Service Manual

ZIRCONIA OXYGEN ANALYZER CONVERTER

TYPE: ZKM

Fuji Electric Co., Ltd.

INZ-TN5A0845b-E

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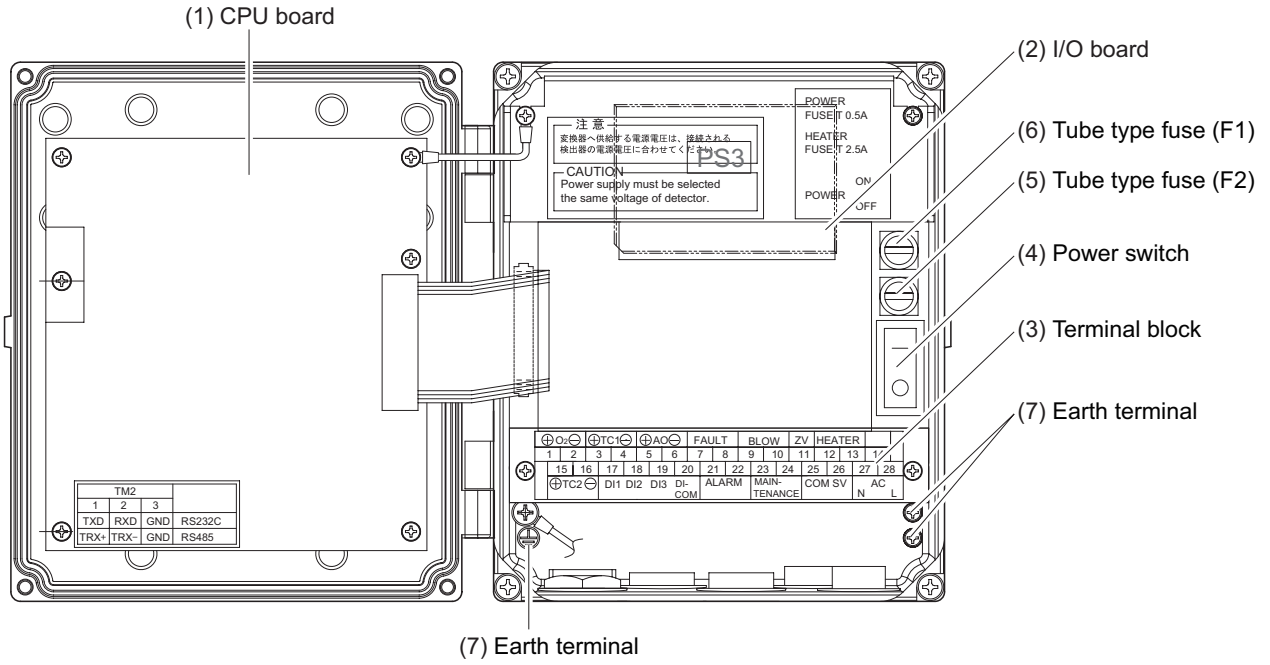
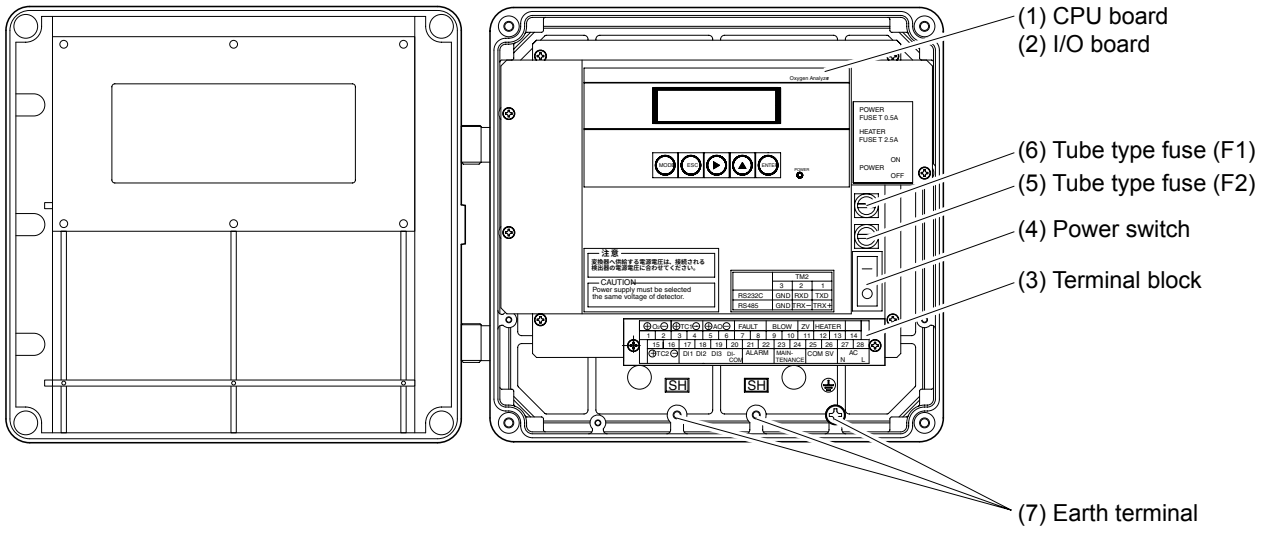
1. GENERAL

1.1 ZKM1 Internal constitution

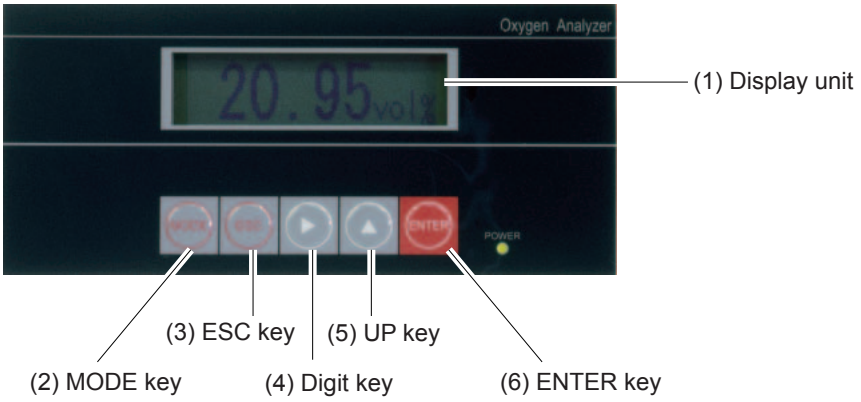


1.2 ZKM2 Internal constitution



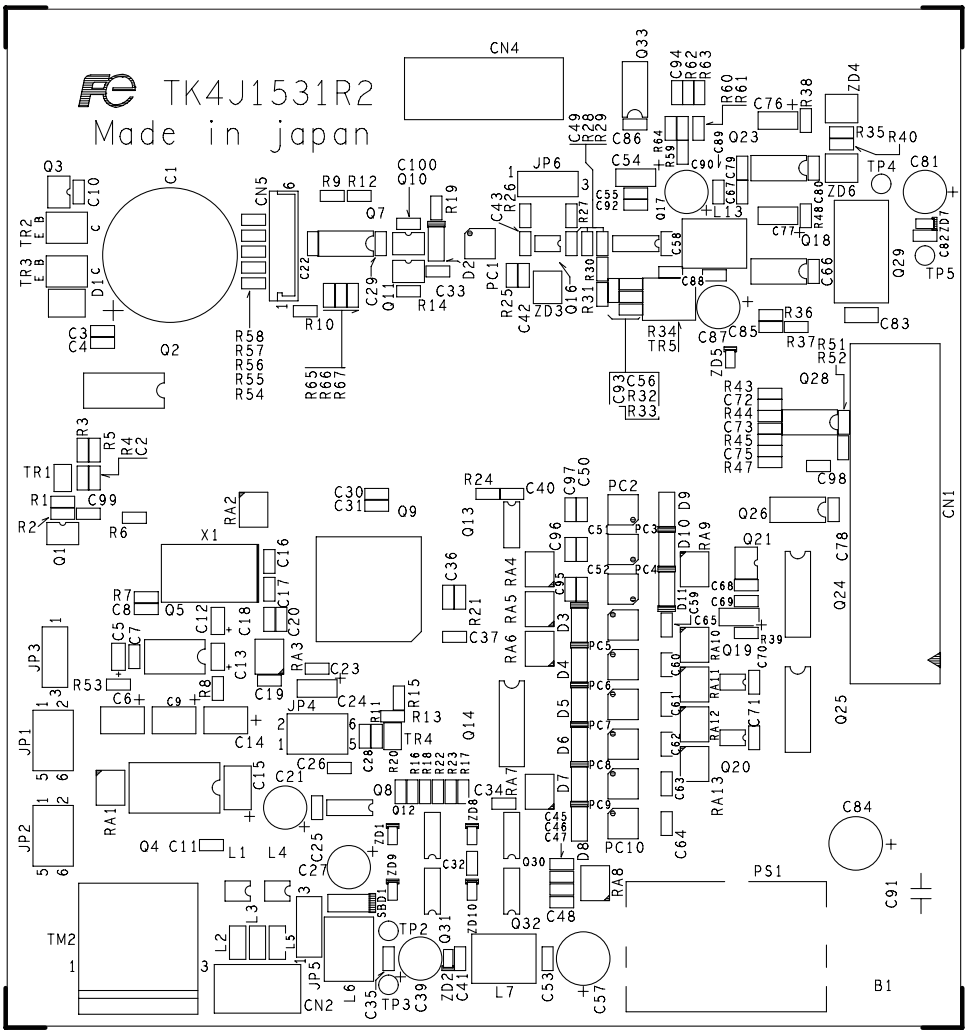
Name	Explanation
(1) CPU board	The liquid crystal display and the memory circuit are installed.
(2) I/O board	The input/output circuit and the power circuit are installed.
(3) Terminal block	Terminal block for various input/output signals.
(4) Power switch	Turns ON/OFF this converter. (“–”: OFF, “○”: ON)
(5) Tube type fuse (F2)	Fuse for the heater. (250 V T 2.5 A)
(6) Tube type fuse (F1)	Fuse for the main unit (250 V T 0.5 A)
(7) Earth terminal	Used as frame gland (FG).

1.3 Description on display/setting section

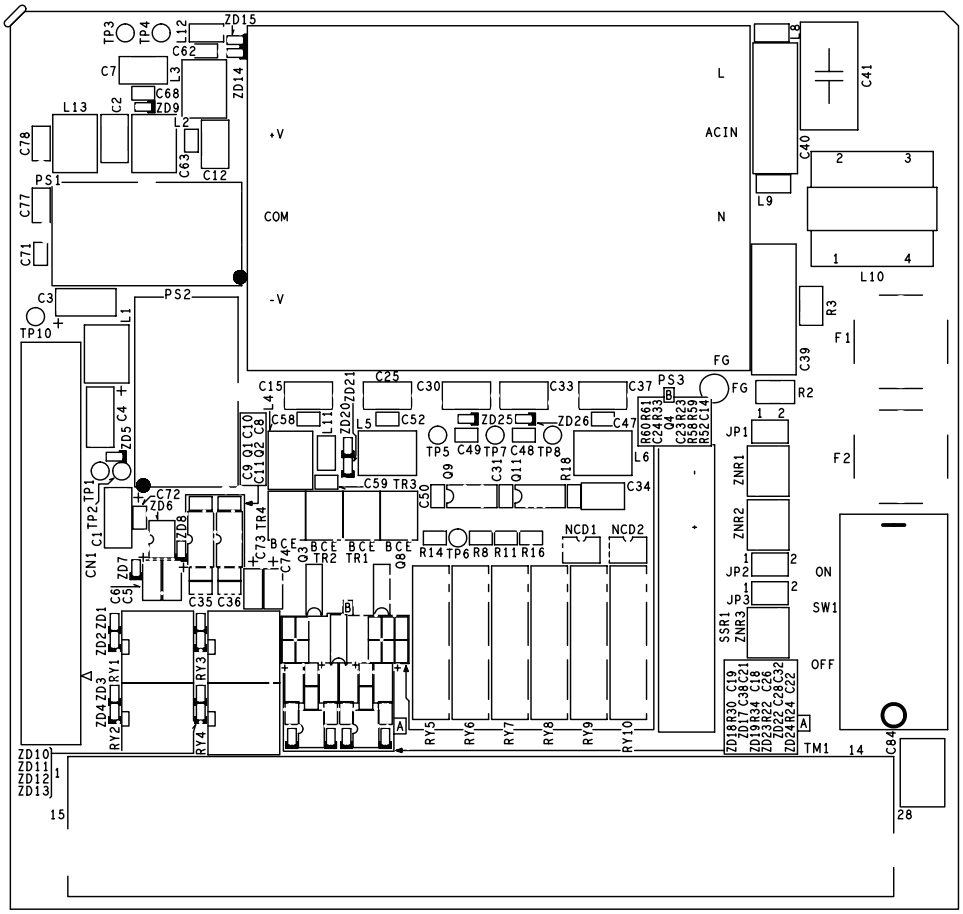


Name	Explanation
(1) Display unit	Displays the concentration value and setting values.
(2) MODE key	Used to switch measurement display and mode display.
(3) ESC key	Used to return to the previous screen or exit the setting.
(4) Digit key	Used to change the setting values.
(5) Up key	
(6) ENTER key	Used to determine the setting values.

