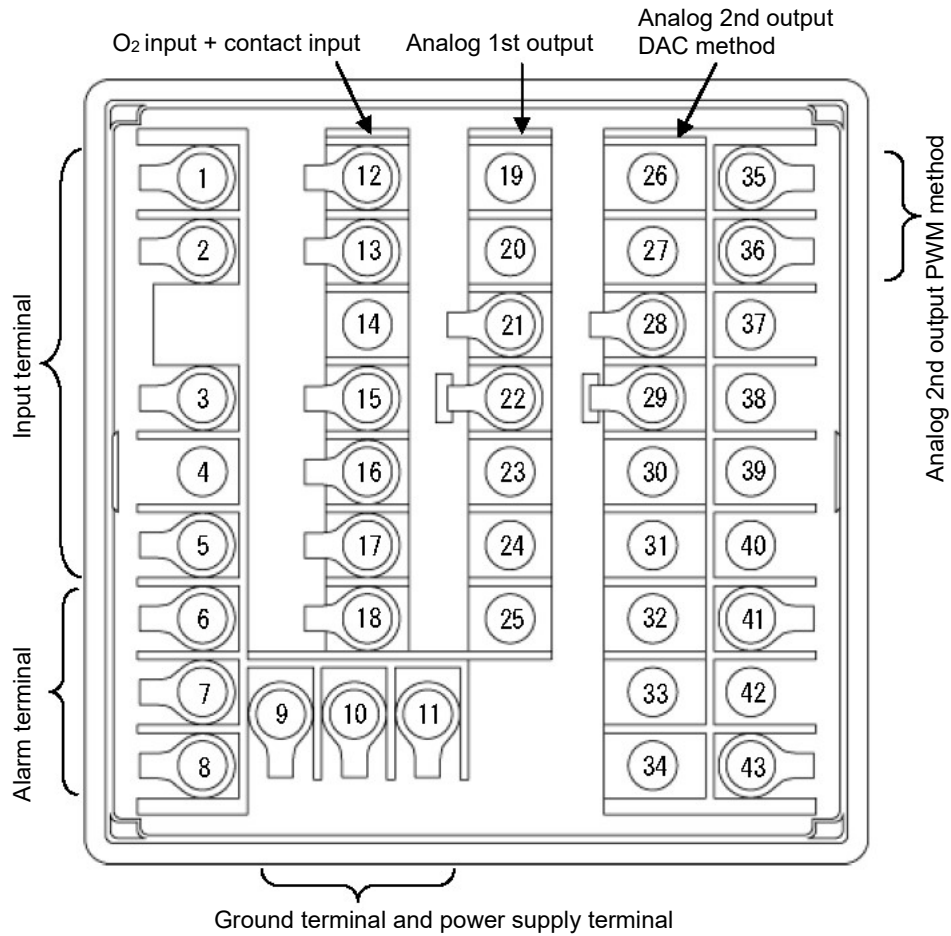
#### 4. Others

- (1) Do not wipe the product with organic solvent (such as alcohol).
- (2) Do not use a portable phone near the product to prevent misoperation.
- (3) Note that the product may cause disturbance to the nearby television or radio.

### 4-3. Wire connection

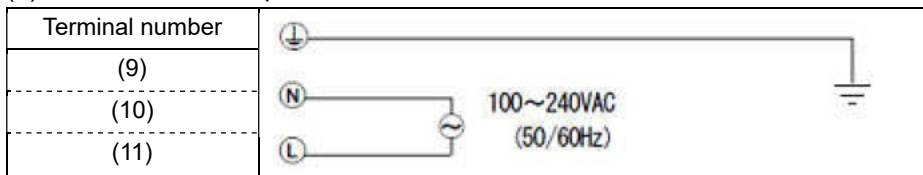
#### 4-3-1. Terminal number and function

Some terminals have no imbedding of terminal screws depending on the product specifications.



#### 1. Power supply terminal

##### (1) General current specifications



2. Input terminal

Terminal number	Thermocouple K, R	CO input 0 to 1V	CO input 4 to 20mA
(1)		(+)	(+)
(2)	(+)		
(3)	(-)	(-)	(-)
(4)			
(5)			(-)

3. O<sub>2</sub> input Mounting bracket

Terminal number	Function
(12)	(+)
(13)	(-)
(14)	
(15)	Sensor is burnout
(16)	CO concentration external input variable
(17)	Computation output display hold
(18)	COM

4. Analog 1st output

Terminal number	Function
(19)	
(20)	
(21)	(+)
(22)	(-)
(23)	
(24)	
(25)	

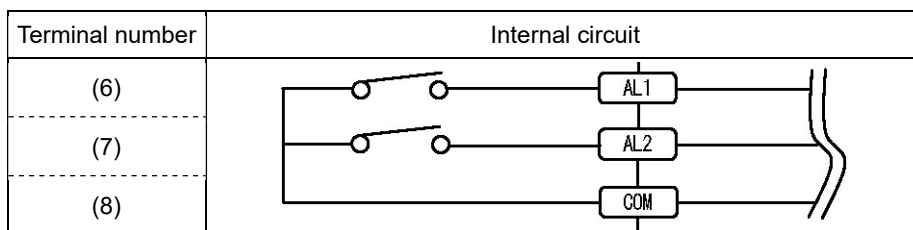
5. Analog 2nd output DAC method

Terminal number	Function
(26)	
(27)	
(28)	(+)
(29)	(-)
(30)	
(31)	
(32)	
(33)	
(34)	

6. Analog 2nd output PWM method

Terminal number	Function
(35)	(+)
(36)	(-)
(37)	
(38)	
(39)	
(40)	

7. Alarm terminal



Note) Common (COM) terminal common to AL1/AL2.



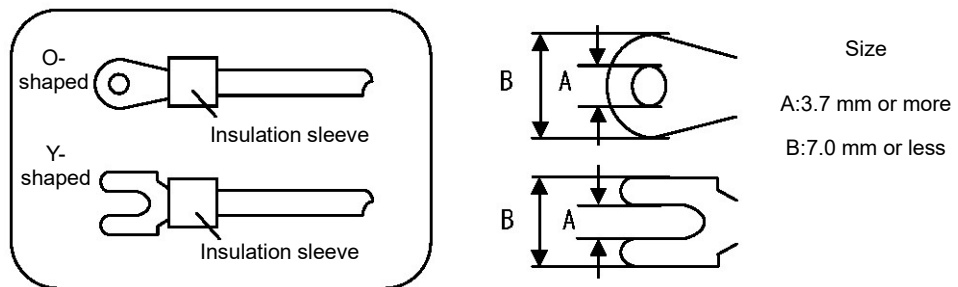
## 4-3-2. Basic of wire connection



For preventing accident, be sure to read and understand the following instructions.

### 1 Connection to terminal

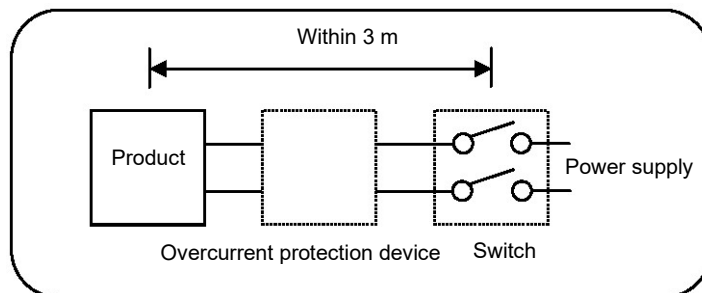
- (1) For wire connection to the terminals, use crimp terminals with insulation sleeve. For the power supply terminals and ground terminals, be sure to use O-shaped terminals for security. It is advisable to employ O-shaped terminals in other cases.



- (2) The tightening torque of the terminal screw is "0.6 - 0.8 N·m". When applying the torque exceeding this value, note that the terminal screw will be broken.

### 2. Power supply terminal

- (1) Provide the power supply with a switch and an overcurrent protection device consistent with the product's rated specifications near at hand within 3 meters.



- (2) For power supply wiring, use wires either equaling or surpassing 600V grade polyvinyl chloride insulated wires (rated 1AAC or higher).
- (3) To prevent misoperation, use a good-quality single-phase power supply less prone to noise, waveform distortion, or voltage fluctuation. In case of a lot of noise, take measures by inserting a noise filter or isolation transformer.
- (4) Be careful that slight leakage current passes in the ground terminal at the rated power supply. The leakage current is approx. 1 mA.



To prevent serious accident, be sure to turn off the product before starting wire connection work.

### 3. Input terminal

- (1) The maximum allowable inputs of the input terminal shall be as follows. Be careful not to apply input exceeding these values. An incorrect application causes the product to fail or results in significant degradation or misoperation.
  - Thermocouple, voltage mV, voltage V:  $\pm 20$  volts or less
  - Current mA:  $\pm 30$  mA or less, or  $\pm 7.5$  volts or less
- (2) The parallel connection of the input is not allowed. Inobservance causes measurement errors and unstable control, thereby leading to non-conformity in the system as a whole.
- (3) For the thermocouple, establish connection up to the product's input terminal using the thermocouple or compensating wire.
- (4) For the resistance thermodetector, be sure to use the cords having the same resistance value to prevent measurement error. Note that the burnout detector is not provided with the four-wire system.
- (5) When connecting the protection element such as Zener barrier for input protection, large measurement errors may occur.  
Be sure to check the combination of protection elements and fully observe the product's specifications values of allowable signal source resistance and allowable wiring resistance.

### 4. Output terminal

- (1) Use the output terminals within the rated range. Connecting a load out of the rated range leads to a failed product, significant degradation or misoperation.

### 5. Alarm terminal

- (1) Use the alarm terminal within the rated range. Applying a load out of the rated range leads to a failed product, significant degradation or misoperation.
- (2) Be sure to connect a load with the alarm terminal through the buffer relay. In addition, be sure to provide the buffer relay coil side with a contact protection element in order to protect the product internal relay contact and reduce noise.

### 6. Optional terminal

- (1) Use the optional terminals within the rated range. Applying a load out of the rated range leads to a failed product, significant degradation or misoperation.

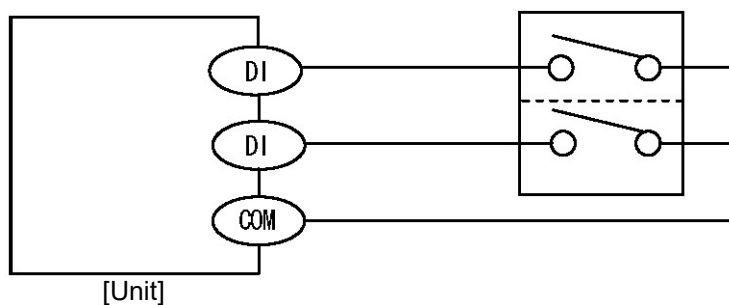


#### **Caution**

- (1) Establishing a connection with a power supply out of the rated range leads to a failed product, significant degradation or misoperation.
- (2) Applying overcurrent or over voltage to the input/output terminal of the unit leads to a failed product, significant degradation or misoperation.

### 4-3-3. Example of wire connection

#### 1. Example of contact input wire connection



As shown in the left figure, approx. 5V/2 mA is applied to the switch. Be careful about the contact capacity.

The contact inputs start to operate by establishing a short circuit between the designated terminal and the common (COM) terminal. Although it is common to use the switch or relay, the contact inputs can be operated with open collector output signals from the peripheral equipment.

#### 4-3-4. Wire connection precaution



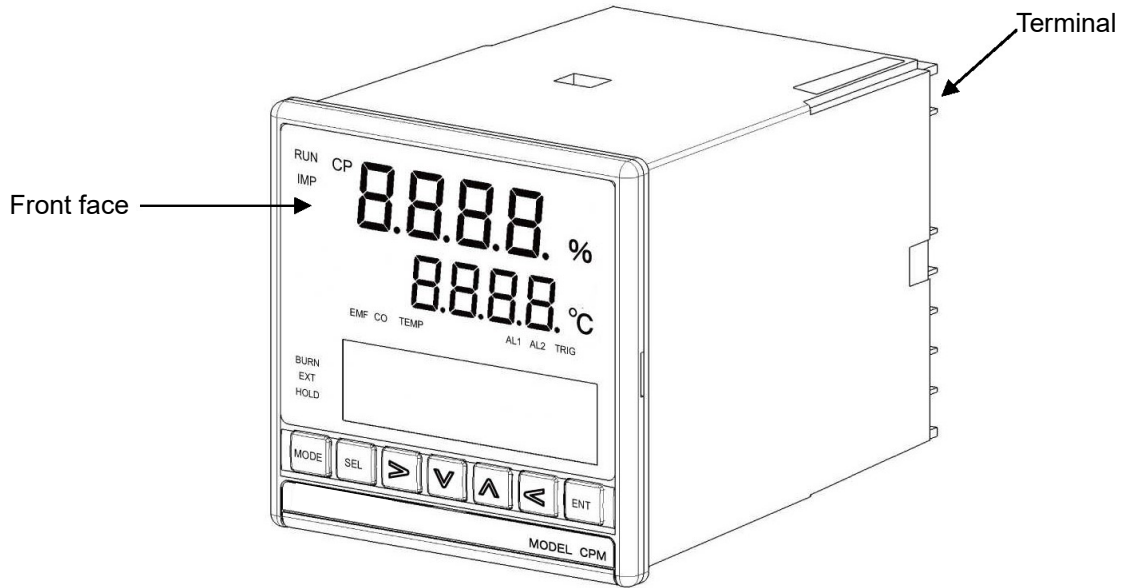
### Warning

For preventing serious accident, be sure to read and understand the following instructions.