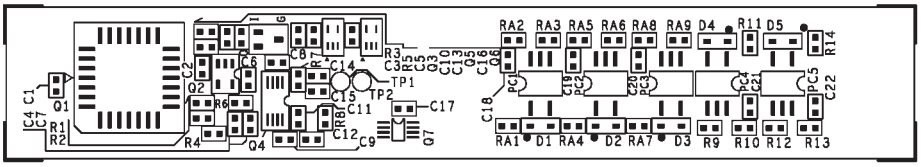
1.4 CPU board layout



1.5 I/O board layout



1.6 RS485 communication board layout



2. ADJUSTMENT

2.1 Necessary equipments for adjustment

Name	Specification	No. of units
Voltage generator	0 to 200 mVDC Min. resolution 0.1 mV	2
Digital multi meter	Voltage measurement : 0 to 20 V DC Min. resolution 0.1 mV Current measurement : 0 to 100 mA DC Min. resolution 0.01 mA	1

2.2 Adjustment flow

The ZKM adjustment flow is as follows.

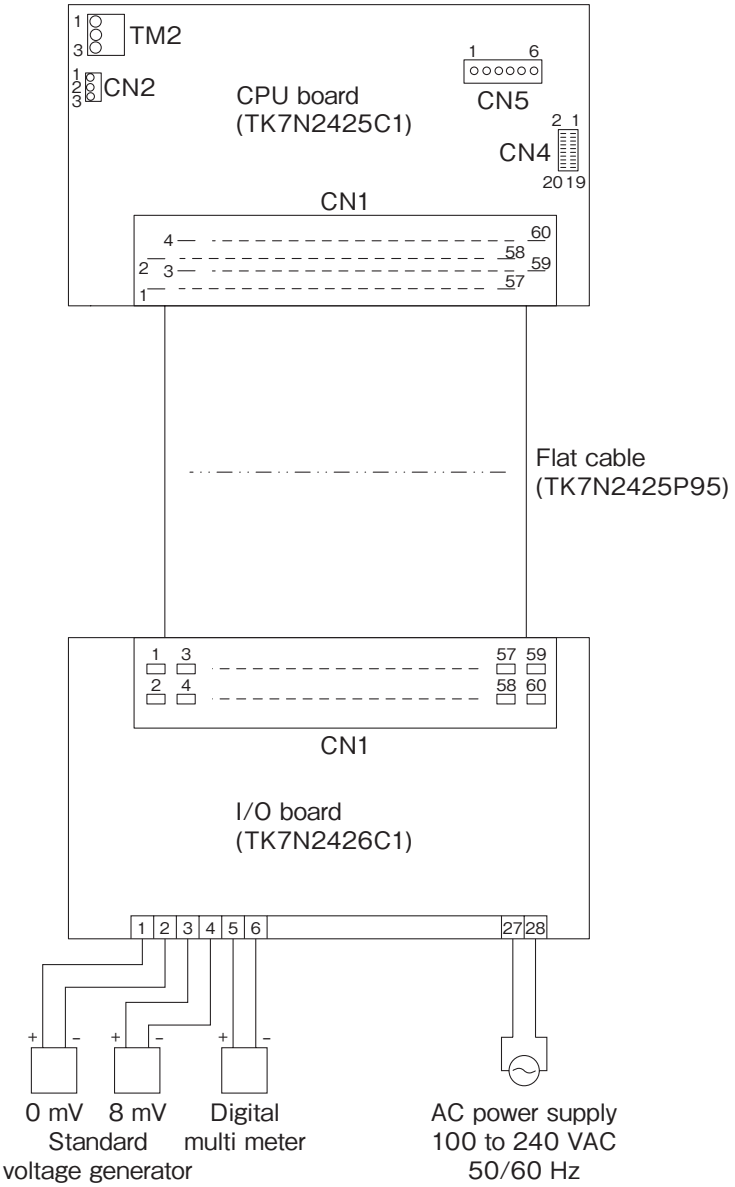
(1) Connection check
(2) Power ON
(3) Voltage check for each section
(4) Factory-set mode
(5) Individual adjustment
(6) Calibration by a simulation input

3. CONNECTION AND CHECK

3.1 Connection check

Check if the connector is mounted appropriately.

3.2 Connection diagram for adjustment



4. POWER ON AND VOLTAGE CHECK

4.1 Power ON

Open the front flap. Turn ON (-) the power switch.

OXYGEN ANALYZER VER ∗.∗∗ YY/MM

The message shown left appears on the LCD screen.

WARM-UP HEATER 234 °C

After about 6 seconds, the display is automatically switched to the Warm-up screen.

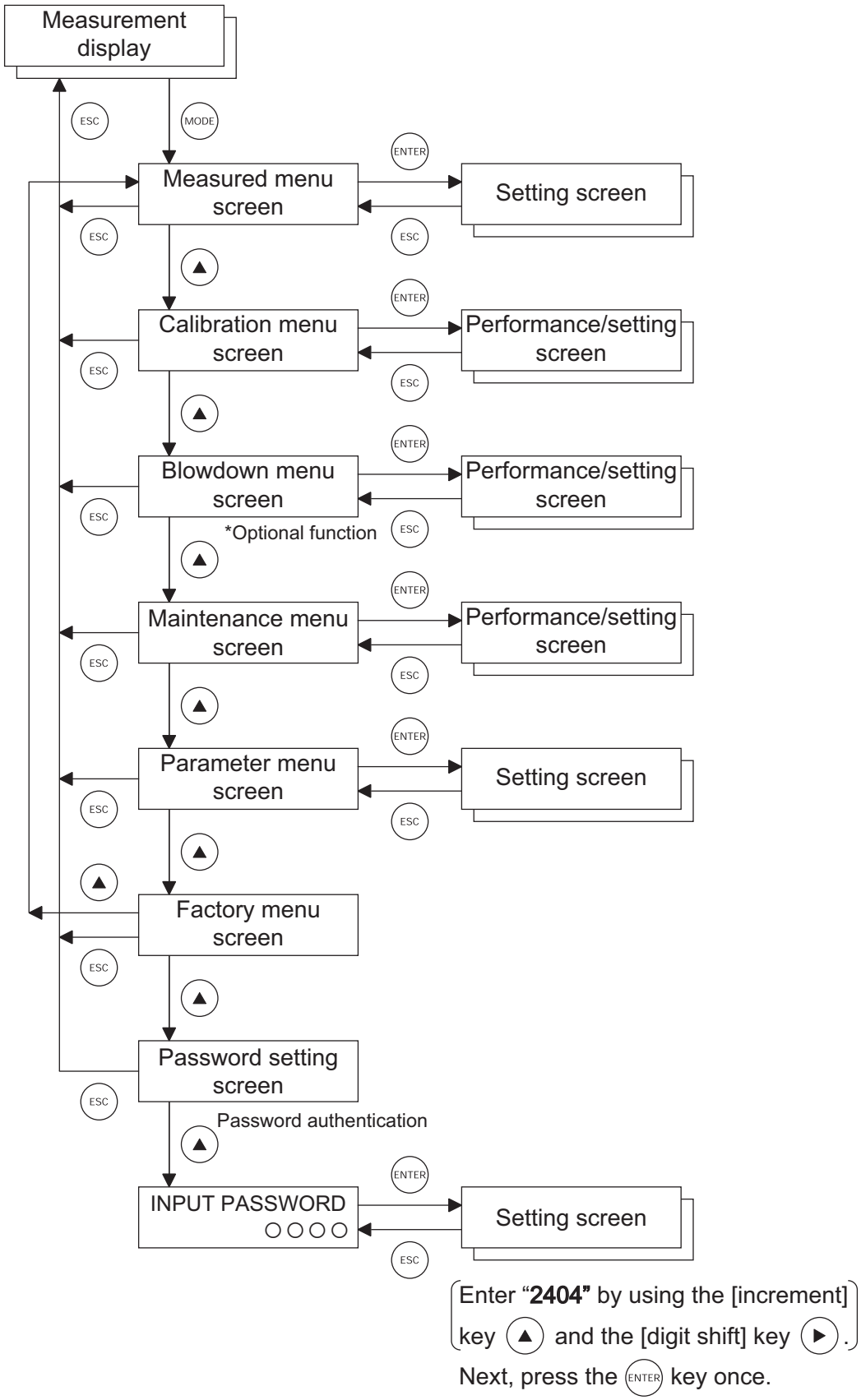
4.2 Check of the power supply voltage

Turn on the power supply of the converter and check the voltage of the printed circuit board according to the table below.

Printed circuit board	Check terminal	Adjusting VR	Adjusting voltage
CPU board (TK7N2425)	Between TP2 and TP3	-	+5.0±0.50V DC
	Between TP4 and TP5	-	+5.0±0.30V DC
I/O board (TK7N2426)	Between TP1 and TP2	-	+5.0±0.30V DC
	Between TP3 and TP4	-	+15.0±0.75V DC
	Between TP3 and TP10	-	-15.0±0.75V DC
	Between TP7 and TP5	-	-12.0±1.00V DC
	Between TP7 and TP8	-	+12.0±1.00V DC

5. FACTORY-SET MODE

5.1 Change settings from the initial screen to the factory-set screen (factory mode).



5.2 Initial setting

The table bellows show the factory-set values.

5.3 Measured menu

Item	Setting item	LCD display	Default value	Remarks
1	Display range	DISPLAY RANGE	RANGE1	
2	Decimal point position	DECIMAL POINT	00.00	
3	Full scale	FULL SCALE	25.00 vol%	
4	Calculation time of max./min. value	CALCULATE TIME	024 h	

5.4 Calibration menu

Item	Setting item	LCD display	Default value	Remarks
1	Automatic calibration YES/NO	AUTO CALIBRATION	NO	
2	Date and time for starting automatic calibration	START DATE	99/01/01 00:00	
3	Automatic calibration cycle	AUTO CAL. CYCLE	07d 00h	
4	Calibration gas	SPAN ZERO	20.600% 02.000%	
5	Calibration wait time	CAL. WAIT TIME	060s	
6	Calibration range operation	ABOUT CAL. RANGE	BOTH	

5.5 Blowdown menu

Item	Setting item	LCD display	Default value	Remarks
1	Automatic blowdown YES/NO	BLOW DOWN	NO	
2	Date and time for starting automatic blowdown	START DATE	99/01/01 00:00	
3	Automatic blowdown cycle	AUTO BLOW CYCLE	24h 00m	
4	Blowdown time	BLOW DOWN TIME	030 s	

5.6 Maintenance menu

Item	Setting item	LCD display	Default value	Remarks
1	Sensor check for calibration	SENSOR CHECK	NO	
2	Sensor recovery for calibration	SENSOR RECOVER	NO	

5.7 Parameter menu

Item	Setting item	LCD display	Default value	Remarks
1	Current date and time	DATE SET	00/01/01 00:00	
2	Contact input	DI 1	NONE	
3	Contact input	DI 2	NONE	
4	Contact input	DI 3	NONE	
5	Alarm contact output	DO ALARM	ALARM NONE	
6	High limit of oxygen concentration	OXYGEN ALARM HIGH ALARM	50.000 vol%	
7	Low limit of oxygen concentration	OXYGEN ALARM LOW ALARM	00.020 vol%	
8	H-High limit of oxygen concentration	OXYGEN ALARM H-HIGH ALARM	55.000 vol%	
9	L-Low limit of oxygen concentration	OXYGEN ALARM L-LOW ALARM	00.010 vol%	
10	Hysteresis	OXYGEN ALARM HYSTERESIS	10 %	
11	Heater temperature error	HEATER ERROR	010 °C 01 %	
12	Output hold YES/NO	OUTPUT HOLD	NO	
13	Hold value	OUTPUT SELECT	0 %	
14	Hold setting value	HOLD VALUE	000 %	
15	Measurement wait time	MEAS. WAIT TIME	010 s	
16	Key lock	KEY LOCK	NO	
17	Automatic backlight OFF time	BACKLIGHT TIME	10 m	
18	Station number	STATION NO	01	

5.8 Factory menu

Item	Setting item	LCD display	Default value	Remarks
1	Analog output	ANALOG OUT TYPE	4 to 20 mA	
2	Blowdown	BLOW DOWN	NO	<Note 1>
3	Combustion efficiency display	COMBUSTIBLE TIME	NO	<Note 1>
4	Warm-up operation monitoring time	WARM-UP TIME	45 m	
5	Movement average time	AVERAGING TIME	02 s	
6	Heater temperature control	TEMP. CONTROL	800 °C	
7	Heater low temperature control	LOW TEMP.	70 °C	
8	Heater low temperature control time	LOW TEMP. TIME	30 m	
9	Heater temperature error	HEATER TEMP.ERR.	70 °C 1%	
10	Thermocouple type	THERMO COUPLE	R-TYPE	
11	Language type	LANGUAGE	ENGLISH	
12	Password	PASSWORD	2404	
13	Manual sensor recovery type	RECOVER TYPE	AC	
14	AC recovery	Ω TIME	100 Ω 005 m	
15	High temperature recovery	HI-TEMP. TIME	900 °C 010 m	
16	PID parameter	P I D	020 03000 00600	
17	Default parameter	DEFAULT PARA SET	YES	
18	Communication	COMMUNICATION	RS232C	<Note 1>
19	Automatic calibration	AUTO CAL. SET	NO	<Note 1>
20	Error check start time	ERR CHECK TIME	420 s	
21	Operation key	OPERATION KEY	5 KEY	<Note 1>
22	Error output	ERROR OUT	YES	
23	RBT contact	RBT CONTACT	NO	<Note 1>
24	Surrounding temperature	SURROUNDING TEMP	ZERO COUNT	
25	Offset at 10°C	OFFSET 10°C	378	
26	Output contact	DIGITAL OUT SET	NO	
27	Wire check start time	WIRE CHECK TIME	05 m	
28	Option password	OPTION PASS	-	
29	Main unit serial number	ID INFO	-	

Note 1: Entry of the option password is required to change settings.

6. SETTING

6.1 Analog output setting

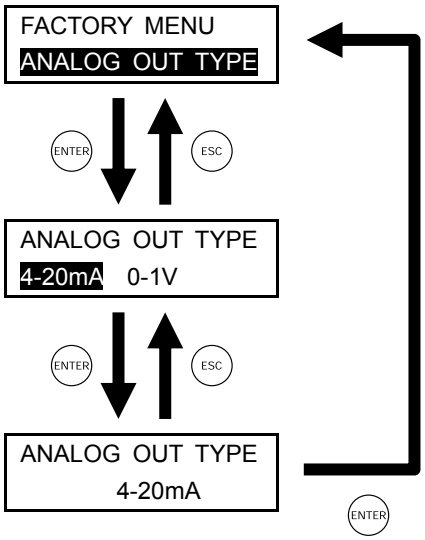
Purpose: To set an analog output type (4 to 20 mA/0 to 1 V).

Procedure:

1) Enter the <FACTORY MENU/ANALOG OUT TYPE> screen.

2) Select the <ANALOG OUT TYPE> screen by the ▲ key.

3) Press the ENTER key to enter the <ANALOG OUT TYPE> screen.



Current setting is highlighted.

4) Select an analog output type by the ▶ key.

Selected type is highlighted.

5) Press the ENTER key to determine the setting.

The set type is displayed.

* Always switch the output jumper pin (JP6) on the CPU printed circuit board after selection of the output.

5th digit of code symbol	Output type	JP6
B	4 to 20 mA	1 to 2
E	0 to 1 V	2 to 3

6.2 Analog output adjustment

Purpose: To adjust "0% (4 mA/0V)" and "100% (20 mA/1V)" of an analog output.

* When "4-20 mA" is selected, adjust an analog output by connecting ammeter to the "5 (+AO)" and "6 (-AO)" of an external terminals.
  When "0-1V" is selected, adjust an analog output by connecting the voltmeter to the "5 (+AO)" and "6 (-AO)" of an external terminals.
* Same adjustment for the factory mode. (both of them are available)

Procedure:

1) Enter the <PARAMETER MENU/A-OUT ADJUST> screen.

2) Select the <A-OUT ADJUST> screen by the ▲ key.

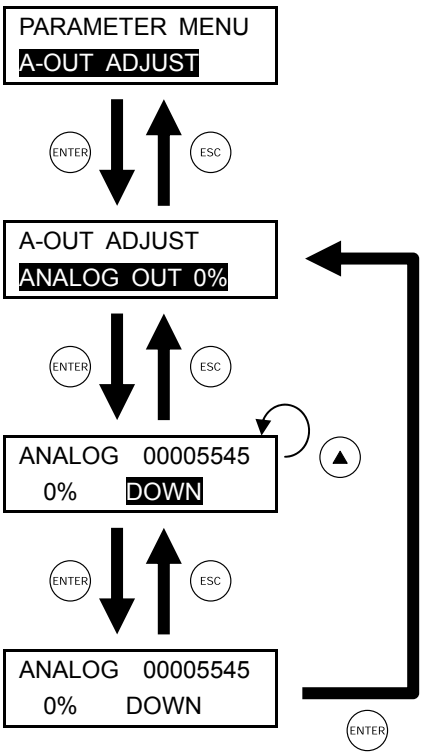
3) Press the ENTER key to enter the <A-OUT ADJUST> screen.

4) Select the analog output adjustment screen by the ▲ key.

5) Press the ENTER key to enter the analog output adjustment screen.

6) Adjust an analog output by the ▲ or ▶ key.
"DOWN" or "UP" is selectable by pressing the ▶ key.
Change an analog output by the ▲ key while checking the analog output by the digital multi meter or the like.

7) Press the ENTER key to determine the setting.



When selecting the analog output adjustment screen ;
If adjust "0% (4 mA/0V)" of the analog output, select "ANALOG OUT 0%".
If adjust "100% (20 mA/1V)" of the analog output, select "ANALOG OUT 100%".

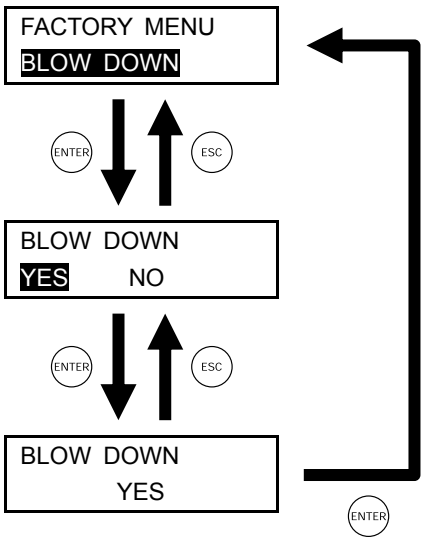
Output type	Output		Count value	
	0 %	100 %	0 %	100 %
4 to 20 mA	4.00 mA	20.00 mA	5550	28070
0 to 1 V	0.00 V	1.00 V	9600	29600

6.3 Blowdown setting screen

Purpose: To set the blowdown function YES/NO (Enabled /Disabled).
If "NO" is set, items for blowdown are not displayed in the menu.
The 9th digit of code symbol is <enabled when 2, 4, 6, or 7 is selected>

Procedure:
1) Enter the <FACTORY MENU/BLOW DOWN> screen.

2) Select the <BLOW DOWN> screen by the ▲ key.
3) Press the ENTER key to enter the <BLOW DOWN> screen.



Current setting is highlighted.
4) Select BLOWDOWN YES/NO by the ▶ key.
Selected one is highlighted.

5) Press the ENTER key to determine the setting.
Your setting is displayed.

Setting: Make a setting as the following table according to the 9th digit of the code symbol.

9th digit of code symbol	Blowdown function	Setting value
Y, 1, 3, 5	Disabled	NO
2, 4, 6, 7	Enabled	YES

Entry of the option password is required to change this parameter.

6.4 Combustion efficiency display setting screen

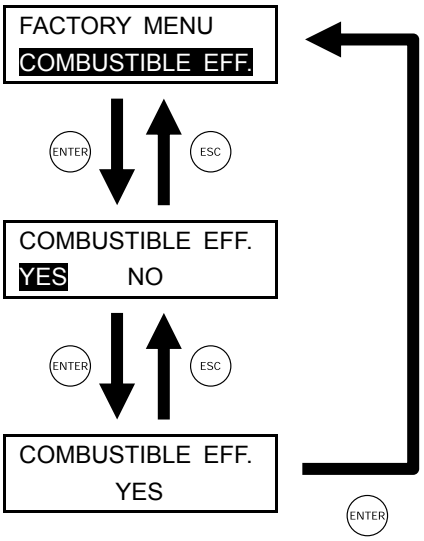
Purpose: To set combustion efficiency YES/NO (Display/Not display).
When “NO” is set, the combustion efficiency screen is not displayed.
The 9th digit of code symbol is <enabled when 1, 4, 5, or 7 is selected>.

Procedure:

1) Enter the <FACTORY MENU/COMBUSTIBLE EFF.> screen.

2) Select the <COMBUSTIBLE EFF.> screen by the (▲) key.

3) Press the (ENTER) key to enter the <COMBUSTIBLE EFF.> screen.



Current setting is highlighted.

4) Select COMBUNTIBLE EFF. YES/NO by the (▶) key.

Selected one is highlighted.

5) Press the (ENTER) key to determine the setting.

Your setting is displayed.

Setting: Make a setting as following table according to the 9th digit of code symbol.

9th digit of code symbol	Screen display	Setting value
Y, 2, 3, 6	Not displayed	NO
1, 4, 5, 7	Displayed	YES

Entry of the option password is required to change this parameter.

6.5 Surrounding temperature correction

Purpose: To adjust an analog input 2 (O_2 sensor thermocouple input).

Procedure:

1) Enter the <FACTORY MENU/SURROUNDING TEMP> screen.

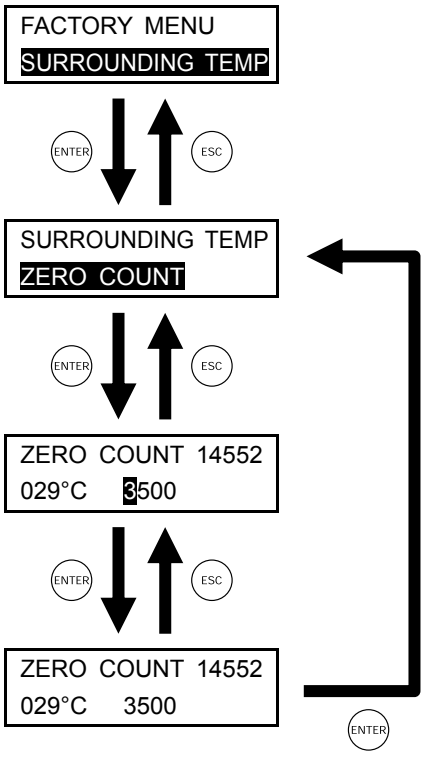
2) Select the <SURROUNDING TEMP> screen by the ▲ key.

3) Press the ENTER key to enter the <SURROUNDING TEMP> screen.

4) Select "ZERO COUNT" by the ENTER key.

5) Set the surrounding temperature near the converter by the ▲ or ▶ key.
   Input a count value (1, 2500, or 5000).
   1 : 34°C 2500 : 25°C 5000 : 20°C

6) Press the ENTER key to determine the setting.



6.6 Thermocouple type setting screen

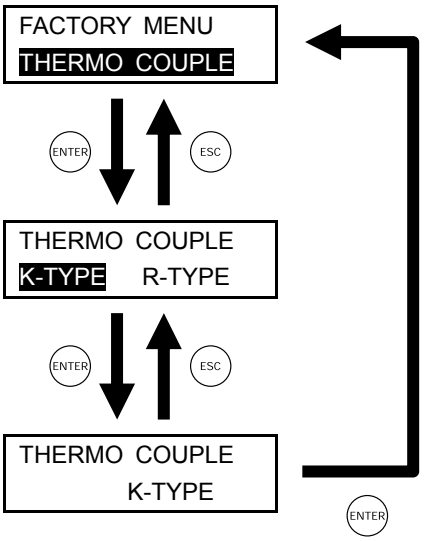
Purpose: To set a thermocouple type for temperature measurement of the detector.
The 4th digit of code symbol <K: when K thermocouple is specified>

Procedure:

Select the <THERMO COUPLE> screen by the ▲ key.
Press the ENTER key to enter the <THERMO COUPLE> screen.

Current setting is highlighted.
Select a THERMO COUPLE K-TYPE/R-TYPE by the ▶ key.
Selected one is highlighted.

Press the ENTER key to determine the setting.
Your setting is displayed.



* R-type thermocouple : I/O board TK7N2426C1 R-thermo
K-type thermocouple : I/O board TK7N2426C2 K-thermo
Circuit constants are different.

6.7 Language type setting

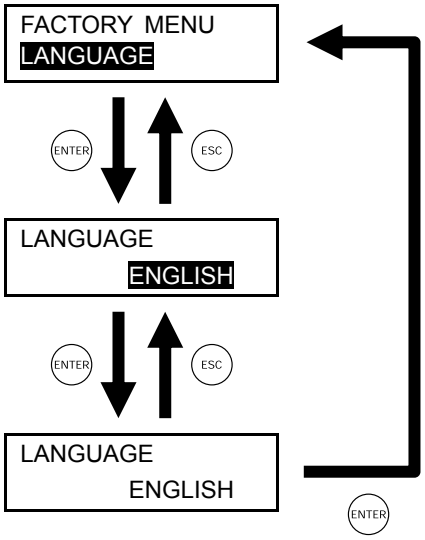
Purpose: To set the characters to be displayed according to the 10th digit of code symbol.

Procedure:

1) Enter the <FACTORY MENU/LANGUAGE> screen.

2) Select the <LANGUAGE> screen by the (▲) key.

3) Press the (ENTER) key to enter the <LANGUAGE> screen.



Current setting is highlighted.

4) Select a language type by the (▶) key.

Selected language is highlighted.

5) Press the (ENTER) key to determine the setting.

Your setting is displayed.

Setting: Set one language from the following table according to the 10 the digit of code symbol.