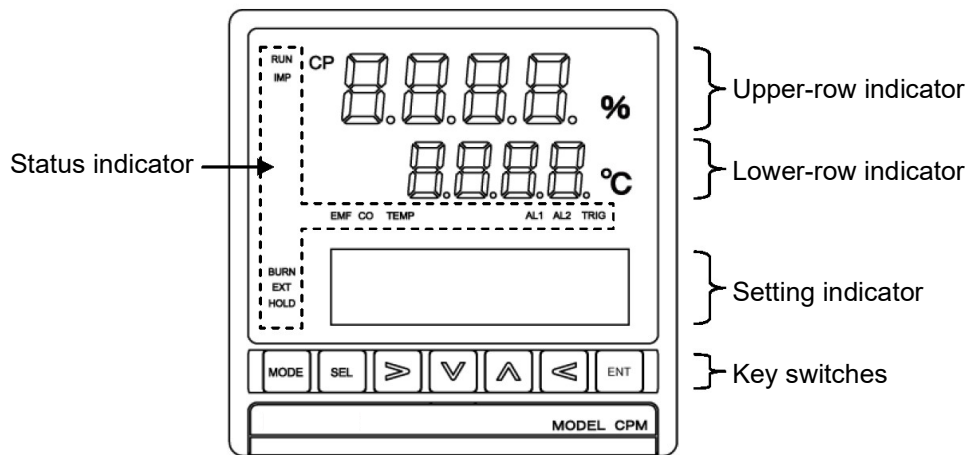
1. Wire connection shall be performed by a specialist.  
Wire connection shall be performed by a worker having the basic knowledge of instrumentation and operational experience.
2. Attaching the terminal cover  
After the completion of wire connection, take measures for safety so that the user cannot touch the unit terminals directly.  
The dedicated terminal cover is prepared as an accessory (optional).
3. Separating from intense electric circuit and noise source  
Do not install the product near the equipment that serves as a noise source (such as magnet relay, motor, thyristor regulator, inverter) to avoid adverse effect due to noise. Separate the wiring of the product from that of these devices without installing in the same duct.  
Take measures against noise as needed.
4. Be careful about the ground terminal connection.  
Good-quality grounding (earth) is of importance in ensuring reliability of the end product as a whole. Generally, it is desirable that each device is connected with a single point grounding. The product is prone to noise in the case of separate grounding. Extra care must be exercised with the grounding route.
5. Separating from heat sources  
Do not install the product near any heat sources in order to avoid adverse effect due to high temperature. A heat source near the product may cause measurement errors or eventually shorten its life. Be careful about the ambient temperature of the product.  
If the product is installed in a place exposed to wind or sharp change in ambient temperature, measurement errors will occur. Avoid such ambient environment.
6. Unused terminal  
Do not connect anything to unused terminals. Failure to observe this causes malfunction.
7. Measures against incorrect output at turn-on  
When the power is turned on, output-related signals are output instantaneously in some cases before the product starts correctly.  
Take measures using an external circuit as needed.

## 5. Parts names

### 5-1. General overview



### 5-2. Front face overview



Name	Function
Upper-row indicator	Displays the CP computation value.
Lower-row indicator	Displays any of EMF value, CO value, and temperature.
Key switches	Used for setting of parameters. The key backlight (blue) lights up (at initialization) when the power is turn on or any key is pressed. When the keys remain unused for about 30 seconds or more, the backlight turns off automatically. Although the backlight turns dark blue in some portions due to uneven luminance, you can use the unit safely because it functions unhindered.

### 5-3. Details of front face

#### 5-3-1. Upper-row indicator

The upper-row indicator displays the CP computation value. When any input value listed in the table below is entered to the CP value, you will see over-range or under-range display.

Parameter	Input value	Display type	Instruction
CP value	Under 0.000	Under	----
	Over 9.999	Over	----

#### 5-3-2. Lower-row indicator

Any of the EMF value, CO value, or temperature can be displayed in the lower-row indicator with a key operation. When any input value listed in the table below is entered to the parameters, you will see over-range or under-range display.

Parameter	Input value	Display type	Instruction
EMF value	Under -260	Under	----
	Over 1660	Over	----
Temperature	Under R -85°C	Under	----
	Over R 1785°C	Over	----
	Under K -60°C	Under	----
	Over K 1260°C	Over	----
CO value	Under 0	Under	----
	Over 99.99	Over	----

When the power is turned on, the start screen appears for three seconds.








#### 5-3-3. Status indicator

The type, light color, and description of the status indicators are shown in the table below.

Type	Light color	Description
RUN	Blue green	Lights up during CP computation and goes out during impedance check.
IMP	Green	Lights up during impedance check.
BURN	Green	Lights up when the sensor burnout signal is turned on.
EXT	Green	Lights up when the CO concentration external input go/no-go signal is turned on.
HOLD	Green	Lights up when the computation output display hold is turned on.
EMF	Green	Lights up when EMF is displayed in the lower-row indicator.
CO	Green	Lights up when the CO concentration is displayed in the lower-row indicator.
TEMP	Green	Lights up when the temperature is displayed in the lower-row indicator.
AL1	Red	Lights up when AL1 is turned on.
AL2	Red	Lights up when AL2 is turned on.


### 5-3-4. Key switches



Name	Function
	Use to switch between the measurement screen and the mode screen of mode 0, and between the setup screen and the mode screen.
	Use to switch the measurement screen and the setup screen.
	Use to move the cursor or select the item.
	Use to descent the set value (or setting item).
	Use to ascend the set value (or setting item).
	Use to move the cursor in reverse or select the item.
	Use to register the setting.

## 6. Measurement screen

### 6-1. Setting indicator

The display of the setter can be switched from EMF to TEMP, CO, and CO<sub>2</sub>, in that order by pressing the  key with the measurement screen displayed.

Displays the measured value set in MODE1 for other than the setup modes or errors. The setting indicator can be turned off with a key operation.

The display returns to the default value in 10 seconds after the completion of operation.

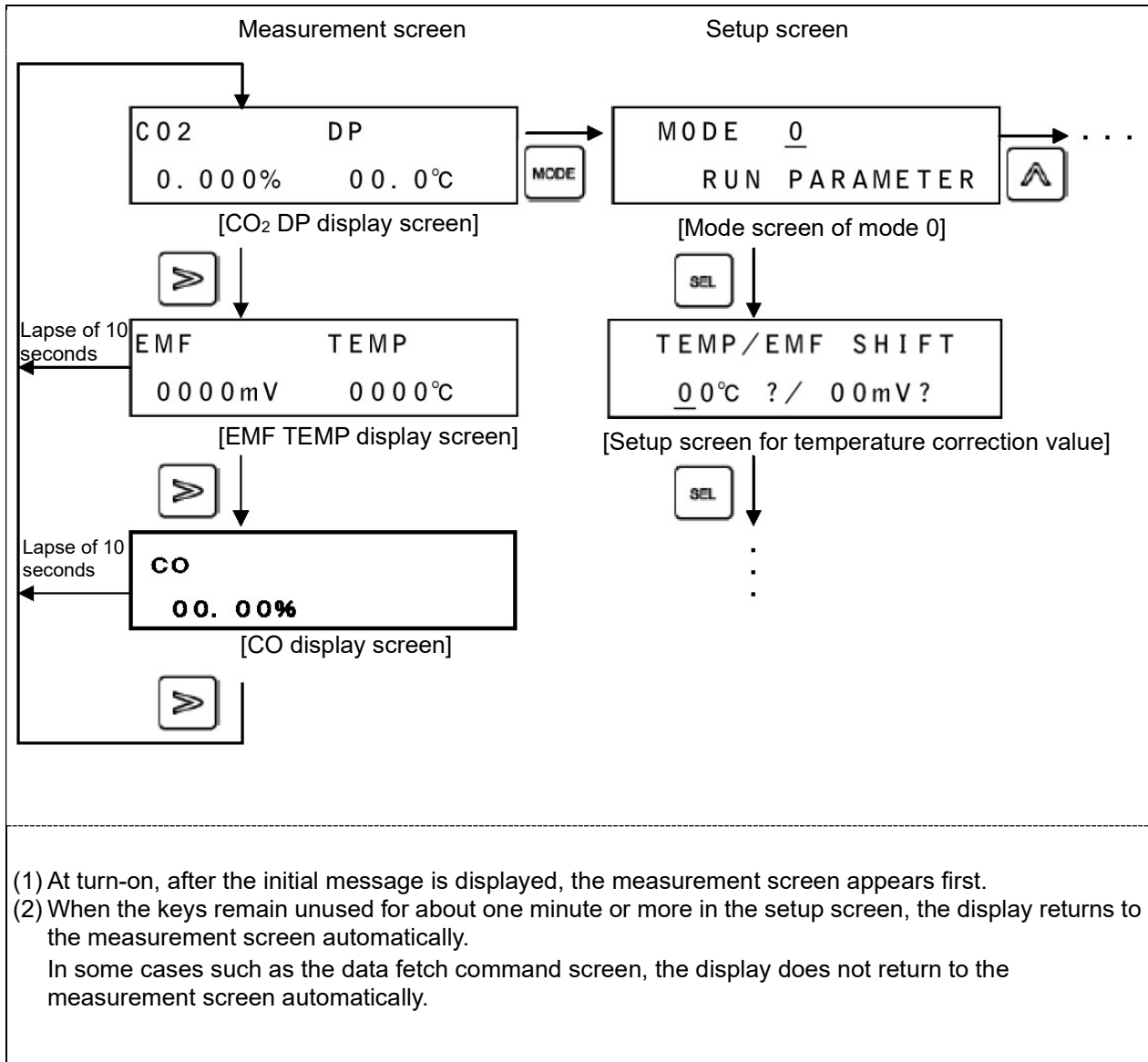
The units of the upper-row and lower-row are percent (%) and centigrade (°C), respectively. As replacement name plates for lower-row indicator, the mV and % seals are supplied with the product. When the CO<sub>2</sub> or DP value exceeds the range as shown below, the numerical value flashes.

Measurement screen	Explanation of screen																								
<p>[CO<sub>2</sub> DP display]</p> <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">C O 2</td> <td style="text-align: center;">D P</td> </tr> <tr> <td style="text-align: center;">0 . 0 0 0 %</td> <td style="text-align: center;">0 0 . 0 °C</td> </tr> </table>	C O 2	D P	0 . 0 0 0 %	0 0 . 0 °C	<p>When the CO<sub>2</sub> value or DP value exceeds the range shown in the table below, the numerical value flashes.</p> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Parameter</th> <th>Calculation result value</th> <th>Indicated value(CO<sub>2</sub>disp)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">CO<sub>2</sub></td> <td style="text-align: center;">CO<sub>2</sub>&lt;0.000</td> <td style="text-align: center;">0.000</td> </tr> <tr> <td style="text-align: center;">CO<sub>2</sub>&gt;50.000</td> <td style="text-align: center;">99.999</td> </tr> </tbody> </table> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Parameter</th> <th>Calculation result value</th> <th>Indicated value(DPdisp)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">DP</td> <td style="text-align: center;">DP&lt;-50°C</td> <td style="text-align: center;">-99.9</td> </tr> <tr> <td style="text-align: center;">DP&gt;50°C</td> <td style="text-align: center;">99.9</td> </tr> </tbody> </table>	Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)	CO <sub>2</sub>	CO <sub>2</sub> <0.000	0.000	CO <sub>2</sub> >50.000	99.999	Parameter	Calculation result value	Indicated value(DPdisp)	DP	DP<-50°C	-99.9	DP>50°C	99.9				
C O 2	D P																								
0 . 0 0 0 %	0 0 . 0 °C																								
Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)																							
CO <sub>2</sub>	CO <sub>2</sub> <0.000	0.000																							
	CO <sub>2</sub> >50.000	99.999																							
Parameter	Calculation result value	Indicated value(DPdisp)																							
DP	DP<-50°C	-99.9																							
	DP>50°C	99.9																							
<p>[EMF TEMP display]</p> <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">E M F</td> <td style="text-align: center;">T E M P</td> </tr> <tr> <td style="text-align: center;">0 0 0 0 m V</td> <td style="text-align: center;">0 0 0 0 °C</td> </tr> </table>	E M F	T E M P	0 0 0 0 m V	0 0 0 0 °C	<p>When the EMF value or temperature exceeds the range shown in the table below, the numerical value flashes.</p> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Parameter</th> <th>Calculation result value</th> <th>Indicated value(CO<sub>2</sub>disp)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">EMF</td> <td style="text-align: center;">EMF &lt;-160(MV)</td> <td style="text-align: center;">-9999</td> </tr> <tr> <td style="text-align: center;">DP&gt;1660(MV)</td> <td style="text-align: center;">9999</td> </tr> </tbody> </table> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Parameter</th> <th>Calculation result value</th> <th>Indicated value(TEMPdisp)</th> </tr> </thead> <tbody> <tr> <td rowspan="4" style="text-align: center;">TEMP</td> <td style="text-align: center;">R&lt;-85°C</td> <td style="text-align: center;">-9999</td> </tr> <tr> <td style="text-align: center;">R&gt;1785°C</td> <td style="text-align: center;">9999</td> </tr> <tr> <td style="text-align: center;">K&gt;-60°C</td> <td style="text-align: center;">-9999</td> </tr> <tr> <td style="text-align: center;">K&gt;1260°C</td> <td style="text-align: center;">9999</td> </tr> </tbody> </table>	Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)	EMF	EMF <-160(MV)	-9999	DP>1660(MV)	9999	Parameter	Calculation result value	Indicated value(TEMPdisp)	TEMP	R<-85°C	-9999	R>1785°C	9999	K>-60°C	-9999	K>1260°C	9999
E M F	T E M P																								
0 0 0 0 m V	0 0 0 0 °C																								
Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)																							
EMF	EMF <-160(MV)	-9999																							
	DP>1660(MV)	9999																							
Parameter	Calculation result value	Indicated value(TEMPdisp)																							
TEMP	R<-85°C	-9999																							
	R>1785°C	9999																							
	K>-60°C	-9999																							
	K>1260°C	9999																							
<p>[CO display]</p> <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">C O</td> </tr> <tr> <td style="text-align: center;">0 0 . 0 0 %</td> </tr> </table>	C O	0 0 . 0 0 %	<p>When the CO value exceeds the range shown in the table below, the numerical value flashes.</p> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Parameter</th> <th>Calculation result value</th> <th>Indicated value(CO<sub>2</sub>disp)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">CO</td> <td style="text-align: center;">CO&lt;0.00</td> <td style="text-align: center;">0.00</td> </tr> <tr> <td style="text-align: center;">CO&gt;99.99</td> <td style="text-align: center;">99.99</td> </tr> </tbody> </table>	Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)	CO	CO<0.00	0.00	CO>99.99	99.99														
C O																									
0 0 . 0 0 %																									
Parameter	Calculation result value	Indicated value(CO <sub>2</sub> disp)																							
CO	CO<0.00	0.00																							
	CO>99.99	99.99																							



## 6-2. Measurement screen and setup screen

The relation between the measurement screen and setup screen is as follows.