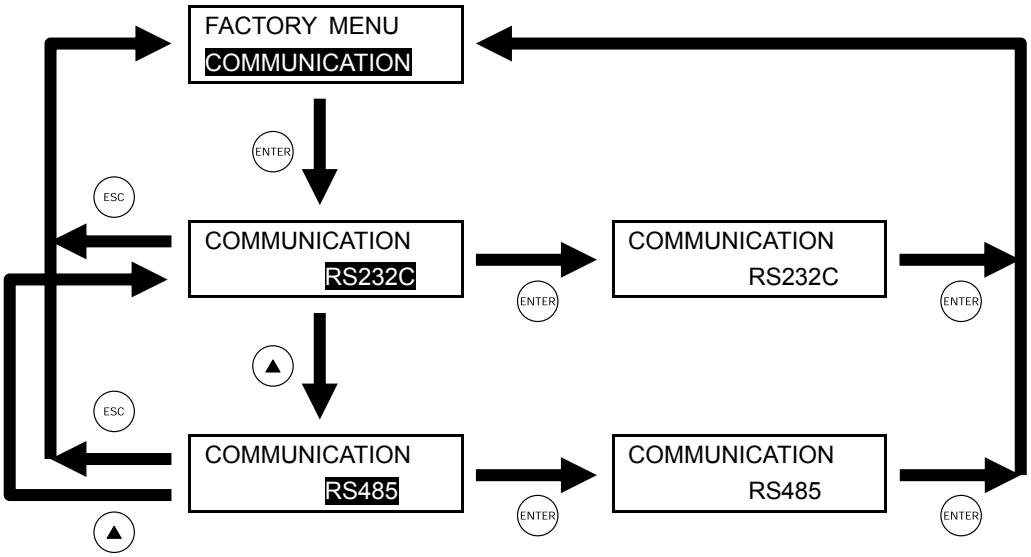
10th digit of code symbol	Display language
J	Japanese
E	English
C	Chinese

6.8 Communication setting

Purpose: To set a communication type.
The 6th digit of code symbol

Procedure:

1) Enter the <FACTORY MENU/COMMUNICATION> screen.



2) Select the <COMMUNICATION> screen by the ▲ key.
3) Press the ENTER key to enter the <COMMUNICATION> screen.
4) Select a communication type by the ▲ key.
5) Press the ENTER key to determine the communication type.
6) Press the ENTER key to determine the setting.

* Always switch the output jumper pin (JP1, JP2) on the CPU printed circuit board after selection of a communication type.

6th digit of code symbol	Communication type	JP1	JP2	JP5	JP6
1	RS232C	3-5 4-6	3-5 4-6	2-3	-
2	RS485	1-3 2-4	1-3 2-4	1-2	-

Entry of the option password is required to change this parameter.

6.9 Automatic calibration setting screen

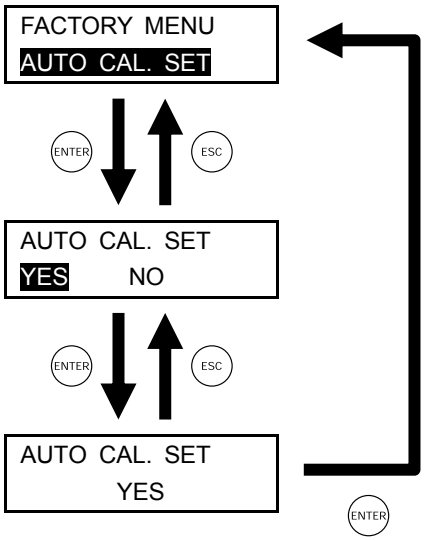
Purpose: To set the automatic calibration function YES/NO (Enabled/Disabled).
When “NO" is selected, items related to the automatic calibration is not displayed in the menu.
The 9th digit of code symbol is <available when 3, 5, 6, or 7 is selected>

Procedure:

1) Enter the <FACTORY MENU/AUTO CAL. SET> screen.

2) Select the <AUTO CAL. SET> screen by the (▲) key.

3) Press the (ENTER) key to enter the <AUTO CAL. SET> screen.



Current setting is highlighted.

4) Select AUTO CAL. SET YES/NO by the (▶) key.

Selected one is highlighted.

5) Press the (ENTER) key to determine the setting.

Your setting is displayed.

Setting: Make a setting as the following table according to the 9th digit of code symbol.

9th digit of code symbol	Auto calibration function	Setting value
Y, 1, 2, 4	Disabled	NO
3, 5, 6, 7	Enabled	YES

Entry of the option password is required to change this parameter.

6.10 AD1 (O_2 sensor input) adjustment

Purpose: To adjust an analog input 1 (O_2 sensor input).

Procedure:

1) Enter the <FACTORY MENU/ADJUDT> screen.

2) Select the <ADJUST> screen by the ▲ key.

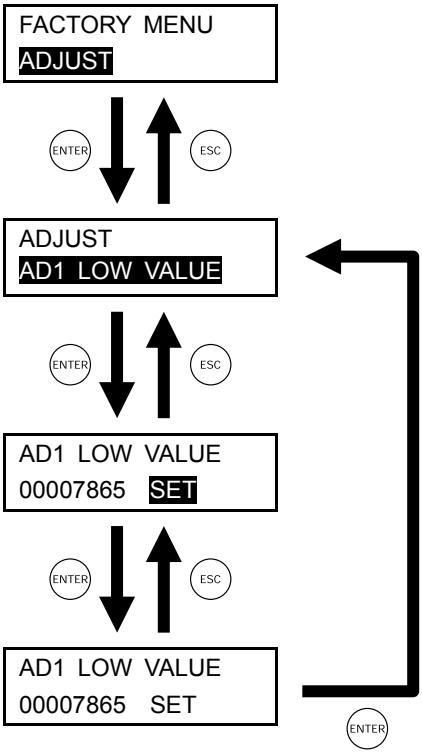
3) Press the ENTER key to enter the <ADJUST> screen.

4) Select the <AD1 LOW VALUE> screen by the ▲ key.

5) Press the ENTER key to enter the <AD1 LOW VALUE> screen.

6) Apply 0.000 mV to "1 (+O_2)" and "2 (-O_2)" of the external terminals. *

7) Press the ENTER key to determine the setting.



* When selecting the O_2 sensor input adjustment screen, select "AD1 LOW VALUE" first, and then apply 0.000 mV to "1 (+O_2)" and "2 (-O_2)" of the external terminals to perform adjustment.
Next, select "AD1 HIGH VALUE" and apply 100.000 mV to "1 (+O_2)" and "2 (-O_2)" of the external terminals to perform adjustment.
Make sure to perform the both adjustments.

Input	Count value
Low : 0 mV	7800
High : 100 mV	17200

6.11 AD2 (O_2 sensor thermocouple input) adjustment

Purpose: To adjust an analog input 2 (O_2 sensor thermocouple input).

Procedure:

1) Enter the <FACTORY MENU/ADJUST> screen.

2) Select the <ADJUST> screen by the ▲ key.

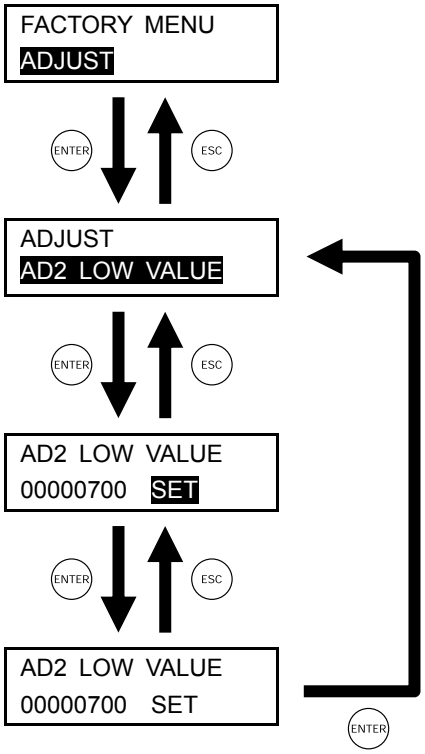
3) Press the ENTER key to enter the <ADJUST> screen.

4) Select the <AD2 LOW VALUE> screen by the ▲ key.

5) Press the ENTER key to enter the <AD2 LOW VALUE>screen.

6) Apply 0,000 mV to “3 (+TC1)” and “4 (-TC1)” of external terminals. *

7) Press the ENTER key to determine the setting.



* When selecting the O_2 sensor thermocouple input adjustment screen, select “AD2 LOW VALUE” first, and then apply 0.000 mV to "3 (+TC1)” and “4 (-TC1)” of the external terminals to perform adjustment. Next, select “AD2 HIGH VALUE” and apply 9.000 mV to "3 (+TC1)” and “4 (-TC2)” of the external terminals to perform adjustment.
Make sure to perform the both adjustments.

R-type thermocouple

Input	Count value
Low : 0 mV	1000
High : 9 mV	29600

K-type thermocouple

Input	Count value
Low : 0 mV	700
High : 40 mV	32700

6.12 AD3 (Thermocouple input for combustion control) adjustment

Purpose: To adjust an analog input 3 (thermocouple input for combustion control).

Procedure:

1) Enter the <FACTORY MENU/ADJUST> screen.

2) Select the <ADJUST> screen by the (▲) key.

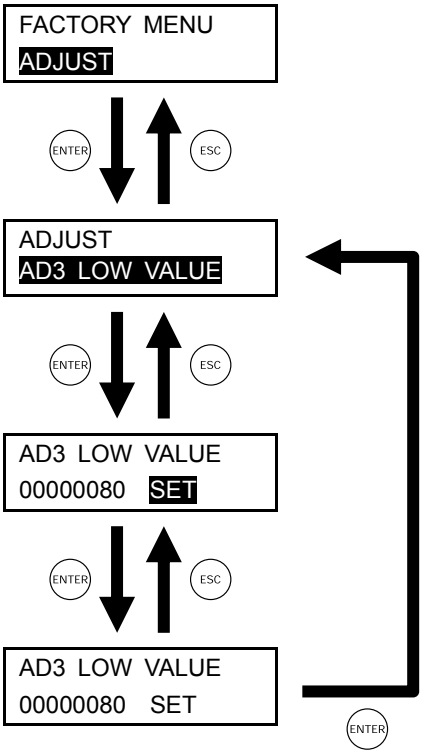
3) Press the (ENTER) key to enter the <ADJUST> screen.

4) Select the <AD3 LOW VALUE> screen by the (▲) key.

5) Press the (ENTER) key to enter the <AD3 LOW VALUE> screen.

6) Apply 0.000 mV to "15 (+TC2)" and "16 (-TC2)" of external terminals. *

7) Press the (ENTER) key to determine the setting.



* When selecting the thermocouple input for combustion control adjustment screen, select "AD3 LOW VALUE" first, and then apply 0.000 mV to "15 (+TC2)" and "16 (-TC2)" of the external terminals to perform adjustment.
Next, select "AD3 HIGH VALUE" and apply 9.000 mV to "15 (+TC2)" and "16 (-TC2)" of the external terminals to perform adjustment.
Make sure to perform the both adjustments.

Input	Count value
Low : 0 mV	1200
High : 9 mV	15800

6.13 Entry of the option password

Purpose: To enter the password for changing settings of option items.

* Password is managed by each unit and it is not public.

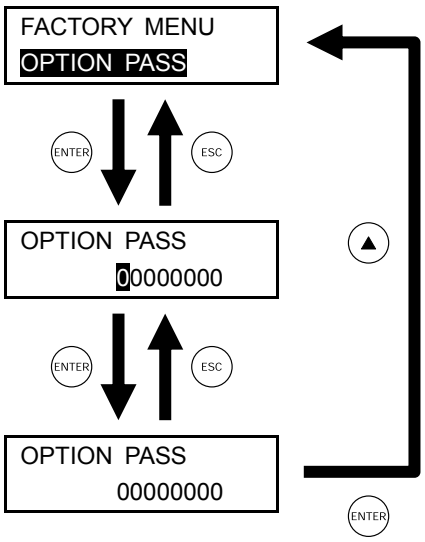
Procedure:

1) Enter the <FACTORY MENU/OPTION PASS> screen.

2) Press the (ENTER) key to enter the <PASSWORD> screen.

3) Press the (▲) and (▶) keys to enter the password.

4) Press the (ENTER) key to determine the setting.



6.14 Serial number

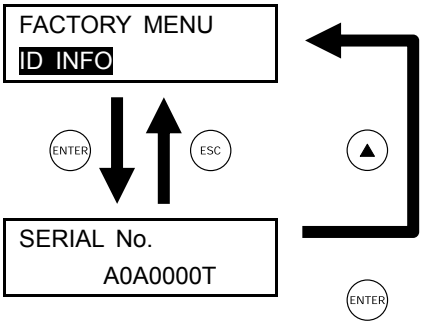
Purpose: To display the serial number of main unit.

Procedure:

1) Enter the <FACTORY MENU/ID INFO> screen.

2) Press the ENTER key to enter the <ID INFO> screen.

3) Press the ENTER key to go back to the <FACTORY MENU/ID INFO> screen.



* You can not change.

6.15 Digital output contact setting

Purpose: To set a digital output contact for COSA, DELTA, and RBT. [Free terminal allocation]
The 4th digit of code symbol <When R or K is specified: for RTB>
The 12th digit of code symbol <When 3, 4, 6, or 7 is specified: for COSA/DELTA>

Differences from the standard specification

Function	Standard spec.	COSA/DELTA spec.
Maintenance(MAINTE)	DO6 (fixed)	DO1 to DO6 (settable)
Calibration (MAINTE)	DO6 (fixed)	DO1 to DO6 (settable)
Blowdown (BLOW)	DO5 (fixed)	DO1 to DO6 (settable)
Span valve (SV)	DO4 (fixed)	DO1 to DO6 (settable)
Zero valve (ZV)	DO3 (fixed)	DO1 to DO6 (settable)
H alarm (ALARM)	DO2 (fixed)	DO1 to DO6 (settable)
L alarm (ALARM)	DO2 (fixed)	DO1 to DO6 (settable)
H-High alarm (ALARM)	DO2 (fixed)	DO1 to DO6 (settable)
L-Low alarm (ALARM)	DO2 (fixed)	DO1 to DO6 (settable)
Equipment failure (FAULT)	DO1 (fixed)	DO1 to DO6 (settable)
Calibration error (ALARM)	DO1 (fixed)	DO1 to DO6 (settable)
Rich mode	-	DO1 to DO6 (settable)
Reserved	-	DO1 to DO6 (settable)

* For ALARM, “Enable” should be set to an alarm output.

Procedure:

1) Enter the <FACTORY MENU/DIGITAL OUT SET> screen.

2) Select the <DIGITAL OUT SET> screen by the ▲ key.

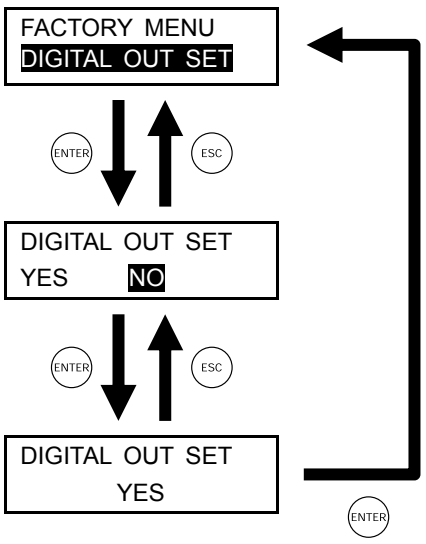
3) Press the ENTER key to enter the <DIGITAL OUT SET> screen.

Current setting is displayed.

4) Select DIGITAL OUT SET YES by the ▲ or ▶ key.

5) Press the ENTER key to determine the setting.

Your setting is displayed.



6.16 RBT contact setting

Purpose: To set a RBT contact specification [Normally closed (NC)].

The 4th digit of code symbol <when R or K is specified>

4th digit of code symbol	Case structure
R	RB spec. of bench type R-type thermocouple
K	RB spec. of bench type K-type thermocouple

Target for NC	Not target for NC
Maintenance (MAINTE)	Blowdown (BLOW)
Calibration (MAINTE)	Span valve (SV)
H alarm (ALARM)	Zero valve (ZV)
L alarm (ALARM)	Rich mode
H-High alarm (ALARM)	
L-Low alarm (ALARM)	
Equipment failure (FAULT)	
Calibration error (ALARM)	

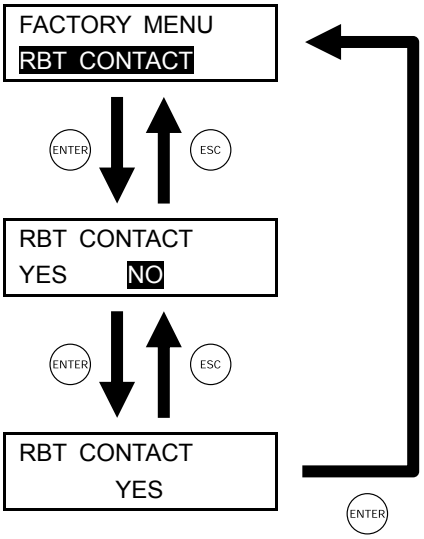
List of targets for normally closed

Procedure:

1) Enter the <FACTORY MENU/RBT CONTACT> screen.

2) Select the <RBT CONTACT> screen by the ▲ key.

3) Press the ENTER key to enter the <RBT CONTACT> screen.



Current setting is displayed.

4) Change the current setting to RBT CONTACT YES by the ▲ or ▶ key.

5) Press the ENTER key to determine the setting.

Your setting is displayed.

Entry of the option password is required to change this parameter.

6.17 Operation key setting

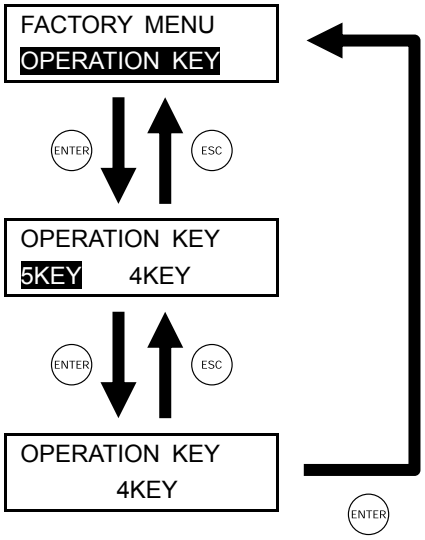
Purpose: To set the RBT operation key from 5 to 4.

Procedure:

1) Enter the <FACTORY MENU/OPERATION KEY> screen.

2) Select the <OPERATION KEY> screen by the ▲ key.

3) Press the ENTER key to enter the <OPERATION KEY> screen.



Current setting is displayed.

4) Change the setting to 4KEY by the ▲ or ▶ key.

5) Press the ENTER key to determine the setting.

Your setting is displayed.

Entry of the option password is required to change this parameter.

6.18 Wire check start time setting

Purpose: To set the wire check time.
When the input signal is beyond 1150 mV, the alarm is output after the wire check time.
(Input signal may be 1150 mV or more at combustion initiation of furnace.)

Procedure:

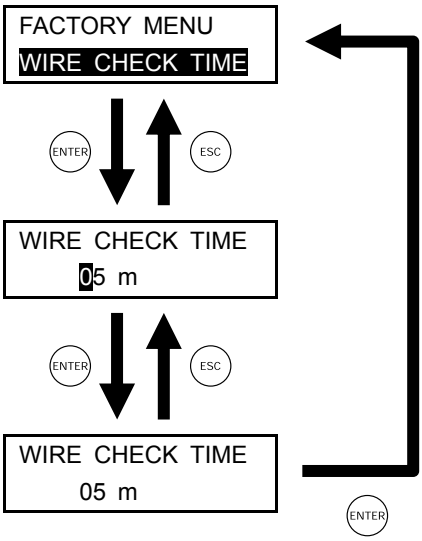
1) Enter the <FACTORY MENU/WIRE CHECK TIME> screen.

2) Select the <WIRE CHECK TIME> screen by the ▲ key.

3) Press the ENTER key to enter the <WIRE CHECK TIME> screen.

4) Current setting is highlighted.

5) Set the time by the ▲ or ▶ key and press the ENTER key to determine.



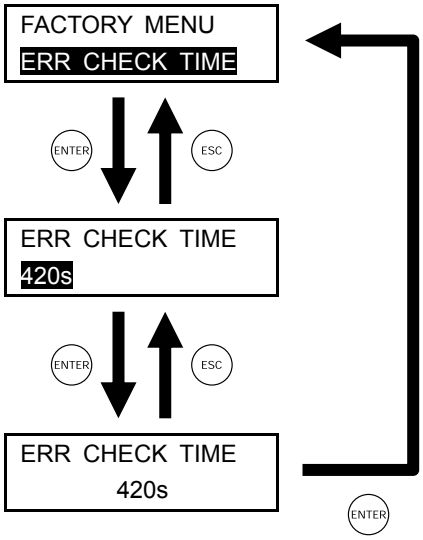
6.19 Error check start time setting

Procedure:

1) Enter the <FACTORY MENU/ERR CHECK TIME> screen.

2) Select the <ERR CHECK TIME> screen by the ▲ key.

3) Press the ENTER key to enter the <ERR CHECK TIME> setting screen.



Current setting is highlighted.

4) Select time by the ▲ key.

Selected time is highlighted.

5) Press the ENTER key to determine the setting.

Your setting is displayed.

7. CALIBRATION BY A SIMULATION INPUT

Purpose: To calibrate SPAN/ZERO.

Note: • After adjustment of AD1 (O2 sensor input), perform SPAN/ZERO calibration.
- After Span calibration, perform Zero calibration.
- SPAN/ZERO calibration are not available during warm-up operation or error (disconnection, abnormal heater temperature, etc.) occurrence.
- Apply to AD2 (O_2 sensor thermocouple input) so that the heater temperature becomes 800°C. The heater temperature to be displayed
  = AD2 (Heater temperature input) + Room temperature. (Refer to "8.1 Table of reference thermal electromotive force of R-type thermocouple")

7.1 Manual SPAN calibration

Procedure:

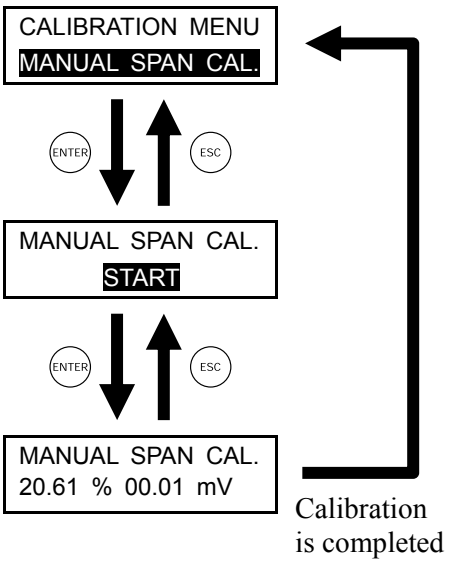
1) Enter the <CALIBRATION MENU/MANUAL SPAN CAL.> screen.

2) Select the <MANUAL SPAN CAL.> screen by the ▲ key.

3) Press the ENTER key to enter the <MANUAL SPAN CAL.> screen.

4) Press the ENTER key after applied 0.000 mV DC (equivalent of 20.6 vol%) to "1 (+O_2)" and "2 (-O_2)" of external terminals.

* If SPAN gas concentration has been changed at "Calibration gas setting screen", apply the voltage which falls into the set concentration.



Oxygen concentration value and electromotive force of O_2 sensor are displayed during execution of manual SPAN calibration. When the calibration is completed successfully, the display transits to the menu screen.

7.2 Manual ZERO calibration

Procedure:

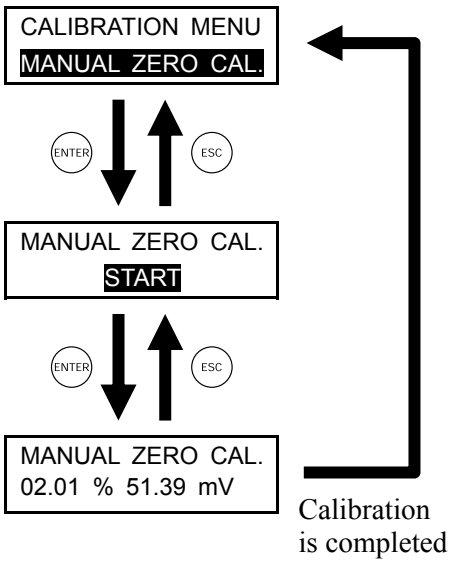
1) Enter the <CALIBRATION MENU/MANUAL ZERO CAL.> screen.

2) Select the <MANUAL ZERO CAL.> screen by the ▲ key.

3) Press the ENTER key to enter the <MANUAL ZERO CAL.> screen.

4) Press the ENTER key while applying 51.39 mV DC (2.0 vol%) to "1 (+O2)" and "2 (-O2)" of external terminals.

* If ZERO gas concentration has been changed at "Calibration gas setting screen", after applied the voltage which falls into the set concentration.



Oxygen concentration value and electromotive force of O_2 sensor are displayed during execution of manual ZERO calibration. When the calibration is completed successfully, the display transits to the menu screen.