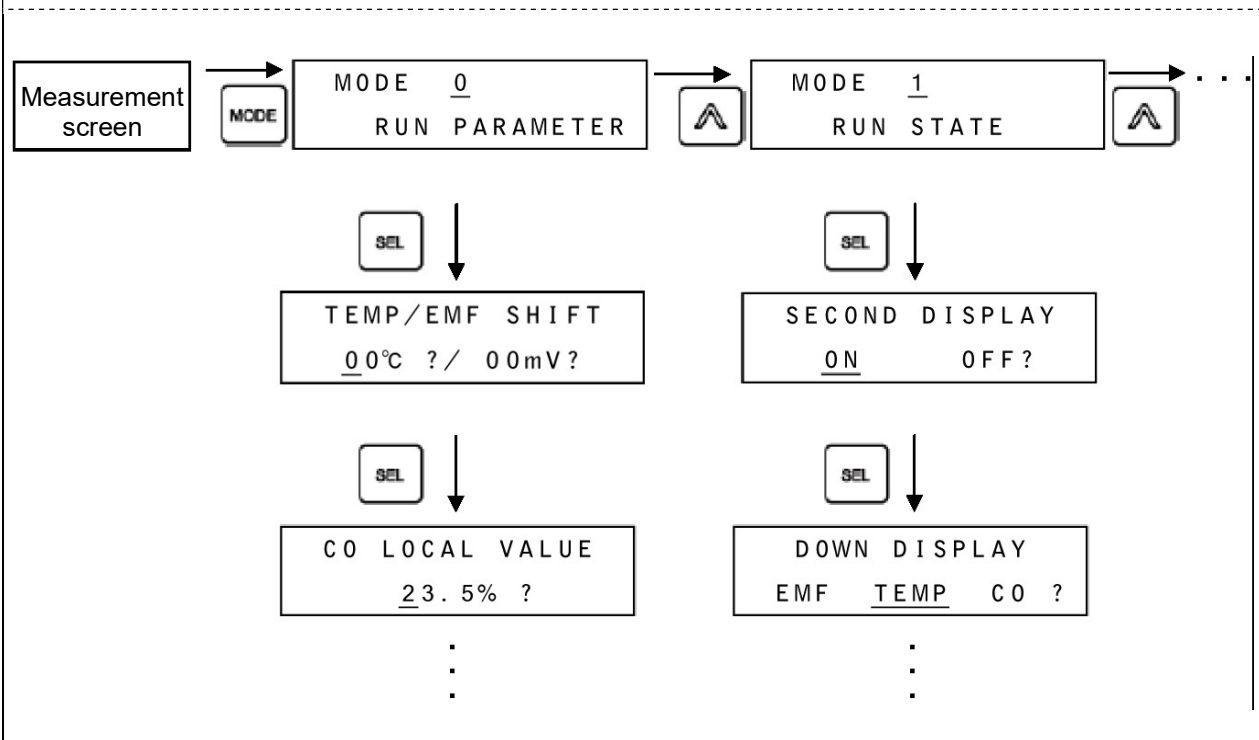
## 7. Setup screen

### 7-1. Basic of setting






#### 7-1-1. Calling of setup screen












(1) The setup screens are grouped by mode as shown in "14. Parameter directory list". Check the setup screen to be called for its mode number and position in a sequence.

(2) Use the **MODE** key to switch the measurement screen and mode screen. Use the **▲** key to select the mode screen. Use the **SEL** key from the mode screen to select the setup screen. Measurement screen








## 7-1-2. Basic operation of setup screen

Change the value or select the item using the , , , and  keys in the setup screen. The setting is completed by pressing the  key completes.



Example of basic operation	
<p>1. Example of value setting</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">           TEMP/EMF SHIFT            00°C ? / 00mV?         </div>	<p>(1) Use the · keys to move the cursor to the digit in which the value is to be changed.</p> <p>(2) Use the · keys to set a desired value. A question "?" mark appears.</p> <p>(3) The value is registered by pressing the  key. The question "?" mark disappears.</p>
<p>2. Example of item setting (1)</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">           SECOND OUT            TEMP ?         </div>	<p>(1) Use the · keys to set a desired item. A question "?" mark appears.</p> <p>(2) The item is registered by pressing the  key. The question "?" mark disappears.</p>
<p>3. Example of item setting (2)</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">           SECOND DISPLAY            ON OFF ?         </div>	<p>(1) Use the · keys to set a desired item. A question "?" mark appears.</p> <p>(2) The item is registered by pressing the  key. The question "?" mark disappears.</p>

To speed up the setting operation, a useful key operation method is available as shown below.

<p>1. Cursor fast forward</p> <p>(1) Normally, the cursor moves on a digit-by-digit basis with the press of the  key. However, the cursor moves on a setting item basis with the press of the  key.</p> <p>(2) For example, the cursor moves as shown below in the setup screen for EMF and temperature correction each time the  key is pressed.</p> <div style="display: flex; align-items: center; justify-content: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">           TEMP/EMF SHIFT            00°C ? / 00mV?         </div> <div style="text-align: center; margin-right: 10px;">    </div> <div style="border: 1px solid black; padding: 5px; margin-left: 10px;">           TEMP/EMF SHIFT            00°C ? / 00mV?         </div> </div>
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## 7-2. Mode 0




In mode 0, you can check or change the parameters.

Measurement screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">           MODE <u>0</u>            RUN PARAMETER         </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px;">           MODE <u>0</u> Lock            RUN PARAMETER         </div>	<p>(1) Mode screen in mode 0</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 0.</p>
<p>2. Temperature correction value</p> <div style="border: 1px solid black; padding: 5px;">           TEMP/EMF SHIFT            00°C ?/ <u>00</u>mV?         </div>	<p>(1) Function to bring the EMF and measurement temperature to the true value.  <math>\text{Measurement temperature} + \text{Temperature correction value} = \text{True value}</math> This value is used for display and computation.</p> <p>(2) The setting range extends from -99 to 99°C.</p>
<p>3. CO concentration local set value</p> <div style="border: 1px solid black; padding: 5px;">           CO LOCAL VALUE  <u>23.5</u>% ?         </div>	<p>(1) In this screen, you can manually set the CO concentration for CP computation in the normal mode.</p> <p>(2) The setting range extends from -0.0 to 99.9%.</p>
<p>4. H<sub>2</sub> concentration local set value</p> <div style="border: 1px solid black; padding: 5px;">           H2 LOCAL VALUE  <u>29.4</u>% ?         </div>	<p>(1) In this screen, you can manually set the H<sub>2</sub> concentration for DP computation.</p> <p>(2) The setting range extends from -0.0 to 99.9%.</p>
<p>5. CP first-order lag constant</p> <div style="border: 1px solid black; padding: 5px;">           CP TIME - LAG  <u>0000</u>sec ?         </div>	<p>(1) This is the constant for first-order lag computation of CP output.</p> <p>(2) The setting range extends from 0 to 9999 seconds.</p>
<p>6. CO first-order lag constant</p> <div style="border: 1px solid black; padding: 5px;">           CO TIME - LAG  <u>0000</u>sec ?         </div>	<p>(1) This is the constant for first-order lag computation of CO input.</p> <p>(2) The setting range extends from 0 to 9999 seconds.</p>
<p>7. Number of input average filters</p> <div style="border: 1px solid black; padding: 5px;">           INPUT AVE FILTER  <u>05</u> ?         </div>	<p>(1) This is the constant for the average filters of temperature, EMF, and CO inputs.</p> <p>(2) The setting range extends from 1 to 10 times.</p> <p>(3) This function dampens a sharp change in the measured value.</p>

<p>8. Temperature moving average time</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> TC RUNNING AVERAGE  <u>00</u>min ? </div>	<p>(1) For the temperature data to be used for CP computation, etc., you can use the moving average data within a given time specified based on the data buffered on a minute-by-minute basis.</p> <p>(2) The setting range extends from 0 to 30 minutes.</p> <p>(3) When set to 0 minute, the function of temperature moving average is disabled.</p>
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### 7-3. Mode 1

In mode 1, you can check or change the state of the normal mode.

Measurement screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> MODE <u>1</u>  RUN STATE </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> MODE <u>1</u> Lock  RUN STATE </div>	<p>(1) Mode screen in mode 1</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 1.</p>
<p>2. Setting indicator display/shutoff</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SECOND DISPLAY  <u>ON</u> OFF? </div>	<p>(1) When setting to the ON position, the CO<sub>2</sub> or DP value on the measurement screen appears.</p> <p>(2) When setting to the OFF position, the CO<sub>2</sub> and DP value on the measurement screen will be shut off.</p>
<p>3. Lower-row display item switching</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> DOWN DISPLAY  EMF <u>TEMP</u> CO ? </div>	<p>(1) Select the data to be displayed in the lower LED from among three types of inputs - EMF, temperature, and CO.</p>
<p>4. 2nd analog output item switching</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SECOND OUT  <u>TEMP</u> ? </div>	<p>(1) Select a data to be output to the 2nd analog output from among EMF, temperature, CO, CO<sub>2</sub> and DP.</p>
<p>5. Temperature display output real/movement switching</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> TEMPERATURE OUT  <u>REAL</u> AVERAGE ? </div>	<p>(1) REAL displays the temperature measured in real time and outputs the displayed value as an analog signal.</p> <p>(2) AVERAGE displays the temperature moving average value and outputs the displayed value as an analog signal.</p>
<p>6. Sensor abnormal reset</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> PV ERROR RESET  ON <u>OFF</u> ? </div>	<p>(1) Set to the ON position and press the  key to activate the sensor abnormal reset. Switched to the OFF position automatically when sensor abnormal reset processing is completed.</p>



## 7-4. Mode 2

In mode 2, you can execute the command to the automatic correction mode.

Measurement screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">           MODE <u>2</u>            AUTO CORRECT         </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px;">           MODE <u>2</u> Lock            AUTO CORRECT         </div>	<p>(1) Mode screen in mode 2</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 2.</p>
<p>2. Corrective data selection</p> <div style="border: 1px solid black; padding: 5px;">           EMF CORRECT  <u>CP</u> CO2 DP ?         </div>	<p>(1) Select the correction value for automatic correction from among three types of inputs - CP, CO<sub>2</sub>, and DP.</p>
<p>3. First data fetch command</p> <div style="border: 1px solid black; padding: 5px;">           FIRST INPUT            START OK?         </div>	<p>(1) Pressing the  key causes the first data fetch command to be sent, allowing the instrument to register the fetched data to the first data area.</p> <p>(2) The first data can be checked in the mode 3 screen.</p> <p>(3) You cannot send the command without pressing the  key.</p> <p>(4) Automatic recovery is disabled in this screen.</p>
<p>4. Second data fetch command</p> <div style="border: 1px solid black; padding: 5px;">           SECOND OUT  <u>TEMP</u> ?         </div>	<p>(1) Pressing the  key causes the second data fetch command to be sent, allowing the instrument to register the fetched data to the second data area.</p> <p>(2) The second data can be checked in the mode 3 screen.</p> <p>(3) You cannot send the command without pressing the  key.</p> <p>(4) Automatic recovery is disabled in this screen.</p>
<p>5. Automatic correction operation start order</p> <div style="border: 1px solid black; padding: 5px;">           EMF CORRECT            START OK?         </div>	<p>(1) Check the first and second data in the mode 3 screen.</p> <p>(2) Pressing the  key causes the automatic correction operation start command to be sent, allowing the instrument to start automatic correction. The Ka, Kb, and A required in automatic correction operation are registered in the present correction factor area.</p> <p>(2) You can check the Ka, Kb, and A in the mode 3 screen.</p> <p>(3) You cannot send the command without pressing the  key.</p> <p>(4) Automatic recovery is disabled in this screen.</p>

## 7-5. Mode 3

In mode 3, you can check and change the parameters for automatic correction mode.