8. APPENDED FIGURES

8.1 Table of reference thermal electromotive force of R-type thermocouple

Unit : mV JIS C 1602-1995

Temperature (°C)	0	100	200	300	400	500	600	700	800	900
0	0.000	0.647	1.469	2.401	3.408	4.471	5.583	6.743	7.950	9.205
10	0.054	0.723	1.558	2.498	3.512	4.580	5.697	6.861	8.073	9.333
20	0.111	0.800	1.648	2.597	3.616	4.690	5.812	6.980	8.197	9.461
30	0.171	0.879	1.738	2.696	3.721	4.800	5.926	7.100	8.321	9.590
40	0.232	0.959	1.831	2.796	3.827	4.910	6.041	7.220	8.446	9.720
50	0.296	1.041	1.923	2.896	3.933	5.021	6.157	7.340	8.571	9.850
60	0.363	1.124	2,.017	2.997	4.040	5.133	6.273	7.461	8.697	9.980
70	0.431	1.208	2.112	3.099	4.147	5.245	6.390	7.583	8.823	10.111
80	0.501	1.294	2.207	3.201	4.255	5.357	6.507	7.705	8.950	10.242
90	0.573	1.381	2.304	3.304	4.363	5.470	6.625	7.827	9.077	10.374
100	0.647	1.469	2.401	3.408	4.471	5.583	6.743	7.950	9.205	10.506

8.2 Table of reference thermal electromotive force of K-type thermocouple

Unit : mV JIS C 1602-1995

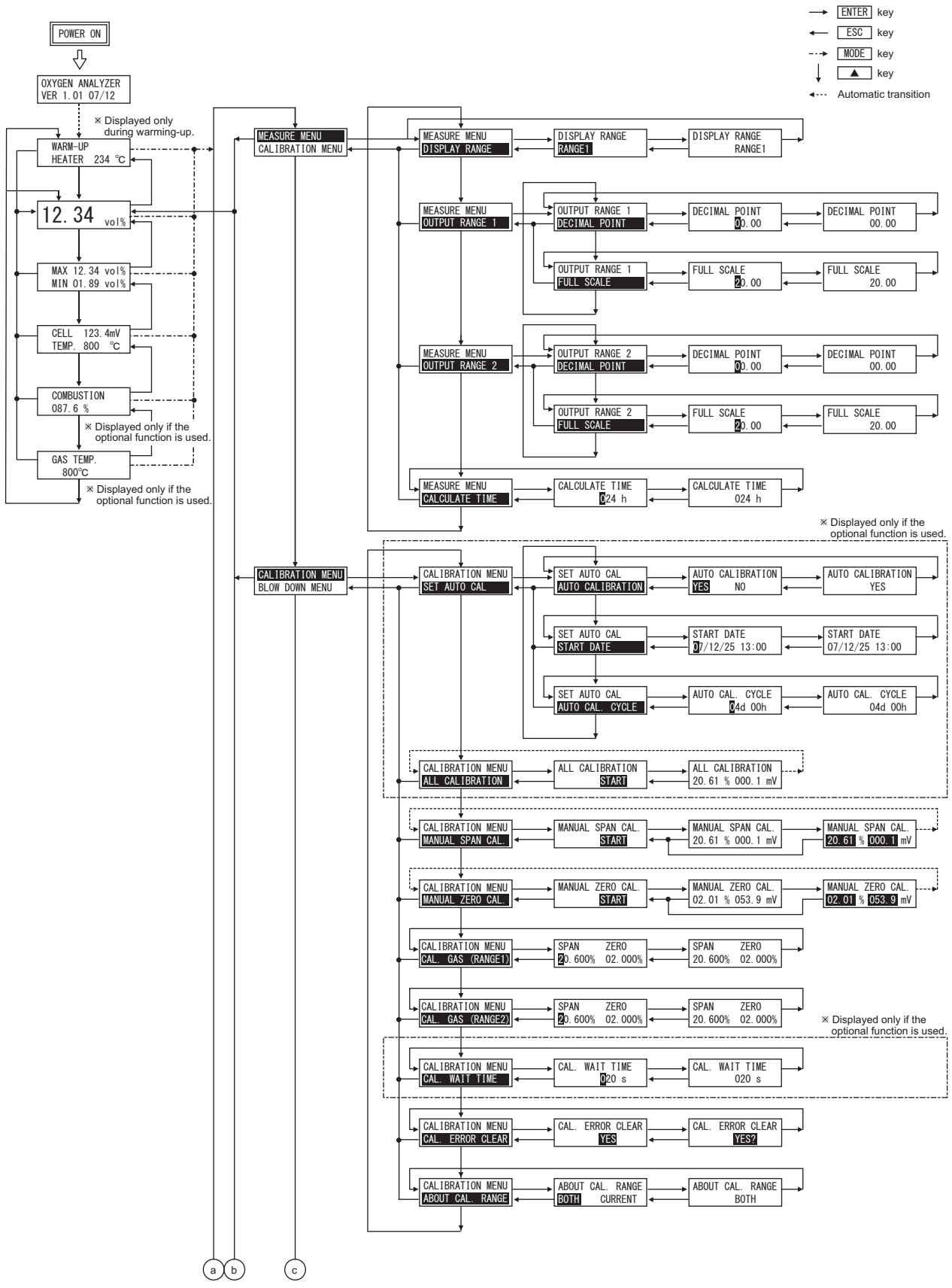
Temperature (°C)	0	100	200	300	400	500	600	700	800	900
0	0	4.096	8.138	12.209	16.397	20.644	24.905	29.129	33.275	37.326
10	0.397	4.509	8.539	12.624	16.820	21.071	25.330	29.548	33.685	37.725
20	0.798	4.920	8.940	13.040	17.243	21.497	25.755	29.965	34.093	38.124
30	1.203	5.328	9.343	13.457	17.667	21.924	26.179	30.382	34.501	38.522
40	1.612	5.735	9.747	13.874	18.091	22.350	26.602	30.798	34.908	38.918
50	2.023	6.138	10.153	14.293	18.516	22.776	27.025	31.213	35.313	39.314
60	2.436	6.540	10.561	14.713	18.941	23.203	27.447	31.628	35.718	39.708
70	2.851	6.941	10.971	15.133	19.366	23.629	27.869	32.041	36.121	40.101
80	3.267	7.340	11.382	15.554	19.792	24.055	28.289	32.453	36.524	40.494
90	3.682	7.739	11.795	15.975	20.218	24.480	28.710	32.865	36.925	40.885
100	4.096	8.138	12.209	16.397	20.644	24.905	29.129	33.275	37.326	41.276

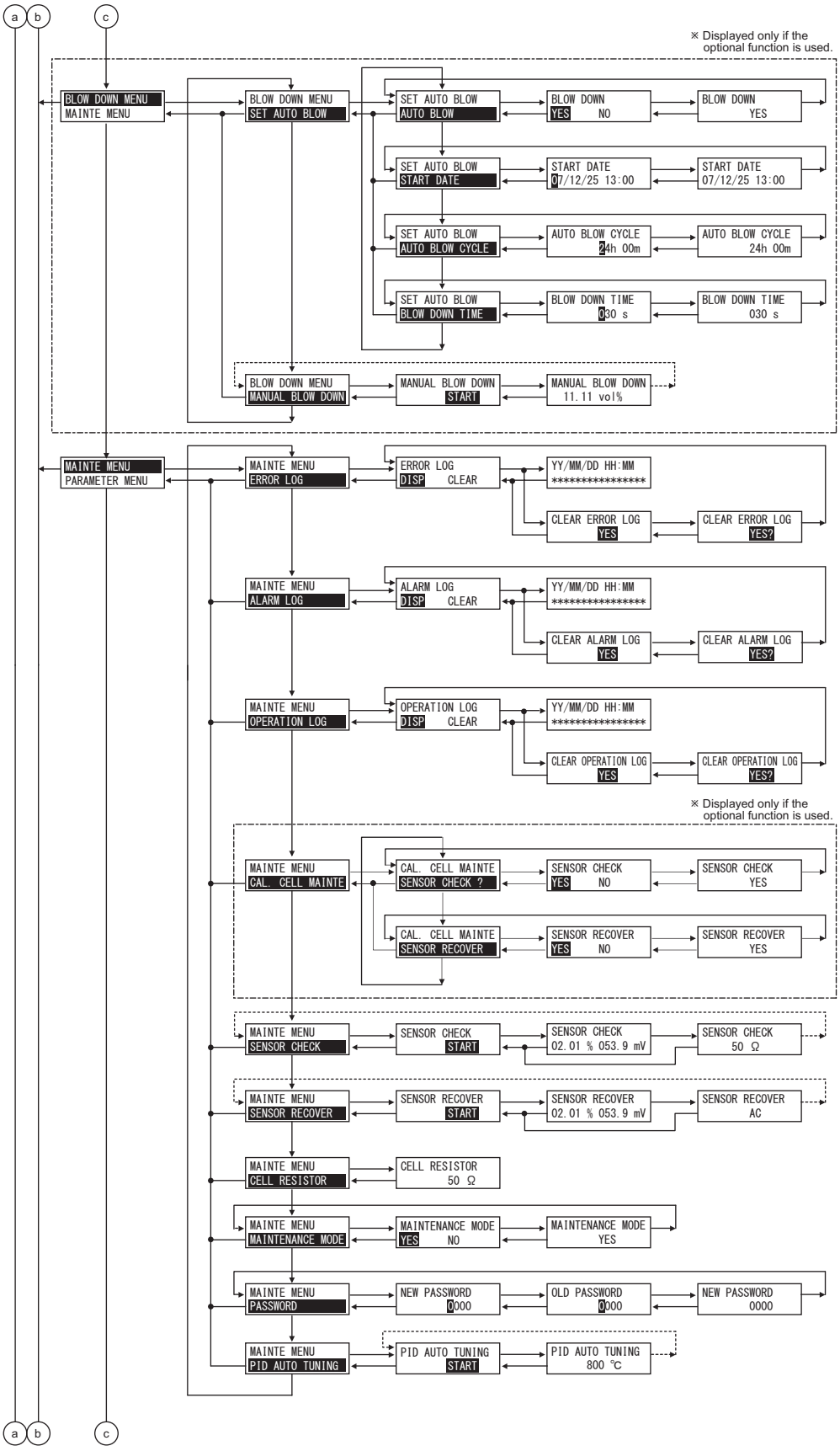
8.3 Table of theory output of zirconia oxygen detector

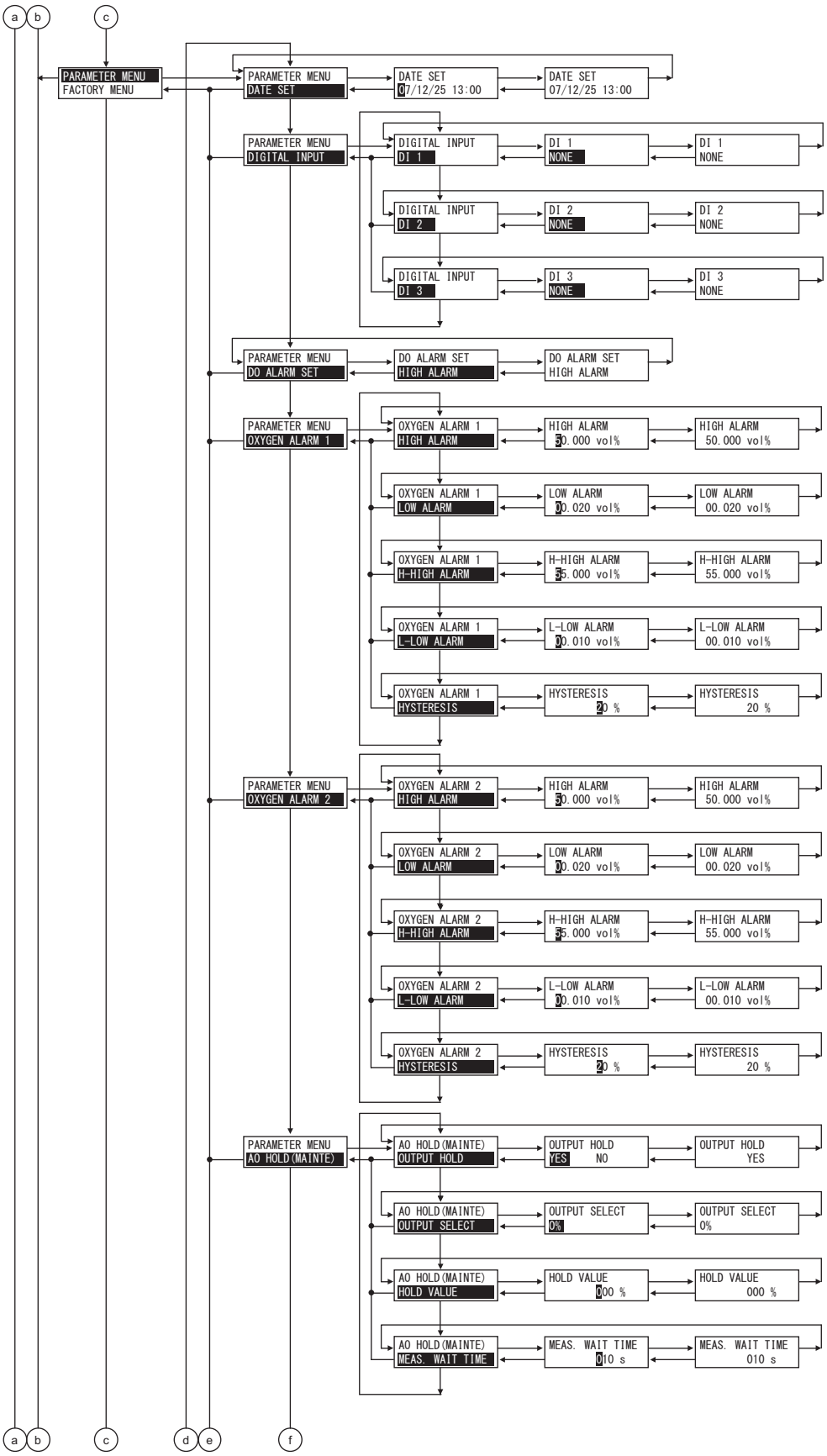
O_2 conc. %	Output mV	O_2 conc. %	Output mV	O_2 conc. %	Output mV	O_2 conc. %	Output mV	O_2 conc. %	Output mV
0.01	168.15	0.9	68.99	5.5	29.10	20	0.651	36	-12.30
0.02	152.87	1.0	66.67	6.0	27.18	20.6	0.000	37	-12.91
0.03	143.94	1.2	62.65	6.5	25.42	21	-0.4238	38	-13.49
0.04	137.6	1.4	59.25	7.0	23.79	22	-1.449	39	-14.06
0.05	132.68	1.5	57.73	7.5	22.27	23	-2.428	40	-14.62
0.06	128.66	1.6	56.31	8.0	20.84	24	-3.366	41	-15.17
0.07	125.27	1.8	53.71	9.0	18.25	25	-4.266	42	-15.70
0.08	122.32	2.0	51.39	10.0	15.93	26	-5.130	43	-16.22
0.09	119.73	2.2	49.29	11.0	13.83	27	-5.962	44	-16.72
0.1	117.41	2.4	47.37	12	11.91	28	-6.763	45	-17.22
0.2	102.13	2.6	45.61	13	10.14	29	-7.537	46	-17.70
0.3	93.20	2.8	43.98	14	8.511	30	-8.284	47	-18.18
0.4	86.86	3.0	42.46	15	6.991	31	-9.01	48	-18.64
0.5	81.94	3.5	39.06	16	5.569	32	-9.71	49	-19.10
0.6	77.92	4.0	36.12	17	4.233	33	-10.38	50	-19.54
0.7	74.53	4.5	33.52	18	2.973	34	-11.04		
0.8	71.58	5.0	31.20	19	1.782	35	-11.68		