Measurement screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">           MODE <u>3</u>            PARA AUTO CORRECT         </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px;">           MODE <u>3</u> Lock            PARA AUTO CORRECT         </div>	<p>(1) Mode screen in mode 3</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 3.</p>
<p>2. This time first EMF/temperature</p> <div style="border: 1px solid black; padding: 5px;">           NOW1 EMF = <u>0</u>000 mV ?            T = 0000°C ?         </div>	<p>(1) Displays the EMF value and temperature value registered in the present first data area. You can also change the settings.</p> <p>(2) The setting range is as follows. EMF: 0 to 1500 mV, T: 0 to 1200°C (when K is selected), 0 to 1700°C (when R is selected)</p>
<p>3. This time first CO/measured value</p> <div style="border: 1px solid black; padding: 5px;">           NOW1 CO = <u>0</u>0.0% ?            CP = 0.00% ?         </div>	<p>(1) Displays the CO value and correction data value (span) of the first data registered in the present first data area. You can also change the settings.</p> <p>(2) For CO, the setting range extends from 0.0 to 99.9%.</p> <p>(3) The setting range of CP, CO<sub>2</sub>, or DP differs depending on the setting. Select the value to be corrected from the mode 2 screen.</p> <p>(4) When CP is selected, the setting range extends from 0.00 to 9.99%.</p> <p>(5) When CO<sub>2</sub> is selected, the setting range extends from 0.000 to 9.999%.</p> <p>(6) When DP is selected, the setting range extends from -30.0 to 30.0°C.</p>
<p>4. This time second EMF/temperature</p> <div style="border: 1px solid black; padding: 5px;">           NOW2 EMF = <u>0</u>000 mV ?            T = 0000°C ?         </div>	<p>(1) Displays the EMF value and temperature value registered in the present second data area. You can also change the settings.</p> <p>(2) When this data and all the setting data (NOW2 CO, C) of the next screen are set to 0, one-point correction will be performed with the NOW1 (first) data.</p> <p>(3) The setting range is as follows. EMF: 0 to 1500 mV, T: 0 to 1200°C (when K is selected), 0 to 1700°C (when R is selected).</p>
<p>5. This time second CO/measured value</p> <div style="border: 1px solid black; padding: 5px;">           NOW2 CO = <u>0</u>0.0% ?            CP = 0.00% ?         </div>	<p>(1) Displays the CO value and correction data value (zero) of the second data registered in the present second data area. You can also change the settings.</p> <p>(2) When this data and all the setting data (NOW2 EMF, T) of the previous screen are set to 0, one-point correction will be performed with the NOW1 (first) data.</p> <p>(3) For CO, the setting range extends from 0.0 to 99.9%.</p> <p>(3) The setting range of CP, CO<sub>2</sub>, or DP differs depending on the setting. Select the value to be corrected from the mode 2 screen.</p> <p>(4) When CP is selected, the setting range extends from 0.00 to 9.99%.</p> <p>(5) When CO<sub>2</sub> is selected, the setting range extends from 0.000 to 9.999%.</p> <p>(6) When DP is selected, the setting range extends from -30.0 to 30.0°C.</p>

<p>6. This time correction value Ka/Kb/A</p> <pre> NOW          K a  0 . 0 0 0 ? K b  0 . 0 0 0 ?  A  0 . 0 0 0 ? </pre>	<p>(1) Displays Ka, Kb, A registered in the present correction factor area. You can also change the settings. (2) The setting ranges are as follows. Ka: -9.999 to 9.999, Kb: -9.999 to 9.999, A: -9.999 to 9.999</p>
<p>7. Previous first EMF/temperature/CO</p> <pre> LAST1      EMF0000 T0000      C000.0 </pre>	<p>(1) Displays the EMF value, temperature value, and CO value registered in the previous first data area. You cannot change the settings. (2) Use the settings to check the present correction data for validity.</p>
<p>8. Previous second EMF/temperature/CO</p> <pre> LAST2      EMF0000 T0000      C000.0 </pre>	<p>(1) Displays the EMF value, temperature value, and CO value registered in the previous second data area. You cannot change the settings. (2) Use the settings to check the present correction data for validity.</p>
<p>9. Previous correction value Ka/Kb/A</p> <pre> LAST          K a  0 . 0 0 0 K b  0 . 0 0 0  A  0 . 0 0 0 </pre>	<p>(1) Displays Ka, Kb, A registered in the previous correction factor area. You cannot change the settings. (2) Use the settings to check the present correction data for validity.</p>



## 7-6. Mode 4

In mode 4, you can check and change the sensor impedance check mode.

Measurement screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">           MODE <u>4</u>            PV IMP CHECK         </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px;">           MODE <u>4</u> Lock            PV IMP CHECK         </div>	<p>(1) Mode screen in mode 4</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 4.</p>
<p>2. Sensor check period</p> <div style="border: 1px solid black; padding: 5px;">           PV CHECK            CYCLE=<u>1440</u>min?         </div>	<p>(1) You can set the periodic time for sensor impedance check.</p> <p>(2) When the data is set to 0, no sensor check will be performed.</p> <p>(3) The setting range extends from 0 to 9999 minutes.</p>
<p>3. Sensor check starting temperature</p> <div style="border: 1px solid black; padding: 5px;">           PV CHECK            START=<u>0750</u>°C?         </div>	<p>(1) When the temperature is higher than the preset temperature, sensor impedance check is performed. When lower than the preset temperature, no sensor impedance check is performed.</p> <p>(2) When the temperature is higher than the preset temperature, Er4 judgment is made. When lower than the preset temperature, no Er4 judgment is made.</p> <p>(3) The setting range extends from 0 to 1000°C.</p>
<p>4. Sensor check starting EMF</p> <div style="border: 1px solid black; padding: 5px;">           PV CHECK            EMF=<u>1000</u>mV?         </div>	<p>(1) When the value is higher than the preset EMF, sensor impedance check is performed. When lower than the preset EMF, no sensor impedance check is performed.</p> <p>(2) The setting range extends from 0 to 1500 mV.</p>
<p>5. Sensor check manual start</p> <div style="border: 1px solid black; padding: 5px;">           PV CHECK            ON <u>OFF</u> ?         </div>	<p>(1) Switch to ON and press the  key. Then, the sensor impedance check will be started.</p> <p>(2) Switched to the OFF position automatically after sensor impedance check start command is completed.</p> <p>(3) It takes about 30 seconds to perform a sensor check.</p> <p>(4) During the sensor check, operation of the  key is blocked.</p>
<p>6. Sensor resistance value</p> <div style="border: 1px solid black; padding: 5px;">           PV 000D06H  <u>01</u> 0000°C 0000kΩ         </div>	<p>(1) Displays the result of sensor impedance check. You cannot make settings.</p> <p>(2) "00" is the latest result.</p> <p>(3) The result of "00" is copied to "01 to 30" every 6 hours.</p> <p>(4) No sensor check is performed when the temperature input is lower than the starting temperature, or EMF is lower than the starting EMF, or the sensor is burnout. Thus, the previous resistance value is retained.</p> <p>(5) If EMF is disconnected, an approximate EMF value immediately before disconnection is retained. Thus, sensor check will be performed when the EMF value immediately before disconnection is higher than the starting EMF.</p> <p>Performing a sensor check at this moment causes the EMF value and resistance value to be set to 0.</p> <p>Note: xxxDxxH in the first line represents the elapsed number of days and hours after activation and is stored as the time information of sensor impedance check.</p>

<p>7. Sensor resistance value data clear</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       PV DATA CLEAR        END EACH: 0<u>1</u>?ALL?     </div>	<p>(1) After "?" appears, pressing and holding the <b>ENT</b> key clears the sensor resistance value data.</p>
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## 7-7. Mode 5

In mode 5, you can make settings of the upper and lower limiter required for CP computation.

Setup screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       MODE <u>5</u>        L - H L I M I T E R     </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       MODE <u>5</u> L o c k        L - H L I M I T E R     </div>	<p>(1) Mode screen in mode 5</p> <p>(2) "Lock" is displayed each time the <math>\rightarrow</math> or <math>\leftarrow</math> key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 5.</p>
<p>2. CO input normal range upper and lower limits</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       C O - L <u>15</u>. 0%?        H 025. 0%?     </div>	<p>(1) You can set the upper and lower limits of the CO input normal range. L and H denote the lower and upper limits, respectively.</p> <p>(2) The setting ranges are as follows. L: 0.0 to 99.9%, H: 0.1 to 100% (L&lt;H)</p>
<p>3. Upper and lower limits of correction value Ka</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       K a - L <u>-0</u>. 200 ?        H 1. 800 ?     </div>	<p>(1) You can set the upper and lower limits of the correction value Ka. L and H denote the lower and upper limits, respectively.</p> <p>(2) The setting ranges are as follows. L: -9.999 to 9.998%, H: -9.998 to 9.999% (L&lt;H)</p>
<p>4. Upper and lower limits of correction value Kb</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       K b - L <u>-2</u>. 500 ?        H 2. 500 ?     </div>	<p>(1) You can set the upper and lower limits of the correction value Kb. L and H denote the lower and upper limits, respectively.</p> <p>(2) The setting ranges are as follows. L: -9.999 to 9.998%, H: -9.998 to 9.999% (L&lt;H)</p>
<p>5. Upper and lower limits of correction value A</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       A - L <u>-3</u>. 000 ?        H 3. 000 ?     </div>	<p>(1) You can set the upper and lower limits of the correction value A. L and H denote the lower and upper limits, respectively.</p> <p>(2) The setting ranges are as follows. L: -9.999 to 9.998%, H: -9.998 to 9.999% (L&lt;H)</p>

## 7-8. Mode 6



In mode 6, you can check and change the instrument input/output settings.

Setup screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">           MODE <u>6</u>            SCALE INPUT         </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px;">           MODE <u>6</u> Lock            SCALE INPUT         </div>	<p>(1) Mode screen in mode 6</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 6.</p>
<p>2. Thermocouple switching R/K</p> <div style="border: 1px solid black; padding: 5px;">           TC TYPE SELECT            R <u>K</u>?         </div>	<p>(1) Select the thermocouple input from either type R thermocouple (0 to 1700°C) or type K thermocouple (0 to 1200°C).</p>
<p>3. CO concentration switching A4/V1</p> <div style="border: 1px solid black; padding: 5px;">           CO INPUT SELECT  <u>4-20mA</u> 0-1V?         </div>	<p>(1) Select the CO concentration from either 4 to 20 mA or 0 to 1 volt.</p>
<p>4. CO output switching</p> <div style="border: 1px solid black; padding: 5px;">           CO OUTPUT SELECT  <u>INPUT</u> CP?         </div>	<p>(1) Select outputting either the CO value input externally or the value (of the lower-row indicator or setting indicator) used for CP value computation to the CO output.</p>
<p>5. CO input span/zero</p> <div style="border: 1px solid black; padding: 5px;">           CO INPUT SELECT            Z=<u>00</u>. 0%? S=50. 0%?         </div>	<p>(1) You can set the zero data and span data for CO input.</p> <p>(2) The setting ranges are as follows. Z: 0.0 to 99.8%, S: 0.1 to 99.9%</p>
<p>6. CP output span/zero</p> <div style="border: 1px solid black; padding: 5px;">           CP OUTPUT            Z=<u>0</u>. 3%? S=1. 3%?         </div>	<p>(1) You can set the zero data and span data of CP output.</p> <p>(2) The setting ranges are as follows. Z: 0.0 to 98%, S: 0.1 to 9.9%</p>
<p>7. EMF output span/zero</p> <div style="border: 1px solid black; padding: 5px;">           EMF OUTPUT            Z=<u>1000</u>mV? S=1200mV?         </div>	<p>(1) You can set the zero data and span data of EMF output.</p> <p>(2) The setting ranges are as follows. Z: 0 to 1499mV, S: 1 to 1500mV</p>
<p>8. Temperature output span/zero</p> <div style="border: 1px solid black; padding: 5px;">           TEMPERATURE OUTPUT            Z=<u>0000</u>°C? S=1000°?         </div>	<p>(1) You can set the zero data and span data of temperature output</p> <p>(2) The setting ranges are as follows. Z: 0 to 1699°C, S: 1 to 1700°C</p>

<p>9. CO output span/zero</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>CO OUTPUT</p> <p>Z = <u>0</u>0. 0%? S = 50. 0%?</p> </div>	<p>(1) You can set the zero data and span data of CO output.  (2) The setting ranges are as follows. Z: 0.0 to 99.8%, S: 0.1 to 99.9%</p>
<p>10.CO<sub>2</sub> output span/zero</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>CO2 OUTPUT</p> <p>Z<u>0</u>0. 000%? S99. 999%?</p> </div>	<p>(1) You can set the zero data and span data of CO<sub>2</sub> output  (2) The setting ranges are as follows. Z: 0.000 to 99.998%, S: 0.001 to 99.999%</p>
<p>11.DP output span/zero</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>DP OUTPUT</p> <p>Z = -<u>3</u>0. 0°C? S = 30. 0°C?</p> </div>	<p>(1) You can set the zero data and span data of DP output.  (2) The setting ranges are as follows. Z: -30.0 to 29.9°C, S: -29.9 to 30.0°C</p>
<p>12.ROM version information</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>CP502 ROM Version</p> <p>1. 00</p> </div>	<p>(1) Displays the ROM version of this instrument.</p>

## 7-9. Mode 11



In mode 11, you can make system-related settings (system initial settings).