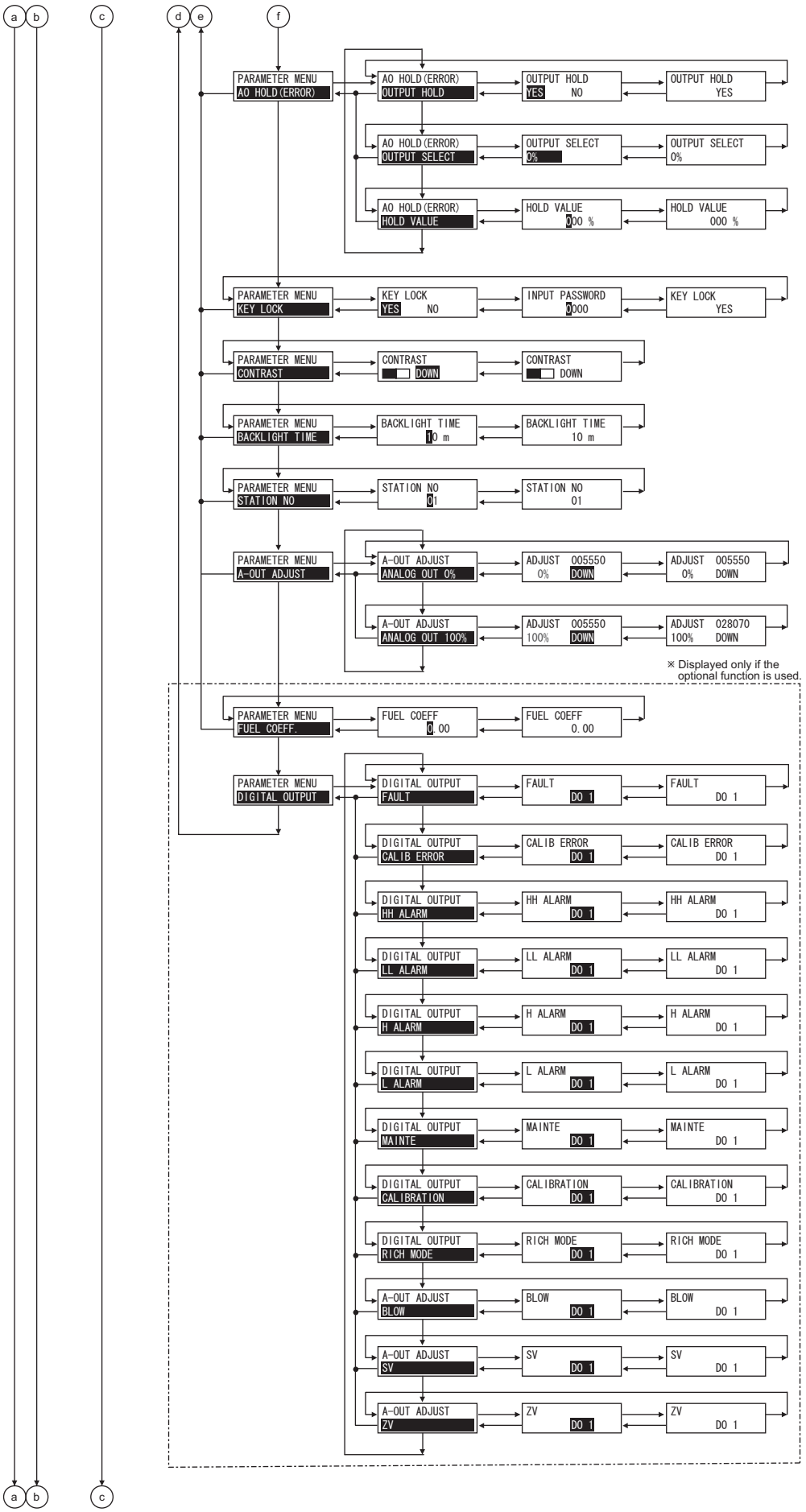
$E\ (mV) = 50.74 \log 20.6/x$

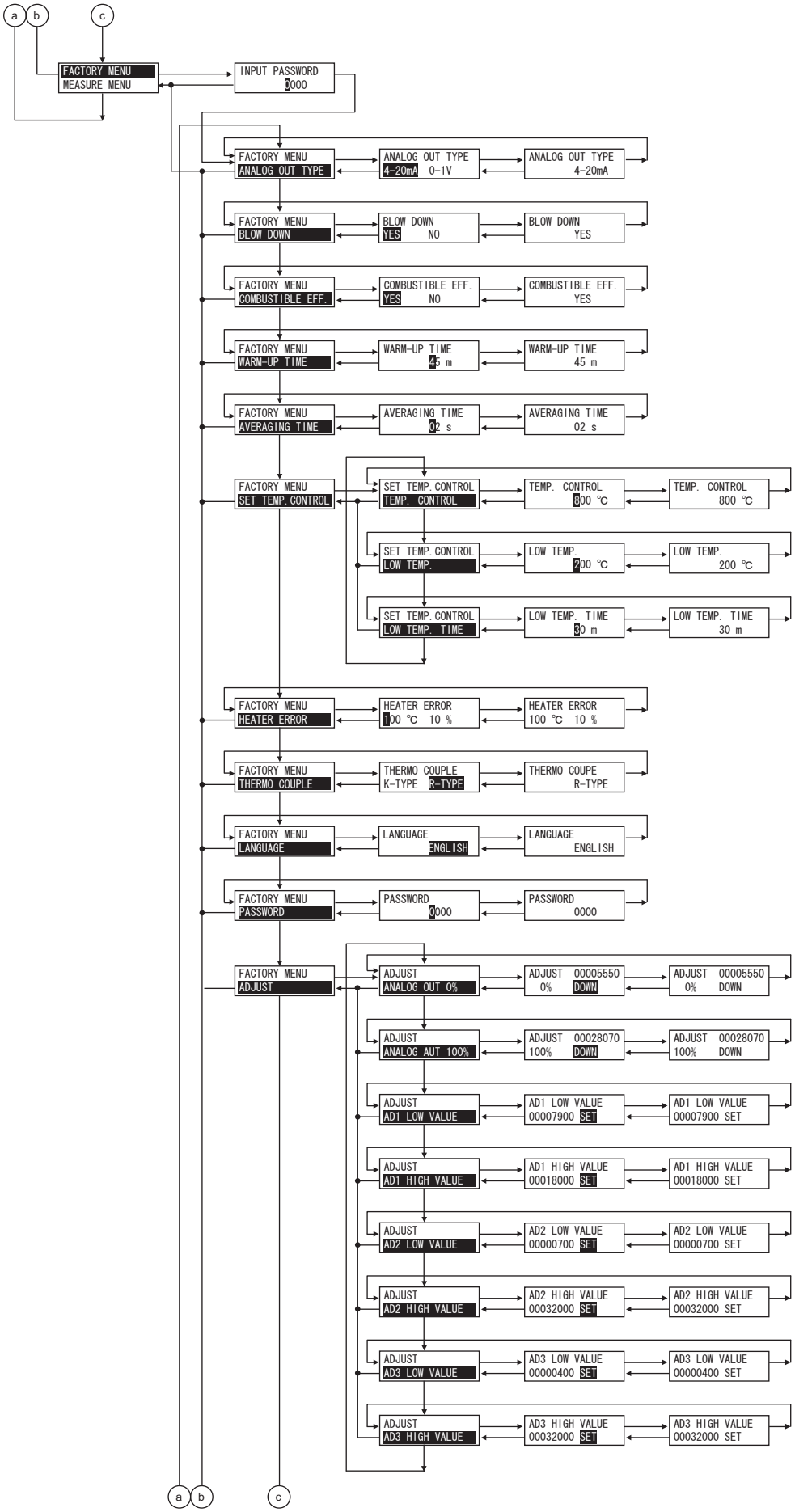
8.4 Key operation flow diagram

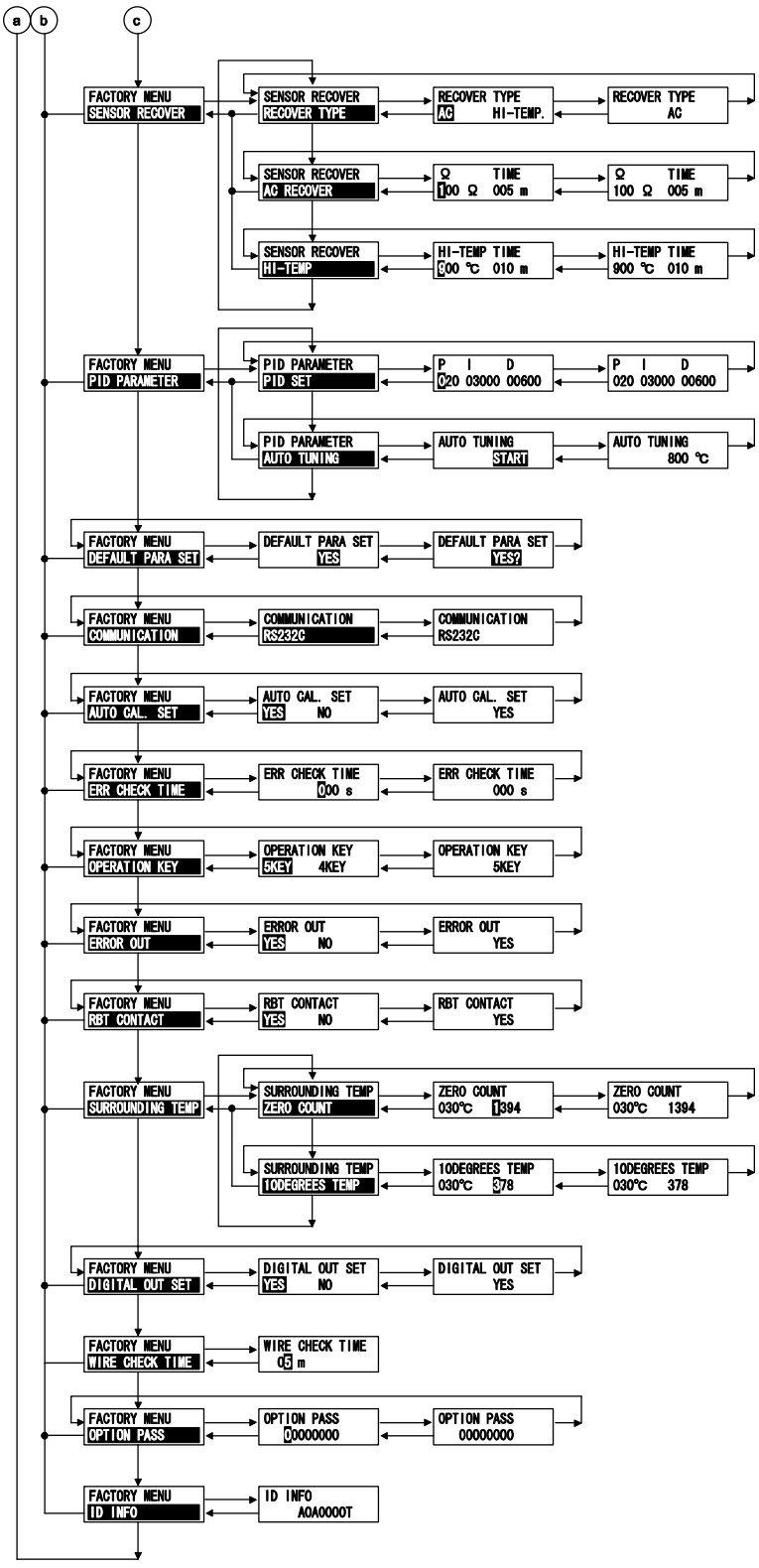



※ Displayed only if the optional function is used.
BLOW DOWN MENU
MAINTE MENU
BLOW DOWN MENU
SET AUTO BLOW
SET AUTO BLOW
AUTO BLOW
BLOW DOWN
YES NO
BLOW DOWN
YES
SET AUTO BLOW
START DATE
START DATE
07/12/25 13:00
START DATE
07/12/25 13:00
SET AUTO BLOW
AUTO BLOW CYCLE
AUTO BLOW CYCLE
24h 00m
AUTO BLOW CYCLE
24h 00m
SET AUTO BLOW
BLOW DOWN TIME
BLOW DOWN TIME
030 s
BLOW DOWN TIME
030 s
BLOW DOWN MENU
MANUAL BLOW DOWN
MANUAL BLOW DOWN
START
MANUAL BLOW DOWN
11.11 vol%
MAINTE MENU
PARAMETER MENU
MAINTE MENU
ERROR LOG
ERROR LOG
DISP CLEAR
YY/MM/DD HH:MM
****
CLEAR ERROR LOG
YES
CLEAR ERROR LOG
YES?
MAINTE MENU
ALARM LOG
ALARM LOG
DISP CLEAR
YY/MM/DD HH:MM
****
CLEAR ALARM LOG
YES
CLEAR ALARM LOG
YES?
MAINTE MENU
OPERATION LOG
OPERATION LOG
DISP CLEAR
YY/MM/DD HH:MM
****
CLEAR OPERATION LOG
YES
CLEAR OPERATION LOG
YES?
※ Displayed only if the optional function is used.
MAINTE MENU
CAL. CELL MAINTE
CAL. CELL MAINTE
SENSOR CHECK ?
SENSOR CHECK
YES NO
SENSOR CHECK
YES
CAL. CELL MAINTE
SENSOR RECOVER
SENSOR RECOVER
YES NO
SENSOR RECOVER
YES
MAINTE MENU
SENSOR CHECK
SENSOR CHECK
START
SENSOR CHECK
02.01 % 053.9 mV
SENSOR CHECK
50 Ω
MAINTE MENU
SENSOR RECOVER
SENSOR RECOVER
START
SENSOR RECOVER
02.01 % 053.9 mV
SENSOR RECOVER
AC
MAINTE MENU
CELL RESISTOR
CELL RESISTOR
50 Ω
MAINTE MENU
MAINTENANCE MODE
MAINTENANCE MODE
YES NO
MAINTENANCE MODE
YES
MAINTE MENU
PASSWORD
NEW PASSWORD
0000
OLD PASSWORD
0000
NEW PASSWORD
0000
MAINTE MENU
PID AUTO TUNING
PID AUTO TUNING
START
PID AUTO TUNING
800 ℃


a
b
c
PARAMETER MENU
FACTORY MENU
PARAMETER MENU
DATE SET
DATE SET
07/12/25 13:00
DATE SET
07/12/25 13:00
PARAMETER MENU
DIGITAL INPUT
DIGITAL INPUT
DI 1
DI 1
NONE
DI 1
NONE
DIGITAL INPUT
DI 2
DI 2
NONE
DI 2
NONE
DIGITAL INPUT
DI 3
DI 3
NONE
DI 3
NONE
PARAMETER MENU
DO ALARM SET
DO ALARM SET
HIGH ALARM
DO ALARM SET
HIGH ALARM
PARAMETER MENU
OXYGEN ALARM 1
OXYGEN ALARM 1
HIGH ALARM
HIGH ALARM
50.000 vol%
HIGH ALARM
50.000 vol%
OXYGEN ALARM 1
LOW ALARM
LOW ALARM
00.020 vol%
LOW ALARM
00.020 vol%
OXYGEN ALARM 1
H-HIGH ALARM
H-HIGH ALARM
55.000 vol%
H-HIGH ALARM
55.000 vol%
OXYGEN ALARM 1
L-LOW ALARM
L-LOW ALARM
00.010 vol%
L-LOW ALARM
00.010 vol%
OXYGEN ALARM 1
HYSTERESIS
HYSTERESIS
20 %
HYSTERESIS
20 %
PARAMETER MENU
OXYGEN ALARM 2
OXYGEN ALARM 2
HIGH ALARM
HIGH ALARM
50.000 vol%
HIGH ALARM
50.000 vol%
OXYGEN ALARM 2
LOW ALARM
LOW ALARM
00.020 vol%
LOW ALARM
00.020 vol%
OXYGEN ALARM 2
H-HIGH ALARM
H-HIGH ALARM
55.000 vol%
H-HIGH ALARM
55.000 vol%
OXYGEN ALARM 2
L-LOW ALARM
L-LOW ALARM
00.010 vol%
L-LOW ALARM
00.010 vol%
OXYGEN ALARM 2
HYSTERESIS
HYSTERESIS
20 %
HYSTERESIS
20 %
PARAMETER MENU
AO HOLD(MAINTE)
AO HOLD(MAINTE)
OUTPUT HOLD
OUTPUT HOLD
YES NO
OUTPUT HOLD
YES
AO HOLD(MAINTE)
OUTPUT SELECT
OUTPUT SELECT
0%
OUTPUT SELECT
0%
AO HOLD(MAINTE)
HOLD VALUE
HOLD VALUE
000 %
HOLD VALUE
000 %
AO HOLD(MAINTE)
MEAS. WAIT TIME
MEAS. WAIT TIME
010 s
MEAS. WAIT TIME
010 s
a
b
c
d
e
f


a
b
c
d
e
f
PARAMETER MENU
AO HOLD(ERROR)
AO HOLD(ERROR)
OUTPUT HOLD
OUTPUT HOLD
YES NO
OUTPUT HOLD
YES
AO HOLD(ERROR)
OUTPUT SELECT
OUTPUT SELECT
0%
OUTPUT SELECT
0%
AO HOLD(ERROR)
HOLD VALUE
HOLD VALUE
000 %
HOLD VALUE
000 %
PARAMETER MENU
KEY LOCK
KEY LOCK
YES NO
INPUT PASSWORD
0000
KEY LOCK
YES
PARAMETER MENU
CONTRAST
CONTRAST
DOWN
CONTRAST
DOWN
PARAMETER MENU
BACKLIGHT TIME
BACKLIGHT TIME
10 m
BACKLIGHT TIME
10 m
PARAMETER MENU
STATION NO
STATION NO
01
STATION NO
01
PARAMETER MENU
A-OUT ADJUST
A-OUT ADJUST
ANALOG OUT 0%
ADJUST 005550
0% DOWN