Setup screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>MODE <u>11</u></p> <p>SYSTEM 1</p> </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>MODE <u>11</u> Lock</p> <p>SYSTEM 1</p> </div>	<p>(1) Mode screen in mode 11  (2) "Lock" is displayed each time the  or  key is pressed.  (3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 11.</p>
<p>2. Display contrast</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>DISPLAY VIEW ANGLE</b></p> <p><b>050% ?</b></p> </div>	<p>(1) You can adjust the contrast of the setting indicator LCD (liquid crystal).  (2) You can adjust and set the contrast to make letters on the LCD (liquid crystal) more visible. The setting range extends from about 40 to 70% as a guide. When this setting range is exceeded significantly, stripes appear in the LCD (liquid crystal). Normally, do not change the initial value (50%).  (3) The contrast is affected by ambient temperature in particular. Make this adjustment after a lapse of about 1 hour after turning on the product and the ambient temperature is stable.</p>

<p>3. Key backlight</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> KEY BACK LIGHT  <u>AUTO</u> OFF ON? </div>	<p>(1) You can set the lighting/shutoff function of key backlight.</p> <p>(2) When AUTO is selected, the following actions will be implemented.  Although the light is normally shut off, it lights up when the power is turned on or any key is pressed.  When the keys remain unused for about 30 seconds or more, the light is shut off.</p> <p>(3) When OFF is selected, the light is normally shut off.</p> <p>(4) When ON is selected, the light is normally turned on.</p>
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## 7-10. Mode 12

In mode 12, you can make system-related settings (customer scale adjustment).  
Normally, you don't have to make settings in this mode. This mode is necessary only when the customer needs to adjust the scale during periodic inspection.

Setup screen	Explanation of screen
<p>1. Mode screen</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> MODE <u>12</u>  SYSTEM 2 </div> <p>[Locked state]</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> MODE <u>12</u> Lock  SYSTEM 2 </div>	<p>(1) Mode screen in mode 12</p> <p>(2) "Lock" is displayed each time the  or  key is pressed.</p> <p>(3) Turn the screen to "Lock" position to prohibit the setting change in the setup screen in mode 12.</p>
<p>2. Analog 1st output/shift correction</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> USER CAL OUT1  SHIFT= <u>00.00</u>? </div>	<p>(1) Function to perform shift correction (intercept) of analog 1st output.</p> <p>(2) When a negative value is set with reference to "0.0", a low output value is displayed. On the other hand, when a positive value is set, a high output value is displayed.</p>
<p>3. Analog 1st output/range correction</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> USER CAL OUT1  RANGE= <u>1.0000</u>? </div>	<p>(1) Function to correct the range of analog 1st output (inclination)</p> <p>(2) Setting a small value with reference to "1.0" decreases the inclination and causes a small output value to be displayed. On the other hand, setting a large value increases the inclination and causes a high output value to be displayed.</p>
<p>4. Analog 2nd output/range correction</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> USER CAL OUT2  SHIFT= <u>00.00</u>? </div>	<p>(1) Function to perform shift correction (intercept) of analog 2nd output.</p> <p>(2) When a negative value is set with reference to "0.0", a low output value is displayed. On the other hand, when a positive value is set, a high output value is displayed.</p>
<p>5. Analog 2nd output/range correction</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> USER CAL OUT2  RANGE= <u>1.0000</u>? </div>	<p>(1) Function to perform shift correction (intercept) of analog 2nd output.</p> <p>(2) Setting a small value with reference to "1.0" decreases the inclination and causes a small output value to be displayed. On the other hand, setting a large value increases the inclination and causes a high output value to be displayed.</p>

<p>6. Analog 1st output manual output</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> ANALOG MAN OUT1  <u>  </u> AUTO ? 000%? </div>	<p>(1) You can set the manual output.  (2) Forcibly outputs the CP value and the manual output value when set to AUTO and MANUAL, respectively.  (3) This function is used in hardware check or customer scale adjustment.</p>
<p>7. Analog 2nd output manual output</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> ANALOG MAN OUT2  <u>  </u> AUTO ? 000%? </div>	<p>(1) You can set the manual output.  (2) Forcibly outputs the value set in MODE1 "2nd analog output item switching" and the manual output value when set to AUTO and MANUAL, respectively.  (3) This function is used in hardware check or customer scale adjustment.</p>

## 7-11. Initialization of settings

When resetting the settings to the initial values, you can perform initialization in the following steps. There are two different initialization types; you can select either type of your choice. Caution is demanded because you cannot restore the original settings after initialization.

Initialization type	Procedures	Screen during initialization
<p>1. Initialization of basic settings (mode 0 to mode 11)</p>	<p>(1) Shut off the power.  (2) Turn on the power while pressing the <b>MODE</b> key  (3) Release the <b>MODE</b> key after confirming that the right screen appears.  (4) The measurement screen appears after initialization.</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> Parameter  Initialize </div>
<p>2. Initialization of all settings (mode 0 to mode 12)</p>	<p>(1) Shut off the power.  (2) Turn on the power supply while pressing the <b>MODE</b> key and <b>ENT</b> key.  (3) Release the <b>MODE</b> key and the <b>ENT</b> key after confirming that the right screen appears.  (4) The measurement screen appears after initialization.</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> All Parameter  Initialize </div>

## 7-12. Setting precaution

Precautions	Description
<p>1. Care must be exercised with the setting range.</p>	<ul style="list-style-type: none"> <li>Note that the value setting parameters have the settable value ranges.</li> <li>When you try to set a value exceeding the settable value range, a warning message appears. When you see a warning message, check the content of the message and make a setting properly.</li> </ul>
<p>2. When the settings are changed, the settings in a different setup screen may be changed.</p>	<ul style="list-style-type: none"> <li>When important key parameter settings are changed, the decimal point and setting range of set values on related different setup screens may be changed or initialized automatically.</li> <li>When the key parameter settings are changed, recheck the settings on other setup screens.</li> </ul>

## 7-13.Warning message

Failure to perform proper setting or operation, you will see the following warning message for about 3 seconds. After checking the content of the message, perform setting and operation again properly.

Warning message	Description of warning
<p>1</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.1 0            KEY LOCK         </div>	<ul style="list-style-type: none"> <li>▪ Because the mode screen is in "Lock" state, you cannot change the settings.</li> <li>▪ Cancel the "Lock" state on mode screen and change the settings.</li> </ul>
<p>2</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.2 1            FIRST INPUT UNDONE         </div>	<ul style="list-style-type: none"> <li>▪ Because the first data fetch command is not completed in mode 2, the second data fetch command or automatic correction operation start order is not executed.</li> <li>▪ First, execute the first data fetch command and register the fetched data to the first data area.</li> </ul>
<p>3</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.2 2            INPUT RANGE OVER         </div>	<ul style="list-style-type: none"> <li>▪ Displays when the following conditions are met on the first data fetch command and second data fetch command screens (mode 2).             <ul style="list-style-type: none"> <li>▪ EMF &lt;0 or, EMF &gt;1500</li> <li>▪ Temperature &lt;0 or, temperature &gt;1200 (when K is selected)</li> <li>▪ Temperature &lt;0 or, temperature &gt;1700 (when R is selected)</li> <li>▪ CO is under or over range.</li> <li>▪ CP is under or over range (When correcting EMF with CP)</li> <li>▪ CO<sub>2</sub> is under or over range (When correcting EMF with CO<sub>2</sub>)</li> <li>▪ DP is under or over range. (When correcting EMF with DP)</li> </ul> </li> </ul>
<p>4</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.2 3            CO RANGE OVER         </div>	<ul style="list-style-type: none"> <li>▪ You cannot set any values out of the range with respect to the values set in the CO input normal range upper and lower limits (mode 5).</li> </ul>
<p>5</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.3 1            INVERTED L&gt;H         </div>	<ul style="list-style-type: none"> <li>▪ Displays when <math>L \geq H</math> on all setup screen in mode5.</li> <li>▪ Check the setting range.</li> </ul>
<p>6</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">           WARNING      No.3 2            INVERTED Z&gt;S         </div>	<ul style="list-style-type: none"> <li>▪ Displays when <math>Z \geq S</math> with CO input span/zero, CP output span/zero, and EMF output span/zero (mode 6).</li> <li>▪ Check the setting range.</li> </ul>

## 8. Initial setting

In "7. Setup screen", explanation is provided on the setup screen on a mode-by-mode basis. However, you don't have to make all those settings. The customer must select necessary parameters and make settings depending on the product specifications and end product system configuration.

Now, explanation is provided on the minimum setting procedures for the end product that must be performed first. Make other settings as needed.



: Required setting



: Setting according to needed

(1) Thermocouple setting: Mode 6



(2) CO concentration A4/V1



(3) CO input span/zero



(4) CP output span/zero

\* You can set the sensor (K thermocouple, or R thermocouple).

\* You can set 4 to 20 mA or 0 to 1 volt.

\* You can set the zero data and span data of the CO input.

\* You can set the zero data and span data of the CP output (analog 1st output).



## 9. Operation

### 9-1. Pre-operation check

Check the following information before starting the operation.

Item	Content to check
1. Wire connection	<ul style="list-style-type: none"><li>▪ Check that the wiring is connected properly. Check the wiring thoroughly in high voltage portions including the power supply, output, and alarm. Check the terminal screws for looseness.</li><li>▪ Check the wire connection of the product as well as that of the end product as a whole.</li></ul>
2. Power supply	<ul style="list-style-type: none"><li>▪ Check that the power supply is within the rated range.</li></ul>
3. Settings	<ul style="list-style-type: none"><li>▪ Check that the settings are made properly. Turning on the power causes measurement to be started immediately.</li></ul>

#### Caution

- (1) Establishing a connection with a power supply out of the rated range leads to a failed product, significant degradation or misoperation.
- (2) Applying overcurrent or over voltage to the input/output terminal of the unit leads to a failed product, significant degradation or misoperation.

### 9-2. Trial operation

After completing the pre-operation check, start a trial operation to perform confirmations with the following as a guide. This procedure is just an example of the most fundamental trial operation procedure. Add check items depending on the product specifications, end product system configuration and control condition, etc.

(1) Check that the system components including this product are normal.



(2) Check that all the signal levels (such as voltage value, current value, ON/OFF signal) connected to between system components including this product are normal.



(3) Check that the actions (such as alarm and external signal input) with the peripheral equipment connected to this product are normal.



(4) Set the parameters of this product as needed.




(5) After a lapse of a few hours after starting operation, check that this product and all the devices constituting the system are normal as the end products.

## 9-3. Precaution during operation

### 9-3-1. Setting change during operation

You can change the settings during operation on any setup screen. However, extra care must be exercised because a setting change during measurement may cause adverse effect on measurement depending on the parameter.

 <b>Caution</b>	<ul style="list-style-type: none"><li>(1) Extra care must be exercised when changing the settings during operation. Because a setting change during operation may cause adverse effect on measurement depending on the parameter.</li><li>(2) Supply good-quality and stable power. Noise or instantaneous power outage may cause adverse effect on the product or result in unexpected misoperation.</li></ul>
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## 10. Detail description of major function

### 10-1. Alarm and error message

Display	Errors	Error processing
Er1	Abnormality in O <sub>2</sub> sensor impedance O <sub>2</sub> sensor impedance value is 130 k ohms or more.	CP, CO <sub>2</sub> , and DP computation will not be performed. Status indicator "AL1" is turned on.
Er2	Abnormality in O <sub>2</sub> sensor input When the following conditions a) and b) are met a) When the input voltage is out of the range or the input is disconnected in impedance check. b) Sensor check starting temperature ≤ Temperature measured value after temperature correction computation	
Er3	Abnormality in TC input The temperature input signal is disconnected or a set value out of the range is input.	
Er4	Abnormality in CO input When the following conditions a) and b) are met a) When the CO input value is out of the preset range in MODE5 "CO input normal range upper and lower limits" or the input signal is disconnected. Disconnection: An input of 0 mA or equivalent when inputting 4 to 20 mA Off-scale out of the input range with a pull-up resistor when inputting 0 to 1 volt DC b) Sensor check starting temperature ≤ Temperature measured value after temperature correction computation	
Er5	Abnormality in RJ data The reference point compensation data (RJ data) inside the instrument is out of the range.	Status indicator "AL2" is turned on.
Er7	Abnormality in A/D converter When the signal from the A/D converter cannot be received.	
Er8	Abnormality in CP correction value As a result of the computation of CP correction, the CP correction value is out of the preset range specified in MODE5 "correction value Ka upper and lower limits", "correction value Kb upper and lower limits", and "correction value A upper and lower limits". Abnormal state is maintained until normal judgment is made in the next correction calculation. However, when Ka, Kb, A are all set to, it is judged to be normal.	CP, CO <sub>2</sub> , and DP computation will not be performed. Status indicator "AL1" is turned on.

- Note) 1. For the values described as out of the range, an allowance of 5% is provided for upper and lower limits each with respect to the span.
- An error indication is displayed on the setting indicator. When the error indication is displayed, CO<sub>2</sub> and DP are not displayed.
  - When the sensor abnormal output is turned on, the AL1 lamp on the front face is turned on. When the instrument is under abnormal conditions, the AL2 lamp is turned on.
  - Once abnormality is developed, it is retained until MODE1 "sensor abnormal reset" operation is implemented.
  - For Er1, 2, and 4, when the temperature is lower than the sensor check starting temperature, the error indication and sensor abnormal output shall be OFF (normal).
  - Er2 to 7, only after the error occurs three times in a row, it is judged as abnormality.

## 10-2. Analog output

There are two analog outputs and both the output signals are 4 to 20 mA DC. Scaling setting is possible for each data (CP, temperature, EMF, CO, CO<sub>2</sub> or DP) in a specified range. (For example, a temperature range of 0 to 1200°C is output at 4 to 20 mA, and 700 to 1000°C at 4 to 20 mA.)