ADJUST 005550
0% DOWN
A-OUT ADJUST
ANALOG OUT 100%
ADJUST 005550
100% DOWN
ADJUST 028070
100% DOWN
※ Displayed only if the optional function is used.
PARAMETER MENU
FUEL COEFF.
FUEL COEFF
0.00
FUEL COEFF
0.00
PARAMETER MENU
DIGITAL OUTPUT
DIGITAL OUTPUT
FAULT
FAULT
DO 1
FAULT
DO 1
DIGITAL OUTPUT
CALIB ERROR
CALIB ERROR
DO 1
CALIB ERROR
DO 1
DIGITAL OUTPUT
HH ALARM
HH ALARM
DO 1
HH ALARM
DO 1
DIGITAL OUTPUT
LL ALARM
LL ALARM
DO 1
LL ALARM
DO 1
DIGITAL OUTPUT
H ALARM
H ALARM
DO 1
H ALARM
DO 1
DIGITAL OUTPUT
L ALARM
L ALARM
DO 1
L ALARM
DO 1
DIGITAL OUTPUT
MAINTE
MAINTE
DO 1
MAINTE
DO 1
DIGITAL OUTPUT
CALIBRATION
CALIBRATION
DO 1
CALIBRATION
DO 1
DIGITAL OUTPUT
RICH MODE
RICH MODE
DO 1
RICH MODE
DO 1
A-OUT ADJUST
BLOW
BLOW
DO 1
BLOW
DO 1
A-OUT ADJUST
SV
SV
DO 1
SV
DO 1
A-OUT ADJUST
ZV
ZV
DO 1
ZV
DO 1
a
b
c


a
b
c
FACTORY MENU
MEASURE MENU
INPUT PASSWORD
0000
FACTORY MENU
ANALOG OUT TYPE
ANALOG OUT TYPE
4-20mA 0-1V
ANALOG OUT TYPE
4-20mA
FACTORY MENU
BLOW DOWN
BLOW DOWN
YES NO
BLOW DOWN
YES
FACTORY MENU
COMBUSTIBLE EFF.
COMBUSTIBLE EFF.
YES NO
COMBUSTIBLE EFF.
YES
FACTORY MENU
WARM-UP TIME
WARM-UP TIME
45 m
WARM-UP TIME
45 m
FACTORY MENU
AVERAGING TIME
AVERAGING TIME
02 s
AVERAGING TIME
02 s
FACTORY MENU
SET TEMP.CONTROL
SET TEMP.CONTROL
TEMP. CONTROL
TEMP. CONTROL
800 ℃
TEMP. CONTROL
800 ℃
SET TEMP.CONTROL
LOW TEMP.
LOW TEMP.
200 ℃
LOW TEMP.
200 ℃
SET TEMP.CONTROL
LOW TEMP. TIME
LOW TEMP. TIME
30 m
LOW TEMP. TIME
30 m
FACTORY MENU
HEATER ERROR
HEATER ERROR
100 ℃ 10 %
HEATER ERROR
100 ℃ 10 %
FACTORY MENU
THERMO COUPLE
THERMO COUPLE
K-TYPE R-TYPE
THERMO COUPE
R-TYPE
FACTORY MENU
LANGUAGE
LANGUAGE
ENGLISH
LANGUAGE
ENGLISH
FACTORY MENU
PASSWORD
PASSWORD
0000
PASSWORD
0000
FACTORY MENU
ADJUST
ADJUST
ANALOG OUT 0%
ADJUST 00005550
0% DOWN
ADJUST 00005550
0% DOWN
ADJUST
ANALOG AUT 100%
ADJUST 00028070
100% DOWN
ADJUST 00028070
100% DOWN
ADJUST
AD1 LOW VALUE
AD1 LOW VALUE
00007900 SET
AD1 LOW VALUE
00007900 SET
ADJUST
AD1 HIGH VALUE
AD1 HIGH VALUE
00018000 SET
AD1 HIGH VALUE
00018000 SET
ADJUST
AD2 LOW VALUE
AD2 LOW VALUE
00000700 SET
AD2 LOW VALUE
00000700 SET
ADJUST
AD2 HIGH VALUE
AD2 HIGH VALUE
00032000 SET
AD2 HIGH VALUE
00032000 SET
ADJUST
AD3 LOW VALUE
AD3 LOW VALUE
00000400 SET
AD3 LOW VALUE
00000400 SET
ADJUST
AD3 HIGH VALUE
AD3 HIGH VALUE
00032000 SET
AD3 HIGH VALUE
00032000 SET
a
b
c


a
b
c
FACTORY MENU
SENSOR RECOVER
SENSOR RECOVER
RECOVER TYPE
RECOVER TYPE
AC HI-TEMP.
RECOVER TYPE
AC
SENSOR RECOVER
AC RECOVER
Ω TIME
100 Ω 005 m
Ω TIME
100 Ω 005 m
SENSOR RECOVER
HI-TEMP
HI-TEMP TIME
900 ℃ 010 m
HI-TEMP TIME
900 ℃ 010 m
FACTORY MENU
PID PARAMETER
PID PARAMETER
PID SET
P I D
020 03000 00600
P I D
020 03000 00600
PID PARAMETER
AUTO TUNING
AUTO TUNING
START
AUTO TUNING
800 ℃
FACTORY MENU
DEFAULT PARA SET
DEFAULT PARA SET
YES
DEFAULT PARA SET
YES?
FACTORY MENU
COMMUNICATION
COMMUNICATION
RS232C
COMMUNICATION
RS232C
FACTORY MENU
AUTO CAL. SET
AUTO CAL. SET
YES NO
AUTO CAL. SET
YES
FACTORY MENU
ERR CHECK TIME
ERR CHECK TIME
000 s
ERR CHECK TIME
000 s
FACTORY MENU
OPERATION KEY
OPERATION KEY
5KEY 4KEY
OPERATION KEY
5KEY
FACTORY MENU
ERROR OUT
ERROR OUT
YES NO
ERROR OUT
YES
FACTORY MENU
RBT CONTACT
RBT CONTACT
YES NO
RBT CONTACT
YES
FACTORY MENU
SURROUNDING TEMP
SURROUNDING TEMP
ZERO COUNT
ZERO COUNT
030℃ 1394
ZERO COUNT
030℃ 1394
SURROUNDING TEMP
10DEGREES TEMP
10DEGREES TEMP
030℃ 378
10DEGREES TEMP
030℃ 378
FACTORY MENU
DIGITAL OUT SET
DIGITAL OUT SET
YES NO
DIGITAL OUT SET
YES
FACTORY MENU
WIRE CHECK TIME
WIRE CHECK TIME
03 m
FACTORY MENU
OPTION PASS
OPTION PASS
00000000
OPTION PASS
00000000
FACTORY MENU
ID INFO
ID INFO
A0A0000T

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