For the analog 1st output, the CP value is output as an analog signal. Specify the range of CP value to be output at 4 to 20 mA DC as the setting item.

For the analog 2nd output, EMF, temperature, CO, CO<sub>2</sub> or DP is selected and output. This selection is independent from the items to be displayed in the lower-row indicator.

The computed result can be output by analog signal output in MODE12 "analog output manual output" when AUTO is selected. (Manual output value is output when MANUAL is selected.)

## 10-3. Contact input

### 1. Sensor is burnout

During signal input (continuity), the BURN lamp is turned on and sensor impedance autocheck and trigger output are discontinued.

### 2. CO concentration external input availability

During signal input (continuity), the EXT lamp lights up. When the following conditions (1) to (3) are met, an external analog-input value is selected as the CO value.

(1) During signal input (continuity)

(2) Er4 is not developed.

(3) The CO input value falls within the range preset in MODE5 "CO input normal range upper and lower limits".

### 3. Computation output hold

During signal input (continuity), the computation and display output value of CP, CO<sub>2</sub> and DP are held. However, the temperature, CO concentration and EMF will not be held.

In the case of signal input (continuity) during first-order lag computation, the output value will be held after stabilization.

## 10-4. EMF correction

The measured O<sub>2</sub> input (EMF) can be corrected with the predetermined compensation formula. The correction parameters for Ka, Kb, and A used in EMF correction computation are calculated in automatic correction processing. However, processing of EMF correction function will not be implemented during impedance check.

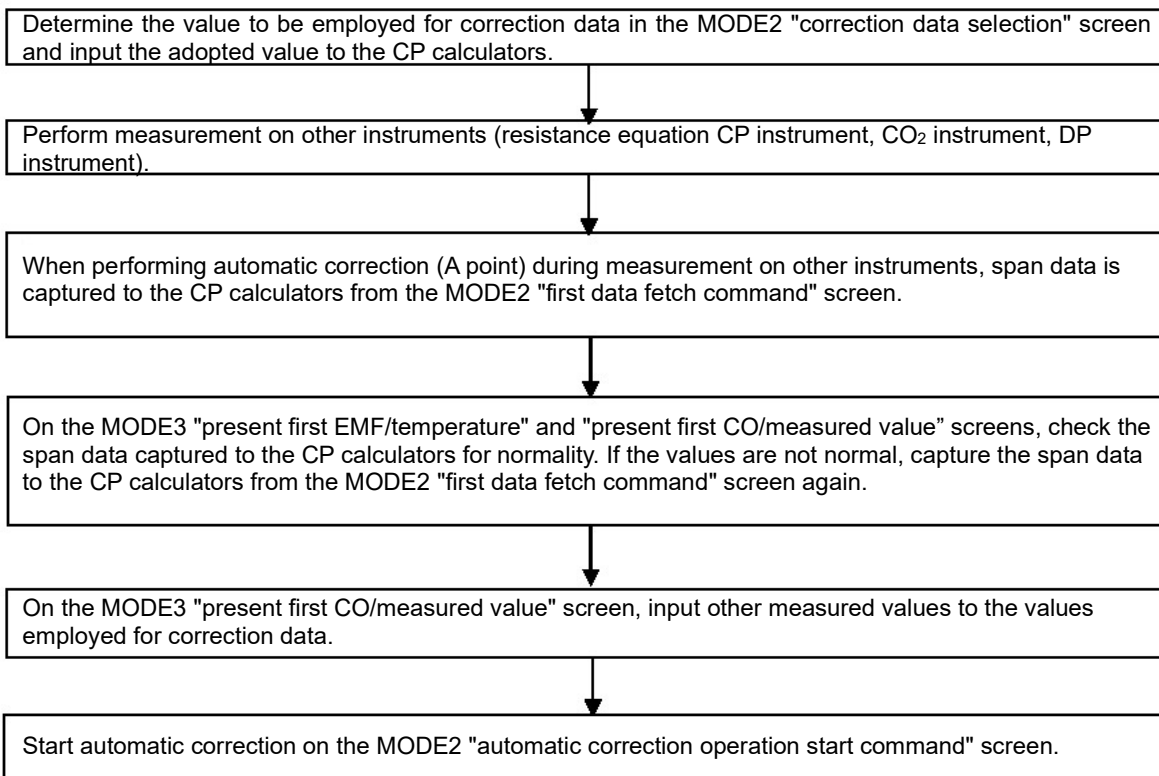
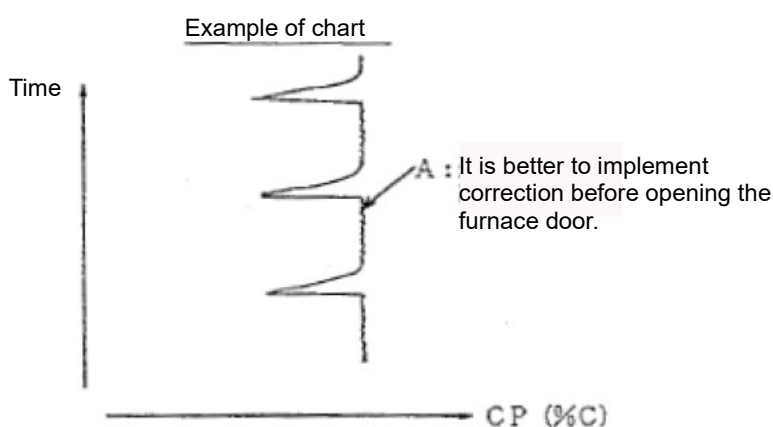
This function is started manually by the customer. Although normal functions are suspended during this operation, CP and TEMP (CO, EMF) outputs are displayed as in the case with normal mode. (Outputs are retained during data fetch and write.)

There are three different correction values - CP value, CO<sub>2</sub> value, DP value. Select any one of the values in advance and input the value from the correction value data selection of the selected system data. The one-point (span) and two-point (span and zero) correction methods are available.

### 1. Correction procedures

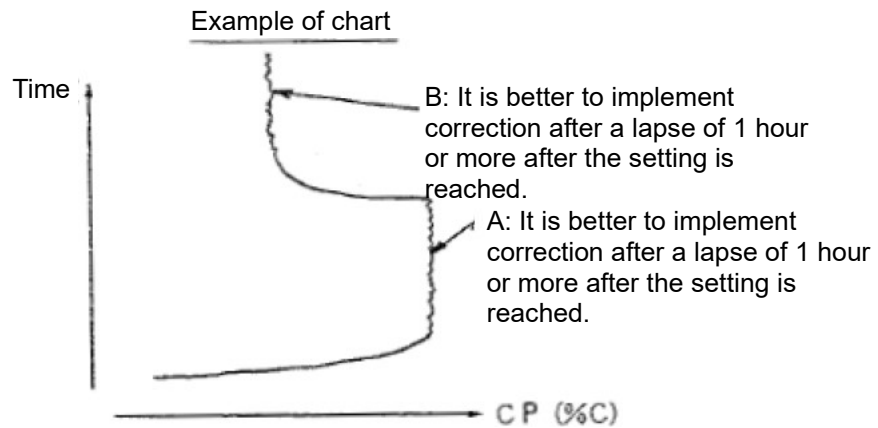
- (1) For one-point correction (such as continuous furnace)

It is effective to implement automatic correction with the workpiece inserted before opening the furnace door.



(2) For two-point correction (such as continuous furnace)

It is effective to employ this method in a continuous furnace in which the settings are changed in a wide range (0.3% C or more)



Determine the value to be employed for correction data in the MODE2 "correction data selection" screen and input the adopted value to the CP calculators.

Perform measurement on other instruments (resistance equation CP instrument, CO<sub>2</sub> instrument, DP instrument) under the highest CP value conditions among the operation conditions.

When performing automatic correction (A point) during measurement on other instruments, span data is captured to the CP calculators from the MODE2 "first data fetch command" screen.

On the MODE3 "present first EMF/temperature" and "present first CO/measured value" screens, check the span data captured to the CP calculators for normality. If the values are not normal, capture the span data to the CP calculators from the MODE2 "first data fetch command" screen again.

On the MODE3 "present first CO/measured value" screen, input other measured values to the values employed for correction data.

When performing automatic correction (B point) during measurement on other instruments under the lowest CP value conditions among the operation conditions, capture the zero data into the CP calculators from the MODE2 "second data fetch command" screen.

On the MODE3 "present second EMF/temperature" and "present second CO/measured value" screens, check the span data captured to the CP calculators for normality. If the values are not normal, capture the span data to the CP calculators from the MODE2 "second data fetch command" screen again.

On the MODE3 "present second CO/measured value" screen, input other measured values to the values employed for correction data.

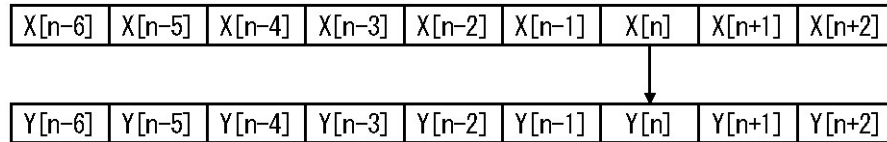
Start automatic correction on the MODE2 "automatic correction operation start command" screen.

## 2. Abnormality judgment of Ka, Kb, and A

Determine whether the calculated Ka, Kb, and A fall within the range of preset upper and lower limits. If the calculated values fall outside this range, determine the abnormality in the CP correction value. Perform successive CP computation using the previous correction value. In the case of abnormality in the CP correction value, abnormal state is maintained until error code display (Er8) and alarm output (AL1) are performed and MODE1 "sensor abnormal reset" operation is implemented, or a new correction operation is performed and a normal value is obtained.

### 10-5. Input average filter

Input average filter computation can be performed with respect to each input of temperature, CO, and EMF.



The computing equation is as follows.

$$Y[n] = \frac{\sum_{k=1}^N X[n-k+1]}{N}$$

Where

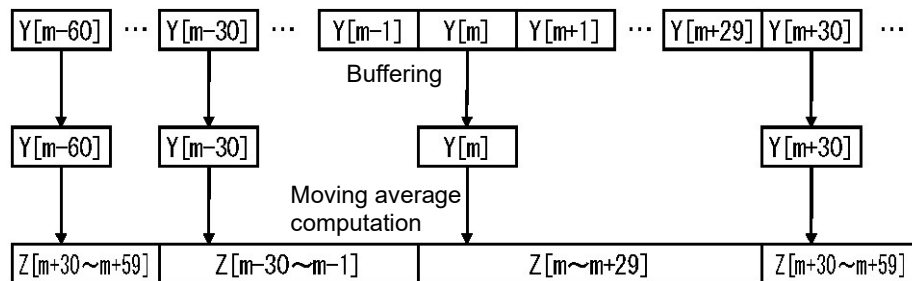
X [n]: value before input average filter computation

Y [n]: Value after input average filter computation

N: Number of input average filters (Set in MODE0 "number of input average filters")

### 10-6. Temperature moving average

For temperature input, temperature moving average computation can be performed in addition to input average filter computation.



1 Temperature buffering is implemented once every minute. Moving average computation is performed with the buffered temperature. The computing equation is as follows.

$$Z[m \sim (m + 29)] = \frac{\sum_{k=1}^{M+1} Y[m - 30(k - 1)]}{M + 1}$$

Where,

Y [m]: temperature after input average filter computation

Z[m]: temperature after temperature moving average computation

M: temperature moving average time

When the temperature moving average is valid, the temperature changes every minute. When m=0, the temperature moving average function is disabled.

## 10-7. Customer scale adjustment

This product is provided with the customer scale adjustment function in mode 12. The customer can perform scale adjustment as long as a high-precision voltage current generator, a digital multimeter, a dial resistor are prepared.

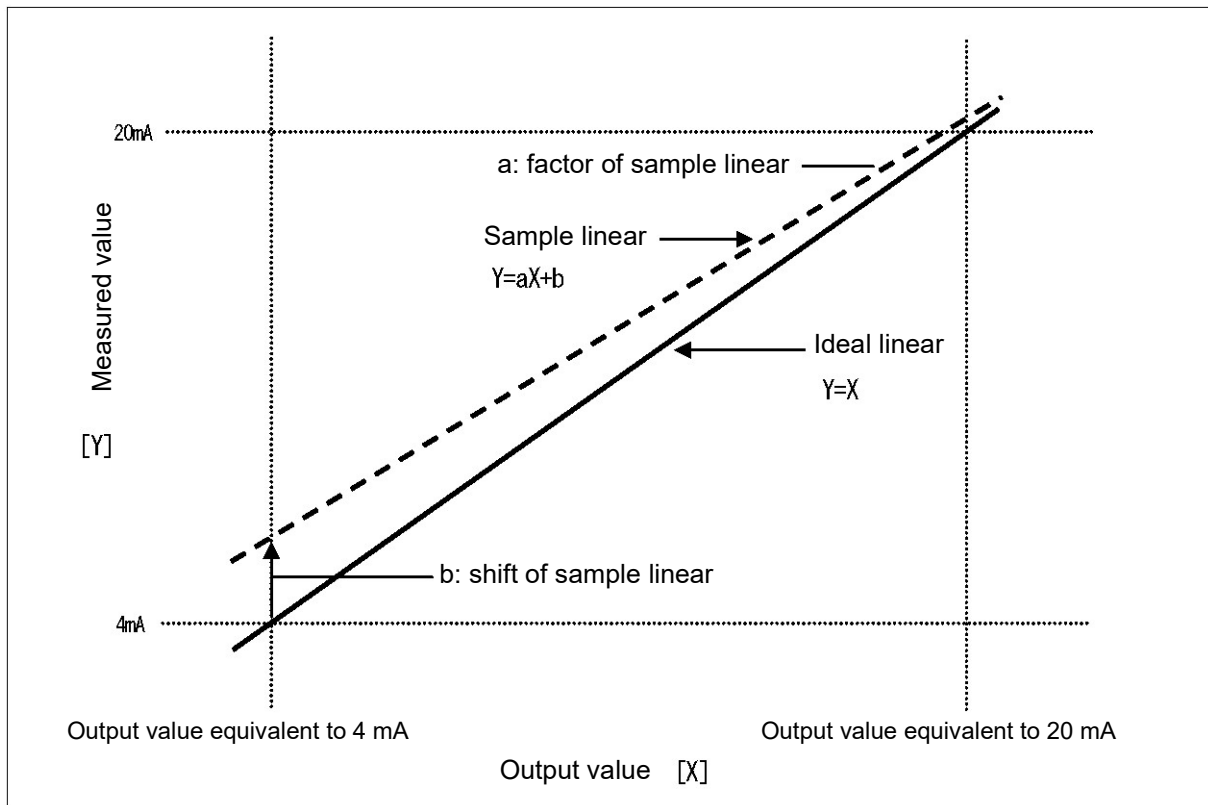
### 10-7-1. Overview

This function allows the user to perform scale adjustment of the following input/output functions.

- Analog 1st output
- Analog 2nd output

### 10-7-2. Concept of scale adjustment

Scale adjustment is implemented with internal computation processing based on the following equation [ $Y=aX+ b$ ] using two correction values as constants - zero correction value (equivalent to  $b$ ) and span correction value (equivalent to  $a$ ).



The ideal linear is a straight line having no measurement errors. When "output value equivalent to 4 mA" is output, 4 mA is output. When "output value equivalent to 20 mA" is output, 20 mA is output.

Thus,  $Y=X$  because there are no correction values.

The sample linear is shifted to + side by around 4 mA and its inclination is smaller in comparison with the ideal linear.

For example, when "output value equivalent to 4 mA" is output, 4.04 mA is output. When "output value equivalent to 20 mA" is output, 20.02 mA is output.

Thus, output deviation can be eliminated by adding a bias ( $b$ ) equivalent to -0.04 mA and multiplying a factor ( $a$ ) to increase the inclination.



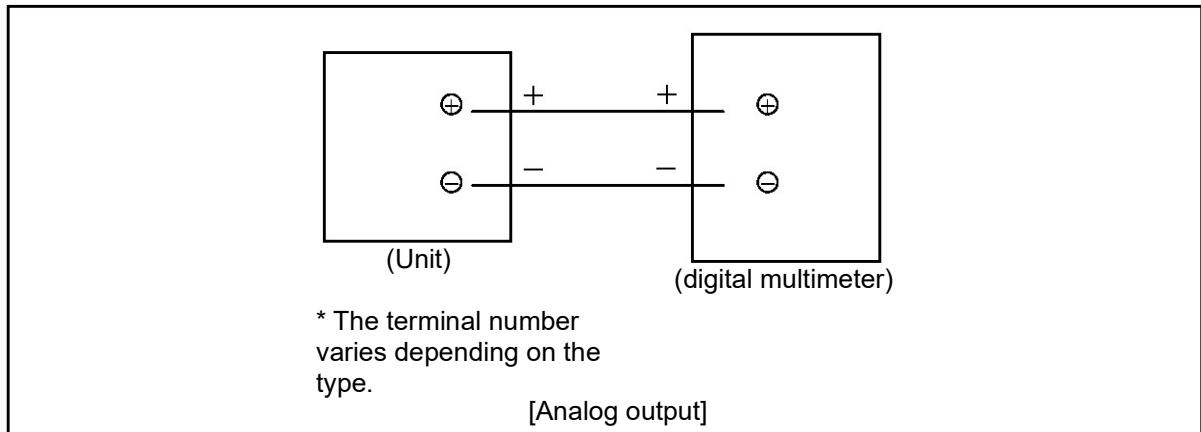
### 10-7-3. Output-related scale adjustment

Explanation of the procedures for adjusting the output-related (analog output) scale is as follows.

#### 1. Preparation for measurement-related device

Input to be adjusted	Required measuring device and instrument
Analog output	(1) Digital multimeter ▪ Accuracy: $\pm 0.05\%$ or less

#### 2. Wire connection



#### 3. Scale adjustment

##### (1) Preparation and energization

- Set the environment conditions of this product to the "reference operating conditions" for ensuring stability.
- After checking the wire connection, energize the product and measurement-related device to ensure stability.

##### (2) Output check before adjustment

- Carry out output checks before adjustment (3 places) with the following as a guide.

	Minimum value: 4 mA (output value: 0%)	Median value: 12 mA (output value: 50%)	Maximum value: 20 mA (output value: 100%)
Output check before adjustment			
Output check after adjustment			

##### (3) Setting of shift correction value

- Set the output to 0%.
- When the minimum value is higher than the ideal value by 4 mA or more, set a negative value for the shift correction value. If not, set a positive value for the shift correction value.
- For the shift correction value, set a value equivalent to the ideal value while checking the digital multimeter.

##### (4) Setting of range correction value

- Output value: Output 100%.
- When the maximum value is higher than the ideal value by 20 mA or more, set a range correction value of 1.0 or smaller. If not, set a range correction value of 1.0 or larger.
- For the range correction value, set a value equivalent to the ideal value while checking the digital multimeter.

##### (5) Readjustment

- Repeat adjustment specified in steps (3) and (4) for a few times until the output value falls within the allowable range.

##### (6) Instruction check after adjustment

- Carry out output checks after adjustment (3 places) as in the case with the checks before adjustment and make sure there aren't any problems.

## 11. Trouble shooting

Trouble	Point to be checked
1. There is an error or instability.	<ul style="list-style-type: none"> <li>▪ Check the wire connection with the sensor for problems.</li> <li>▪ For the thermocouple, check that wire connection is established up to the terminal screw using a thermocouple or a compensating wire.</li> <li>▪ Check that the terminal screw is tightly fastened.</li> <li>▪ Check that the sensor signal is not connected in parallel with other devices.</li> <li>▪ Check for increase in impedance caused by the protection element, etc., connected to the sensor signal.</li> <li>▪ Check the output signal and output specifications (such as impedance) of the sensor for problems.</li> <li>▪ Check that the ground terminal is connected to a good-quality protective grounding.</li> <li>▪ Check for noise.</li> <li>▪ Check that the input conditions (including CO concentration and temperature in the furnace) are properly input.</li> <li>▪ Check the environment and ambience (including ambient temperature and wind) for problems.</li> <li>▪ Check that the parameters (including measurement range, sensor correction, and customer scale adjustment) are set properly.</li> </ul>
2. You see "-----" on the screen.	<ul style="list-style-type: none"> <li>▪ Excessive input or upper limit burnout. Check the sensor signal.</li> </ul>
3. You see "_____" on the screen.	<ul style="list-style-type: none"> <li>▪ Excessively small input or lower limit burnout. Check the sensor signal.</li> </ul>
4. Analog output is instable.	<ul style="list-style-type: none"> <li>▪ Check the wire connection between analog output connection devices for problems.</li> <li>▪ Check that the terminal screw is tightly fastened.</li> <li>▪ Check for noise.</li> <li>▪ Check that the parameters are set properly.</li> </ul>
5. "Er" on the status display lights up.	<ul style="list-style-type: none"> <li>▪ There is abnormality. The product's internal circuit has abnormality or is adversely affected by noise. Check for noise.</li> </ul>
6. Operation is abnormal although the cause is unknown.	<ul style="list-style-type: none"> <li>▪ Check that the parameters are set properly.</li> <li>▪ If the product still behaves abnormally, initialize the settings. Configure all the settings again and check for problems.</li> </ul>
7. There is abnormality in the display of the setting indicator or stripes appear in the display.	<ul style="list-style-type: none"> <li>▪ Optimize the value set for "display contrast" in mode 11. As a guide, set the value to 40 to 70%. If the value falls within the range extending from 80 to 100%, stripes appear. Normally, do not change the initial value (50%).</li> </ul>
8. A warning message is displayed when setting parameters.	<ul style="list-style-type: none"> <li>▪ Settings cannot be registered. Check the warning message and the settings to change the settings properly.</li> </ul>

If no improvement is made after implementing the above-mentioned trouble shooting, contact the supplier(instrumentation dealer, installation dealer, or sales dealer) or the sales office nearest you.



## **Warning**

When repair or modification is necessary, contact the supplier or the sales office nearest you. Repair or modification such as replacing parts must be performed only by our authorized service technician.  
An expected trouble during repair (power outage, earthquake, other unexpected accidents) may erase the set data. Be sure to copy the set data before repairing.  
Should the data be erased, we are not liable for the lost data.

## 12. Inspection and maintenance

### 12-1. Inspection

#### 12-1-1. Inspection during trial operation

Carry out a trial operation every time before starting operation to check the product and the end product for normality.

#### 12-1-2. Inspection of accuracy of restricted parts


Some parts of the product require regular inspection of accuracy such as measurement accuracy and transmission signal output accuracy depending on the customer's needs. These parts may have a slight deviation in accuracy from the time of purchase due to deterioration with age.

You can make adjustments by using the customer scale adjustment function in mode 12. However, we carry out accuracy inspection, so please contact the supplier or the sales office nearest you.

#### 12-1-3. Overhaul

It is advisable to carry out an overhaul every 2 to 3 years to ensure a long-term reliability. For overhauling, please contact the supplier or the sales office nearest you.

### 12-2. Disposal

 <b>Caution</b>	<ol style="list-style-type: none"><li>(1) The components of the product contain a trace quantity of hazardous chemicals below the level defined in the RoHS directive.</li><li>(2) Be sure to ask a specialist for disposal of this product. Or dispose of the product according to the method defined by the local government.</li><li>(3) Separate and process the boxes, plastic bags, cushioning materials, and labels used for packing the product according to the method defined by the local government.</li></ol>
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## 13. Specifications

### 13-1. Analog input specifications

Number of inputs:	3
Input signal :	(a) temperature input ... 0 to 1700°C (R thermocouple) or ...0 to 1200°C (K thermocouple) (b) CO input ... 4 to 20 mA or 0 to 1 volt (0.00 to 99.99%) (c) O <sub>2</sub> input ... -100 to 1500 mV
Input insulation:	Isolation is provided between temperature input and O <sub>2</sub> input No isolation is provided between temperature input and CO input Isolation is provided between CO input and O <sub>2</sub> input
Sampling period:	2 seconds or less
Burnout:	thermocouple input ...over range CO input ...under range O <sub>2</sub> input ... Without
Rated measurement accuracy:	thermocouple input ... $\pm 0.1\%FS \pm 1$ digit (under reference operating conditions) CO input ... $\pm 0.1\%FS \pm 1$ digit O <sub>2</sub> input ... $\pm 0.1\%FS \pm 1$ digit
Reference point compensation accuracy:	type K thermocouple ... $\pm 1^\circ C$ or $\pm 20 \mu V$ equivalent value (an ambient temperature of 13 to 33°C) $\pm 2^\circ C$ or $\pm 60 \mu V$ equivalent value (ambient temperature outside the above range) Type R thermocouple... $\pm 1^\circ C$ or $\pm 40 \mu V$ equivalent value (an ambient temperature of 13 to 33°C) $\pm 3^\circ C$ or $\pm 120 \mu V$ equivalent value (ambient temperature outside the above range)
Input resistance:	temperature ...1 megohm or more CO input ...1 megohm or more (voltage input) Approx. 50 ohms (current input) O <sub>2</sub> input ...10 megohms or more

### 13-2. External contact input

Number of inputs:	3
Input signal:	non-voltage contact, open collector signal
External contact capacity:	5VDC 2 mA
Function:	Sensor is burnout CO concentration external input availability Computation output display hold

### 13-3. Impedance check specifications

Insert a 1-megohm resistor in parallel with the O<sub>2</sub> sensor and carry out an impedance check on the O<sub>2</sub> sensor.

### 13-4. Analog output specifications

Number of analog output points:	2
Analog output signal method:	4 to 20 mA (a) 1st analog output: DAC (b) 2nd analog output: PWM or DAC (specified at time of purchase)
Output signal type:	(a) 1st analog output: CP computation value (b) 2nd analog output: Selected from EMF, temperature, CO, CO <sub>2</sub> , or DP with a key operation

Output scale:	For each data, output scaling setting is possible.
Load resistance:	400 ohms or less
Output update period :	2 seconds or less
Output accuracy:	DAC method ... $\pm 0.1\%$ FS PWM method ... $\pm 0.3\%$ FS
Output insulation:	Inputs and outputs are isolated.

### 13-5. Contact output specifications

Number of output points:	2
Contact capacity:	Resistance load ...100 to 240 volts AC 3.0 A or less, 30 volts DC 3.0 A or less Inductive load ...100 to 240 volts AC 1.5 A or less, 30 volts DC 1.5 A or less
Output form:	AL1...Sensor abnormal output AL2...Instrument abnormal output

### 13-6. General specifications

Rated power supply voltage:	General power supply specifications ...100 to 240 volts AC
Rated power supply frequency:	General power supply specifications ...50 Hz or 60 Hz
Maximum electric power consumption:	General power supply specifications ...15VA at 100 volts AC 20VA at 240 volts AC
Operating temperature range:	-10 to 50°C
Operating humidity range:	10 to 90%RH (there shall be no dew formation) However, the use under conditions other than specified below may lead to degradation in performance. 20 to 65%RH (0 to 50°C) 20 to 80%RH (5 to 40°C)
Measures against power outage:	Retention of settings with EEPROM (number of rewriting: one million or less)
Terminal screw:	M3.5
Insulation resistance:	20 megohms or more between primary terminal and secondary terminal (500 volts DC) 20 megohms or more between primary terminal and ground terminal (500 volts DC) 20 megohms or more between secondary terminal and ground terminal (500 volts DC)
Withstand voltage:	1,500 volts AC between primary terminal and secondary terminal (for one minute) 1,500 volts AC between primary terminal and ground terminal (for one minute) 500 volts AC between secondary terminal and ground terminal (for one minute) * Primary terminals shall be the power supply terminal (100 to 240 volts AC), control output terminal, and alarm output terminal.
Outline material:	Nonflammable polycarbonate
Color:	Gray
Mounting method:	panel flush mounting
External dimension:	H96×W96×D127 mm * Overall depth from the panel surface is 120 mm.
Weight:	approx. 580 grams
EU RoHS directive:	Complied with

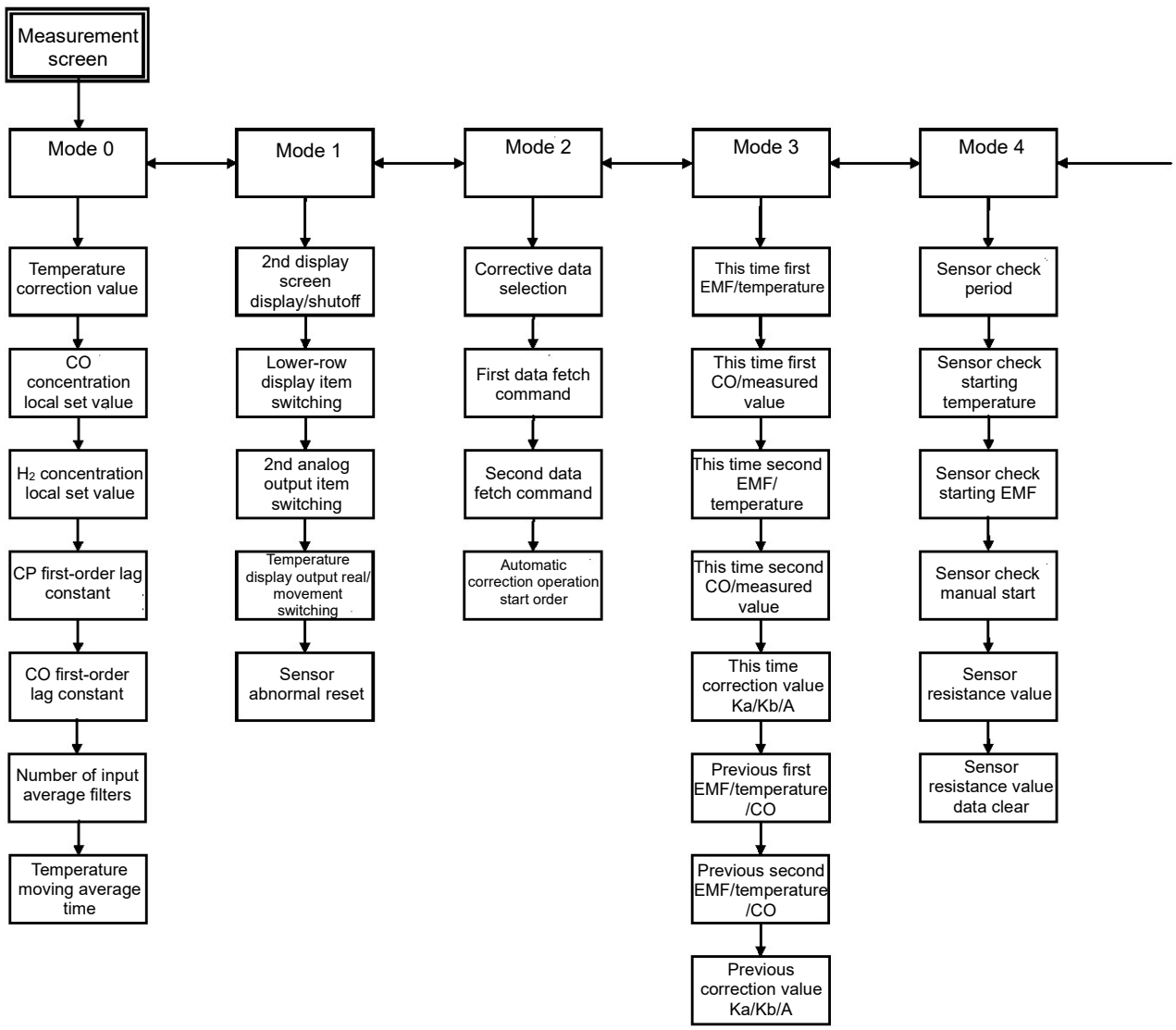
## 14. Parameter list

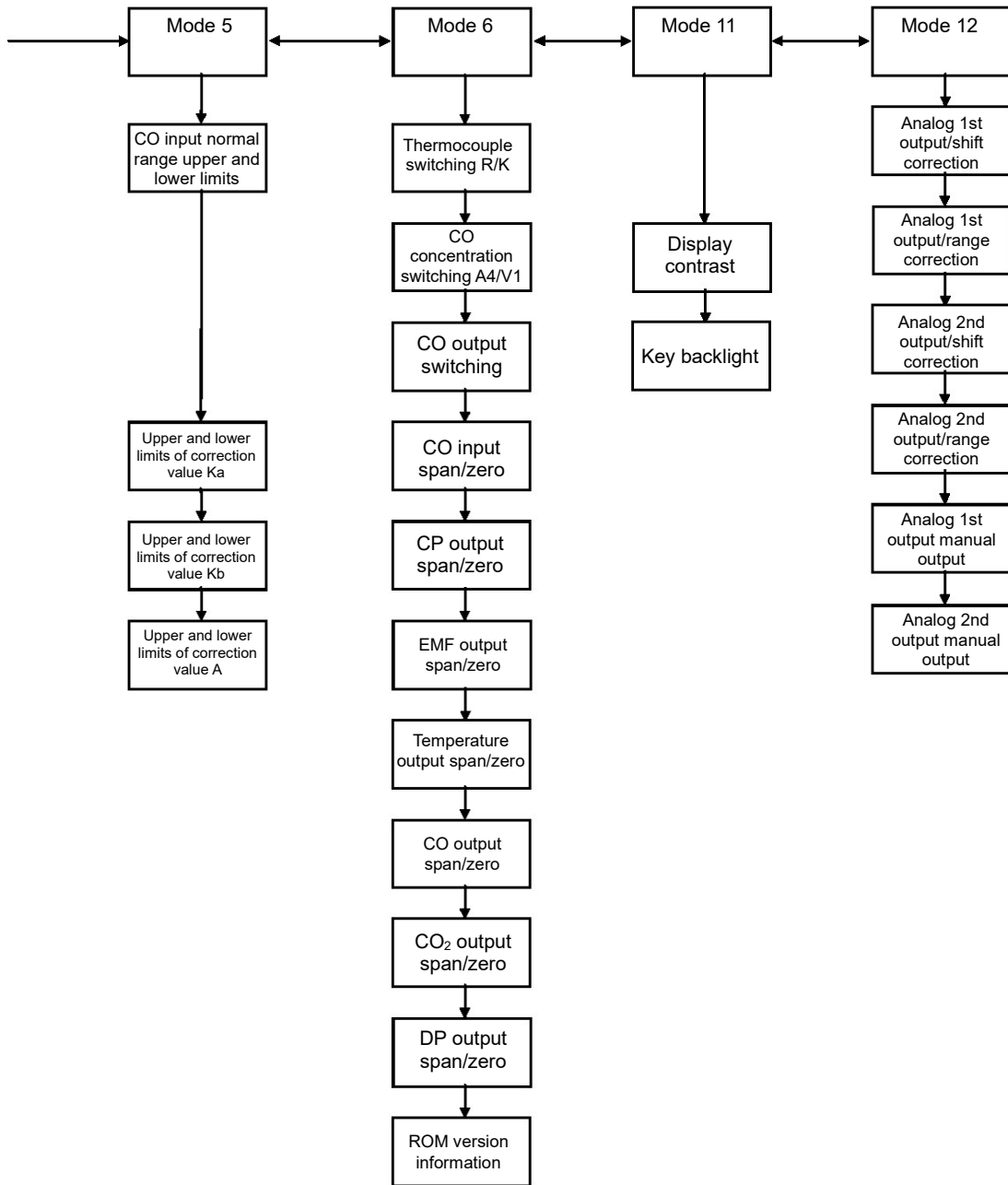
Mode No.	Setting item	Initial value (factory default settings)	Customer set value	Setting range
0	Temperature correction value	00°C		-99 to 99°C
	CO concentration local set value	23.5%		0.0 to 99.9%
	H <sub>2</sub> concentration local set value	29.4%		0.0 to 99.9%
	CP first-order lag constant	0000sec		0000 to 9999 seconds
	CO first-order lag constant	0000sec		0000 to 9999 seconds
	Number of input average filters	05		1 to 10 times
	Temperature moving average time	00min		0 to 30 minutes
1	Setting indicator display/shutoff	ON		ON, OFF
	Lower-row display item switching	TEMP		EMF, TEMP, CO
	2nd analog output item switching	TEMP		EMF, TEMP, CO, CO <sub>2</sub> , DP
	Temperature display output real/movement switching	REAL		REAL, AVERAGE
2	Correction data selection	CP		CP, CO <sub>2</sub> , DP
3	Present first EMF/temperature	EMF	0000mV	0 to 1500mV
		T	0000°C	0 to 1200°C (when K is selected), 0 to 1700°C (when R is selected)
	Present first CO/measured value	CO	00.0%	00.0 to 99.9%
		CP	0.00%	0.00 to 9.99% (when CP is selected)
		CO <sub>2</sub>	00.000%	0.000 to 9.999% (when CO <sub>2</sub> is selected)
		DP	00.0°C	-30.0 to 30.0°C (when DP is selected)
	Present second EMF/temperature	EMF	0000mV	0 to 1500mV
		T	0000°C	0 to 1200°C (when K is selected), 0 to 1700°C (when R is selected)
	Present second CO/measured value	CO	00.0%	00.0 to 99.9%
		CP	0.00%	0.00 to 9.99% (when CP is selected)
		CO <sub>2</sub>	00.000%	0.000 to 9.999% (when CO <sub>2</sub> is selected)
		DP	00.0°C	-30.0 to 30.0°C (when DP is selected)
Present correction value Ka/Kb/A	Ka	0.000	-9.999 to 9.999	
	Kb	0.000	-9.999 to 9.999	
	A	0.000	-9.999 to 9.999	
4	Sensor check period	1440min		0 to 9999 minutes
	Sensor check starting temperature	0750°C		0 to 1000°C
	Sensor check starting EMF	1000mV		0 to 1500mV
5	CO input normal range upper and lower limits	L	15.0%	0.0 to 99.9%
		H	025.0%	0.1 to 100.0%
	Correction value Ka upper and lower limits	L	-0.200	-9.999 to 9.998%
		H	1.800	-9.998 to 9.999%
	Correction value Kb upper and lower limits	L	-2.500	-9.999 to 9.998%
		H	2.500	-9.998 to 9.999%
Correction value A upper and lower limits	L	-3.000	-9.999 to 9.998%	
	H	3.000	-9.998 to 9.999%	
6	Thermocouple switching R/K	K		R, K
	CO concentration switching A4/V1	4 to 20mA		4 to 20mA, 0 to 1V
	CO output switching	INPUT		INPUT, CP
	CO input span/zero	Z	00.0%	0.0 to 99.8%

	CP output span/zero	S	50.0%	0.1 to 99.9%
		Z	0.3%	0.0 to 9.8%
	EMF output span/zero	S	1.3%	0.1 to 9.9%
		Z	1000mV	0 to 1499mV
	Temperature output span/zero	S	1200mV	1 to 1500mV
		Z	0000°C	0 to 1699°C
	CO output span/zero	S	1000°C	1 to 1700°C
		Z	00.0%	0.0 to 99.8%
	CO <sub>2</sub> output span/zero	S	50.0%	0.1 to 99.9%
		Z	00.000%	00.000 to 99.998%
	DP output span/zero	S	99.999%	00.001 to 99.999%
		Z	-30.0°C	-30.0 to 29.9°C
11	Display contrast		050%	0 to 100%
	Key backlight		AUTO	AUTO, OFF, ON
12	Analog 1st output/shift correction		00.00	-10.00 to 10.00
	Analog 1st output/range correction		1.0000	0.9000 to 1.1000
	Analog 2st output/shift correction		00.00	-10. to 10.00
	Analog 2st output/range correction		1.0000	0.9000 to 1.1000
	Analog 1st output manual output		AUTO 000%	AUTO, MANUAL 000 to 100%
	Analog 2st output manual output		AUTO 000%	AUTO, MANUAL 000 to 100%



## 15. Parameter directory list







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



For inquiries regarding product handling, please contact us or our distributors.  
Inquiry form URL : <https://www.energyys.co.jp/english/inq/all.php>  
ENERGY SUPPORT CORPORATION  
1, Aza Kamikobarii, Inuyama, Aichi 484-8505 Japan

